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A Study on Economic Performance of Cocoa Beans in Indonesia

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Abstract **Original Research Article**

Cocoa planted areas in Indonesia are the fourth largest just ranking behind oil palm, coconut, and rubber while cocoa contributes the third highest foreign exchange, next to palm oil and rubber. The objectives of this study are to investigating the structure of cocoa industry and to analyzing the influences on economic performance and export of cocoa beans in Indonesia. A simultaneous equation model with 6 equations is developed to investigate the economic performance of cocoa industry in Indonesia and two-stage least-squares method is adopted to estimate the simultaneous model. Data used to analyze is mainly time series data from 2000 to 2015 obtained from the Central Bureau of Statistics (BPS), Ministry of Agriculture, PUSDATIN, FAO, and UN. As the results, all coefficient signs are significantly as expected. The urea fertilizer price and temperature has a negative and significant effect on cocoa productivity. The cocoa domestic price and cocoa world price significantly has a positive influences on the harvest area of cocoa. The cocoa production is the product of cocoa productivity and harvest area. The cocoa world price has a positive and significant effect on cocoa export, but domestic price significantly has a negative effect on cocoa export. The previous-year cocoa domestic price has a positive and significant effect on the domestic price of cocoa. The income has a significant and positive effect on the cocoa consumption while the domestic price has a significant and negative influence on the cocoa consumption. Finally, the impacts of 5%, 10%, 15%, and 20% of urea fertilizer subsidies are simulated. Leading the increase in cocoa productivity (63.36%), harvest area of cocoa (39.45%), cocoa production (136.19%), cocoa export (62.34%), and domestic price of cocoa (23.70%) and decrease on cocoa consumption (-7.36%), 5% of urea fertilizer subsidy policy is chosen as the best.

Keywords: Cocoa, Production, Export, Policy Simulation, Indonesia.

INTRODUCTION

Cocoa is a plantation that has a production center in Indonesia is concentrated in 6 provinces, namely Central Sulawesi, South Sulawesi, Southeast Sulawesi, West Sulawesi, West Sumatra, Lampung and North Sumatra. The six provinces contributed 80.19% to the total Indonesia production. Central Sulawesi ranks the first with contribution of 21.69%. The second rank is South Sulawesi with a contribution of 16.59%, followed by Southeast Sulawesi and West Sulawesi with contributions of 16.45% and 10.01%, while the contribution of production from West Sumatera, Lampung and North Sumatra contributed less than 10% [1].

Based on data, cocoa production during the period of 1980-2015 fluctuated and tended to decline until 2015 [2]. By land tenure, types of cocoa plantations in Indonesia are divided into smallholder plantations, state plantations, and private plantations. Of the three tenure status, smallholder plantations have the highest annual growth rate of production during 1980-2016, at 23.82%, compared to state plantations being at 2.83% and private plantations at 12.09%.

On the other hand, export contribution in the world market in 2009-2013, Indonesia ranks third out of 7 countries with average export volume amounted to 286.74 thousand tons (9.74%). Ivory Coast is the largest exporter of cocoa in the world with an average export volume of 921.48 thousand tons or 31.31% of the total export volume of world cocoa and Ghana is ranked second with an average export volume of 497.33 thousand ton (16.90%), The next sequence is Nigeria, Netherland, Cameroon and Ecuador, and other countries contribute less than 17.11%, So that Indonesia has the potential to dominate export market [2].

If a country is over produced domestically, then the production will be exported to other countries lacking a commodity, so it can be said that if production

increases, it will increase the export volume of a commodity. So that in the quantity of exports will depend on the amount of cocoa production [3].

In fact, based on data can be analyzed that the development of cocoa production and harvest areas (2000-2016) tends to increase. But in 2011 cocoa production declined despite an increase in the harvest area, until 2016 cocoa production still dropped [4]. This means that the cultivated cocoa productivity tends to decrease. So there are some problems that cause it to happen. So there are some problems that cause it to happen. The development of cocoa in Indonesia is not separated from various problems encountered from the upstream sectors, such as low productivity of plants, and the presence of pests and diseases [5].

