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Consideration Technical Inefficiency and Production Risk in Cotton Farms Khorasan

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ABSTRACT

In the present study, we analyzed technical inefficiency and production risk at the Khorasan cotton farms level using a stochastic frontier production function with a heteroskedastic error structure in the period 2009-2012. A 4-years panel dataset collected from 60 cotton farms was used to estimate inefficiency Tran slog frontier production function. Result indicated that average technical efficiency in the period 4-years in the Tran slog model is 63%. Considerate effective factor on technical efficiency by set from variable social and economic. Result indicates that size household has negative impact and experience have positive impact on technical inefficiency. Machine, distance irrigation, fertilizer and labor were found risk-increasing, whereas seed area planed were found to be a risk- reducing inputs.

KEYWORDS: technical inefficiency, production risk, stochastic frontier production function. Khorasan.

1. INTRODUCTION

Cotton is one of the most important agricultural products and major exports. An item of the past two decades, despite the emphasis policy to self-sufficiency agricultural products and non-oil export, its former position is lost. Fluctuations in cotton production and consequently exports this product to the extent that in some years due to lower production, exports and imports of the product has inevitable.

In the Recent studies frontier production function by using of cross-sectional or combination data is estimated. Random frontier models widely used and by using the maximum likelihood method are estimates. Most of these studies, a production function frontier translog or Cobb Douglas for data analysis is to assume in the field level. In addition, factors that explain why some farmers more than farmers are more efficient, are examined. Variables affect performance including socio - economic specification and management are farmers.

There are risks in production, farmers decide the allocation of inputs and product supply will affect. Therefore necessary will be investigated the risk of impact on how farmers decide to allocate agricultural inputs and efforts to achieve technical efficiency (Renato et al 2006).

In this study, analyzed production risks associated with technical efficiency with use a random frontier production function based on combined data sets for four-year period from 2009 to 2012 in cotton fields Khorasan.

2. MATERIAL

Consider the stochastic frontier production function for a cross-section of *N* sample firms. That the model used has the following form:

$$Y_{it} = f(X_{it}; a)\exp\varepsilon_{it} \qquad i = 1, 2, ..., n \qquad (1)$$

Where Yi measures the quantity of output of the ith firm, Xi, represents input quantities, a is a vector of parameters, and f (Xi;a) is the production function

ε_{it} The error term in the stochastic frontier model that consists of two components V_{it}, U_{it} and its form is as follows:

$\varepsilon_{it} = V_{it} - U_{it}$,

V_{it} is white error component, show random fluctuations in production that is result of factors that not under control farmers. And supposed that have a normal distribution with mean is zero and variance σ_v^2. U_{it} is random variable non negative related to technical efficiency. Will assume that technical deficiency have incomplete normal distribution, with mean $\mu_{it} = \delta_0 + \sum_{j=1}^{J} \delta_j Z_{jit}$ and variance σ_U^2. Z_{jit} Is explanatory variable jth with technical efficiency of farm ith in t year? And δ_0, δ_j is unknown parameters that to be estimated. (Battese and Coelli. 1995).

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The model parameters are estimated using the maximum likelihood method. Variance parameters of Likelihood function to be estimated as follows:

$$\sigma_S^2 \equiv \sigma_V^2 + \sigma^2$$

$$\gamma \equiv \sigma^2 / \sigma_S^2$$

Battese and et.al (1997) introduce a stochastic frontier production function with error term heteroscedasticity. Their model shows positive and negative effect on production risk. And compatible with just and pope framework. Therefore error term in equation 1 as follows: (renato and et. al 2006)

$$\varepsilon_i = g(X_i;\beta)[V_i - U_i]$$

With replace equation 4 in equation 1, can be rewritten as follows:

$$Y_i = f(X_i;a) + g(X_i;\beta)[V_i - U_i]$$

The equation 5, has stochastic frontier production function with Flexible risk properties. (renato and et. al 2006)
Risk of marginal production into jth input introduce as partial derivative production into X_j that is positive or negative. (renato and et. al 2006)

$$or < 0$$

$$\frac{\partial Var(Y_i | X_i, U_i)}{\partial X_{ij}} = 2 \times g(X_{it},\beta)\left[\beta_j + \sum_{k=1}^{6} \beta_{jk} X_{kit}\right] > 0$$

If this value is positive for input, it is risk-increasing and using more inputs increases produce. If this value is negative the input risk- reducing and using more of input the production decreased.

Function and variables

The model was used in the study is translog function because of its flexibility and its acknowledged usefulness in empirical research work. The translog model is defined by:

$$\ln Y_{it} = \alpha_0 + \sum_{j=1}^{6} \alpha_j \ln X_{jt} + 0.5 \sum_{j=1}^{6}\sum_{k=1}^{6} \alpha_{jk} \ln X_{jit} \ln X_{kit} + V_{it} - U_{it}$$

Where y is production (ton), X1 is machine, x2 is seed (kg), x3 is fertilizer (kg), x4 is total irrigation, x5 is labor, x6 is land.
Technical efficiency estimated by index Battese and Coelli as following:

$$\mu_{it} = \delta_0 + \sum_{j=1}^{5} \delta_j Z_{jit}$$

That where z1 is total Promotional meeting, z2 is education, z3 is old, z4 is household size and z5 is experience.

