

Evaluation of Economic Performance of Agricultural Co-Operative Companies (A Case Study of Fars Province)

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ABSTRACT

The present study aims to evaluate the economic performance of service cooperatives (of agriculture sector) in Fars Province. To do so, stochastic profit frontier function was employed along with the model of estimating the causes of inefficiency. The results indicate that the efficiency of units under study was almost 45.93% with high variance (among companies). In addition, chief executive officers' (CEO) characteristics (i.e. level of education, age, managerial and work experience) and characteristics of cooperatives (working life, distance from the city centers, cost of activities, frequency of income-generating and non-income generating activities, number of the employed individuals [simple workers and specialists], and the size of cooperative) affect the economic performance of cooperatives, of which the number of employed people and expenses related to cooperative activities have a negative impact on economic performance of cooperatives.

KEYWORDS: economic performance, cooperatives, stochastic profit frontier, Fars Province.

INTRODUCTION

Although cooperatives can play a vital role in the development of the agriculture sector by improving farm management practices, quality and quantity improvement of soil and water resources utilization, updating marketing of agricultural products, and generating employment can play an important role in agricultural development. Therefore, it appears that improvement of the role of cooperatives through the evaluation of economic performance of cooperative enterprises can motivate managers to make every effort to achieve the stated objectives.

Shajari, Amjadi, and Barikani (2008) in their study "Determining economic efficiency of agricultural production cooperatives and factors affecting economic efficiency of cooperatives in Fars Province" noted that managing directors' level of education and age, their management experience, the size of cooperatives, expenditure relating to all activities, duration of cooperative activities etc are among factors affecting the efficiency of the cooperative companies. They eventually came to the conclusion that CEO's educational level, number of activities done, the distance of cooperatives from city centers have a negative effect on economic inefficiency of cooperatives. Furthermore, the type of public administration compared with self-governed cooperatives and the duration of cooperative activities has a positive effect on economic inefficiency (2).

Osborn and Troblod (2006) examined the economic efficiency of cooperative farms of Russian cereals for the structural changes period of 1998-1993 by employing two parametric and nonparametric methods. The results indicated that the economic efficiency has undergone a downward decrease during the mentioned period because of a decrease in technological and specialized efficiency (10).

MATERIALS AND METHODS

The population under study included 210 active agricultural service cooperatives in Fars Province of which 80 companies have been chosen as the sample in the present study. The required data were collected from managers of agricultural service cooperatives in Shiraz. Two functions of profit and economic inefficiency were estimated in the present study through stochastic profit frontier function (Laurence and Coyle's model, 1972; Frontier 4.1 Software developed by Batt and Coyle, 1992; and Coyle, 1994).

The general formula in the model can be formulated as follows:

$$\Pi_{it} = \exp(x_{it}\beta + v_{it} - u_{it}) \quad t=1, \dots, T \quad i=1, \dots, n$$

Since in this study t is equal to 1, the above formula will be changed as follows:

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$$\Pi_i = \exp(x_i\beta + v_i - U_i) \quad i=1, \dots, n \quad U_i \sim N(Z_{it}, \sigma^2_u)$$

Where in the above formula, x_i is vector $1 \times k$, i.e. factors affecting profits, β is a vector $K \times 1$ as one of the parameters to be estimated, n the number of observations, T the number of the observed periods, Π_i is the benefits resulting from the activities done by the cooperative i th, x_{1i} is the diversity of activities done by the cooperative i th, x_{2i} as expenses related to the cooperative i th, x_{3i} the capital value of the cooperative i th at the present, x_{4i} is initial capital of the cooperative i th, x_{5i} is management knowledge of the cooperative i th (level of knowledge in capital allocation, selection criteria based on economical criteria and public information in the field of agriculture and management), x_{6i} the monetary value of other activities done by the cooperative i th, v_i the random error with mean of zero and standard deviation of Q^2_v , and U_i is the non-negative random variable that represents economic inefficiency with regard to the profit function.

$$Z_i = W_i + U_i \Rightarrow W_i = Z_i - U_i \Rightarrow w \sim N(0, \sigma^2) \quad \delta Z_i \geq W_i$$

Economic inefficiency

$$EE_i = \exp(-U_i) = \exp(-Z_i\delta - W_i)$$

To calculate the economic inefficiency (through the final model of stochastic frontier profit function), the generalized maximum likelihood test is used as follows:

$$LR = -2\{\ln[L(H_0)] - \ln[L(H_1)]\} \quad (5)$$

In equation (5), $L(H_0)$ and $L(H_1)$ are values of likelihood function, under the assumptions of zero and one (with a chi-square distribution). Degree of freedom of LR is equal to the difference between the number of estimated parameters in the two models (the model in Hypothesis H_0 and the model in Hypothesis H_1).

