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Relationship of Pooling to Equity Capital and Current Assets of Large Producer Marketing Cooperatives

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Committed marketing cooperatives have ensured member support and because of pooling may have higher leverage relative to buy-sell cooperatives. The hypothesis tested in this article is that marketing cooperatives with pooling have less market risk compared with those without pools and as a consequence can incur more financial risk and command greater leverage. Using an econometric approach to control for size of cooperative, empirical results suggest that pooling cooperatives have increased leverage, about 9 percent more than nonpooling cooperatives.

Producer marketing cooperatives have been categorized as buy-sell and committed (Black and Knutson). The primary distinction is that buy-sell cooperatives by definition do not operate a pool. Cooperatives with pooling make marketing decisions on behalf of their members, and buy-sell cooperatives do not. Pooling operates in tandem with marketing agreements. Cooperatives that operate pools are the "committed" type. Members of pooling cooperatives sign a formal contract with the cooperative that pledges each member's production to the pool.

There are perceived benefits to cooperatives operating pools with marketing agreements (Black). Committed marketing cooperatives, compared with buy-sell cooperatives, have ensured member support and more predictable costs. The effects of pooling should be reflected in selected financial variables of cooperatives, such as equity capital or leverage, if the perceived benefits of pooling are real. An important hypothesis concerning the perceived benefits of pooling is that marketing cooperatives with pooling have less market risk compared with those without pools and as a consequence can incur more financial risk. Such cooperatives may be able to borrow more money per unit of equity capital. A corollary is that pooling results in

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greater "efficiency" of equity capital in the sense that greater total assets per dollar of equity capital can be controlled by equity owners.

These perceived benefits form the basis for the research reported here. The importance of identifying and quantifying the impact of pooling on the financial aspects of cooperatives is substantial. First, a quantified relationship serves as a test of the general conclusions of previous literature. Second, studies concerning marketing cooperatives sometimes recommend the establishment of a pool or committed structure without any specific quantitative knowledge concerning the long-term implications of pooling on financial structure (Knutson, Cook, and Sporleder). The purpose of this research is to quantify the relationship between pooling and the equity-asset ratio of selected large cooperatives. The relationship of pooling to other financial variables also is addressed.

Previous Research

Pooling, supported by member commitment and vertical integration, often has been suggested as a means for providing volume expansion and, through per-unit retains, generating the capital required for member service and cooperative competitiveness (Fenwick). The per-unit capital retain often associated with the operation of a pool provides cash flow in the same way equity retained from patronage refunds generates cash to finance growth and retire debt (Moore and Fenwick). In this sense, the operation of a pool puts a greater financial burden on current patrons than on past patrons for providing necessary capital.

One problem faced by many cooperatives is to satisfy the needs of member-patrons while attempting to acquire the equity capital required for growth. Cooperatives traditionally have relied on current patrons to provide financing. Meanwhile member-patrons no longer using the cooperative expect relief from their investment (Brown and Volkin). The majority of cooperatives have a redemption system, but the equity redeemed is sometimes 20 to 30 years old (Cobia et al.) Cooperatives that redeem equity do so depending on the amount of savings or retained earnings. The relationship between pooling and equity is important because pooling provides a commitment to combine the output of participating members and to jointly market, and it may change the equity capital requirement of members.

Many cooperatives have experienced pressure to redeem equity from member-patrons in the form of complaints and withdrawals, which have led to testimony and state supreme court involvement (Cook, Sporleder, and Dahl). In 1979, the U.S. General Accounting Office recommended that unless cooperatives offer more equitable retirement programs, the secretary of agriculture should develop legislation for mandatory payment of interest or dividends on retained equity and/or mandatory equity retirement within a specific time period (Royer).

Royer suggests that the threat of mandatory retirement programs could force a weak cooperative into financial failure. However, he allows that some cooperatives might be able to meet mandatory requirements through direct investments, increased retained patronage refunds, or per-unit capital retains.

