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The Effects of Uncertainty and Capital Source on Cooperative Firm Leverage

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Abstract

The organizational structure of cooperatives generates a complex link between member equity and overall corporate capital structure. This link is further complicated by macroeconomic and firm-based risks. This paper presents a model of optimal debt ratio, subject to cooperative financial characteristics and capital requirements. We test the proposition that macroeconomic and idiosyncratic uncertainty tend to decrease the optimal debt to total asset ratio. We find that macroeconomic and idiosyncratic risk negatively affect optimal borrowing in cooperatives with sales of $25 million or less. Conversely, no clear relationship exists between these types of risk and cooperatives with greater sales. These findings suggest an important relationship between firm operations and member equity as small cooperatives contemplate entry into world markets.

Keywords: agricultural cooperative, risk, capital structure, equity valuation

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Introduction

Farmer supply and grain marketing cooperatives are designed to preserve the benefits of economic returns and control over assets. This combination generates a flow of financial benefits over a period of time, some of which is allocated to the patron-owner in the period the benefits are created, and some of which is used temporarily to provide equity for asset investment and reserves against loss. Strategies for obtaining capital and managing sources of risk are examples of decisions made within the cooperative that affect the value of member equity.

The organizational structure of cooperatives adds additional complexity to the linkage between the value of member equity and capital structure (VanSickle and Ladd, 1983). Cooperatives should not only provide an equitable procedure for acquiring and redeeming current equity investments, but provide an adequate supply of equity capital for financing working capital and fixed assets. The traditional firm's objective is to maximize the owner's benefit or wealth (Jensen and Meckling, 1976). This objective must be modified for a cooperative because the member of the cooperative is also the customer. The cooperative's objective now becomes the maximization of the benefit to its member-customers (VanSickle and Ladd, 1983). Inherent within the capital structure decision is also the chosen level of investments that the cooperative is willing or able to make. Investments play a central role in the growth and development of a cooperative (Forster, 1996). Since funds for investments have an opportunity cost associated with them, cooperative members have alternative investments and need to select the "best" investment. This "best" investment decision could be subjectively based on manager and member preferences for risk and return or very objectively based on established investment criteria. Several factors have been shown to determine the return on investment when dealing with agribusinesses and cooperatives, including how cash flow is managed and leverage of the investment (Forster, 1996).

The objective of this article is to detect and measure the effect of leverage, member investment, and sources of risk on cooperative member valuation of member's equity investment. We present a theoretical model of the optimal debt related with the marginal profit of capital; the marginal adjustment cost of investment; the expected marginal adjustment cost; the relative shadow cost of external financing; and the expected base interest rate, as a function of macroeconomic uncertainty. We find that leverage is affected by a combination of member-controlled and manager-controlled variables. Efficient use of assets, liquidity, prior borrowing activities and macroeconomic conditions increase the leverage of a farm supply and grain marketing cooperative under certain conditions. We also find that patronage allocations, either in cash or in retained equity, have almost no effect on leverage. Our model suggests that manager-influenced functions of operating efficiency and liquidity are the primary determinants of leverage.

These results have important implications about the interaction between members and cooperative business management policies. One, management decisions substantially influence firm leverage, yet leverage targets are traditionally set by members. Two, a negative relationship exists between current account liabilities, such as member credit balances, and cooperative business borrowing behavior.

The remainder of this paper is structured as follows. The next section discusses the financial framework of a cooperative and a discussion of the relevant literature. Then follows a presentation of a value maximization model for a cooperative and the empirical model that is used for the analysis. The fourth section describes the data while the fifth section discusses the results, conclusions, and suggestions for further research.

Cooperative framework

There are two sources of investment funding available to a cooperative – debt and equity capital. Taking on debt means borrowing money and is accompanied by the associated cost of borrowing. Equity, the investment user-owners make in the assets of their cooperatives, entails injecting a patron's cash into the company and is accompanied by the patron's expectations for economic returns. It is the basis of all investment capacity and borrowing flexibility (Barton, Parcell and Featherstone, 1996). User-owners finance the cooperative through the accumulation of equity capital by direct investment, per-unit capital retains, and patronage refunds. Per-unit capital retains are the retained portion of the transaction price, held in the user-owner's name as an equity investment. Retained patronage refunds are a distribution of net income to the patron in the form of an equity investment. Categories of these funds may include capital stock, deferred qualified patronage refunds, and nonqualified patronage refunds. The important distinguishing feature of qualified patronage refunds is that they can be excluded from a cooperative's taxable income. Qualified patronage refunds assure that cooperative income is only taxed once – at the member level. Nonqualified refunds are allocations of net income made to patrons on which the cooperative assumes income tax responsibility. Since each category results in different costs, benefits, and length of investment horizon the selection of these categories affects the value of the member's equity investment.

