Testing for the Presence of Financial Constraints in U.S. Agricultural Cooperatives

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Abstract: This study examines the issue of financial constraints in U.S. agricultural cooperatives. We test the cooperative capital constraint hypothesis with a panel data econometric analysis of agricultural cooperatives' investment behavior. Regression results suggest that agricultural cooperatives' capital expenditures are significantly affected by the availability of internal funds. Results also indicate that all cooperative sub-samples face binding financial constraints when making investment decisions, but some cooperatives appear to be less financially constrained than others.

Key words: agricultural cooperatives, cooperative finance, investment behavior, property rights.

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Introduction

Historically, agricultural cooperatives have played an important economic role in providing market access and competitive returns to independent producers in the U.S. In recent years, however, the restructuring of cooperatives through bankruptcies, liquidations, sales, or conversions to corporations have increasingly appeared in business media headlines. These recent "cooperative failures" have led some scholars and industry leaders to question the future viability of the cooperative form of business.

Notwithstanding the multitude of "daunting" internal challenges faced by cooperatives (USDA, 2002), it has been suggested that financial constraints are the "Achilles' heels" of cooperatives in an increasingly concentrated, tightly coordinated, and capital-intensive food system (Vitaliano, 1983; Cook, 1995). According to the cooperative financial constraint hypothesis, agricultural cooperatives are unable to acquire sufficient risk capital to finance profitable investment opportunities. As a result, cooperatives may be insufficiently capitalized to make the necessary investments to grow and remain a viable organizational form.

Financial constraints are largely related to the incentive system inherent in the vaguely defined property rights structure of cooperatives. First, cooperative residual claims are restricted as only active producer-members may provide the organization with voting equity capital (Vitaliano, 1983). Second, cooperative members lack incentives to invest due to free rider, horizon, and portfolio constraints (Knoeber and Baumer, 1983; Vitaliano, 1983; Cook and Iliopoulos, 2000). Third, equity capital is not permanent as a result of over-reliance on retained patronage refund and per-unit capital retain financing (Caves and Petersen, 1986). Lastly, cooperatives have limited access to outside sources of finance, particularly public debt and equity markets.

Although the theoretical arguments for the existence of financial constraints in cooperatives are persuasive, empirical studies have failed to find significant evidence in support of the cooperative financial constraint hypothesis. In the extensive applied literature evaluating cooperative performance, we have found growth, financial ratio, and economic efficiency studies that inform the issue of financial constraints. Growth studies have found higher growth rates in cooperatives relative to corporations in the 1970s (Chen, Babb and Schrader, 1985) and that the long-run growth rate of seven large North American cooperatives is "low, perhaps even zero" (Fulton et al., 1995). Taken together, these two studies support Caves and Petersen's prediction that cooperatives are capable of high short-term growth rates that are not sustainable in the long run as a result of equity capital rotation.

In two separate empirical studies, Lerman and Parliament examine the cooperative *equity* constraint hypothesis by comparing the capital structure of cooperatives relative to corporations. Cooperatives are viewed as "equity bound" and, consequently, are expected to be more leveraged than proprietary firms. Lerman and Parliament (1990) show that median leverage ratios are not significantly different for cooperatives and comparable corporations in the dairy and fruit and vegetable processing industries. Subsequently, Lerman and Parliament (1993) study the financing of asset growth among agricultural cooperatives. Contrary to theoretical expectations, cooperative equity capital is not statistically different from the national average of non-financial corporations. Lerman and Parliament's results have been confirmed by other studies of cooperative financial performance (Hind, 1994; Royer, 1991). But as noted by Lerman and Parliament (1993, p. 439), "the observation of high equity financing proportions among the sample of cooperatives does not unambiguously resolve the hypothesis of equity constraints in cooperatives."

Another strand of the cooperative performance literature focuses on economic efficiency concepts. By estimating multi-product variable cost functions, Akridge and Hertel (1992), Schroeder (1992), and Featherstone and Al-Kheraiji (1995) have found evidence of excess capacity in agricultural supply and marketing cooperatives. Using different methodological approaches, Sexton, Wilson and Wann (1989) and Caputo and Lynch (1993) have also detected physical capital overinvestment in a sample of cotton ginning cooperatives. Evidence of overcapacity in cooperatives is hard to reconcile with the financial constraint hypothesis, but the evidence might simply reflect the 1970s agricultural boom when cooperatives had financial capacity to grow by means of borrowed funds. And even though economic efficiency is an appropriate method to assess efficient use of installed capital, it is less suitable to address the dynamic nature of business investment decisions.

