

# The Effect of Export, Import, and Public Education Expenditure on Foreign Exchange Reserves: A Geographical Perspective Study on Indonesia

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## Abstract

Foreign exchange reserves are assets owned by a country to maintain the stability and resilience of a country's economy, to avoid economic and financial crises. In addition, foreign exchange reserves are an indicator to measure the extent to which the country can compete in international trade. So this study aims to analyze and determine macroeconomic factors, namely exports, imports, exchange rates, and public education expenditure on foreign exchange reserves that occur in Indonesia, both in short-term relationships and long-term relationships. The data used in the study is secondary data annually from 2005 to 2019 (15 years). The results obtained are the short-term equilibrium relationship using the error correction method (ECM) test, the results show that the short-term equilibrium relationship shows that the exchange rate has a significant effect on foreign exchange reserves, while other factors export, import, and public education expenditure do not affect to foreign exchange reserves. Meanwhile, the long-term equilibrium relationship shows that exports, exchange rates, and public education expenditure have a significant influence on the country's foreign exchange reserves. While imports are the opposite, that is, they do not affect foreign exchange reserves.

## Keywords

Foreign Exchange Reserves, Export, Import, Exchange Rate, Inflation

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## Introduction

Every country needs funding for development in their country, including Indonesia, whose main goal is to improve the welfare of the people in their country. One of the important funding for national development is sourced from foreign exchange reserves. Foreign reserves are assets held by the central bank and monetary authorities, usually denominated in different reserve currencies. Indonesian official reserve assets are external assets that can be directly available to and under the control of Indonesia's central bank as the monetary authority to finance the balance of payments imbalances, intervene in the market to maintain exchange rate stability, and/or other purposes. among others, maintaining the resilience of the economy and the exchange rate as well as as a cushion against Indonesia's net obligations (source: metadata of Indonesia's central bank). Apart from that, a country's foreign exchange reserves are an indicator to measure the extent to which a country can conduct international trade and show the strength and weakness of a country's economic fundamentals, besides that it is the main key for a country to be able to avoid economic and financial crises.

Indonesia's foreign exchange reserves are a source of foreign trade financing controlled by Bank Indonesia (central bank of Indonesia) as stipulated in the Law on Bank Indonesia no. 23 of 1999, then the law was revised with Law no. 3 of 2004. The foreign exchange reserves are recorded in the balance of payments of Bank Indonesia. Several components of foreign exchange reserves were put forward by (Kuswanto, 2017), namely: monetary (*gold monetary gold*), international reserve assets (*Special drawing rights*), *Reserve Position in the Fund (RPF)*, foreign exchange (*foreign exchange*).). The relationship between production and foreign exchange reserves, production is intended to create goods for trade, were in this trade financing is needed to produce. The source of international trade financing is in foreign exchange reserves. Below is an overview of the country's foreign exchange reserves from several components in the last 6 years from 2015 to 2020 as follows:

**Table 1.1**  
Indonesia's Foreign Exchange Reserves 2015 – 2020

CADANGAN DEVISA	POSISI CADANGAN DEVISA (JUTA US\$)					
	2015	2016	2017	2018	2019	2020
Emas Moneter	2 661,00	2 876,00	3 345,53	3 229,64	3 843,88	4 758,00
Special Drawing Rights (SDRs)	2 442,00	1 499,00	1 588,14	1 552,90	1 541,95	1 605,00
Reserve Position in the Fund (RPF)	202,00	1 056,00	1 119,31	1 095,83	1 090,05	1 135,00
Cadangan Devisa Lainnya	100 626,35	110 930,59	124 143,39	114 775,90	122 707,40	128 398,00
Uang Kertas Asing (UKA) dan Simpanan	12 086,00	11 388,00	9 114,56	12 548,67	10 326,10	10 385,00
Surat Berharga	87 986,00	98 953,00	114 449,98	101 655,78	111 748,33	117 324,00
Tagihan Lainnya	554,00	590,00	579,00	571,00	633,00	689,00
<b>TOTAL</b>	<b>105 931,00</b>	<b>116 362,00</b>	<b>130 196,38</b>	<b>120 654,27</b>	<b>129 183,28</b>	<b>135 897,00</b>

It can be seen in table 1.1 that Indonesia's foreign exchange reserves have fluctuated over the last six years. However, the trend of Indonesia's total foreign exchange reserves continues to increase (increasing), it's just that in 2018 Indonesia's foreign exchange reserves experienced a very large decline but the following year continued to increase again until 2020. However, if we look at the condition of Indonesia's total foreign exchange reserves if related to the area and the large population, it is very necessary to increase Indonesia's foreign exchange reserves so that the

level of vulnerability of the Indonesian economy can be reduced. When free trade was implemented, Indonesia's foreign trade showed worrying data. The value of Indonesia's exports throughout 2009 fell quite sharply, which was up to 9.69 percent compared to 2008 (Uli, 2016).

