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Deteminant factors to improve Indonesian cocoa performance

Deteminant factors to improve Indonesian cocoa performance

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Abstract. Encouraging the growth of Indonesia's agricultural sector is important for improving the export performance of Indonesia's leading commodities. The purpose of the study was to determine the effect of the IDR exchange rate and the shock of the determinants of cocoa exports on the growth of Indonesian cocoa exports. The research was conducted using time series data from 1969-2017. This study uses the Vector Error Correction Model (VECM). The analysis showed that the data is stationary at the first difference. The causality test shows that cocoa production, IDR exchange rate, GDP affect the growth of Indonesian cocoa exports, but world cocoa prices have no effect on cocoa exports. The results of the impulse response factor (IRF) analysis show that the response of cocoa exports to changes in the exchange rate is more volatile when compared to the response of production, GDP, and world cocoa prices to Indonesian cocoa exports. Analysis of variance decomposition shows that the contribution of the IDR exchange rate to export growth is greater than the contribution of world cocoa prices, GDP, and production at the beginning of exports, however over time the influence of the IDR exchange rate will decrease and it is the number of production factors that will affect Indonesia's cocoa exports. Indonesia needs to increase production by maintaining the quality of cocoa according to export needs considering the demand for cocoa that will continue to increase. Bilateral or multilateral cooperation is needed to strengthen cocoa export cooperation with major importing.

1. Introduction

Cocoa is an agricultural commodity that is only produced in tropical countries. In the international market, the number of cocoa-producing countries is very limited. According to the International Cocoa Organization [1], in 2011/2012 based on region and share of cocoa production, Asia/Oceania which consists of Indonesia, Papua New Guinea, and other countries has a production share of 12.5% of total world production. This figure is far from the countries in Africa and America which control 71.5% and 16% of world production. Countries on the African continent as the main cocoa producers are Côte d'Ivoire, Ghana, Nigeria, and Cameroon. Brazil, Ecuador, and Colombia are the world's cocoa-producing countries in the Americas. Indonesia's share of production and specifically in Asia/Oceania in 2019 fell to only 6%. Demand for cocoa and cocoa products showed an average increase of 4% from 2011 to 2020. According to FAO [2], cocoa bean exports contributed US$ 80,621 million, cocoa butter exports

amounted to US$ 724,605 million and cocoa paste amounted to US$ 79,798 million to Indonesia's gross domestic product in 2019. The main export destination countries for Indonesian cocoa beans are Malaysia and America. Singapore, China, India, and Thailand are importers of Indonesian cocoa beans. Apart from that, Germany and the Netherlands are also export destinations for Indonesian cocoa beans.

In international economic and financial transactions, the value of the exchange is the instrument of the means of payment used and is also a determining reference in determining the purchasing power of traded goods. Exchange rate fluctuation (exchange rate) affects the products traded. As the exchange rate increases, the price of goods exported from the country decreased and vice versa. The price of imported goods increases. The higher the exchange rate in that country, the bigger the economy of that country, which will encourage an increase in foreign exchange reserves.

Cocoa production shows an average increase of up to 8.18% per year. The average development of Indonesia's cocoa exports in 2015-2019 showed a declining rate of 4.46% from year to year despite the depreciation of the IDR exchange rate of 0.27% every year. Figure 1 will explain the development of the IDR exchange rate, cocoa production, and exports. Aftab et al. [3] examines the impact of exchange rate volatility on Pakistan's sectoral exports which shows that exports are negatively affected by exchange rate volatility and relative prices, while positively influenced by foreign income. Exchange rate depreciation will encourage export growth while appreciation hampers exports. Exchange rate volatility positively stimulates agricultural exports, but the effect of exchange rate volatility on exports is much smaller than that of the exchange rate, leading to a negative net effect on exports [4]. Theoretically, the expected exchange rate is the main determinant of exports and imports. An appreciation of the exchange rate is expected to increase imports and reduce exports, while a depreciation of the exchange rate reduces imports and increases exports [5]. The condition of Indonesia's cocoa exports showed negative developments despite the depreciation of the IDR exchange rate. This certainly shows the incompatibility of theory with practice that occurs in reality. The purpose of this study was to determine the effect of the IDR exchange rate on Indonesian cocoa exports.