The declining trend in cocoa production in Indonesia is very influential on cocoa exports which also fluctuate and decrease. The decrease in cocoa export volume may result in a risk to the sustainable development of Indonesia's cocoa exports and will worsen economic performance in Indonesia. The potential increase in Indonesia's cocoa exports can still be improved in various ways, namely the expansion of planting areas. If the expansion of planting area is not possible then the optimization of existing land is required, so that with the optimization of land, cocoa productivity can increase. In addition, fertilizer subsidy is used by farmers to grow cocoa, because most of the land ownership of cocoa is owned by smallholders with highest production in 1980-2016 periods of 23.82% per year [6].

Apart from the methods already mentioned, the government's role in setting policy is also important both in the upstream and downstream aspects. Expected from these ways, the export volume of Indonesian cocoa has increased significantly. Increased cocoa exports directly can also affect the increase in agricultural contribution to Indonesia's GDP. From the previous description, it can be formulated research questions as follows:

- What factors influence the economic performance and export of cocoa beans in Indonesia?
- How is the right policy instrument to increase economic performance and export cocoa beans in Indonesia?

METHODOLOGY

Model Specifications

The model used in this study is an approach using the simultaneous system equation econometric model. The following equation model is presented:

(1) PDT = f (TMP-, PRCP-, UREAP-)
(2) AREA = f (DP+, WP+, UREAP-, CFP-)
(3) PDN = AREA X PDT
(4) EX = f (WP+, PDN+, DP-)
(5) DP = f (PDN-, EX+, DP-1+)
(6) CSM = f (DP-, INC+, CFP+)

Endogenous Variables

AREA = Harvest area (Ha)
PDN= Production (ton)
EX = Export (ton)
DP = Domestic price (rupiah / kg)
CSM = Per capita consumption (ton/capita)
PDT = Productivity (ton/ha)

Exogenous variables

CFP = Coffee price (Rp/kg)
DP-1 = Domestic price for previous year (Rp)
INC = Indonesian per capita income (Rupiah)
PRCP = Number of precipitation (mm)
TMP = Temperature (°C)
UREAP = Urea fertilizer price (Rp/kg)
WP = World price (Dollar / ton)
The expected coefficient signs are indicated by+ or –

Model Estimates

In this research the model used is two stage least square method (2SLS) through a computer application program SAS (Statistical Analysis System), because the identification result of model is over identified. To estimate a simultaneous model, two stages least square (2SLS) is popular and convenient method.

Statistic Test

Coefficient of Determination (R2)

Coefficient Determination is the contribution of independent variables to the dependent variable. The coefficient of determination is generally denoted by the notation R2 [7].

Test

The simultaneous influence test is used to find out whether the independent variables simultaneously affect the independent variables [8]. The F-test results show that the independent variables simultaneously affect the dependent variable if the P-value is smaller than the specified level of significance, or the F-count is greater than the F-table.

Autocorrelation Test

The problem of autocorrelated regression residuals that may arise when using time-series data. Durbin-Watson statistic is shown to provide diagnostic tool for identifying temporal autocorrelation, and the method of two-stage least squares is shown to be one possible method for removing this effect [9].

Validation Test

Model validation through dynamic simulation is used to determine whether the model used can describe economic events during a certain period to produce predictive values for endogenous variables that are not much different from the actual value. The methods used for this model validation are root mean square error (RMSE), root mean square percent error (RMSPE) and Theil's Inequality Coefficient (UTheil).

Method of Collecting Data

The data used to analyze is using time series data from 2000 to 2015 obtained from the Central Bureau of Statistics (BPS), Ministry of Agriculture, PUSDATIN, FAO.

RESULT AND DISCUSSION

Factors that Influence Cocoa in Indonesia

Cocoa Productivity

Factors that affect the cocoa harvest area in Indonesia can be identified by using 2SLS analysis method (Two Stage Least Square) with the SAS program. The variables tested are urea fertilizer price (UREAP), temperature (TPR), number of precipitation (PRCP). The results of the analysis will be presented at the table 1.

Table-1.2: SLS Analysis Result of Productivity (PDT)

Variable	Coefficient	t-statistic	p-Value
Constant	2.419377	5.88	0.0001
UREAP	-0.00027	-5.39	0.0002
TMP	-0.05374	-3.22	0.0081
PRCP	-0.00004	-0.65	0.5321
R square	0.93949		
F value	56.93		
P value	0.0001		
Durbin-Watson	2.137553		

Source: Data Processed (2018)

Based on the results of the variable analysis urea fertilizer price (UREAP) has a negative and significant effect on the cocoa productivity as evidenced by p-value 0.0002 and the parameter coefficient of -0.00027. So it can be concluded that urea fertilizer price affects the productivity of cocoa. If the urea fertilizer price by 1 rp/kg, the productivity will decrease by -0.00027 tons/ha.

