

Exchange Rate Volatility and Economic Growth: Managed Floating and Free-Floating Regime

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Abstract

Indonesia's economy has been in its worst period. At that time, economic growth was below zero percent. One of the reasons is the high volatility of exchange rates in 1997-1998 when the exchange rate regime was transferred from managed floating to free-floating. Now, the high volatility of the exchange rate is feared to have an impact on the economy, especially economic growth, because it is one of the main focuses of the government's current achievements. Therefore, this study aims to see whether volatility impacts Indonesia's economic growth, especially in two different exchange rate regimes, managed floating and free-floating. This empirical research is based on quarterly data for 1994 - 2020, using the estimation method of Generalized Autoregressive Conditional Heteroskedasticity (GARCH) and Vector Autoregressive Model (VAR). The result shows that exchange rate volatility has a significant negative effect on economic growth, while the exchange rate regime moderates the impact of exchange rate volatility on economic growth.

Keywords : Exchange Rate Volatility; Economic Growth; Exchange Rate Regime; Generalized Autoregressive Conditional Heteroskedasticity; Vector Autoregressive Model

JEL Classification : E5, E58

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1. INTRODUCTION

The year 1997 was a period of an economic crisis in some Asian countries. The economic crisis was triggered by the exchange rate crisis, which later disrupted the stability of the regional economy. It started with a financial turmoil in Thailand in 1997 after switching to a floating exchange rate. This regime change aimed at promoting export growth and protecting the country's foreign exchange reserve from speculators. However, the Thai government's efforts were barely successful and, as a result, affected other countries in the region. Indonesia was hit hard by the collapse, with the Indonesian rupiah plunging from Rp4,650/USD at the end of 1997 to Rp8,025/USD in early 1998. This slump

was also caused by the Indonesian monetary authority's implementation of a free-floating exchange rate regime after transitioning from a managed-floating regime. This policy aimed, for example, to reduce volatility caused by speculators.

The volatile exchange rate obviously affected Indonesia's macroeconomic fundamentals, causing the inflation rate to speed up. At the time, inflation in Indonesia was the third-highest in Southeast Asia. Data from Statistics Indonesia exhibit that, in 1998, the country's inflation reached 77.6%. The inflation rate is closely related to economic growth, and fluctuating inflation rate reflects unstable domestic prices. Fluctuations in inflation rate and foreign exchange market pressure will disrupt trading activities and later inhibit economic growth.

According to Statistics Indonesia, Indonesia's economic growth in the third quarter of 1997, which initially grew by 3.4%, plummeted to zero in the last quarter of the same year. In 1998, its average economic growth even fell to its lowest point of -13.3%, while the rupiah depreciated to Rp16,000 against the US dollar. This past economic crisis in Indonesia has demonstrated that exchange rate volatility significantly influences the real sector and economic growth (Suselo, Sihaloho, & Tarsidin, 2008).

Comparing economic growth during the implementation of both managed and free-floating regimes, we found that Indonesia's economic growth during managed floating regimes was 6.21% on average. Meanwhile, under a free-floating regime, the average economic growth between 1998 and 2017 was 4.13%, lower than the average growth during the managed floating regime.

Exchange Rate and Exchange Rate Regime

The exchange rate is the value of a domestic currency when converted to the currency of other countries, and vice versa (Syarifuddin (2016). According to Syarifuddin (2016), Indonesia has implemented three exchange rate systems, or regimes, including (1) fixed exchange rate, (2) managed floating exchange rate, and (3) free-floating exchange rate. In a fixed exchange rate regime, a currency's value is fixed. Meanwhile, under a free-floating exchange rate regime, an exchange rate is determined by supply and demand market forces without any government intervention. A managed floating exchange rate regime is similar to a free-floating exchange rate regime except that an intervention band accompanies it. If an exchange rate exceeds this band, the country's central bank will make an intervention to keep the rate within the band.

Exchange Rate Volatility and Economic Growth

Exchange rate volatility may contribute indirectly to economic growth given the influences of volatility on factors contributing to economic growth such as investment, international trade openness (export and import) and capital flow, and development of the financial sector (Barguelli, Salha, & Zmami, 2018). Direct influences of exchange rate on the economy are reflected in prices of exported and imported goods, while its indirect influences are seen from export and import activities (Figure 1). It is believed that a volatile exchange rate is a threat to international trade stability and will likely interfere with the performance of the real domestic sector, particularly in manufacturing and trading sectors, and stability of domestic price. In the end, it will interfere with the business cycle and potentially stunt the future growth of the economy.

