

Is Monetary Policy Effective for Rupiah Exchange Rate Stabilization? An Analysis of Exchange Rate Determination with Monetary Approach

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Abstract: The Indonesian economic crisis in the period of 1997 and 2008 caused by the depreciation of the rupiah and volatile had an adverse impact on the Indonesian economy. This study aims to analyze whether monetary policy is effective for the stabilization of the rupiah using the monetary approach model of monetary exchange rate determination. The monetary model explains that the exchange rate equilibrium is determined by money supply, real income, and price level. The analytical tool used in this study is the error correction model (ECM) to avoid the problem of regression in both short and long term. The results show that the money supply has an effect on the rupiah exchange rate in the short and long term. It indicates that monetary policy through the money supply control instrument can be used to stabilize the rupiah exchange rate.

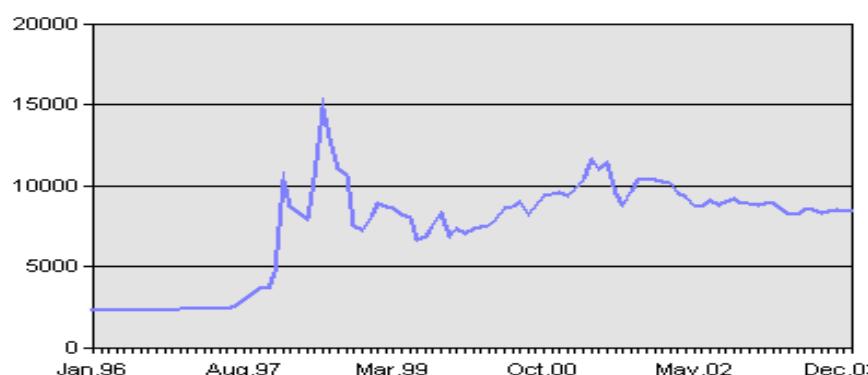
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1. Introduction

The Asia economy crisis occurred in the mid of 1997 was badly and influence foreign exchange rate markets. This crisis caused sharp depreciation of some countries exchange rates to the US dollar. The monetary crisis started with the fall of Thailand bath exchange rate to the US dollar by

21.69% that caused current account deficit and non-performing loan (NPL) in big scale in Thailand. Through the contagion effect, Thailand bath depreciation influenced money market in Asia countries and resulted in the other Asia currencies depreciation.

Figure 1 The fluctuation of the rupiah exchange rate to the US dollar at the beginning of the 1997 crisis



Source: Bank Indonesia

The exchange rate crisis gave a bad impact for Indonesia economy as a consequence of the open economy system. In early 1997, the rupiah exchange rate to the US dollar decreased by 85.46% and resulted in economy paralytic. The indicator could be seen from some economic indicators such as the economic growth from 8% in 1996 and decreased to 4.7% in 1997. It worsen by (- 13.68%) in 1998 and the government consumption level decreased from 2.7% in 1996 into 0.2% in 1997.

Indonesia government through Bank Indonesia had actually tried to solve the crisis through some monetary policies by conducting US dollar intervention in the foreign exchange rate market so the exchange rate would stay in band intervention level. This step was conducted as a consequence of using the managed exchange rate system. In reality, the intervention influenced the amount of foreign-exchange reserves. It became less and lesser. The amount of foreign-exchange reserves in 1996/1997 was 26.6 billion US dollar (7

months import) and decreased to 16.6 billion US dollar (4.6 months import). Facing this problem, Bank Indonesia broaden band intervention that meant to expand rupiah movement and reduce Bank Indonesia intervention. Finally, in 14th of August 1997, Bank Indonesia released band intervention that meant the rupiah exchange rate determining system changed into a free-floating rate. In reality, the policy increased rupiah exchange rate inflation.