Data

The Agricultural Cooperative Service (ACS) of the U.S. Department of Agriculture collects financial data from the 100 largest cooperatives in terms of sales (Davidson, Street, and Wissman). Among the information collected are assets, liabilities, equity capital, and sources and uses of funds. Cooperatives are categorized by major function, tax status, organizational structure, and commodities handled. Variables such as number of members (associations or individuals), cooperative type, major function, commodity type, presence of pooling, presence of integration, and presence of export operations were identified in consultation with ACS personnel. The data set used for the analysis presented here includes large nondairy cooperatives (assets of $19 million or more) over the years 1980, 1981, and 1982. Dairy cooperatives were excluded from the sample because their pooling operations are unique compared with other cooperatives. A total of 198 observations was available for the analysis.

Analysis and Results

Several econometric models were specified and estimated. An econometric approach has the advantage of controlling for the influence of important factors that vary among cooperatives.

Equity Capital Model Specification

It was hypothesized that a cooperative that pools would tend to face less uncertainty because it has a commitment from members to supply their product. Thus pooling cooperatives could be expected to be more efficient and to have less need for cash on hand to meet uncertainties. It was hypothesized that these tendencies would be reflected in greater leverage and less equity for pooling firms, ceteris paribus.

In selecting a dependent variable to address this hypothesized relationship, it was noted that equity capital is positively correlated with cooperative size. To help control for size, equity capital was divided by total assets for each cooperative and used as the dependent variable (denoted by ECT). ECT can vary between zero and 1.0. For the data set, ECT had an average value of .314, a minimum value of .032, and maximum value of .8. Thus the average cooperative had 31.4 cents of equity per dollar of total assets.

Using the ratio of equity to total assets as the dependent variable permits examination of leverage in a direct manner, minimizes potential problems with accounting identities, and avoids problems with heteroscedasticity encountered when only equity is used as the dependent variable. Variation in ECT is more difficult to explain than variation in equity because equity is highly correlated with other variables correlated with firm size.

Heteroscedasticity exists when the variance of the disturbance is not constant over observations. Failure to correct for heteroscedasticity does not imply that the estimate is biased but does imply that the variance is likely to be overstated. Using ECT results in a more stable disturbance that is not related to firm size.

Multicollinearity among possible explanatory variables in this type of specification must be recognized and considered in interpretation. For example, sales; property, plant, and equipment; borrowed capital; assets; and other available variables all tend to be greater in value for larger cooperatives, making it difficult to attribute causation to a particular variable.

The determination of which explanatory variables to include was based partially on the notion that larger firms are more efficient, represent less credit risk, and tend to be more diversified (Sporleder and Skinner). The largest cooperatives tend to command more borrowed capital and obtain greater leverage, implying that total borrowed capital should be an adequate measure of credit worthiness. ECT should tend to be lower, or leverage greater, for cooperatives with greater total borrowed capital. The relationship between total borrowed capital and leverage might be influenced by the presence of pooling and by cooperative function. It was reasoned that a cooperative that pools should obtain greater leverage, or lower values of ECT, when compared with a similar cooperative that commands the same level of borrowed funds but does not pool. The greater relative leverage is a consequence of less market risk, which allows the cooperative to take on more financial risk.

The following model was specified:

$$ECT_i = \beta_0 + \beta_1 P_i + \beta_2(1/T_i) + \beta_3 FS_i + \beta_4 MS_i + \beta_5 I1_i + \beta_6 I2_i + \beta_7 I3_i + u_i \tag{1}$$

where:

ECT_i = equity capital divided by total assets (cents per dollar) for i^{th} cooperative,
P_i = dummy variable, equaling one when pooling is present and zero otherwise,
T_i = total borrowed capital (dollars),
FS_i = sales associated with the farm supply function of the cooperative (dollars),[1]
MS_i = sales associated with the marketing function of the cooperative (dollars),
$I1_i$ = interaction term: $(1/T_i) \times P_i$,
$I2_i$ = interaction term: $(1/T_i) \times$ MARKET (where MARKET equals one when the cooperative has only a marketing function and zero otherwise),
$I3_i$ = interaction term: $(1/T_i) \times$ MIXED (where MIXED equals one when the cooperative has both marketing and farm supply functions and zero otherwise), and
u_i = error term.

