Acreage Response Under Price Policy Program On Corn Production

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Abstract: The aim of research was to learn deeply acreage response using price policy program on agricultural corn production. Because of condition of corn in good position in moment of research, it was caused from government policy implementation on crop production such as input subsidy and support programs. The indicator of successfulness of those programs is influenced by the role of those programs in implementation. One of results of government policy effect was from implementation of support price program which produced better impact in acreage program. Its effect was very crucial in exploring this study, this is caused by high priority government to imply this policy program. In order to learn this phenomena, some approaches was used such as market and risk factors. Using assumption that the movement of policy implementation in the future, it is hoped that it can find the alternative best policy program. Using quantitative method, this mobility program can be analyzed considering some restriction. Research found that in condition of expected market price better than support price, it just used support price program in specific condition. Furthermore, truncation program effect was much better when support price was better than expected market price in making acreage decision.

Index Terms: acreage, response, corn, government programs, subsidy, and price policy program

1 INTRODUCTION

In technological development era, government is eager to explore its resource in order to increase its income. In this case, the role of agricultural sector has played very important in which has been supporting business and improve farmers income nowadays, especially in corn production. One of Corn producing place in Indonesia is Jambi, which presented good movement in corn production in last decade. This condition is supported by improvement in government program facilities such as infrastructure and production facilities for producers [1], [2]. The good condition of corn production in recent years, may be changing in the next years [3], [2]. This changing is caused by the problem in economic and financial sources, which impacted in changing government support for this agricultural sector. Considering in this situations, study on agricultural policy has been emerging in doing research in area of acreage and demand inputs in corn production. studying in acreage response, like input used changing already presented on some studies [4], [5], [6]. However, it just want to explore acreage response and input in terms of price changing. Many agricultural commodities and business constraints are considered on price uncertainty, crops risk, and agricultural policy on Jambi. [1]. The policies are conducted including subsidies on input (like fertilizer, pesticide) and also supporting price policies to increase corn output. This government program is still debatable. To learn this program, this is crucial knowing farmers response to economic trigger like prices and not prices factors [2]. In many situations, it has to follow to changing price of producers response in corn products objectives, which contain using resources such as input land acreage, inside labor force, crop criteria, methods, outside labor force, product value and availability of income uncertainty and also farmers' attitude towards risk.

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Moreover, Edison [3] also expressed economic business in agricultural sector or agribusiness, the situations of risk and uncertainty has been attended. In order to formulate agricultural policy, considering on producers response to price changing is important. In this situation, corn production will be influenced by increasing price, because farmers respond positively to price changing. Therefore, successfulness and right policy in price consider on indicators and significance of estimated acreage response [7], [8]. Policy makers in knowing the effect of other components on production is very crucial. Some constraints such as price input, technological change, management on risk farming and financial items has to be included in learning acreage response on research were crucial and important [9]. Acreage response on agricultural production has played very important role in empirical research nowadays. In order to learn production model on farmers behavior is used Neoclassical theory in which of high profit were already checked and got in the literature [10]. [11] has played theoretically that improved uncertainties causing price decrease in production optimality from competition crop. Even-though, estimation faced many constraints, acreage response has become important things for policy decisions in studying fundamental point of Jambi crop to be effectiveness, the impact of improvement and production developments [12]. Crucial points in learning production response are (a) under ex-ante expectations, production decisions was made and (b) some producers are considering risk component, although it has small income [13]. By considering risk point of view included in production or price on input and output, assumption of behavior used in case it wants to increase expected utility of profit. Considering risk agent point of view, marginal input expectation can differ from factor prices. When it is risk averse, the differences will occur in which risk components decrease risk variable or that variable increases [14]. Sustainable decision draw of agricultural production process generally because the existing time lags from allocation of input to output realization [15]. For Jambi corn production, farmers knowledge prefer to declare crops to be planted by considering on existing of information about prices, weather and insecticides, in study area. Therefore, producers will set input level like man-power, fertilizer and pesticide. When these components were irrational, producers are eager to simulate this model in every level, considering problems of its variable changing. If majority inputs was used, only few producers would apply best production process. And then level of productions characterized with a bundle of outside components like precipitation, dry clime, pesticides, crop diseases, and also inside components that may cause crop development trigger. Therefore, in situation of minimizing of control causes it very hard to evaluate ex-ante acreage function, since the fact that production just viewed in terms to evaluate ex-post acreage function. All information in beginning after that will be expressed : "Can acreage response of farmers to input prices, output prices, government programs in farming, the price of fertilizer, pesticide price, area harvested and other exogeneous variables be explained?" By considering main problems above, study's aims may be stated as follows: "analyzing acreage response of producers to input prices, output prices, government programs in corn production, fertilizer price, pesticide price, area harvested, and other exogenous variables."

