Journal of Agricultural Economics, Vol. 56, No. 3, 2005, 385–397

Testing for the Presence of Financial Constraints in US Agricultural Cooperatives: An Investment Behaviour Approach

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(Original submitted February 2005, revision received July 2005, accepted August 2005.)

Abstract

This study examines the presence of financial constraints in US agricultural cooperatives. We test the cooperative capital constraint hypothesis with a panel data econometric analysis of agricultural cooperatives' investment behaviour. Regression results suggest that agricultural cooperatives' capital expenditures are significantly affected by the availability of internal funds. Results also indicate that the sensitivity of investment to cash flow is correlated with cooperative structural characteristics.

Keywords: *cooperatives; financial constraints; investment decision.*

JEL classifications: *D21, D23, G32.*

1. Introduction

Historically, agricultural cooperatives have played an important economic role in providing market access and competitive returns to independent producers in the US, Western Europe and other advanced agricultural countries. In recent years, however, the restructuring of cooperatives through bankruptcies, liquidations and conversions to corporations have increasingly made business media headlines. These recent 'cooperative failures' have led some scholars to question the future viability of the cooperative form of business. Many possible explanations for such failures have been identified, including inertia in cooperative re-modelling (Nilsson, 1997), increasing member heterogeneity and individualism (Fulton, 1995), collective decision-making costs (Hansmann, 1996), and property rights constraints (Holmstrom, 1999).

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In particular, it has been suggested that financial constraints are the 'Achilles' heel' of cooperatives in an increasingly concentrated, tightly coordinated and capital-intensive food system (Vitaliano, 1983; Cook, 1995).[2] 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 capitalised to make the necessary investments to grow and remain a viable organisational form.

Financial constraints are largely related to the incentive system inherent in the vaguely defined property rights structure of cooperatives (Cook, 1995). First, cooperative residual claims are restricted as only active producer-members may provide the organisation with voting equity capital (Vitaliano, 1983). In other words, risk capital acquisition in the traditional cooperative firm is limited by the number, the wealth, and the risk-bearing capacity of its current members. Second, cooperative members lack incentives to invest because of free rider, horizon and portfolio constraints (Knoeber and Baumer, 1983; Cook and Iliopoulos, 2000). Consequently, traditional cooperatives rely primarily on patronage-based methods for acquiring risk capital, that is, retained patronage refunds and per-unit capital retains. In doing so, equity capital in a cooperative's balance sheet is allocated to individual members, representing a claim against the cooperative by present and former members with retained patronage refunds. This claim is redeemable, with the ultimate payments to members being at the discretion of the cooperative board of directors. Because redeeming equity is a cash outlay to the cooperative, a large portion of its equity capital stock is not considered permanent. Finally, cooperatives have limited access to outside sources of finance, particularly public debt and equity markets, because of restrictions on residual claims (Hart and Moore, 1996).

Although the theoretical arguments for the existence of financial constraints in cooperatives are persuasive, empirical studies have provided inconclusive evidence for the cooperative financial constraint hypothesis. In evaluating the cooperative performance literature, 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 *et al*., 1985) but have also concluded 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 (1986) assertion that cooperatives are capable of high short-term growth rates that are not sustainable as a result of equity capital rotation, which reduces the amount of internal finance for future investments.

In two separate empirical studies, Lerman and Parliament (1990, 1993) examine the cooperative equity constraint hypothesis by comparing the capital structure of

[2] It is important to note that a market characterised by increasing industry concentration, vertical coordination and capital intensity assumes significant market power, which is a major economic reason (along with tax benefits) for cooperative formation. But, at the same time, these structural changes constitute external challenges to cooperatives, which coupled with internal challenges, undermine their competitiveness and survival. Cook (1995) and Hansmann (1996) address these tradeoffs, whereas Chaddad and Cook (2004) discuss the cooperative structures that have emerged as a response to these challenges.

cooperatives with corporations. Cooperatives are viewed as 'equity-bound' and 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 food-processing industries. Subsequently, Lerman and Parliament (1993) study the financing of asset growth in agricultural cooperatives. Contrary to theoretical expectations, cooperative equity capital is not statistically different from the national average of non-financial corporations. 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' because their study does not account for the financing needs of cooperatives or the demand for investment funds.

