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The Analysis Of Supply Responsiveness Of Jambi's Rice Farming

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Abstracts: Farmers' supply responsiveness and input demand planting rice in Jambi Province were estimated using profit function analysis. The objective of study is to analyze rice farmers' supply response. Research was conducted in Jambi Province in the year of 2014. Result showed that farmers do maximise their profit in short term and response to price changing efficiently. Changing in real wages were estimated to have a greater impact on rice profit and supplies than changes in the real prices of mechanised land preparation, fertilizer or pesticides. Rice supply elasticity considering their price was closed to one.

Keywords: supply response, rice farming, profit function and elasticity.

I. Introduction

With the current policy of Indonesian Regional Autonomy (decentralization), every local government is seeking to exploit the potential of its region. Jambi province is one of the major rice producing areas of Indonesia. Jambi as well as other areas in Indonesia, the source of public revenue from the agricultural sector, rice farming has become one of the most strategic business now because it will increase farmers' income. Jambi province is one of the rice-producing areas in Indonesia, showed improvements in rice production from year to year, this is because of the availability of infrastructure and production facilities for farmers (Anonymous, 2014).

The development of this production while effective for last five years, it maybe a little difficult to be repeated in the future. This is because the economic crisis and financial difficulties which resulted in reduced subsidies for this activity. With these conditions, some areas of agricultural policy experts interested in observing the response of supply and demand for inputs on rice farmers. Estimation of supply response of rice such as changes in input use has been reported in several studies (Battese et al, 1998; Dawson and Lingard, 1989). But very few have reported the response of supply and input demand in relation to price changes.

Such a study will be important in informing the policy-setting process. It will include consideration of the many decisions facing farmers such as what resources to devote to rice production (land, fertilizer, family labor), what varieties to select and whether to take-up off-farm employment opportunities. In this context, product and factor prices financial constraints, technology, riskiness of the alternatives and attitudes towards risk are important variables (Darmawi 2005; Keeney and Hertel 2008).

Guyomard et al. (1996) reviewed the problems in estimating the supply response using time series data for output supply and demand is part of a system, these estimates may give inefficient estimates of the relationship with the bidding. So it is better to estimate simultaneously, linkages, output supply and demand equation input.

Profit function analysis is an approach to describe the system of output supply and input demand (Olwande et al., 2009).

Jambi Province is a center of rice production in Indonesia with the reality of the use of technology and resources that may vary among farmers. With this condition the profit model that expresses the maximum profit from a farm suitable to estimate the supply response.

II. Literature Review

The convention method of studying supply response is to use time series data and regress quantity supplied on price allowing for various lags and shifters in the models. Guyomard et al. (1996) reviewed the estimation difficulties inherent in this approach. One problem is that input demand and output supply are parts of a general system, hence estimating the latter alone may provide inefficient estimates of the underlying supply relationship. It is desirable, therefore, to estimate simultaneously the interlinked output supply and factor demand equations. Profit function analysis, the procedure used in this paper, is an approach to deriving simultaneously these systems of output supply and factor demand equations (Pope dan Kramer, 1979).

The profit function model, popularized by Yotopoulus and Lau (1979), expresses the maximum profit of a firm in terms of prices of output and variable inputs and quantities of fixed factors of production. Thus the framework accommodates the reality that prices, technology and resources endowments may vary among farmers.

The assumptions inherent in a profit function model are (Yotopoulus and Lau, 1979):

(a) Firm seek to maximize short-term profits given the resources and technology with which they operate

(b) Firms are price takers with respect to prices received for output and prices paid for inputs and

(c) The production function which underlies the profit function exhibits decreasing returns to scale in the variable inputs.

The assumption of a profit, as opposed to a utility, maximizing objective has been criticized widely (Salassi, 1995). Whether this assumption is valid as a working approximation for a given set of data can be verified statistically within the profit function context (Battese et al, 1998). There are other limitations of profit function methodology. For example, the model is static. Actual profits (which must be positive) are used as a proxy for expected profits. Estimating a profit function is also contingent on different farmers facing different input and product prices. It is critical, therefore, that the price variability farmers for the same input or product; not differences related to farmer's storage or sale policies, quality differences, etc nor differences arising from errors in measurement.