The purpose of this study is to reexamine the issue of financial constraints in agricultural cooperatives. We test the cooperative capital constraint hypothesis with a panel data econometric analysis of U.S. agricultural cooperatives' investment behavior. Specifically, we examine whether agricultural cooperatives' investment is constrained by the availability of internal funds (cash flow) by estimating restricted and cash flow augmented Q investment models. In these models, investment demand is measured by the Fundamental q approach (Gilchrist and Himmelberg, 1995). Additionally, the study attempts to identify if cooperative structural and financial management characteristics are correlated with capital constraints by means of several sample splits. That is, the investment equations are estimated separately for different sub-samples constructed on the basis of firm asset size, relative amount of permanent equity capital to net worth, and credit risk. Regression results suggest that agricultural cooperatives' capital expenditures are significantly affected by the availability of internal funds. Results also indicate that all cooperative sub-samples face binding financial constraints when making investment decisions, but some cooperatives appear to be less financially constrained than others.

Theoretical Framework

The empirical analysis of the cooperative capital constraint hypothesis is based on the Q theory of investment and its subsequent extensions including the effects of informational imperfections on firm investment behavior. The Q theory is derived from the firm's dynamic profit maximization problem.[1] Under the conditions assumed by the Q theory of investment – in particular, that capital markets are frictionless – external and internal sources of funds are perfect substitutes. As a result, financial variables play no role in capital spending. The Q theory predicts that capital spending only responds to marginal q, which is defined as the expected discounted value of profits from new capital investment and a measure of future investment opportunities.

(1) $$I_{it}/K_{it} = \alpha_i + \beta\, q_{it} + \tau_{it} + \varepsilon_{it}$$

Equation (1) is the Q theory specification of the investment equation, where I_{it} denotes investment (capital expenditures) for the i^{th} firm at time t, K_{it} is beginning-of-period capital stock, α_i represents firm-specific effects, q_{it} is marginal q, τ_{it} is the technology shock, and ε_{it} is an optimization error. Since marginal q is unobservable, Tobin's average q is commonly used as a proxy variable in empirical studies of business investment. Tobin's q constructed from financial

[1] For a derivation of the Q investment model refer to Hubbard, 1998.

market data is an appropriate measure of marginal q only under certain conditions, including competitive product and factor markets, homogeneity of fixed capital, and linearly homogeneous production and adjustment cost technologies (Hayashi. 1982). Notwithstanding these caveats, the empirical specification of the Q investment equation is commonly represented by:

$$I_{it}/K_{it} = \alpha_i + \beta Q_{it} + \tau_{it} + \varepsilon_{it}, \quad (2)$$

where Q_{it} is the tax-adjusted value of Tobin's q.

In his survey of the empirical investment literature, Chirinko (1993) observes that equation (2) is the most popular estimable model of firm investment behavior. Yet the empirical performance of the model has been unsatisfactory both in terms of the statistical significance of marginal q and the model's overall explanatory power. Furthermore, financial and capacity variables are consistently found to be statistically significant when included in the Q investment model specification.

Introducing informational imperfections in capital markets extends the neoclassical Q theory of investment. Asymmetric information models find that the presence of information problems in capital markets results in a cost wedge between external finance and internally generated funds. Consequently, the supply curve of finance is a horizontal segment up to the firm's total net worth but is upward-sloping beyond that point as the firm seeks external funds to finance investment projects. In addition, these models posit that the slope of the supply curve of finance is proportional to information costs between the firm and suppliers of external funds. In other words, the pattern of investment sensitivity to internal funds varies systematically across firms and should be higher for those firms with imperfect access to external funds (Hubbard, 1998).

This argument provides the theoretical underpinning for including proxy variables for changes in net worth (e.g., cash flow) in the standard Q investment equation. Consequently, the restricted Q model of investment may be expanded as follows:

(3) $$I_{it}/K_{it} = \alpha_i + \beta\, Q_{it} + \gamma\, CF_{it} + \tau_{it} + \varepsilon_{it},$$

where CF_{it} represents cash flow. Despite recent debate (Kaplan and Zingales, 1997), a positive and statistically significant cash flow coefficient in the investment equation is often interpreted as evidence of financial constraints.

