Journal of Agribusiness 22,1 (Spring 2004):31–48

The Impact of Participation in Cooperatives on the Success of Small Farms

Ashok K. Mishra, Fisseha Tegegne, and Carmen L. Sandretto

This study identifies and analyzes factors that contribute to the success of small farms. Particular attention is given to the effect of participation in marketing and supply cooperatives on the success of small farms. Using modified net farm income per dollar of assets and operator's labor and management income as measures of success, results show participation in marketing and supply cooperatives is positively correlated with success. Further, analysis findings indicate farm size, controlling for variable and fixed costs, type of ownership, management strategies used, working off the farm, and age of the operator are important factors that influence profitability (modified net farm income per dollar of assets and operator's labor and management income) and success.

Key Words: cooperatives, management strategies, marketing, small farms, success, supply cooperative

Farmers routinely face considerable risk of income variability, and that income variability affects the financial performance of many farms. Particularly vulnerable are marginal operations with low production efficiency and small farms (farms with farm sales of $250,000 or less). During the past several decades, small family farms have frequently experienced difficulties in maintaining profitability. Local patterns of production, distribution, and consumption of food have been increasingly replaced by global operations and interests. Small family farms are regularly squeezed out of business by high input costs, low prices for their products, and limited access to markets.

Small farm operators face a number of problems (such as limited purchasing power, availability of markets, access to resources, etc.) as they attempt to develop and operate profitable farm businesses. Some of the limitations facing small farm operators may be overcome by participation in cooperatives (supply or marketing) through a sharing of goals, activities, and objectives of the members of the group. There are many important benefits to membership in a cooperative. For example: (*a*) members

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Ashok K. Mishra and Carmen L. Sandretto are agricultural economists, Economic Research Service, U.S. Department of Agriculture, Washington, DC. Fisseha Tegegne is resource economist, Cooperative Agricultural Research Program, Tennessee State University, Nashville, TN. An earlier version of this paper was presented at the 2000 SAEA meetings in Lexington, KY. The views expressed here are not necessarily those of the Economic Research Service or the U.S. Department of Agriculture.

enjoy increased group purchasing power and marketing opportunities (Barton, 1989); (*b*) improved market strategies can be developed to establish reliable markets; (*c*) niche markets can be more quickly exploited; (*d*) there is a diversity of goods within a cooperative; (*e*) newly identified markets can be explored; (*f*) participation fosters networking among members and sharing of experiences; and (*g*) educational programs can be more easily developed and implemented.

Cooperatives have sought to equalize bargaining power at factor and product pricing points through pooling input purchases and output sales by members.[1] Sexton (1986) points out that cooperatives can accomplish many of the same purposes as vertical integration. Cooperatives can be an institutional response to market imperfections (Chavas, 2001). In addition, cooperatives can provide their members with a variety of services and information regarding new practices and technical innovations. The ultimate goals of farmer-owned cooperatives have been to enhance farm income, increase price stability, and provide more reliable input and output markets (Dunn, Ingalsbe, and Amstrong, 1999). Cooperatives offer producers a way to retain ownership of their commodities further into value-added processing, thereby increasing the potential to enhance their returns on investment.

Many studies (e.g., Azzam and Turner, 1991; Royner, 1991; Brown, 1983; Lerman and Parliament, 1990; Kraenzle and Wilkins, 1983) have investigated the economic performance of cooperatives. Additionally, a number of studies (Bravo-Ureta and Lee, 1988; Lee, Bravo-Ureta, and Ling, 1986; Parliament, Lerman, and Fulton, 1990; Wilkins, 1984; Wilkins and Stafford, 1982) have contributed to the information base on the socioeconomic and technical characteristics of dairy cooperatives and dairy farm cooperatives in general. However, none of these studies have specifically investigated the role of farm supply and marketing cooperatives in the success of small farms.

Given the renewed interest in small farms (USDA, National Commission on Small Farms, 1998), this analysis focuses on national farm-level data utilizing a larger sample than previously used, comprising farms of different economic sizes located in major regions of the United States. Furthermore, it is the first study to investigate the success of small farms, particularly small farms whose operators report farming as their main occupation.

The objective of this study is to identify and analyze factors that contribute to the success of small farms. It is hypothesized that participation in either marketing or supply cooperatives has an effect on the success of small farms. The success of a farm is assumed to be determined by its profitability. Results will provide farmers and policy makers with a better understanding of the factors affecting the viability of small farms.

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[1] There are nearly 3,651 farm marketing and supply cooperatives in the United States, with approximately 3.4 million members [U.S. Department of Agriculture (USDA), Rural Business-Cooperative Service, 1999]. Cobia (1989) presents comprehensive history, evolution, and performance of cooperatives in agriculture.