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 *et al.* (1989) and Caputo and Lynch (1993) have also detected physical capital overinvestment in a sample of cotton-ginning cooperatives. Evidence of overcapacity in cooperatives seems hard to reconcile with the financial constraint hypothesis at first sight, but the evidence might simply reflect the 1970s agricultural boom when cooperatives had financial capacity to grow by means of borrowed funds. In addition, overcapacity at some point in time does not imply sufficient capital for optimal adjustment and growth over a longer time period.

The purpose of this study is to examine the presence of financial constraints in agricultural cooperatives. We test the cooperative capital constraint hypothesis with a panel data econometric analysis of US agricultural cooperatives' investment behaviour. Specifically, we examine whether agricultural cooperatives' investment is constrained by the availability of internal funds by estimating restricted and cash flow-augmented investment models. Additionally, the study examines whether cooperative structural and financial management characteristics affect the sensitivity of investment to cash flow. These structural characteristics include firm asset size, relative amount of permanent equity capital to net worth, credit risk, and financial leverage.

2. 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 and property rights constraints on firm investment behaviour. The Q theory is derived from the firm's dynamic profit maximisation problem (for details regarding theory development and empirical applications, see Hubbard, 1998). Given 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, therefore, predicts that capital spending only responds to marginal q – a measure of investment opportunities – which is defined as the expected discounted value of profits from new capital investment.

$$\frac{I_{it}}{K_{it}} = \alpha_i + \beta q_{it} + \tau_{it} + \varepsilon_{it}. \quad (1)$$

Equation (1) is the Q theory specification of the investment equation, where I_{it} denotes investment (capital expenditures) for the ith 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 optimisation error. As 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 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:

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

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

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).

In addition to informational imperfections, cooperatives are hypothesised to face financial constraints because of the nature of their residual claims as mentioned in the introductory section. Both arguments provide 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:

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

where CF_{it} represents cash flow. A positive and statistically significant cash flow coefficient in the investment equation is 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 behaviour utilise firm-level panel data. Theory suggests that firms facing informational problems in capital markets and internal property rights constraints are prone to experience 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. For example, Fazzari *et al.* (1988) identify 'high information cost' manufacturing corporations on the basis of *a priori* information on observed dividend payout policies. Specifically, low payouts (relative to earnings) signify high information costs. If the cost disadvantage of external finance is large, it should have the greatest effect on firms that retain most of their income. 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. Instead of using market value data to measure investment demand, the authors estimate a set of vector autoregression (VAR) forecasting equations based on the firm's fundamentals – i.e. profits and sales – 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 are not available. Subsequently, the fundamental q approach has been applied to the study of financial constraints in the farm sector (Bierlen and Featherstone, 1998; Barry *et al.*, 2000; Benjamin and Phimister, 2002). This paper utilises the fundamental q approach to examine the investment behaviour of another set of privately held firms – agricultural cooperatives.

3. Econometric Model and Data

In this section we discuss the empirical model and data used to investigate the interdependence of financing and investment decisions in agricultural cooperatives. The employed econometric model follows the Q theory of investment and specifically the fundamental q approach of Gilchrist and Himmelberg (1995). The investment equation is given by:

$$\frac{I_{it}}{K_{it}} = \eta_i + v_t + \beta q_{it} + \gamma CF_{it} + \varepsilon_{it}, \quad (4)$$

where η_i and v_t are firm- and time-specific effects, q_{it} is marginal q, CF_{it} is cash flow, and ε_{it} is a random error. Under the condition of perfect capital access, cash flow has no influence on investment ($\beta = 0$).

