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The Effect of Price on Meta Profit Function Model: A Case of Western Indonesia Soybean

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ABSTRACT

Soybean farming became a strategic commodity in recent year since its role in solving food problem and government effort to improve the level of farmers income. Study used model of meta profit function in order to estimate soybean's supply response and input demand in Western Indonesia. The aim of research was to learn deeply on supply response of farmers' soybean. Study was done in Western Indonesia in 2019. Qualitative and quantitative approach used to analyse soybean farming problems. Results of study expressed that profit maximization and response to change in price was found. Variable prices changing was estimated to have very much effect to meta profit function model compare to input prices or other input prices. The elasticity of soybean response based on changing in price was 0.898.

Keywords: Effect price, soybean response, meta function and profit maximization.

INTRODUCTION:

Development on food crop sector is basically an inseparable part of agricultural development in order to realize a sustainable agricultural development program (Oktaviani and Asmarantaka, 2010). Western Indonesia is an area that is widely planted with food crops, one of which is soybean. Western Indonesia becomes one of main areas of soybean producing in Indonesia. Agricultural sectors were used to increase public income in Western Indonesia, soybean commodity is the main important economic sector nowadays since it can give better of farmers life. Western Indonesia was still appropriate for soybean production because supporting input such as infrastructure and production facilities is still main concern by government (Anonymous, 2018).

In the last couple of year soybean production is still in good condition because of government subsidies, but it will change in next year. The government funding to support in soybean sector changing because of the lack of government funding (Edison, 2011). From this main problems, experts on agricultural economic model is eager to explore price response and input demand on soybean sector. Price effect of soybean exploration for example input used changes has been analyzed by some experts (Battese et al, 1998; Dawson and Lingard, 1989). Meanwhile, only some experts have done research on problem of price changes. Those results become main information to get better policy model. Many farmers decisions like input used (seed, fertilizer, labor) will consider its model. Therefore, in order to find profit function model, some constraints such as product, factor price, resources, uncertainty of the alternatives and risk factors are used in this model (Darmawi 2005; Keeney and Hertel 2008).

Concerning on part of system meta profit function estimation using data of time series for support and variable input was explored by Guyomard et al. (1996). This result showed inefficient estimation on studied relationship with. Therefore, it was much prefer to explore in integrates, linkages on output supply and input demand equation (Colin and Townsend, 2011). Meta Profit function model is a better model to explain problems on supply and demand systems (Olwande et al., 2009; Goodwin et al. 2018).

Western Indonesia is main soybean area in Indonesia in exploring good agriculture activity in using of good input that may differ eah other. The problem of using inputs, land area, capital, labor and irrigation systems are the main concerns in analyzing supply response soybean production function. Based on this picture, meta profit model that studies the maximum profit from soybean farming is appropriate for estimating the effect of price on meta profit function.

LITERATURE REVIEW:

Review of past literature, lags and its shifters in the models was used in profit function method using time series data and estimate price supply quantitatively. Guyomard et al. (1996) examined exploration problems including this issue. Those problems were the linkage of output supply and demand input in general system, so estimating the latter alone can give result inefficient estimation on supply relationship (Yu et al. 2010). Therefore, there was much appropriate to investigate the interrelated both supply and demand equations. In order to find appropriate model, The Meta Profit Function approach, used in this paper, was a model to simultaneously explore the function from supply and demand equations (Edison, 2014).

According to Nainggolan et al. (2018), the profit function is a function that gives the maximum profit for an output price and an input price. To explore this function, Cobb-Douglas production function is used. The relationship between the profit function and the Cobb-Douglas production function is a condition where the profit function is used to provide maximum benefits to certain output and input prices. Cobb Douglas function is one of the production functions that are often used by researchers to derive profit function.

A profit function model in deriving the result considers some assumptions as follows: (Yotopoulus and Lau, 1979):

(a) Consider maximizing profits with existing of resources using technology.
(b) Consider price makers with respect to receiving prices for supply variables and prices paying for demand variables and
(c) Consider term of decreasing returns to scale in input variables underlying in profit production function.

