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Rupiah's Overshooting Phenomenon

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Abstract

This research examines whether Rupiah to US Dollar exchange rate experienced overshooting or not. In addition, this research examines the short-run partial effect between GDP (Gross Domestic Product), Inflation and Interest Rates on the Rupiah exchange rate. The data used in this research were quarterly secondary data on Rupiah/USD spot exchange rates, Constant GDP, Consumer Price Index (CPI), and Bank Indonesia Interest Rates in the 2007-2018 period. The analytical method used in this research is Autoregressive Distributed Lag (ARDL). The results showed that the Rupiah experienced overshooting, in addition to partial testing shows that in the short run, GDP negatively affects the Rupiah exchange rate, Inflation positively affects the Rupiah exchange rate, and Interest rates does not affect the Rupiah exchange rate.

Keywords: Overshooting, Rupiah, GDP, Inflation, Interest Rate

1. Introduction

An important indicator for countries that embrace an open economy is the exchange rate. The exchange rate system reflects the stance of the country in carrying out economic activities especially economic activities related to international trade. One of the crucial phases of the Indonesian monetary and exchange rate system occurred in August 1997 when Bank Indonesia gave up intervention and changed the exchange rate system from managed floating to free floating because the Rupiah had external pressures and the depletion of foreign reserves. However, the policy had a negative impact towards the value of the Rupiah which caused investors to lose their confidence in the Rupiah and made the Rupiah increasingly depressed at that time (Anindhita, 2017).

In an integrated global economy, Rupiah faces unpredicted external pressures. The 2008 financial crisis as a result of the failure of the subprime mortgage mechanism in America had a global impact, including Indonesia. Throughout 2008, the Rupiah had considerable pressures. Noted, from Rp 9,393/$ in the end of January to Rp 12,100/$ in the end of November 2008 (Afif, 2017)

Although the United States economy began to resume, the effects of monetary policy normalization on the crisis which struck in 2008 were still felt by Indonesia. In 2018, there was an improvement in the global economy marked by rising prices of global securities in general. The growth of the American economy also had a significant effect in improving the global economy. On the other hand, to anticipate an overheating economy, the Fed as the US monetary authority was predicted to increase the benchmark interest rate in the future (Suidarma et al., 2018)

In 2018, there were some pressures towards Rupiah in June due to strength of the Dollar globally. The position of the rupiah in mid-June 2018 was Rp 13,853/$. However, due to aggressive changes in monetary policy taken by the Fed in the face of changes in economic policy by China and Europe and anticipating global uncertainty, it triggered the weakening of global currencies including

the Rupiah. At the end of June 2018, the Rupiah was at Rp 14,390 which was deposited quite sharply, at 3.44% from the end of May 2018. Compared to December, the value of the Rupiah at the end of June 2018 had depreciated by 5.72%. This depreciation was much lighter than the currency depreciation occurred in other countries such as the Philippines, India, Brazil and Turkey (Bank Indonesia, 2018)

According to Warjiyo (2013), as a small country with an open economy, the market value of Rupiah rarely reflects its real value. In the face of external and internal pressures, the Rupiah has fluctuated and experienced overshooting. The concept of Exchange Rate Overshooting theory was first introduced by Rudi Dornbusch in 1976. Dornbusch (1976) put forward a hypothesis about high exchange rates that showed exchange rate fluctuations trigger shocks in money supplies in an economy and a sticky price model that explains exchange rate fluctuations. Overshooting is a condition in which changes in monetary expansion in the short run will result in currency depreciation exceeding the long-run balance. There are several reasons which are believed to trigger overshooting. For example when there is speculation and asymmetric financial markets will spurr the exchange rate to increase. In addition, the occurrence of a trade balance deficit toward partner countries is believed to cause overshooting of the currencies of countries experiencing deficits (Amin et al., 2018). In general, the concept of exchange rate overshooting explains the mechanism by which the short-run exchange rate response to exogenous shocks, exceeds the long-run response (Chiliba et al., 2019)

