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Response of Indonesia's Foreign Exchange Reserves as a Result of Changes in Exports, Imports, Rupiah/USD Exchange Rate, and External Debt for the First Quarter of 2008-Fourth Quarter of 2021

Yohan[1] Samuel Yulius Sir[2] Vera Sri Endah Cicilia[3]
Department of Economics and Development Studies, Faculty of Economics and Business, Universitas Tadulako, Palu City, Central Sulawesi Province, Indonesia[1,2,3]
Email: jowe.shine12@gmail.com[1]

Abstract

Foreign exchange reserves are an important indicator for a country in conducting international trade, as well as a benchmark against the strong weak economic fundamentals of a country. This study aims to: 1) Analyze the response of changes in Indonesia's foreign exchange reserves simultaneously as a result of changes in exports, imports, Rupiah/U$D exchange rates, and external debt for the first quarter of 2008 - fourth quarter of 2021, 2) Analyze the response of changes in Indonesia's foreign exchange reserves individually as a result of changes in exports, imports, Rupiah/U$D exchange rates, and external debt for the first quarter of 2008-fourth quarter of 2021. The methods used are autoregressive conditional heteroscedasticity (ARCH) and generalized autoregressive conditional heteroscedasticity (GARCH). The results of the study based on estimates with the GARCH model (1.1) show that together the variables of exports, imports, rupiah exchange rates, and foreign debt have a significant effect on reserves Indonesian foreign exchange. The results of the estimation with the GARCH model (1.1) can be concluded that the export variable has a positive and significant effect on Indonesia's foreign exchange reserves. Import variables have a negative and significant effect on Indonesia's foreign exchange reserves. The rupiah exchange rate variable has a negative and significant effect on Indonesia's foreign exchange reserves, and the external debt variable has a positive and significant effect on the reserve variable. This research is still limited to the variables that are used as the basis for the research model, therefore it is necessary to consider information from the variable measurement of the number of Indonesian workers working abroad at various income levels, so that it can be known the role of Indonesian workers working abroad in increasing foreign exchange reserves.

Keywords: Foreign Exchange Reserves, Exports, Imports, Rupiah/USD Exchange Rate, and External Debt.

INTRODUCTION

Foreign exchange reserves are used as an important indicator that shows the extent to which a country can conduct international trade and as a benchmark against the strong weak economic fundamentals of a country (Hadi, 2001). Foreign exchange reserves are commonly measured through the ratio of official reserves to imports, if the foreign exchange reserves are sufficient to cover a country's imports for three months, then it can be said to be a safe level. If it is only for two months or less then it can cause pressure on the balance of payments. The amount of foreign exchange reserves must be available for the continuity of international transactions to run stably (Kamaludin, 1998).

Efforts to increase foreign exchange reserves, among others, through trade activities, especially exports. (Irawati, 2018). International trade activities in the form of exports and imports cannot be separated from their role for Indonesia, exports and imports can affect Indonesia's foreign exchange reserves positively and imports have a negative effect on foreign exchange reserves (Dani1 et al., 2020; Irawati, 2018; Rini & Suguharti, 2016; Uli, 2016).

Based on data on the position of foreign exchange reserves from 2008-2019 experienced fluctuations, in 2008 foreign exchange reserves amounted to US$ 51,639 million, and experienced an increase every year, namely until 2012 the highest foreign exchange reserves amounted to US$ 112,781 million. The increase in foreign exchange reserves is attributable to well-maintained investor confidence, supported by additional liquidity in global financial markets stemming from monetary expansion in developed countries (Ardianti & Swara, 2018; Juliansyah et al., 2020; Putra & Indrajaya, 2013; Rini & Suguharti, 2016; Uli, 2016).

RESEARCH METHOD

The implementation of this research is based on the guidelines of the descriptive type of research. The descriptive type of research is a form of analysis in the form of inferring large amounts of raw data so that the results can be interpreted (Nazir, 2005; Sugiyono, 2012). The object of this study is to analyze the response of foreign exchange reserves due to changes in the varaibel: 1) Exports, 2) Imports, 3) Rupiah/U$D Exchange Rate, 4) External Debt which is set as an independent variable and Foreign Exchange Reserves as a dependent variable.