Those considerations above in order to maximizing result became the main expert attentions (Salassi, 1995). In case of those considerations used widely, the verification of data is still needed to get good finding in profit function model (Battese et al, 1998). Since the model is dynamic, the verification model to estimate meta profit function because of limitation of those methods. Some proxy approach used to find derivation of this function. Positive proxy expected profit used actual profits. Based on the differentiation on some results, such farmer's outcome, government policy on sale, quality, error in measurement, meta profit function estimations are also contingency (Tripath, and Prasad, 2017).

METHODOLOGY:

Research used primary data that was collected in two provinces. Soybean farmers was collected by stratified random sampling. By considering of soybean farming and productivity, 250 soybean farmers were collected in Western Indonesia. Research that used model of output of soybean production function can be seen as follows:

$$Q = a\Pi F_i^{b_i} G_j^{c_j} \exp dD + E \quad \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots . \ (1)$$

where :

Q = soybean output, per sample (kg)
F_1 = fertilizer used (kg)
F_2 = pesticide used (kg)
F_3 = labor used in land preparation
F_4 = labor used in crop maintenance
G_1 = soybean acreage (ha)
G_2 = modal (IRD)
D = irrigation ranking scale from 1 to 5 based on the reliability of irrigation
E = term of error

Cobb-Douglas form was used in the production function, and limitations was imposed in order to find the results which can be derived from model analysis (Gujarati and Porter, 2009). Considering that limitations such as the constant elasticity coefficients, constant level input share, and unity input of elasticity substitution. Finally, terms of effect of price variable can be seen in this model (Yotopoulus and Lau, 1979).

From equation (1) above, it can expressed in the normalized limited meta profit function as follows:

$$\text{Ln}\ \pi^{*} = \ln \alpha + \Sigma\ \beta_i \ln C_i + \Sigma\ \tau_j \ln R_j + \delta \ln D + E \quad \text{... ... ...} \quad (2)$$

where:

π^* : profit, normalized by soybean price (IDR)
C_1 : fertilizer cost per kg (IDR)
C_2 : pesticide cost per kg (IDR)
C_3 : land cultivation cost (IDR)
C_4 : harvest cost (IDR)
R_1 : acreage (Ha)
R_2 : modal (IDR)
α, β, τ, and δ : estimation parameters

In order to find optimal level of input variables in Cobb-Douglas using restricted profit unction, Shephard-Hotelling lemma concepts used as follows:

$$F_i^{*} = - \delta\pi^{*} / \delta C_i \quad \text{... ... ...} \quad (3)$$

In order to find result of meta profit function, equation (3) was redefined and estimated empirically as follows:

$$(F_i^{*} C_i) / \pi^{*} = \beta_i + E \quad \text{... ... ...} \quad (4)$$

where
F_i^{*} = variables input
E = error term

Considering Cobb Douglas production function, equation (4), and equation of meta profit function (2) can be solve elasticity estimation of demand factors simultaneously, and finally by using method of Zellner's seemingly unrelated regression, it also found efficient parameters of α, β, τ, and δ (Battese et al, 1998).

FINDING AND DISCUSSION:

Profit Maximization:

Profit maximization that was derived from meta profit function need some assumptions. The appropriate condition that was used, can be seen from using Cobb-Douglas production function to get β parameters derived from the profit function or those derived from the factor demand equations at the same time. (Battese et al, 1998). When result found profit maximization on average soybean farmer, it may be caused by insignificant difference on parameter β deriving from two sets of equations. In order to avoid bias problem on these two equations, it is appropriate to estimate profit function and factor demand equations at the same time. Battese et al. (1998) used F statistics to test the null hypothesis that β_i derived from two separate sets are not significantly differences.

Battese et al. (1998) also showed that Lagrange multipliers that applying in Aitkens least squares method was used to evaluate null hypothesis and to impose restrictions that are significantly difference from zero. The hypothesis of profit maximization can be accepted when they do not differ. From result estimation found that Lagrange multipliers were not different significantly from zero, since X^2 test is bigger than X^2 table (Table 1). So the hypothesis of profit maximization for soybean farmer were accepted. Estimation showed that all variables give good results. This result meant that soybean of farmers in Western Indonesia was to maximize profit and risk problems were not main constraint in evaluating profit maximization.