The discounted value of a user-owner's equity is the net present value of future cash flows to the owners of the equity. This includes all the cash patronage, equity redemptions and dividends received by members. The return to the owners' investment in a business includes dividends and patronage refunds. Paying a high percentage of refunds in cash benefits current patrons and may encourage patronage and membership because it maximizes the cash return to members. The cooperative does business with a prior commitment to return any revenues above costs and capital needs to its patrons. Therefore, the cooperative must satisfy its members, who joined the cooperative primarily for economic reasons related to their farm businesses (Cobia, 2008). But higher cash patronage and lower margins may reduce equity sources that provide for stability and growth.

Equity management maintains the owner's equity investment in each of one or more accounts by increasing or decreasing the balance of each. Each account may represent a different class of equity and may have different sources or uses. Royer (1997) outlines two important objectives of a good equity management strategy. First, the strategy must provide an adequate supply of equity capital for financing working capital and fixed assets. Second, the strategy must provide an equitable procedure for acquiring and redeeming current equity investments.

Cooperative members favor cash patronage. Any policy that reduces the current cash patronage may result in a negative response from members. Tubbs (1971) studied the impact of cooperative patronage refunds on the farm operations. He argued that low cash patronage refunds amount and long revolving fund terms may hurt the farmers in the sense of discounted present value because of the immediate tax obligation (Royer and Smith, 2007). A high cash proportion of patronage refunds can ensure that active patrons do not suffer negative cash flows due to taxes and can help a cooperative attract new business. For example, members with income in marginal tax brackets (federal plus state) higher than 20% are interested in a large percentage of cash refunds because they tend to ease the burdens of cash outflows due to tax obligations. Such patrons would have a negative after-tax cash flow on patronage refunds if the minimum cash refund of 20% were given. These patrons insist on a high enough level of cash patronage refunds to offset the additional taxes from qualified refunds.

Patronage refunds may be made to the member in cash or retained by the cooperative to build up member investment and to provide necessary equity. Dividends are cash payments made to equity investors based on the amount of capital the equity holder has in the cooperative. Usually, dividends are paid only on membership stock, but sometimes dividends are paid on allocated retained patronage refunds or capital retains. Dividends have a legitimate role in recognizing returns to equity investment.

The length of time before redeeming member equity investment is a determinant of member equity valuation. A survey conducted in 2008 by U.S. Department of Agriculture showed that the revolving fund length remains long, especially for grain and oilseed cooperatives and farm supply cooperatives whose revolving fund length averages at least 18 years. Under a revolving fund plan, a cooperative pays off or redeems in cash the oldest equities on a first-in, first-out basis, or, in other words, in the same chronological order in which they were allocated. One of the key decisions in using the revolving fund plan is the length of revolving period. The length is a compromise between the time necessary to accumulate equity and the time necessary to redeem it. The largest cooperatives redeemed patron equity more recently but had a revolving fund length that, at 17 years, was four years longer than the smallest cooperatives. One redemption method is patron's age. For example, a cooperative redeems to patrons who reach the age of 70. For the patron's age redemption method, smaller and larger cooperatives redeemed equity to patrons several years younger than did middle-sized cooperatives (Eversull, 2010).

Because money or cash flow has different values depending upon when it is received, the best investment decision making is based on methods that treat cash flows differently across time. Cash flows from different periods of time have different value. Future cash flows should be discounted or reduced in value to make them equal to present day cash flows. In other words, future cash flows should only be evaluated using their present value. Equity redemptions affect the members' expectations of the time their money will be retained in the cooperative. The increase in equity redemptions reduces member's expectations of the time it takes to receive the cash value of the equity credits and decrease in expected time reduces the discount effect on equity credit value. The increased value of equity credits over time results in faster growth.

