Regulatory Environment, Cooperative Structure, and Agency Costs for Cooperative Agribusiness Firms in Canada: Comparative Case Studies

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Agency costs are generated when conflict arises between interests of various stakeholders comprising a firm (Jensen and Meckling 1976; Barnea, Haugen, and Senbet 1985). With distance between managers and directors, the firm may not maximize the welfare of its owners because of agency costs (Laffont and Martimort 2002). As Jensen and Meckling (1976) argue, with an increase in leverage a manager may be more likely to undertake projects that increase her personal benefits in spite of the increase in capital providers' exposure to risk than she would be if she financed the project with her own funds. However, Grossman and Hart (1982) and Jensen (1986) argue that leverage may lead to a potential improvement in efficiency by reducing managerial discretion over free cash flow. While the potential costs and benefits of leverage are well-recognized (e.g., Kim and Maksimovic 1990; Featherstone and Al-Kheraiji 1995), whether leverage forces co-operative agribusiness firm managers toward efficient or inefficient behavior is an open empirical question. Although the benefits and costs of debt as a corporate financing instrument have been theoretically and empirically documented, the influence of industry regulatory structure—such as supply management in the Canadian context—on agency costs of debt remains unknown. Neither has attention been paid to the issue of how co-operative organizational structure (i.e., federated versus centralized) might affect the agency costs of debt.

The objective of this study is to determine if there are agency costs of debt for selected Canadian co-operative agribusiness firms. Specifically, a test for the existence of agency costs of debt is conducted for three agribusiness co-operatives in Canada. Results are compared to previous findings for U.S. co-operatives. This study contributes to the literature in that costs of differing market incentives (i.e., agency costs) are empirically measured for three different Canadian co-operatives. The industry/firm structural differences among the co-operatives are incorporated into the firm specific empirical models.

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Literature Review

Neo-classical economic theory states that in a perfectly competitive market, market pressure resolves the problem of incentives for profit maximization or cost minimization. However, in the principal-agent literature, incentive becomes the central focus of the analysis where the owners of the firm try to align the objectives of various stakeholders, such as owners, workers, supervisors, and managers (Laffont and Martimort 2002; Jensen and Meckling 1976).

Agency problems arise if the owner of the firm delegates a task to a manager who has an incentive incompatibility constraint and the information from the manager to the directors is imperfect. Agency problems may be even more pronounced in the case of a co-operative firm where managers of the firm may not have share-ownership rights. Unless the agency problems are resolved they can lead to suboptimal allocation of resources within the organization, resulting in increased costs of production (Barnea, Haugen, and Senbet 1985).

The financial theory of agency can be considered an application of the economic theory of agency contractual relationships in finance. Agency problems that are related to debt are associated with asymmetric information, risk incentives, investment incentives, and bankruptcy problems (Barnea, Haugen, and Senbet 1985; Jensen and Meckling 1976).

Relatively few studies have estimated the impact of agency costs of debt on costs of production

or total factor productivity (TFP) of firms (e.g., Bernstein and Nadiri 1993; Kim and Maksimovic 1990; Featherstone and Al-Kheraiji 1995; Hossain and Jain 2001).[1] The empirical evidence from these studies indicates that the estimated magnitude of the agency costs would certainly be one of the determinants of the firm's capital-structure decisions. Table 1 contains summary information from these studies, including the industry investigated, the data and methods used, and results.

All of the above studies were conducted for firms in the U.S.; agency costs of debt thus far have not been addressed in the context of agribusiness co-operatives in Canada. This study is unique in that firm-level disaggregated data are used to measure and compare agency costs of debt across different regulatory environments and business structures. Also, none of the previous studies have investigated the agency costs of debt for individual firms.

Does Supply Management Matter?

Supply management is a long-standing policy in some sectors of Canadian agriculture, specifically dairy products, chicken, turkey, and eggs. It may be argued that the supply-management policy may partially mitigate agency costs of debt for co-operative processors facing regulated raw-material supply, such as firms purchasing farm commodities in supply-managed sectors. If the raw material is rationed[2], processors may not operate on their input-demand functions, and observed prices and quantity demanded will not lie on this function (Rude 1992). Furthermore, with increasing market concentration[3] and vertical integration,[4] may create difficulties for processors in acquiring raw materials as dictated by their input-demand curves. Within a regulated industry, with the above structure, the procurement of raw materials becomes a binding constraint for processors. An important issue is whether the impact of agency costs on cost efficiency for processing agribusiness firms differs under such regulatory constraints on raw-material supplies and prices.

