

The Determinants of Exchange-Rate Volatility

Ishak Ramli*

Universitas Tarumanagara, Jl. Tanjung Duren Utara No.1, Jakarta 11470, Indonesia

**Corresponding author. Email: ishakr@fe.untar.ac.id*

ABSTRACT

The IDR/USD volatility during January-March 2018 was the lowest compared to the currencies of high-risk countries (fragile five) and in the ASEAN region. Rupiah volatility is around 8%, while Brazilian real volatility is 15%, Mexican pesos is 13%, Turkish lira is 8.8%, Russian ruble is 14%, South Korean won is 9%, Malaysian ringgit is 9.3%, Philippine peso is 8.2%, and Thai baht is 9%. While being compared to the period 2000-2015, the volatility was the highest within the ASEAN (the average is 10%). What happened to the IDR/USD volatility? Using secondary data from Central Bank and IDR/USD exchange rate from 2004 – 2015, we analyzed 143 data with GARCH 1.1, we found that Trade Openness, Reserve Assets, and Stock Market Index negatively and significantly determined The Exchange-rate volatility. Productivity positively and significantly determined The Exchange-Rate Volatility. While Bank Intervention positively but not significantly determined The Exchange-Rate Volatility, and Inflation negative but not significantly determined The Exchange-Rate Volatility. In order to reduce the exchange-rate volatility, the authority will reduce productivity and increase Trade Openness, Reserve Assets, and Stock Market Index.

Keywords: *exchange-rate volatility, monetary, Stock Market Index, and Inflation*

1. INTRODUCTION

The IDR/USD volatility during January-March 2018 was the lowest compared to the currencies of high-risk countries (fragile five) and in the ASEAN region. Rupiah volatility is around 8%, while Brazilian real volatility reaches 15%, Mexican pesos is 13%, Turkish lira is 8.8%, Russian ruble is 14%, South Korean won is 9%, Malaysian ringgit is 9.3%, Philippine peso is 8.2% and Thai baht is 9%. While being comparing to the period 2000-2015, the volatility was the highest within the ASEAN (the average is 10%). What happened to the IDR/USD volatility?

Literature explains that exchange-rate volatility is determined by Central Bank intervention (bank intervention), but empirically it proved different things. Some documented bank intervention does not significantly determine the exchange-rate volatility [1], but there were some significant evidences that it determined the exchange-rate volatility [2] and [3]. The Central Bank intervention efforts are intended to reduce the exchange-rate volatility of a currency [4], [5], but there are some documents that it actually increases the exchange-rate volatility [6].

Literature found that productivity determines the exchange-rate volatility, but still empirically it proved different results. Productivity did not significantly affect exchange-rate volatility [9], while other researchers proved that productivity positively and significantly influences exchange-rate volatility [7], [8], and other proved that productivity negatively and significantly affected Exchange-rate volatility [10].

Government expenditure determines the exchange-rate volatility, but empirical results proved differently. Government expenditure significantly influences exchange-rate volatility [8], but other evidence proved that

government expenditure negatively and significantly determines the exchange-rate volatility [9].

News announcements might determine the exchange-rate volatility, but empirical evidence proved different results. News announcements will increase exchange-rate volatility [11], [12], [13], [14]. However, some empirical evidence also proved that news announcements do not significantly affect exchange-rate volatility [15].

Trading volume can also determine the exchange-rate volatility. But empirical evidence results vary. Trading volume negatively affects the exchange-rate volatility [16], while other proved that trading volume is positively correlated with the exchange-rate volatility [17].

The next factor that determines the exchange-rate volatility is reserve assets. The empirical evidence proved different results. Reserve assets will reduce the exchange-rate volatility [18], other empirical evidence found that reserve assets significantly influence the exchange-rate volatility [19].

The export performance of a country will determine the volatility of its currency, but the empirical evidence still provides different evidence. Exchange-rate volatility has a negative and significant relationship with export performance [20], while other empirical evidence provides that export performance does not provide significant relationship with the country's currency exchange-rate volatility [21].

