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# The cooperative capital constraint revisited

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**Abstract**

**Purpose**

– There is little reason a priori to expect that a cooperative firm's capital needs are different from a non-cooperative firm's needs if the two firms are otherwise similar in function and size and operate within similar market economies. However, the notion that cooperatives face capital constraints that investor-owned firms (IOFs) do not is a persistent theme in the literature. The paper aims to discuss these issues.

**Design/methodology/approach**

– The authors revisit this hypothesis with an empirical examination of capital constraints in a panel data set of US agricultural supply and grain cooperatives and IOFs.

**Findings**

– The findings are mixed. While the authors find little to suggest that cooperatives face financial constraints on borrowing in the short run, relative to IOFs, the authors do find some evidence that for long-term investments, a capital constraint may exist.

**Originality/value**

– These short and long run differences have implications for the survival and growth of agricultural cooperatives. While in the short run, access to debt financing allows these firms to operative profitably, ultimately long-term large investments in technology and fixed assets will be required to maintain competitiveness in this industry.

**Disciplines**
Agricultural Economics | Growth and Development | Regional Economics

**Comments**
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# The Cooperative Capital Constraint Revisited[1]

Ziran Li, Keri Jacobs, and Georgeanne Artz[2]

Among the major issues facing contemporary agricultural cooperatives are challenges related to identifying the financing activities and equity capital management strategies that will lead to growth and longevity (Barton, *et al*., 2011). There is little reason *a priori* to expect that a cooperative firm's capital needs are different from a non-cooperative firm's needs if the two firms are otherwise similar in function and size, and operate within similar market economies (Cobia and Brewer, 1989). "Cooperatives are not immune from market forces. They must meet the same market test that investor oriented firms meet" (Ginder, 1999, p. 8). However, cooperative finance outcomes and their choices in meeting financing needs are purported to be unique from non-cooperative firms. In particular, cooperatives may be constrained in acquiring sufficient risk capital to finance investments which may in turn limit their growth and ultimately their competitiveness. The essence of this uniqueness derives from a number of defining characteristics of cooperatives: they operate with the "user-owner" principle; there is an implied obligation to pay out accumulated allocated equity to members; they face special tax consequences for profits distributed on the basis of use[1]; and investment, financing, and operational choices may not be driven by profit maximization as the primary objective, as it is with investor-owned firms (IOFs) (Iliopoulos, 2003; Chaddad and Cook, 2002; Cook, 1995; Lerman and Parliament, 1993; Cobia and Brewer, 1989). Whether and the extent to which these characteristics imply relatively higher or lower reliance on debt by cooperatives remains unsettled in previous theoretical and empirical literature. Further, an important consideration in the capital structure discussion, one overlooked in the literature, is the mechanism by which the resulting capital structure is achieved.

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This paper seeks to examine the issue of capital constraints on U.S. agricultural supply and grain cooperatives and investor-owned firms. The objective of this investigation is two-fold: 1) identify whether cooperatives and IOFs have different capital structures; and 2) assess if the observed capital structure is the result of differences in operating and financial decisions that can be measured. A variant of the DuPont model – a decomposition of a firm's rate of return to equity into measures that relate to profitability, efficiency in asset use, and leverage – permits an empirical comparison between IOFs and cooperatives on their activities, debt structure, equity, and liquidity factors. Using firm-level panel data of financial information for cooperative and IOF agricultural grain and supply firms in Iowa, the two ownership types are compared to identify whether significant differences exist in their investment activities and financial efficiency. Restricting our analysis to a common industry and common geographic area limits the extent to which any differences in capital structure are due to heterogeneous market conditions. The panel nature of the data is also an advantage of this study, since it allows us to control for time-invariant, unobserved firm-level characteristics.

Our findings are mixed. While cooperatives in our sample have significantly lower debt-to-asset ratios than comparable IOFs, we do not find evidence that they face financial constraints, at least in the short run. However, for financing long term assets, our data suggest that cooperatives tend to rely more on equity capital, which may reflect a constraint on borrowing.

*Theoretical Underpinnings*

In cooperative theory, discussions of capital structure and access to capital are typically motivated by recognition of the "user-owner principle"; cooperatives are capitalized by those who use them and not by passive outside investors. This is regarded as a limitation on their access to capital and, practically speaking, has implications on equity, leverage, and financial management decisions. An examination of the literature reveals, however, that this principle can logically

result in a greater user of debt financing in some cases and lower use in others. Thus, whether the user-owner principle necessarily leads to a different capital structure in cooperatives relative to similar IOFs is unclear. As will be explored further, this is likely because of the competing interests of members in their three-way role as users, capital providers, and residual claimants to earnings.