On the basis of the empirical specification laid out in equation (3), studies of capital market imperfections affecting investment behavior utilize firm-level panel data in which firms are grouped into "high information cost" and "low information cost" categories. Theory suggests that firms facing informational problems in capital markets are prone to experience credit rationing and binding financial constraints when making investment decisions. As a result, the *difference* between the estimated cash flow coefficients across sub-samples provides a stronger evidence of financial constraints in the sample. Fazzari, Hubbard and Petersen (1988) identify "high information cost" manufacturing corporations on the basis of *a priori* information on observed dividend payout policies. They estimate a Q investment equation with cash flow as a proxy for changes in net worth. Their empirical results indicate a substantially greater sensitivity of investment to cash flow in firms classified a priori as "financially constrained."

Subsequently, Gilchrist and Himmelberg (1995) propose an alternative proxy variable, called "Fundamental q," to measure firm investment opportunities instead of Tobin's q. The authors estimate a set of vector autoregression (VAR) forecasting equations based on the firm's fundamentals and use the estimates from the VAR system to construct marginal q. Gilchrist and Himmelberg's approach is relevant because it allows the Q model of investment to be estimated for non-publicly traded firms for which market data is not available. Following Gilchrist and Himmelberg, the Fundamental q approach has been applied to the study of financial constraints in the farm sector (Bierlen and Featherstone, 1998; Barry, Bierlen and Sotomayor, 2000). This paper utilizes the Fundamental q approach to examine the investment behavior of another set of privately held firms – agricultural cooperatives.

Data and Procedures

Empirical testing of the cooperative capital constraint hypothesis is based on a firm-level panel data set of U.S. agricultural cooperatives. The data set was obtained from CoBank, a financial services organization that collected and standardized the financial data for all firms included in the sample. This centralized approach ensures accurate comparisons among cross-sectional units throughout the study period. In addition, the cooperatives in the sample produce audited annual financial reports certified by a CPA firm and prepared under Generally Accepted Accounting Principles (GAAP), which contributes to the quality and integrity of the data set.

The data set contains complete annual accounting information from 597 U.S. agricultural cooperatives comprising the years 1991 through 2000. The sample includes local farm supply and grain marketing cooperatives, processing cooperatives with operations in food manufacturing industries, agricultural production and service cooperatives, and regional cooperatives involved in wholesale trade activities. Firms with large discontinuities in the reported book value of their physical capital stock are excluded from the sample. Large discontinuities in net fixed assets are often caused by mergers, acquisitions, asset divestitures, and data errors. This criterion removes 90 firms from the sample, leaving a final sample of 507 firms.

The dependent variable in the model is investment (I_{it}), defined as capital expenditures for the construction and acquisition of physical assets (property, plant and equipment). Data on agricultural cooperatives' capital expenditures are not available. As a result, cooperative investment is measured from changes in physical assets between subsequent years. This study follows Hoshi, Kashyap and Scharfstein (1991) and measures cooperative investment as the change in the stock of depreciable capital (net fixed assets) from the previous year plus capital depreciation during the year.

The explanatory variables in the model are cash flow and marginal profitability of capital. Cash flow (CF_{it}) in corporations is obtained by adding non-cash cost items, such as depreciation and amortization, to income after interest and taxes and before extraordinary items (net income). In the computation of agricultural cooperative cash flow, it is not only important to distinguish between cash and non-cash items, but also to recognize sources and uses of cash that are unique to cooperative organizations. The net income series in our data set is consistent among pooling and non-pooling cooperatives as pool distributions are included as an item in "cost of goods sold" in the computation of pooling cooperatives' net income. However, the cooperative net income series includes gains or losses on asset sales and sundry after-tax extraordinary items. Additionally, there are sources of cash flow that are unique to cooperatives, including cash patronage income, per unit capital retains and retained patronage refunds. This study computes cooperative cash flow as the sum of net income, depreciation and amortization, but deducts non-cash patronage income, patronage dividends paid in cash, net retirements of allocated equity (including retains revolved), gains or losses on asset sales, and after-tax extraordinary items from cooperative net income.

In the construction of investment and cash flow series, the variables are first deflated by the GDP Implicit Price Deflator. Subsequently, investment and cash flow are normalized by the firm's capital stock in the beginning of the year to eliminate scale effects. Following Kaplan and Zingales (1997), capital stock is measured as the book value of property, plant and equipment (i.e., net fixed assets).