III. Methodology

Samples of 60 rice farmers were collected in two districts, by using stratified random sampling, with consideration of the widest lowland rice farming and high productivity in Jambi Province. The function of the output of rice production process is expressed as:

$$Y = a\Pi Xi^{bi} Zj^{cj} \exp dD + U \quad \ldots \quad (1)$$

where :

Y = output of rice, per farmer (kg)
X_1 = quantity of fertilizer applied (kg)
X_2 = number of days of labor used in land preparation
X_3 = quantity of pesticide applied (kg)
X_4 = number of days of labor used for crop maintenance
Z_1 = rice area (ha)
Z_2 = capital service flow (IRD)
D = an irrigation scale ranging from 1 to 5 based on the reliability of irrigation supplies
U = error terms

a, b_i, c_j, and d are parameters to be estimated under restriction

Because of the Cobb-Douglas form of the production process limitations are imposed on the generality of the results which can be deduced from the analysis. For example, the elasticity coefficients are constant, implying constant shares regardless of input level, and the elasticity of substitution among inputs is unity. Yet for practical purposes this function form continuous to be applied with effect (Yotopoulus and Lau, 1979).

The normalized limited profit function, derived from the production function (1), described by Yotopoulus and Lau (1979):

$$\text{Ln } \Pi^* = \text{Ln } \alpha + \Sigma\beta_i \ln Pi + \Sigma\tau_j \ln Zj + \delta D + U \quad \dots \quad (2)$$

where:

Π^*: limited profits, normalized by the price of rice (IDR)

P1: the price of fertilizer / kg (IDR)

P2: the price of pesticide / kg (IDR)

P3 : real wages / land preparation (IDR)

P4: real wages / maintenance (IDR)

P5: real wages / harvesting (IDR)

Z1: land area (Ha)

Z2: capital used (IDR)

U: error terms

α, β, τ, and δ areparameters to be estimated

To obtain an optimal level of input variables, Shephard-Hotelling lemma concepts used in the case of the Cobb-Douglas restricted profit function:

$$Xi^* = - \delta\pi^* / \delta Pi \quad \dots \quad (3)$$

Equation (3) was reconstructed and empirically estimated as:

$$(Xi * Pi) / \pi^* = \beta_i + Vt \quad \dots \quad (4)$$

where

Xi * = quantity of input variables

Vt= error terms

Because the production function assumed in the form of Cobb-Douglas, solutions simultaneous equation (4) and profit function (2) complete the estimated elasticity of demand factors, Zellner's seemingly unrelated regression method completed the efficiency parameters α, β, τ, and δ (Battese et al, 1998).

IV. <u>Results and Discussions</u>

4.1. <u>ProfitMaximizing</u>

Important condition to derive the profits function from the production function used is that farmers maximize short term profits. The validity of this assumption can be tested directly by testing whether β parameters derived from the profitfunction and those derived from the factor demand equations simultaneously (Battese et al, 1998). If the parameter β is derived from two sets of equations are not significantly different, then the sample average farmer to maximize short term profit, with the availability of technology and resources. Since it is very feasible to estimate simultaneously profit and factor demand equations to avoid problems of simultaneous equation bias, Battese et al. (1998) using the F statistics for testing the null hypothesis that β_i derived from two separate setsdo not differ significantly.

Battese et al. (1998) shows that this null hypothesis can also be directly evaluated by examining whether the Lagrange multipliers, used in the Aitkens least squares technique to impose the restrictions, differ significantly from zero. If they do not, the hypothesis of profit maximization cannot be rejected. From estimating result showed that Lagrange multipliers are not significantly different from zero, as well as the X^2 test (Table 1). So the hypothesis that rice farmers in the area of research to maximize profits can not be rejected.

Table 1. Restrictions Test on Parameter β Profit Function from Factor Functions

Restrictions	Lagrange (λ)	Multiplier (t)	X^2 Statistics test
Fertilizer	0,539 (1,435)	0,342	
Pesticide	0,225 (4,321)	0,538	5,291
Maintenance	0,102 (4,412)	0,441	
Harvesting	1,218 (3,214)	1,092	

This finding implied that a sample of farmers do maximize expected profit and that uncertainty considerations were not dominant in explaining difference between these farmers' use of inputs in rice production.

4.2. <u>Elasticities of Output Supply and Input Demand</u>

Elasticity of output supply and input demand can be used to see whether one or some parameter changing may influence profit. Parameter estimates of restricted profit function and the elasticity of demand factors can be seen in Table 2. The coefficient is correct in sign, in addition to real price of maintenance, they are greater than zero.