Foreign direct investment (FDI) in a country is affected by the volatility of the country's currency exchange-rates. But the literature provides mixed evidence: FDI positively and significantly influenced the exchange-rate volatility [22], [23]. In contrast to other studies, there was no relationship between FDI and the exchange-rate volatility [24]. Another factor related to the exchange-rate volatility is trade openness. The theory related to the exchange-rate volatility

is trade openness. The link between trade openness and volatility in the country's currency is still questionable. Empirical evidence gives mixed results. Trade openness significantly influenced the exchange-rate volatility in Nigeria [9], but empirical evidence in Hungary and Slovakia did not prove that trade openness significantly influences the exchange-rate volatility [25], while another study found that trade openness positively affects the exchange-rate volatility [26].

Inflation will encourage the currency volatility in the country. Empirical evidence still provides different results. Some found that inflation positively and significantly influences the exchange-rate volatility [27], [28], but there were empirical evidences proving that inflation does not significantly influence or has little impact on the exchange-rate volatility [29], [30], and [31].

Another factor related to the exchange-rate volatility is Stock Market Index. However, some empirical evidence does not unanimously support its impact on the exchange-rate volatility. Stock market index has a strong relationship with the exchange-rate volatility. (Abdalla & Murinde, 1997, Lin, 2012, [7], while another empirical evidence proved that stock market index does not affect its relationship with the exchange-rate volatility (Ajayi et al., 1998).

Money supply is also literaturely thought to have an impact on exchange-rate volatility. Empirical evidence still provides different evidence on money supply. Some significantly determines the exchange-rate volatility [28], and [10], however, some proved negative and not significantly determine the exchange-rate volatility [9], and [31]. Other factors according to the literature that affect exchange-rate volatility include: Interest rates, and exchange-rate regimes that positively and significantly affect the exchange-rate volatility [9], [7], [28].

This paper intended to prove what exactly happened to the IDR/USD volatility. Was the volatility of the IDR / USD exchange rate in 2004-2015 influenced by trade openness, reserve assets, bank intervention, inflation, stock market index, and productivity?

Benefits of the Research: Providing guidelines for trade openness, reserve assets, bank intervention, inflation, stock market index and productivity that affect the exchange-rate volatility to predict the IDR / USD volatility in the future.

2. LITERATURE REVIEW

2.1 Trade Openness and Exchange-Rate Volatility

Trade openness, is the ratio of international trade that occurs to the country's gross domestic income [32], [33], [34]. It is the number of trade currencies from exports and imports carried out by the state as part of gross domestic income [35]. Trade openness will reduce the volatility of the exchange rate with a more flexible aggregate price [36]. In an open economy, it influences the exchange-rate

movements and has a negative correlation [37]. Obstfeld-Rogoff exchange-rate determinant model conveyed that the more open a country's economy is, the more they tend to have more flexible aggregate prices, so that a higher trade openness will reduce the exchange-rate volatility. Exchange-rate movements are the result of two movements, monetary and supply movements [38]. Trade openness affects the exchange-rate volatility in two ways. First, as an approach with a theoretical influence, liberal trade will contribute to the depreciation of the exchange rate in long run through increasing this openness variable. For example, by reducing the tariffs, it will lead to a fall in domestic prices of imported goods [39]. This will be a catalyst for excess demand for imported goods and reduce domestic demand for non-imported goods. As a result, the exchange-rate will depreciate in creating a balance in the non-import market. Second, is for the relationship between exchange-rates and the level of trade openness, that has been emphasized by [40] and [37]. Trade openness will play a role in reducing or increasing the impact of exchange-rate volatility.

2.2 Reserve Assets and Exchange-Rate Volatility

Reserve assets are external assets, available in foreign currencies (liquid), and gold reserves, the reserves owned by the Central Bank or both [41]. A higher level of reserve assets will reduce the tendency of the exchange rate to experience a crisis [42]. Further explained, reserve assets will be related to two things, including monetary policy and sentiment creation to the market [18]. Regarding monetary policy, the higher the reserve asset is, the more it is possible for the Central Bank to intervene in the forex market in order to stabilize the exchange rate. The reserve asset itself can be used as an intervention tool by the monetary authority. In addition, reserve assets can provide market sentiment. A high level of reserve assets will produce market confidence in currencies. The smaller the reserve assets is, the riskier the country will experience in a crisis. Higher reserve assets are always associated with smaller foreign borrowing costs because of the smaller the risk default [43]. This market sentiment makes the exchange-rate volatility decrease, since the increasing reserve assets will bring confidence if the currency held increases.