Methodology and Conceptual Framework

The appropriate measure of economic success has been a topic of much interest among both economists and accountants. Some would argue that accrual net farm income (before taxes) is an effective measure of overall financial performance. Others suggest return to labor and management is the preferable measure. Yet other researchers have used a number of financial ratios to measure farm financial performance (e.g., Plumley and Hornbaker, 1991). In their study of successful dairy farm management strategies, Kauffman and Tauer (1986) used four different measures of farm performance, including net farm income, labor management income per operator, and rate of return on equity capital excluding appreciation.

Success can be a subjective term and depends, in part, upon the time frame considered as well as the goals of the farm business and/or farm household. Therefore, the criterion by which a farm's performance is measured must be clearly defined. According to guidelines set forth by the Farm Financial Standards Task Force (FFSTF), financial performance is based on the results of production and financial decisions made over single or multiple periods of time (Forbes, 1991). FFSTF further recommends that measures of financial performance such as net farm income (NFI) include the effect of external and uncontrollable forces (for example, drought, flood, and grain embargoes), as well as the results of operating and financing decisions made during the course of the production process. However, because the net farm income measure is an absolute amount and is size-driven, any comparison across farm businesses based solely on this measure must be interpreted with caution.

Several earlier studies have investigated the use of net farm income as a performance measure (Melichar, 1979; Haden and Johnson, 1989; Seger and Lins, 1986). The benefits of using NFI as a measure of profitability have been well documented in previous studies (Lins, Ellinger, and Lattz, 1987; Seger and Lins, 1986). Positive value of NFI is critical to the long-term survival of the farm. Most farmers must balance equity growth with the need to meet short-term cash commitments. The use of NFI as a sole performance measure has limitations because it is an accounting measure and may not account for opportunity costs. Hence, the use of NFI as an economic performance measure does not necessarily accurately reflect optimal use of the resource base. The measure is a dollar amount, and it is therefore difficult to compare across farm businesses differing in size. The form of business organization (family owned, corporation, etc.) can also cause problems for interpretation of results. In this study, we use modified net farm income per dollar of assets (*MNFIDOA*) as a performance measure. *MNFIDOA* is defined as the ratio of net farm income plus interest payments to total assets. Net farm income is the difference between gross farm income[2] and total farm operating expenditures,[3] and *MNFIDOA* is considered

[2] Gross farm income = gross cash farm income + net change in value of crop, livestock, feed, and fertilizer inventory and accounts receivable + value of farm products used or consumed on the farm + gross imputed rental value of the farm operator's dwellings.

[3] Total farm operating expenses = total cash operating expenses + estimate of noncash expenses for paid labor (includes feed, fuel, housing, meals and other food, utilities, water coolers, and vehicles for personal use) + depreciation on farm business assets.

as the internal rate of return. Further, *MNFIDOA* also measures the return to farm assets, and operator labor and management (see El-Osta and Johnson, 1998; McBride and El-Osta, 2002; Mishra and Morehart, 2001; Mishra, El-Osta, and Johnson, 1998, 1999).

In light of the problems identified above, we use operator's labor and management income (*OLMI*) as another measure of financial performance. *OLMI* allows concentration on factors affected by management decisions and is defined as net farm income, less opportunity cost on total capital and the return to non-operator labor (for example, unpaid workers such as farm operator's spouse and family members).[4] This measure (*OLMI*) may be deemed to be an appropriate indicator of operator performance, because the success of a farming operation ultimately falls upon the ability of the owner-operator to manage resources used in production (Alchian and Demsetz, 1972).

Conceptual Framework

Consider a profit-maximizing farm operator who in each period selects the combination of inputs and outputs that will maximize profits (total revenue minus total costs) subject to production constraints. Based on this assumption, the following model can be estimated:

$$NFI = \alpha_0 + \sum \boldsymbol{\beta}_{ij}\mathbf{X}_{ij} + \varepsilon, \tag{1}$$

where *NFI* is net farm income and $\mathbf{X}_{ij}$ is a vector of farm, operator, and financial characteristics. However, because net farm income does not address opportunity costs as a measure of financial performance, the dependent variable in equation (1) is replaced with modified net farm income per dollar of assets (*MNFIDOA*) or operator's labor and management income (*OLMI*) as a measure of financial performance. Specifically, we estimate the following linear model, using a weighted least squares procedure:

$$FP_i = \alpha_0 + \sum \boldsymbol{\beta}_{ij}\mathbf{X}_{ij} + \varepsilon, \tag{2}$$

where FP_i denotes either *MNFIDOA* (modified net farm income per dollar of assets as a measure of profitability) or *OLMI* (operator's labor and management income as a measure of profitability) of the ith farm ($i = 1, ..., n$); $\mathbf{X}_{ij}$ is a set of farm operators', farm, and financial characteristics; $\boldsymbol{\beta}_{ij}$ is a vector of parameters to be estimated; and ε is the unexplained random component.