According to Frankel (1979), there are a number of macroeconomic variables which cause exchange rates to fluctuate in the short run. These variables are changes in the short-run money supply, Gross Domestic Product (GDP), interest rates and domestic inflation rates. Therefore, this research will try to analyze whether overshooting occurs due to changes in the money supply, GDP output, interest rates, and domestic inflation in Indonesia

2. Literature Review

Overshooting Theory of Dornbush

Dornbusch (1976) proposed a theory about exchange rate overshooting which states that Overshooting process would occur if the exchange rate moves to its fundamental value faster than the price of goods and services. Furthermore, Dornbusch described the price level as a variable which is rigid and slow in adjusting to its equilibrium value. This theory explains that adjustments to exchange rates and price levels do not occur at the same speed. If there is monetary expansion by the central bank in the short run, increases of money in circulation will definitely trigger increases in interest rates, where the exchange rate will adjust to the equilibrium value. In 1980, Dornbusch developed the concept of dynamic exchange rates which explained the process of adjusting the exchange rates toward monetary variables. The monetary injection by the central bank will make the exchange rates depreciated in the short run, which will cause interest rates to increase. During exchange rates' adjustment period, it's possible for good and service's prices to increase in line with the newly-adjusting prices of goods and services due to an increase in interest rates. Besides, the inflation rates can skyrocket if the prices of good and service are unstable as the result of the intermittently adjusting value of the exchange rates. In Dornbusch's theory, it is explained that the inflation is a critical channel of monetary policy transmission to influence domestic aggregate output (Dornbusch, 1980)

Exchange Rate

Mankiw (2007) defines the exchange rate as the currency's value toward unit or value of other countries' in conducting trade. There are two types of currencies. First, the nominal exchange rate is

a measure of comparison of currencies among countries, in which this comparison is relative. This exchange rate is often related to the nominal price of a country's currency in the financial market. Second, the real exchange rate is a relative comparison of goods and prices' value between two countries when carrying out a trade. The real exchange rate is valued with the nominal exchange rates and comparing price levels of both two countries.

The Money Supply

Total of money supply is an money available in an economy in a country (Sukirno, 2004). The money supply is divided into two runs; Firstly, the money supply in the narrow meaning (M1) consists of the total of money in circulation added with demand deposits owned by the community. Secondly, the money supply in the broad meaning (M2) consists of M1 added with savings, time deposits, and foreign exchange accounts owned by the domestic and private sector.

Inflation

According to Rahardja (2008) the inflation is a circumstance where the prices of goods increase continuously. Besides, Boediono (1998) classifies inflation into two groups. First, inflation is classified from its origin, namely domestic inflation that happens as increases of goods' prices in the country. Then, imported inflation happens as increases of goods' prices abroad. Second, inflation is classified as the factor. The causes of inflation can be divided into three. First, core inflation is inflation which occurs due to general economic development such as inflation expectations, the exchange rate, and the balance between demand and supply aggregate. Second, volatile food inflation is inflation which occurs due to food material turmoil due to certain factors such as weather and harvest season. Third, administered inflation is inflation that the development is regulated by the government such as changes in fuel prices.

Interest Rate

Husnan (2006) explaines the interest rate as the ratio of return on a number of investments in return given to investors. Sjahrial (2007) explains that the effect of interest rates on a financial asset depends on the level of asset price sensitivity and the maturity of the asset. The longer the maturity of a financial asset is, the greater the influence of the interest rate is where the high interest rate will make the risk of the financial asset higher.

Gross Domestic product

Total value of goods and services produced in an economy in a certain period is defined as Gross Domestic Product. The GDP's calculation is conducted without considering the owner of the factors of production. Therefore, GDP takes into account the value of goods and services produced both from these citizens and foreign nationals (Sukirno, 2004).

Previous Research

Suidarma et al., (2018) conducted Overshooting Theory of Dornbusch in Indonesia in period of 2010-2017 using VECM. The results showed the variable money supply both in the short and long does not affect the exchange rate. This proves that the Rupiah did not experience overshooting in this period.