Elasticity of Supply and Demand:

Elasticity is estimated to describe unit independent factors changing in response change in independent factors. The elasticity of supply and demand can be used to see whether one or some independent parameter changing may response in changing on dependent parameter such as profit variable. Estimation of meta profit function and the elasticity of demand factors can be seen in Table 2. Estimation showed good results which they were difference from zero.

Elasticity supply for soybean with respect to its own price (estimated as $\Sigma\beta$) was found 0.898. This implied that, farmers were response to changing on soybean prices. For implication point of view, 1% soybean price changes, ceteris paribus, would bring a similar change (0.898%) soybean supply on Western Indonesia.

It also implied that 10% labor cost changes, will cause approximately 4.47% change in soybean supply, consisting of 1.08% decrease in maintenance cost, and 3.39% decrease in harvesting cost. Price elasticity estimation of demand for fertilizer was 0.216, this meant that 10% of fertilizer price goes up, causing a 2.16% decrease fertilizer cost used in the short term. So the main point on elasticity of profit function existing, will influence profit by the same proportion. And it also happened on price elasticity of demand for pesticide was 0,197, this meant that 10% of the price of pesticide goes up, causing a 1,97% decrease pesticide cost used in the short term. Therefore, elasticity of output with input demand considering the land cost exceeds modal. So in the farm scale will have an impact on the profit when comparing to the increase in modal intensity of farming.

Production Elasticity:

Based on Duality concept, there has a linkage between production and profit functions. The result 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 variables input ……… ……………………… (5)

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

where:

$\mu = \Sigma\beta_i$, and

β_I and τ_j are meta profit estimation

The elasticity of production (b_i' and c_j') that directly estimated from the production function equation (2) can be seen in Table 3. It is found that the coefficient parameter showed good result and elasticity of production are logically and reasonably significant. Two points can be found in elasticity of directly production and elasticity of indirectly production. Firstly, the results of primal (production) and dual (profit) of production showed equivalently. As an estimation results, we do believe in the soybean supply and input demand elasticity reported in Table 3. The next point, the bias of simultaneous equation did not become to be main concern when it was evaluated in the reduction elasticity from the production function specified in equation (1).

The estimation of directly (1.167) and indirectly (0.898) of profit function, which low elasticity of production mentioned that decreasing returns to scale is found. The elasticity of production was estimated to land (0.463) is consistent with that reported by Kikuchi and Hayami (1980). The elasticity of production rather small compared to fertilizers to pesticides. It is not reasonable because farmers are now using local varieties of response to fertilizers, and are also resistant to some pesticides.

CONCLUSION:

From result and finding above, it can conclude that soybean elasticity of supply and demand of farm inputs are estimated using meta profit function for a sample of farmers in Western Indonesia which has implemented a good cultivation. In applying meta profit function, some assumptions are used in this model, with the availability of good resources. Research result showed that the farmers do maximizes profits by considering the price of the input variables.

Results of study also expressed that maximization profit and response to price changing efficiently was found. Changing in labor cost were estimated to have very much effect to meta profit function model compare to input prices or other input prices. The elasticity of soybean response based on changing in price was closed to one.

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REFERENCES:

Anonymous, (2018). Annual Report. *Food Crop Agricultural Service Level II Sumatera Region,* Full River. Western Indonesia.

Anonymous, (2018). *Wester Indonesia Annual Report.* Bappeda Western Indonesia.

Battese, G.E., Coelli, T.J. and Rao, D.S.P. (1998). *An Introduction to Efficiency and Productivity Analysis*. Kluwer Academic Publishers. London.

Colin, T. and Townsend, R. (2011). *Dynamic Supply Response Estimation*, Annual Conference of AARES. Melbourne. Australia, 35 – 42.

Darmawi, H. (2005). *Risk Management. Penerbit Bumi Aksara*. Jakarta.

Dawson, P.J. and Lingard, J. (1989). Measuring farm Efficiency over time on Phillipine Rice Farms. *Journal of Agricultural Economics*, 40,168-177

Edison, (2011). *The Responsiveness of Jambi Rice Acreage to Price and Production Costs*. Proceeding International Seminar CRISU-CUPT 2011 in University of Sriwijaya. Palembang, 24 – 31.

