

FACTORS INFLUENCE SUGARCANE FIELD EXPANSION IN INDONESIA

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Abstract

Sugarcane field in Indonesia has been developing over 20 years, but the rising field is not numerous improvement. That's the reason that sugar production is low in growth. There should have been factors influenced the sugarcane field expansion in Indonesia. That's the reason there is a need to conduct a research what factors influence sugarcane field expansion in Indonesia.

The result of research said, price of sugar is the factor influences sugarcane field in Indonesia . The higher price of sugar the more opportunity for sugarcane field to expand with coefficient regression of 18.67. Farmers grow sugarcane have liberated decision which doesn't depend on the prices of paddy and maize, either on lending of interest rate.

After the factor has been found, the research is continued with the scenario how if the farmer's floor price is increased 30 % in order to rise price of sugar. The result gave effect on raising of sugar price of 14.4 %, and both sugarcane and sugar production will rise 4.7 %. It measures that increasing floor price can be made use of government policy instrument to build up sugar price which links to sugarcane field expansion as well as sugarcane and sugar production improvement.

Keywords : Sugarcane field expansion, sugarcane production, sugar production, sugar, sugarcane

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1. Background

In Indonesia, mostly sugarcane farmers meet with paddy and maize as their alternatives to grow. In other countries, they confront with different products. In Brazil, sugarcane farmers have been opposite grains headed for sugarcane (Fischer, Teixeira, Hizsnyik and Velthuizen, 2008) while in Thailand, sugarcane farmers are in the direction to choose cassava and watermelon in north-east region and peanut and maize in the north (FAO, 1997).

Decisively, if farmers have decided sugarcane as their choice, so therefore they will grow sugarcane. However, product choices should have not been the only factor to grow sugarcane. There are other necessity factors influence the decision of sugarcane farmers more than just price of paddy and maize. Lending interest rate for farmers, price of sugar, and last year of sugarcane field are predicted factors may cause in sugarcane expansion.

In Thailand, the government operates a credit program under which farmers can borrow an amount equivalent to their advance payment for sugar delivered to mills, at below market-interest rates (FAO, 1997). It means, Thailand also believes that low lending interest rate will be effective to increase sugar production. Indeed it happened in Indonesia, the government gave low lending interest rate, but it is not particularly for sugarcane farmers. Sometimes the program is not targeted only for sugarcane farmers, but it is said just for small entrepreneurs but the certainty, it is not as easy as unconditional.

In Vietnam, sugar price certainly works on farmers' willing to grow sugarcane. Faced with relatively low sugar price, some farmers in the south were reportedly considering alternative crops (FAO, 1997). It denotes, sugar price is important to be stated in order to raise sugarcane production.

For those reasons, there is a necessity to know, what factors influence sugarcane. Are those factors above stimulus to develop sugarcane field in Indonesia. And if yes, what next to do with the factors?

2. Aim of the Research

This research aims to know what factors influence farmers to grow sugarcane, therefore sugarcane field can increase sugar production. This research also will find how to increase sugarcane field.

3. Method of Research

Data used in this research is time series data from Indonesia Bureau of Statistics Center , starting 1982 until 2013. Data has been managed as real data by dividing Consumer Price Index in year 2000. The program which assists in the processing is SAS version 9.

The process of data analyzing will start from developing econometrics structural model though the correlation between explanatory variable toward endogen variable as dependent variable. The model should pass the specification after mathematical model has been created, such as goodness of fit through coefficient determinant (R^2), statistically and econometrically significant , for instance unbiased, consistent and efficient.

There are 2 equations which are needed to use :

- (a) Distributed Lag equation : $Lt_1 = LAG(Lt)$ where Lt_1 is last year sugarcane field and Lt is sugarcane field (hectare)
- (b) Behavior Equation : : $Lt = A_0 + A_1*Pg - A_2*Pa - A_3*Pj - A_4*ir + A_5*Lt_1$, where Lt = sugarcane field (hectare) , Pg = price of sugar (Rupiah / kg) , Pa = price of paddy (Rupiah /kg), Pj = price of maize (Rupiah/kg) , ir = lending interest rate and Lt_1 is last year of sugarcane field.

4. Result and Discussion

The predicted of sugarcane response toward sugarcane field has good result by following with F calculate of 40.9 which is significant with error level is less than 1 percent. Determinant coefficient value is 0.89 means that exogenous variables can be explained by the model as 89 percents (Table 1).

Table 1. Result of Predicted Function Response of Sugarcane Field.