The marginal profitability of capital (marginal q), a measure of investment demand, is constructed from the estimates of a bivariate VAR system using a vector of firm fundamentals ($\mathbf{x}_{it}$) that includes cash flow (as the jth element), sales and lagged values thereof:

$$\mathbf{x}_{it} = \mathbf{A}\mathbf{x}_{it-1} + f_i + d_t + u_{it}. \quad (5)$$

Note that the inclusion of lagged values in $\mathbf{x}_{it}$ implies a VAR of higher order than 1. Fundamental q is then defined by the projection of future profits based on the estimated coefficients of the VAR, A, defined as:

$$q_{it} = [\mathbf{c}'(\mathbf{I} - \lambda\mathbf{A})]^{-1}\mathbf{x}_{it}, \quad (6)$$

where $\mathbf{c}$ is a conformable vector of zeros with a 1 in the jth row, $\mathbf{I}$ is the identity matrix, and λ is a constant representing the sum of the discount factor and depreciation rate. This allows substituting q_{it} in equation (4) with the right-hand side of equation (6).

Following Bierlen and Featherstone (1998), the modified investment equation (4) and the VAR in equation (5) are estimated simultaneously using the generalised method of moments (GMM) estimator accommodating heteroskedastic errors and endogeneity in the model. The instrument set includes lagged values of firm fundamentals such as cash flow, sales, net worth, net income and depreciation. For estimation purposes, all variables are first-differenced in order to eliminate fixed effects (Holtz-Eakin *et al.*, 1988).

Empirical testing of the cooperative capital constraint hypothesis is based on a firm-level panel dataset of US agricultural cooperatives. The dataset was obtained from CoBank, a financial services organisation that collected and standardised the financial data for all firms included in the sample. This centralised 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 an accounting firm and prepared under the generally accepted accounting principles (GAAP), which contributes to the quality and integrity of the dataset.

The dataset contains incomplete annual accounting information from 1271 agricultural cooperatives comprising the years 1991 to 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 cooperatives involved in wholesale trade activities. Firms with negative equity and fixed assets are excluded from the sample because they are financially troubled. It is a common practice in the empirical investment literature to exclude from the sample firms with extreme values of investment, cash flow, sales or other variables of interest. The model can be sensitive to outliers, especially if firms have very low capital stock, which is used to normalise the variables in the model. We therefore apply outlier rules to the data and delete observations if they fall in the 1% tails of the respective variable's distribution. Finally, we require that firms have at least 7 years of available data for the variables of interest to be included in the sample. The final sample consists of 876 firms and 7293 observations.

The construction of the variables included in the empirical model of cooperative investment behaviour is conducted as follows. Investment (I_{it}) is defined as capital expenditures for the construction and acquisition of physical assets (property, plant and equipment). However, as data on agricultural cooperatives' capital expenditures are not available, investment is measured from changes in physical assets between subsequent years. This study follows Hoshi *et al.* (1991) and measures cooperative investment as the change in the stock of depreciable capital from the previous year plus capital depreciation during the year.

Cash flow (CF_{it}) in corporations is obtained by adding non-cash cost items, such as depreciation and amortisation, 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 recognise sources and uses of cash that are unique to cooperative organisations. The net income series in the dataset 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 amortisation, but deducts non-cash patronage income,

Table 1
Summary statistics for the cooperative sample, 1996–2000 (n = 4216)

Variable	Mean	Standard deviation	Maximum	95th percentile	5th percentile	Minimum
Total assets ($million)	30.05	165.02	2,934.70	66.63	0.98	0.11
Net worth ($million)	12.08	59.17	1,030.40	26.92	0.63	0.03
Capital stock ($million)	9.69	56.79	925.95	21.11	0.18	0.01
Investment ($million)	1.70	12.29	474.78	3.59	−0.01	−14.48
Cash flow ($million)	1.80	10.82	290.89	3.71	0.01	−16.50
Sales ($million)	75.68	497.09	10,830.27	167.51	1.71	0.15
Investment/capital stock	0.21	0.23	1.62	0.69	−0.01	−0.07
Cash flow/capital stock	0.26	0.19	1.50	0.63	0.02	−0.29
Sales/capital stock	10.44	7.30	81.51	22.73	2.44	0.80
Debt to equity ratio	0.91	0.92	10.00	2.45	0.13	0.00
Permanent equity/net worth	0.42	0.29	1.00	0.99	0.00	0.00
Retained earnings/net worth	0.33	0.23	1.00	0.82	0.00	0.00
Z-score	4.97	9.91	45.66	8.82	2.16	0.15

