# Cooperatives capital structure adjustment during the agricultural downturn

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**Abstract:** This study investigates adjustments in capital structures for agricultural cooperatives and differences before and during the agricultural downturn which started in 2013. We estimate a simultaneous equation model to test for cooperatives' capital structure strategies based on two main theories from the corporate finance literature: the trade-off theory and the pecking order theory. Estimation results reveal that agricultural cooperatives in the U.S. generally adjust to short-term financial targets for equity and debt, supporting the trade-off theory while there is little support for the pecking order theory within the agricultural cooperatives sector.

*Key words: agricultural cooperatives, capital structure, trade-off theory, pecking order theory.*
*JEL codes:* Q13, Q14

## 1. Introduction

A fundamental issue within corporate finance concerns the capital structure choices that firms make. A careful balance between debt and equity could mitigate financial frictions caused by asymmetric information issues (Jensen and Meckling, 1976) and achieve better profitability and higher growth. In the agricultural economics literature, a growing body of research addresses farms' and agricultural cooperatives' access to financing as well as their financing strategies based on their capital structures (Richards, Manfredo, 2003; Zhao, Barry and Katchova, 2004; Li, Jacobs and Arts, 2015). Similarly, a basic premise within the literature on agricultural cooperatives is identifying the optimal strategies for equity management and financing activities and achieving growth and longevity (Barton et al., 2011). Furthermore, researchers have argued that financial constraints are one of the major reasons leading to cooperatives' failures in the food system which has become capital-intensive, tightly coordinated, and concentrated (Vitaliano, 1983; Cook, 1995; Chaddad, Cook and Heckelei, 2005).

Classical finance literature has provided two main theories to study the determinants of optimal capital structure within businesses -- the trade-off theory and pecking order theory. A preference to use internal funds indicates that firms' capital choices follow the pecking order theory to mitigate agency costs associated with adverse selection and moral hazard. Adjusting the firm debt ratio to an optimal level suggests that firms are willing to trade-off debt and equity to maintain certain targets of capital structure. Previous research has claimed that the trade-off theory and the pecking order theory have contributed significantly and jointly to understanding the capital structure of corporate firms (Fama and French, 2002).

Determining which theory agricultural cooperatives follow to achieve optimal capital structure is important. First, agricultural cooperatives' distinct "user-owner principle" characteristic puts limitations on cooperatives' access to the capital market and has implications for their leverage, equity and financial management decisions. Second, cooperatives as part of the agribusiness industry tend to be more sensitive to the periodic episodes of financial crises or economic downturns, which may significantly impact their internal finance positions as well as investment activities (Hubbard and Kashyup, 1992; Bierlen and Featherstone, 1998). Previous research has been conducted to test various capital structure theories for farms (Barry, Bierlen and Sotomayor, 2000; Zhao, Barry and Katchova, 2004), however, little research has been done on agricultural cooperatives.

Our objective is to test the applicability of the trade-off theory and pecking order theory to cooperatives' financial structure. We implement our approach in two steps: first, we test the pecking order theory whether internal funds are preferred over external funds, such as the use of short-term and long-term debt. The pecking order theory is then compared with the trade-off theory in which debt, equity, and patronage refunds adjust toward their optimal targets. Second, we compare how the cooperative capital structure change before and during the agricultural downturn, which is defined to have started in 2013 when farm incomes fell and remained at 50% of their peak. We estimate a simultaneous equation system which allows us to disentangle the effects of each component in the capital structure. We explore different time periods to account for impacts of the recent agricultural downturn and show that trade-off hypotheses are partially supported while the pecking order hypotheses fail to be supported in almost every equation of the model. Meanwhile, significant changes have been observed before and during the agricultural downturn period which imply that cooperatives tend to lean more toward trade-off adjustments after the downturn.