The marginal profitability of capital (q_{it}), a measure of investment demand, is constructed from the estimates of a bivariate VAR system of order two. The order of the VAR is determined based on the likelihood ratio test described in Enders (p. 313). This study follows Gilchrist and Himmelberg's method and includes cash flow, as previously defined (CF_{it}/K_{it}), and the ratio of sales over capital (S_{it}/K_{it}) in the specification of the VAR system. In the estimation of the VAR forecasting system with the cooperative panel data set, all variables are first-differenced in order to eliminate fixed-firm effects (Holtz-Eakin, Newey and Rosen, 1988). Additionally, the model includes time dummies to account for aggregate shocks and industry dummies to account for industry specific effects. The VAR system is estimated with the generalized method of moments (GMM) estimator. The use of GMM is necessary in this context as it is a heteroskedasticity robust estimator that accommodates the presence of endogeneity in the model. The instrument set includes lags 2 to 4 of CF_{it}/K_{it} and S_{it}/K_{it}, as any lagged values beyond the first lag are valid instruments (Griliches and Hausman, 1986). The estimates of the VAR are then used to construct Fundamental q (F_{it}) defined in Gilchrist and Himmelberg (1995) as:

(4) $$F_{it} = [\mathbf{c}' - (\mathbf{I} - \lambda\mathbf{A})]^{-1}\, \mathbf{X}_{\text{it}},$$

where $\mathbf{X}_{\text{it}}$ is a vector containing CF_{it}/K_{it} as the j^{th} element and S_{it}/K_{it}, $\mathbf{c}$ is a conformable vector of zeros with a 1 in the j^{th} row, $\mathbf{I}$ is the identity matrix, λ is a constant representing the discount factor and the depreciation rate, and $\mathbf{A}$ is the matrix of VAR coefficient estimates. Given the order of the VAR and the lags involved in constructing model variables, the initial 5 years of the panel cannot be used in estimating the investment model. The investment model is, therefore, estimated for the years 1996-2000.

It is a common practice in the empirical investment literature to exclude from the sample firms with extreme values of investment, cash flow, Tobin's Q or other variables of interest. This study utilizes an alternative procedure to treat outliers in that observations are "winsorized" if the value of the variable exceeds pre-determined cutoff values (Cleary, 1999). The following cutoff values are used: (i) assign a value of 2 (-2) if I_{it}/K_{it} is greater (less) than 2 (-2); (ii) assign a value of 5 (-5) if CF_{it}/K_{it} is greater (less) than 5 (-5); and (iii) assign a value of 30 if S_{it}/K_{it} is greater than 30. This approach reduces the impact of extreme observations in the regression analysis and allows the use of a larger number of observations than would be possible if these extreme observations were deleted from the sample. The econometric analysis of cooperative investment is robust to this procedure. Regression results do not change when the model is estimated with non-winsorized data.[2]

Summary statistics for the balanced panel of 507 firms is shown in Table 1. The average cooperative in the sample has \$29 million in assets and sales of \$78 million. It generates \$1.6 million in cash flow and invests \$2.1 million in fixed assets per year. In addition, the average cooperative has \$17.7 million in total debt, which translates to a 0.41 debt-to-asset ratio. Note, however, that only 39 percent of cooperative equity capital is permanent as 59 percent of total equity is allocated to individual member accounts and, therefore, redeemable.

<Insert Table 1>

[2] These results are available upon request.

Construction of Sub-Samples

This study investigates three alternative sample splits to discern financially constrained from unconstrained firms in the balanced panel: firm size, permanent equity capital, and credit risk. The common justification for using the size variable as a sample splitting criterion is that small corporations are more likely to face financing constraints because they are typically younger, less well-known, and hence more vulnerable to capital market imperfections induced by information asymmetries and collateral constraints (Schaller, 1993). This might not be necessarily the case for cooperatives as they have a dependable source of debt capital from a dedicated lender. In addition, members' incentives to invest might be lower in large cooperatives due to the free rider problem. This study uses total assets to measure the size of cooperative firms. As firm size is a continuous variable, the sample splitting criterion is based on a pre-determined cutoff value. A firm is identified as small if its size falls below the 25th percentile in 1991. In doing so, the size criterion distinguishes between 127 small firms and 380 large firms. The average size for large firms is $38.3 million, whereas small firms' size is slightly above $2 million (Table 1). On average, small cooperatives invest more and generate more cash flow and sales than large cooperatives. Small cooperatives tend to adopt more conservative financial structures as indicated by their relatively low debt-to-asset ratio and high permanent equity ratio. These differences suggest that small cooperatives might be less constrained than large cooperatives when making capital investment decisions.