Thus the behavioral objective of such a co-operative agribusiness firm will be to maximize short-run members' restricted welfare or minimize restricted variable costs conditional on a given level of raw material, output, debt, and capital stock. The restricted cost function for the processors in a regulated industry is then given as

$$(1)\quad SVC = c(w^i, \bar{x}^i, k, y, D) = \min_x \begin{Bmatrix} w^i x^i + w^j \bar{x}^j : y \le f(k, e, x^i, \bar{x}^j); \\ e, k \in \arg\max_{e,k} \mathrm{E}(S \mid S \ge 0) \end{Bmatrix}.$$

The unrestricted cost function for the firm in unregulated industry is given as

$$(2)\quad SVC = c(w^i, w^j, k, y, D) = \min_x \begin{Bmatrix} w^i x^i + w^j x^j : y \le f(k, e, x^i, x^j); \\ e, k \in \arg\max_{e,k} \mathrm{E}(S \mid S \ge 0) \end{Bmatrix},$$

where $\bar{x}^j$ is the supply-managed raw material. In this case, it is convenient to assume that the constraint on the raw material is always binding so that all raw materials available are utilized and the fixed raw material does not necessarily minimize costs. However, Shephard's Lemma can be invoked to derive shadow prices (values) for fixed (supply-managed) inputs in restricted cost functions. The raw-material input-demand function can then be solved for from the derivative result.

For the restricted short-run cost function, the degree of economic importance of agency costs can be obtained by investigating the elasticity of input misallocation caused by agency costs of debt as

$$(3)\quad \varepsilon_{Di}^{S} = \left(\frac{\partial \ln c_i(w^i, \bar{x}^j, k, y, D)}{\partial \ln D_i}\right) = -\left(\frac{\partial \ln C}{\partial \ln y}\right)\left(\frac{\partial \ln f(x^i, \bar{x}^j, k, e)}{\partial \ln e(k, D)}\right)\left(\frac{\partial \ln e(k, D)}{\partial \ln D}\right).$$

[1] In Featherstone and Al-Kheraiji (1995), while the estimated agency costs are an aggregate for the firms affiliated with Farmland Industries, the co-operatives were of a similar structure.

[2] Volume and prices are established prior to undertaking production and are common knowledge throughout the industry. In many cases, these prices are negotiated or determined in consultation with processors either separately or jointly in a province.

[3] In a concentrated market without supply management, individual firms could have a much bigger impact on raw material price than otherwise would be the case.

[4] A producer/marketing co-operative may be considered to be a form of vertical integration.

Table 1. Comparison of Findings from Previous Agency Costs Studies.

Industry/Firms	Agricultural co-ops sector	Airlines industry	Manufacturing industry	Food-manufacturing industry
Authors	Featherstone and Al-Kheraiji (1995)	Kim and Maksimovic (1990)	Bernstein and Nadiri (1993)	Hossain and Jain (2001)
Data	Panel of 29 U.S. agricultural supply and marketing co-operatives over 10 years	Panel of 17 U.S airline firms over 12 years	36 year (the U.S. manufacturing industry)	36 year (the U.S. food manufacturing industry)
Method	Short-run cost function	Short-run cost function	Variable profit function	Variable profit function
Impact of 1% increase (+) in debt	(+) 0.167% in variable costs	(+) % 0.034 in variable costs	(-) 3.3% in TFP	(-) 12.25% TFP

For the unrestricted cost function the general form for elasticity of input misallocation is given as

$$(4)\quad \varepsilon^{S}_{Di} = \left(\frac{\partial \ln c_i(w^i, w^j, k, y, D)}{\partial \ln D_i}\right) = -\left(\frac{\partial \ln C}{\partial \ln y}\right)\left(\frac{\partial \ln f(x^i, \bar{x}^j, k, e)}{\partial \ln e(k, D)}\right)\left(\frac{\partial \ln e(k, D)}{\partial \ln D}\right).$$

Given production controls and invoking the Le Chatelier-Samuelson principle, more restrictions make choice variables less responsive to changes in exogenous variables (Chambers 1988). This suggests that the degree of economic importance of agency costs may be different for firms operating in regulated versus unregulated industries. The agency costs of debt may be less pronounced under supply management. If a fixed-proportion production technology is assumed (Royer and Bhuyan 1995) between the raw materials supplied by members and the output of the processing co-operative firms, agency costs may be zero, since $\partial f(.)/\partial e = 0$.

