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Size and industry effects in the performance of agricultural cooperatives

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ABSTRACT

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The objective of this study is to determine if there are important size and industry effects on financial performance of agricultural cooperatives. The performance of 43 dairy, food, grain, and farm supply cooperatives in the U.S. was analyzed over the period 1970–1987 using financial ratios derived from accounting data. The analysis revealed significant size and industry effects. Large regional cooperatives are more efficient in utilizing their assets to generate sales, while small regional cooperatives have higher profitability. The findings suggest that the emphasis on growth may not always produce beneficial results among agricultural cooperatives. Among the four industries studied, the dairy regional cooperatives appear to be the strongest performers, while the food marketing cooperatives are characterized by the lowest performance measures. Since both dairy and food cooperatives engage in value-added processing, this difference in performance makes it difficult to reach clear conclusions about possible advantages of disadvantages or vertical integration relative to traditional cooperative activities. Trend analysis indicates that the profitability of the agricultural cooperatives in all industry and size categories declined in response to the downturn in U.S. agriculture after 1980. While the decline in profitability was at similar rates for both large and small cooperatives, the variation of efficiency and leverage was in opposite directions. Large cooperatives may be expected to continue improving their asset utilization without relative improvement in profitability, and increasing the level of their debt in relation to equity.

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INTRODUCTION

Performance evaluation of cooperatives has always been a topic of considerable interest in agricultural economics, primarily because of the significance of the cooperative form of organization in agriculture in both developed and developing countries. Traditionally, agricultural cooperatives have been encouraged as a vehicle for economic development, because the cooperative form of organization, in addition to being equitable, enables small producers to capture economies of size and increases their marketing power. Governments in both developed and developing countries actively promote and assist agricultural cooperatives. Justification of continued public support of the cooperative form of organization requires evaluation and monitoring of cooperative performance.

The objective of this study is to determine if there are significant size and industry effects on performance among cooperatives. Size effects, if detected, may help to determine whether cooperatives should emphasize growth, as has been evident in the persistence of mergers among U.S. cooperatives. Industry effects, if found, may indicate whether the cooperative form of organization is more successful in the traditional industries of input supply and raw produce marketing than in the vertically integrated industries that include valued-added processing. The industry results may provide some evidence to resolve the conflict between cooperative strategists emphasizing traditional service activities and those advocating a shift toward value-added processing.

The next section describes the data and the methodology. The two sections that follow present the results on size and industry effects. Conclusions and policy implications are given in the last section.

DATA AND METHODOLOGY

Financial economists generally agree that investor-owned firms may be viewed as value-maximizers and their performance can be measured by profitability adjusted for risk. The objective function of cooperatives is much less clearly defined, however, especially because the cooperative exists in order to provide a service to its members and the benefits of the cooperative form of organization are not restricted to earning a return on investment. As a result, there is a lack of accepted measures of cooperative performance.

The present research partially overcomes this difficulty by adopting a multidimensional approach. Four measures of business performance of cooperatives are examined: leverage, efficiency, liquidity, and profitability. Performance is analyzed by financial ratios based on reported accounting

TABLE 1

Financial ratio measures of performance

Performance criteria	Ratio	Definition
Leverage	Debt to equity	$\frac{\text{Total liabilities}}{\text{Total equity}}$
Efficiency	Asset turnover	$\frac{\text{Sales}}{\text{Total assets}}$
Liquidity	Quick ratio	$\frac{\text{Current assets}}{\text{Current liabilities}}$
Profitability	Rate of return on equity	$\frac{\text{Profit before tax}^{a}}{\text{Total equity}}$

[a] The before-tax rate of return on equity is used because some cooperatives do not report taxes in their income statement due to the possible impact of patronage refund policies on tax obligation. Eight cooperatives in the sample do not report profit or net margins in their financial statements. For these cooperatives (all in the food industry), the profit was estimated using the technique developed in Lerman and Parliament (1990a).

data, a standard technique borrowed from investor-owned firms for financial performance evaluation of cooperatives (Babb and Lang, 1985; Chen et al., 1985; Schrader et al., 1985; Parliament et al., 1990). These performance measures focus on the cooperative as a business firm and do not capture possible additional benefits to members. Yet financial ratios reflect the effect of strategic decisions and should reveal if differences exist among cooperatives in different size and industry categories.