That statement is consistent with another research, that balanced fertilizer use has increased cocoa productivity. In this study, more and more urea fertilizer (150 kg) with a balanced combination of another fertilizer have increased yield of dry beans by 1160 kg / ha, while using 100 kg of urea fertilizer, got yields of dry beans 1050 kg / ha with fertilizer dosage other same [10].

Temperature variable has a negative and significant effect on the variable productivity, as evidenced by p-value 0.0002 (sig. <0.05) and the parameter coefficient value is -0.05374. It was concluded that, if the conditions in the cocoa growing environment increased by 1 ºC, then the cocoa productivity would decrease by -0.05374tons / ha. This happens because the growth of cocoa is suitable to be planted at a temperature that is not too high. Number of precipitation doesnot have significant effect to productivity variable.

Harvest Area

Factors that affect the harvest area in Indonesia can be identified used 2SLS analysis method (Two Stage Least Square) used the SAS program. The variables tested are domestic (DP), urea fertilizer price (UREAP), coffee price (CFP), world price (WP). The result the results of the analysis will be presented at the table 2.

Table-2: 2SLS Analysis Result of Harvest Area (AREA)

Variable	Coefficient	t-statistic	p-Value
Constant	873928.8	2.36	0.0399
DP	66.52840	2.52	0.0306
WP	13.49866	2.90	0.0158
UREAP	-253.144	-0.69	0.5038
CFP	-11.5879	-1.33	0.2139
R square	0.91366		
F value	26.46		
P value	0.0001		
Durbin-Watson	1.268482		

Source: Data Processed (2018)

Domestic price has a positive and significant effect on the harvest area of Indonesian cocoa. It is proven by the value of the t test results with p-value (0.0306) which is significant level of error of 5% or at

the level of confidence of 95%. The coefficient parameter value of the domestic price of cocoa 66.52840 indicates that, if domestic price of cocoa increase 1 rupiah / kg, it will be increase harvest area by 66.52840 ha.

It is happened because, with an increase in the domestic price of cocoa, the producers (farmers) will be pushed to meet the domestic cocoa market by increasing production. The statement is in accordance with "The Law of Supply" which reads when the price of items goes up, the producer will attempt to maximize their profits by increasing the quantity offered for sale. One way to increase quantity or production is to increase or expand the harvest area of cocoa [11].

World price variable has a significant effect on the harvest area of cocoa in Indonesia. It can be seen in the results of the t-test analysis with p-value of 0.0158 which is not significance level 5% or at the confidence level of 95%. So that the fluctuate world price give affect farmers to increase or reduce the harvest area of Indonesian cocoa. The coefficient parameter value of the domestic price of cocoa 13.49866 indicates that, if world price of cocoa increase 1 US$/ kg, it will be increased harvest area by 13.49866 ha. Another variable urea fertilizer price (UREAP) and coffee price (CFP) does not have significant effect to harvest area variable.

Cocoa Export

Factors that affect export of Indonesia can be identified by using 2SLS analysis method (Two Stage Least Square) used the SAS program. The variables tested are world price (WP), production (PDN), domestic price (DP). The results of the analysis will be presented at the table 3.

Table-3: 2SLS Analysis Result of Cocoa Export (EX)

Variable	Coefficient	t-statistic	p-Value
Constant	210232.8	1.99	0.0722
WP	7.199364	3.79	0.0030
PDN	0.339053	2.08	0.0621
DP	-13.1637	-4.64	0.0007
R square		0.77357	
F value		12.53	
P value		0.0007	
Durbin-Watson		1.790122	

Source: Data Processed (2018)

Based on the analysis results show that world price has a positive and significant effect on cocoa exports, as evidenced by the p-value of 0.0030 (sig. <0.05) with a parameter coefficient of 7.199364. So if there is an increase export for previous year of 1 ton, it will increase the number of exports in the next year by 7.199364 ton.

The world price determines the quantity of export of cocoa beans, when world prices are high, the quantity exported will also be high, vice-versa. Indonesia is a country that functions as a price taker, which, regardless of the prevailing world prices, Indonesia cannot change it. The statement is in accordance that as a price taker in the world economy it cannot change the price of the world and must accept its provisions. Every time you export or import existing world goods or commodities the price will always be the benchmark [12].

