Order Flow and Exchange Rate Dynamics: The Case of Indonesia

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ABSTRACT

This paper examines the short-term exchange rate dynamics in Indonesia based on the microstructure framework of foreign exchange markets where the main explanatory variable is order flow. This study has three main findings. First, this study confirms that order flows has a positive and significant effect on short term exchange rate returns, consistent with the basic microstructural approach. Second, short-term movement of the Rupiah is mainly driven by foreign players. Third, there is evidence the existence of asymmetric behavior where the magnitude impact of demand of US Dollar on Rupiah movement is higher in depreciation period than appreciation period.

JEL Classification: E58, F 31, G14.

Keywords: Rupiah Exchange Rate, Market Microstructure Approach, Order flow.

1. INTRODUCTION

The Rupiah exchange rate movement holds a very important role in the economy of Indonesia. The main macroeconomic objectives, such as a high and sustainable economic growth, a healthy balance of payments, full employment, and price stability, are very much influenced by the exchange rate movement.

The experience of the 1997/1998 crisis shows that the sharp exchange rate fluctuation has a negative impact in the Indonesian economic performance. The sharp Rupiah depreciation causes economic growth to experience a contraction and high inflation.

Under the floating exchange rate regime, the Rupiah exchange rate movement has experienced considerable volatility. Before the adoption of floating exchange rate regime in July 1997, the movement of the Rupiah is fairly limited, with daily and yearly historical volatility around 0.07% and 3.5%. Whereas after the adoption of floating exchange rate regime, the average daily and yearly volatility of the Rupiah increase to 0.63% and 11,4% with the highest daily and yearly volatility around 29% in and 31% in 2008.
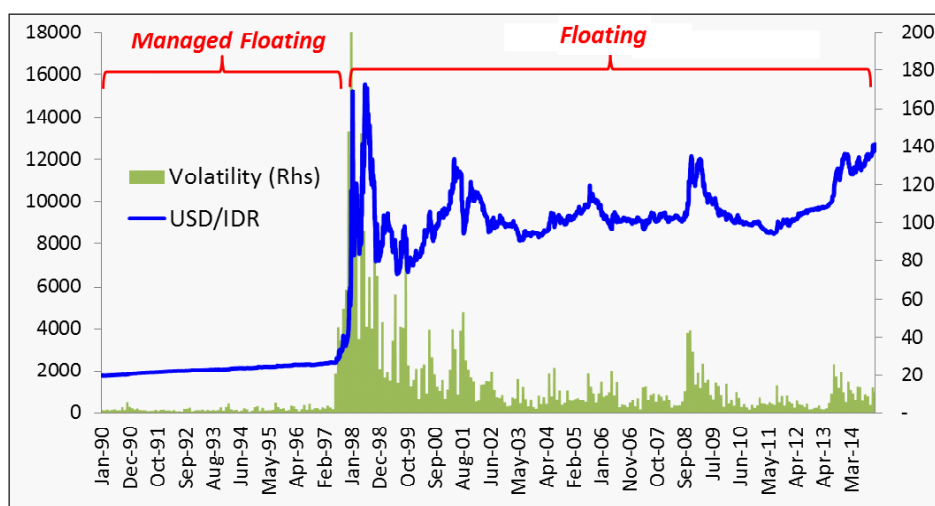
Graph 1.1: Daily Movement Rupiah January, 1990 - December 2014
Source: **Bank Indonesia, authors' calculation**

Considering the importance of managing the Rupiah exchange rate volatility under the floating rate regime, a better understanding of the exchange rate movement and factors that influence its movement is crucial. Generally, there are two primary factors that influence the exchange rate. First, fundamental or macroeconomic factors such as economic growth, inflation, and competitiveness, which will influence the exchange rate through the balance of payment and capital balance. Second, non-fundamental factors related with behaviors in the foreign exchange market such as the need for liquidity, supply trading, and sentiments.

Empirically, fundamental (macroeconomic) exchange rate models were failure to explain the exchange rate movement in the short term (see Meese and Rogoff (1983) and Copeland (2005)), since the assumptions used in the fundamental model could not capture the reality of exchange rate movement. The fundamental model is built on three fundamental assumptions: (1) the players in the foreign exchange market are homogenous, (2) the available information is symmetrical, and (3) no transaction cost in implementing every transaction. It implies that the movement of exchange rate is only a "macroeconomic phenomena". However, those three assumptions do not reflect the reality in foreign exchange market where the players are heterogenic, available information is asymmetrical, and there is a cost for doing transaction. Therefore, there is a "theoretical gap" between the fundamental model with the reality of short-term exchange rate movement.

To address the shortcoming of the fundamental exchange rate model, a microstructure approach has introduced. Using this new approach, the three assumptions under the fundamental model are relaxed and taking into account the presence of non-fundamental factor such as trading factor into the exchange rate model. In the order flow approach, Evans and Lyons (2002) argued that the order flow variable is the most important factor in the movement of exchange rate because flow data contains information that could help explain and forecast exchange rate movement in the short term. The order flow is net transaction between buyer and seller in foreign exchange market. Thus, it is an indicator to measure of net buying pressure. The omitting important explanatory variable such as order flow can lead a systematic bias to the model. It could be one explanation why the macroeconomic model cannot adequately capture the movement of short-term exchange rate. Another advantage of using the order flow variable is the ability to observe the level of influence that market players have in foreign exchange market during normal and pressured conditions.