Table 1 presents the definitions of the four financial ratios used in this research. These particular financial ratios were chosen because of their direct link to corporate strategy and objectives. The relevance of these financial ratios for measuring the performance of cooperatives is discussed by Parliament et al. (1990), who also review some alternative measures of cooperative performance that focus on benefits to members.

The database for this research consists of the audited annual reports of a sample of 43 U.S. regional cooperatives for the period 1970–1987. The data were collected by writing to over 200 non-bargaining cooperatives listed in the *Directory of Farmer Cooperatives* of the USDA Agricultural Cooperative Service (ACS) (Jermolowicz and Kennedy, 1989). The sample includes all the respondents that provided their annual reports by the end of 1989. These are mainly regional cooperatives, similar in sales volume characteristics to the top 100 U.S. cooperatives regularly surveyed by ACS.

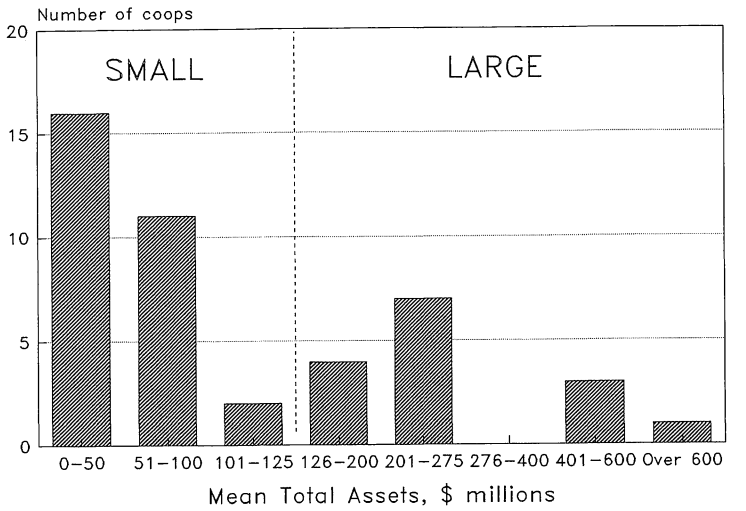

Fig. 1. Distribution of mean assets.

The 43 regional cooperatives were classified into four industries: 12 dairy cooperatives, 12 supply cooperatives, 14 food marketing and processing cooperatives, and five grain and cotton marketing cooperatives. [1] The cooperatives were also classified into two size categories, 'small' and 'large', by their total assets. The range of mean total assets of the cooperatives in the sample was from $3 million to $911 million (averaged over the sample period). The distribution of mean asset size for the cooperatives is shown in Fig. 1. For purposes of size analysis, 29 cooperatives with mean total assets up to $125 million were classified as 'small' and 14 cooperatives with mean total assets of over $125 million were classified as 'large'. The size classification threshold was identified by an agglomerative cluster analysis of the cooperatives by mean asset size. Figure 2 presents the distribution of the 43 cooperatives by industry and by size within each industry.

[1] There was initial uncertainty as to the proper classification of grain and cotton cooperatives in the sample. Because grain marketing cooperatives also sell farm inputs to their members, it could be argued that they should be classified as supply cooperatives. Because cotton cooperatives operate on a pooling basis, it could be argued that they should be classified with the pooling food cooperatives. The uncertainty was resolved by applying multivariate discriminant analysis, which indicated that grain marketing cooperatives were distinct from the supply cooperatives and furthermore could be combined with the cotton cooperatives into one category. Discriminant analysis also established that cotton cooperatives could not be classified with food cooperatives. It was thus decided to classify the grain and cotton marketing cooperatives as a separate, although admittedly small, category.