The important position of determining exchange rate caused some concepts related to exchange rate fluctuation in an attempt to find factors that influence the foreign exchange rate. The monetary approach was one of them. The monetary approach had two main ideas. First, the occurrence of purchasing power parity theory and second, the existence of stable money demand from some economy aggregate variables. Based on this approach, the foreign exchange rate was influenced by the fundamental economic variables, such as real output level, interest rate level, and inflation. The explanation above showed the importance of rupiah exchange rate stability in relation to macroeconomic stability as it may disturb the sustainability of economic growth in the long term.

Frankel (1976) conducted an empirical test about the relation between the amount of circulated money, price level, expected exchange rate. The test was conducted in Germany about Deutsch Mark and the US dollar during the period of 1920-1923 when hyper-inflation happened. The result showed that monetary policies played a crucial role to determine the foreign exchange rate. It means that monetary variables like the amount of circulated money and price level influenced the exchange rate.

David H Papel (Richard Baile and Patrick Mc Mahon, 1989) conducted price and foreign currency exchange rate test by using Dornbusch Sticky Price Model. In the empirical study, the model was derived in the structural model which conducted in four countries: Germany, Japan, US, and England by using the data from the 1973.1-1984.4 period of time. The test used Vector Autoregressive Model and Moving Average Model along with the non-linear constraint parameter. The result showed that the variables in the Dornbusch Model significantly influence the foreign exchange rate.

Mark (1995) activated the hope of monetary approach by showing that the derivation from tested monetary variables showed relative money supply and relative real output were able to use to conduct prediction on US dollar currency in 1981-

1991. Berben and Von Dijk (1998), Berkowitz and Giorgianni (2001) however gave critics towards Mark's (1995) study. It was related to the assumption about the co-integration constant relations among exchange rate, relative money supply, and relative output level that were unstable and tend to decrease. Besides, Mark was judged as failing to provide the existence of co-integration of the three variables in the long term.

Smith and Wikken (1986) in their study which published in "An Empirical Investigation into Causes of Failure of Monetary Model of Exchange rate", conducted analysis toward monetary model validity. The object of the study was US dollar and Germany Deutsch Mark in 1973.1 to 1982.3. The results showed that the monetary model was not valid. Smith and Wikken also gave the reason for the failure of the monetary model since the purchasing power parity condition and misspecification in money demand function did not apply.

2. Review of Literature

2.1 Monetary Approach

Monetary approach was a development from purchasing power parity approach and money quantity theory. In this approach, monetary factors underlined the function of money demand and supply that became the main cause of exchange rate fluctuation. Based on this, exchange rate equilibrium was determined by these variables: the amount of circulating money, real income, interest rate level, and inflation difference. The assumption used were: (1) the application of purchasing power parity concept, (2) flexible exchange rate system, (3) perfect capital mobility, (4) the amount of circulated money and real income, and (5) domestic money demand.

There are two monetary approaches toward foreign exchange rate: the flexible and sticky price monetary model.

a. Flexible price version

There are three main basic factors of this theory: quantity theory, flexible price theory, and purchasing power parity theory. The assumption used in this model was market balance condition: money demand (m^d) equal with money supply (m^s). Money demand was influenced by real income (y), price level (p) and interest rate (r), while money supply was given. If domestic money supply increases (relative towards foreign money stock) foreign exchange rate will increase. It means domestic currency value decreasing towards the

foreign currency. This condition happens because excess supply that makes domestic price increases and domestic currency value decrease.

On the contrary, the increase in domestic real income will make domestic currency values increase. The mechanism is explained as: the increase of domestic real income will cause domestic currency excess demand. If economic agents try to increase money balance in real condition, they will reduce the outcome and there will be price decreasing until it reaches the balance. The following impact, if the price decreases (by using purchasing power parity concept), domestic exchange rate value will increase. Meanwhile, the increase of interest rate has the same impact with the increase of domestic real income that makes domestic currency value decreases. It happens because of the increase in the domestic interest rate, reducing domestic currency demand. As a result, the price level increases and domestic currency value decreases. Nevertheless, the Mundell Fleming model gives a different explanation. The increase in the domestic interest rate will result in an increase in foreign investment flow. Thus, the domestic currency value increases.

b. Sticky price version

In this monetary approach, there are two assumptions by inserting Keynesian. Firstly, the money supply in each country is endogenous. It means that the market interest rate positively influences the money supply. Secondly, the purchasing power parity condition is only applied in the long term (assumed that inflexible price is applied in the short term). In this condition, the foreign exchange rate value in the spot exchange rate is below the level of long term balance. As a result, the domestic currency value decreases. In contrary, if the exchange level is above balance, the domestic exchange rate will increase. Meanwhile, the expected difference in inflation will result in the expected spot exchange rate value. Accordingly, the expected spot exchange rate is counted by combining information, market equilibrium, and the expected inflation by using a sticky price monetary approach.