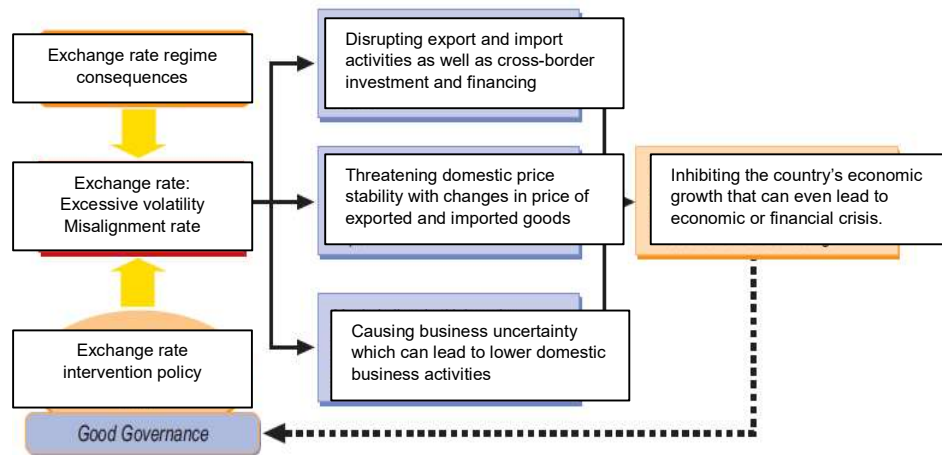


Figure 1. The Impacts of Exchange Rate Volatility and Misalignment
 Source: Bank Indonesia, 2016

The relationship between exchange rate and macroeconomic variables, particularly economic growth, has gained popularity among international researchers. Barguelli, Salha & Zmami (2018) concluded that the exchange rate negatively influences economic growth. However, exchange rate volatility depends on the exchange rate regime and financial openness, which is more harmful when a country adopts a flexible exchange rate and financial transparency. Studying the influence of the exchange rate regime on economic growth, Bailliu, Lafrance & Perrault (2002) stated that the monetary policy framework that accompanies the exchange rate regime plays a critical role. Similarly, Bacchetta and Wincoop (2000) mentioned that, under either fixed or floating exchange rates, the degree to which the economy grows is subject to preference and the monetary policy that accompanies the exchange rate regime.

Furthermore, some studies have also confirmed the significant influences of exchange rate volatility on economic growth. Dollar (1992) analyzed the relationship between exchange rate volatility on economic growth in 95 developing countries throughout 1976–1985 and found a negative correlation between these variables. Bosworth et al. (1995) studied factors determining economic growth in 88 developed and industrialized countries over the period of 1960–1992 before concluding that exchange rate volatility influences output growth negatively by decelerating the growth of productivity.

Schnabl (2009) identified the effect of exchange rate volatility on growth in a panel-data set of 17 emerging Europe countries and 9 East Asian countries using Generalized Least Square Fixed Effect (GLS) and GMM methods and found that volatility exerts a negative influence on the economic growth of some European and Asian countries. Similarly, Vieira et al. (2013) found evidence on the negative effect of exchange rate volatility on long-term economic growth after studying a sample group consisting of 82 developed and developing countries throughout 1970–2009.

Indonesia is currently implementing a free-floating exchange rate. Therefore, it is likely that the impacts of exchange rate volatility on economic growth are stronger. In addition, with varied results of previous empirical studies, a more comprehensive review of the subject matter is needed, particularly in Indonesia, considering the higher volatility of the Indonesian rupiah amidst the government's targets for economic growth. Hence, the

extent to which exchange rate volatility influences Indonesian economic growth amid two different regimes is an exciting subject to study.

2. METHOD, DATA, AND ANALYSIS

Data and Data Source

This research aims to analyze the impacts of exchange rate volatility on economic growth under managed-floating and free-floating exchange rate regimes. Data on economic growth, measured using real Gross Domestic Product growth rate (%), were derived from quarterly data between 1994 and 2020 available on *www.bi.go.id*.

Meanwhile, data on exchange rate volatility resulted from an estimate using a time series model that incorporated nominal exchange rate data collected daily starting January 1, 1994, to December 30, 2020, from *investing.com*. These data were then turned into quarterly volatility data. The present empirical studies did not specify any criteria for using nominal or real exchange rates (Barguellig, Salha, & Zmami, 2018). Given the situation, only the study involved only nominal exchange rates to see whether nominal shocks impact economic growth. As a categorical variable, the exchange rate regime was assigned numeric indices of 0 and 1.