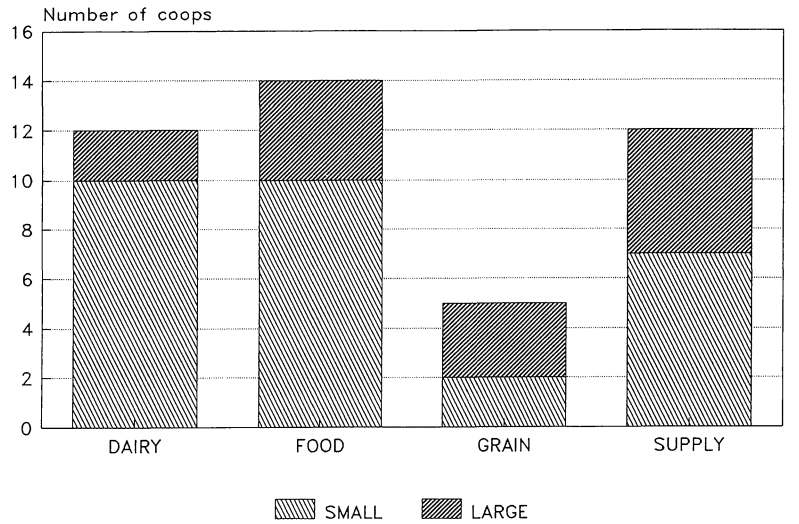

Fig. 2. Distribution of cooperatives by industry and size:

Size	Industry				
	Dairy	Food	Grain	Supply	Total
Small	10	10	2	7	29
	(23%)	(23%)	(5%)	(16%)	(67%)
Large	2	4	3	5	14
	(5%)	(9%)	(7%)	(12%)	(33%)
Total	12	14	5	12	43
	(28%)	(32%)	(12%)	(28%)	(100%)

The financial ratios of all the cooperatives were calculated from their audited annual reports for each year during the period 1970–1987. The time-series data were used to trace the behavior of cooperatives in different categories over time. For each observation year, the median of each of the four financial ratios was calculated separately in each industry and size category. In this way, a time series of 18 median observations was obtained for each financial ratio by industry and size categories. The median was chosen as the descriptive statistic because it is more robust to outliers than the mean, and examination of the data revealed occasional outliers.

The 1970–1987 time series of the median financial ratios were analyzed using the nonparametric Kruskal–Wallis test ("one-way analysis of variance by ranks") in order to detect significant differences among industry and size categories (Daniel, 1978). In application to the two size categories, the Kruskal-Wallis test coincides with the Wilcoxon rank-sum test. The test ranks the pooled median financial ratios in different categories and forms the sums of the ranks for the pooled sample. If the rank sums, or the

average scores, are sufficiently different among the categories, the test rejects the null hypothesis that the median financial ratios are the same across categories and establishes that, with a certain probability, the industry or size categories have different median financial ratios. The average rank scores in each category can be used to rank performance. The performance ranking of the different categories over the 1970–1987 period obtained in this way was verified by Page's nonparametric test for ordered alternatives (Daniel, 1978). Since the Page test results confirm and reinforce the Kruskal–Wallis test results, only the latter are reported in full.

In addition to tests of the performance ranking of categories, linear regression analysis of the median time series was used to identify differences in financial ratio trends by size and industry and to predict possible future changes in the performance rankings observed for the period 1970–1987. Trends were determined by running ordinary least-squares regressions for each median ratio on time with dummy variables for size and industry. The large cooperatives were the base for estimation of regression coefficients with size dummy variables, and the dairy category was the base for regression coefficient estimation with industry dummy variables. Two groups of tests were performed on the estimated regression coefficients: (a) homogeneity-of-slopes tests for significant difference of the estimated parameters between the base category and other categories, and (b) multivariate tests for significant difference from zero of the estimated parameters corresponding to different size and industry categories.

SIZE EFFECTS

Pronounced size effects were observed between large and small cooperatives over the period 1970–1987. The Kruskal–Wallis test results presented in Table 2 show that three of the four ratios (profitability, liquidity, and

TABLE 2

Kruskal–Wallis rank test of median financial ratios of cooperatives by size

Ratio	Mean score		Chi-square statistic	Prob. > Chi-square [a]
	Small	Large		
Debt to equity	17.3	19.7	0.48	0.486
Sales to assets	12.2	24.8	12.78	0.000
Quick ratio	24.4	12.6	11.25	0.000
Return on equity	23.9	13.1	9.42	0.002

[a] The probability that the Chi-square statistic exceeds the observed value under the null hypothesis that the median financial ratios are equal for the two size categories.

efficiency) were significantly different between the large and small cooperatives at the 5% level of significance. The median efficiency of asset utilization was significantly higher for the large cooperatives, while the median liquidity and profitability measures were significantly higher for the small cooperatives. Only the median leverage was not found to be significantly different between the two size categories.