This specification isolates the relationship between leverage and pooling by accounting for factors related to firm size and function.

Usually the leverage of the largest cooperatives is not greatly affected by changes in the amount of borrowed capital. A difference of $10 million in borrowed funds, for example, reveals little insight into possible differences in leverage for large cooperatives. This does not hold true for smaller cooperatives. Generally a difference of $10 million in borrowed capital would indicate a significant difference in leverage for relatively smaller cooperatives. In other words, the impact of total borrowed capital is not linear.

This suspected nonlinearity is incorporated into the model by the inclusion of the inverse of the total borrowed capital variable (1/T). The interaction terms I1 and I3 allow the relationship between total borrowed capital and ECT to vary according to cooperative function. The pooling interaction term and the dummy variable for pooling allow quantification of the relationship between pooling and ECT.

Equity Capital Model Interpretation

As previously mentioned, there is a high degree of correlation among total borrowed capital, sales, and certain other variables because many of these variables are to varying degrees proxies for firm size. Thus total borrowed capital and sales reflect firm size. However, interpretation of how the independent variables are related to ECT provide some quantitative evidence on how pooling may be related to equity capital.

The sign of the 1/T coefficient implies that smaller firms tend to have a larger equity-asset ratio (table 1). T approaches an asymptote as total borrowed capital increases. The estimated impact of borrowed capital, exclusive of any influence of pooling, is $\hat{\beta}_2(1/T_i)$ for a farm supply cooperative, is $(\hat{\beta}_2 + \hat{\beta}_6)(1/T_i)$ for a marketing cooperative, and is $(\hat{\beta}_2 + \hat{\beta}_7)(1/T_i)$ for a mixed cooperative. FS and MS have only minor impacts. Because sales are correlated with total borrowed capital and related to cooperative function, it is misleading to interpret FS and MS in isolation. These relationships are included in the model to account for differences not attributable to pooling.

Table 1.—Results of Ordinary Least Squares Analysis of Leverage (ECT), Selected U.S. Nondairy Cooperatives, 1980–82

Variable	Symbol	Parameter Estimate[a]	t-value
Intercept	β_0	3.0304 E-1	20.18***
Pooling	P	−5.8818 E-2	−3.073***
Total Borrowed Capital	1/T	1.5114 E6	7.38***
Farm Supply	FS	3.4463 E-11	2.041**
Marketing	MS	−4.2311 E-11	−3.24***
Borrowed Capital and Pooling	I1	−6.2477 E5	2.56***
Borrowed Capital and Marketing	I2	−3.7766 E5	−1.43*
Borrowed Capital and Mixed	I3	−4.9907 E5	−1.91*
	$R^2 = .4727$		

[a]Scientific notation is used to indicate the decimal place: E-X indicates the decimal should be moved X places to the left; without the minus sign, the decimal should be moved X places to the right.
*Significant at the .85 confidence level.
**Significant at the .90 confidence level.
***Significant at the .95 confidence level.

The relationship between pooling and ECT varies with total borrowed capital. The estimated effect of pooling equals $\hat{\beta}_1 + \hat{\beta}_5(1/T_i)$ and is plotted in figure 1. This effect is independent of the impact of cooperative function and is considered in addition to it. The graph indicates that pooling cooperatives having relatively lower levels of borrowed capital tend to obtain more leverage than simliar cooperatives that do not pool. As the extent of borrowing increases, the impact of pooling on leverage tends to decrease, approaching −0.0588 at higher levels of borrowed capital.