3. Research Methods

3.1 Basic Model: Monetary Approach Model

The monetary approach greatly influences the concept of the exchange rate model which in theory

is the development of the quantity theory of money demand. This model uses five basic equations :

$$s_t = (p_t - p_t^*) \quad (1)$$

$$m_t - p_t = k + \varphi y_t - \lambda r_t \quad (2)$$

$$m_t^* - p_t^* = k^* + \varphi^* y_t^* - \lambda^* r_t^* \quad (3)$$

$$r_t - r_t^* = f_t - s_t \quad (4)$$

$$f_t = E_t s_{t+1} \quad (5)$$

Note:

s: spot exchange rate; f: forward exchange rate;
y: real national income; p: price; m: money supply;
r: interest rate

Equation (1) represents the short-term and long-term assumptions of PPP validity resulting in no terms of trade effect and equilibrium equity markets in the short run. Equation (2) and (3) are money demand functions in accordance with Cagan (1956). Assuming that the real income elastic and the elastic interest rate on money demand in two countries, the monetary model can be formulated:

$$s_t = (k - k^*) + (m_t - m_t^*) - \varphi (y_t - y_t^*) + \lambda (p_t - p_t^*) \quad (6)$$

Note:

m_t and m_t^* : circulated money in Indonesia and US

y_t and y_t^* : Indonesia and US national income

p_{t-1} and p_{t-1}^* : Indonesia and US price

s_t : Rupiah spot exchange rate towards US dollar

4. Results

4.1 Short Term Estimation

Basically, there was long term fix balance among economy variables. If there was an imbalance in the short term, ECM would correct it through the long term. Thus, by using this mechanism, regression problems could be avoided by using fix different variable in the model without losing long term information as the result of using different data. It could be concluded that the ECM model was consistent toward a co-integration concept or Granger representation theorem.

Error correction model was one alternative to test the co-integration possibility of observed variables. If the error correction term (ECT) in the regression result was significant, it meant that the error correction model was valid and the observed model was co-integrated or the residual regression was stationer.

Table 1 Monetary Model Estimation

Variable	Coefficient	Std. Error	Prob.
C	14264.35	3718.235	0.0004
DY	0.001399	0.003246	0.6686
DM	0.004590	0.002451	0.0679
DP	7.684638	17.71369	0.6666
BY	-0.883362	0.169177	0.0000
BM	-0.881974	0.168954	0.0000
BP	17.24511	12.53511	0.1760
BECT	0.882807	0.168865	0.0247
R-squared	0.491038		
Adjusted R-squared	0.408184		
F-statistic	5.926528		
Prob(F-statistic)	0.000073		

Source: Processed data

The data processed result showed that ECT probability score was 0.0247. It indicated a significant regression result. It meant that ECM was valid and the observed variable was co-integrated. Next, observation of the influence of the independent variable in short term analysis: national income, price level, and the amount of circulating money toward exchange rate were conducted. It showed that only the amount of circulating money (M) influenced exchange rate significantly with significant level by 90%. Price level (P) and national income (Y) did not significantly influence the exchange rate.