To illustrate the dispersion of the ratio values in each year, the top and bottom (25% and 75%) quartiles of the financial ratios were calculated for each year for the large and the small cooperatives. The interquartile range traces a band around the median that contains 50% of the observed ratio values in the sample of cooperatives for each particular year (this band is not necessarily symmetric about the median). The interquartile range is a nonparametric measure of dispersion analogous to standard deviation. Examination of the interquartile range of the two size categories over time provides a visual confirmation of the Kruskal–Wallis test results presented in Table 2.

Figure 3 (panels a to d) superimposes the interquartile range of small and large cooperatives for each ratio. Panel a shows that the interquartile range of the leverage ratio for the large cooperatives lies almost entirely within the interquartile range for the small cooperatives over the period 1970–1987. The overlapping interquartile ranges indicate that the median leverage is not significantly different for the small and the large cooperatives.

In panel b, the interquartile range of the efficiency ratio for the large cooperatives lies within the interquartile range for the small cooperatives until about 1979, after which the top quartile value of the large cooperatives is consistently higher than the top quartile value of the small cooperatives. The graphical presentation reveals that the difference between large and small cooperatives became more pronounced over the later period 1979–1987. Large cooperatives thus appear to be more efficient than the small cooperatives in utilizing their assets to generate sales.

In panel c, the top quartile of the liquidity ratio for the small cooperatives consistently lies above the top quartile for the large cooperatives, while the bottom quartiles roughly overlap. This indicates that the small cooperatives maintain a higher liquidity than the large cooperatives.

Panel d presents the interquartile range of the profitability ratio. The upper quartile of the rate of return on equity (ROE) for the small cooperatives lies above the upper ROE quartile for the large cooperatives in 17 out of 18 years, and the bottom quartile of the small cooperatives lies above the bottom quartile of the large cooperatives in 14 out of the 18 years. The ROE for the small cooperatives is thus observed to be higher over most of the sample period than for the large cooperatives.