One way to increase the country's total foreign exchange reserves is to increase exports and reduce imports so that there is a surplus in Indonesia's trade balance and try to reduce foreign debt.

The occurrence of fluctuations in the country's foreign exchange reserves as described above, of course, some factors influence it. Several factors affect the country's foreign exchange reserves, including exports, imports, exchange rates, and public education expenditure rates. The country's foreign exchange reserves can be obtained from trade activities between countries, where a country has limited and scarce resources (according to the international trade theory proposed by David Ricardo in *comparative advantage* and Adam Smith in *absolute advantage*). This can encourage trade between countries known as export and import activities. Foreign exchange reserves are also the main key to avoid the crisis (Ridho, 2015). Excess foreign exchange reserves also have an important role in reducing exchange rate fluctuations and encouraging the economic progress of a country (Ridho, 2015). Stable fluctuations in the exchange rate of the rupiah against foreign currencies (especially the US dollar) will greatly affect foreign exchange reserves. The position of a country's foreign exchange reserves is usually declared safe if it meets the needs of imports for at least three months, if the foreign exchange reserves of a country are not sufficient for three months of imports, then the condition is considered vulnerable (Ridho, 2015). Public education expenditure is one of the factors that affect the level of foreign exchange reserves of a country. If the public education expenditure that occurs in a country is high, the prices of goods and services in the country will be high. This causes changes in currency values, has an impact on commercial bank demand deposits, and has an impact on foreign exchange reserves. In other words, the higher the public education expenditure rate, the higher the value of a currency due to the rising prices of goods and services in the market (Kuswanto, 2017).

So this study aims to analyze the country's foreign exchange reserves and to determine several macroeconomic factors that affect foreign exchange reserves, namely exports, imports, Rupiah exchange rates, and public education expenditure rates on Indonesia's foreign exchange reserves, both simultaneously and partially as well as long-term equilibrium relationship in the period 2005 to 2019

## Literature Review

### Foreign Exchange Reserves

Foreign exchange reserves (*foreign exchange reserves*) are an asset or assets owned or controlled by the central bank and monetary authority may at any time be used in an emergency. These assets are in the form of different foreign currency reserves, usually, those that apply internationally such as USD, euros, pounds sterling yuan, and so on. Thus, there is a link between foreign exchange reserves and international trade, which can be used as international trade transactions, besides that foreign exchange reserves can be used as foreign debt payments, can be used to maintain monetary stability, especially the stability of the exchange rate and are also state-owned savings. Thus, foreign exchange reserves are part of national savings so that the growth and size of foreign exchange reserves is an indicator for *global financial markets* of the credibility of the country's monetary policy. In addition, the country's foreign exchange reserves encourage the economic progress of a country and influence the achievement of monetary and macroeconomic stability of a country. country.

### Inflation

Public education expenditure is one of the most influential factors on the country's foreign exchange reserves. Public education expenditure is a very serious macroeconomic factor that must be addressed quickly. The high rate of public education expenditure will cause a spike in the prices of goods, especially basic needs and services that occur in the country. This will affect the volume and the value of exports will decrease but the value and volume of imports will increase resulting in a trade balance deficit. Exports of a country's commodities are foreign exchange that must be increased and fought for, while imports are consumptive expenditures so that there will be a trade balance deficit and this will also reduce the country's foreign exchange reserves. In

general, public education expenditure will cause imports to grow faster than exports. One of the causes of the rising public education expenditure rate is too much (*excess supply*) money in circulation (money supply) which causes the price of goods in the country to increase compared to the price of goods in one country (overseas). The occurrence of a fairly high public education expenditure rate will cause foreign consumers to reduce their purchases of the country's products (domestic). This causes the domestic currency to depreciate and will have an impact on the trade balance of the two countries so that it will affect the country's income (foreign exchange).