2.3 Bank Intervention and Exchange-Rate Volatility

Bank intervention is in the form of sale or purchase of foreign currencies by monetary authorities due to changing the exchange rate of the country's currency against one or more other foreign currencies [44]. In some cases, bank intervention has a systematic impact on the exchange rate, while in other cases, this intervention can reduce the exchange-rate volatility [45] and [46]. Bank intervention seems to be more effective when it is in line with monetary

policy [47], [48]. So, the results can vary depending on the monetary objectives and the use of these interventions. Bank interventions carried out in developing countries generally has a greater impact than those in developed countries, since the Central Bank will have more information about the market and the ability to regulate a larger market [49].

To have a significant effect on the spot exchange rate, the bank intervention needs to change market expectations regarding further movements in the exchange rate. So, the way to see the magnitude of the effect of this intervention is to see the changes that occur in comparing to the estimated exchange-rate movements [50]. The success of bank intervention to change the direction of the spot exchange-rate will also have an impact on the success to change the direction of exchange-rate movements in long-run [51]. Bank intervention can also fail in the expectations of exchange-rates. Interventions will increase the heterogeneity of individual estimates, so that it cause the increasing uncontrolled movements and finally will increase the exchange-rate volatility [12].

2.4 Inflation and Exchange-Rate Volatility

The effect of inflation on exchange-rate volatility can be positive or negative depending on the objectives of the Central Bank [28]. Countries that affected by hyperinflation will have increased exchange-rate volatility in an effort to stabilize it [27]. The exchange-rate will tend to experience devaluation with higher inflation [52], [53], [54]. Higher inflation will cause an increase in interest-rates, this will then lead to an increase in capital inflow, so that the exchange-rate will experience volatility [55]. Thus, inflation will tend to have a negative rather than a positive effect on the exchange rate.

2.5 Stock Market Index and Exchange-Rate Volatility

Stock market index, which is a market value index that is weighted from the price of shares traded, and is usually used to measure the performance of the entire stock market. It is a barometer of the performance of an overall or sectoral economic in the market [56]. Stock Market Index will positively affect the exchange-rate volatility. Stock market performance will cause capital inflow or outflow, so that it affects the exchange-rate volatility[7]. The link between the stock market and foreign exchange is also seen in many Asian developing countries[57]. During a crisis, changes in the stock market index at that time had an impact on the exchange rate, causing considerable volatility.

2.6 Productivity and Exchange-Rate Volatility

Productivity is total production of products and services in a country's economy. Productivity is a measure of economic

growth by comparing between how much is produced by the system and how much the use of resources needed to produce it [58].

Successful economic development is marked by the improvements in living standards and is also accompanied by currency appreciation. So, the influence of productivity differentiation will follow the doctrine of Balassa-Samuelsson [59], which is of the hypotheses known to many people with the exchange-rate equation. Rapid economic growth will be accompanied by an appreciation of the exchange rate due to the growth in the country's productivity.

Balassa-Samuelsson explained the carried out productivity will increase the level of wages as the economy grows. This wage level will then drive price increases on domestic goods relatively and encourage currency appreciation [60]. From this appreciation of the exchange rate, volatility occurs.

3. RESEARCH METHODS

Population in this study was the Indonesian Rupiah/USD exchange rate from the year 2004 to 2015. Samples were carried out by using the purposive sampling technique on a monthly basis data. There were 144 samples and 143 data that could be processed.

4. OPERATIONALIZATION OF VARIABLES

4.1 Real Exchange-Rate Volatility (RERVOL)

The real exchange rate (RERVOL) (MacDonald and Ricci, 2003): Monthly base

$$RERVOL = E \times \frac{CPI^*}{CPI}$$

RERVOL = Real Exchange-Rates Volatility; E = IDR / USD nominal exchange rate; CPI * = Foreign Price Index; CPI = Domestic Price Index

4.2 Trade Openness (OPEN)

Trade openness is the ratio of international trade carried out by a country in terms of exports and imports with its trade partners compared to the country's gross domestic income. The ratio of exports plus imports compared to gross domestic product (GDP) [8].

$$OPEN = \frac{X + M}{GDP}$$

OPEN = Trade Openness; X = Export; M= Import; GDP = Gross Domestic Product

4.3 Reserve Assets (RES)

Central Bank reserves and gold reserves that are liquid and managed by monetary authorities [18].

$$RES = \frac{Reserve\ Assets}{Gross\ Domestic\ Product}$$

4.4 Bank Intervention (INV)

INV is an Open Market Operations (OPT) by Bank Indonesia (BI) during the period of 2004-2015.