Research hypotheses are expressed as follows:

1) $\gamma = 0$ ($\gamma = \sigma^2/\sigma^2_v + \sigma$). The confirmation of this hypothesis indicates the nonexistence of the effects of economic inefficiency (If $\gamma = 0$ and since the mean of W_i is zero, then it indicates that inefficiency is nonexistent). Given that U_i is a random variable, then economic efficiency must also be random.

2) $\delta_0 = 0$: This hypothesis suggests that the constant is equal to zero in relation to factors affecting economic inefficiency.

3) $\delta_0 = 0\delta_1 = \dots = \delta_n = 0$: This hypothesis implies that explanatory variables of the model have no effect on economic efficiency of cooperative units.

Explanatory variables in the economic efficiency function of agricultural service cooperatives are:

Z_1 : managing directors' level of education, Z_2 : age of managing directors, Z_3 and Z_4 : managerial experience of CEOs inside and outside the cooperative sector, Z_5 : the cooperative activity duration (number of years), Z_6 : the cooperative distance from downtown, Z_7 : the cost of cooperative activities, Z_8 and Z_9 are the number of income generating and non-income generating activities, Z_{10} : the virtual variable associated with the CEO's level of education. $Z_{10} = 1$, when it is related to the cooperative activities, otherwise $Z_{10} = 0$, Z_{11} : the virtual variable related to the location of the cooperative. If the cooperative is situated in Marvdasht, $Z_{11} = 1$, otherwise $Z_{11} = 0$, Z_{12} : If the cooperative is located in Darab (Fars Province), $Z_{12} = 1$, otherwise $Z_{12} = 0$, Z_{13} : if the cooperative is in Mamasani, $Z_{13} = 1$, otherwise $Z_{13} = 0$, Z_{14} : If the cooperative is located in Shiraz, $Z_{14} = 1$, otherwise $Z_{14} = 0$, Z_{15} : the cooperative size (number of members), Z_{16} : number of people employed in the cooperative, Z_{17} : The number of skilled workers in the cooperative, Z_{18} : If the CEO is a woman $Z_{18} = 1$ and If the CEO is a man $Z_{18} = 0$.

Model estimation, discussion, and conclusion

The results of random border models estimations and the effects of the economic inefficiency of the cooperative understudy and the results of maximum likelihood ratio tests for borderline profit parameters and inefficiency are presented in tables 1 and 2.

The first hypothesis won't be accepted according to Table 1 and Table 2; suggesting that the economic efficiency has a random and observable distribution. Therefore, the application of maximum likelihood test (stochastic frontier method) for estimating the economic efficiency is advantageous over the revised ordinary least squares method (fixed boundary method).

The hypothesis indicating that the value of coefficient is zero in economic inefficiency function of agricultural services cooperatives was rejected.

The null hypothesis of ineffectiveness of variables understudy (including the CEOs' level of education, age, management experience inside and outside the cooperative sector, the company lifespan, the cooperative distance from downtown, the number of income generating and non-income generating activities, number of employees, number of skilled workers, expenses related to cooperative activities, and the cooperative size (number of the

cooperative members) on economic efficiency was not confirmed in the study suggesting that the above variables affect cooperatives efficiency.

Table 1: Estimated coefficients of border random profit functions and the model of economic inefficiency effects

variables	coefficients	t-statistics
c	-3.72 *	-2.75
X₁	0.72 *	2.77
X₂	-1.10 *	-7.86
X₃	0.05	0.55
X₄	8.64 *	4.96
X₅	1.68 **	1.85
X₆	-0.009	-0.3
σ₂	19.91*	20.31
γ	0.9917 *	141.67
c	-4.31*	-4.35
Z₁	-2.38 *	-3.22
Z₂	-1.06 *	-3.12
Z₃	-2.99 *	-4.67
Z₄	-1.52 *	-2.81
Z₅	-1.43 **	-1.91
Z₆	-0.23 *	-4.60
Z₇	0.00000023**	2.09
Z₈	-0.75 ***	-1.42
Z₉	-1.99**	-1.86
Z₁₀	-1.35 ***	-1.35
Z₁₁	1.34	1.26
Z₁₂	0.15	0.15
Z₁₃	-1.07	-1
Z₁₄	-0.47	-0.47
Z₁₅	-0.53 ***	-1.39
Z₁₆	1.63***	2.36
Z₁₇	-1.19***	-1.45
Z₁₈	-0.34	0.34
Log likelihood	67.81	Log likelihood

Source: Findings of the study (*, ** and *** indicated coefficients are significant at the level of 1%, 5%, and 10%).