## 2. Theoretical Foundation

Agricultural cooperatives are different from investor-owned firms (IOFs) in significant ways due to their unique characteristics especially due to their "user-owner principle." Unlike IOFs, cooperatives are capitalized by member users in addition to outside investors. While such principle is consistent with the mission of cooperatives and might lead to the conclusion that cooperatives tend to focus on equity financing, a careful examination of the literature suggests that cooperatives could also be debt financing because of the user-owner principle. The user-owner principle implies that decisions within cooperatives are jointly determined by users who both use and invest in the cooperatives, which not only limits the pool of investors but also the rate at which equity is accumulated within cooperatives. Meanwhile, cooperatives have limited access to the capital market and cooperative equity does not appreciate according to market trends which further reduce the users' incentives to invest in their cooperatives when facing higher opportunity costs (Soboh *et al.,* 2012) or other long-term investment choices (Porter and Scully, 1987; Cook and Iliopolos, 2000). On the other hand, member equity within cooperatives accumulates over time but might be redeemed to members sometime in the future. Equity redemption will be recognized as a negative sign by agricultural lenders due to the expectation that cooperatives might eventually redeem all equity back to members. Though cooperatives must be profitable to continue serving their members, their ultimate goal might not be to maximize profits, as the IOF's goal is, but to maximize patronage refunds or overall member value. The objectives selected by cooperatives will influence their financing behaviors and be reflected in their capital structure. The goal of cooperatives is to maximize on-farm profits, which reduces the speed of equity accumulation and causes the use of more debt financing. In contrast, equity accumulation will become faster and if cooperatives set profit maximization as the ultimate goal.

Classical capital structure studies in financial economics include two prevalent main theories—the trade-off theory and the pecking order theory. The trade-off theory (or partial adjustment theory) was first introduced by Miller (1977), who claims that the firm optimal debt ratio is the outcome of trading off the benefits and costs of an additional dollar of debt and that firms will gradually adjust their debt ratio to the optimal level to maximize the value of assets. Benefits of debt include interest that is deductible from the company's tax (Modigliani and Miller, 1963), less cash flow problems (Jensen, 1986; Stulz, 1991), and allowing for the option to liquidate

(Harris and Raviv, 1990a). Disadvantages of debt consist of potential costs of financial distress (Kim, 1878) and agency costs arising between owners and lenders (Jensen and Meckling, 1976; Myers, 1977). If an adjustment to a changing target is costly, the trade-off theory is appropriate. The trade-off theory arises when firms are not able to fully adjust to their optimal capital structure in imperfect financial markets. Myers (1984) showed that this trade-off approach implied a mean reverting process, where the company is reverting its financial structure to a target or optimal level. Hovakimian, Opler and Titman (2001) found that such target or optimal levels depend on the characteristics of the firm.

The pecking order theory of capital structure is another influential capital structure theory. In contrast to the trade-off theory, Myers (1984) and Myers and Majlauf (1984) suggested that firms do not have target capital structure. Instead, firms' choices of capital structure are driven by their preference of different sources of funds due to adverse selection in the financial markets. For example, corporate managers usually have a better understanding of the performance and health of their firm compared to outside investors. Because of transactions costs when issuing new securities, firms are also facing information costs because the capital market would recognize the issuing of equity as a negative sign, resulting in the firm equity to be undervalued. Typically, there are three sources of funding available to firms: retained earnings, debt, and equity. Retained earnings have no adverse selection problems, debt tends to be riskier than retained earnings, and equity has the most adverse selection problems. For outsiders, equity is strictly riskier than debt. And from the perspective of the firm, retained earnings are a better source of funds than debt, and debt is better than equity financing. As a result, the pecking order theory predicts a hierarchical order in firm financial policies. Internal funds are the most preferred sources of financing, followed by lower risk debt financing only if internal funds become insufficient, with equity financing being the last choice. According to the pecking order theory, cooperatives will increase cash holdings or pay fewer patronage refunds during profitable periods and draw down cash holding and then increase debt levels during economic downturns.

**3. Model**

Following Jalilvand and Harris (1984) and Vogt (1994), the firm realized capital structure can be recognized as the outcome of a partial equilibrium between the firm inflow and outflow of funds. The inflow of funds can be categorized as cash flows and changes in equity, debt, and other liabilities, while the outflow of funds is usually considered as fixed investment spending, change in assets and dividend payoffs. We follow such flow identity, with several modifications to accommodate data availability and the uniqueness of U.S. agricultural cooperatives, to define the flow of funds identity for cooperatives as:

(1) $inv + PAT = ld + sd + cf$

Where *inv* is the change in investment from one year to the next, $PAT$ is the patronage refund (or patronage dividend paid back to members), $ld$ is the change in long-term debt, $sd$ is the change in short-term debt, and $cf$ is cash flow. In this study, all stock variables are denoted by upper case letters while lower case letters denote flow variables. After we re-arrange the equation, the demand for external funds (short/long-term debt in our case) would be expressed as

(2) $sd + ld = inv + PAT - cf$

Another result from Jalilvand and Harris (1984) demonstrates that each component of external funds is a function of the demand for total external funds (*sd*+*ld*) and the deviation of its stock value from the optimal target. By using $sd+ld$ as an explanatory variable, as Vogt (1994) claims, information about investment will be lost. Therefore, we split the demand for total external funds into each component and make the investment endogenized to ensure that our model is consistent with the trade-off and pecking order hypotheses. We define the unobservable factors into two groups: one that varies over time (due to the fluctuation of macroeconomic factors) and another that varies by size (due to differences in operational, industrial, and business units). We then include year and size fixed effects into our model to control for such variations.