Success of a farm is defined as profitability (measured here as *MNFIDOA* and *OLMI*). The independent variables hypothesized to affect the farm's profitability

[4] *OLMI* = net farm income (before taxes) ! charge to non-operator unpaid labor ! charge to capital. Charge to non-operator labor = (number of hours) × wage rate. Wage rate = state average hired worker's wage rate + social security tax for 1997. Charge to capital = (net worth) × 2.28%.

(*MNFIDOA* and *OLMI*) encompass the following four areas: (*a*) farm operator characteristics; (*b*) farm characteristics (such as farm size, marketing strategies, risk management strategies, participation in government programs, working off the farm, enterprise diversification, and soil productivity); (*c*) management strategies; and (*d*) region and farm type. The independent variables are defined in table 1.

A number of studies (e.g., Garcia, Sonka, and Yoo, 1982; Wood, Johnson, and Ali, 1987; Ali and Johnson, 1987; Mishra, El-Osta, and Johnson, 1998, 1999) have investigated the relationship between profit and farm characteristics.[5] Several farm production characteristics are hypothesized to contribute to farms' financial performance: machinery value per dollar of output, participation in a crop insurance program, ratio of cash operating expenses to the value of agricultural production, managerial practices, business organization, and diversification. Machinery value per dollar of output (*FIXED$VP*) is expected to be negatively related to farm performance. In developing a return to labor and management model, machinery expense per tillable acre was used by Ali and Johnson (1987) as one of the explanatory variables. Their findings indicate a negative and significant correlation between machinery expense per tillable acre and labor earnings.

The variable defined as the ratio of cash operating expense to the value of farm production (*COPE$VP*) is used to take into consideration the variable costs of production. Cash operating expenses include expenditures on hired labor, purchased inputs, maintenance and repair, and custom hire work. It is hypothesized that more successful farms will have a significantly lower *COPE$VP* ratio than less successful farms. Plumley and Hornbaker (1991) used a similar variable to study (via mean analysis) characteristics of successful and less successful Illinois grain farms. Kauffman and Tauer (1986), as well as Haden and Johnson (1989), used expenditures on hired labor to measure the same effect. Therefore, a negative relationship is hypothesized between *COPE$VP* and *MNFIDOA*.

The age of the operator (*OP$AGE*) plays an important role in financial performance. Age relates to technology adoption and wealth accumulation. One notion is that as farmers age, they accumulate more wealth and may carry less debt. Another important factor affecting farm profitability is soil productivity (*MEAN$PI*). With greater soil productivity, one would expect short-run profitability to be higher for any given level of input use.[6] The debt-to-asset ratio (*DEBT$ASSET*) is expected to have a negative effect on financial performance—i.e., higher leverage means there is more interest expense for servicing debt.

As noted by Newbery and Stiglitz (1981), crop diversification is one of the ways in which farmers can reduce risk and variability associated with farm income. Farm diversification, as measured by an entropy index (*ENTROPY$IN*) popularized by

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[5] Fox, Bergen, and Dickson (1993) provide a comprehensive summary and analysis of studies from 1948 to 1988 that have examined farm financial performance (in terms of profitability and viability).

[6] A soil productivity index, ranging from 0 to 100, is used. This measure of ranking soil productivity classifies the least productive soil at zero, with 100 being the most productive soil. See Pierce et al. (1983) for details.

Table 1. Variable Definitions and Mean Values of Variables Used in Weighted Least Squares Regression, Farming as Main Occupation Small Farms (FOSFs)

Variable	Definition	Mean
OP$AGE	Age of the farm operator (years)	56.0
WORK$OFF	Participation in off-farm work (= 1 if operator participated; 0 otherwise)	0.27
FIXED$VP	Ratio of fixed expenses to value of production	0.57
COPE$VP	Ratio of cash operating expenses to value of production	1.37
ENTROPY$IN	Entropy measure of farm diversification	0.15
DEBT$ASSET	Debt-to-asset ratio	0.12
VAL$PROD	Value of production sold by the farm ($10,000s)	8.05
FARM$SOLE	Type of business organization (= 1 if sole proprietorship; 0 otherwise)	0.90
F$MANAGE	Actively using budgeting and record keeping to manage cash flow and control costs (= 1 if using; 0 otherwise)	0.71
M$COOP	Participation in marketing cooperative (= 1 if participated; 0 otherwise)	0.22
S$COOP	Participation in supply cooperative (= 1 if participated; 0 otherwise)	0.40
MEAN$PI	Mean productivity index, an indicator of soil productivity (%)	78.40
NORTHEAST	= 1 if farm is located in Northeast; 0 otherwise	0.19
WEST	= 1 if farm is located in West; 0 otherwise	0.14
SOUTH	= 1 if farm is located in South; 0 otherwise	0.22
MIDWEST	= 1 if farm is located in Midwest; 0 otherwise	0.45
CGRAIN	= 1 if farm is classified as cash grain farm; 0 otherwise	0.32
OCROPS	= 1 if farm is classified as other crop farm; 0 otherwise	0.16
FVEGT	= 1 if farm is classified as fruit, tree nuts, vegetables, nursery and greenhouse farm; 0 otherwise	0.08
BEEF	= 1 if farm is classified as beef, hog, and poultry farm; 0 otherwise	0.26
GENLIV	= 1 if farm is classified as general livestock farm; 0 otherwise	0.04
DAIRY	= 1 if farm is classified as dairy farm; 0 otherwise	0.14
MNFIDOA [a]	Modified net farm income per dollar of assets (a ratio of net farm income plus interest expense to total assets)	0.044
OLMI	Operator labor and management income ($)	! 14,063

