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Research Article

Does Exchange Rate Determine Foreign Debt? An Empirical Evidence from Indonesia

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Abstract: This study aims to explore both short- and long-run effect of foreign exchange reserves and exchange rate on foreign debt in Indonesia over the period from 2010.Q1-2017.Q4. Using the Autoregressive distributed lag (ARDL) approach; the study found that, in the long-run, the foreign exchange reserves have no significant effect on foreign debt, while the exchange rate has a positive significant effect on foreign debt. On the other hand, both foreign exchange reserves and exchange rates have positive significant effects on foreign debt in the short-run. These findings implied that to manage the foreign debt in the country, the economic policy should be focused on stabilizing the Indonesian Rupiah against the currencies of major trading partners.

Keywords: International trade; foreign debt; Exchange reserves; Exchange rates; ARDL.

INTRODUCTION

Economic progress in developing countries to a great extent contributes to global economic development. In the current global era, countries have been more adhering to and implement an open economic system. Thus, international trade has been becoming an integral part of the economic progress of a country. According to Seyoum (2014), international trade is the exchange of goods and services that cross different regional boundaries. International trade is a forum and opportunity that can increase wider employment opportunities, increase income, and most importantly as a forum that might be able to increase a country's foreign exchange reserves. On the other hand, international trade can also cause losses and negative impact to the country itself such as dependence on imported goods that are of higher quality and high technology, which consequently creates foreign debt in large quantities. Apart from foreign trading, foreign debt also arises due to the need for a country to fund national development through international borrowings.

Indonesia is a country that records high and fluctuating foreign debt. Over the past few years, Indonesia has recorded a steady increase in foreign debt where foreign debt in 2016 is estimated to increase by 3% from the previous year. Indonesia's foreign debt also increased again in 2017 to 10.1%. According to Suryabrata (2015), when viewed from sectoral allocations, the increasing amount of Indonesia's foreign debt is due to government targeting of various infrastructure developments such as public infrastructure, defence and security, and energy infrastructure. The need for various infrastructure financing has prompted the government to make a decision to continue to owe other countries.

There have been many variables affecting changes in foreign debt. Foreign exchange reserves are one of the variables that can affect the fluctuation of foreign debt in a country where foreign exchange reserves are a source of foreign debt financing. Bank Indonesia (2018) emphasizes that foreign exchange reserves are one of the variables that play an important role in maintaining macroeconomic and financial system stability. Theoretically, the high amount of foreign exchange reserves will have an impact on the decrease in the amount of foreign debt and conversely, the low amount of foreign exchange reserves will have an impact on increasing foreign debt.

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Indonesia recorded the lowest foreign exchange reserves in the 2013 - 2013 periods. Ironically, Indonesia's foreign exchange reserves recorded in the two periods were considered quite well when compared to foreign exchange reserves in the last few periods. According to Bank Indonesia (2014), Indonesia's foreign exchange reserves in 2013 were considered capable of financing 5.7 months of imports and foreign debt. Indonesia's foreign exchange reserves then began to decline again in the first quarter of 2015 before finally returning to increase until the 2017 period.

Another variable that affects foreign debt is the exchange rate. Ekananda (2014) argues that exchange rates are the price of a currency relative to the currencies of other countries that have an important role in spending decisions because the exchange rate allows us to translate prices from various countries into a common language. The exchange rate can also determine the value of the amount of foreign debt that must be repaid where when a country pays the debt it is paid in the form of foreign currency in accordance with the currency of the country loaned. The Indonesian Rupiah (IDR) exchange rate includes a weak exchange rate per USD. The IDR continued to depreciate after the 1998 crisis where at that time the IDR reached IDR10,000 per USD, whereas before the crisis occurred, in 1996 the average IDR was estimated at only IDR 2,000 per USD. According to Mourad (2016), the depreciation of the IDR was supported by the application of the free-floating exchange rate system on August 14, 1997.