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 variables, investment, cash flow, sales and instrumental variables are first deflated by the consumer price index (CPI). Subsequently, all variables are normalised by the firm's capital stock in the beginning of the year to eliminate scale effects and to lower heteroskedasticity across firms in the sample. Following Kaplan and Zingales (1997), capital stock is measured as the book value of property, plant and equipment (i.e. net fixed assets).

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 between 1996 and 2000. Descriptive statistics for the unbalanced panel of 876 firms are shown in Table 1. The average cooperative in the sample has $30 million in assets and sales of $76 million. It generates $1.8 million in cash flow and invests $1.7 million in fixed assets per year. In addition, the average cooperative has a debt to equity ratio of 0.91. However, only 42% of cooperative equity capital is permanent as a high fraction of total equity is allocated to individual member accounts and is, therefore, redeemable.

4. Empirical Results

In this section, the empirical results from estimating the Q investment model for the sample of US agricultural cooperatives are analysed (Table 2). Results are based on the following instruments: lagged values 2 to 4 of cash flow and sales as well as net worth, net income and depreciation. 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 – after controlling for investment demand – suggests the presence of binding financial constraints in the full cooperative sample (model 2).

Table 2
Cooperative investment model estimates (p-value in parentheses)

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9
Fundamental q	0.094	0.046	0.031	0.040	0.056	0.054	0.047	0.039	0.041
	(0.001)	(0.010)	(0.055)	(0.051)	(0.021)	(0.012)	(0.009)	(0.059)	(0.055)
Cash flow	–	0.456	0.430	1.174	0.659	0.663	0.439	0.877	0.852
	–	(0.002)	(0.002)	(0.000)	(0.009)	(0.000)	(0.003)	(0.004)	(0.005)
Cash stock	–	–	0.074	–	–	–	–	0.080	0.080
	–	–	(0.000)	–	–	–	–	(0.000)	(0.000)
Size * cash flow	–	–	–	−0.106	–	–	–	−0.066	−0.064
	–	–	–	(0.002)	–	–	–	(0.050)	(0.059)
PK * cash flow	–	–	–	–	−0.421	–	–	–	–
	–	–	–	–	(0.273)	–	–	–	–
Z-score *	–	–	–	–	–	−0.002	–	−0.0002	–
cash flow	–	–	–	–	–	(0.000)	–	(0.294)	–
Debt ratio *	–	–	–	–	–	–	0.00002	0.0004	0.0004
cash flow	–	–	–	–	–	–	(0.000)	(0.000)	(0.000)

Model 3 introduces a stock measure of liquidity in the investment model as accumulated liquid resources may provide a financial cushion reducing the sensitivity of investment to cash flow for firms facing imperfect access to outside capital. Our measure of liquidity is cash stock, defined as the sum of cash plus securities that are readily convertible into cash. Cash stock is measured at the beginning of the period and is also deflated by the CPI and normalised by capital stock. The results support the view that liquidity has a significant effect on investment. Even though the cash flow coefficient is reduced, it is still statistically significant.

In order to ascertain whether cooperative structural and financial characteristics affect the sensitivity of investment to cash flow, interaction terms are added to the investment model. In this study, we focus on the effects of firm size, permanent equity capital, credit risk and leverage on cooperative investment behaviour. Regarding firm size, the literature suggests that small firms 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 study uses total assets to measure the size of cooperative firms. Empirical results suggest that cooperative size significantly affects the sensitivity of investment to cash flow (model 4). In particular, the larger the size of the cooperative, the smaller the sensitivity of investment to cash flow.

Another financial characteristic hypothesised to affect cooperative access to external sources of capital is 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 retained earnings 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 better access to external sources of finance. The interaction term between permanent capital (PK) and cash flow suggests that the sensitivity of investment to cash flow is negatively correlated with permanent capital but the estimated coefficient is not statistically different from zero (model 5).