Does the Structure of the Co-operative Matter?

Another factor that may influence the importance of agency costs is co-operative organizational structure. The potential impact of co-operative organizational structure on agency costs of debt has been ignored despite the fact that many co-operatives operate under different structural arrangements. The potential impact of organizational structure (i.e., federated vs. centralized) may be seen through an assessment of the reliance of "members" on the performance of the co-operative in terms of the impact on their own welfare. In the case of a centralized co-operative structure, members are individual farmers or business owners. Their welfare and viability are largely determined by the performance of their own businesses, as patronage from the co-operative typically represents a relatively small proportion of their total income.

In contrast, members of a federated co-operative are themselves (local) co-operatives. Their livelihood depends on profits earned by retailing goods and services to their individual members (i.e., farmers or business owners). The success of these local co-operatives is very much dependent on the cost efficiency of the federated co-operative. Any inefficiency at the federated co-operative level can be transferred, through higher prices paid for goods and services, to individual local co-operatives. Thus these local co-operatives may have a stronger impetus to mitigate agency problems at the federated co-operative level.

Given the decentralized nature of the federated co-operative, in order to ensure survival, the individual local co-operatives will demand efficient and effective decision-making authority at the board level by taking into account the optimal balance between the business and association incentives of the federated co-operative. Accordingly, it can be argued that if there is efficient co-operative governance, the agency costs of debt leveraging are minimal under the federated co-operative scenario. In sum, it can be claimed that organizational structure may exacerbate or mitigate the agency costs of debt arising from conflict of interests; and the impact of

co-operative organization structure on agency costs of debt warrants investigation.

Model and Data

Agency costs of debt are not easily tractable and testable. In an attempt to deal with an intractable problem, the agency costs of debt are defined as a variable that represents a shift in the production function through the influence of managerial efforts. For example, variables such as time can be included in a production function as an argument to capture intractable technological change (Chambers 1988) since outputs and inputs may vary with time. To empirically investigate the impact of agency costs of debt on resource allocation, the neo-classical theory of the firm is adopted. In this study, the translog short-run cost function[5] that incorporates pre-existing debt (D_{t-1}) as a "shift-variable" is proposed for use:

$$(5)\quad \ln SVC_t = \alpha_0 + \beta_T T + \beta_y \ln y_t + \Sigma_j \beta_j \ln w_{jt} + \beta_k \ln k_t + \beta_D \ln D_{t-1} + \tfrac{1}{2}\left[\beta_{yy}(\ln y_t)^2 + \Sigma_j \Sigma_i \beta_{ji} \ln w_{it} \ln w_{jt} + \beta_{DD}(\ln D_{t-1})^2 + \beta_T T^2\right] + \Sigma_j \beta_{jy} \ln y_t \ln w_{jt} + \beta_{yk} \ln y_t \ln k_t + \beta_{yD} \ln D_{t-1} \ln y_t + \Sigma_j \beta_{jk} \ln w_{jt} \ln k_t + \Sigma_j \beta_{jD} \ln w_{jt} \ln D_{t-1} + \beta_{kD} \ln k_t \ln D_{t-1} + \Sigma_j \beta_{jT} \ln w_{jt} \ln T_t + \varepsilon_t ,$$

where SVC_t is the observed short-run variable cost in the t^{th} time period, y_{it} represents output in the t^{th} time period, w_{jt} is the price of the j^{th} variable input in the t^{th} time period, D_{t-1} is the level of lagged debt in the t^{th} period, k_t is the level of quasi-fixed capital stock in the t^{th} period, T is time (included to capture variation in technology over time), β's are parameters to be estimated, and ε_{it} is a stochastic term. For a co-operative operating in a supply-managed industry, Equation 5 is modified by replacing price of raw materials by quantity of raw materials used, where $\bar{x}_t$ is the level of raw material available to a co-operative operating in a supply-managed industry. From the translog cost function, the input share equations are specified as

$$(6)\quad S_{jt} = \beta_j + \Sigma_j \beta_{ji} \ln w_{jt} + \beta_{jy} \ln y_t + \beta_{JD} \ln D_{t-1} + \beta_{jk} \ln k_t + \beta_{jT} T + \varepsilon_{jt} ,$$

where S_{jt}s are the input share equations. The translog cost and input share equations are simultaneously estimated.