## Exchange Rate

An exchange rate can be used as a tool to measure the economic condition of a country. Stable growth in the value of the currency indicates that the country has a relatively good or stable economic condition (Salvator, 1997:10). In addition, the difference in the exchange rate of a country in principle is determined by the amount of demand and supply of the currency (Levi, 1996:129). The most influential factor on international trade is the exchange rate. The depreciation of the domestic currency against foreign currency will increase the value of exports because the country's commodities become cheaper in the international market, but imported products will become expensive so it is likely that people will reduce imported products so that this will experience a trade balance surplus.

According to the Keynesian flow, another factor that affects foreign exchange reserves is the exchange rate. According to Mishkin in Pamungkas et al. (2020), he explained that foreign exchange reserves have an important role in the position of a country's exchange rate. The increase in reserves in the balance of payments provides a stimulus to make the rupiah appreciate. The relationship between the exchange rate and foreign exchange reserves is that the more foreign exchange or foreign exchange owned by the government and residents of a country, the greater the country's ability to conduct international economic and financial transactions and the stronger the value of the country's currency.

Indonesia adheres to a free-floating exchange rate system in full (*floating exchange rate systems*) which began in August 1997 to the present, it means that the position of the rupiah against foreign currency is wholly determined by the market mechanism. Since then, fluctuation is determined by international market forces. The role of Bank Indonesia (Indonesian central bank) in this exchange rate system will intervene in the foreign exchange market because it is solely to maintain the stability of the rupiah exchange rate, which is largely determined by market forces.

## Exports

Exports (X) depend on foreign country income (Y\*) and exchange rate (exchange). The high income of foreign countries will increase the demand of these foreign countries which in turn will increase exports. On the other hand, the increase in the real exchange rate, the relative price of foreign goods in relation to domestic goods will also increase exports. So that there is a positive relationship between the trade balance and foreign country income, the real exchange rate. This can be represented by the function of domestic exports to foreign demand as follows:

$$EX = X(Y^*, e) \quad \dots\dots\dots 2.11$$

(+, +)

An increase in the output (Y\*) of the importing country will lead to an increase in the country's demand for all goods. The decrease in the relative price of foreign goods ( ) will increase exports. So that if the level of exports decreases, it will be followed by a decrease in foreign exchange reserves owned by a country because exports are one of the country's foreign exchange reserves.

## Import

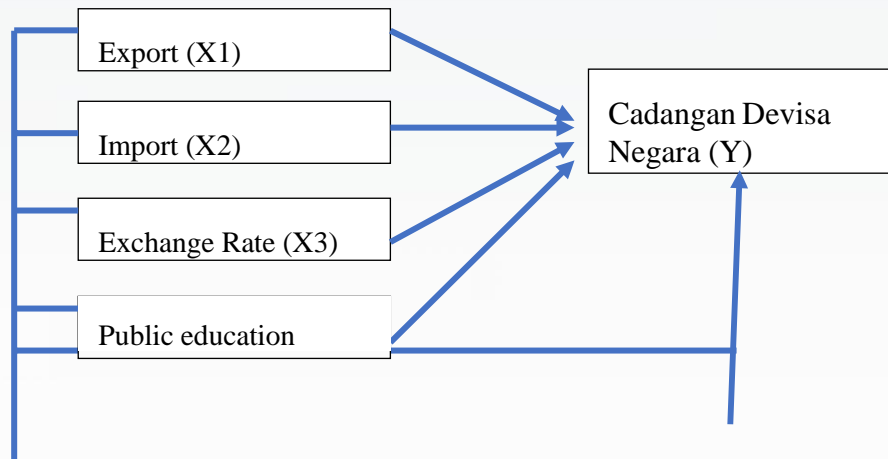
The occurrence of imports of goods from a country is a demand from domestic countries due to the absence of these goods (rare) or cheaper prices of foreign goods for domestic goods. This is in accordance with the international trade theory proposed by David Ricardo (comparative theory) and Adam Smith (absolute theory). The value of imports depends on the domestic

country's income or output. Increased income will also increase imports. In addition, the value of imports also depends on the value of the domestic currency. If the domestic currency appreciates (strengthens) against the foreign currency, it will make foreign goods relatively more expensive, causing a decrease in the number of imports. There are several factors that affect imports which can be expressed by the following equation:

$$IM^* = IM^*(Y^*, e) \quad (+, -)$$

Where  $Y^*$  is the relative price of the importing country's goods in the form of domestic goods and  $e$  is the real income of the importing country (foreign country).