4.5 Inflation (INF)

Consumer Price Index (CPI) monthly data for the period of 2004-2015.

4.6. Stock Market Index (CSPI)

The Composite Stock Price Index (CSPI) on the Indonesia Stock Exchange (IDX) during the period of 2004-2015.

4.7. Productivity (PROD)

Trade exports conducted by Indonesia during the period of 2004-2015.

We analyzed the data using Generalized Autoregressive Conditional Heteroskedasticity (GARCH) for the econometrics approach and processed by Eviews 9 software. We used the model GARCH (1,1).

5. ANALYSIS AND DISCUSSION

The result showed that Trade Openness, Reserve Assets, and Stock Market Index negatively and significantly determined The Exchange-Rate Volatility. Productivity positive and significantly determined The Exchange-Rate Volatility. While Bank Intervention positively but not significantly determined The Exchange-Rate Volatility, the Inflation negatively but not significantly determined The Exchange-Rate Volatility (Tabel 1.)

Tabel 1. RERVOL Regression
 Method: ML ARCH - Normal distribution (BFGS / Marquardt steps)
 Presample variance: backcast (parameter = 0.7)
 GARCH = C(8) + C(9)*RESID(-1)^2 + C(10)*GARCH(-1)

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	0.016793	0.003370	4.983242	0.0000
OPEN	-0.057223	0.011208	-5.105769	0.0000
RES	-0.010019	0.004848	-2.066758	0.0388
INV	1.27E-08	8.30E-09	1.533289	0.1252
INF	-0.000459	0.000393	-1.168662	0.2425
IHSG	-3.96E-06	4.74E-07	-8.370586	0.0000
PROD	1.21E-07	1.45E-08	8.328359	0.0000
R-squared	0.312691	Mean dependent var		0.005573
Adjusted R-squared	0.282369	S.D. dependent var		0.003680
Durbin-Watson stat	1.519466			

Sources: Data processed by Eviews 9

ARCH Model:

$$REERVOL = 0.016793 - 0.057223 OPEN - 0.010019 RES + 1.27E-08 INV - 0.000459 INF - 3.96E-06 IHSG + 1.21E-07 PROD + e$$

REERVOL= Exchange-Rate Volatility; OPEN= Trade Openness; RES= Reserve Asset ; INV= Bank Intervention; INF= Inflation; IHSG= Stock Market Index; PROD = Productivity

6. DISCUSSION

It was found that trade openness negatively and significantly affected the exchange-rate volatility [9]. Liberal trade will contribute to the depreciation of the exchange rate in long run. The higher the trade openness is, the more open the country's trade from other countries will be. It did not rule out the possibility of cooperation between countries to support each other's economy, so that the regulations facilitate the trade between countries. Regulations that are negotiated can be in the form of tariff reductions that will results in the lower price of imported goods. So with the increasing trade openness, it will cause a decrease in prices for imported goods. In accordance with

the economic law, the cheaper an item is, the greater the demand for the item will be. It will then encourage the interest of public to start buying imported goods. There will be excess demand, thereby reducing demand for non-imported products. The result is that the exchange-rate will depreciate to reach the balance again, thereby reducing the exchange-rate volatility [37].

It was found that the value of the reserve asset has a negative and significant effect on exchange-rate volatility. Reserve assets are the reserves of wealth owned by the state and can be used to balance the payment needs and intervene in the foreign exchange market to influence the exchange rate [61]. The more reserve assets owned by the state is, the greater the ability of the state will be to control the exchange rate by intervening when it is needed [18]. One type of intervention that can be carried out is by buying or selling foreign currencies. The reserve assets will become inventory when intervening in buying or selling foreign currencies in the foreign exchange market. If the exchange-rate movements become uncontrollable, then the intervention with buying or selling foreign currencies can be carried out at any time and reduce the volatility of the market. The more reserve assets is owned, the less the exchange-rate volatility will occur. Countries with minimal reserve assets will certainly find it difficult to intervene with regard to buying or selling foreign currencies because of their limitations. Apart from that, another role of reserve assets in reducing the exchange-rate volatility is to provide market sentiment in form of confidence in the country's currency [43]. This trust comes from countries with high levels of reserve assets, and they will have a smaller risk of default probability than do the countries with low reserve assets. Lower default risk could certainly be easier to obtain a foreign loan with a smaller interest rate. The market will also respond by trusting the country's currency due to the high collateral level, so that if an event occurs that affects the currency or the country, the market will be more calm in responding to the event due to a strong foundation of reserve assets. Therefore, high reserve assets will reduce the volatility of exchange-rate through the ability to intervene by the monetary authority. It will have to buy or sell foreign currencies and with the presence of sentiment of confidence in the market, it will allow a quieter and non-volatile exchange-rate movement.