Equity is risk capital which refers to funds used for high-risk, high-reward investments. On one side, equity holders have rights to all the residual returns of the cooperative. All increases in cooperative value belong to them. A strong equity base also provides security for lenders and makes it possible for borrowers to receive more favorable interest rates. On the other side, equity exists to serve as a buffer during periods of economic misfortune. Any losses experienced by the cooperative are subtracted from the cooperative's equity pool until it is exhausted. In case of liquidation, all liabilities must be satisfied before any cash can be returned to equity holders. It generates both the special benefits of cooperative returns and the possibility of loss.

Numerous valuation approaches, such as net present value method, exist to estimate the value of the target company. A well-known method employed by practitioners to value a target company is market multiple analysis. This involves applying a market-determined multiple to net income, EBITDA (earnings before interest, taxes, depreciation, and amortization), earnings per share, sales, book value, or other measures. This approach helps to identify a value range for the target and is useful when there are no acceptable comparable transactions or comparable public companies (Mukherjee and Baker, 2004). Liu, Nissim, and Thomas (2002) examined the valuation properties of a comprehensive list of value drivers and found that multiples derived from forward earnings explain stock prices remarkably well: forward earnings measures are followed by historical earnings measures, cash flow measures and book value of equity are tied for third, and sales performs the worst.

Several articles, including Beierlein and Schrader (1978), Royer (1987; Royer, Mohamad and Mohamad, 1997), and Corman and Fulton (1990), have used the present value of the cash flows received from a cooperative as the criterion for evaluating the effects of various equity financing and redemption practices on patrons as a group. There is, however, little literature evaluating equity by using the present value of the cash flow.

Cooperative's financial statements can help us determine its cash flow. The flow of funds to finance a business includes cash inflow and cash outflow. Cash inflow has equity investments, sales of fixed assets, sales of inventory, accounts receivable collection, and depreciation. Cash outflow consists of purchasing of fixed assets, purchasing of inventory, advances on products purchased, paying accounts payable, and customer credit. The net financial benefit or cost of "cash flow" investment in the cooperative over the interval depends on: (1) the amount of cash flow received from each year's cash patronage refund after taxes, (2) number of years in the interval to be evaluated, and (3) the rate at which cash flow costs or benefits are compounded to account for the time value of money (Junge and Ginder, 1986) The cash flow to equity includes debt payments, after covering capital expenditure and working capital needs. The discounted free cash flow to equity model is the basic model to value of equity, which is under the constant growth model. It is a function of the expected free cash flow to equity in the next period, the stable growth rate and the required rate of return.

Model specification

We formulate a dynamic, stochastic, partial equilibrium model of cooperatives' value optimization problem. The theoretical model proposed here builds on the firm value optimization problem developed by Baum, Stephan and Talavera (2009). The objective is to maximize the present value of the member's investment in the cooperative, which is equated to the expected discounted stream of dividends paid to members:

(1) $$V_t(K_t) = \max_{\{I_{t+s}, B_{t+s}\}} D_t + E_t\left[\sum_{s=1}^{\infty} \beta^s D_{t+s}\right]$$

where:

D_t Dividend generated in period t

β Discount factor used to discount expected dividends in period $t + s$

$E_t[.]$ An expectation conditioned on information available in period t

The objective function is maximized subject to five constraints faced by cooperatives. The first is the capital stock accounting identity:

(2) $$K_{t+1} = (1-\delta)\ K_t + I_t$$

where:

K_t Capital stock of cooperatives at the beginning-of-period

I_t Investment expenditure

δ Constant rate of economic depreciation

The second constraint defines cooperatives' dividends:

(3) $$D_t=\Pi(K_t, \Phi_t)-C(I_t, K_t)-I_t+B_t-B_{t-1}R(\tau_t)\eta(B_{t-1}, K_t, \xi_t)$$

where:

Π Maximized value of current profits

C Real cost of adjusting I_t units of capital

B_t Financial liabilities of the cooperative

R Base rate of return

τ_t Macroeconomic uncertainty

η External premium

ξ_t Stochastic shock

Discrete time makes variables have different values. At time t, all present values are certain, while all future variables are stochastic. According to "pecking order" theory, we assume that equity financing is so expensive that cooperatives exhibit a strict preference for debt financing (Frank and Goyal, 2003). In this way, the role of debt financing is isolated from equity financing. Another assumption is that managers have rational expectations. In order to incorporate financial frictions, we use external premium η (B_{t-1}, K_t , ξ_t) to express members' risk preference. It depends on cooperative-specific characteristics such as debt and capital stock as well as a stochastic shock ξ_t . Besides, the gross interest rate is equal to $R(\tau_t)\ \eta\ (B_{t-1}, K_t , \xi_t)$ where $R(\tau_t)$ is the base rate of return, which depends on the macroeconomics environment but not on cooperative-specific characteristics. Interest rate is diverse in different years. Lower interest rates reduce the borrowing cost to the members.