No. of sample farms = 2,886
Population represented = 212,900

Source: USDA, "1998 Agricultural Resource Management Study" (ARMS).
[a] *MNFIDOA* is defined as the ratio of *MNFI* (net farm income plus interest payments) to total assets, and is the dependent variable in the regression function.

Theil (1972),[7] is used as an explanatory variable in the model because of the several desirable properties it possesses (see Hackbart and Anderson, 1978). We assume diversification may lead to economies of scope, which lower costs and increase profits (*MNFIDOA*) (Chavas and Aliber, 1993). Pearse (1966) reported increased cropping intensity was associated with increased returns to operator labor. Haden and Johnson (1989) examined the relationship between farm income and milk sales as a percentage of total farm sales for a sample of Tennessee dairy farms. Milk sales as a percentage of total farm sales were negatively related to cash farm income, but were not related to net farm income. However, Purdy, Langemeier, and Featherstone (1997) found contradictory evidence when they assessed the financial performance of a sample of Kansas farms. Specifically, they reported certain specializations, such as swine, dairy, and crop production, increased mean financial performance. Therefore, one cannot predict the effect of *ENTROPY$IN* on *MNFIDOA*. Nonfarm income may affect labor and management. If the farm operator works off the farm, then one would expect the effort expended to detract from farm labor and management, therefore contributing to lower performance of the farm.

The type of business organization, either sole proprietorship (or individually owned) or multi-owner forms (such as family-held corporation, cooperative, or non-family corporation), could have an impact on financial performance of the farm (Burton and Abderrezak, 1988; Garcia, Sonka, and Yoo, 1982; Kauffman and Tauer, 1986). Burton and Abderrezak, in their study of Kansas farms, found the proportion of non-ownership was positively correlated to expected profits. Garcia, Sonka, and Yoo found the degree of land ownership by the operator was inversely related to short-run profits. In contrast, based on their study of successful dairy farms in New York, Kauffman and Tauer concluded the sole-proprietorship form of business organization increased a farm's chances of success. Therefore, one cannot predict the effect of business organization on financial performance. In this study, the variable *FARM$SOLE* was used to indicate the form of business organization chosen for the farm operation. The variable assumes a value of 1 if the farm was individually owned, and 0 otherwise.

Farm size is another factor related to financial performance (Boessen et al., 1990; Haden and Johnson, 1989; Kauffman and Tauer, 1986; Sonka, Hornbaker, and Hudson, 1989; Ford and Shonkwiler, 1994). A recent study by El-Osta and Johnson (1998) confirms a positive correlation between farm size and net farm income. In this study, we use value of farm production (*VAL$PROD*) as a measure of farm size. Farm size is expected to be positively related with financial performance (*MNFIDOA*). This hypothesis is in line with Barlett's (1984) notion that larger and more resource-endowed farms are better able to take advantage of sophisticated,

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[7] It is important to note *ENTROPY$IN* takes a value of 1 when a farm is diversified and 0 when a farm is specialized:

$$ENTROPY\_IN = \sum_{i=1}^{N} (\%\ \text{value of production from enterprise } i)\ \frac{\ln\left(\frac{1}{\%\ \text{value of production from enterprise } i}\right)}{\ln(N)},$$

where 1 refers to each of the *N* possible enterprises.