4.2 Long Term Regression Coefficient Analysis

For long term analysis, the information about regression coefficient and long term deviation should be acknowledged before. It could be counted by estimating the regression coefficient and related variant-covariant matrix parameter. Both scores can be used to observe long term relation among economy variables. The result of the model in long term regression coefficient are presented in Table 2:

Table 2 Long Term Regression Test Result

S _t	- 18301.79	+ 1.13341 Y	+ 1.13165 M	+ 22.1276 P
t-hit	0.00026	5.2199	3.934	0.0797

Source: Processed data

Based on long term analysis estimation by using error correction model, it can be concluded that national income (Y) and the amount of circulated money (M) influenced exchange rate by 90% in long term. In contrary, price level (P) was not significantly influenced the exchange rate. This was in accordance with short term analysis that price level was not able to explain the behavior of rupiah exchange rate to the US dollar.

depreciation of rupiah currency to the US dollar. It happened because the increase in the amount of domestic money supply would result in money excess supply. During the economic crisis, it caused the increase of foreign currency (US dollar) to protect its liquidity or to get profit. The following impact was domestic currency depreciation. It was consistent with demand and supply theories by using monetary approach.

Short term national income (Y) did not influence the movement of the exchange rate. The inability of national income to explain the exchange rate was the result of the increase of income in the short term (Keynes consumption theory). Most of the income was used to increase consumption where the value of marginal propensity to consume was bigger than marginal propensity to save for developing countries (including Indonesia). The increase in consumption

5. Discussion

5.1 Short-term Analysis

Short term analysis based on the output model of the monetary approach showed that only the money supply (M) was able to explain the exchange rate fluctuation. The money supply coefficient showed a positive sign. It implied the increase of the amount of money supply would lead to the

was just in basic needs limit. It did not relatively push import (demand of US dollar). As a result, the increase in national income did not influence the exchange rate. The little value of marginal propensity to save in relation to national income increase resulted in low investment. It made the little emerging possibility for the company or foreign currency demand from a company. In conclusion, the increase in national income did not influence the exchange rate.

At the other hand, short term price level (P) did not influence the inflation of exchange rate. In the short term, the behavior of the rupiah exchange rate to the US dollar could not be explained by the price level. Thus, it was not in accordance with the purchasing power parity theory. The explanation was that some assumptions (no transportation cost, homogenous goods) that underlying this theory was not fulfilled in reality. It resulted in inflation in many countries that weren't reflected the same price behavior in many countries. Thus, the underlying law price theory was not proven. In addition, the reality showed that the transportation cost among countries existed. Inflation counting should count it as purchasing power parity did not count it in.

5.2 Long-term Analysis

Long term analysis was based on long term regression coefficient in the main model by looking at the backward variable. It could be concluded that long term national income (Y) influenced the exchange rate. In the long term, the increase of national income was used to increase the consumption of goods or service from the foreign market. It was the assumption that in the long term, the economy of a country has been established and the prosperity level has been good. Thus, the increase in income would be applied with the increase of goods and service import demand. As a result, the value of the domestic currency (rupiah) to the US dollar would decrease in the long term.

At the other hand, the amount of circulating money (M) for the long term has also influenced the movement of the exchange rate. In

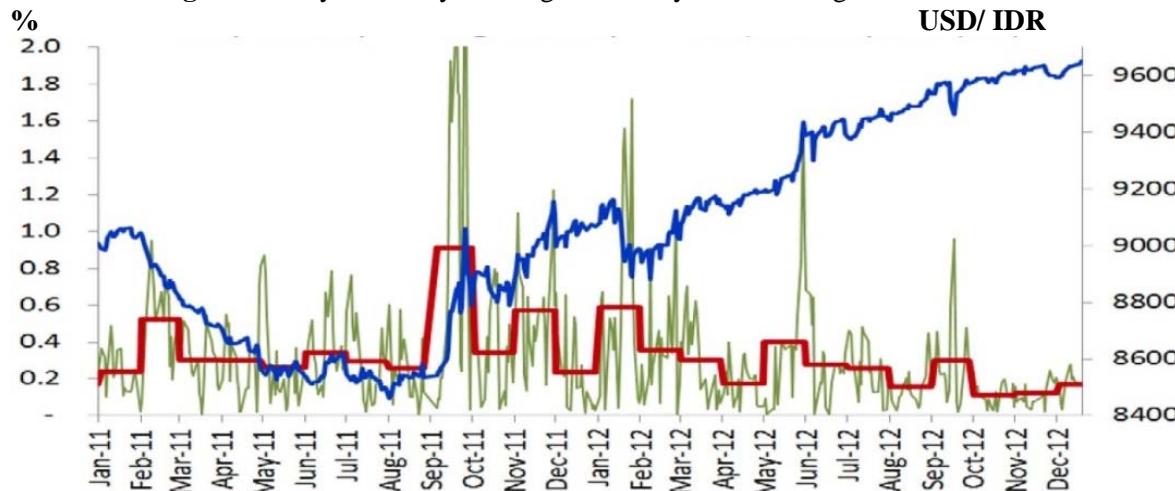
the long term, the increase of the amount of circulated money (based on Irving Fisher's quantity theory) would result in domestic inflation towards foreign inflation. Thus, both consumers and producers as economic agents would increase import as it had cheaper price. In the end, the increase in import demand would also increase foreign currency (US dollar). As a result, rupiah depreciation happened.