Another criterion to distinguish financially constrained from unconstrained cooperatives is to examine the amount of permanent equity capital relative to total net worth. Permanent equity capital is defined as the sum of common stock, preferred stock and unallocated equity and is intended to measure the amount of "true" equity capital held by agricultural cooperatives. The rationale for using this criterion is that cooperatives with relatively high amounts of permanent equity might have more favorable access to external sources of finance. Additionally, cooperatives with low amounts of permanent equity need to constantly redeem allocated equity to member-patrons, which is a source of cash outlay that decreases the volume of internally generated capital available for investment. Since permanent equity capital is a continuous variable, the sample splitting criterion is based on a pre-determined cutoff value. A firm is classified as "low permanent equity (PEK)" if it falls below the 25th percentile. This criterion identifies 127 low PEK firms and 380 high PEK firms. Low PEK firms have on average 15 percent of permanent equity and 83 percent of allocated equity relative to total net worth (Table 1). In contrast, high PEK firms have on average net worth consisting of 47 percent of permanent equity and 51 percent of allocated equity. Unallocated equity is the largest component of permanent equity capital in both sub-samples, as U.S. cooperatives have in general relatively low amounts of common and preferred stock.

In addition to firm asset size and permanent equity capital, this study uses credit risk (Z-score) as a sample splitting criterion. The Z-score is a measure for predicting bankruptcy that lenders use in conjunction with other credit scoring techniques to assess the probability that a customer will not pay. The following variables are used to compute Z-score: working capital, retained unallocated earnings, before-tax income, total net worth, and net sales revenue. Given the dependence of most agricultural cooperatives on borrowed capital as a source of external funds, the ability to access credit markets distinguishes financially constrained from non-constrained cooperatives. Z-score is a continuous variable and sample splitting is based on a pre-determined cutoff value. A firm is classified as "high risk" if it falls below the 25th percentile in the Z-score sample distribution. This criterion identifies 125 "high risk" firms and 382 "low risk" firms. "High risk" cooperatives have an average Z-score of 4.05, whereas the average for the "low risk" sub-sample is 5.01 (Table 1). "High risk" cooperatives have relatively lower amounts of unallocated equity and permanent equity, in addition to being more leveraged than "low risk" cooperatives.

Empirical Results

In this section the empirical results from estimating the Q investment model for the sample of U.S. agricultural cooperatives are analyzed (Table 2). The restricted and the cash flow augmented Q investment models are estimated with the GMM estimator. GMM is an instrumental variable technique that corrects the potential errors-in-variables bias introduced by Fundamental q. Full sample regression results suggest that the unrestricted Q model adds explanatory power when compared to the restricted model without cash flow. In line with theoretical predictions, both Marginal q and cash flow are found to positively affect cooperative physical capital investment. The fact that cooperative investment is significantly sensitive to cash flow suggests the presence of binding financial constraints in the full cooperative sample.

<Insert Table 2>

Since the magnitudes of parameter estimates are dependent on the levels of the variables included in the model, elasticities are better representatives of the sensitivity of investment to the explanatory variables. Elasticity estimates are calculated at the means of each independent variable (Table 3). In the restricted model, the elasticity for the Fundamental q parameter is 0.351, i.e., investment expenditure is inelastic with respect to the marginal profitability of capital. In the unrestricted model, the elasticity estimate for Fundamental q is 0.192 and 0.218 for cash flow. In other words, a one percent change in the ratio of cash flow to capital is expected to prompt an increase in the ratio of investment to capital of approximately 0.2 percent. Using median values of investment and cash flow it is possible to compute how investment responds to changes in cash flow in nominal terms. Based on the cash flow elasticity estimate, a one standard deviation change in cash flow of $116,525 will prompt an increase of $28,617 in capital expenditures. This calculation is extended to the 2,535 observations in the balanced panel. Results show that the incremental investment associated with an increase in cash flow is within the bounds of that cash flow in 93 percent of the total number of firm-years. This provides further support to the claim that cooperatives depend on internally generated capital to finance investment.