The methods used are autoregressive conditional heteroscedasticity (ARCH) and generalized autoregressive conditional heteroscedasticity (GARCH) (Widarjono, 2009). To explain how the ARCH and GARCH models are formed, it is necessary to use a simple regression model as follows:

$Y = a + b_1X_1 \ldots\ldots\ldots b_nX_n + e$ ..... (1)

Information:

Y : Bound variables
a : *Intercept*
b_1b_n : Partial regression coefficient
e : Standard error
X_1X_n : Free variables

The model is transformed into:

$\ln Y = \alpha + \beta^1 \ln X^1 + \beta^2 \ln X^2 + \beta^3 \ln X^3 + \beta^4 \ln X^4 + et$ ..... (2)

1. The ARCH model can be expressed in the form of the following equation:
   $Y_t = \beta_0 + \beta^1 \ln X^1 + \beta^2 \ln X^2 + \beta^3 \ln X^3 + \beta^4 \ln X^4 + et$ ..... (3)
   Information:
   Y_t : Dependent variables
   X_t : Independent variables (X1: Eskpor; X2 : Impor; X3: Rupiah Exchange Rate/USD; X4: External Debt.
   β_0 : *Intercept*
   β_1 : Regression Coefficient
   e_t : Standard error
   $\sigma^2{}_t = \alpha_0 + \alpha_1 e^2{}_{t-1} + \alpha_2 e^2{}_{t-2} + \ldots + \alpha_p e^2{}_{t-p}$ ..... (4)
   a. The third equation shows the residual variety ($\sigma^2{}_t$) has two elements: constant (α_0) and residual squares of past periods ($e^2{}_{t-p}$).
   b. The second equation of the linear model, the third equation of the non-linear model, so the OLS method cannot be for model estimation.
   c. Can only be estimated by the Maximum Likelihood method.
2. The GARCH model can be expressed in the equation as follows:
   $\sigma^2{}_t = \alpha_0 + \alpha_1 e^2{}_{t-1} + \ldots + \alpha_p e^2{}_{t-p} + \lambda_1 \sigma^2{}_{t-1} + \ldots + \lambda q \sigma^2{}_{t-q}$ ..... (5)

a. The equation shows the residual variety (σ^2_t) not only affected by the residual square of past periods (e^2_{t-p}), but also by the residual variety of past periods ($\sigma^2_{t-}q$).
b. Model GARCH like the ARCH model, also estimated using the Maximum Likelihood method (LM).

In this study, the variance equation (ARCH-GARCH) became:
$e_t = \sigma^2_t = \alpha + \beta_1 \sigma^2_{t-1} + \beta_2 \sigma^2_{t-2} + \lambda_1 \varepsilon^2_{t-1} + \lambda_1 \varepsilon^2_{t-2} + e$
Information:

σ^2_t	: Variety of residues of the current year
α_0	: *Intercept (constant)*
$\alpha_1, \alpha_2, \lambda_1,$ $\lambda_2,$	: Regression coefficient
ε^2_{t-1}	: Residual square a year ago
ε^2_{t-2}	: Residual square two years ago
σ^2_{t-1}	: Residual variety a year ago
σ^2_{t-2}	: Residual variety two years ago
e	: Eror

Short-term testing consists of unit or stationary root tests, ARCH/GARCH tests and classical assumption tests, while tests carried out in the long term are cointegration tests. The hypothesis submitted for testing through Uji_F can be seen in the following section:

1. $H_0 : \beta_1;\beta_2; \beta_3; \beta_4; \beta_5 = 0$, indicates that H0 is accepted, meaning that being independent simultaneously does not exert an insignificant effect on Indonesia's Foreign Exchange Reserve Variables.
2. $H_0 : \beta_1;\beta_2; \beta_3; \beta_4; \beta_5 \neq 0$, shows that H0 is rejected meaning that it is independent simultaneously to have an insignificant influence on Indonesia's Foreign Exchange Reserve Variables.

Individual hypothesis testing is spelled out in the following sections:
First Hypothesis:
$H_0 : \beta_1 = 0$, Partial independent variables do not have a significant effect on Indonesia's Foreign Exchange Reserves Variables.
$H_0 : \beta_1 > 0$, Independent variables partially have a positive and significant effect on Indonesia's Foreign Exchange Reserves Variables.

RESULTS OF RESEARCH AND DISCUSSION

Research Results

This section outlines the estimated results of the response of Indonesia's foreign exchange reserves to changes in exports, imports, rupiah/USD exchange rates, and external debt in the observation period of the first quarter of 2008 - fourth quarter of 2021. The use of ARCH and GARCH analysis methods is based on the reason that it does not view heteroskedasticity as a problem, but utilizes these conditions to create a model, by utilizing heteroskedasticity in the right errors, a more efficient estimator will be obtained.

Test the Roots of the Unit

In regression using time series data, it is a problem of non-stationary data. Regressions involving two or more time series data, which are not stationary, will result in spurious regression. Early indications of regression are indicated by the high value of R2 and the low

value of Durbin-Watson (DW) statistics. Before conducting a regression analysis, it is necessary to first conduct a stationary test, whether at zero degree I(0) stationary or not. The procedures performed to test the stationarity of the data are the Dickey-Fuller (DF) and Augmented Dickey-Fuller (ADF) tests. This test can be viewed as stationary, since the test is intended to observe whether a certain coefficient of the estimated autoregressive model has a value of one or not. Based on the Augmented Dickey-Fuller test it can be concluded that all variables are not stationary at the level level, So it must be continued with the integration degree test and it can be concluded that all variables in the study have been stationary at the first level of differentiation. The results of the unit root test in this study are:

Table 1. Research Variable Unit Root Test Results

Variable	ADF	
	t-Statistic	**Prob.**
Foreign Exchange Reserves	-11.06097	0.0000
Export	-8.264720	0.0000
Import	-6.697079	0.0000
Rupiah Exchange Rate	-5.512345	0.0000
External Debt	-6.404163	0.0000

Based on Table 1 it can be inferred on the Augmented Dickey-Fuller (ADF) test that the data used has been stationary at the first level of differentiation (*1st difference*) with α = 5 percent.