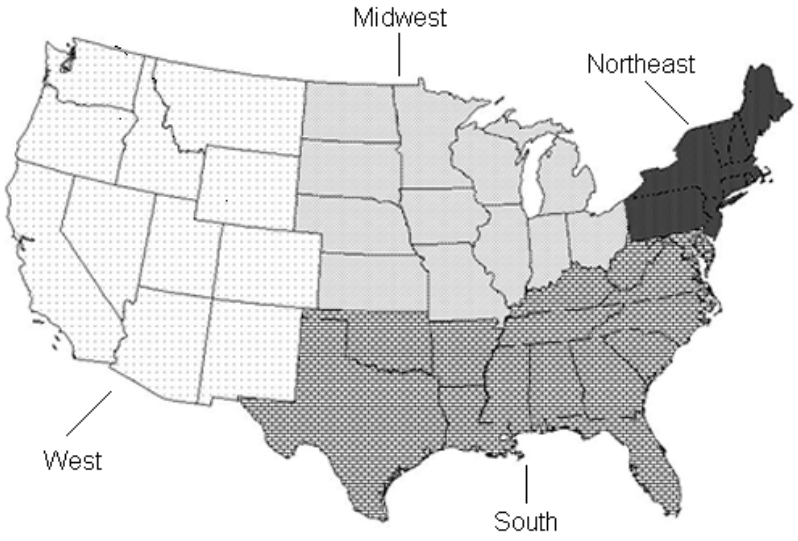

Figure 1. Delineation of ARMS survey regions

productivity-enhancing technology, and ultimately more likely to generate higher incomes. In a study of farm size and profitability, Hoffman (1996) concluded well-managed small farms, based on farm records, are better able to compete in per unit profitability with farms many times larger. In our study, the variable *F$MANAGE* is used—based on actively managing cash through budgeting and record keeping (on income and expenditures)—as a proxy for managerial ability.[8] We hypothesize a positive correlation between *F$MANAGE* and *MNFIDOA*.

As discussed earlier (the reasons are well documented), the effect of participation in cooperatives (either supply or marketing) on performance is expected to be positive. According to Cobia (1989), participation in supply cooperatives (*S$COOP*) reduces costs (which could be both fixed and variable costs), and hence higher profits accrue to the farm. On the other hand, participation in marketing cooperatives (*M$COOP*) may increase the prices and revenue received by the farms.

To account for factors such as climate, transportation, and other infrastructure that may impact farm profitability, four regional dummy variables are included in the regression model: *NORTHEAST*, *WEST*, *MIDWEST*, and *SOUTH* (*MIDWEST* is treated as the base group). These dummy variables represent the four census regions as defined by the USDA for the ARMS survey (see figure 1).

Another factor that may influence financial performance is farm type. Six major farm types are identified in the data: (*a*) cash grain (*CGRAIN*) includes corn, wheat, soybean, grain sorghum, general cash grain, and rice farms; (*b*) other crops (*OCROPS*) includes general crop, peanut, tobacco, and cotton farms; (*c*) fruit and

[8] As one discussant pointed out, there could be potential endogeneity with *F$MANAGE*, *WORK$OFF*, and *DEBT$ASSET*, which is a topic for further research.

vegetable (*FVEGT*) includes fruits and tree nuts, vegetables, and nursery and greenhouse farms; (*d*) beef (*BEEF*) includes beef, hogs, and poultry farms; (*e*) dairy (*DAIRY*) includes dairy farms; and (*f*) general livestock (*GENLIV*), which is used as the base group.

Data Description

The data source for this analysis was the "1998 Agricultural Resource Management Study" (ARMS). ARMS, a complex stratified national annual survey of farms, is jointly conducted by the USDA's Economic Research Service (ERS) and the National Agricultural Statistics Service (NASS). The survey collects data to measure the financial condition (farm income, expenses, assets, and debts) and operating characteristics of farm businesses, the cost of producing agricultural commodities, and the well-being of farm operator households. The survey design of ARMS allows each sampled farm to represent a number of farms that are similar, referred to as a survey expansion factor. The expansion factor, in turn, is defined as the inverse of the probability of the surveyed farm being selected.

The small farm category includes farms that differ both in the level of their commitment to farming and in their capacity to earn income. A recently constructed typology of U.S. farms (see Hoppe, 1998) separates small farms (gross sales < $250,000, as suggested by the National Commission on Small Farms) into five groups: (*a*) limited resource farms (i.e., gross sales under $100,000, farm assets under $150,000, and farm operator household income under $20,000); (*b*) retirement farms (operators report they are retired); (*c*) residential lifestyle farms (operators report a major occupation other than farming); (*d*) farming occupation/lower-sales farms (i.e., farm sales under $100,000 but more assets and/or income than the limited resource farms, and operators report farming as their main occupation); and (*e*) farming occupation/higher-sales farms (i.e., farm sales are $100,000 to $249,999, and operators report farming as their main occupation).[9] This study focuses on just one category of small farms, consisting of small farmers with farming as their main occupation (FOSFs)—which includes only groups (*d*) and (*e*) as described above. The FOSFs category combines farming as main occupation "lower-sales" and "higher-sales" farms, and is of major interest to researchers and policy makers since farming is the main focus of the operators and they are directly affected by changes in farm policies.

The 1998 ARMS also asked the farmer respondents to describe their use of cooperatives. The farm operators were asked three questions about cooperatives:

- In 1998, did you sell any farm products to, or purchase farm supplies or services from, farmer-owned cooperatives?
- In 1998, were you a member of a marketing cooperative?
- In 1998, were you a member of a farm supply or related service cooperative?