The third constraint restricts dividends to be non-negative.

(4) $$D_t \geq 0$$

The fourth constraint is a transversality condition that prevents the cooperative from borrowing an infinite amount to pay out as dividends:

(5) $$\lim_{T\to\infty}[\Pi_{j-t}^{T-1}\beta_j]B_T = 0, \forall t.$$

We construct $V_t(K_t) = D_t + \lambda_t D_t + \beta(D_{t+1} + \lambda_{t+1} D_{t+1})$ to solve the optimization problem. From the first-order conditions for investment, we derive:

(6) $$C_{I,t}+1= E_t\ [\beta\Theta_t(\Pi_{K,t+1} + (1-\delta) \times \left(C_{I,t+1} + 1\right) - R_{t+1}\eta_{K,t+1}B_t)]$$

The Lagrange multiplier λ_t can be interpreted as the shadow cost of internally generated funds. Note that $\Theta_t = (1 + \lambda_{t+1}) / (1+\lambda_t)$. Expression $\beta\Theta_t$may serve as a stochastic time-varying discount factor, which is equal to β in the absence of financial constraints ($\lambda_{t+1} = \lambda_t$). This derivative explains how much value will change when investment changes one unit.

From the first-order conditions for debt, we derive:

(7) $$E_t\ [\beta\Theta_t R_{t+1}(\eta_{t+1}+\eta_{B_{t+1}}B_t)] =1$$

The derivative of value for debt means how much value will change when debt changes one unit. Combining the first-order conditions we derive the optimal level for borrowing as:

(8) $$B_t = \frac{E_t\ [\Pi_{K,t+1}\Theta_t]+(1-\delta)E_t\ [\Theta_t C_{I,t+1}]-E_t[\Theta_t\eta_{t+1}R(\tau_{t+1})]-1/\beta C_{I,t}}{\eta_B E_t[\Theta_t R(\tau_{t+1})]+\eta_K E[R(\tau_{t+1})]}$$

We find that leverage is affected by a combination of member-controlled and manager-controlled variables. It is a function of revenue affected by capacity, adjustment cost changed by investment and risk from debt and capital. We also find that patronage allocations, either in cash or in retained equity, have almost no effect on leverage of a farm supply and grain marketing cooperative. Since members will require a return on their equity capital that includes a large risk premium as well as the risk-free interest rate if a cooperative's investments are risky, the leverage level will fluctuate as premium change. Therefore, risk does have a significant effect on firm value.

In order to achieve the objectives of this paper, we present two propositions derived from Equation 9. As shown in Equation 3, we assume risk affects the value of user-owner equity in a cooperative firm. Cooperatives will become less valuable when sources of risk external to the firm increase. From equation (8) we derive the marginal effect of macroeconomic uncertainty τ on optimal borrowing as:

$$(9) \qquad \frac{\partial B_t}{\partial \tau_{t+1}} = \frac{\partial B_t}{\partial E_t\{R(\tau_{t+1})\}} \frac{\partial E_t\{R(\tau_{t+1})\}}{\partial \tau_{t+1}}$$

We posit Equation (9) is negative. First, we assume $\frac{\partial B_t}{\partial E_t\{R(\tau_{t+1})\}} < 0$; higher rates of return in period t+1 induces less leverage. We assume the second factor is positive; taking risks into consideration, higher macroeconomic risks are accompanied with higher rate of return. Hence cooperatives will decrease the level of debt to cover the higher costs of external financing caused by uncertainties when they in increasingly uncertainty circumstances. Hence, according to equations (8) and (9), the optimal level of debt B_t is related to the marginal profit of capital, $\Pi_{K,t+1}$; the marginal adjustment cost of investment, $C_{I,t}$; the expected marginal adjustment cost, $E_t\left\{C_{I,t+1}\right\}$; the relative shadow cost of external financing, Θ_t; and the expected base interest rate, a function of macroeconomic uncertainty, $R(\tau_{t+1})$.