The Framework of Research in research is as follows:



**Figure 4**  
Framework of Research

## Hypothesis

H<sub>1</sub> : Exports have a positive and significant effect on the country's foreign exchange reserves

H<sub>2</sub> : Imports have a negative and significant effect on the country's foreign exchange reserves

H<sub>3</sub> : Exchange rates have a negative and significant effect on the country's foreign exchange

H<sub>4</sub> : Public education expenditure has a negative and significant effect to foreign exchange

H<sub>4</sub>: exports, imports, exchange rates and public education expenditure have an effect simultaneously (simultaneously) to foreign exchange.

## Research Method

This research is quantitative, namely in drawing conclusions based on hypotheses from statistical and mathematical calculations. ). The data used in this study uses secondary data and *time series* annually (annually) and is a long-term relationship, namely data from 2005 to 2019 (15 years). The research model for foreign exchange that will be made in this study is to look at several macroeconomic variables that have a relationship or influence on the country's foreign exchange as described above, namely exports, imports, exchange rates, foreign debt, and inflation. In the research conducted using the method *Ordinary Least Square* (OLS). So to answer and prove the research objectives above as well as to see the coefficients of each independent variable used in the research model with multiple linear regression equations as follows:

$$\ln(FER_t) = Q_0 + Q_1 \ln(EX_t) + Q_2 \ln(IM_t) + Q_3 \ln(ER_t) + Q_4 \ln(inflation_t) + u_t \quad \dots (1)$$

Keterangan:

FER : Foreign Exchange Reserves

EX : Export

IM : Import

ER : Exchange Rate (IDR/USD)

Public education expenditure : Public education expenditure

For the research carried out to produce results that are Best Linear Unbias Estimator (BLUE), then to answer the research objective, namely analyzing foreign exchange reserves and the factors that influence foreign exchange reserves, it is necessary to carry out several stages of statistical tests as follows:

### **First Stage: Hypothesis Testing This**

the first stage is intended to estimate the research model and determine the coefficients of each dependent variable in equation 2 above. In addition, in this first stage to see whether each independent variable has an influence (contribution) on the dependent variable through t-test (partial), simultaneous test (model) with F-test whether all independent variables simultaneously affect the dependent variable, test the feasibility of the research model (*goodness of fit*) by looking at the termination coefficient R<sup>2</sup>, Akaike info criterion (AIC).

### **Second Stage: Classical Assumptions**

The second stage is carried out to see if the research model has problems with classical assumptions (Auto Correlation test, Heteroscedastic test, and Multicollinear test) so that the results of the research conducted are more BLUE (Best, Linear, Unbiased and Estimator)

### **Third Stage: Stationarity Testing**

This third stage is to find out whether all the data used in this study are stationary or not, it is necessary to do a stationary test using the unit *root test*, namely by using the Dickey-Fuller test (ADF test).

### **Stage Four: Cointegration Test The**

The purpose of this stage is to determine whether between the independent variables (exports, imports, exchange rates, and inflation) there has been a short-term equilibrium relationship to the dependent variable (*for eight reverse*). This cointegration test uses the Johansen Cointegration test

### **Stage Five: Error Correction Model (ECM)**

Error Correction This model is a stage that aims to determine the short-term equilibrium relationship that occurs in the research model used. Although the long-term research model has a balanced relationship through cointegration testing, in the short term it does not necessarily have a balanced relationship between the independent variables and the dependent variables in the research model used. To test this ECM using the Engle-Granger test.

## **Research Analysis and Results**

### **Normality Data Test**

The first before estimating the research model is the normalization test for all operational variable data used in the model. The normality test was carried out using the *Jarque-Bera* (JB) test. The results of the normalization test performed using the method *Jarque-Bera* using the E-Views software are as follows:

**Table 4.1**

Normality Test

**Normalitas Test Terhadap Variabel-variabel Model**

No.	Variabel	Hasil	JB Test	Prob.	Keterangan
1	Foreign exchange reserves	Normal	1.720068	0.423148	Prob. greater than $\alpha=0.05$
2	Export	Normal	1.280987	0.527032	Prob. greater than $\alpha=0.05$
3	Import	Normal	1.426560	0.490034	Prob. greater than $\alpha=0.05$
4	Exchange Rate	Normal	1.772605	0.412177	Prob. greater than $\alpha=0.05$
5	Inflation	Normal	1.636396	0.441226	Prob. greater than $\alpha=0.05$

**Sumber:** Output Eviews 6.0 (processed)

From the results of the above normality test using the Jarque-Berra test, it is greater than Prob. Dan Prob. Bigger than alpha. This shows that  $H_0$  is accepted (*accept*  $H_0$ ) which means that all the data used in this study are normally distributed.