Furthermore, research about Rupiah's overshooting was also conducted by Afif (2017) using the ARDL method. The results showed that the monetary injection will not cause Rupiah's depreciation based on period from 2005 to 2016. Thus, the Dornbusch's theory is not proven in that period. In addition, the research also examined other macroeconomics variables' effects towards exchange rates, where GDP both in short and in long run effects the exchange rates. Furthermore, Interest rates both in the short and long run positively effect on the volatility of Rupiah. In addition, inflation does not affect the short run but, in the long run, negatively affects the Rupiah's volatility.

The same findings about the ineffective monetary policy and short-run macroeconomic variables in influencing the Rupiah's value are also shown by the research of Amin et al., (2018). In his research, he used the variables of broad money, domestic inflation, interest rates and the exchange rate of Bangladesh from 1980 to 2015. The results showed that all variables the independent had no short-run effects on the exchange rate which proved overshooting does not occur toward the Bangladesh's exchange rate. However, the research had flaws as data used were very short only with annual data.

A different result is shown by Pratikto (2012). His research shows that Rupiah experienced overshooting in the period 1997 to 2004. His research reveals that monetary injections to the market liqudity, will trigger the Rupiah to depreciate beyond its long-run equilibrium level. In addition, the results of his research revealed that exchange rate control policies through the impossible trinity was not possible, and in his research, the capital flow variable is the variable that has to be sacrificed to achieve a stable exchange rate.

Falianty (2003) in her thesis examines Rupiah exchange rate volatility of a free floating regime using ECM. The findings show that Rupiah will be depreciated if the central bank injects the monetary liquidity. In addition, the effect of money supply in a free floating system has a significant effect toward Rupiah's volatility.

Besides, Wati (2014) researches the Rupiah's volatility using OLS using interest rates and inflation as the independent variables. Results of the research indicate that increases in interest rates will increase Rupiah, and decreases in the inflation rate will depreciate Rupiah.

Hypothesis:
H1: Rupiah exchange rate experienced an overshooting condition in which money supply affects positively toward Rupiah's exchange rate in the short run.
H2: GDP negatively affects the Rupiah's exchange rate in the short run.
H3: Inflation positively affects the Rupiah's exchange rate in the short run.
H4: Interest rates negatively affect the Rupiah's exchange rate in the short run.

3. Methodology

Data analysis techniques are used in answering research problems in the form of: Augmented Dickey-Fuller Test, Johansen Test of Cointegration and Autoregressive Distributed Lag (ARDL). Sample is a collection of objects which is researched (Algifari, 2016). The sample used in this research is quarterly data on the Money Supply (M2), Real GDP, Inflation, Bank Indonesia Domestic Interest Rates and Rupiah Spot Exchange Rates for the period 2007 to 2018. All data used in this study are obtained from the United States Central Bank of The Fed St. Louis through its website (https://fred.stlouisfed.org).

Research Model

This research model is developed from research model of Amin et al., (2018).The dependent variable in this research is the Rupiah/USD Spot Exchange Rate symbolized by ER, while the

independent variables used in this study are: M2 as a proxy for money supply circulating in Indonesia in Rupiah units, GDP shows Real Gross Domestic Product in Rupiah units and used to show Indonesia's economic growth, INF as a symbol of domestic inflation in Indonesia is measured using a percentage, and IR is an Interest Rate that shows the cost of holding assets in Indonesia. The following is basic model in this study:

$$LNER_t = \beta_0 + \beta_1(LM2) - \beta_2(LGDP) + \beta_3(INF) + \beta_4(IR)$$

In which:
LNER: Exchange Rate Logarithm
LM2: M2 Logarithm
LGDP: Real GDP Logarithm
INF: Inflation
IR: Interest Rate
t : Year of research observation