The user-owner principle implies the decision to use a cooperative is a joint decision by the producer to both use and invest in it. The investment is the purchase of the membership stock and a retained allocation of the profits in the form of equity. This principle not only limits the potential pool of investors – those who contribute equity to the business must also patronize the business – but also limits the rate at which equity can be acquired. In a cooperative, equity is built through the allocation and retention of the co-op's profits to its members. An agricultural supply or grain marketing firm operating as an IOF can solicit investors without the tied requirement to buy products or deliver grain, and an IOF does not rely on equity accumulation through profits. For these reasons, it is often said that cooperatives are capital constrained, and the conclusion drawn is that cooperatives will rely more heavily on debt than their IOF counterparts for investments (Lerman and Parliament, 1990). Cooperative equity accumulation is further challenged considering that members' equity in a traditional cooperative is non-marketable, non-transferable, and its stated value does not appreciate through changes in market values. Also, if producers consider and weigh heavily the opportunity cost to investing in the cooperative instead of pursuing other investments (Soboh, Lansink and Van Dijk, 2012) – potentially in their own operation – added strains to equity accumulation occur. Finally, illiquidity of members' equity creates a horizon problem. Older members who may soon retire from farming have little business incentive to support investments in long-term projects when the benefits from the investment will accrue to those who use the cooperative in the future (Porter and Scully, 1987; Knoeber and Baumer, 1983; Cook and Iliopolos, 2000).

The user-owner principle not only impacts equity accumulation and management issues from producers' perspectives, it has implications for a cooperative manager's attitudes towards and propensity to take on risk. Cooperative managers may view the cooperative principle of risk sharing and mutual responsibility as an insurance policy, prompting them to assume more risk and borrow more heavily than managers of IOFs (Lerman and Parliament, 1990; Gentzoglanis, 1997). As a result, cooperatives may be less discriminating in their investments than IOFs, causing an overinvestment in assets and lower asset efficiency in generating profits.

While certain features of the cooperative business form imply a greater reliance on equity capital to finance investments relative to IOFs, other features suggest the contrary: that cooperatives will rely more heavily on debt than equity to finance growth. The user-owner principle creates an implied obligation to return a co-op's profits to members via equity redemption. Patrons are allocated a portion of the current year's savings (profits) proportional to their individual use, a portion of which is paid in cash to the patron-member and a portion retained as allocated member equity. A member's equity accumulates over time as s/he uses the cooperative and may be redeemed (paid) to the member at some time in the future. Lenders may not consider cooperative equity to be as secure as equity in IOFs because there is an expectation for cooperatives to eventually redeem in cash the equity held by their members.

The illiquidity of member equity and the uncertainty surrounding the timeframe for redeeming member equity in a traditional cooperative has implications for management as well. Except by continued use, members do not expect a direct appreciation of their equity investment as investors in IOFs do, so managers may treat this portion of equity as a costless source of capital and members' incentive to monitor management's use of it may be weaker, leading both to ignore the opportunity costs of capital (Lerman and Parliament, 1990; Dahl and Dobson, 1976). If the opportunity cost of this capital is not realized, reliance on equity financing may be greater than in an IOF where stock is valued based on expectations and management outcomes.

Even absent constraints on borrowing, cooperatives have an incentive to utilize equity capital in lieu of debt due to the differential tax treatment of profits in cooperatives. Profits in an IOF are taxed at the entity level and any profits passed to owners through stock dividends are taxed again at the individual level. Most profits in a cooperative are taxed only once – at the cooperative level or member level – depending on how the profits are distributed. The Modigliani-Miller theory of capital structure implies that the pass-through single taxation of earnings reduces the incentive for co-ops to maximize debt financing as compared with IOFs (Caves and Peterson, 1986). IOFs use the cost of debt financing to reduce their taxable income but cannot do the same with dividends paid to stockholders. Cooperatives deduct both the cost of borrowing and the profits distributed to patrons from taxable income, creating an additional incentive for equity financing, particularly when members and management do not assign the appropriate value or cost of equity capital.