Based on the equation for the demand of external funds and the concept of endogenizing the change in investment as well as the patronage refunds, we build the following the simultaneous equation system to capture the financing behaviors of cooperatives:

(3) $PAT_{it} = \alpha_1 cf_{it} + \alpha_2 ld_{it} + \alpha_3 sd_{it} + \alpha_4 PAT_{i(t-1)} + \alpha_5 Size_i + \alpha_6 YR_t$
(4) $ld_{it} = \beta_1 inv_{it} + \beta_2 cf_{it} + \beta_3 sd_{it} + \beta_4 PAT_{it} + \beta_5 \left(LD_i^* - LD_{i(t-1)}\right) + \beta_6 Size_i + \beta_7 YR_t$
(5) $sd_{it} = \gamma_1 inv_{it} + \gamma_2 cf_{it} + \gamma_3 ld_{it} + \gamma_4 PAT_{it} + \gamma_5 \left(SD_i^* - SD_{i(t-1)}\right) + \gamma_6 Size_i + \gamma_7 YR_t$
(6) $inv_{it} = \delta_1 Sl\_Gr_{i(t-1)} + \delta_2 cf_{it} + \delta_3 PAT_{i(t-1)} + \delta_4 Size_i + \delta_5 YR_t$

where *LD* and *SD* are the stock variables of long-term and short-term debt, *Sl_Gr* is the sales growth rate, a proxy for the investment opportunity, and *Size* and *YR* represent the size and year fixed effects. This model is estimated using Generalized Method of Moments. Due to the limited number of observations, we cannot use cooperative-level fixed effects. Otherwise, the number of parameters to be estimated would be larger than the number of observations and would make the GMM unidentifiable. Therefore, we create size fixed effects based on the total assets of cooperatives. To create size fixed effects, we sort the total assets for all cooperatives in the sample and assign cooperatives to 10 groups by using the 10th-90th quantiles as thresholds for each size category. The terms $\left(LD_i^* - LD_{i(t-1)}\right)$ and $\left(SD_i^* - SD_{i(t-1)}\right)$ measure the deviation of long-term and short-term debt toward their optimal target levels $LD_i^*$ and $SD_i^*$, respectively. To reduce heteroskedasticity, we follow the scaling method adopted by Vogt (1994) and Barry, Bierlen, and Sotomayor (2000), and scale each variable in our model by the beginning-of-period fixed assets *k*. After scaling, the variables in our model are effectively transformed into financial ratios.

In the patronage refunds equation, patronage refunds are described as a function of the ratios for cash flow, short-term and long-term debt, and lagged patronage refunds. In the equations of long-term and short-term debt, the change in long-term (short-term) debt is defined as a function of the ratios for investment, cash flow, short-term (long-term) debt, patronage refunds, and mean deviation terms, which measure the speed of adjustment toward their optimal targets. We split the debt into long-term and short-term categories to test whether the change in internal funds will have a greater impact on each type of debt. Patronage refunds are a proxy for the availalbity of internal funds in our model; the cooperative might choose a lower level of patronage refunds to cover short-term financing needs, therefore, changes in the patronage refunds variables should have a larger impact on short-term debt than long-term debt.

In the investment equation, we estimate the investment opportunities as a function of cash flow, lagged sales growth and lagged patronage refunds. Ideally, the investment opportunities should be estimated as Tobin's *q*, which is the ratio of market value of assets to the replacement cost of assets, however, this method is not applicable in our study since the market values of cooperatives are unobservable. A proxy for Tobin's $q$, the fundamental $q$, which is the marginal profitability of capital, is introduced (Gilchrist and Himmelberg, 1995) and has been adopted to measure the investment opportunity for firms with limited access to capital market as well as private agricultural business units (Bierlen and Featherstone, 1998; Barry, Bierlen, and Sotomayor, 2000; Chaddad, Cook and Heckelei, 2005). However, the estimation of fundamental $q$ would consume too many degrees of freedom since it involves several lagged values as instrumental variables, and would not allow us to identify the impact of the agricultural downturn on cooperatives' capital structure. Therefore, we follow another stream of measuring the investment opportunity in prior finance literature (Lehn and Pouslen, 1989; Shin and Stulz, 1998; Whited and Wu, 2006; Badertscher, Shroff and White, 2013) by using the sales growth as a proxy.