An impact of −0.06, for example, implies that a pooling cooperative, when compared with a nonpooling cooperative of similar size and function, would have a value of ETC that is 0.06 lower. In other words, the pooling cooperative in this example would have six cents less equity per dollar of borrowed capital. The impact of pooling is depicted for values of T between $4 million and $250 million. For greater values of T, the impact approaches −0.0588.

Several functional forms capturing nonlinear relationships were considered, but the inverse specification for T was deemed the most appropriate. The general shape of the relationship depicted in figure 1 implies that differences in leverage between pooling and nonpooling cooperatives tend to be greatest for relatively smaller cooperatives.

If the interaction variables I1, I2, and I3 are removed from the model, a constant impact of pooling is implied, and the estimated coefficient for the pooling variable P is −0.0923 (the t-value is −5.45). However, the impact suggested by the model including the interaction terms appears more accurate. Similar results are obtained when interaction is specified between pooling and other variables highly correlated with total borrowed capital.[2] Models based only on marketing or marketing and mixed cooperatives yield similar implications.

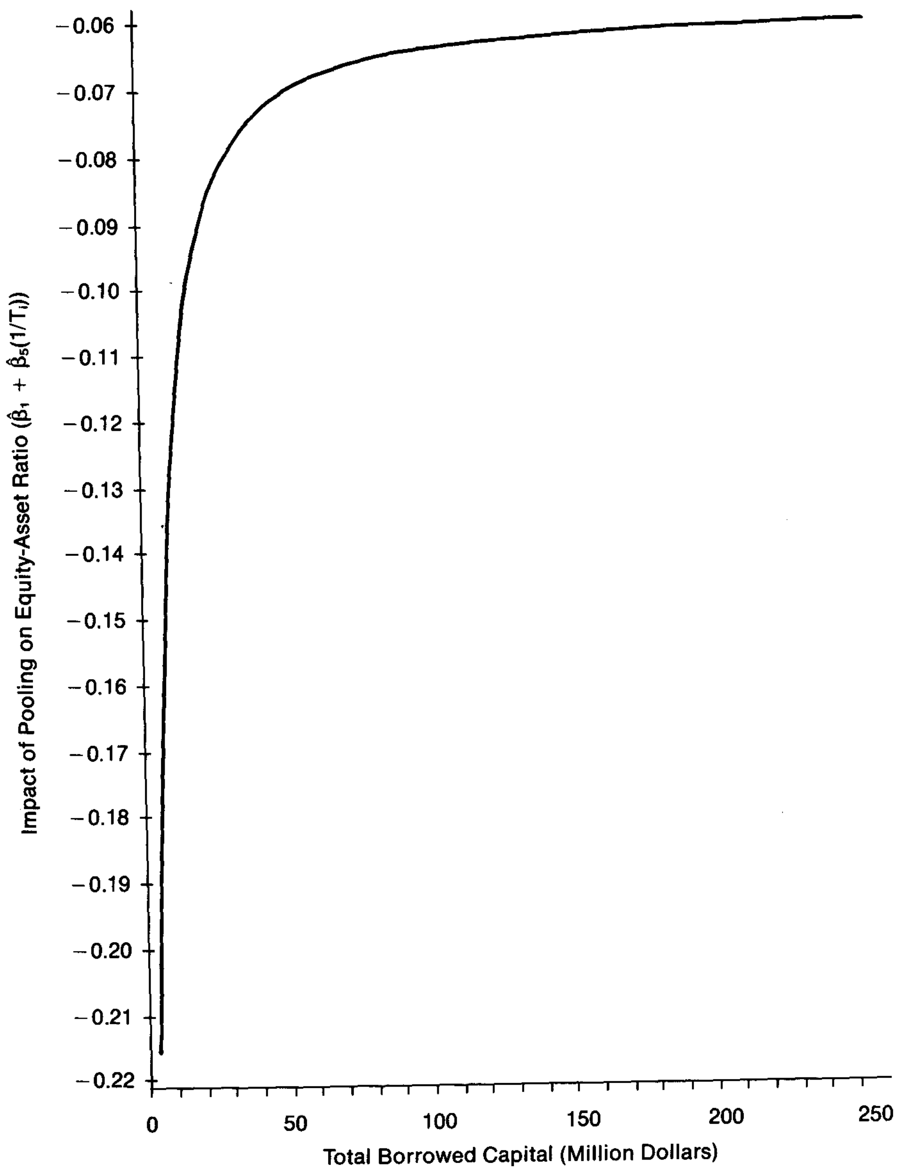
Per-Unit Capital Retains

Two models were estimated using per-unit capital retains instead of pooling to explain leverage. Firms that deduct per-unit capital retains generally operate pools, but not all pooling firms deduct per-unit retains.

The models were estimated using two alternatives to account for per-unit retains. The first alternative used a dummy variable PU, which indicated the presence of per-unit retains, instead of the pooling dummy variable P. The second specification used a variable IU1, determined by multiplying PU by 1/T, instead of I1. The dummy variable PU had an estimated coefficient of −0.289 (t-value = −1.496), and the coefficient for the interaction variable IU1 had a value similar to that for I1 (−6.1652 E5). The other coefficients were similar to those reported in table 1. If the level of per-unit retains (designated PER) was used along with IU1, PER was not significant (t-value = −0.905). Otherwise, the results of the model also were similar to those in table 1.