The empirical model is estimated using time-series data for three case co-operative agribusiness firms: 1) *Lilydale Foods Limited* (2005), a centralized marketing co-operative operating in supply-managed industry; 2) *Alberta Honey Producers Co-operative* (2005), a centralized marketing co-operative operating in an unregulated industry; and 3) *Federated Co-operative Limited* (2005), a federated (or decentralized) supply co-operative operating in an unregulated industry.

The three cases were selected to be representative of the hypotheses discussed previously. LF was established in 1940, when a group of farmers established the "Alberta Poultry Producers Ltd." to help them provide better quality poultry products to a wider consumer base.

> *"[Currently], Lilydale Foods is the largest poultry [processing co-operative] in the country. Lilydale operates eight processing plants, five hatcheries, six corporate farms, one egg plant and one manufacturing plant. Lilydale generates hundreds of products, which are sold throughout Canada as well as to an international marketplace."* (Lilydale Foods 2004).

Over the study period Lilydale Foods has undergone major structural changes. These periods are provided in Table A1 in the Appendix.

The Alberta Honey Producers Co-operative Limited (AHP) has marketed honey for its member producers since 1940. In 1994 the co-operative developed a value-added operation to process and market producers' wax, a by-product of honey production and a market open only to those with the technology to refine the wax for the marketplace. Other products include wax sheets and bulk beeswax for the candle, craft, and hobby industries. Any beekeeper operating in Alberta, Saskatchewan, or British Columbia may apply for membership in AHP provided the beekeeper is able to ship a minimum of 5,000 pounds of honey annually. The AHP co-operative also contains a retail outlet which, of course, sells honey.

The establishment of Federated Co-operatives Limited (FCL) follows the amalgamation of Saskatchewan Federated Co-operatives Limited

[5] The approach used in this study is similar to Kim and Maksimovic (1990) and Featherstone and Al-Kheraiji (1995). Bernstein and Nadiri (1993) and Hossain and Jain (2001), however, used a variable profit function to estimate the impact of agency costs of debt on total factor productivity.

(SFCL) and Manitoba Co-operative Wholesale (MCM) in 1955. FCL is owned by more than 300 retail co-operatives as their own central wholesaling, manufacturing, and administrative organization. FCL is involved in business operations such as petroleum retailing, grocery, family fashions, feed, food, forest products, and hardware and building products.

Annual data on sales of co-operative output, costs of labor, costs of raw material inputs, costs of other variable inputs, depreciation, capital investment, property, buildings, equipment, and long-term debt, are obtained from annual reports for the three co-operatives. Additional data are obtained from various Statistics Canada publications and web sites. Although FCL reported no long-term debt over 1997–2001, to avoid problems related to taking the logarithm of zero the value 0.0001 is added to the debt series. The retail-trade industry hourly wage rate is obtained from Statistics Canada Database Table L180481; consumer price index for transportation (as a proxy for marketing services) from Table P200174 and for utilities (water, fuel, and electricity) from Table P200089 (CANSIM 2005).

For LF and AHP, data on prices of raw materials are obtained from the Annual Survey of Manufacturers (ASM) by dividing the aggregate value of the commodity shipped by the quantity shipped for the industry. Raw-materials price indices for grains and other commodities are obtained from CANSIM Table 3300001 (2005). Raw-material quantity (i.e., kilograms of bird slaughter) is obtained from Agricultural and Agri-Foods Canada (2005). For LF and AHP, wage rates are obtained from the ASM by dividing the total wages of production workers by the hours worked by the production workers for both industries. Raw-material prices for honey are obtained from CANSIM II series V170371 (CANSIM 2005) by dividing the value of farm production by the quantity of honey produced. To obtain honey output, sales are deflated by prices of output. Output prices of processed poultry products are obtained from ASM and Agriculture and Agri-Food Canada. The consumer price index (CPI) (Table P700000), price index of honey containers (CANSIM II series V1574833), price index of utilities, and interest rates (Table B14016/Matrix 2526) are obtained from Statistics Canada (2005). The GDP deflator (V647710) and Fixed Capital GDP deflator (V647718) are obtained from CANSIM II (2005) and are used to compute the per-unit cost of capital. Table 2 depicts the descriptive statistics for the data used in the analysis.

Table 2. Descriptive Statistics for Federated Co-operative Limited, Alberta Honey Producers Co-operative and Lilydale Foods (1974–2001).