Our second proposition is related to the effect of idiosyncratic uncertainty on the optimal level of borrowing. Cooperatives will become less valuable when idiosyncratic sources of uncertainty inside the firm increase. From equation (8) we derive the marginal effect of idiosyncratic uncertainty τ on optimal borrowing as:

$$(10) \qquad \frac{\partial B_t}{\partial \Phi_{t+1}} = \frac{\partial B_t}{\partial E_t\{\Pi(\Phi_{t+1})\}} \frac{\partial E_t\{\Pi(\Phi_{t+1})\}}{\partial \Phi_{t+1}}$$

We posit Equation (10) is negative. First, we assume firms are allowed to borrow less when expected profits decline. Second, we assume that expected profits decline as idiosyncratic uncertainty increases. Hence, according to Equation (10), the marginal change in borrowing is negatively affected by a marginal change idiosyncratic uncertainty in the next period.

Traditional investment models assume costs of capital adjustment are convex. Here, we adopt a quadratic cost specification and consider the following specification of the adjustment function:

$$(11) \qquad C(I_t, K_t) = \frac{\gamma}{2}\left(\frac{I_t}{K_t}\right)^2 K_t$$

where γ is a parameter. The adjustment cost function is decreasing and convex in K_t and non-decreasing and convex in I_t. As a proxy for the value of K_t, estimate equation (11) for capital adjustment costs as:

$$(12) \qquad C_I = \gamma\left(\frac{I_t}{TA_t}\right)$$

This is the marginal adjustment cost of investment of a cooperative at time t. TA is total assets of a cooperative at time t, which is a proxy for capital K_t. The first-order condition for costs of adjustment relates the marginal adjustment cost to the investment and capital at time t.

In order to empirically measure the marginal effect of capital on profit, we follow Gilchrist and Himmelberg (1998). They provided the marginal profit of capital by using a sales-based measure rather than income measure:

$$(13) \qquad \Pi_{K,t+1} = \theta_1(S_t/TA_t)$$

The expected profitability of capital is parameterized as a linear function of the marginal profitability of fixed capital (S_t/TA_t). S is the cooperative's sale, TA is total assets.

We assume a cooperative's idiosyncratic risk is a linear function of the variation of annual industry profitability, as measured by the coefficient of variation across all firms:

$$(14) \qquad \Phi_t = a_t ROE$$

where ROE means return on equity.

We now discuss the empirical specification of the relative shadow cost of external financing, Θ_t. Another aspect provided by Gilchrist and Himmelberg

(1998) is that debt aggravates the probability of financial distress, while the availability of liquid assets alleviates the external finance constraint:

(15) $\Theta_t = a_0 + a_1 Cash_t + a_2 B_{t-1}$

where:

$Cash_t$ Cash and cash equivalent

a_0 A firm-specific measure of financial constraints

As to the base interest rate $R(\tau_t)$, we assume that it is a linear function of macroeconomic uncertainty as:

(16) $R(\tau_t) = \omega_1 \tau_t + Macro_t$

where $Macro_t$ is an index of macroeconomic variables.

The final empirical specification is:

(17) $\frac{B_t}{TA_t} = \beta_1 \frac{B_{t-1}}{TA_{t-1}} + \beta_2 \frac{Cash_t}{TA_t} + \beta_3 \frac{S_t}{TA_t} + \beta_4 \frac{I_{t+1}}{TA_{t+1}} + \beta_5 \frac{I_t}{TA_t} + \beta_6 \tau_{t-1} + \beta_7 Macro + e_t$

Data sources and sample size

The main propositions of this paper are that β_6 and β_7 of Equation 17 are negative: idiosyncratic and macroeconomic uncertainties have an inverse relationship with the empirically observed leverage ratio. To test these, cooperative-level financial data are regressed on the optimal level of borrowing. This will show any effects risks, debt and investment may have on the optimal level of debt. Financial data used to test these propositions are gathered from balance sheets and income statements of 82 farm input supply and grain marketing cooperatives with headquarters in North Dakota based on operations for the fiscal years 2002 through 2008. A study using data only from North Dakota farm supply and grain marketing cooperatives has merit since the average sales volume of many states is larger than that of cooperatives in North Dakota. North Dakota is similar to Alabama, Mississippi, Oklahoma, and Texas in that there are 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 sales from 45 states reported by the USDA (Kraenzle et al., 2003). In 2006, average net sales per North Dakota cooperative were \$20 million, ranking 34th of the 47 states surveyed (DeVille et al., 2007).