In addition to firm size and permanent equity capital, this study evaluates whether credit risk (Z-score) of a cooperative affects its investment behaviour. 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 (Altman, 1968). The following variables are used to compute the Z-score: working capital, retained unallocated earnings, before-tax income, total net worth, and net sales revenue.[3] 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. Indeed, the estimated coefficient for the interaction term suggests a negative and statistically significant relationship between Z-score and the sensitivity of cooperative investment to cash flow (model 6). As a cooperative's bankruptcy risk decreases, it has better access to borrowed funds thus becoming less dependent on internally generated capital to invest.

Finally, we also examine whether capital structure affects cooperative investment behaviour. We expect cooperatives with high debt ratios to be more dependent on internal funds as a source of investment capital as the cost of borrowed funds increases with leverage. Results support this prediction showing a positive and significant relationship between leverage and the sensitivity of investment to cash flow (model 7).

For the current models to be valid in the sense that the estimated marginal effects of the interaction terms are related to these variables (i.e. no omitted variable bias) we would have to assume that interaction terms are not correlated with each other. If they are correlated, one would expect that some of them are not significant in combination, because they might pick up the same underlying characteristic of the cooperative. Thus the investment model is estimated with all interaction terms simultaneously (model 8). Results show that financial variables (cash flow and cash stock) play a significant role in cooperative investment behaviour after controlling for marginal q. In addition, the sensitivity of investment to cash flow is reduced for large cooperatives but augmented for cooperatives with high financial leverage. The credit risk (Z-score) interaction term, however, loses significance possibly because of its correlation with debt ratio. These results are corroborated in model 9, which does not include the interaction term for credit risk. We note, however, that the coefficients of the remaining variables hardly change compared with model 8.

5. Firm Investment Behaviour in the US Food Industry

To verify the robustness of our results we repeat the preceding analysis of cooperative investment behaviour using only firms in food manufacturing industries. We collect financial data from publicly traded food manufacturing firms from Standard

[3] Z-score was calculated by the lender who provided the data using the following formula: Z-score = 1.2 ∗ [(total current assets − total current liabilities)/total assets] + 1.4 ∗ (retained unallocated earnings/total assets) + 3.3 ∗ [(profit before distribution and tax + interest expense)/total assets] + 0.6 ∗ [(total net worth − net intangibles goodwill − net intangibles other)/total liabilities] + 0.999 ∗ (net sales revenue/total assets).

Table 3
Food industry sub-samples: Mean values of variables, 1996–2000

Variable	Corporations	Cooperatives
Total assets ($million)	2402.92	151.58
Net worth ($million)	766.27	54.64
Capital stock ($million)	788.13	48.43
Investment ($million)	93.15	8.68
Cash flow ($million)	269.85	8.68
Sales ($million)	2935.11	376.01
Investment/capital stock	0.20	0.18
Cash flow/capital stock	0.32	0.22
Sales/capital stock	4.58	11.55
Debt to equity ratio	2.53	3.01
Permanent equity/net worth	1.00	0.28
Retained earnings/net worth	0.75	0.19
Number of observations	435	431

and Poor's Compustat® database (www.compustat.com). 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 organisation-specific assets (Fama and Jensen, 1983, p. 312). It is, therefore, reasonable to expect that publicly traded firms be *a priori* financially unconstrained.

Summary statistics for the two food industry sub-samples are shown in Table 3. The corporations in the sample are larger than the cooperatives in terms of assets, net worth, capital stock and sales. They also invest relatively more and generate more cash flows. Regarding capital structure, corporations are on average less leveraged than cooperatives. In addition, corporate net worth is permanent whereas cooperatives rely more heavily on redeemable sources of equity capital. Note that unallocated retained earnings represent 19% of food industry cooperative total net worth compared with 75% for their corporate counterparts.