Granger Causality Test

The Granger Causality Test is a test to see the causality relationship or causality relationship between the variables of foreign exchange reserves, exports, imports, rupiah exchange rates, foreign investment, and foreign debt.

Table 2. Granger Causality Test

Pairwise Granger Causality Tests			
Null Hypothesis:	**Obs**	**F-Statistic**	**Prob.**
EKSPOR does not Granger Cause CADANGAN_DEVISA	46	0.01790	0.9823
CADANGAN_DEVISA does not Granger Cause EKSPOR		2.39352	0.1040
IMPOR does not Granger Cause CADANGAN_DEVISA	46	0.04483	0.9562
CADANGAN_DEVISA does not Granger Cause IMPOR		5.94851	0.0054
NILAI_TUKAR does not Granger Cause CADANGAN_DEVISA	46	1.30194	0.2830
CADANGAN_DEVISA does not Granger Cause NILAI_TUKAR		7.63435	0.0015
ULN does not Granger Cause CADANGAN_DEVISA	46	3.63793	0.0351
CADANGAN_DEVISA does not Granger Cause ULN		1.16933	0.3207

The Granger Causality test results in Table 2 show that:

1. There is no causality relationship between export variables to foreign exchange reserve variables with a probability value of 0.9823> α = 5 percent, while foreign exchange reserve variables also have no causality or influence relationship to export variables with a probability value of 0.1040 > α = 5 percent;
2. There is no causality relationship between the import variable and foreign exchange reserves where the probability value of imports to foreign exchange reserves is 0.9562persen and the variable foreign exchange reserves to imports is 0.0054 < 5 percent, so it can be concluded that there is a causality relationship to the import variables and foreign exchange reserves;

3. The rupiah exchange rate does not affect foreign exchange reserves with a probability value of 0.2830> α = 5 percent. Meanwhile, foreign exchange reserves have an influence on the rupiah exchange rate with a probability of 0.0015< α = 5 percent, So it can be concluded that foreign exchange reserves have an influence on the rupiah exchange rate and do not apply vice versa;
4. Foreign debt has an influence on foreign exchange reserves with a probability of 0.0351> α = 5 percent. Meanwhile, the variable of foreign exchange reserves has no influence on foreign debt with a probability value of 0.3207 > α = 10 percent, so it can be concluded that the variable of foreign exchange reserves has an influence on foreign debt and does not apply vice versa.

Cointegration Test

After the data are known to be stationary in the unit root test at the first differentiation, a cointegration test is then carried out to determine whether there is a long-term relationship between the variables used in the study. This study used Johansen's cointegration test:

Table 3. Johansen Cointegration Test

Trend assumption: Linear deterministic trend Series: CADANGAN_DEVISA; EKSPOR; IMPOR; NILAI_TUKAR; ULN; Lags Interval (In fisrt differences):1 to 1				
Hypothesized No. of CE(s)	**Eigenvalue**	**Trace Statistic**	**0.05 Critical Value**	**Prob.****
None*	0.590914	125.1956	95.75366	0.0001
At most 1*	0.512158	84.07945	69.81889	0.0024
At most 2*	0.404801	51.06228	47.85613	0.0242
At most 3	0.310893	27.19473	29.79707	0.0970
At most 4	0.062626	2.974961	3.841466	0.0846
Trace test indicates 2 cointegrating eqn(s) at the 0.05 level *denotes rejection of the hypothesis at the 0.05 level *MacKinnon-Haug-Michelis (1999) p-values				
Hypothesized No. of CE(s)	**Eigenvalue**	**Max-Eigen Statistic**	**0.05 Critical Value**	**Prob.****
None *	0.590914	41.11619	40.07757	0.0381
At most 1	0.512158	33.01717	33.87687	0.0631
At most 2	0.404801	23.86755	27.58434	0.1394
At most 3	0.310893	17.12850	21.13162	0.1660
At most 5	0.062626	2.974961	3.841466	0.0846
Max-eigenvalue test indicates 1 cointegrating at the 0.05 level denotes rejection of the hypothesis at the 0.05 level *MacKinnon-Haug-Michelis (1999) p-values				

Table 3, shows that the none* trace statistic value > critical value or 125.1956> 95.75366 and the Max-Eigen Statistic value > critical value or 41.11619 > 40.07757. Furthermore, at most 1* trace statistics > critical value or 84.07945> 69.81889, so it can be concluded that in the long term there is cointegration at a significant level of α = 5 percent, meaning that the observation variables have a long-term relationship between the free variable and the bound variable.