Thus it appears that there is a stronger statistical relationship between pooling and ECT than between per-unit retains and ECT. Per-unit retains yield significant results only to the extent that they serve as a proxy for pooling.

Figure 1.—Reduction in the Equity-Asset Ratio Associated with Pooling



Total Current Asset Model Specification

Of the other financial variables modeled, a measurable empirical impact of pooling was strongest for total current assets. However, when the total current assets model is corrected for heteroscedasticity, pooling's impact is not significant.

Total current assets are working assets consisting of cash and other assets that can be turned into cash during the accounting year. Pooling may decrease uncertainty through commitment, which would decrease the need for current assets. This hypothesized relationship raises a liquidity issue—whether or not liquidity varies significantly between pooling and nonpooling cooperatives, ceteris paribus. Here the notion tested is that pooling may reduce market risk significantly enough that the cooperative can afford to be less liquid. In specifying the model, the goal was to control for cooperative size and function so as to isolate the relationship between pooling and current assets in a manner similar to the specification for the equity capital model. The current asset model was specified as follows:

$$CA_i = \beta_0 + \beta_1 T_i + \beta_2 T1_i + \beta_3 T2_i + \beta_4 T3_i + u_i \qquad (2)$$

where:

CA_i = total current assets (dollars) for the i^{th} cooperative,
T_i = total borrowed capital (dollars),
$T1_i$ = interaction term: $T_i \times P_i$ (P_i equals one if pooling exists and zero otherwise),
$T2_i$ = interaction term: $T_i \times$ MARKET (where MARKET equals one when the cooperative has only a marketing function and zero otherwise),
$T3_i$ = interaction term: $T_i \times$ MIXED (where MIXED equals one when the cooperative has both marketing and farm supply functions and zero otherwise), and
u_i = error term.

Total Current Asset Model Interpretation

The results imply that an additional dollar of borrowed capital for a farm supply cooperative will result in an increase in current assets of $0.9657 (table 2). Increasing total borrowed capital by one dollar will increase total current assets by $1.4508 for a marketing cooperative and by $1.0176 for a cooperative having both farm supply and marketing functions.