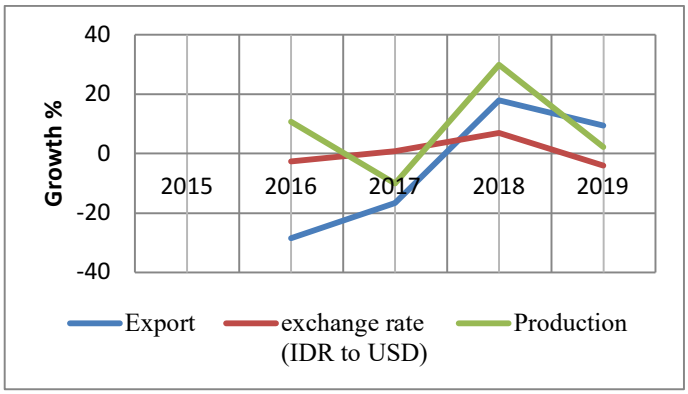

Figure 1. Export development, production, and IDR exchange rate

2. Materials and methods

This research was conducted in Indonesia because the contribution of the agricultural sector to the national gross domestic product is quite large. The research was carried out in 2019. The type of data used in this study is secondary data obtained indirectly in the field utilizing library research, collecting data to be analyzed through reports published by relevant agencies such as Bank Indonesia, FAO, UN-Comtrade with HS code 1801. The data is taken in a time series from 1969–2017. The econometric method in this

study uses the Vector Error Correction Model (VECM). The VECM model used in this study is as follows:

$$Yat = \lambda 1 + \alpha 1Yat\text{-}1+\ldots..+\alpha kYat\text{-}k + ß1PCat\text{-}1+\ldots\ldots+ ßkPCat\text{-}k + \gamma 1Ertat\text{-}1+\ldots\ldots+ \gamma kErtat\text{-}k + \partial 1PDBat\text{-}1 + \ldots\ldots+\partial\, kPDBat\text{-}k + \delta 1Hcwat\text{-}1 +\ldots\ldots+ \delta kHcwat\text{-}k +$$

Information:

Yat	: Cocoa export volume in year t (tons)
Pcat	: Cocoa production in year t (tons)
Hcwat	: Cocoa export price in year t divided by Indonesian CPI (IDR/kg)
Ertat	: IDR exchange rate against US Dollar in year t (IDR/USD)
PDBat	: Indonesia's gross domestic product based on constant prices in year t (IDR)
Λ	: intercept
K	: number of lags
αk,ßk, γk, ∂k, δk	: parameter coefficient
μ	: error

This study uses the VECM model estimation steps as follows (1) data stationarity test; (2) cointegration test; and (3) optimal lag test. In the VECM model, the following analysis is used: (1) causality test; (2) response to the action (impulse response); and (3) variance decomposition. Impulse response analysis aimed to find the effect of each endogenous variable if given an impulse (shock) [6]. Meanwhile, variance decomposition analysis aimed to predict the contribution of each variable (percentage of the variance of each variable) caused by changes in certain variables in a system.

3. Results and discussion

3.1. Stationarity test

The data stationarity test was carried out using the unit root test. In testing the unit root, the Augmented Dickey-Fuller (ADF) test is used, namely by comparing the ADF test value with the Mackinnon critical value of 1.00%, 5.00%, and 10.00% [7]. The results of the unit root test show that some data are not stationary in the level form, so to overcome the non-stationary data in the form of levels, a stationarity test is carried out through the ADF test, namely testing the unit-roots of the data in the form of first difference or second difference. Table 1 shows the ADF test which says that the variable is stationary at the first difference I (1).

Table 1. Stationarity test on first difference.