Parameter	Description	Estimation	t Value	Pr > t
Pg	Price of Sugar (Rupiah per kg)	18.67359	2.72	0.012
Pa	Price of Paddy(Rupiah per kg)	20.73875	0.71	0.482
Pj	Price of Maize (Rupiah per kg)	-23.264	-0.73	0.4748
Ir	Lending Interest Rate (%/year)	-734.872	-0.75	0.4588
Lt1	Last year sugarcane field (hectare)	0.685545	8.93	<0.0001
<i>F Value</i> = 40.9;		<i>Pr > F</i> = <0,0001	<i>R-Square</i> = 0.89496	

Table 1 shows factors influence sugarcane field is price of sugar (Pg), however price of paddy (Pa), price of maize (Pj) and lending interest rate (ir) are not significant. The notation of parameter from sugar price which is positive and significant with error level of 1.2 percent

means that the higher price of sugar, the more opportunity for sugarcane field to expand with coefficient regression of 18.67. Parameters of paddy (Pa) and maize (Pi) prices which are not significant indicate that farmers grow sugarcane have liberated decision which doesn't depend on the prices of paddy and maize. The parameter of lending interest rate (ir) which is not significant designates the farmers who grow sugarcane don't depend on the lending of interest rate.

5. Next Action

From this research, it concludes that the domestic price of sugarcane is important to be confirmed by government. In real circumstances, domestic price of sugarcane is determined by government through some organizations of sugar and sugarcane. Every year, those organizations have discussion to decide sugarcane farmers' floor price and recommend it to the government. After government announced its floor price, retail price of sugar will be produced in market place with above of floor price because all costs have to put together, such as transportation, distribution agents, etc. Next, subsequent to sugar price influences to sugarcane expansion, then it follows with scenario what will happen if government will increase the floor price 30 %. Will it help to increase sugarcane field?

For this purpose, there is an essential to include other factors as endogenous variables into the model of scenario. Other factors involved are in the following:

Table 2. Factors as Endogenous Variables Involved in the Scenario :

Variable	Description
Yt	Sugarcane Productivity (ton/ha)
rt	Sucrose content (%)
Qt	Sugarcane Production (ton)
Qg	Sugar Production (ton)
Dg	Domestic Sugar Demand (ton)
Mg	Import of Sugar (ton)
Sg	Domestic Sugar Supply (ton)
Pg	Price of Sugar (Rupiah/kilogram)

In order to fulfill the requirement of specification and validation of the factors involved into the model, it is necessary to analyze how far the model can represent the reality. The measurements for specification and validation model are:

1. Root-mean square deviation (RMSD) or root-mean-square-error (RMSE) to measure the difference of predicted value or estimator value comparing with actual value which are observed. RMSE formula is

$$RMSE = \sqrt{\frac{\sum_{i=1}^n (X_{obs,i} - X_{model,i})^2}{n}}$$

where :

X_{obs} = observed variable

X_{model} = variables on model

n = number of observations

i = period when observation has been conducted

The smaller of RMSE shows the better condition it has.

2. Reg UR is another measurement for statistical, which has formula :

$$UR = (\sigma_p - \rho \sigma_\alpha)^2 / MSE$$

Where : σ_p = standard deviation of predicted variable

ρ = correlation coefficient

σ_α = standard deviation of actual variable

MSE = Mean of Standard Error

Value of good UR is between 0 – 1, the smaller the better.

3. Var US is the proportion of variance, where it indicates the ability of model to replicate degree of variability on endogenous variable. The formula is

$$US = (\sigma_p - \sigma_\alpha)^2 / MSE$$

Where, σ_p = standard deviation of predicted variable

σ_α = standard deviation of actual variable

MSE = Mean of Standard Error

Var US estimates around 0 – 1, the smaller the better.

4. Covar UC is value for error after it is processed from average deviation and average variabilities . The formula of Covar UC is:

$$UC = [2(1-\rho) \sigma_p \sigma_\alpha] / MSE$$

Where, ρ = correlation coefficient

σ_p = standard deviation of predicted variable

σ_α = standard deviation of actual variable

MSE = Mean of Standard Error

The best of covariance value is 1.

5. Bias UM is a situation when error and measurement are higher than average of predicted and actual value. The formula is:

$$\frac{(E(y) - E(\hat{y}))^2}{\frac{1}{N} \sum_{t=1}^N (y_t - \hat{y}_t)^2}$$

Where, $E(y)$ = expected value of actual y

$E(\hat{y})$ = expected value of predicted y

N = number of observations

y_t = actual value at period of t

\hat{y}_t = predicted value at period of t

Bias UM would be better between 0 and 1.