<Insert Table 3>

In order to ascertain whether cooperative structural and financial attributes affect the magnitude and statistical significance of the sensitivity of investment to cash flow, the investment equations are estimated separately for each of the aforementioned sub-samples. In order to do so, the VAR forecasting system is estimated and parameter estimates are used in the construction of Fundamental q for each sub-sample. The investment equation is then re-estimated for the "constrained" and "unconstrained" sub-samples with the GMM estimator. Results are found in Table 2. In the restricted model, investment by large cooperatives, cooperatives with high permanent capital and low credit risk responds significantly to investment opportunities.

Focusing on the cash flow augmented model of large and small cooperative investment behavior, parameter estimates are positive as predicted by theory. Fundamental q parameter estimates are not statistically significant, whereas cash flow coefficients for both sub-samples are significant. The sensitivity of investment to cash flow for the large cooperative sub-sample is found to be larger than the investment-to-cash flow sensitivity of small cooperatives. The null hypothesis that small and large cooperative cash flow coefficients are equal is probed with the t-test, which indicates that the null hypothesis of parameter equality should be rejected. This suggests that small cooperatives are less financially constrained than large cooperatives.

In the regression of the investment model for the sub-samples based on permanent equity capital, the Fundamental q coefficient estimates are positive but not statistically significant (Table 2). The cash flow coefficient estimates, in turn, are positive and statistically significant for both sub-samples. The investment-to-cash flow sensitivity is found to be larger for the low PEK cooperatives, corroborating the theoretical prediction. The null hypothesis of cash flow parameter equality is rejected. It is, therefore, concluded that high PEK cooperative firms are less financially constrained than low PEK counterparts when making investment decisions.

Table 2 also provides parameter estimates for high credit risk and low credit risk cooperatives. All parameter estimates have the correct anticipated sign, that is, investment expenditures are positively correlated with both Fundamental q and cash flow but Fundamental q estimates are not statistically significant. Cash flow coefficients are statistically significant for both high credit risk and low credit risk cooperatives. As expected from the theoretical discussion, the cash flow coefficient for the low risk sub-sample is smaller than in the high-risk sub-sample. On the basis of the t-test for parameter equality, it is concluded that high credit risk cooperatives are more financially constrained than low credit risk cooperatives.

In sum, the tests for excess sensitivity of investment to cash flow show that all the cooperative sub-samples face binding financial constraints when making investment decisions, but some cooperatives appear to be less financially constrained than others. In particular, small cooperatives, cooperatives with relatively high amounts of permanent equity capital, and low credit risk cooperatives are found to be less constrained than their large, low permanent equity capital, and high credit risk counterparts. The estimation of the investment model with sub-sample data provides further support to the financial constraint interpretation of cash flow in agricultural cooperative investment behavior.

Robustness Check: Firm Investment Behavior in the Food Industry

To verify the robustness of our results we repeat the preceding analysis of cooperative investment behavior using only firms in food manufacturing industries.[3] The greater homogeneity and cyclical behavior of food processors generate a more accurate VAR forecasting system. In addition, we collect financial data from publicly traded food manufacturing firms from COMPUSTAT. The unrestricted residual claim characteristic of common stock is the most effective means of "generating large amounts of wealth from residual claimants on a permanent basis" in order to finance organization specific assets (Fama and Jensen, 1983, p. 312). It is, therefore, reasonable to expect that publicly traded firms be *a priori* financially unconstrained.

The results are shown in Table 4. First, note that the Fundamental q coefficients are positive in all regressions and statistically significant except in the unrestricted model estimated for the cooperative sub-sample. Second, the cash flow coefficient is positive and significant for the cooperative sub-sample but not for the corporate sub-sample and the pooled data regression. In other words, the evidence suggests that cooperatives are financially constrained, whereas corporations are not. Comparing the investment behavior of cooperatives versus corporations in the food industry, therefore, provides further support to the capital constraint interpretation of the cash flow coefficient.

<Insert Table 4>

[3] Firms are included in the food industry category if their primary SIC code falls within the 2000-2099 range.