[9] The typology is based on the occupation of the operators and the sales class of farms.

Thirty-three percent of small farm operators indicated they sold or purchased farm supplies from cooperatives, 9% responded that they were a member of a marketing cooperative, and 24% reported membership in a farm supply cooperative. In the case of operators who indicated farming as their main occupation (FOSFs), a higher percentage participated in cooperatives (48%). Further, 17% reported participation in marketing cooperatives and 37% reported participation in farm supply cooperatives.[10] The ARMS sample of small farm operators indicating farming as their main occupation (FOSFs) contained 2,886 farms, representing 212,900 farms in the United States.

Results

Weighted least squares estimates of factors affecting the success of small farms (farming as main occupation small farms, FOSFs), as measured by *MNFIDOA* and *OLMI* and as depicted in equation (2) for 1998, are presented in table 2. The respective R^2 statistics (adjusted) of 0.36 and 0.33 for *MNFIDOA* and *OLMI* indicate that the explanatory variables used in the weighted least squares model explained 36% and 33% of the variation in the profitability of small farms. These levels of explained variation are fairly typical when analyses are based on cross-sectional data (El-Osta and Johnson, 1998).

Results reported in table 2 show farming as main occupation small farms (FOSFs) that participate in marketing and farm supply cooperatives have higher returns to farming, as measured by *MNFIDOA*. The coefficients on both the marketing (*M$COOP*) and supply (*S$COOP*) cooperatives dummies are positive and significant at the 10% level. Specifically, the results here indicate that FOSFs participating in marketing cooperatives (*M$COOP*) are likely to have returns, on average, about one-tenth of one percent (0.1%) more than FOSFs not participating in marketing cooperatives. One reason for this finding could be that participation in marketing cooperatives helps small farms improve their marketing efficiency. Cooperative marketing provides the power and market share often enjoyed by big producers. In contrast, farms participating in supply cooperatives (*S$COOP*) are likely to earn higher returns, about 2% more on average, than nonparticipating farms. Participation in supply cooperatives has a higher impact on returns to farming than participation in marketing cooperatives. Participation in farm supply cooperatives may help small farms (FOSFs) to reduce their costs, and hence increase farm profits. Also, by participating in supply cooperatives, the farm operators increase their asset base for farming operations by gaining access to specialized tools and equipment and infrequently needed machinery or implements without having to purchase these items, thereby reducing capital expenses and debt service costs. On the other hand, when success is measured by returns to operators' labor and management (*OLMI*), only the coefficient on supply cooperatives (*S$COOP*) is significant.

[10] Due to data limitations, one can only determine if the farms participated in marketing cooperatives but cannot identify the specific commodity marketed through the cooperative.

Table 2. Regression Estimates of Factors Affecting Success of Farming as Main Occupation Small Farms (FOSFs)
[Dependent Variables = *MNFIDOA* and *OLMI*]

	Parameter Estimate[a]	
Explanatory Variable	*MNFIDOA*	*OLMI*
Intercept	0.1245**	!28,334.00
	(0.0568)	(18,375.00)
Operator age (*OP$AGE*)	!0.0047**	!20.380**
	(0.0023)	(10.290)
Operator age squared ($OP\$AGE^2$)	0.0001*	!2.874
	(0.0000)	(4.421)
Operator's participation in off-farm work (*WORK$OFF*)	!0.0080**	!617.258
	(0.1652)	(2,210.670)
Ratio of fixed expenses to value of production (*FIXED$VP*)	0.0017	!1,024.357**
	(0.0012)	(524.900)
Ratio of cash operating expenses to value of production (*COPE$VP*)	!0.0023***	!1,334.785***
	(0.0007)	(238.570)
Entropy measure of farm diversification (*ENTROPY$IN*)	!0.0189	!13,948.00
	(0.0279)	(8,958.59)
Debt-to-asset ratio (*DEBT$ASSET*)	!0.0062	!13,555.00***
	(0.0232)	(5,138.81)
Farm size (*VAL$PROD*)	0.0002*	81.38**
	(0.0001)	(41.70)
Business organization (*FARM$SOLE*)	0.0129**	11,637.00***
	(0.2480)	(3,172.90)
Budgeting and record keeping (*F$MANAGE*)	0.0032*	916.84
	(0.0500)	(2,130.65)
Participation in marketing cooperatives (*M$COOP*)	0.0010*	1,217.92
	(0.0124)	(2,683.90)
Participation in supply cooperatives (*S$COOP*)	0.0172*	5,678.33***
	(0.0087)	(2,179.77)
Soil productivity index (*MEAN$PI*)	0.0010**	156.84
	(0.0199)	(139.55)
Northeast (*NORTHEAST*)	0.0021	!2,385.24
	(0.0086)	(2,837.43)
West (*WEST*)	0.0115	!14,880.00***
	(0.0077)	(3,263.94)
South (*SOUTH*)	!0.2210	!3,546.33
	(0.0089)	(2,881.24)
Cash grain farms (*CGRAIN*)	0.0207**	13,700.00***
	(0.0103)	(4,117.27)
Other crop farms (*OCROPS*)	0.0013	14,028.00
	(0.0100)	(9,787.75)

(continued . . .)