Finally, differences in financing behavior and performance stem from differences in business objectives of cooperatives and non-cooperatives (Sexton and Iskow, 1993; Lerman and Parliament, 1993; Akridge and Hertel, 1992; Soboh, Lansink, Giesen, and Van Dijk, 2009; Soboh Lansink and Van Dijk, 2012). Cooperatives must be profitable; however, within the scope of the user-owner principle, a cooperative can be managed to achieve an objective other than strict profit maximization, such as maximizing patronage payments, optimizing net prices to producers, maximizing value to members, and maximizing quantities of products sold and marketed. The objective chosen by a cooperative will influence financing behavior. If the co-op positions itself in the purest sense of a cooperative – acting as an extension of the farm – then it will maximize members' on-farm profits, leading to lower firm profitability, slower equity accumulation and, ceteris paribus, a greater proportional use of debt financing. Conversely, a cooperative that pursues profit maximization will accumulate equity more quickly and be in a position to finance investments relying more heavily on equity.

*Empirical Evidence*

These theories of cooperatives provide reasons why one might expect a higher reliance on debt capital in some cases and a lower reliance in others. As such, the question of relative debt becomes an empirical exercise. Not surprising, the evidence here, too, is mixed. Lerman and Parliament's (1990) analysis of capital structure in a sample of dairy firms finds debt to asset ratios are not significantly higher for cooperatives relative to IOFs. A later study by these same authors finds cooperatives finance about half of investment in assets with equity, roughly the same as IOFs between 1973 and 1983, but significantly higher than IOFs after 1984, when IOFs reduced equity financing and used more long-term debt financing (Lerman and Parliament, 1993). Hardesty and Vikas (2007) report that California cooperatives in a variety of agricultural sectors (grain, dairy, fruit and vegetables, and farm supply) had lower debt-to-equity ratios than their counterpart IOFs. In contrast, Gentzoglanis (1997) examines 12 large Canadian dairy firms – half cooperatives and half IOFs – from 1986 to 1991 and finds that cooperatives in the sample use significantly more debt than IOFs. More recent investigations of the Italian wine sector and of agribusinesses in Greece similarly find that cooperatives have debt ratios higher than similar IOFs (Fazzini and Russ, 2014; Sergaki and Semos, 2006).

## Methodology

A firm's capital structure is the result of firm decisions as they react to market conditions. Because our ultimate goal is to contrast cooperative and IOF capital structures and understand why differences, if any, exist, we rely on the known relationships that exist between operational and financial outcomes. The DuPont Profitability linkage model is used to decompose a firm's return on equity ratio into its fundamental ratios: the asset turnover, profit margin, and leverage ratios. DuPont analysis is widely utilized by analysts to identify the impact of managerial decisions on financial performance and interactions among important financial/efficiency ratios (Barnard and Boehlje, 2004). This model has been introduced in the agricultural economics

literature as a diagnostic tool to understand the drivers of profitability and to identify which operational activities could be improved (Melvin *et al*., 2004). Theoretical contributions to this topic have included analyzing the relationship between a firm's decisions and capital structure (Collins, 1985) and the linkage between a firm's production and investment decisions (Gabriel and Baker, 1980). Featherstone *et al*. (1988) draw on Collins' model to assess the impact of farm policies on farm financial leverage, while Mishra, Moss, and Erickson (2009) and Mishra *et al.* (2012) apply a DuPont expansion to analyze differences in rates of return on equity and key profitability drivers across regions and time at the farm level. In this paper we utilize DuPont techniques to examine and compare the impact of important financial ratios on the capital structure of cooperative and investor-owned firms.

*Determinants of Capital Structure*

Collins (1985) derives the optimal capital structure – the debt to asset ratio – for a farm enterprise using the DuPont identity in an expected utility maximization framework in which the objective is to maximize the expected return on equity. In that study, he assumes that firms choose a level of debt given their equity positions. In reduced form, the optimal capital structure, δ* is a function of the expected return on assets $E(R_A)$, variance of the anticipated return on assets ($\sigma_A^2$), interest rate on debt ($i$), and risk aversion ($\rho$):

$$\delta^* = \delta(E(R_A), i, \rho, \sigma_A^2) \tag{1}$$

Following the DuPont expansion method, a firm's return on assets, $R_A$, can be decomposed into its profit margin and asset turnover ratios as follows:

$$R_A = \frac{\pi}{A} = \frac{\pi}{S} \cdot \frac{S}{A} \quad , \tag{2}$$

where π denotes profit (gross revenue minus the cost of production), $A$ are total assets, and $S$ is sales revenue. The ratio of profit to sales $\left(\frac{\pi}{S}\right)$, is profit margin ($margin$), a measure of operating efficiency. Asset turnover ($ATO$) measures how efficiently a firm's assets are used to

generate revenue, and is given by $\left(\frac{S}{A}\right)$. Although an increase in either of these efficiency ratios creates a greater return on assets, they imply different things about a firm's performance.