Summary and Caveats

It is commonly argued in the literature that agricultural cooperatives are financially constrained because they are unable to acquire sufficient risk capital to invest in productive assets. In this research we addressed the issue of capital constraints in agricultural cooperatives and examined whether physical capital investment is constrained by availability of finance. It was observed that cooperative investment responds positively and significantly to both the marginal profitability of capital and cash flow. When the cash flow variable was included in the investment equation with Fundamental q, there was a positive and statistically significant correlation between investment and cash flow for the full cooperative sample. In other words, cash flow appears to have influence on cooperative investment over and above its predictive content about the future profitability of capital.

In addition, the tests for excess sensitivity of investment to cash flow were extended to three a priori sample splitting criteria used to sort cooperatives into sub-samples of "constrained" and "unconstrained" firms. It was found that all cooperative sub-samples face binding financial constraints when making investment decisions, but some cooperatives appear to be less financially constrained than others. In particular, small cooperatives, cooperatives with relatively high amounts of permanent equity capital, and low credit risk cooperatives were found to be less constrained than their large, low permanent equity capital, and high credit risk counterparts.

Our empirical results lend support to the hypothesis that cooperatives are financially constrained when making investment decisions. This conclusion, however, is affected by the informational requirements posed by theory and methodological approach. More specifically, conclusions should be drawn in light of the following maintained assumptions: a) Fundamental q is an appropriate measure of cooperative investment opportunities; and b) the a priori classification of firms is reasonable and leads to consistent results.

Theoretical models of capital market imperfections predict a role for net worth on business investment holding investment opportunities constant. In the Q theory of investment, investment opportunities are summarized in the value of marginal q. As marginal q is unobservable, empirical models must identify a proxy for investment opportunities. In this study Fundamental q is used as a proxy for investment opportunities because Tobin's q cannot be measured for private firms such as agricultural cooperatives. The Fundamental q measure of marginal q explicitly incorporates cash flow as a predictor of investment opportunities. Because cash flow enters in the specification of the VAR forecasting system, Fundamental q decomposes the effects of cash flow on investment in two parts: one that forecasts the future profitability of capital and a residual component that may be attributable to financial constraints. Our full sample results clearly show that cash flow has significant effects on cooperative investment behavior in addition to its ability to predict future profits.

This study followed the measurement approach suggested by Gilchrist and Himmelberg (1995), in which firm fundamentals such as cash flow and sales are used to predict future profits from additional capital investment. One shortcoming of this approach is that fundamental q and cash flow are highly correlated thereby leading to loss of accuracy in the estimation of model coefficients. Indeed, the coefficient on fundamental q lost its significance in all sub-samples. Notwithstanding data availability constraints, it would be useful for future research to refine the measurement of fundamental q with an explicit treatment of additional factors affecting the marginal profitability of capital.

In addition to investment demand, the theoretical model of investment behavior also emphasizes cross-sectional differences in the effects of internal funds on firms' investment. Following Fazzari, Hubbard and Petersen (1988), applied researchers attempt to sort firms based on pre-sample information to construct sub-samples of financially constrained and unconstrained firms. This study uses firm size, permanent equity capital, and credit risk as a priori criteria to distinguish financially constrained from unconstrained cooperatives. This empirical approach stresses the difference between the estimated cash flow coefficients across sub-samples as a stronger evidence of the presence of financial constraints in "high information cost" firms. The criteria utilized in this study proved to be unsuccessful in identifying financially unconstrained cooperatives, as the estimates of the cash flow coefficient are significantly different from zero in all sub-samples. Future studies could attempt to sort cooperatives by means of alternative a priori criteria.

Investment constraints arise in agricultural cooperatives as a result of free rider, horizon, and portfolio problems. Vaguely defined property rights emerge in cooperatives because residual claims are restricted to members, non-transferable, redeemable, and with benefit distribution proportional to usage rather than shareholdings. If agricultural cooperatives are to remain viable organizations in the 21st century, their leaders might need to revisit these restrictions on residual claims. This study does not empirically establish that the nature of cooperative residual claims causes financial constraints. Nor does it claim that eliminating restrictions on residual claims is a sufficient condition to ameliorating financial constraints in agricultural cooperatives. However, this empirical study of the cooperative capital constraint hypothesis suggests that eliminating restrictions on residual claims might be a necessary condition for the attenuation of capital constraints in agricultural cooperatives.