3. Empirical Application

The flexible risk stochastic frontier production function (1) is applied in the analysis of data obtained from a survey of 60 farmers in Khorasan 2009-2012. Estimated result of maximum likelihood parameter of random frontier production function show in table 1.

variable	parameter	coefficient
constant	α_0	1.4
machine	α_1	-0.84*
seed	α_2	-0.52*
ferilizer	α_3	0.026
irrigation	α_4	0.49
labor	α_5	0.56*
land	α_6	0.58*
(Mashin) (Mashin)	α_7	0.073
(Mashin)(seed)	α_8	0.19*

(Mashin)(fertilizer)	α_9	0.022*
(Mashin)(irrigation)	α_{10}	0.27
(Mashin)(labor)	α_{11}	-0.11*
(Mashin) (land)	α_{12}	-0.10
(seed) (seed)	α_{13}	0.12
(seed) (fertilizer)	α_{14}	0.032
(seed) (irrigation)	α_{15}	0.28
(seed) (labor)	α_{16}	-0.18*
(seed) (land)	α_{17}	-0.072*
(fertilizer) (fertilizer)	α_{18}	0.031
(fertilizer) (irrigation)	α_{19}	-0.007
(fertilizer) (labor)	α_{20}	-0.053
(fertilizer) (land)	α_{21}	-0.022
(irrigation) (irrigation)	α_{22}	-0.53*
(irrigation) (labor)	α_{23}	0.096
(irrigation) (land)	α_{24}	-0.47*
(labor) (labor)	α_{25}	0.10*
(labor) (land)	α_{26}	0.18*
(land) (land)	α_{27}	0.16
variance		3.3
maximum likelihood function		-129.57
	γ	0.98*

The result of table 1 shows that seed, machine, land and labor in the translog model have signification in level 5%. Machine and seed have negative and less than one that negative marginal production. Fertilizer and irrigation have not impact signification. The γ parameter has showed that 98% of deviation in production function in translog model is due technical inefficiency. And the rest deviation is due to factors that have not under the control of the farmer.

By use of maximum likelihood estimated, parameters of inefficiency model for translog function. That result is table 2.

Table 2. Estimated parameters inefficiency model for translog function

variable	parameter	coefficient	Standard deviation
constant	δ_0	-4	3.8
total Promotional meeting	δ_1	-0.08*	0.051
education	δ_2	0.03	0.04
age	δ_3	0.008	0.01
Household size	δ_4	-0.51*	0.31
experience	δ_5	0.004	0.009

The result showed that total Promotional meeting and household size is signification and have impact negative on inefficiency farmers. Since the most of labor consist household labor, thus increased labor and increased efficiency farmer. So increased total Promotional meeting thus increased technical efficiency farmer.

Promotional meeting cause increased technical farmer, new method cultivation, optimal use of inputs and increase technical efficiency farmer.

The annual average technical efficiency farm level calculated based on combined data for four- years and cross-sectional data for each year. The estimated results are shown in table 3.

Table 3- annual average and range of technical efficiency for cotton farms

year	average	min	max
2009	0.70	0.2	1
2010	0.75	0.18	0.99
2011	0.82	0.11	0.99
2012	0.88	0.40	0.97
All years	0.67	0.06	0.97

Source: calculate research

By attention to table that technical efficiency increased in the period 2009-2012. And average technical efficiency is 0.67. If farmer to more effectively use of technology the average of production increased to 33%.
In the table 6 is being distribution technical efficiency for years.

Table 4- technical efficiency, total and percentage of cotton farmers of Khorasan in the 2009-2012

year	2009		2010		2011		2012	
Degree of technical efficiency	Total	Percentage	Total	Percentage	Total	Percentage	Total	Percentage
0.06-0.1	0	0	0	0	1	1	0	0
0.11-0.2	0	0	1	1	1	1	0	0
0.21-0.3	2	3	4	6	0	0	0	0
0.31-0.4	4	7	5	8	1	1	0	0
0.41-0.5	4	7	1	1	2	3	2	3
0.51-0.6	8	13	4	6	4	6	2	3
0.61-0.7	11	18	3	5	4	6	1	1
0.71-0.8	10	17	9	15	9	15	4	6
0.81-0.9	10	17	9	15	5	8	8	13
0.91-0.1	11	18	24	40	33	55	43	71

Source: calculate research

The result of estimated production marginal risk show in the table 5. The result show that seed and land is risk- reducing therefore using more of these inputs is reduced production risk. Machine, fertilizer and labor is risk-increasing therefore using more of these input is increased production risk.

Table 5- estimated of production marginal risk

input	coefficient	Standard error
machine	48.3	57.3
seed	-86.9	87.2
fertilizer	85.3	142.7
irrigation	77.9	86.9
labor	123.4	118.7
land	-9.9	39.9

Source: calculate research

4. CONCLUSION

The main purpose of study is providing empirical applications of the estimates production risk and technical efficiency. The result of estimated show that machine and seed is negative and signification and labor is positive and signification impact on produce.

The result estimate of technical efficiency show that total Promotional meeting and household size is effective on efficiency. Also the result of production marginal risk show that seed and machine is risk- reducing and fertilizer, labor, irrigation and machine is risk-increasing.

According to the findings of study in order to increase efficiency farmers in the production necessary education and familiarize farmers to new method cultivation.

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