Methods	t statistic	Probability
Im, Pesaran and Shin W-stat	-8.24582*	0.0000
ADF - Fisher Chi-square	82.6244*	0.0000
PP - Fisher Chi-square	125,626*	0.0000

Note: *significant at 95% confidence level

3.2. Cointegration test

The cointegration test results of the dependent variable using trace statistics and maximum eigenvalue statistics can be seen in Table 2 and Table 3. In Table 2, it can be seen that the results of hypothesis testing using trace statistics. *P-value* is 0.0434 less than (5%) (the trace statistic value is 91.59139 greater than the table value 69.81889 at 5%. Thus, it can be concluded that there is a cointegration equation. For this

reason, an examination of the next hypothesis was carried out. In Table 2, it can also be seen that *p-value* for each hypothesis sequentially there is a value greater than (5%). Thus, based on this analysis, it can be concluded that the cointegration test results using trace statistics indicate that there is at least one cointegration equation that can be formed.

Table 2. Cointegration test (trace).

Hypothesized no. of CE(s)	Eigenvalue	Trace statistics	0.05 critical value	Prob.**
None *	0.603141	91.59139	69.81889	0.0004
At most 1 *	0.373438	50.00359	47.85613	0.0310
At most 2	0.256629	28.96573	29.79707	0.0621
At most 3 *	0.215811	15.62053	15.49471	0.0479
At most 4 *	0.098791	4.680810	3.841466	0.0305

In Table 3, it can be seen the results of hypothesis testing using statistics of the maximum Eigenvalue. There are p-value trace statistics for each hypothesis sequentially and there is a p-value in the two hypotheses which is smaller than (5%). The statistical value of the maximum Eigenvalue is also greater than the critical value at the time of (5%) for each hypothesis. This means that each hypothesis is accepted. Thus, hypothesis testing based on the maximum Eigenvalue, shows that there is a cointegration equation that occurs.

Table 3. Cointegration test (maximum Eigenvalue).

Hypothesized no. of CE(s)	Eigenvalue	Max-Eigen statistics	0.05 critical value	Prob.**
None *	0.603141	41.58780	33,87687	0.0050
At most 1	0.373438	21.03786	27.58434	0.2739
At most 2	0.256629	13.34520	21.13162	0.4210
At most 3	0.215811	10.93973	14.26460	0.1573
At most 4 *	0.098791	4.680810	3.841466	0.0305

From the results of the cointegration test with the two methods above, it can be concluded that there is at least one form of cointegration equation. Based on the results obtained, it is possible to estimate the form of the VECM equation.

3.3 Optimal lag test

Optimal lag determination uses several information criteria such as Likelihood Ratio (LR), Akaike Information Criterion (AIC), Schwarz Information Criterion (SIC), Final Prediction Error (FPE), and Hannan-Quinn (HQ). In this study, the determination of the optimal lag is based on the majority of information criteria indicating a certain optimal lag as in Table 4. Based on Table 4 the optimal lag is at lag 4 which is indicated by the number of asterisks (*) from the information criteria LR, FPE, AIC, SC, and HQ. In lag 4, the lowest AIC value is obtained among other lags.

Table 4. Optimal lag test.

lag	LR	FPE	AIC	SC	HQ
0	NA	1.62e+49	127.4974	131.1334	127.5726*
1	41.25746	1.72e+49	127.5480	128.7645	127.9992
2	8.985353	4.26e+49	128.4121	130.6424	129.2392
3	43.70311	3.15e+49	127.9877	131.2316	129.1907
4	51.71294*	1.32e+49*	126.8756*	127,7001*	128.4546

3.3.1 VECM estimation. VECM estimation has been used to find the influence of short-term and long-term relationships between variables X and Y variables and vice versa by comparing the t-value of the estimated statistic with the t-table value (0.05/2(n-1)=2.021) as shown in table 5. Table 5 showed that in the short term, there were four significant variables at the five percent level of significance plus one error correction variable. The alleged significant error correction parameter (CointEq1) proves that there is an adjustment mechanism from short to long term. The amount of adjustment from short term to long term is -0.386803%. The dependent variable Y is statistically influenced by DPC(-2), DPC(-4), DERT(-2), and DPDB(-1) which is indicated by the t-count value of -3.38129, 2.07086, 2.12268, and -3.44944 greater than 2.021 or less than -2,021. World cocoa price variables and constants do not affect Indonesian cocoa exports. The model with a significant variable on Indonesian cocoa exports is Y= -0.523760PC(-2) + 0.510479 PC(-4) + 30.21945 ERT(-2) -0.00000482PDB(-1). The coefficient in the equation model means that if there is a 1% increase in cocoa production in the previous 2 and 4 years, it will increase Indonesia's cocoa exports by -0.52 percent and 0.51 percent in the current year. The IDR exchange rate two years ago, if it increased by 1.00%, would increase cocoa exports this year by 30.21% if not influenced by other variables. The increase in gross domestic product last year by 1.00% will reduce cocoa exports this year by 0.0000048% if it is not influenced by other variables. In the short term, the findings of production and exchange rate affected export [8, 9].