Production does not have significant effect to export, but domestic price has a negative and significant effect on cocoa exports, as evidenced by the p-value of 0.0007 (sig. <0.05) with a parameter coefficient -13.1637. So if there is an increase domestic price 1 rupiah, it will be decreased the number of exports in the next year by -13.1637 tons.

Domestic Price

Factors that affect the domestic price can be identified by using 2SLS analysis method (Two Stage Least Square) with the SAS program. The variables tested are production (PDN), export (EX), domestic price on previous year (DP-1) as independent variable and dependent variable is domestic price. The results of the analysis will be presented at the table 4.

Table-4: 2SLS Analysis Result of Domestic Price (EX)

Variable	Coefficient	t-statistic	p-Value
Constant	-255.605	-0.07	0.9444
PDN	0.003818	0.57	0.5797
EX	-0.00150	-0.21	0.8355
DP-1	0.957950	10.83	<0.0001
R square		0.77357	
F value		12.53	
P value		0.0007	
Durbin-Watson		1.790122	

Source: Data Processed (2018)

Based on the result of analysis production (PDN) and export (EX) does not effect to domestic price (DP), but domestic price of cocoa for previous year has a positive and significant effect on the domestic price of cocoa, as evidenced by the p-value of <.0001 (sig <0.10) and has a parameter coefficient 0.957950. It was concluded that if an increase in the domestic price of cocoa for previous year amounted to 1 rupiah, it would be increased the domestic price of cocoa by 0.957950 rupiah.

Consumption

Factors that affect of cocoa consumption in Indonesia can be identified used 2SLS analysis method (Two Stage Least Squares) with the SAS program. The variables tested are domestic price (DP), income (INC), coffee price (CFP). The results of the analysis will be presented at the table 5.

Table-5: 2SLS Analysis Result of Consumption (CSM)

Variable	Coefficient	t-statistic	p-Value
DP	-0.00003	-2.84	0.0148
INC	2.086E-7	15.11	<0.0001
CFP	5.159E-6	0.94	0.3637
R square		0.99580	
F value		948.54	
P value		<0.0001	
Durbin-Watson		1.803051	

Source: Data Processed (2018)

Based on the results of the analysis show that the domestic price of cocoa has a negative and significant effect on the consumption of cocoa. This is proven by the p-value of 0.0148 (sig <0.05) with the parameter coefficient value of -0.00003. This shows that if there is an increase in the price of domestic cocoa by 1 rupiah, it will reduce the consumption of cocoa by -0.00003 kg, whereas if there is a decrease in the domestic price of cocoa by 1 rupiah, it will reduce the consumption of cocoa.

That happens because the community will reduce the purchase of cocoa or processed cocoa products if the price offered is high, so consumption will also be low. This statement is supported, that one of the factors influencing the demand for consuming goods is the price of the commodity, with the Ceteris Paribus assumption, things being equal, the demand for commodity is inversely related to it price. Its implies that the lower the price of goods offered, the higher the consumer demand for the goods, vice-versa [13].

The results of the analysis show that income variable of Indonesian people has a positive and significant effect on cocoa consumption, as evidenced by p-value of <0.0001 (sig <0.05) and parameter coefficient of 2.086E-7. This value indicates that if income of Indonesian people increases by 1 rupiah, it will be increase the consumption of cocoa by 2.086E-7 ton.

This is because if income of Indonesian people increases, the opportunity to spend non-primary food is also increasing, so opportunity to consume of cocoa or processed cocoa products is higher too. This statement is supported by another statement, that one of the factors influencing consumers to demand for consumption of a commodity is the level of income of the household. With Ceteris Paribus assumptions, if the level of income of the household increases, the ability to consume an item will also be high, and vice versa [13]. The results of the analysis show that coffee price does not significant effect on cocoa consumption, as evidenced by p-value of 0.3637 (sig <0.05) and parameter coefficient of 0.94.