Table 2. Continued

Explanatory Variable	Parameter Estimate [a]	
	MNFIDOA	*OLMI*
Fruits, vegetables, nursery and greenhouse farms (*FVEGT*)	0.0844**	18,444.00***
	(0.0335)	(5,246.34)
Beef farms (*BEEF*)	0.0272	3,791.33
	(0.160)	(9,619.67)
Dairy farms (*DAIRY*)	0.0433***	21,675.00***
	(0.0097)	(4,815.26)
R^2 (adjusted)	0.36	0.33

Notes: Single, double, and triple asterisks (*) denote statistical significance at the 10%, 5%, and 1% levels, respectively. Values in parentheses are standard errors.

[a] *MNFIDOA* is defined as the ratio of *MNFI* (net farm income plus interest payments) to total assets; *OLMI* is defined as operator's labor and management income.

Another factor that affects farm profitability, and hence the success of farms, is soil productivity. As shown in table 2, soil productivity (*MEAN$PI*) has a positive sign and is statistically significant at the 5% level when success is measured by *MNFIDOA*. With higher soil productivity, one would expect short-run profitability to be higher for any given level of input use. These results are consistent with the findings of Garcia, Sonka, and Yoo (1982). Results show a negative and significant relationship between debt-to-asset ratio (*DEBT$ASSET*) and success as measured by *OLMI*. A possible explanation is that most small farms likely have a rate of return which is less than the cost of borrowing capital; hence, higher levels of debt-to-asset ratio reduce the level of profitability. Additionally, higher levels of debt increase expenses (interest cost, etc.) associated with servicing debt. Our findings are consistent with those reported in other studies (Kauffman and Tauer, 1986; Lins, Ellinger, and Lattz, 1987; Lazarus, Streeter, and Jofre-Giraudo, 1990).

Controlling costs is one of the components contributing to farms' profitability and success (Mishra, El-Osta, and Johnson, 1998, 1999). Results reveal a negative and significant relationship between the ratio of variable costs to the value of agricultural production (*COPE$VP*) and both measures of success, *MNFIDOA* and *OLMI*. Results show farms that decreased variable costs are successful, ceteris paribus. Farms whose operators have controlled their cash operating and fixed expenses are more successful than farms whose operators do not exercise these controls. These results support the conclusions of Kauffman and Tauer, 1986; Haden and Johnson, 1989; Korth, 1984; Luckham, 1976; Sonka, Hornbaker, and Hudson, 1989; Ali and Johnson, 1987; and Wood, Johnson, and Ali, 1987.

The coefficient on the ratio of fixed costs to the value of agricultural production (*FIXED$VP*) is negative and statistically significant only when success is measured by returns to operator's labor and management income (*OLMI*). Economically, it makes sense to have less capital tied up in machinery and other equipment. Member-

ship in supply cooperatives can provide access to infrequently used tools and implements when needed. Further, farmers can lease or custom hire machinery needed in their farm operations.

Management strategies such as keeping books and records (*F$MANAGE*) on farm income and expenditures are important determinants for the success of farms. The coefficient for *F$MANAGE* is positive and statistically significant at the 10% level when success is measured by *MNFIDOA* (table 2). Results suggest farm operators who keep track of their income and expenditures through record keeping and managing cash flow are more successful in their business. These results are consistent with findings reported by Hoffman (1996).

A farm operator may generate a higher total net income by combining on- and off-farm work, but when investigating the success of farm firms as a business, what mattered the most was farm income. When measuring success in terms of *MNFIDOA*, results show that working off the farm (*WORK$OFF*) is associated with lower returns on the farm for FOSFs. A possible explanation is that farm operators who work off the farm have less time to manage the farm, resulting in less effective use of resources in the production process.

The coefficient of the farm size (*VAL$PROD*) variable had the expected sign and was significant at the 10% level when success is measured by *MNFIDOA*, and at the 5% level when success is measured by *OLMI*. These results suggest beneficial effects from overall economies of scale, and are consistent with the findings of Ford and Shonkwiler (1994); Haden and Johnson (1989); and El-Osta and Johnson (1998), and support arguments presented by Barlett (1984).