Data Analysis Method

Data analysis began with exchange rate volatility estimation before using it as a predictor in the model to explain its correlation with economic growth under both managed-floating and free-floating regimes.

Exchange rate volatility was estimated using the GARCH (Generalized Autoregressive Conditional Heteroskedasticity) model and GARCH(1,1) specification as equations 1 and 2.

$$\text{Mean equation} \quad : \quad ex_t = \beta_0 + \varepsilon_t \quad (1)$$

$$\text{Variance Equation} \quad : \quad \sigma_{dt}^2 = \delta + \sum_{i=1}^q \alpha_i u_{t-1}^2 + \sum_{i=1}^p \beta_i \sigma_{t-1}^2 \quad (2)$$

ex_t symbolizes the logarithm of the nominal exchange rate while $\sigma^2 t$ represents a conditional variance of the exchange rate. The use of GARCH(1,1) is supported by the study conducted by Barguellig, Salha, & Zmami (2018). Volatility was estimated in two periods separated based on data homogeneity over the period of January 1, 1994 - December 30, 2020. This was done because the mean is more sensitive to significant data fluctuations, and it was feared that estimation results would not represent its actual mean. Meanwhile, a mean deviation is a part we want to see while estimating volatility. Having the estimation results, we then estimated the volatility of the exchange rate on a quarterly basis together with economic growth using equation 3.

$$vex_w = \frac{1}{w} \times (h_{d1} + h_{d2} + h_{d3} + \dots h_{dw}) \quad (3)$$

vex_w denotes volatility every quarter, h_d Denotes volatility daily, and w represents the number of data collected every day within a quarter.

Results of volatility estimate using the first model were then used as a predictor in the model that links volatility to economic growth and exchange rate regime. Specification of the model is presented in Equations 4 and 5.

$$Y_t = \beta_{10} + \sum_{i=1}^k \beta_{1i}Y_{t-i} + \sum_{i=1}^k \gamma_{1i}vex_{t-i} + \delta_{1i}D_{1i} + \sum_{i=1}^k \mu_{1i}vex_{t-i}D_{t-i} + u_{1t} \quad (4)$$

$$vex_t = \gamma_{20} + \sum_{i=1}^k \beta_{2i}Y_{t-i} + \sum_{i=1}^k \gamma_{2i}vex_{t-i} + \delta_{2i}D_i + \sum_{i=1}^k \mu_{1i}vex_{t-i}D_{t-i} + u_{2t} \quad (5)$$

Y_t symbolizes economic growth, vex_t Represents exchange rate volatility, and D is dummy variables (1 is under a free-floating regime and 0 is under a managed-floating regime).

Using time series data for an estimate in equations (4) and (5) requires a series of diagnostic tests, including stationarity and, probably, cointegration tests. Consider, VAR or VECM system was considered the most suitable method of model estimate.

3. RESULT AND DISCUSSION

Diagnostic Tests for GARCH Models

Results of the ARCH test using data from January 1, 1994, to December 30, 2020, presented in Table 1. suggest that exchange rate data indicate the presence of heteroscedasticity.

Table 1. Results of Heteroscedasticity Test on Exchange Rate under Managed-Floating Regime
IDR Exchange Rate

Probability Value	0.0000
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Source: Research Findings.

Table 2. Results of Heteroscedasticity Test on Exchange Rate under Free-Floating Regime
IDR Exchange Rate

Probability Value	0.0000
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Source: Research Findings.

The exchange rate volatility was estimated using GARCH models. Estimation results are presented in Tables 3 and 4.

Table 3. Results of GARCH Estimation from January 3, 1994, to January 7, 1998

Dependent Variable: nt_managed				
Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	2328.660	0.141713	16432.20	0.0000
Variance Equation				
C	5.677718	1.529584	3.711935	0.0002
RESID(-1)^2	0.978570	0.194984	5.018728	0.0000
GARCH(-1)	0.051934	0.042175	1.231387	0.2182

Table 4. Results of GARCH Estimation from January 8, 1998 to December 30, 2020

Dependent Variable: PRICE				
Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	9122.650	1.459467	6250.671	0.0000
Variance Equation				
C	386.3104	63.13837	6.118473	0.0000
RESID(-1)^2	0.608880	0.039239	15.51706	0.0000
GARCH(-1)	0.409655	0.014636	27.98876	0.0000

Source: Research Findings.