Table 5. VECM analisis analysis in short term.

Variable	Coefficient	t statistic
CointEq1*	-0.3868030	-2.30501
DY(-1)	-0.2396360	-1.19559
DY(-2)	-0.2396360	-1.19559
DY(-3)	-0.0610420	-0.39269
DY(-4)	0.0570190	0.28621
DPC(-1)	-0.1667630	-0.78937
DPC(-2)*	-0.5237600	-3.38129
DPC(-3)	0.0234000	0.07902
DPC(-4)*	0.5104790	2.07086
DERT(-1)	9.3483570	0.75934
DERT(-2)*	7.4589020	2.12268
DERT(-3)	7.4589020	0.47881
DERT(-4)	2.4003370	0.19131
DGDP(-1)*	-0.0000048	-3.44944
DGDP(-2)	0.0000006	0.36398
DGDP(-3)	-0.0000015	-0.98104
DGDP(-4)	-0.0000024	-1.31562
DHCW(-1)	-5.0125050	-0.21249
DHCW(-2)	0.6112750	0.02455
DHCW(-3)	-34.1508100	-1.39708
DHCW(-4)	15.2677900	0.62698
C	17389.9400	1.87555

The long-term equation model in table 6 shows that the variables of cocoa production (PC), IDR exchange rate (ERT), and gross domestic product (GDP) are significant at a five percent significant level that affects Indonesian cocoa exports (Y). Variable gross domestic product (GDP) and the exchange rate have a positive influence on cocoa exports that is equal to 0.00000152 and 80.93. That is if there is an increase in gross domestic income (GDP) and exchange rate (depreciation) it will cause cocoa exports to increase by 0.00000152% and 80.93%, respectively. This condition is following the research that has been done by Sugiharti et al. [10] and Chen et al. [11], which states that when there is an increase in the

exchange rate (depreciation), it will cause an increase in Indonesian cocoa exports. The effect of production on Indonesian cocoa exports in the long term is negative.

Table 6. VECM analysis in the long term.

Variables	coefficient	t statistic
PC(-1)	-1.880596	-11.9392*
ERT(-1)	80.93607	8.66141*
PDB(-1)	0.00000152	3.75449*
HCW(-1)	-22.96285	-1.20906

By conducting a simultaneous test through the F-test, the calculated F-value in the dependent variable model for cocoa exports or D(Y) is the highest at 4.775110 compared to the F table (α (0.05), df (48)=2.0021) with an adjusted value R-squared (0.648340). This shows that the model with the dependent variable D(Y) was good. The independent variable can explain 64.83% of the dependent variable where the rest was explained by other variables outside the model. Export variables are influenced by production variables, exchange rates, and gross domestic product.

3.4. Granger causality test

The results of the Granger causality test can be seen in Table 7. The results of the causality test show that there was a short-term relationship between production, IDR exchange rate, and GDP on Indonesian cocoa exports, while world cocoa prices have no causal relationship. The short-term relationship showed that production will not affect cocoa exports due to the seasonal nature of agricultural production and must wait for the harvest period to export. The distance between the production center and the long export port also causes production to not respond well to exports.