Overall, it can be concluded that changes in foreign exchange reserves will have an impact on the composition or amount of foreign debt where if a country's foreign exchange reserves are recorded in large quantities, the greater the foreign debt that can be paid or paid off. While the appreciation of the exchange rate is also a very important measure because it can determine the amount of foreign debt to be repaid because when paying the foreign debt the government will pay the current exchange rate (Mourad, 2016).

Previous studies on the topic of foreign exchange reserves, exchange rates, and foreign debt have been investigated, focusing on the developed and developing countries using various econometric approaches and different period of study. For example, based on the cointegration approach, Fida *et al.,* (2012) found a cointegration relationship in the long term between the variable exchange rate and foreign debt. For the case of the Nigerian economy, Abdullahi *et al.,* (2015) found a negative influenced of exchange rate on short- and long-run foreign debt, while and Anidiobu and Okolie (2016) found a positive response of exchange rate to foreign debt. Using a vector autoregressive (VAR) model, Qian and Steiner (2017) found that foreign exchange reserves have a positive relationship with government foreign debt and private foreign debt. Finally, for the case of Indonesia, Lygina *et al.,* (2015) examined the Granger-causal relationship between foreign exchange reserves and foreign debt over the period 2003-2013 and documented a unidirectional relationship between foreign exchange reserves and foreign debt.

Unlike the above previous studies that investigated the interrelationships between foreign exchange reserves, exchange rates, and foreign debt using VAR, cointegration, and Granger causality approaches, this study using the autoregressive lag (ARDL) technique to investigate and analyze more deeply whether foreign exchange reserves and exchange rates affect Indonesia's foreign debt in both the long- and short-run perspectives. Due to its superiorities over the other econometric techniques (Majid, 2007c; Yusof and Majid, 2007; Kassim and Majid, 2008; Majid and Yusof, 2009; Karim and Majid, 2010; Majid and Kassim, 2015; Majid *et al.,* 2018; and Dewi at al., 2018), the adoption of ARLD in this study is hoped to enrich the existing debatable relationship between foreign exchange reserves, exchange rates, and foreign debt for the case of Indonesia.

The rest of this study is structured in the following sequences. Section 2 reviews selected relevant previous studies on the investigated topic. Section 3 provides the estimated model and its estimation technique. Section 4 discusses the findings and their implications, and finally, Section 5 concludes the study.

LITERATURE REVIEW

Previous studies on the topic of foreign exchange reserves, exchange rates, and foreign debt have been focused on the developed and developing countries using various econometric approaches and different period of study. For example, Fida *et al.,* (2012) examined the role of foreign debt in exchange rate fluctuations by using the Johansen cointegration approach to explore the long-run relationship between exchange rate and foreign debt. They found a cointegration relationship between the exchange rate and foreign debt.

For the case of India, Mehta and Hatim (2014) found that, one of the factors that led to an increase in the amount of foreign debt and the depreciation of the exchange rate was the decline in the value of the domestic currency in which foreign debt payments resulted in an increase in demand for foreign currencies. This study found that the rate of debt acceleration was 11.80% in the compound annual growth rate. The Indian Rupee exchange rates also depreciated as debt increased.

Meanwhile, for the case of Nigeria, Abdullahi *et al.,* (2015) analyzed whether foreign debt stock was determined by macroeconomic components such as interest rates, national savings, exchange rates, and budget deficits both in the long- and short- term. They found that interest rates, exchange rates, and budget deficits were negatively and significantly related to short- and long-term foreign debt stocks. Unlike the study by Abdullahi *et al.*, (2015), Anidiobu and Okolie (2016) found that, foreign exchange rates had a positive response to foreign debt in Nigeria, suggesting that in achieving a realistic exchange rate, foreign debt must be directed at increasing production in the non-oil sector, efforts to import less and export more.

Furthermore, in their study, Senibi *et al.,* (2016) found that foreign debt is used to increase foreign exchange reserves, balance the payment deficit, and shortages in income. These have caused a continuous increase in debt stock at an alarming rate. The study further revealed that public debt and foreign exchange reserves were positively and significantly related in the long run, which showed that the sovereign debt crisis can be associated with exogenous and endogenous factors such as the nature of the economy, economic policy, high dependence on oil, and foreign exchange. The exchange rate also affected foreign debt where theoretically if the exchange rate depreciates, it caused an increase in foreign debt and vice versa.