The trade-off (or partial adjustment) hypotheses claim that based on the performance in the previous period, cooperatives' borrowing and dividend policies correspond to the adjustment toward the optimal debt and equity. Since cash flow and the reduction in patronage refunds could be considered as sources of internal funds, cooperatives should respond to an increase in cash flow by increasing borrowing and reducing dividend payments to maintain their target debt and equity ratios. Therefore, the relationships between cash flow and debt, and between cash flow and patronage refunds are expected to be positive, while the relationship between debt and patronage refunds is expected to be negative under the trade-off hypotheses. Meanwhile, significant positive coefficients for the adjustment speed of long-term debt $\beta_5$ and short-term debt $\gamma_5$ should be observed if the trade-off hypotheses hold. If adjustment behaviors occur immediately in a frictionless market, we should observe the adjustment speed coefficients to equal to 1, however, because of frictions in the market, the coefficients would fall between 0 and 1.

Besides the trade-off between cash flow, debt and patronage refunds, the structure of debt is as important as the level of debt for cooperatives. Therefore, cooperatives also need to trade-off between short-term and long-term debt due to their unique risks and cash flow characteristics. If cooperatives have a global debt ratio, then short-term and long-term would be viewed as substitutes and therefore would be negatively correlated.

In contrast to the trade-off theory, the pecking order theory assumes that no optimal target adjustment behaviors exist in the firm capital structure. Under the pecking order hypotheses, the coefficients of adjustment speed should not differ significantly from 0. Meanwhile, the pecking order theory implies that if cooperatives follow the financing preference of internal funds over debt and equity, a negative relationship between cash flow and debt should be observed. Based on this, we would expect the relationship $\gamma_2 < \beta_2 < 0$ to exist.

The patronage refunds to member-users of cooperatives are deducted from internal funds. A reduction in patronage refunds could be viewed as a tool to increase internal funds, which is preferred over debt financing (especially short-term debt since patronage refunds are generally adjusted on an annual base). Therefore, we should expect that positive relationships between patronage refunds and short-term and long-term debt will be observed. Under the pecking order theory, cooperatives with higher current and expected investments will have to maintain a higher flow of internal funds. When large investments are projected, cooperatives will maintain low risk debt under the pecking order preference in order to avoid financing investments with new risky securities. Therefore, conditional on the investment opportunity, exogenous increases in current period cash flow should increase investments while increases in previous period patronage refunds would result in investments to decrease.

The system of equations is estimated with the Generalized Method of Moments (GMM) approach, using instrumental variables for each equation in the system. The number of instruments should equal or be greater than the number of endogenous variables in each equation. Based on these criteria, we use the lagged value of investment stock and lagged cash flow as instruments in the patronage refunds equation. The investment equation in the system does not have an endogeneity problem since all independent variables are exogenous. We use the lagged sales growth in the long-term and short-term debt equations to instrument investments. To instrument different sources of debt, we need to find a corresponding instrumental variable that is only correlated with only one of the short- or long-term debt but independent from the other.

Previous studies have suggested that agricultural cooperatives that are financially constrained generally have limited access to channels of long-term borrowing, which will in turn force cooperatives to turn to equity or short-term debt financing (Richards and Manfredo, 2003; Li, Jacobs and Artz, 2016). We create a dummy variable which indicates whether cooperatives are financially constrained and use it as an instrumental variable for long-term debt. Different measurements of financial constraints have been well defined in the finance literature by using data on publicly traded U.S. firms (Kaplan and Zingales, 1997; Whited and Wu, 2006). One such measurement of financial constraints, especially in conditions where access to capital markets is imperfect, comes from observing managers' actions regarding their financial positions. One policy is cash holdings on the balance sheet since managers will increase cash holdings if they believe financial constraints will become greater in the future (Erel, Jang and Weisbach, 2015). In addition, other empirical studies find that firms' incremental cash flow on investments and cash holdings should be higher when facing financial constraints (Almeida, Campello, and Weisbach, 2004). Following Erel, Jang and Weisbach (2015), we use the cash-to-asset ratio as a measurement of financial constraints, and use the 90th percentile within the sample as a threshold to define whether cooperatives are financially constrained. If the cash-to-asset ratio is above the threshold, the cooperatives will be categorized as financially constrained, otherwise, cooperatives would not be financially constrained. We use the lagged term of the difference between sales and costs of goods sold as the instrumental variable for short-term debt. This is because it is easier for cooperatives to adjust short-term debt based on sales and cost of goods sold performance and use long-term debt as a tool to finance investments.