Substituting (2) into (1), a firm's optimal capital structure is:

$$\delta^* = \delta(E(margin), E(ATO), i, \rho, \sigma_A^2). \quad (3)$$

Factors that increase a firm's expected return on assets will also lead to greater leverage. Conversely, high interest rates, greater risk, and risk aversion tend to reduce a firm's use of debt. Thus, a higher profit margin and asset turnover have positive impacts on $\delta^*$ while higher interest rates and risk have negative impacts. Cooperatives and IOFs choose a level of debt given their equity positions. Patrons of cooperatives are also the owners, thus, the different ownership structures of cooperatives and IOFs may give rise to different operational and financing strategies.

*Data and Empirical Strategy*

The data employed in this analysis are a panel of annual accounting information for approximately 100 agricultural grain marketing and supply co-ops and 50 IOFs in Iowa from 1992 to 1995 collected by survey. The firms were selected via random sample from the population of facilities licensed in Iowa with the Grain Warehouse Bureau of the Iowa Department of Agriculture and Land Stewardship, the regulatory arm that monitors facilities licensed to store grain. Financial data were provided by the Grain Warehouse Bureau from the required financial monitoring data they receive from all licensed facilities[2] (Ginder and Baumler, 1997).

Table 1 provides variable descriptions and summaries from the data; table 2 defines the ratio constructions that will be used in the empirical model and provides means and differences by firm type. Collins' (1985) work provides a theoretical foundation for an empirical strategy to understand the key financial characteristics that differentiate co-ops from IOFs using measures of firms' capital structure $(\delta_{jt})$, asset use efficiency $(ATO_{jt})$, operating efficiency $(marin_{jt})$, and

interest. To operationalize his model for our purposes, we use standard constructs for these variables except interest. Here, the effect of interest is captured by an inverse interest coverage ratio $(ICR_{jt})$ covariate.[3] In addition to the covariates suggested by Collins, our model includes measures for liquidity $(Liq_{jt})$ and debt structure $(DebtStr_{jt})$. A firm's liquidity is the ratio of the value of inventory (e.g. grain, fertilizer, chemical, fuel) to current assets. Gabriel and Baker (1980) show that liquidity serves as a risk management tool to offset cash shortages, and a large inventory relative to total current assets suggests short-term financing needs that will impact a firm's capital structure. In an extended version of the empirical model presented later, a firm's debt structure – the ratio of long-term liabilities $(LTL_{jt})$ to current liabilities $(CL_{jt})$ – is added to examine the difference between impacts of the financial measures on short-term and long-term borrowing.

A key observation from table 1 is that cooperatives in our sample are significantly larger than the IOFs in balance sheet and income statement measures. However, the ratios in table 2 that enter into the empirical model are relative measures which can be compared among firms of various sizes. To test for statistical significance of these measures between cooperatives and IOFs, we estimate the following regression:

$$F_{jt}^{k} = \alpha + \gamma^{k} type_{j} + \mu_{j} + \xi_{jt}, \tag{4}$$

where $F_{jt}^{k}$ is financial ratio $k$ for firm $j$ at time $t$; $type_j$ is a binary variable which takes a value of 1 if the firm is a cooperative and 0 otherwise, $\mu_j$ are firm-specific unobserved time-invariant effects that capture the difference in firm $j$'s average measure from the average of other firms of the same type, and $\xi_{jt}$ is the remaining disturbance which satisfies the i.i.d. assumption. The last column in table 2 contains estimates for $\gamma^{k}$, the type-specific average differences.[4] The estimates suggest that there are differences in the financial constructs of cooperatives and IOFs, and, in particular, rather large differences in their asset use efficiency $(ATO_{jt})$, inventory relative to total current assets $(Liq_{jt})$, and debt structure $(DebtStr_{jt})$. Consistent with prior studies,

cooperative firms in our sample have a lower debt to asset ratio $(\delta_{jt})$ on average than do investor-owned firms. Also, these cooperatives on average have a larger proportion of their current assets as inventory (versus cash), which may partially explain their relatively lower asset use efficiency.[5] IOFs on average have a higher proportion of their total debt as long-term debt. Finally, while interest expense is a greater portion of earnings $(EBIT_{jt})$ for cooperatives than IOFs, the difference is statistically insignificant. Plots of the observed debt-to-asset ratio for each firm against its prior year liquidity, profit margin, inverse interest coverage, and asset turnover ratios show that a given financial ratio for IOFs tends to have greater variability than for the cooperatives in our sample.