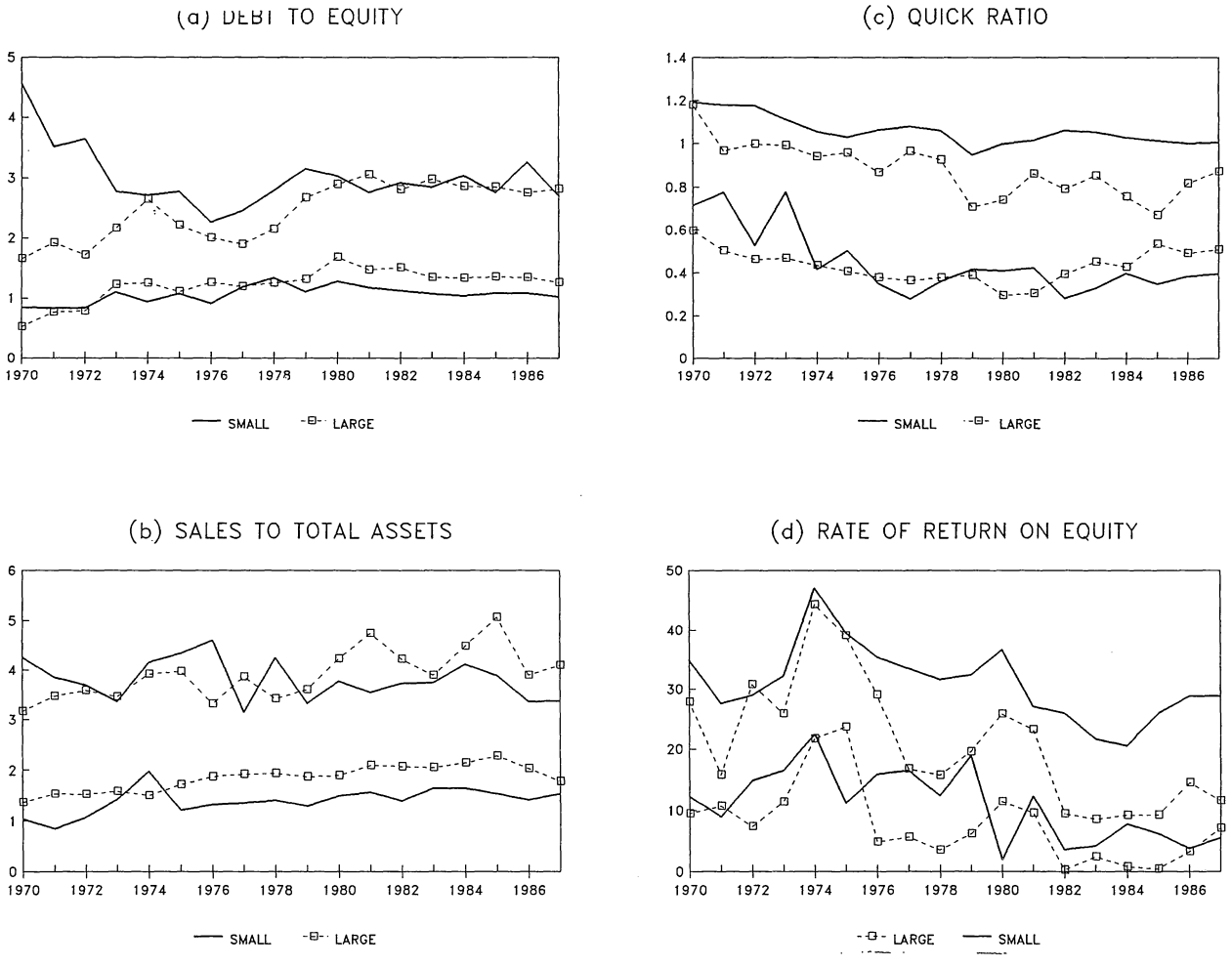

Fig. 3. Interquartile range of the financial ratios by size category, 1970–1987.

TABLE 3

Estimated trend of median financial ratios by size, 1970–1987

	Large	Small	Adj. *R*-square
Debt to equity	0.03 [a]	−0.04 [a,b]	0.34
Sales to assets	0.03 [a]	−0.03 [a,b]	0.46
Quick ratio	−0.01 [a]	−0.02 [a,c]	0.68
Return on equity	−0.74 [a]	−0.72 [a,c]	0.54

[a] Indicates significantly different from 0 at 5% level.
[b] Indicates significantly different at 5% level from Large.
[c] Indicates not significantly different at 5% from Large.

Trend analysis results for the median financial ratios of the large and the small cooperatives are presented in Table 3. The median leverage ratio shows significantly different trends for the two size categories, increasing over time for the large cooperatives and declining for the small cooperatives. If this difference continues, large cooperatives may develop in the future significantly higher levels of debt relative to equity than the small cooperatives, contrary to the pattern observed between 1970 and 1987 (Fig. 3a). The median efficiency of the large cooperatives increases over time, while that of the small cooperatives declines, which should only strengthen in the future the advantage that large cooperatives had between 1970 and 1987 in utilizing their assets to generate sales (Fig. 3b). Both profitability and liquidity reveal a declining trend, but the rate of decline is not significantly different for the large and the small cooperatives, which suggests that the advantage in profitability and liquidity observed for the small cooperatives between 1970 and 1987 may be maintained in the future.