## 4. Data

We use a panel dataset of US agricultural cooperatives that was collected and standardized by CoBank to ensure the accuracy of comparisons among cross-sectional units throughout the sample period. The sample contains annual accounting information for 711 agricultural cooperatives for the accounting years 2011 to 2015. Cooperatives are required to have at least four years of data, and we also exclude outliers since the model could become sensitive to extreme values. Since the endings of the accounting periods are different across cooperatives in the sample, we follow the Fama and French (1992) and assume a 6-month gap between fiscal year end and year effects as well as the downturn variable. Earlier work (Basu, 1983) assumes that accounting data are available within three months of fiscal year ends, which implies that the financial information at the first half of the year is actually reflecting the cooperative performance in the previous year. Therefore, we decide to account the financial information reported before July 31 of year *t* as financial information in year *t-1*, and information reported after August 1st of year *t* would be considered as information in year *t*. Then the first year of observations for each cooperative are dropped for the variables of interest to be considered in the sample since certain lagged variables are included the models. The final sample consists of 708 cooperatives with 2443 cooperative-year observations. Due to the limited availability of data, we assume the annual impact on cooperatives' performance occurs at the same time point, even though the ends of fiscal years vary across cooperatives.

A comparison between our dataset from CoBank and data from USDA from 2012 to 2015 is presented in Table 1. Cooperatives in the CoBank dataset represent all agricultural cooperatives in the U.S. fairly well based on the average values of assets, equity, and debt. Detailed information on the components of equity and debt show that cooperatives in our dataset rely more on short-term debt as debt financing and assign fewer patronage refunds to their members while holding more retained earnings compared to the national average for all cooperatives. These statistics suggest that the CoBank data can generally represent capital adjustment strategies for the US agricultural cooperatives industry.

Variables utilized in the empirical model are constucted as follows. To calculate cash flow (*cf*) we should not only focus on identifying cash and non-cash items, but also on the sources and uses of cash that are unique for agricultural cooperatives. Following Chaddad, Cook and Heckelei (2005), cash flow is calculated as net income with added non-cost items such as depreciation and amortization, and changes in current assets and deducted dividends paid in cash, retains revolved, and gains or losses on assets. Short-term and long-term debt are measured by current liablities and long-term liabilities, respectively. Patronage refunds are computed as the sum of patronage dividends in both equity and cash terms.

Summary statistics for key variables in the model and cooperatives' characteristics are shown in Table 2. Cooperatives in our data had on average $40.3 million in assets, $103 million in net sales, and $2.9 million in cash flows. Total debt averaged $22.9 million, resulting in an average debt-to-asset ratio of 46.5%. The average growth rate of sales was -63.5%, indicating cooperatives also had significantly declining revenues or increasing costs during the agricultural downturn years, which has implications for the strategies that cooperatives were using during that time.

**5. Estimation Results**

The empirical estimation of the model is conducted for the full sample period and then before and during the agricultural downturn period to disentangle the impacts of the downturn on the cooperatives capital structure choices. In order to account for the use of instrumental variables, the first two years of observations are dropped. Overall, several coefficients in the short-term debt equation and some coefficients in the other equations are significant at the 5% significance level. The trade-off hypotheses are supported in the short-term debt equation while partially supported in the long-term debt equation. However, there is limited support for the pecking order hypotheses due to the lack of significance of coefficients.

The results of the model for the full time period are presented in Table 3. As predicted, a positive significant coefficient on cash flow has been found in the short-term debt equation but not in the long-term debt equation, indicating that when cash flow and internal funds increase, cooperatives will attempt to reach the optimal target debt ratio by adjusting short-term debt. The trade-off hypothesis that cooperatives might trade-off patronage refunds and debt to maintain the optimal debt ratio fails since no significant relationship is found in the patronage refunds equation. Meanwhile, the coefficients on the lagged value of stock short-term and long-term debt are negative and significant in the short-term and long-term equations, which support the claims that adjustment behaviors for debt exist for agricultural cooperatives. These results further imply that cooperatives may have optimal levels of short-term and long-term debt even though the results do not fully justify the existence of an optimal debt ratios. Moreover, the adjustment speed of long-term debt (0.197) is faster than that of short-term debt (0.091). This implies that cooperatives rely more on short-term debt financing and will adjust long-term debt quicker when there are sufficient funds.