Using equation (3) as the basis for our empirical specification and adding the covariates described above, the empirical equation for optimal capital structure is given as:

$$\delta_{jt} = \beta_0 + \gamma_0 type_j + \beta_1 Liq_{jt} + \sum_{k=2}^{K} \beta_k F^k{}_{j,t-1} + \gamma_1 Liq_{jt} \cdot type_j + \sum_{k=2}^{K} \gamma_k F^k_{j,t-1} \cdot type_j + \rho_{jt} + \varepsilon_{jt}, \qquad (5)$$

where $\delta_{jt}$ is firm $j's$ capital structure at time $t$; $type_j$ is a binary variable which takes a value of 1 if the firm is a cooperative and 0 otherwise; $F^k_{j,t-1}$ is a vector of financial constructs, *k,* for firm $j$ at time *t-1* and $\varepsilon_{jt}$ is a standard error term. The term $\rho_{jt}$ captures the unobserved firm-specific attributes including the firm's risk attitudes and management quality, expressed as:

$$\rho_{jt} = \xi_j + \alpha Z_{jt}\ , \qquad (6)$$

where $Z_{jt}$ is the firm's wealth and $\xi_j$ represents the unobserved firm-specific characteristics that impact its risk tolerances. Because the firms in our data are cooperatives and IOFs in the same industry in a relatively small geographic area, we impose the assumption that the unobservable risk is faced equally by all firms, $\xi_j = \bar{\xi}, \forall j$. This becomes a component of the constant term. Risk attitudes are linear in a firm's wealth, measured using the value of fixed assets. To identify the effect that firm type has on capital structure and the firm type-specific effects on financial performance measures, we estimate the empirical model in equation (5) with and without firm-

type interactions using a random effects Feasible Generalized Least Squares (FGLS) estimation strategy.[6]

The DuPont deconstruction of a firm's return on equity is an identity, and by construction, at any time period *t*, each of the financial measures in the model are determined simultaneously and highly correlated. Endogeneity is a concern that estimation strategies based on the DuPont decomposition must address. We do two things. First, the explanatory variables are constructed so they continue to capture the important financial performance indicators given in the DuPont deconstruction while not being identical to elements in the DuPont system. For example, the construction of the interest expense ratio and the addition of the liquidity measure vary from the standard DuPont decomposition. Second, we lag the independent variables one-time period.[7] Only $Liq_{jt}$ enters contemporaneously with the debt-to-asset ratio.

The empirical regression model in equation (5) incorporates an interaction of firm type with the financial covariates[8]. In aggregate, prior theoretical and empirical investigations of differences in capital structure between cooperative firms and IOFs suggest ambiguity in the firm-type effect. This estimation strategy allows us to be agnostic about the firms' objectives and adherence to profit maximization. If the financial constraint hypothesis holds for cooperatives, and they rely more heavily on equity than debt to finance activities, the debt-to-asset ratio of cooperatives should be less sensitive to interest rate changes relative to IOFs. We would also expect that increases in operating and asset use efficiency would lower the debt level of cooperatives as the difficulty in accessing risk capital implies a higher cost of borrowing.[9] In the contrary case, if cooperatives are not able to obtain sufficient equity funds from patron members, the limited pool of potential equity investors implies a relatively greater reliance on debt financing by cooperatives relative to IOFs.

## Results and Discussion

Coefficient estimates and model fit statistics are provided in table 3. Column (1) presents the estimates without the interaction terms for firm type and column (2) adds the interaction terms between firm-type dummy and financial measures as additional explanatory variables. Where in column 1 the marginal impact on capital structure of financial measures is forced to be equal for cooperatives and IOFs, the estimates in column 2 permit them to be different.

When we allow no distinction by firm type, only the liquidity ratio is significantly related to capital structure for these firms. The positive sign of the coefficient is as expected: firms with a large inventory relative to total current assets on average are more leveraged. Once the interaction terms are added, however, differences emerge between the two firm types both in terms of the magnitude and direction of the effect of financial measures and capital structure. The estimated coefficient on firm-type is significant and negative, indicating that cooperatives in our sample carry lower leverage than their in-state counterparts. That cooperatives in our sample rely more on equity financing than the IOFs may not be the result of a borrowing constraint but rather a reflection of the member-benefit objective of the cooperatives.

Table 4 presents the marginal effects on debt to asset ratio for each of the financial measures for each firm type with elasticities provided in the brackets. The results for the cooperative firms are consistent with Collins' model. Higher profit margin and asset turnover are associated with increased leverage, and while the coefficient on the inverse interest coverage ratio is insignificant, it is negative, as predicted by the theory.