**Research Model Estimation**

After the normalization test is performed, the next step is to estimate the research model used to see the long-term equilibrium relationship. The estimation results are as follows:

**Table 4.2:**

Estimation of Research Model Output

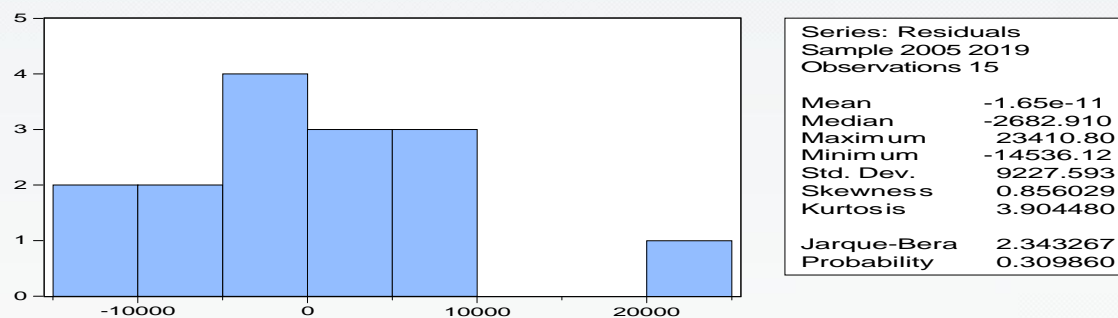
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-42773.21	41745.67	-1.024614	0.3297
Export	1.23E-06	4.44E-07	2.759266	0.0202
Import	-6.39E-07	4.04E-07	-1.581129	0.1449
Exchange Rate	4.750978	2.295007	2.070137	0.0503
Inflation	-2309.161	887.1461	-2.602910	0.0264
R-squared	0.920146			
Adjusted R-squared	0.888204			
F-statistic	28.80709			
Prob.(F-statistic)	0.000018			
Akaike info criterion	21.69546			
Schwarz criterion	21.93147			
Hannan-Quinn criter.	21.69294			
Durbin-Watson stat	2.326066			

From the estimation results (output) above, the multiple regression equation from the research model can be obtained as follows:

$$\text{FOREIGN EXCHANGE} = -42773.2069957 + 1.22631750311e-06 * \text{EXPORT} - 6.38559511661e-07 * \text{IMPORT} - 2309.16124422 * \text{PUBLIC EDUCATION EXPENDITURE} + 4.75097758005 * \text{ER} \dots \dots \dots (4.1)$$

From the regression equation 4.1 above, it can be explained that the export factor has a positive relationship (directly proportional) to foreign exchange reserves with a coefficient of **1.22631750311e-06**, meaning that if there is an increase of IDR 1 from the export value, this will also increase foreign exchange reserves by **1.22631750311 e-06** vice versa. The import factor has a negative relationship (inversely proportional) to foreign exchange reserves with a coefficient of **-6.38559511661e-07**, meaning that if imports increase by IDR 1 this will reduce foreign exchange reserves by **6.38559511661e-07** vice versa. The public education expenditure factor has a negative relationship (inversely proportional) to foreign exchange reserves with a coefficient of **-2309.16124422**, meaning that if the public education expenditure rate increases by 1%, this will

reduce foreign exchange reserves by **2309.16124422** vice versa. Meanwhile, the exchange rate factor has a positive relationship (directly proportional) to foreign exchange reserves with a coefficient of **4.75097758005**, meaning that if there is an increase in USD 1 (appreciation), this will also increase foreign exchange reserves by **4.75097758005**, vice versa. We also see the normality test of the research model with the following results:



The results of the normality test output above on the research model show that the probability of 0.30986 is greater than = 5%. This shows that the research model used is normal.

## Hypothesis Testing

From the estimation results in table 4.1 above, it is explained that the relationship is partially tested between the independent variables, namely export, import, exchange rate and public education expenditure to the dependent variable of foreign exchange reserves where export, exchange rate and public education expenditure have a significant effect or have a significant relationship on foreign exchange reserves, this can be seen and proven from the value of each Prob. (probability) of the third variable is smaller than alpha of 0.05 per cent, means that  $H_0$  accept. So that if there is a change in the three independent variables, it will also affect foreign exchange reserves. While Imports have no effect or have no significant relationship to foreign exchange reserves, this can be seen and proven from the value of Prob. (probability) is greater than alpha of 0.05 percent, which means reject  $H_0$  for the independent variable partially to the dependent variable.