Policy Simulation to Cocoa Performance in Indonesia

Model Validation Test

A good model is the model able to explain the phenomena that exist in the real world, because the model is a representation of the simplified real world. The indicator used in measuring model validation if the smaller the value of the Root Mean Square Percentage Error (RMSPE), the better the estimation of the model. On the other hand, to see the ability of the model for forecasting or simulation that is seen from the value of U-Theil with values ranging from 0-1, the smaller the value of U-theil the better estimation of the model. A model has a good predictive power if the decomposition of U-Theil, namely the value of UM and US is close to 0, and the UC value is close to one.

Table-6: Validation Results of the Indonesian Cocoa

Descriptive Statistics					Alteration	
Variable	Actual		Predicted			
	Mean	Std Dev	Mean	Std Dev	Value	Percentage (%)
PDT	0.5346	0.1085	0.5270	0.1061	-0,01422	-1,42
AREA	1359684	363491	1356902	345895	-0,00205	-0,20
PDN	695393	111343	687416	115777	-0,01147	-1,15
EX	442833	81227.6	437519	77174.5	-0,012	-1,20
DP	13579.8	6078.5	13573.9	5844.5	-0,00043	-0,04
CSM	1.6325	0.1045	1.6091	0.1469	-0,01433	-1,43

Source: Data Processed (2018)

Based on analysis shows that the results of predicted values of endogenous variables do not deviate too far from the actual values. In addition, another analysis the validation of the model with the Theils Inequality Coefficient (U-Theil) decomposition shows that the model in this study is good. The UM value close to zero means that the proportion of bias between the simulation value and the actual value is very small. The US value close to zero indicates that the regression slope deviation is very small. The UC value close to one indicates that the residual bias component is also very small. The U value is generally close to zero indicating that the model in this study is already well used for simulation.

Scenario for subsidizing Urea fertilizer

The existence of a government policy will certainly affect the cocoa economy in Indonesia. Likewise with the provision of fertilizer subsidies, it will have an impact on other endogenous variables contained in the cocoa economic model (specifically to increase cocoa exports).

Impact of Subsidizing Urea Fertilizer (5%)

Table-7: Results of the urea fertilizer subsidy policy (5%)

Descriptive Statistics					Alteration	
Variable	Actual		Predicted			
	Mean	Std Dev	Mean	Std Dev	Value	Percentage (%)
PDT	0.5346	0.1085	0.8733	0.0429	0.3387	63.36
AREA	1359684	363491	1896058	467695	536374	39.45
PDN	695393	111343	1642417	351325	947024	136.19
EX	442833	81227.6	718873	104210	276040	62.34
DP	13579.8	6078.5	16798.1	6851.7	3218.3	23.70
CSM	1.6325	0.1045	1.5124	0.1584	-0.1201	-7.36

Source: Data Processed (2018)

Based on the result of analysis show that with a subsidy of 5% UREA fertilizer, it has an impact on productivity (PDT), harvest area (AREA), production (PDN), export (EX), domestic price (DP), but decreases domestic consumption (CSM) amounting to 7.36%. The highest increase in production is 136.19%. Impact of Subsidizing Urea Fertilizer (10%)

Table-8: Results of the urea fertilizer subsidy policy (10%)

Descriptive Statistics					Alteration	
Variable	Actual		Predicted			
	Mean	Std Dev	Mean	Std Dev	Value	Percentage (%)
PDT	0.5346	0.1085	0.8551	0.0457	0.3205	59.95
AREA	1359684	363491	1864982	460010	505298	37.16
PDN	695393	111343	1580138	331207	884745	127.22
EX	442833	81227.6	700525	100028	257692	58.19
DP	13579.8	6078.5	16587.9	6781.5	3008.1	22.15
CSM	1.6325	0.1045	1.5187	0.1575	-0.1138	-6.97

Source: Data Processed (2018)

Based on the result of analysis the impact of giving a 10% urea fertilizer subsidy, namely an increase in productivity (PDT), harvest area (AREA), production (PDN), export (EX), domestic price (DP), but decreasing domestic consumption (CSM) of 6.97%. The highest increase, which is on production, is 127.22%.