Stationarity Test

In ARDL test, the first step is to ensure that the data have been stationary. In time series regression, it is often found the result of spurious regression or not real results. Therefore, to ensure that no spurious regression occurs, the unit root test must be carried out. In time series data, non-stationary data that is often found at the level level, the data must be transformed into different forms of data (Gujarati, 2009). In this research, the stationary level experiment used the Augmented Dickey-Fuller Test (ADF). if the result of ADF value is higher than the Mac Kinnon statistical test value, the conclusion shows that the data are stationary.
The following below are hypotheses in ADF test:
H0: $\delta = 0$ so, data are not stationary or there is unit root
H0: $\delta \neq 0$ so, data are stationary or there is no unit root

Cointegration Test

Engle and Granger (1987) reveal concept about the concept of cointegration in which in the presence of non-stationary and cointegrated data, there will be a long-run balance. Furthermore, Pesaran and Shin (1999) introduced the Bound Test Cointegration method to produce balance in the long run, this cointegration test occurs if it follows the following equation:
$Y_t = \beta_0 + \beta_1 x_1 + e_t$
Then, operationalization of the variant of the equation can be written as follows:
$E_t = y_t - \beta_0 - \beta_1 x_1$
The decision making from Bound Test Cointegrations by comparing the value of F test obtained in cointegration test with the value of upper bound. If the F value is higher than that of upper bound, the conclusion is that there is cointegration. Conversely, if the F value is lower than that of upper bound, then no cointegration exists.

Derunination of Optimal Lag

The derunination of optimal lag length needs to conduct in doing test in the ARDL model. If a lag that is too short included in the econometric model, the model is not able to capture the dynamics of the overall model. However, if the lag entered is too long, then the model becomes inefficient because the value of the degree of freedom is reduced (Basuki & Prawoto, 2017).
The derunination of optimum lag length is based on the smallest value of lag which is proposed information criteria above. The processing length of the lag in E-views can produce

different results from each criterion. However, in this research, the best lag will be selected from the lag generated by the Akaike Information Criterion (AIC) criteria.

Autoregressive Distributed Lag (ARDL) and Error Correction Model (ECM)

This method is one of Econometrics tool to examine the long-run as well as short-run relation of independent variables toward the dependent variable. This model can be used when data is not at a different level of stationarity. The ARDL estimation results will produce a consistent long-run coefficient. The most important in ECM regression in the ARDL model is that the cointEq coefficient must be negative and significant to alpha. It shows that the ECM model is valid and can be used.

Significance Test (Partial Test)

Significance test is used to find out the partial effect of independent variables to the dependent variables. Alpha used is 5%. It means that the risk of error in decision making is 5%. If the prob. value is beyond the alpha, then the hypothesis proposed is rejected. Conversely, if the prob. value is lower the alpha, then the hypothesis proposed is accepted.

4. Result and Discussion

Statistic Test

The stationarity test is done using the ADF method by comparing the probability of output produced with a significance of 10%.

Table 1. Stationarity Test Result

	Level		1st Difference	
Variable	Probability	Information	Probability	Information
LNER	0.8734	Not stationary	0.0000	Stationary
LM2	0.0052	Stationary	0.0100	Stationary
LGDP	0.2174	Not stationary	0.00785	Stationary
INF	0.0000	Stationary	0.0000	Stationary
IR	0.2947	Not stationary	0.0002	Stationary

Source; processed Eviews 9.0

Based on the summary in Table 1 above, it is seen that two stationary variables are stationary in level and three variables are not. The stationary variables at the level are LM2 and INF. While the variables which are not stationary at the level level are LNER, LGDP, and IR. To make those variables stationary at the same level, thus the data will be differentiated to first level differentiation. Also seen from Table 1 above, all variable is stationary at the first level of differentiation at alpha 10%. Then the test can proceed to the Cointegration Test.

Table 2. ARDL Bound Test

Test Statistic	Value
Fstatistic	5.967730*
Significance	**1Bound**
10%	3.52
5%	4.01
2.5%	4.49
1%	5.06*

Source: Eviews 9.0 (Processed)

Table 2 shows that data used are already cointegrated in the long run. the F-statistic shows a higher value than that of upper bound. Thus, testing the data in this study is cointegrated in the long run.