Thus, while the large cooperatives are observed to be more efficient in utilizing their assets to generate sales, the small cooperatives have higher profitability and liquidity. The results suggest that large cooperatives may enjoy scale economies in terms of efficiency, but the benefits of size do not necessarily translate into higher profitability. The higher rate of return on equity for the small cooperatives is consistent with the "small-firm effect" observed for investor owned corporations, which shows that investors in small firms usually earn higher rates of return on investment [see Levy and Lerman (1985) and references therein]. With respect to liquidity, it could be hypothesized that small firms, with a relatively small asset base, prefer to maintain a higher liquidity buffer than large, asset-rich firms. With respect to leverage, it could similarly be argued that small cooperatives would have a lower leverage than the large, more secure cooperatives. While the results for the period 1970–1987 fail to detect significant

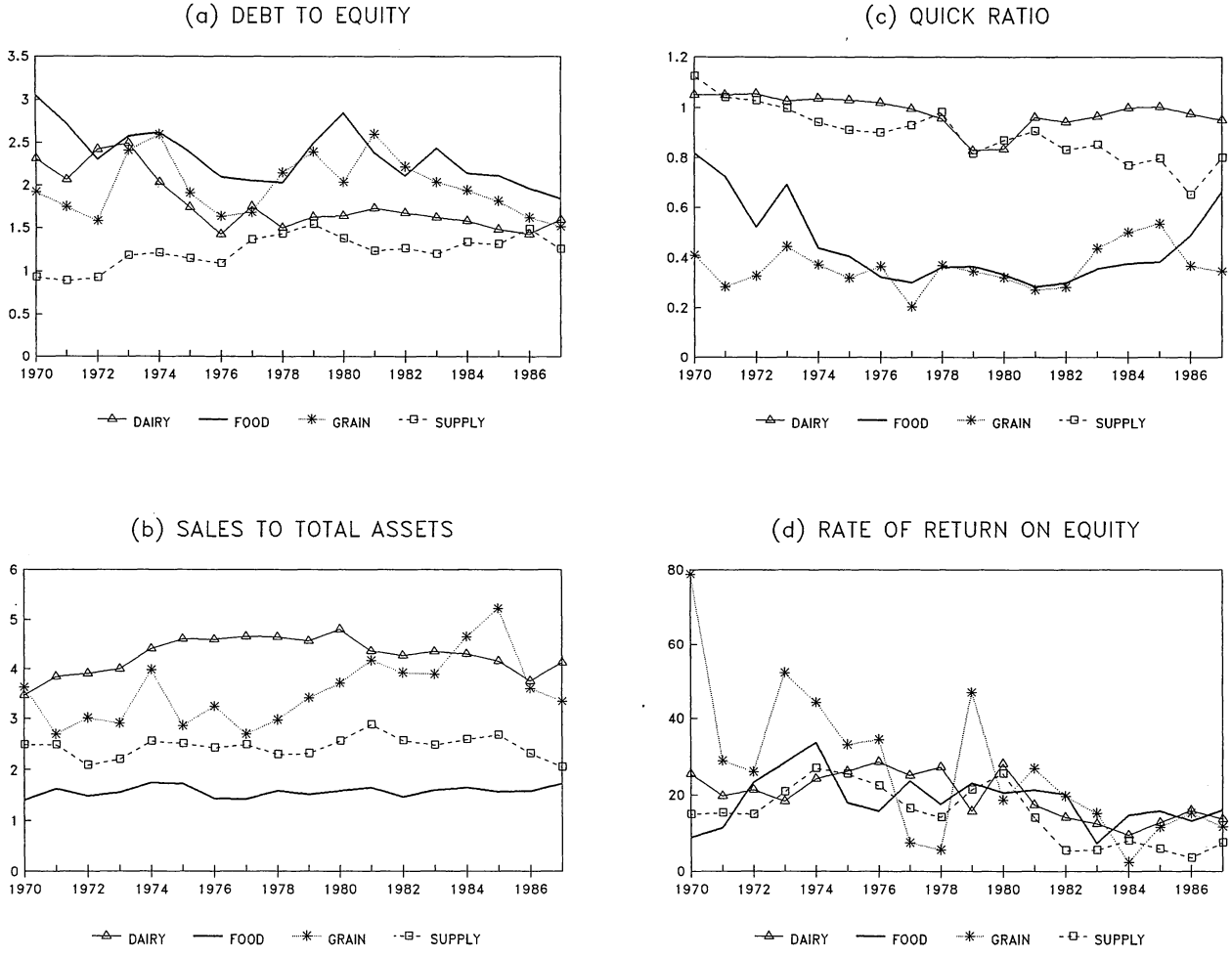

Fig. 4. Median financial ratios by industry, 1970–1987.

differences in capital structure between small and large cooperatives, the trend analysis results support an expectation of higher leverage for the large cooperatives.