2 LITERATURE REVIEW

Model of lagged in production in learning acreage response under risk in aggregation and farm level has been knowing traditionally long time [16]. But, it is still main problems in studying expected revenue and acreage model considering risk modelling constructing. The good solution from constructing best models will cause crucial impact on for policy construction and studies. In linking with making best programs, information explained theoretically main points on acreage response cases and its usage on crop production. Fundamental cases conducted in this study of risk problem are acreage response cases on analysis of risk production, usage in supporting price and subsidy input programs successfulness. Even-though one or more product production decision is studied [17], risk component is not presented in models. In the case of empirically constructions in production decision based on risk applying one product problem is expressed.

Acreage decision model can be expressed as follows:

$$A = f(\Phi, Z, \lambda, \theta) \quad (1)$$

note: Φ = farmers gross income each hectare
Z = profit
λ = risk variable
θ = producers policy program

Then producers aims based on risk was to get expected utility maximization function is expressed:

$$\text{Max } E\{U(Z)\} = E\{U[(I, \theta, R).A - P.X.A - C]\} \quad (2)$$

note: Z = profit
I. = input used each hectare
θ = producers program on policy
R = proxy components
A = component of acreage
P. = price of input used
C = production cost

Gross income each land acreage is expressed to $\Phi = (X, \theta, R)$ A. When it applied the assumption of f'(.) = 0 as first order condition for level of maximum, it is found solution in next equations:

$$A^* = A(\Phi, P, \theta, R) \quad (3)$$

$$I^* = I(\Phi, P, \theta, R) \quad (4)$$

Let the stochastic gross income be $\Phi_I = \Phi_I^* + \lambda$ (5)

note : Φ_I^* = farmers' expected income each hectare, and
λ = crop risk

After that it finds equation of acreage response and input demand:

$$A^* = A(\Phi^*, \lambda, P, \theta, R) \quad (6)$$

$$I^* = X(\Phi^*, \lambda, P, \theta, R) \quad (7)$$

By converting of (3 – 7) to (2), the derivation of expression indirect expected utility function is showed:

$$V((\Phi^*, \lambda, P, \theta, R) = E\{U[(X^*, \theta, R).A^* - P.X^*.A - C]\} \quad (8)$$

Function of $V(\Phi^*, \lambda, P, \theta, R)$ is continuous and differentiable (Φ^*, λ, P). Meanwhile, [18] stated, homogeneity and conditions of symmetry were not consistent based on risk and risk aversion.

3 METHOD

Based on Jambi is one of corn production in Indonesia, it was used as research location for study. Study was conducted on 2019. In order to answer research objectives, many sources of secondary data were used. Data in series year that was used is data year of 1986 – 2018 for Jambi province. This kind of series data has meant to explore the time of economic crises that differed in economic crises level are high, medium and small. Furthermore, it also explained two era of government such as new order and reformation era [19].

Model of Acreage Response Function

Considering on variability of production, supply response model focused in evaluating of acreage model because of differentiation on production. In order to learn this phenomena, acreage model can be learnt from production, or acreage model. In case of extensively of using input land and new hybrid, production response can be used. Alternatively, since the reflection of uncontrollable components in actual production levels like clime, crop disorder and its supporting, using acreage model on production is questionable.

Function of acreage model equation is

$$A_t = \alpha_0 + \alpha_1\Phi_t + \alpha_2 \lambda_t + \alpha_3 I_t + \alpha_4 \theta_t + \varepsilon_t \quad (9)$$

note: A_t = component of acreage each hectare in year t
Φ_t = expected gross income in year of t
λ_t = expected risk in year of t
I_t = input prices in year of t
θ_t = producers program on policy in year of t
α_0 = intercept
α_1 - α_4 = parameters
ε_t = error term

The components from equation (9) can be expressed:

a) Gross Revenue Component (Φ_t)

$$\Phi_t = \Sigma P_t.Q_t.A_t \quad (10)$$

note: Φ_t = expected gross revenue in year of t
P_t = production cost in year of t
Q_t = yield per hectare in year of t
A_t = component of acreage each hectare in year of t

b) Producers Expected Gross Income [$E(\Phi_t)$]

$E(\Phi_t) = \alpha_1 \Phi_{(t-1)} + \ldots + \alpha_p \Phi_{(t-p)} + \beta_1 \varepsilon_{(t-1)} + \ldots + \beta_q \varepsilon_{(t-q)}$ (11)

note:

$\Phi_{(t-1).}$ = gross income each hectare in year (t-p), which is an auto-regressive (AR) component

$\varepsilon_{(t-q).}$ = error term of lagged in year of q, which is a moving average (MA) component

c) Risk Variable (λ_t)

$\lambda_t = [\Phi_t - E(\Phi_t)]^2$ (12)

d) Producers Expected Risk Variable [E(λ_t)

$E(\lambda_t) = \alpha_1 (\lambda_{(t-1)}) + \ldots + \alpha_\iota (\lambda_{(t-\iota)} + \beta_1 U_{(t-1)} + \ldots + \beta_s \varepsilon_{(t-s)}$ (13)

note:

$(\lambda_{(t-\iota)}$ = the risk variable in year (t-ι), which is an AR component

$\varepsilon_{(t-s)}$ = error term of risk associated with production lagged year of s, which is MA Component

Since model used time series data, checking stationary of data was necessary. In estimating final results, it is influenced by Non-stationary data of time series. According to [11], there is serious response causing of not stationary time series data, any shock, even an unexpected policy shock, and the problems are not back to the shock level before except it rearranges direction. Alternatively, only transitory responses exists in stationary time series. In order to check whether there a conflict between null and alternative hypothesis corn acreage model is a unit root steps, acreage process should be stationary in terms of a linear trend. To check hypothesis, equation is formulated:

$\delta(A_t) = \beta_0 + \beta_1 T + \beta_2 A_{t-1} + \beta_3 \delta(A_{t-1}) + \varepsilon_t$ (14)

note:

$\delta(A_t)$ = acreage gap between year of t and year of (t-1)
T = linear trend of time
A_{t-1} = acreage component in year of t-1
ε_t = term of error
β_0 = intercept
β_1 - β_3 = parameters

It can be stated null hypothesis in terms of coefficients estimation on equation (12):

$H_0 : \beta_1 = \beta_2 = \beta_3 = 0$

Acreage procedure is a unit root procedure, so H_0 should not be rejected. Then, acreage model includes acreage and production model of corn. Expressions are focused on linearity and tested using seemingly unrelated regression method. Lagged acreage existed in the model, so it used partial adjustment assumptions. Acreage equations can be formulated as follows:

$A_t = f(P^*_{t-1}, A_{t-1}, \theta_t , T, \Phi_t)$ (15)

note:

A_t = acreage component in year of t
P^*_{t-1} = effective producer price deflated by index the variable production cost in year of t-1
θ_t = policy program variable in year of t
T = linear trend of time
Φ_t = expected gross income in year of t

Ordinary least squares test is used to estimate that equation above under risk. In order to test hypothesis, value of Durbin-Watson is used. These findings will be help to learn the impact risk on acreage response and then the empirically elasticity of acreage with considering on risk [21].

4 RESULT AND DISCUSSION

In order to find model of acreage response for corn production, government policy program was used such as price support and input subsidy programs. Risk method used to learn that model. In finding hypothetic coefficient estimation, expected utility profit function was implied. This model used some constraints such as price policy and input subsidy programs. This method used was to find best way to make appropriate decision. Furthermore, lagged production function was used to learn the role of successfulness of government policy.

A. Estimation of Lagged Production Function

In order to learn model of acreage response, lagged production function was used [22]. OLS was used to estimate acreage model. Considering significant test model, terms of null hypothesis can be written as $H_0 : \beta_1 = \beta_2 = \beta_3 = 0$. The estimation model can be seen in Table 2. This hypothesis can be rejected using Durbin Watson test. It meant that it was not the same of zero for all parameters. To estimate acreage model, it was used two things. In the beginning, it identified components of estimation variables such as producers expected gross income per hectare and risk variable. Then, to find risk expected gross revenue estimation per hectare, these variables were identified as an autoregressive-moving average process of Φ_t[23]. The result of ARMA (3, 3) was written:

$E(\Phi_t) = \Phi_t^* = 104{,}4 + 0{,}72\Phi_{(t-1)} + 0{,}26\Phi_{(t-2)} + 0{,}31\Phi_{(t-3)} - 0{,}23\varepsilon_{(t-1)} - 0{,}08\varepsilon_{(t-2)} - 0{,}37\varepsilon_{(t-3)}$ (16)

Expected risk variable (λ) was identified as an autoregressive-moving average process of $(\Phi_t - \Phi_t^*)^2$. Result of ARMA (3, 3) can be written:

$\lambda = 78{,}2 - 0{,}46\lambda_{t-1} + 0{,}37\lambda_{t-2} + 0{,}58\lambda_{t-3} - 0{,}09\, U_{t-1} + 0{,}18\, U_{t-2} - 4{,}27\, U_{t-3}$ (17)

Furthermore, from empirical point of views, economic time series are mostly not stationary, so that their associated error will not be stationary reasonably. By consideration of a unit root (stationary) for this model process, it was used Dickey-Fuller test to evaluate hypothesis that $H_0 : \beta_1 = \beta_2 = \beta_3 = 0$. The findings can be found in Table 1 below.