Theoretically, the IDR exchange rate will affect cocoa exports in the short term. If the IDR exchange rate depreciates, it will stimulate exporters to export more. Exports in reverse will not affect the IDR exchange rate. This was following some previous findings. GDP will affect Indonesia's cocoa exports. The increase in GDP was an increase in people's income in general although the increase based on table 5 has a very small impact on cocoa exports. The results of this study were the same as those of which say that exports, imports, and investment affect economic growth [12,13]. World prices do not affect cocoa exports because cocoa exports are mostly carried out by exporters and not direct farmers. Farmers will not respond to the increase or decrease in world cocoa prices because the direct effect is the price agreement with exporters [14].

Table 7. Granger causality test.

Causality	F-Statistics	Prob.
Production against export	0.36041	0.8351
Export to production	3.15177	0.0255*
IDR exchange rate against exports	2.98835	0.0315*
Exports against the IDR exchange rate	2.10031	0.1010
GDP to exports	5.94902	0.0009*
Exports to GDP	1.94865	0.1235
World cocoa prices to exports	0.82715	0.5167
Exports to world cocoa prices	0.50179	0.7346

3.5. Impulse response

Impulse response analysis served to determine the impact of shock from endogenous variables on other variables in the VECM system. Export responses to production shocks, IDR exchange rate, GDP, and world cocoa prices can be seen in Figures 2 to 5. The response of Indonesian cocoa exports to production shocks is very positive. This means that an increase in production will increase Indonesia's cocoa exports. Theoretically, the excess production of an item will stimulate export activities.

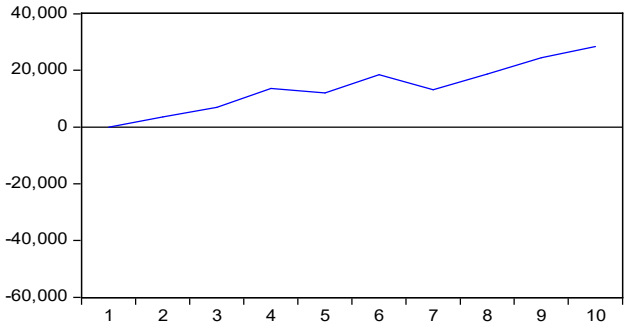

Figure 2. Cocoa export response to production shock.

The response of cocoa exports to exchange rate shocks tends to fluctuate considering that agricultural products were seasonal and to carry out export activities several processes must be passed, such as adjustments to the demands of importing countries and packaging. The existence of export tariffs or import tariffs will also affect the response of exports to the exchange rate. High export duty rates will discourage exporters from sending cocoa abroad [15].

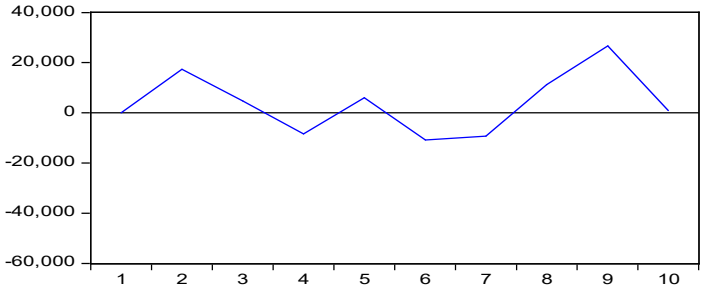

Figure 3. Cocoa export response to IDR exchange rate shock.

Economic growth that increases and was stable every year (period) will increase the prices of export commodities and have an impact on increasing production and export value. This can happen due to economic growth which will increase people's income which will cause cocoa farmers and to buy goods needed for cocoa production inputs [14,15]. The ability to buy input goods will have an impact on increasing cocoa production and bargaining power abroad.

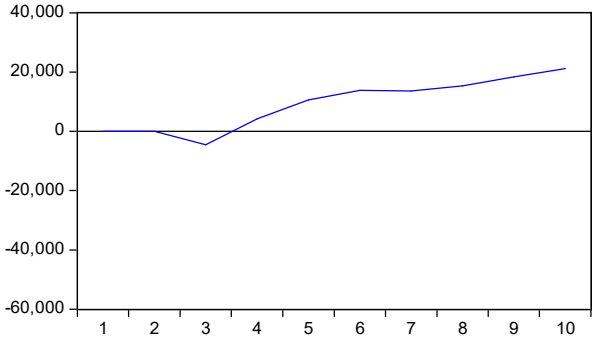

Figure 4. Cocoa export response to GDP shock.