6. U Theil : is statistical measurement which is relatively accurate to compare the predicted and responded data with historical data. The formula is:

$$U = \frac{MSE}{\sqrt{\frac{1}{N} \sum_{t=1}^N (y_t)^2} + \sqrt{\frac{1}{N} \sum_{t=1}^N (\hat{y}_t)^2}}$$

Where, MSE = Mean of Standard Error

N = Number of observations

Y_t = actual value

\hat{Y}_t = predicted value

t = period when observation was conducted

Interpretation of U'Theil is when it is < 1 = the prediction is better than estimation, 1 = prediction is as well as estimation, >1 = prediction is worse than estimation.

The result of specification and validation shows in Table 4 and 5 in the following:

Table 3. Estimation Result of Actual and Predicted Values from Endogenous Variables Involved

Variable	Description	Actual	Predicted	RMS Error (%)
Lt	Sugarcane Field	372,967	374,866	7.39
Yt	Productivity of Sugarcane	74.42	74.4	4.85
rt	Sucrose content	7.34	7.3	7.49
Qt	Sugarcane Production	27,754,365	27,896,475	9.13
Qg	Sugar Production	2.038.300	2.048.000	10.77
Dg	Demand of Sugar	2.671.406	2.674.705	8.39
Mg	Import of Sugar	1.407.217	1.403.108	10,49
Sg	Supply of Sugar	2.052.400	2.062.100	10.64
Pg	Price of Sugar	3,264.2	3,279.3	13.08

Table 4. Result of Decomposition Proportion U Theil

No	Variable	Description	Reg (UR)	Var (US)	Cover (UC)	Bias (UM)	U Theil
1	Lt	Sugarcane Yield	0,11	0,24	0,75	0,01	0.0259
2	Yt	Sugarcane Productivity	0.01	0.41	0.59	0	0.0237
3	rt	Sucrose Content	0	0.45	0.55	0	0.0335
4	Qt	Sugarcane Production	0.01	0.14	0.86	0	0.0388
5	Qg	Sugar production	0.13	0.33	0.67	0	0.0431
6	Dg	Sugar Domestic Demand	0	0.09	0.91	0	0.0421
7	Mg	Import of Sugar	0	0.03	0.97	0	0.1086
8	Sg	Supply of Sugar	0.12	0.32	0.68	0	0.0426
9	Pg	Price of Sugar	0	0.1	0.9	0	0.0521

All the result of RMSE and U Theil is acceptable to represent variable endogenous in the model per required specification and validation of the model.

Subsequently, following process finds the base of value to compare with the value in scenario if floor price is increased 30 % :

Table 5. Scenario Result When Sugarcane Floor Price Increases 30 %

Variable	Deskripsi	Base Value to compare	Floor Price is Increased 30%	Improvement (%)
Lt	Sugarcane Yield	374866	383526	2.31
Yt	Sugarcane Productivity	74.38	75.71	1.79
rt	Sucrose Content	7.35	7.35	0
Qt	Sugarcane Production	27896475	29060016	4.17
Qg	Sugar production	2048000	2133400	4.17

Dg	Sugar Domestic Demand	2674705	2582068	-3.46
Mg	Import of Sugar	1403108	1375110	-2
Sg	Supply of Sugar	2062100	2147200	4.13
Pg	Price of Sugar	3279.3	3743	14.14

When scenario was created that sugarcane increases 30 %, gives effect to the upsurge of sugar price 14.14 %, growth in sugarcane and sugar production of 4.17 % , and sugarcane field will increase 2.31 %. Other improvements are sugar domestic demand will decrease 3.16 %. This is as a consequence of demand theory, when price is strengthening, the demand will decline. This situation is followed by import behavior since demand declined, import will reduce with a number of 2 %. This position makes supply of sugar raised 4.13 %.

6. Conclusion

Factor influences sugarcane field expansion in Indonesia is price of sugar and the higher price of sugar the more opportunity for sugarcane field to expand with coefficient regression of 18.67. Farmers grow sugarcane have liberated decision which doesn't depend on the prices of paddy and maize, either on lending of interest rate. When floor price is created to increase 30 % in order to improve sugar price in the market place, the result gave effect on raising of sugar price of 14.4 %, even on sugarcane and sugar production is increased 4.17 %. It measures that increasing floor price can be made use of government policy instrument to build up sugar price which links to sugarcane field expansion as well as sugarcane and sugar production improvement.

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