Impact of Subsidizing Urea Fertilizer (15%)

Table-9: Results of the urea fertilizer subsidy policy (15%)

Descriptive Statistics					Alteration	
Variable	Actual		Predicted			
	Mean	Std Dev	Mean	Std Dev	Value	Percentage (%)
PDT	0.5346	0.1085	0.8369	0.0486	0.57	56.55
AREA	1359684	363491	1834235	452483	0.35	34.90
PDN	695393	111343	1519318	311886	1.18	118.48
EX	442833	81227.6	682607	96192.8	0.54	54.15
DP	13579.8	6078.5	16382.5	6713.5	0.21	20.64
CSM	1.6325	0.1045	1.5249	0.1566	-0.07	-6.59

Source: Data Processed (2018)

Based on the results of the analysis with the provision of subsidize of urea fertilizer price at 15%, it has an impact on other endogenous variables. The detailed explanation is as follows. The productivity of cocoa has increased to 56.55%, as well as the harvest area has increased to 34.90%. Cocoa production and cocoa export experienced increases of 118.48% and 54.15% respectively, domestic price variable increased to 20.64 %, and the last variable, consumption of cocoa decrease to -6.59%. So that it can be concluded that the existence of a subsidy of 15% has a large influence on other endogenous variables. With this policy, cocoa exports can be increased because productivity and production also increase.

Impact of Subsidizing Urea Fertilizer (20%)

Table-10: Results of the urea fertilizer subsidy policy (20%)

Descriptive Statistics					Alteration	
Variable	Actual		Predicted			
	Mean	Std Dev	Mean	Std Dev	Value	Percentage (%)
PDT	0.5346	0.1085	0.8186	0.0517	0.284	53.12
AREA	1359684	363491	1803809	445113	444125	32.66
PDN	695393	111343	1459933	293358	764540	109.94
EX	442833	81227.6	665111	92704.5	222278	50.19
DP	13579.8	6078.5	16182.0	6647.6	2602.2	19.16
CSM	1.6325	0.1045	1.5309	0.1558	-0.1016	-6.22

Source: Data Processed (2018)

Based on the result of analysis shows that with the provision of subsidies of UREA fertilizer of 20% the effect of increasing all dependent variables except the consumption variable decreased to 6.22%. The highest increase is in the production variable at 109.94%.

Based on the results of the analysis with differences in treatment the provision of UREA fertilizer subsidies from 5% to 20% shows that, the more the percentage of subsidies it provides results in a decrease in productivity (PDT), harvest area (AREA), production (PDT), export (EX) , domestic price (DP). Unlike the more variable consumption variable urea fertilizer subsidy, the higher consumption variable. Proven in table 7 to10. Factors that cause higher subsidies for urea fertilizer cause a decrease in productivity, because if the government provides a high subsidy to urea fertilizer, it stimulates farmers to buy higher amounts of fertilizer. Perceptions of farmers in Indonesia when applying more fertilizer to the crops they plant, the productivity obtained is higher. In fact, if the application of fertilizers exceeds the dose, it decreases productivity. So that is what causes a decrease in productivity, production which in the end exports also decline.

So that it can be concluded that the provision of 5% urea fertilizer is the best choice, because it produces the highest productivity compared to other subsidized simulations. On the other hand the 5% fertilizer subsidy is very likely to be implemented by the government in Indonesia.

CONCLUSION

In equation 1, the variable that has a significant effect on cocoa productivity, namely the urea fertilizer price has a negative and significant effect of -0.00027. Temperature variable has a negative and significant positive effect on productivity of -0.05374.

In Equation 2 independent variables that have a significant effect on the harvest area, namely domestic price (DP) and world price (WP). Domestic price has a significant positive effect on the harvest area of 66.52840. Next variable is world price has a positive effect relation to the harvest area, so that when there is an increase in the world price of 1 US $ / Kg, it will increase the harvest area by 13.49866 Ha and vice versa.

In Equation 3, the world price has a significant positive effect on exports amounting to 7.199364.

Likewise, with the production variable has a positive and significant effect of 0.339053, which means that when an increase in production of 1 ton / ha will increase the export quantity by 0.339053 tons. Meanwhile the domestic price variable has a significant and negative effect on the cocoa export of -13.1637

In Equation 5, the domestic variable price for previous year has a positive and significant effect on the domestic price of cocoa with a value of 0.957950. In the last equation 4.6, domestic price has a significant and negative effect on the per capita consumption of -0.00003. The next income variable has a positive and significant effect on per capita consumption of 2,086E-7 kg.

For subsidies UREA fertilizer is the best choice is 5% can increase cocoa productivity (63.36%), harvest area of cocoa (39.45%), cocoa production (136.19%), cocoa export (62.34%), domestic price of cocoa (23.70%) and decrease cocoa consumption (-7.36%).

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