Figures 1 and 2 present results of the volatility estimate obtained from the estimation model in Table 3 (between January 3, 1994, and January 7, 1998) and Table 4 (between January 8, 1998, and December 30, 2020)

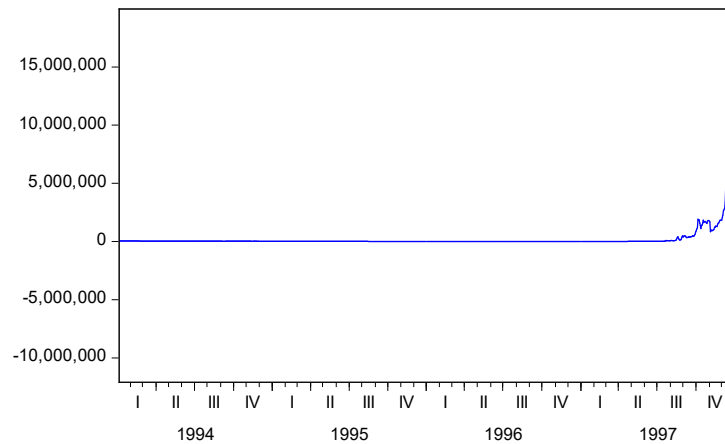


Figure 1. Exchange Rate Volatility between January 3, 1994, and January 7, 1998

Source: Research Findings.

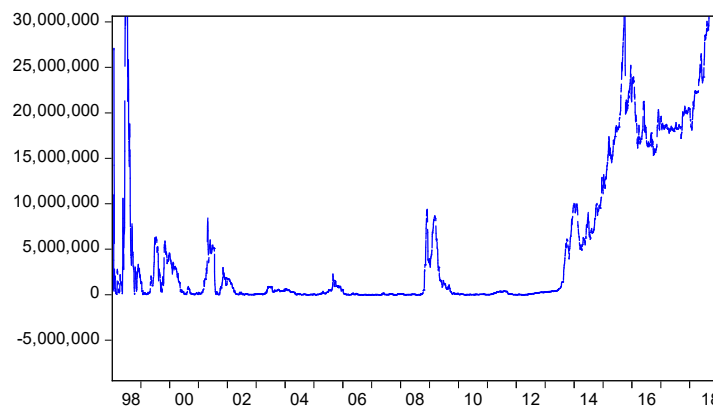


Figure 2. Exchange Rate Volatility between January 8, 1998, and December 30, 2020

Source: Research Findings.

Accordingly, in Figures 1 and 2, exchange rate volatility increased significantly during the third quarter of 1997. It was when the exchange rate regime was switched from managed-floating to free-floating, or in August 1997. Volatility remained high until 1998 and, as can be seen in Graph 2, peaked later that year. Exchange rate volatility was also seen sometime between 1998 and 2001, but it remained stable from 2002 to 2008. Exchange rate volatility grew again in 2009 due to the United States subprime mortgage crisis. Since 2013, volatility has shown a positive trend and kept rising until 2015. However, it slowed down between 2016 and 2017, along with a more stable rupiah. Since 2018, volatility has been rising as the rupiah weakens.

Diagnostic Test and Dynamic Model Estimate

Day-to-day volatility generated using GARCH estimate was then transformed into quarterly data. These time series quarterly data were then used as a predictor in a model trying to explain the effect of volatility on economic growth under both managed-floating and free-floating regimes. The effect of volatility on economic growth and its relation to the exchange rate regime was measured using the μ_1 parameter in equation (4); moreover, referring to the results of the stationarity test presented in Table 5 and cointegration test in Table 6, there is a lack of statistical evidence to support the idea that economic growth and exchange rate volatility will move together in the long run. In other words, there is no cointegrating relationship among these two variables.

Table 5. Results of ADF Stationarity Test

No.	Variable	ADF I(1)	Integration Degree
1	Volatility	-1.945870	I(1)
2	Economic Growth	-4.138212	I(0)

*Critical Value ADF with $\alpha = 5\%$ is -2.888932

Source: Research Findings.

Table 6. Results of Johansen Cointegration Test

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	Critical Value 0.05	Prob.**
None	0.116334	13.06203	15.49471	0.1126
At most 1	0.003135	0.323394	3.841466	0.5696

Trace test indicates no cointegrating at the 0.05 level

Source: Research Findings.

In the absence of cointegration between economic growth variable and exchange rate volatility variable, analysis on interactive dynamics of the two variables was conducted using vector autoregression (VAR) with an optimal lag of 2 (according to Schwarz and Hannan-Quinn information criterion). The results are presented in Table 7.