These results are for cooperatives that do not pool. If pooling exists, the impact would be to decrease current assets by an average of $0.4443 for each dollar increase in total borrowed capital. In other words, pooling cooperatives tend to have less total current assets for any given cooperative size and function. A cooperative of average size that pools (T_i = $90 million) had $40.0 million less total current assets on the average than a cooperative of similar size and function that does not pool. A relatively smaller cooperative that pools (T_i = $10 million) had about $4.4 million less total current assets than a simlar nonpooling cooperative. For a relatively larger cooperative (T_i = $400 million), the difference is $177.7 million. Estimates

Table 2.—Results of Ordinary Least Squares Analysis of Total Current Assets, Selected U.S. Nondairy Cooperatives, 1980–82

Variable	Symbol	Parameter Estimate[a]		t-value
Intercept	β_0	2.2734	E7	3.86***
Total Borrowed Capital	T	9.96576	E-1	13.60***
Borrowed Capital and Pooling	T1	−4.4426	E-1	−2.93***
Borrowed Capital and Marketing	T2	4.8460	E-1	3.19***
Borrowed Capital and Mixed	T3	5.1824	E-2	0.71
	R^2 = .8799			

[a]Scientific notation is used to indicate the decimal place: E-X indicates the decimal should be moved X places to the left; without the minus sign, the decimal should be moved X places to the right.
*Significant at the .85 confidence level.
**Significant at the .90 confidence level.
***Significant at the .95 confidence level.

based on specifications using other variables correlated with firm size, instead of total borrowed capital, yielded similar results.

Heteroscedasticity was suspected and, when the model was tested for it, was found to be significant. Several equations were estimated to explain how the predicted error term $\hat{u}_i$ varies as T_i increases. The following relationship was estimated and used to correct for heteroscedasticity:

$$|\hat{u}_i| = 1{,}424.76(T_i^{0.56}) + \text{error}, \qquad (3)$$

where $|\hat{u}_i|$ is the absolute value of the reported error from equation (2). The R^2 for this regression is .567, and the t-value is 15.96. To correct for heteroscedasticity, equation (2) was estimated using ordinary least squares after all variables were divided by 1,424.76 ($T^{.567}$). These results are reported in table 3 and may be interpreted in a fashion similar to the results in table 2. The impact of pooling by itself is not statistically significant after the correction for heteroscedasticity.

Summary and Conclusions

The primary purpose of this research was to investigate the relationship of cooperative pools to equity capital and total current assets. Commitment by a marketing cooperative's members to use its services has been suggested as a key to success. Commitment ensures delivery and allows a cooperative to operate with knowledge of the product volume it will handle in a given season. The evidence presented here suggests that pooling is a proxy for commitment, which in turn reflects lower market risk to the cooperative. With a pooling operation, there typically is producer commitment to deliver the product, eliminating the management and marketing uncertainty inherent in buy-sell marketing cooperatives.

Table 3.—Results after Correcting for Heteroscedasticity in the Current Assets Model

Variable	Symbol	Parameter Estimate[a]		t-value
Intercept	β_0	1.1472	E7	6.33***
Total Borrowed Capital	T	1.1058	E0	11.43***
Borrowed Capital and Pooling	T1	2.8728	E-2	0.22
Borrowed Capital and Marketing	T2	6.9777	E-2	0.15
Borrowed Capital and Mixed	T3	3.5742	E-2	0.32
	R^2 = .8522			

[a]Scientific notation is used to indicate the decimal place: E-X indicates the decimal should be moved X places to the left; without the minus sign, the decimal should be moved X places to the right.
*Significant at the .85 confidence level.
**Significant at the .90 confidence level.
***Significant at the .95 confidence level.

The results suggest that there is increased leverage associated with pooling. The reduction in the equity-asset ratio associated with pooling is about 9.23 percent on the average. This implies that pooling cooperatives, because of commitment and reduced market risk, can operate on a smaller equity investment compared with nonpooling cooperatives. Stated another way, the quantitative evidence supports the hypothesis that pooling results in greater efficiency of equity capital through greater total assets controlled by equity owners per unit of equity capital.

Notes

1. For most cooperatives, either FS or MS will equal zero. Both will have positive values if the cooperative has both marketing and farm supply functions.
2. Models specified and estimated with equity as the dependent variable and with total assets, total assets squared, and the pooling variable, among others, on the right-hand side imply that equity is decreased by pooling for smaller cooperatives compared with larger cooperatives. When these models are corrected for heteroscedasticity, the results are only marginally significant.

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