ARCH and GARCH

Estimation of the ARCH/GARCH model cannot be done in one second time, meaning that it must go through an interative process to get the best estimation results. According to Widarjono (2007: 326), one of the existence of the ARCH effect can be seen based on the

probability in F-statistics, if the probability value in F-statistics is smaller than the significant value of α = 5 percent, then there is an ARCH effect and vice versa.

The various models of ARCH and GARCH proposed in this study are the result of experiments on these models and residual lags and certain variants. The existence of various forms of ARCH and GARCH models tested, it is expected to provide the best and appropriate models for research. The model can be seen in Tables 4 and 5.

The estimation results of the various ARCH and GARCH models in Table 4 and Table 5, then compared with each other and how well the estimated results are. By looking at the coefficient of the estimation parameter, the significant test of the influence of independent variables on the dependent variable through the t test, F test and t probability value (p) test, coefficient of determination (R2), autocorrelation, Akaike Info Criterion, Schwarz Criterion, and normality (Widarjono, 2007: 53).

Table 4. Arch Model Estimation Results (1), (2) and GARCH (1.1), (1.2)

	ARCH(1)		ARCH(2)		GARCH(1.1)		GARCH(1.2)	
	Coef	Prob	Coef	Prob	Coef	Prob	Coef	Prob
C	-3.471189	0.0008	-4.389095	0.0009	**2.520400**	**0.0597**	-2.153072	0.3773
Ekspor	0.913417	0.0000	1.024976	0.0000	**0.426146**	**0.0021**	0.856413	0.0001
Impor	-0.381273	0.0000	-0.451335	0.0001	**-0.244738**	**0.0001**	-0.381503	0.0065
Nilai Tukar	-0.101156	0.0000	-1.088524	0.0000	**-0.681160**	**0.0000**	-0.880062	0.0000
ULN	1.595104	0.0000	1.639838	0.0000	**1.053717**	**0.0000**	1.387908	0.0000
AR(1)	-0.163817	0.2120	-0.070416	0.6666	**-0.033274**	**0.7078**	-0.220471	0.2529
Variance Aquation								
C	(-)	Sig	(-)	Sig	(+)	**Sig**	(-)	Tidak Sig
Ekspor	(+)	Sig	(+)	Sig	(+)	**Sig**	(+)	Sig
Impor	(-)	Sig	(-)	Sig	(-)	**Sig**	(-)	Sig
Nilai Tukar	(-)	Sig	(-)	Sig	(-)	**Sig**	(-)	Sig
ULN	(+)	Sig	(+)	Sig	(+)	**Sig**	(+)	Sig
AR(1)	(-)	Tidak Sig	(-)	Sig	(-)	**Tidak Sig**	(-)	Tidak Sig
C	0.000178	0.1500	0.001893	0.1384	**0.000512**	**0.0030**	0.000601	0.0501
RESID(-1)^2	4.210362	0.2682	2.062045	0.2858	**-0.116361**	**0.0000**	-0.023986	0.4264
RESID(-2)^2	-	-	-0.080765	0.2510	-	-	-	-
GARCH(-1)	-	-	-	-	**0.972835**	**0.0000**	1.483013	0.0000
GARCH(-2)	-	-	-	-	-	-	-0.544125	0.0000
R-squared	0.611286		0.605751		**0.505518**		0.595902	
Adjusted R-squared	0.529452		0.509853		**0.385238**		0.483652	
Durbin-Watson stat	2.152968		2.325593		**1.909434**		1.991126	
Akaike info criterion	-0.974574		-0.775383		**-2.077676**		-1.520975	
Schwarz criterion	-0.620290		-0.381735		**-1.684027**		-1.087962	
F-statistic	7.469796		6.316595		**4.202863**		5.308729	
Prob(F-statistic)	0.000006		0.000023		**0.000843**		0.000089	