INDUSTRY EFFECTS

Clear industry effects were found for all median financial ratios. The Kruskal–Wallis test results (Table 4) show that for leverage, efficiency, and liquidity the industry effects were significant at 1%. The statistical test results are visually confirmed by the time series graphs in Fig. 4 (panels a to d). The graphs in Fig. 4 plot only the median ratios by industry over the period 1970–1987, as it was not practicable to superimpose the interquartile ranges for the four industries.

The leverage ratio (panel a) was found to be the highest for the food marketing cooperatives and the lowest for the supply cooperatives, with the dairy and grain cooperatives lying in the middle.

The four industries are also clearly differentiated by efficiency (panel b). Dairies consistently have the highest efficiency, followed by grain and supply cooperatives in this order, with the food marketing cooperatives consistently at the bottom of the ranking.

Liquidity is the highest for dairy and supply cooperatives, which both have relatively high quick ratios near the level of 1.0 (panel c), while food and grain cooperatives have relatively low quick ratios around 0.5. The Kruskal–Wallis test indicates that only the differences between the food and grain cooperatives are not significant.

The differences in profitability between dairy, food, and grain cooperatives are not statistically significant. Yet the median ROE of the cooperatives in these three industries combined is significantly higher than that of

TABLE 4

Kruskal–Wallis rank test of median financial ratios of cooperatives by industry

Ratio	Mean score				Chi-square statistic	Prob. > Chi-square [a]
	Dairy	Food	Grain	Supply		
Debt to equity	34.8	57.1	44.1	10.0	48.8	0.000
Sales to assets	60.4	9.5	48.4	27.7	28.5	0.000
Quick ratio	59.2	21.6	15.8	49.4	54.6	0.000
Return on equity	39.7	35.9	42.9	27.5	5.4	0.143

[a] The probability that the Chi-square statistic (the large-sample approximation of the Kruskal–Wallis statistic) exceeds the observed value under the null hypothesis that the median financial ratios are equal for the four industry groups.

TABLE 5

Estimated trend of median financial ratios by industry, 1970–1987

	Dairy	Food	Grain	Supply	Adj. R-square
Debt to equity	−0.05 [a]	−0.04 [a,c]	−0.01 [b]	0.02 [a,b]	0.74
Sales to assets	0.01	0.01 [c]	0.07 [a,b]	0.00 [c]	0.89
Quick ratio	−0.01	−0.01 [a,c]	0.00 [c]	−0.02 [a,b]	0.90
Return on equity	−0.74 [a]	−0.31 [c]	−1.79 [a,b]	−0.93 [a,c]	0.34

[a] Indicates significantly different from 0 at 5% level.
[b] Indicates significantly different at 5% level from Dairy.
[c] Indicates not significantly different at 5% from Dairy.

the supply cooperatives (at 5% level of significance by the Kruskal–Wallis test).

The trends of the median financial ratios by industry are presented in Table 5. The median debt to equity ratios of the cooperatives in the four industries show a converging trend, mainly as a result of the declining leverage of the dairy and food cooperatives and the increasing leverage of the supply cooperatives (compare Fig. 4a). It might be conjectured that the highly leveraged food and dairy cooperatives benefited from erosion of their fixed-rate debt in the inflationary period 1973–1980: their equity component may have increased through unrealized capital gains, driving the leverage ratio down over time. The median sales to assets ratio of the dairy, food, and supply cooperatives does not show a significant trend over time, and the relative efficiency ranking of these industries will probably be maintained in the future (Fig. 4b). The grain cooperatives show a significant improvement of their sales to assets ratio, and as a result may challenge in the future the top ranking dairy cooperatives. The rate of return on equity (ROE) reveals a significant declining trend for cooperatives in three of the four industries; only the estimated coefficient of the food cooperatives, while negative, is not significantly different from zero. The estimated decline in median ROE may be due to the general downturn in the U.S. agricultural sector during the 1980s, as separate analysis using only the 1970–1979 data did not reveal significant downward trends in profitability during the pre-1980 decade for three out of the four industries (except the grain cooperatives).