The empirical investment model introduced above is estimated for corporations and cooperatives separately.[4] Regression results for the two relevant coefficients in the investment equation are shown by sub-sample in Table 4. First, we discuss the results of the model augmented with the cash flow variable. Both types of firms respond positively to marginal q as indicated by the sign of the estimated coefficient. In other words, food industry cooperatives and corporations invest more when the demand for capital measured by marginal q is larger. The implied adjustment cost parameter is lower for corporations compared with cooperatives, which suggests that corporations react more quickly with investment to exogenous shocks than their cooperative counterparts. The p-value of the marginal q estimate for the cooperative sub-sample is such that a statistical significant influence would be rejected at the 10% confidence level. Consequently, the data do not show marginal q to be a strong determinant of investment in the case of cooperatives with operations in the food industry.

[4] We performed a Wald test on the H_0 hypothesis that all coefficients are equal across groups. The hypothesis was rejected at the 1% significance level (p-value = 0.000).

Table 4
Investment behaviour in the food industry (p-values in parentheses)

	Corporations	Cooperatives
Cash flow-augmented model		
Fundamental q	0.328 (0.057)	0.668 (0.167)
Cash flow	−0.547 (0.483)	0.608 (0.022)
Model without cash flow		
Fundamental q	0.454 (0.000)	0.252 (0.092)

Cash flow has a significant influence on investment for cooperatives beyond the indirect influence of marginal q, but this is not the case for corporations. In other words, the evidence suggests that cooperatives are financially constrained, whereas corporations are not. Therefore, our comparison of the investment behaviour of cooperatives versus corporations provides further support for the cooperative capital constraint hypothesis.

Given that the influence of cash flow is not statistically significant for corporations, we set beta equal to zero and re-estimate the model for corporations (Table 4). We observe that marginal q is still positive and significant but larger than in the augmented model. Nevertheless, it still implies a quicker reaction of corporations to changing environments than cooperatives in the relevant augmented model. We also report the estimate of the marginal q coefficient in the model without cash flow for cooperatives. The substantially different coefficient would lead the analyst who just looks at this model to falsely believe that marginal q is a statistically significant and highly relevant determinant of cooperative investment. It is a reminder that the model with only marginal q is relevant only in the absence of capital constraints.

6. Summary and Conclusions

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 address the issue of capital constraints in agricultural cooperatives and examine whether physical capital investment is constrained by availability of finance. It is observed that cooperative investment responds positively and significantly to both the marginal profitability of capital and cash flow. When the cash flow variable is included in the investment equation with marginal q, there is a positive and statistically significant correlation between investment and cash flow for the cooperative sample. When focusing on investment behaviour in the US food industry, results suggest that cash flow plays a significant role in the investment behaviour of cooperatives but not in publicly traded corporations. In other words, cash flow influences cooperative investment over and above its predictive content about the future profitability of capital.

In addition, tests for excess sensitivity of investment to cash flow are extended with the inclusion of interaction terms in the cooperative investment equation. These interaction terms are added to examine whether cooperative structural and financial variables affect the sensitivity of investment to cash flow. It is found that size, credit risk and leverage significantly affect cooperative investment behaviour. These results suggest that cooperative managers might be able to alleviate capital constraints by pursuing growth-related strategies while maintaining a conservative capital structure.

Investment constraints arise in agricultural cooperatives as a result of free rider, horizon, and portfolio problems. Cooperatives face vaguely defined property rights constraints because residual claims are restricted to members, non-transferable, redeemable, and with benefit distribution proportional to patronage rather than members' capital contributions. If agricultural cooperatives are to remain viable organisations 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 for ameliorating financial constraints in cooperatives. However, our empirical results suggest that eliminating restrictions on residual claims – such as in the corporate ownership structure – might be a necessary condition for the attenuation of cooperative capital constraints. Perhaps not surprisingly, cooperatives in advanced agricultural countries are beginning to adopt organisational structures that relax some restrictions on traditional cooperative residual claims (Chaddad and Cook, 2004). The survival and growth of agricultural cooperatives in responding to the challenges brought about by the industrialisation of agriculture will likely depend on the relative efficiency of such organisational innovations.

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