Along with the trade-off among different funding sources, cooperatives adjust short-term debt in response to the level of long-term debt, while the adjustment of long-term debt shows little correlation with the level of short-term debt. The significant negative coefficient on the long-term debt change in the short-term debt equation implies that cooperatives view short-term and long-term debt as substitutes rather than complements and will adjust total debt based on a global target debt ratio with a joint consideration for all debt types.

Little evidence has been found to validate the hypotheses claimed by the pecking order theory. According to the pecking order theory, there should not be any debt adjustment by cooperatives, yet the empirical results show that the coefficients of adjustment speeds are negative and significant. The positive relationship between debt and cash flow also rejects the claim of pecking order theory that cooperatives have preferences toward internal funding sources. In addition, the relationship between debt and patronage refunds is not significant, which implies that the pecking order preference is not supported. Another explanation is that patronage refunds cannot reflect well cooperatives' dividend decisions since little evidence of significance has been found in the patronage refunds equation. Finally, the coefficient of sales growth on investment is positive and significant. Though a positive coefficient of cash flow on investment could be a reason for pecking order preference, the positive and significant coefficient of the lagged patronage refunds on investment is opposite of the model prediction. These results combined with previous evidence against the pecking order theory make it plausible that cash flow is not often used for investment.

Our model offers little information in explaining the relationship between long-term debt and investment, patronage refunds and other debt variables. However, we observe a significant relationship between long-term debt and the size of cooperatives. Cooperatives that are larger in size tend to have more long-term borrowing compared to smaller ones, which implies that cooperatives are facing financial constraints in long-term borrowing. Agricultural lenders prefer to finance higher quality borrowers with lower credit risk, and because long-term debt generally is riskier than short-term debt, such preference will be more strongly present in the long-term lending-borrowing relationship. In determining borrowers' credit capacities, lenders need information to distinguish accurately the quality of different borrowers, thus reducing the adverse selection problem. The cooperatives' collateralizable wealth, therefore, can lead to credit rationing and help agricultural lenders to screen cooperatives. Larger size means more assets within cooperatives could be collateralized, giving cooperatives more opportunities to generate long-term debt.

To further test the impact of the agricultural downturn on the performance and capital structure choice among cooperatives, the equation system is estimated before the downturn years (2011-2012) and during the downturn years (2013-2015), with the agricultural downturn defined as the period when farm incomes fell and remained low.

The results, which are reported in Table 4, show cooperatives' capital structure choices vary significantly before and during the agricultural downturn. Before the downturn, cooperatives show more pecking order preference along with some trade-off choices. However, during the downturn, more trade-off capital adjustment choices are observed by cooperatives while no pecking order preference is supported by the model.

In the pre-downturn estimation, cash flow is negatively significantly correlated with patronage refunds and with long-term debt, while it is positively significantly correlated with short-term debt. Although the positive coefficient of cash flow in the short-term debt equation may indicate some short-term trade-off adjustment, the pecking order preference of internal financing to external financing still exists if we consider the overall effects of cash flow. During the downturn period, cash flow becomes only positively significantly correlated with patronage refunds and short-term debt, which is consistent with the trade-off hypothesis.

Meanwhile, the simultaneous positive relationship between short-term debt and patronage refunds, and the positive significant coefficients of the patronage refunds in the long-term debt equation in the pre-downturn estimation also provide support for the pecking order theory. Yet, the positive coefficient of short-term debt in the patronage refunds equation flips to negative in the downturn estimation, switching from supporting the pecking order theory to supporting the trade-off theory. This result also indicates that members are more willing to invest in cooperatives and take fewer patronage refunds when the agricultural economy experiences boom, which reflects the expectation that cooperatives request more external funds during the boom period.

Besides differences in the justification of the different models, we also observe differences in the long-term and short-term debt adjustments. Before the downturn, the coefficient of stock short-term debt in the short-term debt equation is negative and significant, while during the downturn, such significance is present for the stock of long-term debt in the long-term debt equation. This suggests that cooperatives tend to focus more on adjusting long-term debt during the downturn years, which could be a sign that cooperatives have difficulties in having access to both short-term and long-term debt and could only use long-term debt to maintain the optimal debt ratio.