Meanwhile, the simultaneous relationship between the four independent variables (exports, imports, exchange rates and inflation) on the dependent variable (foreign exchange reserves) which is the model test (F-test) of the study is very influential or has a very strong relationship. significant, this is evidenced by the probability value of F is 0.000018 which is smaller than = 0.05 . This means that  $H_0$  is accepted for all independent variables simultaneously (simultaneously) on the dependent variable. In addition, it can be seen from the results of the *goodness of fit* test of the research model in table 4.1 above which is used the study very well, this can be seen from the determinant coefficient of the Adjusted R-squared value of 0.888204 which means the contribution between exports, imports, exchange rates, and public education expenditure to the foreign exchange reserves amounted to 88.8 percent.

However, although the explanation estimation model output of research such as that shown above is pretty good, in this study the need for prudence will be the regression spurious or counterfeit (**Spurious** Regression). Regression fakes this has the feature where almost all of the data used in the study is not stationary, but from the estimation of the research model it is *the goodness of fit* quite good which is characterized by having a determinant coefficient ( ) is greater than Durbin-Watson (D/W), each data has a high significance value (t) but has a low Durbin-Watson (D/W) value. So to prove whether there has been a spurious or false regression (**Spurious** This regression) requires a further process by conducting a stationary test for all research data used in research and cointegration testing.



## Classical Assumptions Against Research Models

For the analysis carried out on the research model used to be BLUE (Best, Linear, Unbias and Estimator), the classical assumption test will first be carried out, namely to find out whether in the research model there are problems with classical assumptions.

### Autocorrelation

Test was conducted on the research model using the Breusch-Godfrey Serial Correlation LM Test with the following results:

**Table 4.3**

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	0.231699	Prob. F(2,8)	0.7983
Obs*R-squared	0.821296	Prob. Chi-Square(2)	0.6632

From the output above where the value of Obs\*R-squared is 0.821296 and the value of Prob. F(2.12) is 0.6632, this value is greater than  $\alpha = 0.05$ , this indicates that  $H_0$  is accepted, meaning that the research model used does not occur autocorrelation. Another way to test autocorrelation is to use Durbin-Watson. It can be seen that the results from the DW above are 2.326066, this shows that there are no autocorrelation problems.

### Heteroscedastic Testing

The heteroscedasticity test was carried out on the research model using WhiteTest with the following results:

**Tabel 4.4**

Heteroscedasticity Test: Glejser

F-statistic	1.215910	Prob. F(4,10)	0.3634
Obs*R-squared	4.908260	Prob. Chi-Square(4)	0.2968
Scaled explained SS	3.391615	Prob. Chi-Square(4)	0.4945

From the results of the Glejser test output above where the value of Prob. Obs\*R-squared is 4.908260 and the value of Prob. F (9.8) is equal to 0.3634 is greater than  $\alpha = 0.05$ , it that  $H_0$  accept that the model used in this research does not happen heteroscedastic (homoscedastic).

### Multi collinear

Test The multicollinear test is used to determine the presence or absence of [correlation](#) high between independent variables (predictors) in a multiple linear regression model. If there is a high correlation between the independent variables, then the relationship between the independent variable and the dependent variable (predicant) will be disturbed. Multikoliner their condition characterized by wherein determinate coefficient ( $R^2$ ) high but many independent variables is not significant

The multicollinearity test can be expressed by the following hypothesis:

$H_0$  : There is no multicollinearity in the model.

$H_1$  : There is multicollinearity in the model.

The statistical tool used to test multicollinearity in this study is to use the *variance public education expenditure factor* (VIF).

## Stationary Testing

After several stages of statistical testing have been carried out, the next step is a stationary test using the unit root test for each data used in the research model. A stationary test is carried out so that the research data can be analyzed for short-term relationships. This stationary test uses the Dickey-Fuller (ADF test). If it is known that the data is not stationary at the level, then the next step is to perform a unit root test at the 1st Difference or 2nd Difference level, until the data is stationary. The hypothesis for this test is:

$H_0 : = 0$  (there is a unit root, it is not stationary).