	FCL		AHP		LF	
Variables	Mean	Std. dev.	Mean	Std. dev.	Mean	Std. dev.
Wage rate (Can$/hour)	9.13	(0.44)	14.19	(3.71)	9.71	(0.46)
Raw material price (Can $/kg)	—	—	0.14	(0.04)	—	—
Other inputs price (index)	81.29	(31.76)	76.13	(5.75)	74.60	(9.30)
Raw material quantity (million kg)	—	—	—	—	106.27	(33.94)
Total variable cost (million Can $)	121	(17.91)	8.28	(1.75)	52.52	(25.60)
Output (value added) (million Can$)*	215	(54.37)	0.72	(0.47)	175.50	(109.33)
Output (million kg)			6.60	(1.60)		
Long-term debt (million Can$)	59.75	(51.74)	0.74	(0.67)	12.89	(8.09)
Capital stock (million Can$)	34.11	(10.24)	2.43	(1.03)	30.58	(10.74)
Labor cost share	0.56	(0.04)	0.08	(0.02)	—	—
Raw material cost share	—	—	0.62	(0.06)	0.54	(0.07)
Other variable cost share	0.44	(0.04)	0.30	(0.05)	0.46	(0.07)

* Based on the retail industry literature (Waldorf 1966), the constant dollar value added is used to measure the output for FCL.

Model Results and Discussion

The parameters for the systems of cost and share equations are estimated using nonlinear least-squares procedures in Time Series Processor (TSP) 4.5. Three separate short-run cost and input-cost share systems of equations are estimated—two for processing marketing co-operatives (LF and AHP) and one for a federated wholesaling co-operative (FCL) (Appendix Tables A2, A3, and A4). Most of estimated cost function parameters are statistically significant at a 5-percent level of significance. The R^2s for the estimated equations are within a reasonable range (Table 3). Tests for autocorrelation are conducted for each model using the Likelihood Ratio test. The calculated chi-square values are given in Table 3. The critical chi-square value is 3.841 for one degree of freedom at 5-percent significance level, suggesting that there are autocorrelation problems for the AHP and LF models. The existence of residual autocorrelation for LF and AHP models may indicate an incorrect functional form, omitted variables, or a missing dynamic specification (Verbeek 2000). Those models were corrected for first-order autocorrelation.

For the co-operative firms' optimization behavior to be consistent with cost minimization, the estimated cost functions must fulfill the regularity properties of a dual-cost function. In this study, the homogeneity and symmetry restrictions were imposed prior to estimation. The curvature and monotonicity conditions were checked. Monotonicity requires that the estimated cost-shares equations and the estimated elasticity of cost with respect to output be nonnegative. Monotonicity in input prices and output was evaluated at the mean value and was found to be satisfied for all models. Thus, on average, the case firms' behavior was consistent with cost minimization.

Concavity requires the Hessian matrix be negative semi-definite. The cost function is concave if the eigenvalues of the Hessian matrix are negative or zero at each data point. The eigenvalues were calculated at the mean value of variables in the model. The calculated eigenvalues were non-positive for all estimated cost functions. Thus the current cost functions fulfill the regularity property of concavity. In general, the estimated cost functions were consistent with the cost-minimization behavior, given other un-modeled effects.

Measure of Agency Costs of Debt

Agency costs of debt are measured and tested using the statistical significance of the cost elasticity of debt. From the translog cost function (Equation 5), the cost elasticity of debt is estimated as

$$(7)\quad \frac{\partial \mathrm{SVC}_t}{\partial D_{t-1}} = (\beta_D + \beta_{DD}\ln D_{t-1} + \beta_{yD}\ln y_t + \Sigma_j \beta_{jD}\ln w_{jt} + \beta_{kD}\ln k_t),$$

and for a co-operative operating in a supply-managed industry as

$$(8)\quad \frac{\partial \mathrm{SVC}_t}{\partial D_{t-1}} = \beta_D + \beta_{DD}\ln D_{t-1} + \beta_{yD}\ln y + \Sigma_{(j-1)}\beta_{(j-1)D}\ln w_{(j-1)t} + \beta_{D\bar{x}}\bar{x}_t + \ln k_t + \beta_D \ln k_t .$$

For an upward-rising marginal cost function, agency costs of debt exist if the term $\partial SVC_t / \partial D_{t-1}$ is greater than zero. For each co-operative, the cost elasticity of debt is calculated at the beginning (1975), and ending (2001) data points and at the mean values of the variables in the model (Table 4). A t-test is used to test the significance of the estimated cost elasticity of debt. Results of the Wald test were not different.

Table 3. Model Tests for Cost Function.