Price (P) was not a significant influence on the exchange rate fluctuation. This result was in accordance with short term analysis. A lot of restriction on trades in developing countries like Indonesia caused the insignificance of price towards exchange rate movement (both long and short term). Thus, the real price did not reflect the real power of demand and supply.

5.3 Bank Indonesia Policy and Distortion

Indonesia Bank has used monetary policy that is the intervention policy as liquidity management tools to balance government spending since the managed exchange rate system was changed into a free exchange rate system in August 1997. At the same time, the intervention was able to stabilize rupiah volatility especially during the depreciation associated with excess liquidity. According to Arifin (1998) in a concrete intervention policy was intended to (a) maintain the flexibility of the exchange rate level itself to stimulate the economy; (b) maintain a rational equilibrium based on economic fundamentals; and (3) maintain medium and long-term stability by strengthening fiscal and monetary policies.

The monetary policy adopted by Bank Indonesia for the stabilization of the rupiah has not been successful. This is proved by seeing the movement of the rupiah exchange rate against the US dollar and the average exchange rate volatility has a bigger gap. The conclusion is supported by Warjiyo (2013) that the gap between the average movement of volatility and exchange rate of USD / IDR increased since September 2011. This is due to the existence of large capital outflow.

Figure 2 Daily Volatility, Average Volatility and Exchange Rate USD / IDR

Source: BIS Papers no 73

Note:

- : exchange rate USD/ IDR
- : average volatility
- : daily volatility

The results of the regression analysis of the monetary model using error correction model show that the value of ECT coefficient is positive (0.9764). It indicates that the movement of the rupiah exchange rate and the average exchange rate volatility has an increasing gap. The two explanations above conclude that the monetary policy is undertaken by Bank Indonesia precisely causes a distortion in the stabilization of the rupiah exchange rate.

6. Conclusion

This study concluded that based on short term analysis, money supply influenced the exchange rate fluctuation. In contrary, the price and national income did not influence the exchange rate fluctuation. It gave the conclusion that monetary policies through money supply could be used as rupiah exchange rate stabilization instrument. In addition, both short and long term analysis showed that the rupiah exchange rate stabilization was possibly conducted by money supply. However, the monetary policy is undertaken by Bank Indonesia precisely caused distortions in which the movement of the rupiah exchange rate and the average exchange rate of volatility has an increasing gap. This indicated that monetary policy is inefficient for the stabilization of the rupiah exchange rate.