Sumber: Lampiran 11-14

Tabel 5. Hasil Estimasi Model GARCH (2.1), GARCH (2.2), (1.2) dan E-GARCH

	GARCH(2.1)		GARCH(2.2)		E-GARCH	
	Coef	Prob	Coef	Prob	Coef	Prob
C	0.113276	0.8666	1.603690	0.2638	-4.609739	0.2041
Ekspor	0.490643	0.0000	0.326985	0.0395	0.942411	0.0042
Impor	-0.211098	0.0000	-0.106664	0.3199	-0.441315	0.1321
Nilai Tukar	-0.444108	0.0171	-0.721094	0.0000	-1.077480	0.0000
ULN	1.000963	0.0000	1.148251	0.0000	1.726269	0.0000
AR(1)	0.505986	0.0008	0.249533	0.0434	-0.163214	0.5558
Variance Equation						
C	(+)	Tidak Sig	(+)	Tidak Sig	(-)	Tidak Sig
Ekspor	(+)	Sig	(+)	Sig	(+)	Sig
Impor	(-)	Sig	(-)	Tidak Sig	(-)	Tidak Sig
Nilai Tukar	(-)	Sig	(-)	Sig	(-)	Sig
ULN	(+)	Sig	(+)	Sig	(+)	Sig
AR(1)	(+)	Sig	(+)	Sig	(-)	Tidak Sig
C	0.000103	0.3916	0.000182	0.2672	-	-
RESID(-1)^2	0.259566	0.1635	0.183214	0.3640	-	-
RESID(-2)^2	-0.381380	0.0925	-0.294280	0.1883	-	-
GARCH(-1)	1.065602	0.0000	0.922399	0.000	-	-
GARCH(-2)	-	-	0.094752	0.3360	-	-
C(8)	-	-	-	-	-0.817199	0.0331
C(9)	-	-	-	-	0.734257	0.0681
C(10)	-	-	-	-	0.011391	0.9646
C(11)	-	-	-	-	0.950074	0.0000
R-squared	**0.386152**		**0.486157**		**0.613457**	
Adjusted R-squared	**0.215638**		**0.324664**		**0.506083**	
Durbin-Watson stat	**2.788183**		**2.517411**		**2.226363**	
Akaike info criterion	**-2.144887**		**-2.218842**		**-0.683999**	
Schwarz criterion	**-1.711873**		**-1.746464**		**-0.250986**	
F-statistic	**2.264643**		**3.010383**		**5.713314**	
Prob(F-statistic)	**0.035555**		**0.006374**		**0.000044**	

The results of estimating various ARCH and GARCH models, by comparing significantly each ARCH and GARCH models, it was obtained that the selected model was the GARCH model (1.1) whose variables were significant at α = 5 percent, and judging from the Durbin-Watson statistical value of 1.909434 which was included in the criteria did not have autocorrelation. When viewed from the R2 value of 50.55 percent and the Akaike info criterion value which is low at -2.077676 and the Schwarz criterion value of -1.684027, it can be concluded that the GARCH model (1.1) is the best model of other models. After selecting the GARCH model (1.1) to be the best model, the model used in the analysis is as follows:

Table 6. GARCH Model Estimation Results (1.1)

Dependent Variabel: CADANGAN_DEVISA Method: ML – ARCH (Marquardt) – Normal distribution Sample (adjusted): 2008Q2 2021Q4			
Variabel	**Coefficient**	**z-Statistic**	**Prob.**
C	2.520400	1.882696	0.0597
Ekspor	0.426146	3.077457	0.0021
Impor	-0.244738	-3.991749	0.0001
Nilai Tukar	-0.681160	-4.088218	0.0000
ULN	1.053717	8.844217	0.0000
AR(1)	-0.033274	-0.374748	0.7078
R-squared Adjusted R-squared	0.505518 0.385238	Durbin-Watson stat	1.909434

The equation obtained from the estimation results of the GARCH Model (1.1) is:

Table 7. GARCH Model Estimation Results

CaD = 2.520400 + 0.426146 Ekspor - 0.244738 Impor – 0.681160 Nilai Tukar + 1.053717 ULN - 0.033274 AR(1) + *e* (1.882696) (3.077457)*** (-3.991749)*** (-4.088218)*** (8.844217)*** (-0.374748)**
Keterangan: (***) Signifikan pada α = 1 persen; (**) Signifikan pada α = 5 persen; (*) Signifikan pada α = 10 persen

The obtained variance conditional equation is:

Table 8. Variance Conditional Equations

$\ln \sigma_t = C + RESID(-)^2 \lvert e_{t-1}/\sigma_{t-1}\rvert + GARCH(-) \ln \sigma^2_{t-1}$ $\ln \sigma^2_t = 0.000512 - 0.116361 \lvert e_{t-1}/\sigma_{t-1}\rvert + 0.972835 \ln \sigma^2_{t-1}$ (2.971804)*** (-4.107001)*** (14.86567)***
Keterangan: (***) Signifikan pada α = 1 persen (**) Signifikan pada α = 5 persen (*) Signifikan pada α = 10 persen

The meaning of the first equation or conditional mean equation is to indicate the condition of shock volatility (heterochedasticity problem) that occurs very small.