Case Firms	Translog cost function (R^2)	Labor cost share (R^2)	Material cost share (R^2)	Autocorrelation (LR) test
Lilydale Foods	0.997	0.956	—	15.458
Federated Co-operative Ltd.	0.915	0.948	—	0.100
Aleberta Honey Producers Co-operative	0.930	0.662	0.636	7.582

Table 4. Estimates of Elasticity of Variable Cost Indebtedness Elasticities (Agency Cost) for Lilydale Foods, Federated Co-operative Limited, and Alberta Honey Producers Co-operative (1974–2001).

Case firms	1975		2001		Mean	
	Estimate	Std. dev.	Estimate	Std. dev.	Estimate	Std. dev.
Lilydale Foods	-0.169	(0.149)	-0.168	(0.130)	-0.109***	(-0.046)
Federated Co-op Limited	-0.021	(0.022)	0.019	(0.015)	-0.0237	(0.017)
Alberta Honey Producers Co-op	0.141***	(0.037)	0.100***	(0.025	0.067***	(0.018)

*** denotes 1% level of significance.

Alberta Honey Producers Co-operative

For the Alberta Honey Producers Co-operative model, on average, the estimated cost elasticity of debt is 0.067, and is statistically significant. This is consistent with the prediction that agency costs of debt may cause a potential deterioration in cost efficiency (Barnea, Haugen, and Senbet 1985; Jensen and Meckling 1976). This finding suggests that, other things held constant, a 10% increase in the level of debt results in a 0.67% increase in the total variable costs of production for Alberta Honey Producers Co-operative that is attributable to agency problems.

Lilydale Foods

For Lilydale Foods the estimated cost elasticity of debt is negative and statistically significant. This suggests that the agency costs of debt decrease with increased leverage. Based on the hypothesis and empirical results it is possible that supply management might have lessened agency costs of debt. This might have been due to the fact that supply management, through predetermined levels of raw materials, may be equivalent to a system of monitoring the level of processor output and avoiding managerial *shirking-effects* that negatively affect the level of output. According to the Lilydale Foods 2001-2002 annual report:

> Within the industry, supply of product to processing plants is governed by national and provincial boards that directly impact quantities and live prices. As a result, the Co-operative only has control over the efficiency of its operations, which is a much smaller component of the total cost of merchandise [i.e., total variable costs] sold (p.28).

In the estimation of the systems of cost and shares equations, dummy variables are included for Lilydale model in order to capture major structure changes that have occurred over time. These periods are provided in Appendix Table A1. Results suggest that the cost share of labor has gone down since the purchase of the de-boning plant in Edmonton in 1995. The coefficients of dummy variables representing the structural changes in the 1980s (i.e., in 1983 and 1986/87) are statistically significant and positive. This suggests that total cost and cost share of labor has increased after these changes. Finally, the coefficient for the purchase of a plant in Saskatchewan (in 1999) is negative for the labor-cost share equation but is not statistically significant. However, the coefficients for structural changes in the translog cost function are all positive, suggesting that the total costs of production have increased after these changes.

Federated Co-operative Limited

For Federated Co-operative, cost elasticities of debt are statistically insignificant at every data point examined. The absence of agency costs of debt for Federated Co-operatives may be partially explained in terms of effective monitoring by member co-operatives. In the quest for a successful business operation, good governance—the way a company is directed and controlled—is indispensable. As noted earlier, there is a stronger impetus within a federated governance structure for individual member co-operatives to mitigate agency problems. As acknowledged in its annual reports, one of the

principal activities of the Federated Co-operative Limited involves provision of organizational and management services to the member co-operatives. The Canadian Co-operative Association cites Federated Co-operative Limited as one example of good co-operative governance:

> "... Federated Co-operatives Ltd. conscientiously breathes life into the co-operative principles in its governance.... Member co-ops are supported by courses in human resources, financial services, member relations, etc." (Canadian Co-operative Association 2002)

Federated Co-operative may be mitigating agency costs of debt because the decision-making process is performed with the active involvement of grassroots members. Furthermore, a closer look at the trend in the long-term debt of Federated Co-operative shows a consistent decline over time, reaching zero in 1998 and afterwards. This may indicate a behavioral change on the part of the decision makers in order to reduce the costs of borrowing (both direct and indirect).