$H_1 : 0$  (no unit root, stationary)

The output results of unit root testing with ADF-test for all variables used can be as follows:

**Table 4.4**

Unit Root Test Results (ADF-Test)

Variable	Level		First Difference	
	Prob.	Keterangan	Prob.	Keterangan
Foreign exchange reserves	0.5080	No Stasioner	0.0236	Stasioner
Export	0.2419	No Stasioner	0.0758	Stasioner
Import	0.4994	No Stasioner	0.0017	Stasioner
Exchange Rate	0.8286	No Stasioner	0.0128	Stasioner
Inflation	0.7540	No Stasioner	0.0000	Stasioner

**Sumber:** Output Eviews 6.0 (processed)

The output of the stationary test with ADF-Test above shows that the critical value used as the limit for statistical testing is the Mac Kinnon critical value with a limit of =5%. The output results in table 4.2 show that all variables are not stationary at *Level*. This can be seen from the value of Prob. greater than =5%, so this is continued in the next step, namely the *1st Difference level* where all Prob. becomes smaller than =5%, indicating that all data are stationary.

## Co-integration Test.

The next in this research is to perform a cointegration test. The goal, as explained in the previous section, is to find out whether there is a short-term *equilibrium* relationship between the independent variables (exports, imports, exchange rates, and inflation) to the dependent variable (foreign exchange reserves) with the cointegration test. The first thing to do in the cointegration test is to see whether the residuals from the results of the above model estimation output used in the study are stationary at the level or not. This test uses the Augmented Dickey-Fuller (ADF-Test) test. The results obtained from the residual stationary test that have been carried out are as follows :

**Tabel 4.5**

Unrestricted Cointegration Rank Test (Trace)

Hypothesized		Trace	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None *	0.424963	7.193165	3.841466	0.0073

From the results of the unit root test output on the residual model above, it can be concluded that  $H_0$  is rejected, this shows that there is no unit root in the residuals in the research model which is

indicated by the Trace Statistics value of 7.193165 which is greater than the Critical Value (0.05) of 3.841466. can also be seen the value of Prob. of 0.0073 less than 0.05. The results of the co-integration test on the research model that have been carried out are as follows:

$$D(DEVISA,2) = 933.731203987 + 3.10734485035e-07*D(EKSPORT,2) - 1.18832224221e-07*D(IMPORT,2) + 801.629593926*D(INFLASI,2) - 10.7080840398*D(KURS,2)$$

**Tabel 4.6**

Co-integration Estimation Output

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	933.7312	2769.386	0.337162	0.7447
D(EKSPORT,2)	3.11E-07	2.19E-07	1.420105	0.1934
D(IMPORT,2)	-1.19E-07	1.97E-07	-0.602567	0.5635
D(INFLASI,2)	801.6296	456.9616	1.754260	0.1175
D(KURS,2)	-10.70808	2.118979	-5.053416	0.0010
F-statistic	7.808342			
Prob(F-statistic)	0.007234			

From the results of the co-integration estimation of the research model, it is found that the exchange rate has an effect on foreign exchange reserves in a short-term equilibrium relationship, this can be proven by the prob value. in table 4.6 is 0.001 smaller than 0.05. Meanwhile, exports, imports, and public education expenditure in a short-term equilibrium relationship do not affect foreign exchange reserves, this can be seen in the t-statistics and Prob, respectively. in table 4.6 above where all independent variables are not significant (above 0.05). However, in the short-term the four independent variables (export, import, inflation, and exchange rate) simultaneously have a significant effect on foreign exchange reserves, this can be seen in table 4.6 model test (F-statistics) and prob. (F-statistics) of 0.007234 smaller than 0.05

### Estimation of Error Correction Model (ECM)

The ECM test is used to correct the above cointegration test whether there has been a short-run equilibrium relationship between exports, imports, exchange rates, and public education expenditure on foreign exchange reserves. ECM estimation results obtained the following estimation equation:

$$D(DEVISA,2) = 594.7272 + 4.00562e-07*D(Export,2) - 1.145e-07*D(Import,2) - 8.223*D(ER,2) + 585.525*D(Inflation,2) - 0.4208*ECT(-1)$$