Hypothesis Test

F-statistical test (test together)

To answer the hypothesis of point (1), it will be done by looking at the F-statistical value, on the condition that Fstatistik> Ftabel. If these conditions have been met, it can be interpreted

that together independent variables have a significant effect on dependent variables. This test is carried out to determine whether independent variables together have an influence on dependent variables. With the criteria being Fhitung> Ftabel at α = 5 percent, the independent variables together have a significant influence on the dependent variables. In the GARCH model (1.1) can be seen F_{hitung}> F_{tabel} i.e. 4.202863> 2.32, at α = 5 percent with a probability of 0.000843, thus it can be concluded H_o is rejected. This means that together independent variables affect the dependent variables and statistically, the four independent variables, namely exports, imports, exchange rates, and external debt, can predict the value of Indonesia's foreign exchange reserves. The conclusion that can be put forward is that the hypothesis of point (1) is answered, that together independent variables have a significant effect on dependent variables.

T-statistical test (Individual Test)

To answer the hypothesis of points (2), (3), (4), (5), and (6), it can be done by testing or looking at the t-statistic value. In the results of the linkage test of each independent variable to changes in the dependent variable, a statistical test t(t-test) is used, to determine whether there is a significant influence between the independent variables partially on the dependent variable. The t-test is performed by comparing the t-count value with the t-table value as well as looking at the significance of each variable. If the value of t-count > t-table, then the variable has a partial effect and is significant.

Table 9. t Test Results

Variable	t-*statistic*	t-tabel	Prob.
Export	3.077457	1.68195	0.0021
Import	-3.991749	1.68195	0.0000
Exchange rate	-4.088218	1.68195	0.0000
External debt	8.844217	1.68195	0.0000
AR(1)	-0.374748	1.68195	0.7078

The export variable has a t-statistic > t-table, which is 3.077457 >1.68195and a probability value of 0.0021, which means that the export variable has a positive and significant effect on the foreign exchange reserve variable at α = 5 percent. It can be concluded that the above statement corresponds to the hypothesis of point (2).

The import variable has a t-statistic< t-table value, which is -3.991749 < 1.68195 and a probability value of 0.0001, which means that the import variable has a negative and partially significant effect on the foreign exchange reserve variable at α = 5 percent. From the discussion above, the hypothesis point (3) is answered according to conjecture.

The exchange rate variable has a t-statistic< t-table value, which is -4.088218 < 1.68195 with a probability value of 0.0000, which means that the exchange rate variable has a negative and significant effect on the foreign exchange reserve variable at α = 5 percent. Based on the hypothesis point (4), it can be concluded that the above explanation corresponds to the statement of the hypothesis that has been made.

Then for the foreign debt variable, it has a t-statistical value > t-table, namely 8.844217 > 1.68195 with a probalita value of 0.0000, which means that the foreign debt variable has a positive and significant influence on foreign exchange reserves at α = 5 percent. Based on the hypothesis point (6), it can be concluded that the above explanation corresponds to the statement of the hypothesis that has been made. Meanwhile, AR(1) has a t-statistic < t-table, namely -0.374748 < 1.68195 with a probability value of 0.7078, which means that AR(1) has no significant effect on foreign exchange reserves at α = 5 percent.

Coefficient of Determination (R2)

The coefficient of determination (R2) is used to determine the degree of closeness of the relationship between independent variables and dependent variables which is indicated by the magnitude of R2. Based on the regression results of the GARCH model (1.1), an R2 value of 0.505518 or 50.55 percent was obtained, meaning that 50.55 percent of the variation in foreign exchange reserves could be explained by exports, imports, rupiah exchange rates, and foreign debt. While 49.45 percent is explained by other variables outside the research model.

Test Classical Assumptions

A good regression model is a regression model that produces a non-biased linear (Best Linear Unbiased Estimator/BLUE). This condition will occur if it is met with several assumptions, which are called classical assumptions. The classical assumptions used in this study are as follows:

Multicholinearity Test

The multicholinearity test was carried out to see whether there was a correlation between one independent variable and another independent variable, namely between export, import, exchange rate, and foreign debt variables. The following are the results of the correlations test:

Table 10. Multicholinearity Test

	Export	Import	Exchange rate	PMA	ULN
Export	1	0.8802202637318493	-0.1633657909972759	0.5563703629884652	0.3777482290716614
Import	0.8802202637318493	1	0.04142931062940558	0.6233718138834412	0.4974313447525026
Exchange rate	-0.1633657909972759	0.04142931062940558	1	0.2946450357751182	0.7929146041352586
External debt	0.3777482290716614	0.4974313447525026	0.7929146041352586	0.6236664656357923	1

The multicholinearity test in Table 10, shows that the matrix value between the independent variables owned < 0.90 can then be concluded that in the model used as an independent variable there is no correlation between other independent variables, namely between the variables of export, import, exchange rate, and foreign debt.

Heteroskedasticity Test

Table 11 below is the result of the calculation of the heteroskedasticity test. The heteroskedasticity test aims to see whether heteroskedasticity occurs or not. Based on the chi-squared value, if the chi-squared value > 5 percent, then it can be concluded that there is no heteroskedasticity in the estimation model.