In other empirical evidence (Kim and Maksimovic 1990; Featherstone and Al-Kheraiji 1995; Hossain and Jain 2001; Bernstein and Nadiri 1993) the existence of agency costs of debt, regardless of the type of firms included in their analysis, has been reported. For example, previous aggregate studies of supply and marketing co-operatives (Featherstone and Al-Kheraiji 1995) suggested that a 10-percent increase in debt leads to a 1.67-percent increase in variable costs of production. The agency costs of debt estimated in these studies were aggregate values for all the firms in the sample or for the aggregate industry, suggesting that all the firms in the industry are experiencing agency problems. However, based on our model estimates, not all firms experience agency costs of debt. Firm- and industry-specific characteristics are found to have important effects on the existence of agency costs of debt. Thus it is "appropriate" to account for firm- or industry-specific differences when estimating agency costs of debt.

Conclusion

Although previous empirical evidence has invariably reported the existence of agency costs for aggregate samples or industries, the agency costs of debt in these case studies were found to be firm-specific. Agency costs of debt may have consequential influence on the cost efficiency of co-operative agribusiness firms. Thus if there are any agency costs, capital investment decisions or capital budgeting analysis should account for the agency costs of debt and cash flows should be discounted at the agency-cost-adjusted cost of capital. The agency costs of debt may have different impacts under different regulatory environments and business structures. In our case studies, we found evidence of statistically significant agency costs of debt in one of the case co-operatives. Finally, since this is a comparative case study, we cannot claim to generalize the findings to other co-operatives beyond these cases. This study is an exploration to see if there might be research potential in looking at specific firm type or industry structure in fuller panel-data-type analysis.

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Appendix

Table A1. Major Structural Changes from 1974 to 2001 for Lilydale Foods.

Period	Activity	Dummy
January 1983	LF Purchased Maple Leaf 50% Pincrest Food	Dum83+
November 1984	Lilydale Merger with Pan Ready Poultry	
1986	Merger with Scott Co-operative Association, British Colombia	Dum86+
June 1987	Van Sausage was bought for further processing	
1995	Lilydale bought de-boning plant in Edmonton Bought Sunrise Limited	Dum94+
1999	Bought Sun Poultry Co-operative (the only processor in Saskatchewan)	Dum98+

Table A2. Nonlinear Parameter Estimates of the System of Equations the Translog Cost and Share Functions for LF Co-operative (N=28).

Variables		Estimate	Std. dev.	Variables		Estimate	Std. dev.
Constant	β_0	16.329***	(0.377)	Output^2	β_{YY}	-0.809	(0.670)
Labor Price	β_L	0.592***	(0.048)	Output x Debt	β_{YD}	0.076	(0.226)
Other Price	β_H	0.408***	(0.048)	Output x Capital	β_{YK}	-0.096	(0.225)
Material Quantity	β_M	-2.277***	(0.810)	Labor x Debt	β_{LD}	0.014	(0.012)
Output	β_Y	1.530**	(0.682)	Other x Debt	β_{HD}	-0.014	(0.012)
Debt	β_D	-0.196	(0.248)	Debt^2	β_{DD}	-0.154	(0.154)
Capital	β_K	-0.0004	(0.230)	Debt x Capital	β_{DK}	0.038	(0.113)
Labor^2	β_{LL}	0.058	(0.042)	Labor x Capital	β_{LK}	0.008	(0.016)
Labor x Other	β_{LH}	-0.058	(0.042)	Other x Capital	β_{HK}	-0.008	(0.016)
Other^2	β_{HH}	0.058	(0.042)	Capital^2	β_{KK}	0.067	(0.278)
Labor x Material	β_{LM}	0.126***	(0.049)	Dum83+	α_{1C}	0.078*	(0.044)
Other x Material	β_{HM}	-0.126	(0.049)	Dum86+	α_{2C}	0.269*	(0.052)
Material^2	β_{MM}	-4.856***	(1.595)	Dum94+	α_{3C}	0.269***	(0.052)
Material x Output	β_{MY}	2.453***	(0.836)	Dum98+	α_{4C}	0.046	(0.055)
Material x Debt	β_{MD}	0.017	(0.317)	Dum83+	α_{1S}	0.029*	(0.018)
Material x Capital	β_{MH}	0.330	(0.496)	Dum86+	α_{2S}	0.062***	(0.018)
Labor x Output	β_{LY}	-0.078	(0.054)	Dum94+	α_{3S}	-0.034***	(0.013)
Other x Output	β_{HY}	0.078	(0.054)	Dum98+	α_{4S}	-0.025	(0.018)
AR(1)	ρ	0.735***	(0.077)				
Log likelihood Function		149.407					
Schwarz B.I.C.		-89.572					

***, **, and * refer to 1-percent, 5-percent, and 10-percent level of significance, respectively. α_{iC} = coefficients of year dummies for cost function; α_{iS} = coefficients of year dummies for share equations, i=1, 2, 3,4.