Then, to derunine optimal lag, it is based on lag criteria generated by the Akaike Information Criteria (AIC) criteria;

Table 3. The Derunination of Optimum Lag

Akaike Information Criteria (top 20 models)
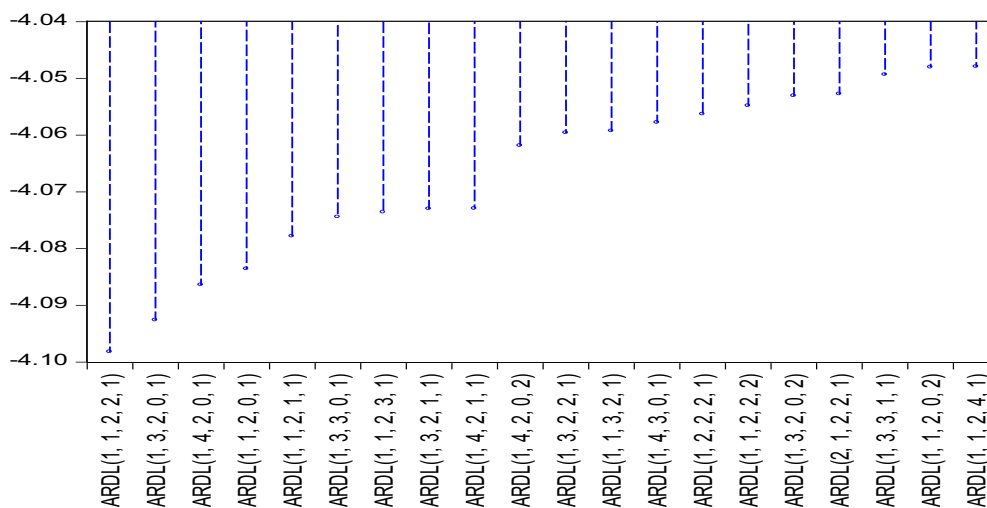
Source: Eviews 9.0 (Processed)

Table 3 points out the result from optimum lag derunination which shows optimal criteria for ARDL model is 1,1,2,3,1.

Hypothesis Test

After obtaining the best lag used in this study, the process is continued to Hypothesis test. The Table 4 shows the result of ECM ARDL processed with Eviews 9.0;

Table 4. ECM ARDL Regression

Cointegrating Form			
Variable	**Coefficient**	**Probability**	**Decision**
D(LM2)	0.888720	0.0175	H1 is accepted
D(LGDP)	-7.958761	0.0003	H2 is accepted
D(IR)	-0.017828	0.1178	H3 is rejected
D(INF)	0.020502	0.0005	H4 is accepted
CointEq(-1)	-0.171059	0.0466	

Source: Eviews 9.0 (processed)

LM2 variable shows a short-run positive coefficient of 0.888720 and the significance value of 0.0175, in which the significance value is smaller than alpha 5%. This means that Hypothesis 1 which states the overshooting occurs toward the Rupiah is accepted. LDGDP variable shows a short-run negative coefficient of 7.958761 and the significance value of 0.0003, in which the significance value is lower than alpha 5%. This means that hypothesis 2 which states that in the short-run, GDP negatively affects the Rupiah's exchange rate is accepted. IR variable has a negative coefficient of 0.0178 and a significance value of 0.1178, in which the significance value is greater than alpha 5%. This means that Hypothesis 3 which states that interest rate negatively affects the Rupiah's exchange rate is rejected. The INF variable shows a positive coefficient of 0.021 and a significance value of 0.0005, in which the significance value is smaller than alpha 5%. This means that hypothesis 4 which states that Inflation positively affects the Rupiah's exchange rate is accepted. CointEq value shows a negative coefficient of 0.171 and a significance value of 0.0466 in which the significance value is lower than 5%. It means that the ECM regression results are valid and can be used.

Overshooting Rupiah

The finding shows that monetary injection either through the forex market or securities in the short run will only depreciate the Rupiah value away from the its long-run value. Bank Indonesia's efforts to maintain the stability of the rupiah through monetary operations in this research period is ineffective. Therefore, in a controlled floating regime system, Bank Indonesia will only intervene through a systematic range of bands to keep Rupiah volatility from being too high or too low.