Table 2. JointlyEstimated Normalised Profit Functions and Factor Demand Elasticities

Variable	Restricted Estimation	Factor Demand Elasticity
Constant	34,126	
Fertilizer Price	-0,207** (0,112)	-0,207** (0,112)
Pesticide Price	-0,208** (0,118)	-0,208** (0,118)
Labour of Maintenance	-0,135(0,286)	-0,135 (0,286)
Labour of Harvesting	-0,346**(0,085)	-0,346** (0,085)
Land Acreage	0,451** (0,128)	
Modal	0,407* (0,187)	
Irrigation	0,104* (0,098)	

Note: ** = significance level at α 0.05

* = significance level at α 0.10

The output (i.e. supply) elasticity for rice with respect to its own price (estimated as $\Sigma\beta$) is estimated close to unity (0.896). The implication, the sample farmers in response to changes in rice prices. For planning purposes, 1% rice price changes, ceteris paribus, would bring a similar change (0.896%) rice supply from Jambi Province.

Estimates explained that 10% real wage increase, will cause approximately 4.81% decrease rice supply, consisting of 1.35% decrease due to plant maintenance, and 3.46% decrease due to reduction in labor used for harvesting. If real wages rise, an adjustment in labor used for maintenance may be part of the increased use of fertilizer.

Estimated price elasticity of demand for fertilizer is 0.207, this means that 10% of the price of fertilizer goes up, causing a 2.07% decrease fertilizer use in the short term. So with profit function exists, will reduce profit by the same proportion. And its also happened for estimated price elasticity of demand for pesticide is 0,208, this means that 10% of the price of pesticide goes up, causing a 2,08% decrease pesticide use in the short term.

The elasticity of output with input considering the land exceeds the temporary capital. So in the size of the farm will have an impact on the profit when compared with the increase in capital intensity of farming.

4.3. Production Elasticity

Through the concept of Duality, there is a correspondence between production and profit functions. The result is an implicit production elasticity can be derived from profit functions. The elasticity of production (bi'and cj') was derived from profit function parameters as follows:

$b_i' = -\ \beta_I\,(1 - \mu)^{-1}$ for the input variables ……… ………………………… (5)

$c_j' = \ \tau_j\,(1 - \mu)^{-1}$ for fixed input …………………………………………….. (6)

where:

$\mu = \Sigma\beta_i$, and

β_I and τ_j are estimated from equation (2)

The indirect production elasticity (bi 'and cj') and the elasticity of production estimated directly from the production function equation (1) is shown in Table 3.

Table 3.MLE Production Functions and Elasticity Production derived from Function Profit

Variable	Unit	MLE Estimation	Indirect Estimation
Constant		412,22	-
Fertilizer	Kg	0,101** (0,004)	0,082
Pesticide	Kg	0,059** (0,013)	0,044
Maintenance Labour	Days	0,289** (0,031)	0,063
Harvesting Labour	Days	0,312** (0,027)	0,304
Land Acreage	Ha	0,457** (0,041)	0,424
Modal	IDR	0,015** (0,003)	0,031
Irrigation	Scale	0,034** (0,005)	-

Note: ** = significance level at α 0.01

It is shown that the parameter estimation gives the right in sign and production elasticity are logical and reasonably similar. The similarity between the directly and indirectly production elasticity has two implications. First, the primal (production) and dual (profit) models of production showed equivalently. As a results we do confidence in the rice supply elasticity and demand elasticity reported in Table 3. Second, simultaneous equation bias does not seem to be a problem when estimating the reduction elasticity from the production function specified as equation (1).

The estimated directly (1.233) and indirectly (0.948), which lowered production elasticity explained that decreasing returns to scale is indescribable. The elasticity of production is estimated to land (0.457) is consistent with that reported by Kikuchi and Hayami (1980). The elasticity of production a little low compared to fertilizers to pesticides. It is not strange because farmers are now planting local varieties of response to fertilizers, are also resistant to some pesticides.

V. Conclusions and Further Recommendations

5.1. Conclusions

The elasticity of supply and demand of farm inputs for rice are estimated using analysis of profit function for a sample of farmers in Jambi Province which has implemented a good cultivation technology. It is assumed in this approach is tested that farmers maximized short term profit, with the availability of technology and resources that remain. Analysis of samples showed that the average farmer maximizes profits by considering the normal price of the input variables,

The analysis also explains that the rice farmers in the area of research in response to price changes efficiently. Initial output is a response to the price of rice. In the input demand, many are sensitive to the wage rate, cost of maintenance / harvesting. The price elasticity obtained by completing part of the necessary data base to evaluate the implications of alternative pricing policies of rice supply and demand inputs.

5.2. Further Recommendations

From the above conclusions can be recommended that the profit function can be explained that the factor prices associated with rice plants is crucial for farmers to decide what to plant crops so as to provide benefits. The price was a determining factor, is determined from the market and existing government policies. It is recommended that farmers can overcome the problem it faces, the government is expected to play a role to stabilize the output and input prices and subsidized inputs and price is profitable for farmers.

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