Finally, according to Sayoga and Tan (2017), foreign exchange reserves are external assets that have liquid criteria, a ratio that shows the ability to repay debt, in the main foreign currency denomination, under the control of the monetary authority and can be used to settle international transactions or international trade. Thus, foreign exchange reserves are related to foreign debt. Similarly, using the VAR approach, Qian and Steiner (2017) found that foreign exchange reserves have a positive relationship with foreign debts, both government foreign debt and private foreign debt. The higher reserves the country has, it could reduce the cost of short- and long-term foreign debt by reducing the risk of debt contracts. For the case of Indonesia, Lygina *et al.,* (2015) examined the Granger-causal relationship between foreign exchange reserves and foreign debt over the period 2003-2013 and documented a unidirectional relationship between foreign exchange reserves and foreign debt.

Using various empirical frameworks, focusing on different countries, and utilizing different data period, the above-reviewed studies showed mixed findings of the relationship between foreign exchange reserves, foreign currency, and foreign debt. Thus, to enrich the existing empirical evidence on the topic with the latest data period from the perspective of the emerging Asian economy, this study explores the short- and long-run relationship between foreign exchange reserves, foreign currency, and foreign debt for the case of Indonesia using the latest cointegration technique of the ARDL.

RESEARCH METHOD

Data

This study utilizes secondary quarterly data over the period from 2010 to 2017. These data are gathered from Bank Indonesia, the World Bank, and CEIC's Global Database. All variables in this study are transformed into a natural logarithm. This include foreign debt (LFD) as the dependent variable, which expressed in the USD million, foreign exchange reserves (LFXR) as the independent variable, which is expressed in the USD million, and exchange rate (LXR) as the independent variable, which is expressed in the cross rate, IDR/USD.

Empirical Model

The following model is proposed to be analysed using the ARDL techniques, as follows:

$$D(\mathrm{LFD})_t = \beta_{01} + \sum_{i=1}^{k} \beta_{11}(\mathrm{LFD})_{t-i} + \sum_{i=1}^{k} \beta_{12}(\mathrm{LFXR})_{t-i} + \sum_{i=1}^{k} \beta_{13}(\mathrm{LXR})_{t-i} + \theta_{11}\mathrm{LFD}_{t1} + \theta_{12}\mathrm{LFXR}_{t1} + \theta_{13}\mathrm{LXR}_{t1} + \varepsilon_{t1} \quad (1)$$

where L is the natural logarithm, FD is the foreign debt, FXR is the foreign exchange reserves, XR is the exchange rate, D is the first difference, β_{ii} are the constant and the estimated short term coefficient, θ_{ii} are the estimated long term coefficient, ε is an error term, and k is the lag-length.

FINDINGS AND DISCUSSION

Prior to the ARDL model estimation, there are several tests need to conduct such as tests of the stationary test, optimal lag-lengths' determination, cointegration, diagnostics (i.e., normality, autocorrelation, and heteroscedasticity), and model stability to ensure the goodness of fit of the estimated model.

Table 1 illustrates the findings from the stationary test based on the Philips-Perron. The results of the stationary test showed that the foreign debt (FD) and exchange rate (XR) were stationarity at first different [I (1)], while the foreign exchange reserves were stationarity at the level [I (0)]. These findings satisfy the use of ARDL technique as the model requires the dependent variable, FD to be stationarity at the first difference, while other independent variables can be stationarity either at the level or first difference (Majid, 2007a; Majid, 2008).

Table1. Test of stationarity

Variable	Log Level	First-Difference	Remark
	P-value		
FD	0.0717	0.0000**	I(1)
FXR	0.0467**	0.0387	I(0)
XR	0.9009	0.0015**	I(1)

Note: ** indicates significance at the 0.05 level.