It was found that bank intervention positively but not significantly affect the exchange-rate volatility. Bank intervention can have various results depending on the monetary objectives and the use of these interventions [49]. Bank intervention is intended to form expectations of the market, so that the exchange-rate will move in the direction desired by the monetary authority [51]. However, another thing that can happen is that bank intervention is done to undermine the expectations of the market, so that it increases to heterogeneous and individual estimates, thus the exchange-rate movements will become increasingly erratic and increase in volatility due to the increasing number of views differ regarding the direction of the next exchange rate. The bank intervention also only makes changes in volatility that occur in a short-time after the intervention, but the effect will return to normal in the long-

run [3]. This explains why bank intervention does not have a significant effect and after the occurrence of bank intervention, it will increase the volatility of exchange-rate. Inflation negatively but not significantly affect the exchange-rate volatility. Inflation in this study had a negative influence on the volatility of exchange-rate. The increasing inflation in Indonesia will reduce the exchange-rate volatility. High inflation will encourage higher interest rates. So, high interest-rates will encourage people to save more. With more and more money saved, it will reduce the level of consumption from the community. Declining consumption levels will have an impact on the decline in demand in the community. This decline in demand will then change prices to lower or depreciate it, so that the exchange-rate volatility will slowly fall. In addition, with more money saved later, it will certainly reduce the existing money supply. This reduced money supply will have an impact on smaller exchange-rate volatility [9]; [31]. Less money supply will reduce the circulation of money available, thus the fewer transactions in the exchange-rate causes a decrease in the exchange-rate volatility.

Stock market index negatively and significantly affects the exchange-rate volatility. Stock market index will reduce the exchange-rate volatility. The higher the index is, the greater the investor's confidence in investing their capital will be. The capital market in Indonesia as a developing country is related to foreign investment which results in exchange-rate transactions. The strong correlation between the capital market and the exchange rate in Asia is due to the current economic growth [57]. Therefore, many foreign funds will go out, if the capital market fluctuates. Thus, if the stock market index is high, it will show the performance of a good market, so that these foreign funds will remain in the capital market and the outflow will not occur and this will have a negative impact on the exchange-rate volatility, which will encourage a significant impact of the stock market index on exchange-rate volatility.

Productivity positively and significantly affects the exchange-rate volatility. An increase in productivity will be accompanied by economic growth. The better the economic growth of a country is, the better the standard of living of its people will be. Economic growth will also cause appreciation in currencies. So, rapid economic growth will be accompanied by an appreciation of the exchange rate due to the growth in the country's productivity [60]. The appreciation of exchange-rate is what makes the exchange-rate volatility higher than the increase of productivity. Another scenario of productivity will lead to economic growth. The occurrence of economic growth will also increase the wage level of its workers as the economy advances. However, this wage increase will also affect the price of goods produced further, because their wages are calculated as costs in producing an item. As a result, there will be an increase in prices, and it will then cause the increase in volatility. That is an explanation of how productivity will increase the exchange-rate volatility.

7. CONCLUSION

Exchange rate volatility measures the risk of an economy, because it influences the firms' income in Indonesia. So, it

is important to lower the exchange-rate volatility in an economy. Interestingly, this study found that bank intervention does not significantly influence the exchange-rate volatility, but in fact, it can only affect within a limited-term. What positively and significantly determines the exchange rate volatility is the production, since they still have low local content in their products. In order to lower the volatility, the production of goods in Indonesia should be followed by exporting the products as well. The government should keep increasing trade openness, reserving assets, and increasing market-index. The more trade openness, reserves assets, and market index are, the lower the exchange-rate volatility will be.

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