Table 2: Results of maximum likelihood ratio test of borderline profit parameters and inefficiency

Test No.	Hypothesis	Computational χ ²	Degrees of freedom	χ ² Mixed Table	Test Results
1	$\gamma = 0$	82.6	2	5.138	Rejection *
2	$\delta_0 = 0$	10.34	1	2.706	Rejection
3	$\delta_1=\delta_2=\delta_3=\delta_4=$ $\delta_5=\delta_6=\delta_7=\delta_8=$ $\delta_9=\delta_{10}=\delta_{11}=$ $\delta_{15}=\delta_{16}=$ $\delta_{17}=0$	164.6	13	14.853	Rejection

Source: Findings of the study (* at the level of 5%)

The economic efficiency distribution of Shiraz agricultural service cooperatives is presented in Table 3, showing that the means of economic efficiency of the cooperatives under study is 45.93%. In other words, the cooperative enterprises under investigation on average have been 54.07% unsuccessful in gaining the maximum profit. In addition, the standard deviation of economic efficiency is very high (22.4) so that the number of the most efficient companies is eight times more than the number of the least efficient cooperatives and it is possible to increase the profitability of these companies by promoting managerial factors.

Table 3: Distribution of the economic efficiency of agricultural service cooperatives in Fars Province

Percentage of economic efficiency	Total	Percentage
100-90	1	2
90-70	13	26
70-50	12	24
50-30	14	28
30-10	10	20
Average		45.93%
Standard deviation		22.4%
Minimum		12%
Maximum		100%

Source: Findings of the study

Coefficients of variables related to managers' characteristics (level of education, age, managerial experience inside and outside the cooperative sector, the relatedness of managers' education to cooperative activities) and cooperatives characteristics (lifespan, distance from the city center, the cost of activities, number of income and non-income generating activities, the number simple and skilled employees, and the size of cooperatives) were all statistically significant and the signs of all variables except those related to the number of employees and expenditures are negative, indicating that the positive effect of these factors on economic efficiency and the negative effect of the number of employees and expenses on economic efficiency. In addition, there was no significant difference between the cooperative efficiency in all cities under study.

Suggestions

Based on the results of the study, it is recommended that individuals pay attention to the initial capital as an effective factor for profitability of cooperative companies before establishment of such companies and carry out the necessary investigations:

- Given that an annual increase in level of education, CEOs' managerial experience inside and outside the cooperative sector will lead to 2.24, 2.81, and 1.86% of economic efficiency, managers with higher level of education and experience should be selected.
- Conducting some investigations on the proper location of the cooperative are necessary before the establishment of agricultural service cooperatives.
- Training managers in defined areas of activity (technical, engineering, consulting, and services in agricultural mechanization) and other economic activities (such as conversion industries and warehousing) is a vital issue.
- Transferring managerial factors from highly efficient companies to less efficient companies through continuous communication of the Cooperative Department with cooperative companies, and evaluating their performance and factors affecting their success.
- Two other methods of economic efficiency analysis (i.e. income and cost methods) were analyzed and the obtained results were considered to make better decisions to prevent possible and intangible errors.

REFERENCES

- Coelli, T.J. 1994. A guide to frontier version 4.1: a computer program for stochastic frontier production and cost function estimation. Departments of Econometrics university of New England, Armidale.
- Battese, G.E., Coelli, T.J. 1992. Frontier production functions. technical efficiency and panel data: With application to paddy farmers in India. Journal of Productive analysis. 3: 153-169.
- Coelli, T.J., Rao, D.S.P., Battese G.E. 2002, An introduction to efficiency and productivity analysis. Kluwer Academic Publisher U.S.A. sixth printing. 132-166.
- Kumbhakar, S. 1993. Efficiency estimation in a profit maximising model using flexible production function. Journal of Agricultural Economics. 10: 143-152.
- Kumbhakar, S., Lovell, C.A.K. 2000. Stochastic frontier analysis. United Kingdom. Cambridge University Press.
- Lawrence, J., Yotopoulos, P. A. 1972. Profit supply and factor demand functions. Am. J. Agr. Econ. 11-18.
- Osborne, S., Trueblood, M.A. 2006. An examination of economic efficiency of Russian crop production in the reform period. Journal of Agricultural Economics. 34: 25-38.