Table 7. Results of VAR Estimates

Vector Autoregression Estimates, Sample (adjusted): 1994Q4 2020Q4, Included observations: 105 after adjustments, Standard errors in () & t-statistics in []

	EG	DVEX
EG(-1)	0.948581 (0.08599) [11.0308]	-16975.64 (137118.) [-0.12380]
EG(-2)	-0.172817 (0.08436) [-2.04857]	175867.4 (134513.) [1.30744]
DVEX(-1)	-1.68E-06 (5.5E-07) [-3.08723]	-0.172219 (0.86935) [-0.19810]
DVEX(-2)	-3.13E-06 (5.6E-07) [-5.53626]	1.842593 (0.90017) [2.04695]
C	1.183943 (0.25623) [4.62068]	-429840.1 (408557.) [-1.05209]
DVEXDUM(-1)	1.44E-06 (5.5E-07) [2.64864]	0.073045 (0.86990) [0.08397]
DVEXDUM(-2)	3.05E-06 (5.6E-07) [5.44600]	-2.053738 (0.89368) [-2.29808]

Remarks: [] t-statistic and t-tabel = ± 1.984

Source: Research Findings.

Table 7 indicates that current economic growth is influenced significantly by the dynamics of exchange rate volatility in the past and economic growth in the previous period. It can be seen from t-statistic values of -3.08723 and -5.53626 (exchange rate volatility's lag) and 11.00308 and -2.04857 (economic growth's lag). Therefore, it can be concluded that exchange rate volatility has a significant and negative effect on economic growth, indicating that the more volatile the rupiah exchange rate is, the lower its economic growth will be.

In addition, with positive and significant t-statistic values of 2.64864 and 5.44600, respectively, it is proven that the exchange rate regime has a significant moderating effect on the relationship between exchange rate volatility and economic growth.

Discussion

Under a free-floating regime, the exchange rate was more volatile than under a managed-floating regime. However, under a free-floating regime, the adverse effects of volatility could apparently be cushioned. Results suggest that when the free-floating regime took place, the impacts of increased volatility on reduced economic growth were less intense than those in the managed-floating regime. These findings implicitly suggest

that Monetary Authority plays significant roles with empirical evidence suggesting that Central Bank actively and continuously imposed monetary policies while implementing a free-floating exchange rate regime to keep the economy stable without direct intervention against the exchange rate. It, for example, made some adjustments to BI 7-day Reverse Repo Rate (BI7DRR), Deposit Facility rates, and Lending Facility rate. This decision was made to maintain the attractiveness of the domestic financial market amidst an attempt to strengthen Indonesian external resilience while facing global market uncertainty (Bank Indonesia, 2018).

Empirical evidence of the study is consistent with that of Bailliu, Lafrance, and Perrault (2002) and Bacchetta and Wincoop (2000), suggesting the correlation between exchange rate volatility and economic growth is highly dependent on monetary policy preference and framework accompanying the exchange rate. Bailliu, Lafrance, and Perrault (2002) studied the effect of exchange rate regimes on economic growth and found the critical importance of the monetary policy framework that accompanies an exchange rate regime. Similarly, Bacchetta and Wincoop (2000) declared that the degree to which the economy grows depends on preference and monetary policy that comes with the regime.

4. CONCLUSIONS

Results of the study show that exchange rate volatility has a significant negative effect on economic growth. Similarly, one of the main variables of the study—exchange rate regime—also demonstrates a significant moderating effect on exchange rate volatility and economic growth. Under a free-floating regime, the intensity of the negative impacts of exchange rate volatility on economic growth is lower than it was under a managed-floating regime. It may be attributable to the policy implemented by Monetary Authorities to accompany a free-floating regime. The policy is capable of minimizing the negative impacts of exchange rate volatility on economic growth. This finding strengthens and supports the idea that preference and monetary policy framework accompanying the exchange rate regime have a significant moderating effect on the relationship between exchange rate volatility and economic growth.

With exchange rate volatility exerting a negative influence on economic growth, monetary and financial authorities must always maintain their country's exchange rate stability. Academically, studies analyze determinants of a currency's volatility comprehensively. And from this study, it can also be implied that, to ensure a free-floating regime do not exert a negative moderating effect on the relationship between exchange rate volatility and economic growth, the central bank or, in this case, Bank Indonesia needs to formulate effective monetary policy strategies amidst global uncertainty.

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