Interestingly, the empirical relationship between profit margin and debt to asset ratio is distinctly different between co-ops and IOFs. This suggests that higher profit margins, which ceteris paribus, imply firms are able to generate more internal cash flow, result in deleveraging activities for IOFs but increasing the leverage for co-ops. In other words, IOFs tend to rely more on equity financing as they become more profitable, while co-ops increase debt financing. The estimated elasticity on *Margin* implies that a 10 percent increase in profit margin results in a 10 percent increase in debt to asset ratio for the cooperative firms. More leverage is associated

with higher sales, perhaps because it allows the cooperatives to either invest more in capital, such as equipment or storage capacity in the long run, or enables cooperatives to purchase more product from members in the near term. Combining this finding with the impact of inventory to current ratio on capital structure, the latter case seems more plausible.

For both cooperatives and IOFs, a greater inventory to current asset ratio results in higher leverage; however cooperatives are on average more sensitive to inventory-related changes than are IOFs. For cooperatives, the estimated elasticity implies that a 10 percent increase in the inventory to current assets ratios is associated with a 5.5 percent increase in the debt to asset ratio. This is roughly four times as large as the estimated elasticity for IOFs. For additional units of inventory per unit of current assets, co-ops borrow more to finance the inventory than do IOFs.

Overall, the estimation results show that cooperatives rely less on debt financing than IOFs in our sample, which is consistent with the hypothesis that cooperatives may face greater difficulty accessing the external capital market relative to similar IOFs. An alternative hypothesis that cannot be ruled out is that cooperatives use more equity financing because managers view it as a costless source of capital. We do observe that cooperatives are likely to seek more debt financing when operating efficiency, as characterized by operating margin and asset turnover, improves.

One limitation of this analysis is that the financial ratios are only lagged by one period. Thus, the evidence of a capital constraint for cooperatives suggested here is only relevant to short-term borrowing. The impact of long-term borrowing cost on cooperatives' capital structure is not clear. To investigate this issue further, we add a measure of debt structure (the lagged ratio of long-term liabilities to current liabilities) to our model to examine the potential difference in financing strategies between the two firm types. Long-term borrowing finances firms' long-lived assets whereas current liabilities reflect borrowing for operations. [10] Firms with a higher proportion of long-term debt to current debt will have a higher debt-to-asset ratio, if firms finance investments with debt, as opposed to equity capital. Summary statistics of the debt ratio measure are

presented in table 2. Note that long-term liabilities are only 15% of the value of current liabilities for the cooperatives in the sample, which is about one-third the proportion for IOFs.

The third column of table 3 presents the regression results, and the marginal effects are shown in table 4. The estimates on the other financial measures are robust to this change in specification. Comparing the marginal effect of debt structure on leverage between co-ops and IOFs in table 4, we find that as long-term liabilities increase relative to current liabilities, the debt-to-asset ratio increases for IOFs, but has no impact for cooperatives. This suggests that for cooperatives, debt structure does not significantly impact leverage. This may reflect a greater reliance on equity rather than debt to finance the long-lived capital assets, perhaps because they view equity as a costless source of capital, or co-ops may just take a conservative investment strategy, financing fixed assets with available equity (Lerman and Parliament, 1993).

## Conclusions

Utilizing panel data of agricultural grain and supply firms in Iowa, we find that ownership structure does impact the operating capital structure of a firm. Our empirical findings have shown that cooperatives are less leveraged on average, relative to IOFs but the evidence that cooperatives face a capital constraint is mixed. While we find that cooperatives in our sample have lower debt to asset ratios on average than IOFs, our regression results suggest that as cooperative firms become more profitable and more efficient in their use assets, they increase their leverage, whereas IOFs do the opposite. The positive effects of increasing inventories on debt to asset ratios suggest that the increased leverage is likely tied to short-term borrowing to finance inventories. Yet, when we compare debt structure between cooperatives and IOFs, we find that cooperatives have much lower ratios of long-term to current debt and that debt structure does not impact overall leverage for cooperatives. This suggests that cooperatives tend to use more equity to finance investments relative to IOFs, and could reflect a constraint on long-term borrowing, or could indicate that managers view equity as a costless source of capital, or perhaps,

just reflect a more conservative investment approach. These short- and long-run differences have implications for the survival and growth of agricultural cooperatives. While in the short run, access to debt financing allows these firms to operate profitably, ultimately in the longer term, large investments in technology and fixed assets will be required to maintain competitiveness in this industry. Future work in this area to further investigate these short-term and longer-term differences could lead to an improved understanding of the extent and nature of these financial constraints**.**

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[1] As a reviewer noted, in cooperative parlance, "profits" are usually called "net margins," "net earnings," "net returns," or "net income." They may also be referred to as "savings." Throughout the paper we will use the terms profits and earnings interchangeably.