Table 11. Heteroskedasticity Test

Heteroskedasticity Test: ARCH			
F-statistic	0.010025	Prob. F(1,45)	0.9207
Obs*R-squared	0.010469	Prob. Chi-Square(1)	0.9185

The heteroskedasticity test is the minimum lag variant, the estimator coefficient becomes biased, the significance tester of the regression coefficient becomes strong. In this study, the value of Chi-Square was 0.9185 with a probability of 0.9207 which is α > 5 percent, statistically insignificant, so it can be concluded that in this model there is no heteroskedasticity problem.

Atocorrelation Test

The next classical assumption test performed is the autocorrelation test. In this test, to test the presence or absence of autocorrelation in the model used by the researcher, the

researcher used the Durbin-Watson test using the Durbin-Watson table.To analyze the presence or absence of autocorrelation in the model used in this study, by looking at the statistical D-W value in the GARCH estimation results (1.1).

Estimation results from the GARCH model (1.1). to find out the existence of autocorrelation can be seen from the Durbin-Watson statistical value of 1.909434 thus, the decision on the presence or absence of autocorrelation can be seen by testing as follows using the Durbin-Watson table with α = 5 percent, after obtaining D-W statistics from the estimated results, then to find out whether autocorrelation occurs or not in the statistical D-W value estimation model must be compared with the dL value, dU, 4 – dU, and 4 – dL found in the following Durbin-Watson table:

Table 12. Durbin-Watson Test

R-squared	0.505518	Mean dependent var	11.45819
Adjusted R-squared	0.385238	S.D. dependent var	0.493820
S.E. of regression	0.387188	Akaike info criterion	-2.077676
Sum squared resid	5.546834	Schwarz criterion	-1.684027
Log likelihood	58.82538	Hannan-Quinn criter.	-1.929543
F-statistic	4.202863	Durbin-Watson stat	1.909434
Prob(F-statistic)	0.000843		

The following Figure 1 will explain that the result of the D-W table values with n = 48 and k (independent variable) as many as 2, then obtained the value dL = 1.3167, dU = 1.7725. The sum result of 4 – dU = 2.2275 and 4 – dL = 2.6833. In Table 4.18, the D-W statistic value is 1.909434. In Chart 4.1 it is known that the D-W values are 1.909434 > dL and dU < 4 – dU and 4 – dL. With the proof using the D-W table, it can be concluded that in the GARCH estimation model (1.1) used by the researcher, there is no autocorrelation. The results of the proof can be seen in figure 1 below:

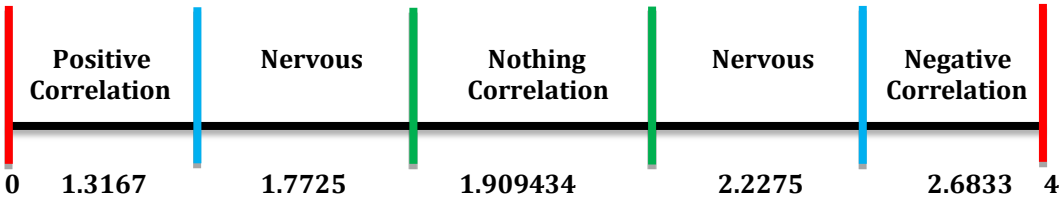

Figure 1. Proof of Autocorrelation Assumption Test

Normality Test

The normality test aims to find out whether the distributed data is normal or vice versa, by looking at the probability value ofJarque-Bera should be greater than 5 percent. Here are the results of the normality test calculation:

Table 13. Normality Test

Jarque-Bera	2.146956
Probability	0.341818

Source: Appendix 15

Table 13 shows that the Jarque-Fallow statistical value is 2.146956> 0.05 with a probability of 0.341818, so it can be argued that the residuals in the GARCH model (1.1) are normally distributed.

Discussion

Response of Foreign Exchange Reserves to Changes in Exports

The response of foreign exchange reserves to changes in exports is based on the results of estimation of export variables to foreign exchange reserves using the GARCH model (1.1), it can be seen that exports (X1) have a positive relationship and a significant influence on foreign exchange reserves at α = 5 percent, and the value of the coefficient is 3.077457> 1.68195 with a probability of 0.0021, meaning that if exports increase by 1 unit, foreign exchange reserves will increase by US$ 3,077457 million from the original value.

Exports are closely related to foreign exchange reserves, judging from the results of the study shows that export variables have a positive and significant effect on Indonesia's foreign exchange reserves. The results of this study are in accordance with the theory put forward by David Hume who said that if a country has a trade balance surplus (exports > imports), there will be an influx of gold which causes the money supply to increase, which means it will increase foreign exchange reserves. Meanwhile, according to the theory of mercantilism, in order to develop the national economy and economic development, the amount of exports must be greater than the amount of imports. If exports are greater than imports, it will increase foreign exchange reserves. The results of this study are also in line with research conducted by Benny (2013), Agustina and Reny (2014), Sayoga and Tan (2017), and Putri (2017) which shows that exports have a positive effect on Indonesia's foreign exchange reserves. Putri (2017), stated this because when exports increase, the country's income in the form of foreign exchange or foreign exchange reserves will increase. So it is proven that exports can increase foreign exchange reserves.