TABLE 1.
ACREAGE RESPONSE ON DICKEY-FULLER TEST

	Results
T-test	72,136
Critical Value	5,18
Judgment	Reject H_0
Implication	No unit root

Findings showed that estimation data has no unit roots. Therefore, differentiation data for these variables was not available in estimating acreage model. It was found significant and positive coefficient on expected gross revenue . It meant acreage response has impact as farmers' expected revenue for corn moves up. From acreage response model, estimated parameters can be found in Table 2 below.

TABLE 2.
ESTIMATION OF ACREAGE RESPONSE UNDER LAGS

	Parameters	Std. Error
Intercept	- 8.628	
Φ_t*	0.0058**	
λ	- 0.0046**	0.0009
C_1	0.0023	0.0028
C_2	0.0036	0.0061
θ_1	0.0724*	0.0028
θ_2	0.0396**	0.0662
T	0.0029	0.0298
R^2	0.7815	0.0913
D.W	2.6878	

note:
Φ_t* = expected gross income
λ = expected risk
C_1 = fertilizer cost
C_2 = pesticide cost
θ_1 = price support program
θ_2 = input subsidy program
T = linear trend of time
R^2 = adjusted R^2
D.W = Durbin-Watson statistics

Estimation also showed that positive parameter on risk variable, λ, found significantly. This showed that corn producers were risk averse, and link risk factor with gross revenue existed, acreage shift to the left. Furthermore, support price parameter, θ_1, was higher than zero in 10% significance level. This meant that policy of support price can make good parameter in acreage decisions so it can shift acreage model curve to the right.

B. The Fertilizer and Pesticide Impact on Corn Production
Because effect of trade problems on fertilizer and pesticide subsidy program, impact of fertilizer and pesticide used on corn production needed to be learnt. Based on founding that program already played good impact on improving production and support to imply high corn production hybrid that use fertilizer and pesticide per hectare in year before and time trend, and also constrained linearly in formulation:

$$Y_t = \beta_0 + \beta_1 \iota_{t-1} + \beta_2 \Phi_{t-1} + \beta_3 T + \varepsilon_t \quad (18)$$

note:
Y_t = corn crop yield in year of t
ι_{t-1} = fertilizer used per hectare in year of t-1
Φ_{t-1} = pesticide used per hectare in year of t-1
T = linear trend of time
β_0 = intercept
β_1 - β_3 = parameters
ε_t = error time

In estimating acreage response model, method of Ordinary Least Square was used. Model used as follows:

$$\delta(A_t) = 512.8 + 0.068\ T + 0.328\ A_{t-1} + 1.408\ \delta(A_{t-1}) \quad (19)$$
$$(42.4).\quad (0.032).\quad (0.178).\quad (0.216)$$

D.W. = 0.5216
$R^{2.}$ = 0.7925

It can be seen that productivity on corn implying fertilizer and pesticide improve in significant level, by seeing some indicators such as coefficient and significant level. It can imply that by using more fertilizer and pesticide appropriately, it will give significant influence in increasing corn production. In order to find better impact on corn production, government implied subsidy program such as fertilizer and pesticide. Because of fertilizer implementation program, productivity of corn increased significantly. So in order to find good impact , this program played an important role. Finally, effect of this program will give positive impact to improve corn production.

5 CONCLUSIONS

From result and discussion, it can conclude that model of analyzing in using risk has played an important role to find research result. Using some key considerations, model of acreage corn production can be used to learn the successfulness of government policy programs. Using some approaches, the role of risk variables showed very important thing to analyze acreage response. It also found that corn producers were risk averse, so government should imply risk and dynamic conditions. Moreover, in order to learn successfulness of government program, risk components should be used to find better acreage response model.

6 ACKNOWLEDGEMENT

This study was funded by the University Fund Grand. Acknowledgement of gratitude also the research team who contributed so much during data collection. The researcher also thanked the respondents for their corporation in this study.

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