## 6. Conclusions

This paper provides empirical evidence related to the capital structure of U.S. agricultural cooperatives using panel data covering a six-year period from 2010 to 2015. The hypotheses that are tested in this study are derived from the trade-off and pecking order theories. A simultaneous equation system is estimated to discern which of the two theories performs better, i.e., which theory better describes the financial behavior of cooperatives. Meanwhile, empirical evidence is obtained before and during the agricultural downturn to investigate the effects of the downturn on the cooperatives' financial choices. The model estimation utilizes the generalized method of moment (GMM) technique.

The results of this study show significant support for the trade-off theory of cooperatives capital structure relative to the pecking order theory. Especially important are the relationships between cash flow, debt, and patronage refunds. This research fills the gap in the literature on capital structure for cooperatives since past research generally focuses on farms or firms in the economy.

Regarding the trade-off theory, our results suggest that cooperatives might be facing transaction costs derived from agency problems and financial constraints in the capital market. Meanwhile, transaction costs in adjusting long-term borrowing tend to be higher than for short-term borrowing and such adjustments tend to be more severe during the agricultural downturn.

Concerning the pecking order theory, less empirical evidence is found in the overall estimation. Although evidence of the pecking order theory is found during the pre-downturn period, the significance in results disappears during the downturn period, suggesting that cooperatives do not have preferences in using different sources of funding predicted by the pecking order theory.

In future research, the trade-off and pecking order theories could be tested for other types of cooperatives and in other regions and countries, where the impacts of the agricultural downturn may be different. More comprehensive data, with larger sample size and longer time periods, could be used for better experimental design and alternative econometric approaches could be utilized as well. Explaining cooperatives capital structure, therefore, remains a promising area for further study.

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Table 1. Comparing Cooperatives using CoBank versus USDA datasets

| | 2012 | | 2013 | | 2014 | | 2015 | |
|---|---|---|---|---|---|---|---|---|
| | USDA | CoBank | USDA | CoBank | USDA | CoBank | USDA | CoBank |
| Average total assets | 37.28 | 40.5 | 37.77 | 38.7 | 41.35 | 42.1 | 43.1 | 41.77 |
| Average total liabilities | 23.79 | 23.94 | 21.92 | 20.06 | 23.5 | 19.93 | 23.31 | 19.57 |
| Average short-term liabilities | 11.01 | 20.3 | 15.83 | 16.6 | 16.87 | 15.8 | 16.33 | 15.66 |
| Average long-term liabilities | 12.78 | 3.64 | 6.09 | 3.46 | 6.63 | 3.93 | 6.98 | 3.91 |
| Average equity | 13.48 | 15.5 | 15.84 | 17.6 | 17.85 | 19.5 | 19.79 | 20.96 |
| Average allocated equity | 3.12 | 6.03 | 9.86 | 6.48 | 10.67 | 7.76 | 11.83 | 7.68 |
| Average retained earnings | 1.74 | 9.52 | 5.99 | 10.8 | 7.18 | 13.2 | 7.96 | 13 |
| Number of cooperatives | 2236 | 683 | 2186 | 688 | 2106 | 694 | 2047 | 678 |

Note: All values are in millions of dollars.

Table 2. Summary Statistics

| Variable | Mean | Std. Dev. |
|---|---|---|
| Total assets ($ million) | 40.3 | 60.4 |
| Total liabilities ($ million) | 22.9 | 41.4 |
| Net sales ($ million) | 103 | 197 |
| Cash flow ($ million) | 2.9 | 26 |
| Change in short-term debt ($ million ) | -1.8 | 12 |
| Change in long-term debt ($ million) | 0.1 | 3.2 |
| Change in investment ($ million) | 0.4 | 1.7 |
| Patronage refunds ($ million) | 1.2 | 2.6 |
| Sales Growth (%) | -63.5 | 4000 |