Response of Foreign Exchange Reserves to Changes in Imports

The response of foreign exchange reserves to changes in import variables has a negative and significant effect on the variables of Indonesia's foreign exchange reserves as indicated by a coefficient value of (-3.991749)< 1.68195 with a probrillity value of 0.0001 at α = 5 percent. This means that if the import of nail 1 unit, it will cause foreign exchange reserves to decrease by US $ (-3.991749) million from the original value. This is because import financing will reduce Indonesia's foreign exchange reserves.

Changes in import variables have a negative and significant effect on Indonesia's foreign exchange reserves. In the theory of mercantilism, Where to develop the national economy and economic development, the amount of exports must be greater than imports. If exports > imports, then foreign exchange reserves will increase. Likewise, according to David Hume, who stated that if exports > imports, it would increase foreign exchange reserves.

The results of this study are in line with the results of the study (Benny, 2013), which states that imports have a negative and significant effect on foreign exchange reserves. In importing, the Indonesian government will finance these imports with Indonesia's foreign exchange reserves, namely if the number of imports increases, foreign exchange reserves will decrease. However, the increase in imports was triggered by strong domestic demand for these imported goods followed by cheaper raw materials in Indonesia and cheap labor costs, thus attracting investors to make foreign investment in Indonesia by building factories for goods that are always imported, so that the inflow of foreign capital funds will result in a surplus in Indonesia's trade balance so that foreign exchange reserves also increase.

Response of Foreign Exchange Reserves to Changes in Rupiah Exchange Rate

The response of foreign exchange reserves to changes in rupiah exchange rate variables has a negative and significant effect on the variables of Indonesia's foreign exchange reserves

as indicated by a coefficient value of (-4.088218)< 1.68195 with a probability of 0.0000 at α = 5 percent. This means that if the exchange rate increases by 1 unit, foreign exchange reserves will decrease by US$ (-4.088218) million from the original value.

The relationship of the exchange rate to foreign exchange reserves can be explained through a phenomenon that shows that the more foreign exchange is owned by the government and residents of a country, which means that the greater the country's ability to conduct international economic and financial transactions and the stronger the value of the currency. The higher the currency exchange rate in one's own country indicates that the stronger the country's economy is, so it can earn more foreign exchange.

If the rupiah exchange rate weakens and economic conditions are unstable, it will cause foreign exchange reserves to also weaken. The results of this study are in line with the results of research by Dianita and Zuhroh (2018) which stated that the variable rupiah exchange rate has a negative and significant effect on Indonesia's foreign exchange reserves.

Response of Foreign Exchange Reserves to Changes in External Debt

The response of foreign exchange reserves to changes in foreign debt variables has a positive and significant effect on Indonesia's foreign exchange reserves as indicated by a coefficient value of 8.844217 > 1.68195 with a probability of 0.0000 at α = 5 percent. This means that if foreign debt increases by 1 unit, then Indonesia's foreign exchange reserves will increase by US$ 8,844217 million from the original value.

Coefficient of foreign parameters the positive can indeed increase foreign exchange reserves, which was originally in the form of loans that can strengthen foreign exchange reserves. External debt is an external source of finance in the form of grants or loans that can play an important role in trying to supplement the shortage of domestic sources to accelerate foreign exchange growth and savings. Foreign debt can indeed increase foreign exchange reserves which were originally in the form of loans that can strengthen foreign exchange reserves, but every foreign loan received by Indonesia will increase the accumulated debt and in turn the accumulated debt must be paid through debt repayment where this payment will obviously increase foreign exchange. The results of this study are in line with the research (Sayoga and Tan, 2017; Putri, 2017), which states that the variable external debt has a positive and significant effect on Indonesia's foreign exchange reserves.

CONCLUSION

Estimates with the GARCH model (1.1) show that together the variables of exports, imports, rupiah exchange rates, and external debt have a significant effect on Indonesia's foreign exchange reserves. The results of the estimation with the GARCH model (1.1) can be concluded that the export variable has a positive and significant effect on Indonesia's foreign exchange reserves. Import variables have a negative and significant effect on Indonesia's foreign exchange reserves. The rupiah exchange rate variable has a negative and significant effect on Indonesia's foreign exchange reserves, and the external debt variable has a positive and significant effect on the reserve variable. This research is still limited to the variables that are used as the basis for the research model, therefore it is necessary to consider information from the variable measurement of the number of Indonesian workers working abroad at various income levels, so that it can be known its role in the reserves of increasing foreign exchange reserves in terms of labor.

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