The response of cocoa exports to changes in world cocoa prices leads to a negative response. Cocoa prices cannot be responded to properly because the availability of cocoa produced will not be timely in responding to price changes. The existence of export barriers, both domestic tariffs and the establishment of special standards in export destination countries, also prevents exports from responding well to world cocoa prices [16]. In the country, farmers also act as price recipients and are not price makers or policymakers regarding prices. Exporters mostly hold export price policies.

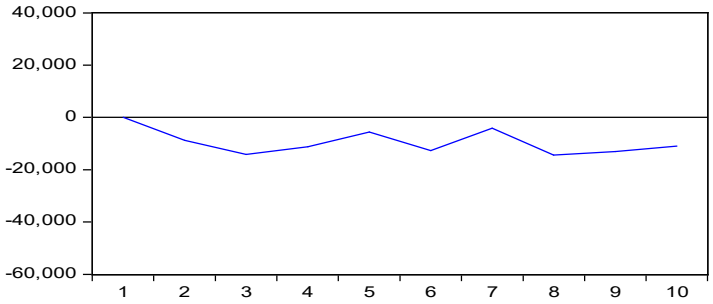

Figure 5. Cocoa export response to world cocoa price shock.

3.6. Variance decomposition

In a year (period) 1, the cocoa export shock contributed to cocoa exports by 100.00%, while the production shock, exchange rate, GDP and world cocoa prices did not contribute. Furthermore, until year 2, the proportion of cocoa export shock contribution to cocoa exports has decreased to 70.14%. The shock of production value, exchange rate, GDP, and world cocoa prices increased to cocoa exports until period 10. In period 10 the contribution of a cocoa export shock to cocoa exports decreased to 39.69% remaining. Meanwhile, the exchange rate shock, which in period 2 made a large contribution (23.11%) near the end of the period, contributed 13.09% to cocoa exports. The contribution of the IDR exchange rate was replaced by a production shock.

Table 8. Variance decomposition of Indonesian cocoa exports, 1969-2017.

Period	Y	ERT	GDP	HCW	PC
1	100,0000	0.000000	0.000000	0.000000	0.000000
2	70.14392	23.11815	0.000270	5.729535	1.008121
3	59.35456	19.40350	1.196482	16.34551	3.699946
4	48.31285	18.91128	1.806500	19.13647	11.83290
5	42,46968	17.72665	6.127683	17.64390	16.03209
6	34.40504	16.25793	10.08341	17.53021	21.72342
7	32.91411	15.91510	13.20962	15.24685	22.71432
8	27.16642	15.39595	15.47414	16.50757	25.45591
9	31.26738	18.68664	13.99342	12,53029	23.52227
10	39.69329	13.09366	13.77968	9.828847	23.60452

4. Conclusion

The results of the analysis show that the data was stationary at the first difference. There was a cointegration relationship between cocoa exports and the independent variables. Optimal lag occurs in the fourth lag. The VECM estimation results showed that the dependent variable of cocoa exports was statistically influenced by DPC(-2), DPC(-4), DERT(-2), and DPDB(-1). The results of the impulse response factor (IRF) analysis indicated that the response of cocoa exports to changes in the exchange rate was more fluctuate considering that agricultural products were seasonal and to carry out export activities several processes must be passed, such as adjustments to the demands of importing countries and packaging. The existence of export tariffs or import tariffs will also affect the response of exports to the exchange rate. High export duty rates will discourage exporters from sending cocoa abroad. Analysis of variance decomposition shows that the contribution of the IDR exchange rate to export growth is greater than the contribution of world cocoa prices, GDP, and production at the beginning of exports but over time the influence of the IDR exchange rate will decrease and it is precisely the number of production factors that will affect Indonesian cocoa exports. Indonesia needs to increase production by maintaining the quality of cocoa according to export needs considering the demand for cocoa that will continue to increase. Bilateral or multilateral cooperation is needed to strengthen cocoa export cooperation with major importing countries (European Union, East Asian countries, and other countries).

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