In this research period, Bank Indonesia used a range of upper and lower bands that were tenuous in its interventions on the money market because the range of tenuous bands allowed the rupiah to fluctuate depending on real sector conditions, and if the rupiah had exceeded the specified band's range, Bank Indonesia would intervene.

The role of real sector highly affects fluctuations in the value of the rupiah. The trade balance deficit will make the rupiah weaker, therefore, a strict coordination is needed from related parties, especially the ministries of finance, trade and Bank Indonesia to improve the condition of the trade balance deficit. Intervention policies which are accommodative toward economic growth must continue to be carried out by Indonesian banks. The Ministry of Trade seems to have to consider the condition of overshooting the rupiah as a gap to encourage exports to tighten the trade balance deficits. This finding is in line with the research done by Pratikto (2012).

The effect of GDP toward Rupiah's Exchange Rate

Test result shows that in short run, the growth of GDP will strenghten the Rupiah's value. This proves that the improvement on the real sector will boost the Rupiah's value toward USD. Economic growth which is supported by still-resilient purchasing power and increasing levels of public

consumption must be maintained by the government and Bank Indonesia in the midst of increasingly uncertain global economic conditions. These findings are in line with the research done by Afif (2017).

The effect of Inflation toward Rupiah's Exchange Rate

The finding shows that inflation affects positively toward Rupiah's exchange rate in the short run, where an increase in inflation will depreciate the Rupiah's value further away from the balanced value. The role of the TPID (Regional Inflation Control Team) seems to be effective, since it was formed in 2008, the TPID has been tasked with controlling regional inflation through market operations to maintain the stability of the prices of goods and services in the community.

Therefore, synergy between the government and Bank Indonesia is needed to stabilize the price, that is shown by the stable and subdued inflation. A low inflation will maintain purchasing power of society which will ultimately drive economic growth. Also, this finding is in line with result obtained by Wati (2014).

The Effect of Interest Rate toward Rupiah Exchange Rate

Test result shows that in short run, the interest does not negatively affect the rupiah's exchange rate. The central bank's intervention through the sale and purchase of securities is not able to affect the Rupiah's exchange rate in this period. Bank Indonesia intervention through interest rates is solely carried out to maintain domestic purchasing power and maintain cash flows which enter and exit from Indonesia. Although no effect exists to the exchange rate, the interest rate instrument is expected to provide a picture of the central bank's policy stance in monetary operations for the real sector. High interest rates will slow the performance of the real sector, which is influenced by rising investment costs due to high interest rates. Therefore, competitive interest rates are expected to excite the real sector, which in turn will strenghten the position of Rupiah against USD. This finding is in line with the result obtained by Wati (2014)

5. Conclusion

From the results and discussion of the research, it can be drawn some conclusions as follow; Rupiah was experiencing overshooting. GDP negatively affects the Rupiah's exchange rate. Inflation positively affects the Rupiah's exchange rate. Interest rates does not effect on the Rupiah exchange rate. Rupiah which was overshooting will make monetary policy is ineffective, therefore it is necessary to synergize the policy mix of the government and the central bank to encourage the performance of the real sector especially exports in order to keep Rupiah stable. A positive effect of GDP to the Rupiah shows that the role of the government in maintaining political and economic stability needs to be carried out, bearing in mind that global trends indicate that Indonesia's trading partner countries are entering a phase of economic recession.

The finding shows that the low inflation rate needs to be maintained continuously by Bank Indonesia and TPID in order to maintain people's purchasing power. Even though nterest rate doesn't affect toward Rupiah exchange rate, interest rate instruments can be used as a benchmark for banks to benchmark lending rates and stance over the central bank's monetary policy, in which loan interest rates will affect people's interest and investment interest. Therefore, Bank Indonesia is expected to continue to provide competitive interest rates to maintain the level of public consumption and maintain the volatility of capital inflows into and out from Indonesia.

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