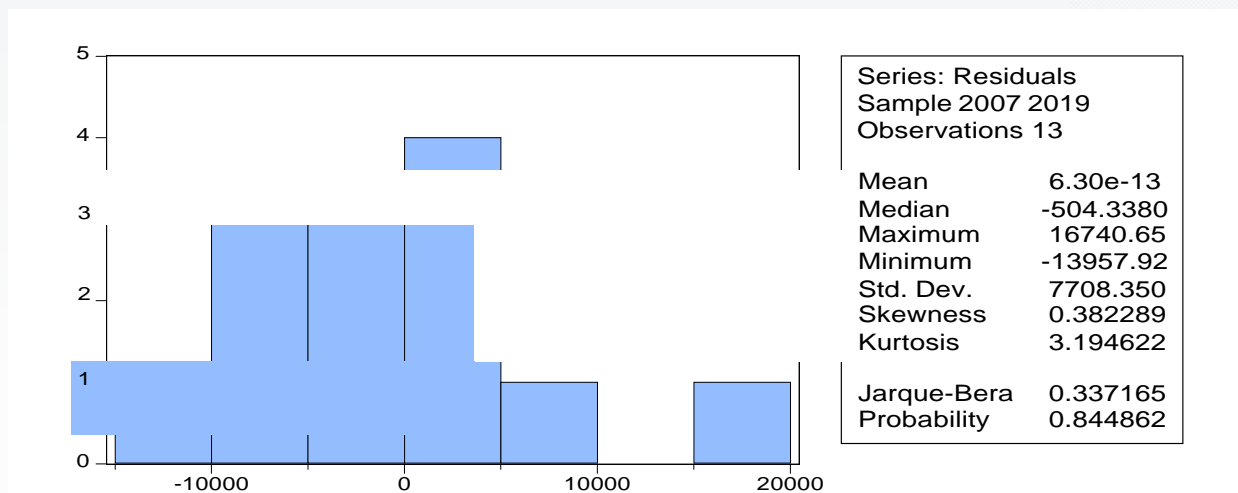
**Tabel 4.7**

Output Estimation Research Model

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	594.7271	2842.418	0.209233	0.8402
D(Export,2)	4.01E-07	2.46E-07	1.630705	0.1470
D(IMPORT,2)	-1.15E-07	2.01E-07	-0.571041	0.5858
D(ER,2)	-8.223058	3.599483	-2.284511	0.0463
D(INFLASION,2)	585.5252	527.8777	1.109206	0.3040
ECT(-1)	-0.420886	0.488443	-0.861689	0.0417
F-statistic	6.194117			
Prob(F-statistic)	0.016561			

The results of the error correction model (ECM) test above where the *lag of residual value* is negative, which is -0.0420886 and this should be a negative result. This shows that the correction of mistakes (*error correction* term) amounted to 42.08% and the results are significant.

In addition, the results of each independent variable (export, import, and inflation) partially show that all variables are not significant to the dependent variable (foreign exchange reserves), this shows that the independent variable does not have a short term equilibrium relationship with the dependent variable foreign exchange reserves, this is evidenced by the probability value (Prob.) of each variable which is greater than 5 percent, except for the exchange rate and ECT (error correction) which have a significant effect on foreign exchange reserves except for the residual which shows a significant (prob. less than 5) percent). However, simultaneously all independent variables have an effect on foreign exchange reserves in the short term, this is evidenced by the value of Prob. (F-statistic) is 0.016561, this value is smaller than =5% which means reject H0. Next, we see the normality test on the model from the ECM with the following results:



**Figure 4.2**  
Normalization Test Results on the ECM Model

Figure 4.2 is the result of the normality test using Jarque-Bera stating that the Jarque-Bera value is 0.337165 below 2 and the probability value of JB is 0.844862 greater than 0.05, this shows that the estimation of the Error Correction Method model is normal

## Discussion And Conclusion

From the results of research that has been conducted on the effect of exports, imports, exchange rates, and public education expenditure on foreign exchange reserves, using data for the *time series* years 2005-2019, the results show that there is a partial relationship where the export factor has a positive relationship (directly proportional) to foreign exchange reserves, the import factor has a negative relationship (inversely proportional to foreign exchange reserves, the public education expenditure factor has a negative relationship (inversely proportional) to foreign exchange reserves, while the exchange rate factor has a positive relationship (directly proportional) to foreign exchange reserves. There is a significant long-term equilibrium relationship between exports, exchange rates, and public education expenditure on foreign exchange reserves. So that if there is a change in the three independent variables, it will also affect foreign exchange reserves. Meanwhile, imports do not affect or have no significant relationship to foreign exchange reserves. However, the simultaneous relationship between the four independent variables (export, import, exchange rate, and inflation) on the dependent variable (foreign exchange reserves) which is the model test (F-test) of the study is very influential or has a significant relationship. very significant. The short-term equilibrium relationship with the co-integration test and error correction method (ECM) shows that the exchange rate affects foreign exchange reserves. Meanwhile, exports, imports, and public education expenditure in a short-term equilibrium relationship do not affect foreign exchange reserves. However, in the short term, the four independent variables (export, import, inflation, and exchange rate) simultaneously have a significant effect on foreign exchange reserves.

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