The North Dakota farm supply and grain marketing cooperative sector has been evolving in ways that reflect national trends. The number of grain marketing and farm supply cooperatives in North Dakota is following a nationwide trend of declining numbers. In 2001, 210 farm supply and grain marketing cooperatives were in operation in North Dakota (Kraenzle et al., 2003). By December 2006, this number had declined to 197 (DeVille et al., 2007). In addition, 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 2007, sales at the largest North Dakota cooperative were $219 million. This number is significantly less than larger cooperatives in Nebraska and Iowa. The largest cooperative in South Dakota had $1.2 billion in sales in 2008. In general, North Dakota has not seen the consolidation in local cooperatives relative to these states (Spencer 2001).

Several macroeconomic variables were gathered in order to test the proposition in Equation 12. State-level gross domestic product data and real dollar exchange rates with countries receiving approximately 90% of North Dakota's[3] agricultural exports, as measured in revenue, were gathered from the Bureau of Economic Analysis. An agricultural commodity price index was obtained from the World Bank and used as a proxy for macroeconomic uncertainty in world agricultural commodity prices. Indices of prices received by farmers and prices paid by farmers were obtained from the Economic Research Service of the USDA.

Table 1 provides descriptive statistics of the cooperative firms and macroeconomic uncertainty proxy variables. All financial variables are measured at the end of the fiscal year. The variables in Equation 17 are measured as follows. The leverage ratio is measured as the ratio of borrowing and nominal total assets in the current fiscal year, or in the previous year in the case of a lag. The cash-to-asset ratio, sales to asset ratio, and investment to asset ratio are measured using current assets, sales, and depreciation, respectively.

3 Exchange rate data was gathered for Canada, Brazil, China, European Union, United Kingdom, and Australia.

Table 1: Selected statistics of financial ratios for North Dakota, USA agricultural cooperatives

	Sales greater than $25,000,000			Sales less than $25,000,000		
	Mean	Standard Deviation	Median	Mean	Standard Deviation	Median
Long term debt to total assets	0.47	0.17	0.47	0.37	0.65	0.31
Lagged total debt to total assets	0.44	0.17	0.45	0.38	0.6*5	0.32
Sales to total assets	0.59	0.16	0.58	0.53	0.56	0.49
Cash to total assets	2.71	1.48	2.33	2.72	6.43	1.98
Future investment to total assets	0.03	0.01	0.03	0.03	0.02	0.03
Investment to total assets	0.03	0.01	0.03	0.03	0.02	0.03
Idiosyncratic risk	0.13	0.07	0.13	0.12	0.07	0.09
Dollar index	88.08	9.16	83.87	87.38	9.66	83.87
Farm price index	115.48	11.58	116.00	117.60	14.25	116.00

We categorize the cooperatives into two markets based on sales volume. Relatively large cooperatives, those with sales of $25,000,000 or greater, provide farm output marketing services and sell farm input products. Relatively small cooperatives, those with sales below $25,000,000, only provide farm supply sales services.

A few of these statistics suggest the optimal borrowing of these two sizes of cooperatives may be distinct. First we note the insignificant difference in the mean leverage of large and small cooperatives. We note the average value of several other explanatory variables have similar means across the two groups. The principal difference is the magnitude of the standard deviation. Relatively small cooperatives have much more variation in the value of these variables than relatively large cooperatives.

We estimate Equation 17 using the financial and macroeconomic data described. Since the cooperatives are managed independently of each other, experience different grain and input prices, and interact with a variety of lenders and members, we assume the estimated errors in the equation are uncorrelated across cooperatives. The equation is, therefore, estimated using a one-way fixed effects model, with each cooperative used to estimate an intercept coefficient. Also, since not all 82 farm supply and grain marketing cooperatives appear in all years of the data, unbalanced panel estimation methods are used. Table 2 provides the estimated coefficients from the models estimated from each subset of our data. The estimates were obtained using PROC PANEL in SAS. The variable “intercept” is the value of the last cooperative-level intercept estimate; the estimated intercept coefficients of the other cooperatives can be provided upon request.