The age of the farm operator (*OP$AGE*) has a significantly negative influence on returns to farming as measured by both *MNFIDOA* and *OLMI*. Haden and Johnson (1989) report a similar finding in their study of dairy farms in Tennessee. The results support the notion that farmers have fewer assets and often lower profits when they are young. However, when farmers get older, the situation is often reversed, as evident from the significant positive relationship between $OP\$AGE^2$ and *MNFIDOA* (table 2). Another interpretation of this finding is that older farmers have more experience and can better allocate resources where they are needed and keep them fully utilized.

The *FARM$SOLE* variable was used to indicate the form of business organization of the farm. The coefficient on *FARM$SOLE* is positive and significant on both measures of success (*MNFIDOA* and *OLMI*). Farms organized as sole proprietorships are found to be more profitable than farms with other forms of legal organization. This result is in agreement with the findings of Kauffman and Tauer (1986). One explanation for this finding is that farms controlled by one individual are in a better position to manage resources efficiently. In the case of sole proprietorship, the person making decisions has an incentive to perform well because the returns accrue directly to the individual. Further, the decision-making process is simpler and more direct under a sole proprietorship than in other forms of business organization, resulting in lower transaction costs. Moreover, there is no dilution of earnings, since earnings will not have to be divided among other partners (see Kauffman and Tauer,

1986). Yet another potential reason for the greater profitability of sole proprietorships is that other forms of business organization allow more expenses to be deducted, which in turn results in lower profits. For instance, certain corporations are able to deduct salaries to corporate members who are working on the farm, and also deduct insurance premiums.

Geographic location of farms determines their cropping pattern, rainfall amounts, and productivity. As noted earlier, four regional dummy variables were used to denote farm location, and none of the regional dummies were significant when financial performance is measured by *MNFIDOA*. However, in the case of *OLMI*, only the coefficient for *WEST* is negative and statistically significant at the 1% level. Compared to farms in the Midwest (the benchmark), western farms' operators have lower returns to their labor and management (*OLMI*). This may not be surprising, because farms in the West tend to specialize in beef cattle production, where prices are not stable and returns vary across years.

Finally, results from table 2 show farms specializing in cash grains (*CGRAIN*), fruits and tree nuts, vegetables, nursery and greenhouse (*FVEGT*), and dairy (*DAIRY*) are more successful compared to farms specializing in general livestock (*GENLIV*). The coefficients for *CGRAIN*, *FVEGT*, and *DAIRY* are statistically significant at the 5% level or less for both measures of success, *MNFIDOA* and *OLMI*.

Summary and Conclusions

During the past several decades, small family farms have experienced continuing difficulties in maintaining profitability of their operations. Cooperatives have sought to equalize bargaining power at factor and product pricing points through pooling input purchases and output sales by member farmers. The primary objective of this study was to investigate the effect of marketing and supply cooperatives on the success of small farms. These small farms represent a group of farms that are very relevant to policies and policy makers. Using data from the "1998 Agricultural Resource Management Study" (ARMS) and a weighted least squares procedure, we measure the success of farming as main occupation small farms (FOSFs) given farm and operator characteristics, production and marketing contracts, and participation of farms in marketing and supply cooperatives. The study utilizes modified net farm income per dollar of assets (*MNFIDOA*) and operator's labor and management income (*OLMI*) as measures of success or financial performance. However, the scope of the analysis is limited by the characteristics of ARMS data (the survey involves stratified sampling, and the data are cross-sectional in nature).

Using modified net farm income per dollar of assets (*MNFIDOA*) as a measure of success for small farms (FOSFs), farm size, participation in marketing and supply cooperatives, management strategies, and soil productivity all have a positive impact on the success of FOSFs. Management strategies such as keeping books and records on income and expenditures help operators to be efficient and eventually contribute toward the success of small farms. Small farms organized as sole proprietorships have higher returns than farms organized as partnerships or family corporations.

Further, the analysis shows that small farms specializing in cash grain, fruit, vegetable, greenhouse, and dairy production have higher financial performance compared to general livestock farms. On the other hand, age of the operator, ratio of variable costs to value of production, and working off the farm have a negative impact on the success of small farms. Controlling for variable and fixed costs, in particular the variable costs, can help farms increase their financial performance.

When measuring success in terms of operator's return to labor and management (*OLMI*), almost all of the same variables affect the success of small farms. However, participation in marketing cooperatives is no longer significant. Additionally, leverage (debt-to-asset ratio) becomes an important determinant in the success of small farms. Specifically, the results suggest lower debt-to-asset ratios could increase the profitability (returns to operators' labor and management) of small farms.

These results have important implications for operators, farm managers, analysts, and policy makers. First, sound management of income and expenditures of the farming operation increases the opportunity for profitability and success of small farms (FOSFs). Investment in more efficient record keeping and analysis is therefore warranted. Second, evidence from this study indicates participation in marketing and supply cooperatives by operators of small farms (FOSFs) increases their success in farming. Policy makers can design policies aimed at encouraging small farmers to join and participate in farmer cooperatives, thereby improving the financial performance of small farms.

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