In summary, on a naive multiobjective scale that assigns equal weights to the four ratios (Table 6), the dairy cooperatives appear to be the strongest performers among the four industries, ranking first in efficiency and liquidity and second in leverage and profitability. The food marketing cooperatives are the weakest performers, ranking lowest in leverage, effi-

TABLE 6

Multiobjective performance scores of cooperatives by industry, 1970–1987 (1, lowest; 4, highest)

	Profitability	Leverage [a]	Efficiency	Liquidity	Unweighted score
Dairy	3	3	4	4	3.50
Food	3	1	1	1.5	1.63
Grain	3	2	3	1.5	2.38
Supply	1	4	2	3	2.50

[a] Leverage scores are assigned in the inverse order of the numerical values of the leverage ratio, because low leverage is considered superior to high leverage due to the lower associated risks.

ciency, and liquidity. The supply and grain cooperatives are in the middle of the ranking.

CONCLUSION

One of the persistent trends among cooperatives is growth through mergers and acquisitions. The findings of this study indicate that although larger cooperatives improve efficiency through economies of scale, the higher efficiency of asset utilization does not translate into higher profitability. This suggests that the benefits of mergers may be overemphasized, which is consistent with recent findings indicating that the profitability of cooperatives does not significantly improve after a merger (Parliament and Taitt, 1989).

The industry effects revealed in this study do not provide conclusive evidence to support either side of the strategic conflict between the advocates of traditional service activities and the advocates of diversification through value-added processing. The dairy cooperatives, which engage in value-added processing, are the highest ranking performers among the four industries by leverage, efficiency, liquidity, and profitability ratios. The food cooperatives, on the other hand, are at the bottom of the ranking, although they also engage in extensive value-added processing.

The grain and supply cooperatives, which have generally limited their activities to the traditional areas of raw produce marketing and input purchasing, show a higher performance ranking than the food cooperatives engaging in value-added processing. It could be argued that the relatively strong performance of the dairy cooperatives in the U.S. is related to government guaranteed prices for the milk used in dairy products. If this is

indeed so, the inferior performance of the food processing cooperatives may be interpreted as consistent with the view that, in the absence of specific support programs for value-added processing, cooperatives should consider restricting their scope to traditional activities.

In a recent comparison of cooperatives and investor-owned firms (Lerman and Parliament, 1990b), the food cooperatives were found to have a weaker performance than the investor-owned firms in the same industry by three of the six performance measures considered while the dairy cooperatives performed not worse than the investor-owned dairies by all measures. These findings indicate that the relatively weak performance of the food cooperatives observed in the present study cannot be entirely attributed to industry-specific factors. There are indications that, of the two value-added processing industries, the dairy cooperatives have a higher proportion of pass-through sales than the food-processing cooperatives: the proportion of fluid milk sales in dairies is higher than the proportion of raw produce sales in food-processing cooperatives. These factors also could be interpreted as supporting the view that expansion into value-added processing has not been a total success for cooperatives.

An international comparison is provided by a recent study of two regional agricultural cooperatives in Israel (Yacobi, 1989), where the cooperative engaging in value-added food processing had significantly higher leverage, lower profitability, and lower efficiency than the cooperative that limited its activities to raw produce marketing. The Israeli analogy, however limited, appears to support those who believe that manufacturing of value-added consumer products may not be a particularly advantageous activity for cooperatives, despite the allure of forward integration. Cooperatives may find it difficult to acquire the necessary resources for successful penetration of the consumer food markets.

Support programs, product mix, and market characteristics are ultimately responsible for success or failure of value-added processing. Further research is needed in order to identify and separate the government support component in the performance of U.S. dairy cooperatives and to analyze the cooperatives in the two valued-added processing industries on the basis of the specific mix of pass-through sales and value-added products. More detailed comparisons between cooperatives and investor-owned firms in corresponding industries are needed in order to separate between industry-specific and cooperative-specific factors. This additional research may produce more conclusive results regarding the debate between supporters of traditional cooperatives and advocates of vertical integration. At this stage, the striking difference in performance between the two value-added processing industries in our sample makes it difficult to generalize about the relative merits of value-added processing for cooperatives.

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