Our main finding for relatively small cooperatives is that there is generally a negative and significant relationship between optimal borrowing and macroeconomic risk. There is also significant relationship between idiosyncratic risk and optimal borrowing, but it is quadratic in nature. The estimated magnitude of these effects indicates that as long as average return on equity is positive, increased variation tends to increase the amount of optimal borrowing. Conversely, average annual losses will decrease optimal borrowing. Idiosyncratic risk has the largest effect on optimal borrowing when compared with any other factor studied. We also observe that future investment tends to increase borrowing, but current investment may not. Finally, total borrowing in the previous period has a negative effect on long term borrowing in the current period. Together, these last two observations suggest the important role communication between cooperative business managers and lender representatives has in setting lending requirements for any given period.

Our main finding for relatively large cooperatives is distinct from that for relatively small cooperatives. Our results do not indicate a significant relationship between macroeconomic or idiosyncratic risk on optimal long term borrowing by cooperatives. We have used a set of macroeconomic indices different from those for relatively small cooperatives to capture the idea that, since most sales are related to grain marketing, most macroeconomic risk faced by grain marketing cooperatives is related to world grain prices and fluctuations in the real value of the dollar among trading partners. We also maintain the assumption of a quadratic relationship between idiosyncratic risk of variation in ROE and optimal long term borrowing. Similar to relatively small cooperatives we observe that total borrowing in the previous period and current investments have significant effects on optimal borrowing, with current investment having the larger, positive effect. We also observe that expected investment has a significant, but negative effect on optimal borrowing in the current period.

Table 2: Results of the regression model estimating effects of risk on optimal borrowing, by firm size

	Sales less than $25,000,000		Sales greater than $25,000,000	
	Coefficient	Standard Error	Coefficient	Standard Error
Intercept	**0.84**	0.46	-0.10	0.18
Leverage_{t-1}	**-0.01**	0.01	-0.02	0.02
Current assets_t to total assets_t	**0.05**	0.02	**-0.16**	0.04
Sales_t to total assets_t	**-0.01**	0.00	**-0.01**	0.00
$\text{Depreciation}_{t+1}/\text{total assets}_{t+1}$	**0.67**	0.27	**-0.97**	0.38
$\text{Depreciation}_t/\text{total assets}_t$	0.13	0.18	**-1.47**	0.51
ROE_t coefficient of variation	**-1.53**	0.77	-0.18	0.26
$(\text{ROE}_t \text{ coefficient of variation})^2$	**4.62**	2.26	-0.25	0.74
Dollar index	**-0.01**	0.00	-0.00	0.00
Propane index	**0.00**	0.00		
Gasoline index	0.00	0.00		
Diesel index	0.00	0.00		
Farm output price index			-0.00	0.00

Note: Numbers in boldface type are statistically significant at the 10% level.

Conclusions

The objective of this paper was to understand the relationship between sources of risk, leverage, and how members value their equity in a cooperative. To our best knowledge, there is no paper that addresses these questions using the specified business model. Based on the results, we are able to provide some key findings. The first is that there was no measurable effect of macroeconomic risk on larger cooperatives. The optimal leverage ratio for larger cooperatives should experience smaller changes in optimal leverage ratios because of idiosyncratic and macroeconomic risk. This is important because it raises the question of whether a federated system absorbs some of the macroeconomic risk associated with agricultural marketing cooperatives. Additionally, the magnitude of idiosyncratic risk is larger for agricultural cooperatives than for industries used in previous studies. This also suggests a more stable pattern of monitoring and control for patron-directors and that it becomes easier for cooperatives to credibly reveal their creditworthiness as they grow. Together, these findings indicate that a growing cooperative that encounters risk can increase its value to the patron-investor.

For small cooperatives, we found mixed evidence in support of our proposition. Most elements of idiosyncratic and macroeconomic risk negatively affect optimal borrowing. To the extent variations in the average annual coefficient of variation in profitability are small and positive across cooperatives then increased idiosyncratic risk may increase borrowing overall. If macroeconomic factors change more than the idiosyncratic factors, optimal borrowing declines. Finally, we conclude that current and future investments matter for cooperative borrowing practices. The relatively large coefficients associated with investments suggest a need for lenders, management, and cooperative boards to closely align their borrowing policies.

This paper has provided evidence that small and large cooperatives are impacted by different factors. This distinction will provide direction for future cooperative research. The data in this paper came primarily from marketing cooperatives. Hence it remains for future study to detect whether cooperatives marketing farm output and selling farm inputs experience similar effects on optimal lending.

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