References:

- [1] Adler M and B Prasad, 1983, "On Universal Currency Hedges", *Journal of Finance and Quantitative Analysis*, 27, 19-37.
- [2] Anderson, Ronald W, and Danthine, 1979, "Cross Hedging", Columbia University Graduate School of Business, Working Paper.
- [3] Anthony Saunders, 1994, "Financial Institution Management", IRWIN.
- [4] Batiz F 1 and Luis Rivera, 1985, "International Finance and Open Economy", Mc Millan Publishing Comp, New York.
- [5] Black. F, 1989, "Equilibrium Exchange Rate Hedging", *Journal of Finance*, 43, 899-908.
- [6] Caramazza, Francesco and Jahangir, 1997, "Fixed or Flexible? Getting The Exchange Rate Right in the 1990s", World Economic Outlook.
- [7] Dennis R Appleyard and Alfred J F, 1995, "International Economic", IRWIN.
- [8] Edy Dwi T, 1988, "Fundamental Ekonomi, Contagion Effect dan Krisis Asia", *Bulletin Ekonomi Moneter dan Perbankan*, Vol 1 No. 2.
- [9] Eun C and B Resnick, 1988, "Exchange Rate Uncertainty, Forward Contracts, and International Portfolio Selection", *Journal of Finance*, 43, 197-216.
- [10] Gujarati D, 1995, "Basic Econometrics", Mc Graw Hill Inc.
- [11] Hariyadi R, 1998, "Analisis Efisiensi Pasar Valuta Asing di Lima Negara Asia

- Menggunakan Uji Kointegrasi”, *Buletin Ekonomi Moneter dan Perbankan*, Vol 1 Nomor 3.
- [12] Jack Glen and Phillip Jorion, 1993, "Currency Hedging for International Portfolios", *The Journal of Finance*, Vol. XLVIII No. 5.
- [13] Johnson L, 1960, “The Theory of Hedging and Speculation in Commodity Future”, *Review of Economic Studies*, Vol. 27 No. 3, 139.
- [14] Kaplanis E and S Schaefer, 1991, "Exchange Risk and International Diversification in Bonds and Equity Portfolio", *Journal of Economics and Business*, 43, 287-308.
- [15] Louis H E, 1979, “The Hedging Performance of The New Future Market”, *The Journal of Finance*, Vol XXXIV.
- [16] Michael J B and H Henry Cao, 1997, “International Portfolio Investment Flow”, *The Journal of Finance*, Vol LII No 5.
- [17] Mudrajat K, 1996, “*Manajemen Keuangan Internasional*”, BPFE, Yogyakarta.
- [18] Ralfo J, 1978, “Optimal Hedging Under price and quantity Uncertainly”, *Journal of Political Economy*, Forthcoming.
- [19] Rasmo Saimaun, 1998, “Evaluasi Program intervensi di Pasar Valuta Asing dalam rangka Stabilisasi Nilai Tukar”, *Bulletin Ekonomi Moneter dan Perbankan*, Vo. 1 No. 3.
- [20] Ronald W A and Jean Pierre D, 1980, “Hedging and Joint Production: Theory and Illustration”, *Journal of Finance*, Vol XXXV No. 5.
- [21] Stein J L, 1961, "The Simultaneous Determination of Spot and Future Prices", *American Economic Review*, Vol LI No. 5.
- [22] Stulz R, 1981, "A Model of International Asset Pricing", *Journal of Finance Economies*, 9, 383-406.
- [23] Santosa, AB, 2017, “Equilibrium and Disequilibrium Exchange Rate: Case of Rupiah Exchange Rate”, *International Journal of Economics and Financial Issues*, 7 (2), 81-85.
- [24] Santosa, AB, Sugiyanyo, FX, Poerwonono D, 2017, "Dornbusch Sticky Price Model Test in Explaining the Exchange Rate Fluctuation of Rupiah to American Dollar", *International Journal of Economic Research*, Vol 14 No 4.
- [25] Siegel Jeremy J, 1972, “Risk, Interest Rate and the Forward Exchange”, *Quarterly Journal of Economic*, 82, 303-309.
- [26] Telser L, 1962, “Safety First and Hedging”, *Review of Economic Studies* 23, 1-16.
- [27] Thomas RL, 1997, “*Modern Econometric*”, Addison Wesley Logman.
- [28] Uppal Raman, 1993, "A General Equilibrium Model Of International Portfolio Choice", *Journal of Finance*, 48, 529-554.
- [29] Uppal Raman, 1975, “Risk, Interest rates, and the Forward Exchange”, *Quarterly Journal of Economic*, 89, 173-175.