In the next step, the study determines the lag-length to be included in the estimated ARDL model. Using the Akaike Information Criteria (AIC), the optimal lag-length = 5 was found to be the number of optimal lag to be included in the model.

After identifying the lag-length, the study proceeds to test the existence of cointegration relationship among the variables using the Pesaran *et al.,* (2001) bound testing to cointegration. The purpose of this test is to determine whether non-stationary variables are cointegrated or not. Table 2 reports the findings from the cointegration test.

Table2. Test of cointegration

F-statistics	Critical Values		Remark
	Lower Bound, I(0)	Upper Bound, I(1)	
1% significance level	5.15	6.26	Cointegrated
5% significance level	3.53	4.42	
10% significance level	2.91	3.69	

As observed from Table 2, the result of a cointegration test showed that the value of F-statistics of 8.255 is greater than the critical values of I(0) bound and I(I) bounds, indicating the rejection of the null hypothesis of no cointegration at the 1% level of significance. In other words, our findings imply a cointegration relationship existed between foreign exchange reserves and exchange rate and foreign debt in the Indonesia economy.

Having identified the existence of cointegration among the variables, in the next step, the ARDL model is estimated to identify the nature and magnitude of the effects of foreign exchange reserves and exchange rate on the foreign debt. The findings from the ARLD model are reported in Table 3.

Table3. The estimated ARDL Model (5, 4, 2)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LFD(-1)	0.1797	0.1806	0.9949	0.3379
LFD(-2)	0.1682	0.1765	0.9527	0.3581
LFD(-3)	-0.1294	0.1668	-0.7757	0.4518
LFD(-4)	0.1626	0.1746	0.9360	0.3663
LFD(-5)	0.4809***	0.1622	2.9651	0.0109
LFXR	-0.2434*	0.1184	-2.0558	0.0605
LFXR(-1)	0.3368**	0.1560	2.1049	0.0553
LFXR(-2)	-0.1515	0.1697	-0.8931	0.3880
LFXR(-3)	-0.2738	0.1727	-1.5858	0.1368
LFXR(-4)	0.1238	0.0965	1.2824	0.2221
LXR	-0.2107	0.1657	-1.2714	0.2259
LXR(-1)	0.6007***	0.2346	2.5605	0.0237
LXR(-2)	-0.2794	0.1922	-1.4538	0.1697
Constant	3.1715	1.0045	3.1572	0.0076
R^2 = 0.994; Adj. R^2 = 0.988; D-W stat = 1.881; F-stats. = 172.337; Prob. = 0.000				

Note: ***, **, and * indicate the 1%, 5%, 10% significance levels.

As observed from Table 3, the estimated ARDL (5, 4, 2) model showed that the foreign exchange reserves of the current period and one previous period had affected foreign debt at the 10% and 5% levels of significance, respectively. The exchange rate is also found to affect the foreign debt at the 5% level of significance. Meanwhile, the foreign debt in the previous five periods also affected the current value external debt at the 1% level of significance. Overall, the variations in foreign debt could be explained by the changes in foreign exchange reserves and exchange rate by 98.8%, as showed by the value of adjusted R-squared of 0.988.

In the next section, the findings of long- and short-run relationships between foreign exchange reserves and exchange rate and foreign debt are reported in Tables 4 and 5, respectively. As shown by Table 4, in the long-run, the foreign exchange reserves were found to have no significant effect on foreign debt, implying that changes in foreign exchange reserves would not affect Indonesia's foreign debt position. This finding is in line with the previous study by Lygina *et al.,* (2015) who found no relation between foreign exchange reserves and foreign debts in Indonesia's and Singaporean economies.

Table4. The long-run relationship between foreign exchange reserves, Exchange rate and foreign debt

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LFXR	-1.5166	2.5201	-0.6018	0.5577
LXR	0.8055***	0.2094	3.8472	0.0020
C	23.0992	30.6446	0.7538	0.4644

Note: *** indicates the 1% significance level.