[2] We omit from our analysis three firms reporting a debt-to-asset ratio greater than one.

[3]Two common measures for capturing the effect of interest are the interest expense ratio and the interest coverage ratio. The interest expense ratio is a firm's interest expense divided by debt. The interest coverage ratio is profit before taxes and interest expense (EBIT) divided by interest expense. We use an inverse interest coverage ratio ($Int_{jt}$) to avoid the issue of dividing by zero as some observations in our data have no interest expense. Also, because our explanatory variable is a measure of debt, the interest expense ratio would introduce endogeneity as a firm's interest rate, and therefore interest expense, is affected by the amount of debt it carries.

[4] Since our sample consists of firms selected randomly from the population of grain and farm supply firms in Iowa; we assume $\mu_j$ is uncorrelated with firm type.

[5] This is consistent with the cooperative culture: cooperatives tend to maintain inventories for the benefit of their members, even when it is not most efficient or profitable to do so. This means they need, relatively speaking, larger operating lines to finance these current assets.

[6] The Breusch and Pagan Lagrangian multiplier test for random effects (RE) indicates the existence of unobserved individual attributes that need to be controlled for. The model was also

estimated in a fixed effects (FE) framework. We compared the FE and RE specifications using the robust Hausman test (Woodridge, 2010) due to the presence of heteroskedasticity across firms, and we cannot reject the assumption that independent variables are uncorrelated with individual unobservables. If we control for time fixed effects and firm type in the RE specification, all estimates are similar to those under FE and bear the same signs. So we conclude that time fixed effects and firm type capture the unobservable factors reasonably well under RE, and RE is an appropriate specification for the subsequent analysis.

[7] $E_{t-1}(F^k{}_{jt})$ is the expected value of financial covariate $k$ for firm $j$ at time $t$. We assume it takes a naïve expectation form given by $E_{t-1}(F^k{}_{jt}) = F^k{}_{j,t-1}$.

[8] The IOFs in our study can be of various business structures, e.g., sole proprietorships, corporations, LLCs. A reviewer suggested that including IOF business type in our model would be more informative about the effect of business type on financial performance and capital. However, our data do not permit us to identify the firm structure of the IOFs.

[9] Chaddad, Cook, and Heckelei (2005) test for the presence of financial constraints in cooperatives using panel data for U.S. agricultural cooperatives from CoBank by examining the sensitivity of investment in physical assets to cash flow. The key hypothesis is that investment should not be a function of cash flow if cooperatives do not face financing constraints; yet the authors do find a positive and significant effect of cash flow in investment. In comparison, cash flow does not affect investment in a comparable sample of IOFs in the food manufacturing industry.

[10] Current liabilities may also include proceeds payable to members at the end of the year, so they may be greater for cooperatives than IOFs (Royer, 1991).

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Table 1. Description of Variables

| | | Cooperatives | | Investor-Owned Firms | |
|---|---|---|---|---|---|
| **Variable** | **Description** | **Mean (in millions)** | **St. dev. (in millions)** | **Mean (in millions)** | **St. dev. (in millions)** |
| $A_{jt}$ | Total Assets | \$8.50 | \$1.02 | \$1.77 | \$2.24 |
| $D_{jt}$ | Total Liabilities | \$4.25 | \$4.60 | \$ 0.96 | \$1.20 |
| $\Pi_{jt}$ | Pre-tax Profit | \$0.34 | \$0.43 | \$0.05 | \$0.12 |
| $Rev_{jt}$ | Total Revenue | \$21.11 | \$25.30 | \$6.83 | \$7.45 |
| $S_{jt}$ | Sales (Revenue – non-operating income) | \$20.10 | \$24.70 | \$6.69 | \$7.32 |
| $EBIT_{it}$ | Earning before tax and interest | \$0.49 | \$0.48 | \$0.09 | \$0.01 |
| $Int_{jt}$ | Annual Interest Expense | \$0.16 | \$0.16 | \$0.05 | \$0.06 |
| $CA_{jt}$ | Current Assets | \$4.86 | \$8.64 | \$1.10 | \$1.22 |
| $Z_{jt}$ | Fixed Assets | \$2.15 | \$1.98 | \$0.57 | \$0.99 |
| $Inv_{jt}$ | Inventory | \$2.94 | \$3.21 | \$0.55 | \$0.84 |
| $LTL_{jt}$ | Long-Term Liabilities | \$0.62 | \$0.99 | \$0.24 | \$0.43 |
| $CL_{jt}$ | Current Liabilities | \$3.62 | \$3.90 | \$0.725 | \$0.88 |