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Table 1. Means for the Full Sample and Sub-Samples, 1996-2000

Variable	Full Sample	Large	Small	High PEK	Low PEK	Low Risk	High Risk
Investment ($)	2,141,726	2,797,878	178,438	1,919,414	2,806,912	2,211,154	1,929,554
Cash Flow ($)	1,607,193	2,097,907	138,914	1,461,731	2,042,435	1,672,119	1,408,781
Sales ($)	78,336,226	102,961,971	4,652,896	76,129,502	84,939,024	89,045,617	45,608,327
Capital Stock ($)	8,117,942	10,652,656	533,757	7,602,067	9,661,503	8,006,728	8,457,811
Total Debt ($)	17,704,790	23,390,702	691,825	15,452,943	24,442,602	18,066,796	16,598,501
Total Assets ($)	29,242,273	38,336,898	2,030,007	27,975,964	33,031,228	29,563,321	28,261,150
I/K	0.34	0.33	0.36	0.35	0.31	0.35	0.29
CFL/K	0.28	0.28	0.30	0.27	0.32	0.28	0.30
S/K	10.27	9.90	11.37	10.72	8.92	11.19	7.46
Debt to Asset	0.41	0.45	0.31	0.41	0.43	0.39	0.49
Permanent Equity	0.39	0.37	0.47	0.47	0.15	0.42	0.32
Unallocated Equity	0.30	0.28	0.36	0.37	0.12	0.32	0.25
Allocated Equity	0.59	0.61	0.52	0.51	0.83	0.57	0.64
Z-Score	4.77	4.53	5.49	4.97	4.19	5.01	4.05
Number of Firms	507	380	127	380	127	382	125
N	2535	1900	635	1900	635	1910	625

Table 2. Effects of Fundamental q and Cash Flow on Cooperative Investment, 1996-2000

The dependent variable is the investment-capital ratio (I_{it}/K_{it}), where I_{it} is investment in physical assets and K_{it} is beginning-of-period capital stock. Explanatory variables include Fundamental q, constructed from estimates of a bivariate VAR (3) forecasting system, and (CF_{it}/K_{it}), which is the cash flow-to-capital ratio. All variables are first-differenced to eliminate firm-fixed effects. The equations are estimated with fixed year and industry effects, which are not reported. The instrument set includes lags 2 to 4 of (CF_{it}/K_{it}) and (S_{it}/K_{it}). Standard errors of parameter estimates appear in parentheses. The estimation period is 1996-2000.

	Full Sample	**Small**	**Large**	**Low PEK**	**High PEK**	**High Risk**	**Low Risk**
				Q Investment Model			
Fundamental q	0.130*	0.088	0.154**	0.049	0.150*	0.190	0.074**
(Standard Error)	(0.048)	(0.066)	(0.065)	(0.054)	(0.063)	(0.198)	(0.035)
				Augmented Q Investment Model			
Fundamental q	0.071	0.049	0.075	0.022	0.085	0.098	0.028
(Standard Error)	(0.048)	(0.057)	(0.066)	(0.059)	(0.065)	(0.171)	(0.034)
Cash Flow	0.265*	0.177**	0.333*	0.368*	0.180**	0.666*	0.184*
(Standard Error)	(0.067)	(0.072)	(0.105)	(0.093)	(0.082)	(0.179)	(0.065)
Number of Firms	507	127	380	127	380	125	382
N	2535	635	1900	635	1900	625	1910

* Coefficient estimates are statistically significant at 1% confidence level.
** Coefficient estimates are statistically significant at 5% confidence level.

Table 3. Elasticity Estimates (calculated at the means)

Independent Variables	Elasticity Estimates
Q Investment Model	
Fundamental q	0.351
Augmented Q Investment Model	
Fundamental q	0.192
Cash Flow	0.218

Table 4. Investment Behavior in the Food Industry: Cooperatives versus Corporations

	Pooled Sample	Corporations	Cooperatives
		Restricted Q Model	
Fundamental q	3.471**	2.201*	3.971***
(Standard Error)	(1.536)	(0.621)	(2.352)
Cash Flow	-	-	-
		Unrestricted Q Model	
Fundamental q	3.614	3.045**	1.498
(Standard Error)	(2.224)	(1.592)	(1.083)
Cash Flow	0.190	-0.547	0.608**
(Standard Error)	(0.769)	(0.779)	(0.264)
Number of Firms	109	56	53
N	545	280	265

* Coefficient estimates are statistically significant at 1% confidence level.
** Coefficient estimates are statistically significant at 5% confidence level.
*** Coefficient estimates are statistically significant at 10% confidence level.