In contrast to foreign exchange reserves, the exchange rate is found to have a significant effect on foreign debt at the 1% level of significance, indicating a change in the exchange rate caused the changes in the position of Indonesia's foreign debt. The finding is supported by Arize and Igwe (2017), who found that exchange rate depreciation caused an increase a surplus in the trade balance, and conversely, the appreciation of the exchange rate resulted in a deficit trade balance and consequently increased the foreign debt. When the exchange rate of a country appreciates, the price for the country's exported goods would decline, whilst the price of imported goods would increase (Karim and Majid, 2009). Similar results are also found in the study by Widharma and Budhi (2011), who found a significant effect of the exchange rate on the government foreign debt.

Finally, Table 5 reports the findings of the short-run relationships between foreign exchange reserves and exchange rate on foreign debt in Indonesia over the 2010-2017 periods.

Table5. Short-run relationship between foreign exchange reserves, exchange rate, and foreign debt

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LFD(-1))	-0.6830***	0.1368	-4.9922	0.0002
D(LFD(-2))	-0.5149***	0.1385	-3.7173	0.0026
D(LFD(-3))	-0.6443***	0.1298	-4.9654	0.0003
D(LFD(-4))	-0.4809***	0.1422	-3.3824	0.0049
D(LFXR)	-0.2434***	0.0910	-2.6752	0.0191
D(LFXR(1))	0.3016***	0.0903	3.3383	0.0053
D(LFXR(2))	0.1500	0.0976	1.5373	0.1482
D(LFXR(3))	-0.1238	0.0767	-1.6139	0.1306
D(LXR)	-0.2107	0.1237	-1.7031	0.1123
D(LXR(-1))	0.2794*	0.1365	2.0468	0.0614
ECT(-1)	-0.1373***	0.0215	-6.3751	0.0000

Note: ***, **, and * indicate the 1%, 5%, and 10% significance levels.

As illustrated in Table 5, the short-term estimation, the error correction term (ECT) is included in the analysis to identify the speed of adjustment of short-run disequilibrium to be cleared in the long-run. The study found that the contemporaneous foreign exchange reserves and one previous period have a significant effect on foreign debt at the significance level of 1%, while the exchange rate of one previous period also found to affect foreign debt at the level of significance of 10%. Additionally, the previous period's foreign debt is also documented to affect foreign debt. Specifically, the previous one-to-four period of foreign debt has a significant effect on the current period of foreign debt at the significance level of 1%. These findings signify the importance of both foreign exchange reserves and exchange to be well-managed by the policy-makers in order to control the acceptable level of foreign debt in the country.

As for the estimated ECT value, the study found it positively significance at the 1% level with the value of -0.1373. This indicates that any short-run disequilibrium existed in the foreign debt; it would be corrected by 13.73% in the next quarters to moving towards long-run equilibrium. In other words, it would take about 7.5 quarters for short-run imbalances to restore into the long-run equilibrium.

Finally, to ensure the robustness of our estimated model, the assumptions of classical linear regression models such as the normality test, autocorrelation, and heteroscedasticity are provided. If all these assumptions are fulfilled, the estimation results would be BLUE estimator (Best Linear Unbiased Estimator). Thus, testing assumptions to obtain a BLUE model can be done through the diagnosis of residual values (Pesaran *et al.*, 2001; Majid, 2007b). In this study, the normality test is carried out using the Jarque Bera test, while the heteroscedasticity and autocorrelation are tested using the Breusch-Godfrey LM test and Breusch Pagan test. The findings of these classical assumptions are reported in Table 6.

Table6. Diagnostic tests

Test	Statistic value	p-value
Normality (Jarque-Bera test)	1.1679	0.5576
Autocorrelation (Breusch-Godfrey LM test)	0.1158	0.7569
Heteroscedasticity(Breusch Pagan test)	0.3286	0.9870

As shown from Table 6, the study found all classical assumptions are fulfilled, as indicated by the insignificance of the statistic values of Jarque Bera test for normality, Breusch-Godfrey LM test for heteroscedasticity and Breusch Pagan test for autocorrelation are tested. These findings confirmed that the data estimated using the ARDL model in this study were all normally distributed, non-autocorrelated, and homoscedastic, thus indicating that our estimated model is a valid or BLUE model.