Table 2. Firm-type average financial ratios

| | | Cooperatives | IOFs | |
|---|---|---|---|---|
| Ratios | Definition | Mean | Mean | Difference |
| $\delta_{jt}$ | Debt to Asset Ratio = $D_{jt}/A_{jt}$ | 0.468 | 0.519 | -0.052* |
| $margin_{jt}$ | Operating Profit Margin = $\pi_{jt}\ /Rev_{jt}$ | 0.1387 | 0.1474 | -0.008 |
| $ATO_{jt}$ | Asset Turnover = $S_{jt}\ /A_{jt}$ | 2.467 | 5.115 | -2.648*** |
| $Liq_{jt}$ | Liquidity = $Inv_{jt}\ /CA_{jt}$ | 0.605 | 0.434 | 0.170*** |
| $ICR_{jt}$ | Inverse Interest coverage ratio= $Int_{jt}/EBIT_{jt}$ | 0.318 | 0.0689 | 0.249 |
| $DebtStr_{jt}$ | Debt Structure = $LTL_{jt}/CL_{jt}$ | 0.157 | 0.477 | -0.290*** |

Notes: * denotes significance at 10%, ** denotes significance at 5%, *** denotes significance at 1%.

Table 3. Random effects estimates of equation (5)

| Variable | Model 1 | Model 2 | Model 3 |
|---|---|---|---|
| *Liquidity* | 0.240*** | 0.125*** | 0.155*** |
| | (0.034) | (0.047) | (0.047) |
| *Margin* | -0.017 | -0.568*** | -0.594*** |
| | (0.176) | (0.230) | (0.226) |
| *ATO* | 0.001 | -0.003 | -0.004 |
| | (0.0037) | (0.003) | (0.003) |
| *ICR* | 0.001 | 0.001 | 0.001 |
| | (0.002) | (0.002) | (0.0028) |
| *type* (= 1 if co-op) | | -0.586*** | -0.537*** |
| | | (0.085) | (0.085) |
| *type*Liquidity* | | 0.299*** | 0.273*** |
| | | (0.065) | (0.064) |
| *type*Margin* | | 1.555*** | 1.478*** |
| | | (0.357) | (0.357) |
| *type*ICR* | | -0.0030 | -0.003 |
| | | (0.007) | (0.0034) |
| *type*ATO* | | 0.039*** | 0.035*** |
| | | (0.010) | (0.011) |
| *Debt Structure* | | | 0.055*** |
| | | | (0.013) |
| *type*Debt Structure* | | | -0.001 |
| | | | (0.045) |
| *Fixed Asset* | 0.001 | 0.001** | 0.001** |
| | (0.001) | (0.001) | (0.001) |
| *Yr94* (dummy) | -0.003 | 0.001 | 0.0045 |
| | (0.008) | (0.008) | (0.008) |
| *Yr95* (dummy) | 0.346*** | 0.030*** | 0.033 *** |
| | (0.008) | (0.008) | (0.008) |
| *Constant* | 0.335*** | 0.549*** | 0.514*** |
| | (0.039) | (0.051) | (0.051) |

Notes: Estimated standard errors are given in parentheses. Asterisks denote significance levels as follows: * 10 percent; ** 5 percent; and *** 1 percent significance.

Table 4. Estimated marginal effects on capital structure, difference between firm types

| | **Cooperatives** | **Investor Owned Firms** | **Difference** |
|---|---|---|---|
| *Margin* | 1.088*** | -0.5938*** | 1.4784*** |
| | (0.001) | (0.019) | (<0.001) |
| | [0.322] | [-0.169] | |
| *ATO* | 0.0342*** | -0.004 | 0.0382*** |
| | (0.003) | (0.152) | (0.001) |
| | [0.180] | [-0.039] | |
| *Liquidity* | 0.4277*** | 0.1551*** | 0.2726*** |
| | (< 0.001) | (0.001) | (<0.001) |
| | [0.553] | [0.130] | |
| *ICR* | -0.0020 | 0.0011 | -0.0031 |
| | (0.548) | (0.548) | (0.390) |
| | [-0.001] | [<0.001] | |
| *Debt. Str* | 0.0548 | 0.0548*** | -0.00001 |
| | (0.207) | (<0.001) | (1.000) |
| | [0.018] | [0.050] | |

Notes: Marginal effects and elasticities estimated from the random effects model on debt to asset ratio.

P-value in parentheses. Significance levels indicated as: * p<0.1; ** p<0.05; *** p<0.01. Elasticities in brackets.