Edison, (2014). The Responsiveness of Rice Area to Price and Production Cost in Jambi, *International Journal of Agricultural System*, 2 (2), 133-139.

Goodwin, B.,Ramsey, K., and J. Chvosta, J. (2018). *Applied Econometrics with SAS: Modelling Demand*, Supply and Risk. SAS Institute Inc. Cary, NC. USA, 1 – 74.

Gujarati, D.N. and Porter, D.C. (2009). *Basic Econometrics*. International Edition (5th edition) McGraw-Hill New York, 1 – 900.

Guyomard, H., Baudry, M. and Carpenter, A. (1996). Estimating Crop Supply Response in the Presence of Farm Program: Application to the CAP, *European Review of Agricultural Economics,* 23, 401-420.

Keeney, R. and Hertel T.W. (2008). *Yield Response to Prices: Implications for Policy Modeling.* Working Paper Dept. of Agricultural Economics Purdue University, 1-36.

Kikuchi, M. and Hayami, Y. (1980). Inducement of Institutional Innovations in an Agrarian Community, *Economic Development and Cultural Change,* 29 (1), 21-36.

Nainggolan, S., Murdy, S. and Malik, A. (2018). Kajian Pendugaan Fungsi Produksi Usahatani Padi Sawah di Kabupaten Muaro Jambi Provinsi Jambi. Fakultas Pertanian Universitas Jambi, *Jurnal Penelitian Pertanian*, 1(1), 71-86.

Olwande, J., Ngigi, M. and Nguyo, W. (2009). *Supply Responsiveness of Maize Farmers in Kenya: A Farm-Level Analysis*, International of Agricultural Economics'2009 Conference, Beijing, China.

Pope, R.D. and Kramer, R.A. (1979). Production Uncertainty and Factor Demands for the Competitive Firm, *Southern Economics Journal*, 46, 489-501

Salassi, M.E. (1995). The Responsiveness of U.S. Rice Acreage to Price and Production Costs. *Journal Agric. And Applied Economics*, 27(2), 386-399.

Tripath, A. and Prasad, A.R. (2017). *Estimation of Agricultural Supply Response of Co-integration Approach*, Crauch Institute of Development Research. India, 106 – 131.

Yotopoulus, P.A. and Lau, L.J. (1979). Profits, Supply and Factor Demand Functions, *American Journal of Agricultural Economics*, 54 (1), 11-18.

Yu, B., Liu, F. and You, L. (2010). *Dynamic Agricultural Supply Response Under Economic Transformation*, IFPRI Discussion Paper. Washington, D.C. USA, 1 – 21.

TABLES

Table 1: Estimation Meta Profit Restriction Function

Restrictions	Lagrange (λ)	Multiplier (t)	X^2 Statistics test
C_1	0,539 (1,435)	0,342	5,291
C_2	0,225 (4,321)	0,538	
C_3	0,102 (4,412)	0,441	
C_4	1,218 (3,214)	1,092	

Table 2: Integrated Estimation on Normalised Meta Profit and Factor Demand Function

Variable	Restricted Estimation		Factor Demand Elasticity	
Constant	471,902			
C_1	-0,216**	(0,109)	-0,216**	(0,109)
C_2	-0,197**	(0,113)	-0,208**	(0,113)
C_3	-0,108	(0,298)	-0,135	(0,296)
C_4	-0,339**	(0,136)	-0,339**	(0,135)
R_1	0,463**	(0,128)		
R_2	0,384*	(0,187)		
D	0,169*	(0,098)		

Note: ** = significance level at α 0.05
* = significance level at α 0.10

Table 3: Estimation of MLE and Indirect on Meta Production Function

Variable	Unit	MLE Estimation	Indirect Estimation
Constant		726,19	-
F_1	Kg	0,173** (0,005)	0,097
F_2	Kg	0,087** (0,011)	0,052
F_3	Days	0,194** (0,037)	0,059
F_4	Days	0,289** (0,021)	0,298
G_1	Ha	0,401** (0,043)	0,389
G_2	IDR	0,023** (0,004)	0,026
D	Scale	0,047** (0,008)	-

Note: ** = significance level at α 0.01