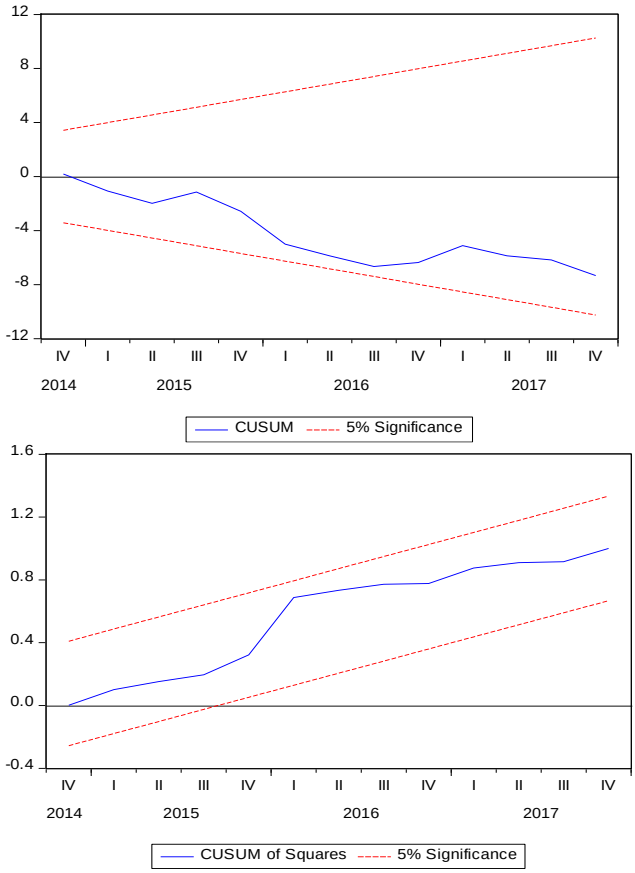

Figure1. Plots of CUSUM and CUSUMQ

The stability of our estimated ARDL model is also shown by the following CUSUM (cumulative sum) and CUSUMQ (cumulative sum of squares) tests. The results of the CUSUM and CUSUMSQ tests are presented in Figure 1. As illustrated by Figure 1, our estimated parameters are found to be stable at the level of 5%, as indicated by the cumulative sum and cumulative sum of squares plots are within the 5% significance lines. In short, our estimated model was BLUE and stable, thus its findings could robust and be

referred by policy-makers in designing a proper macroeconomic policy to manage foreign debt by focusing on stabilizing the foreign exchange reserves and exchange rate.

CONCLUSION

This study provided the empirical shreds of evidence of the short- and long-run effects of foreign exchange reserves and exchange rate on foreign debt in Indonesia over the period from 2010.Q1-2017.Q4. Using the Autoregressive distributed lag (ARDL) approach; the study documented that, in the long-run, the foreign exchange reserves have no significant effect on foreign debt, while the exchange rate has a positive significant effect on foreign debt. On the other hand, both foreign exchange reserves and exchange rates have positive significant effects on foreign debt in the short-run. These findings implied that to manage the foreign debt in the country, the economic policy should be focused on stabilizing the Indonesian Rupiah against the currencies of major trading partners. In addition, the government and monetary authorities should enhance foreign exchange reserves by promoting exports of goods and services to its trading partners that benefit the domestic economy of Indonesia.

To further enhance the empirical findings on the relationship between exchange reserves and exchange rate on foreign debt in Indonesia, future studies might incorporate more economic and non-economic factors and countries into the model. Identifying the causal relationship between the variables could also provide a comprehensive insight into the directional causalities between foreign debt and its determinants using panel cointegration analysis. Finally, comparing foreign debt and its determinants growth across ASEAN countries could also offer a comprehensive picture of the investigated topic.

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