Table A3. Nonlinear Parameter Estimates of the System of Equations the Translog Cost and Share Functions for AHP Co-operative (N=28).

Variables		Estimate	Std. dev.	Variables		Estimate	Std. dev.
Constant	β_0	0.132*	(0.078)	Output x output	β_{YY}	-0.453	(0.355)
Labor Price	β_L	0.073***	(0.006)	Labor x Debt	β_{LD}	-0.001	(0.002)
Materials Price	β_R	0.643***	(0.026)	Raw x Debt	β_{RD}	0.010	(0.009)
Others Price	β_H	0.284***	(0.025)	Other x Debt	β_{HD}	-0.009	(0.009)
Output	β_Y	0.715***	(0.079)	Output x Debt	β_{YD}	-0.153***	(0.054)
Debt	β_D	0.034	(0.029)	Debt x Debt	β_{DD}	-0.047*	(0.028)
Time	β_T	-0.023	(0.141)	Labor x Time	β_{LT}	0.011**	(0.005)
Capital	β_K	0.112*	(0.070)	Raw x Time	β_{RT}	-0.022	(0.022)
Labor x Labor	β_{LL}	-0.013**	(0.006)	Other x Time	β_{HT}	0.011	(0.021)
Labor x Raw	β_{LR}	-0.025***	(0.010)	Time x Time	β_{TT}	-0.004	(0.125)
Labor x Other	β_{LH}	0.039***	(0.011)	Labor x Capital	β_{LK}	-0.003	(0.006)
Raw x Raw	β_{RR}	0.031	(0.048)	Raw x Capital	β_{RK}	0.092***	(0.028)
Raw x Other	β_{RH}	-0.006	(0.066)	Other x Capital	β_{HK}	-0.088***	(0.030)
Other x Other	β_{HH}	-0.033	(0.074)	Output x Capital	β_{YK}	0.533**	(0.233)
Labor x Output	β_{LY}	-0.045***	(0.010)	Debt x Capital	β_{DK}	0.047	(0.040)
Raw x Output	β_{RY}	0.050	(0.044)	Capital x Capital	β_{KK}	-0.544***	(0.221)
Other x Output	β_{HY}	-0.004	(0.038)	AR(1)	ρ	0.286***	(0.068)
Log-likelihood Function		194.270					
Schwarz B.I.C.		-137.142					

***, **, and * refer to 1-percent, 5-percent, and 10-percent level of significance, respectively.

Table A4. Nonlinear Parameter Estimates of the System of Equations the Translog Cost and Share Functions for FCL (N=28).

Variables		Estimate	Std. dev.	Variables		Estimate	Std. dev
Constant	β_0	0.929***	(0.070)	Other x Other	β_{HY}	-0.033*	(0.019)
Labor Price	β_L	0.444***	(0.013)	Debt x Debt	β_{DD}	-0.003	(0.002)
Other Price	β_H	0.557***	(0.013)	Labor x Debt	β_{LD}	0.001***	(0.0004)
Output	β_Y	0.516***	(0.165)	Other x Debt	β_{HD}	-0.001***	(0.0004)
Debt	β_D	-0.036	(0.025)	Other x Debt	β_{YD}	-0.032	(0.029)
Capital	β_K	-0.111*	(0.065)	Time x Time	β_{TT}	0.596**	(0.254)
Time	β_T	-1.171***	(0.189)	Labor x Time	β_{LT}	0.096***	(0.014)
Labor x Labor	β_{LL}	0.149***	(0.009)	Other x Time	β_{HT}	-0.096***	(0.014)
Labor x Other	β_{LH}	-0.149***	(0.009)	Capital x Capital	β_{KK}	-0.114	(0.160)
Other x Other	β_{HH}	0.149***	(0.009)	Labor x Capital	β_{LK}	-0.033***	(0.007)
Output x Other	β_{YY}	-1.796	(1.248)	Other x Capital	β_{HK}	0.033***	(0.007)
Labor x Other	β_{LY}	0.033*	(0.019)	Output x Capital	β_{YK}	-0.661*	(0.377)
Debt x Capital	β_{DK}	-0.016	(0.012)				
Log likelihood Function		138.391					
Schwarz B.I.C.		-102.490					

***, **, and * refer to 1-percent, 5-percent, and 10-percent level of significance, respectively.