Table 3. GMM Estimation for All Cooperatives

| Variables | (1) *Pat(t)* | (2) *ld(t)* | (3) *sd(t)* | (4) *inv(t)* |
|---|---|---|---|---|
| *Endogenous variables* | | | | |
| *sd(t)* | -0.171 | -0.072 | | |
| | (0.270) | (0.082) | | |
| *ld(t)* | 35.428 | | -3.466*** | |
| | (47.840) | | (1.209) | |
| *Pat(t)* | | -0.008 | 0.596 | |
| | | (0.021) | (0.364) | |
| *inv(t)* | | -0.243 | -1.164 | |
| | | (0.450) | (3.612) | |
| *Exogenous variables* | | | | |
| *cf(t)* | 0.189 | 0.028 | 0.368*** | 0.014** |
| | (0.150) | (0.041) | (0.138) | (0.007) |
| *sd(t-1)* | | | -0.091** | |
| | | | (0.039) | |
| *ld(t-1)* | | -0.197*** | | |
| | | (0.030) | | |
| *Pat(t-1)* | 0.624*** | | | 0.028** |
| | (0.064) | | | (0.011) |
| *Sl_Gr(t-1)* | | | | 0.000** |
| | | | | (0.000) |
| *Size fixed effects* | | | | |
| size = 2 | 0.925 | 0.082 | -0.179 | 0.226*** |
| | (1.131) | (0.071) | (0.401) | (0.056) |
| size = 3 | 0.627 | 0.022 | -0.129 | 0.051** |
| | (0.868) | (0.022) | (0.156) | (0.025) |
| size = 4 | -0.759 | 0.061*** | 0.114 | 0.011 |
| | (1.216) | (0.020) | (0.195) | (0.021) |
| size = 5 | -0.531 | 0.060*** | 0.109 | 0.003 |
| | (0.955) | (0.018) | (0.144) | (0.015) |
| size = 6 | 0.149 | 0.055*** | -0.048 | 0.009 |
| | (0.509) | (0.015) | (0.116) | (0.017) |
| size = 7 | 0.095 | 0.063*** | 0.039 | 0.014 |
| | (0.470) | (0.018) | (0.124) | (0.017) |
| size = 8 | 0.139 | 0.048*** | 0.008 | 0.010 |
| | (0.525) | (0.017) | (0.119) | (0.015) |
| size = 9 | 0.429 | 0.014 | -0.194 | -0.015 |
| | (0.676) | (0.042) | (0.220) | (0.020) |
| size = 10 | 0.781 | 0.052** | 0.166 | -0.023 |
| | (0.732) | (0.026) | (0.149) | (0.021) |
| N | 1960 | 1960 | 1960 | 1960 |

Notes: Standard errors are in parentheses. Asterisks *,**,*** denote statistical significance at the 10%, 5%, and 1% level, respectively.

Table 4. GMM Estimation for Before and During the Agricultural Downturn

| | Pre-Downturn (2011-2012) | | | | During the Downturn (2013-2015) | | | |
|---|---|---|---|---|---|---|---|---|
| Variables | *Pat(t)* | *ld(t)* | *sd(t)* | *inv(t)* | *Pat(t)* | *ld(t)* | *sd(t)* | *inv(t)* |
| *Endogenous variables* | | | | | | | | |
| *sd(t)* | 2.184* | 0.496 | | | -0.341** | -0.241 | | |
| | (1.193) | (0.232) | | | (0.153) | (0.178) | | |
| *ld(t)* | -1.585 | | -0.088 | | -8.872 | | -2.241 | |
| | (7.561) | | (0.824) | | (13.013) | | (1.427) | |
| *Pat(t)* | | 0.048*** | 0.806* | | | 0.187 | 0.671 | |
| | | (0.017) | (0.465) | | | (0.203) | (0.916) | |
| *inv(t)* | | -0.423 | -5.368*** | | | -2.657 | -2.088 | |
| | | (0.440) | (0.841) | | | (1.734) | (3.230) | |
| *Exogenous variables* | | | | | | | | |
| *cf(i)* | -0.992* | -0.227*** | 0.507*** | -0.001 | 0.151* | 0.149 | 0.420* | 0.019 |
| | (0.544) | (0.105) | (0.041) | (0.002) | (0.087) | (0.114) | (0.230) | (0.012) |
| *sd(t-1)* | | | -0.123* | | | | -0.080 | |
| | | | (0.074) | | | | (0.050) | |
| *ld(t-1)* | | -0.107 | | | | -0.234*** | | |
| | | (0.093) | | | | (0.067) | | |
| *Pat(t-1)* | 0.977*** | | | 0.018*** | 0.531*** | | | 0.054** |
| | (0.070) | | | (0.001) | (0.121) | | | (0.026) |
| *Sl_Gr(t-1)* | | | | -0.006 | | | | 0.000 |
| | | | | (0.008) | | | | (0.000) |
| N | 277 | 277 | 277 | 277 | 1683 | 1683 | 1683 | 1683 |

Notes: Standard errors are in parentheses. Asterisks *,**,*** denote statistical significance at the 10%, 5%, and 1% level, respectively.