Based on empirical studies, microstructure approach where including the order flow variable in the exchange rate model provides a more robust result. Evans and Lyons (2002) show that the order flow and exchange rate variable have strong relations in case of Deutsche Mark (DM/US$) and Japanese Yen (¥/US$). Their model shows that the order flow variable has a positive and significant influence to exchange rate movement. Furthermore, the model has a high determination coefficient (R^2) which is 60% for the Deutsche Mark and 40% for the Yen which means the model is able to explain about 40% and 60% of exchange rate movement in the two currencies. However, exclusion of the order flow variable would decrease R^2 significantly to 1%. It shows that microstructure factors tend to dominates macroeconomics factor in exchange rate movements.

Motivated by the work of Evan and Lyons (2002) who argues that the exchange rate model that incorporate order flows could give a better result than the macroeconomic model, this paper aims to incorporate the microstructure approach to model the Rupiah exchange rate movement. The use of this microstructure approach is expected to provide a robust and a new perspective to the Rupiah exchange rate model which previously only incorporate the macroeconomic factors. Furthermore, this model expected to be beneficial for decision makers in understanding exchange rate movement.

2. PREVIOUS EMPIRICAL EVIDENCE

Several studies in the literature show that incorporating microstructure factor such as order flows in the fundamental exchange rate models gives a positive and significant influence on the movement of the exchange rate in the short-term which shown in the higher model R^2. Furthermore, Evans and Lyons (2002) and Danielson et. al., (2002) show that projection power of the model by using a microstructure approach is better when compared to those of the naïve model.

Previous microstructure researchers also show the presence of the heterogeneity factor in the foreign exchange market. The research of Evans and Lyons (2005), Kohlscheen (2012), Wu (2012), Carpenter and Wang (2003), Marsh and O'Rouke (2005), Gereben and Kiss (2006) attempt to differentiate participants based on: (1) domestic vs. foreign, (2) financial institutions vs nonfinancial institution, and (3) mutual funds vs. hedged fund. Based on those research, they found that the order flows have different influences to the exchange rate movement.

Furthermore, study in emerging country also introduce the global and domestic risk variable into the model. The previous study in Brazil by Wu (2012) incorporates some risk variables such as the global risk variable using the volatility index (VIX) and the domestic risk variable such as the spread yield domestic bond to foreign bond yield in the model. For the case of Indonesia, the use of the global and domestic risk variables is considered relevant to consider due to the amount of foreign capital flow that enters the Indonesian economy.

The aim of the research is to present that the exchange rate model with the microstructure approach is relevant in the case of Indonesia. It can be argued, the exchange rate model using the macroeconomic model is not adequate to explain short-term exchange rate movement. This research also uses the domestic and global risk variables in the microstructure considering the amount of foreign capital flow that enters the Indonesian economy. In particular, the global and domestic risk factors will hold an important role in determining the capital flow to Indonesia. Other than that, this research will differentiate order flow participants into three participants which are foreign, corporations, and customers in order to observe the heterogeneity from those participants. The differentiation is important for testing the hypothesis that foreign participant has a stronger influence compared with domestic participants.

3. MAIN CHARACTERISTIC OF THE INDONESIA FOREIGN EXCHANGE MARKET

The Indonesia foreign exchange market has three main participants: (1) non-bank domestic (customers and domestic corporations), (2) domestic banks, and (3) foreign players. From the three participants, foreign players have a more important role compared to the other participants. Foreign players account for 43% of the total spot transaction followed by the non-bank domestic (customers and corporations) for 39% and domestic banks for 17%. Transactions of foreign participant are primarily for selling and buying securities in Indonesia. While transactions of the domestic corporation are primarily related to the need of export and import and payment of foreign debt. On the other side, domestic customers engage in foreign exchange transactions for education payment and insurance.

Foreign exchange turnover in Indonesia are still limited. From the Triennial survey by the Bank for International Settlement (BIS) in 2013, daily transactions of foreign exchange in Indonesia is only 5 billion USD/day far below regional countries such as Singapore (average USD 383 billion per day) as well as Thailand and Malaysia whose turnovers are USD 12 billion/per day and USD 11 billion/per day.

Moreover, foreign exchange transactions in Indonesia tend to be segmented, which reflected from the few foreign exchange transaction between banks. The segmented market is caused by the implementation of transaction limits by foreign banks. In the domestic foreign exchange market, foreign banks provide limits to other domestic banks due to credit risk. Because of the presence of those limits, the need for foreign exchange from domestic banks is often not fulfilled by foreign banks. In that condition, significant increase in foreign exchange demand would pressure the exchange rate to weaken faster.

Generally, foreign exchange demand of domestic participants are always larger than the supply. In other word, there is an persistent foreign exchange net demand. The foreign exchange demand of the domestic participants primarily came from corporates which need foreign exchange to finance international trade activities and to pay debt. Meanwhile, based on type of banks, the market share of foreign exchange transactions are dominated by foreign banks which account for 35% transaction, followed by national

private banks for 33%, private banks for 20% and mix banks for 12%. The large amount of foreign bank transactions is caused by fact that foreign banks are price makers in the domestic market due to wider foreign exchange liquidity access, a better credit rating, a more reliable transaction ability, and a better support of the system and technology.

Furthermore, foreign banks play an important role in domestic foreign exchange market from a capital flow point of view. Foreign investors use foreign banks to enter a transaction in Indonesian domestic securities. When foreign investors purchase domestic securities (capital inflow), foreign banks will act as the foreign exchange buyer from foreign investors. On the other hand, when foreign investors sell domestic securities (capital outflow), foreign banks will act as the foreign exchange seller to foreign investors.

4. DATA AND METHODOLOGY

4.1. Data

This research uses several data: (1) US Dollar (USD)/Indonesian Rupiah (IDR) exchange rate, (2) Order flow (3) Fed Funds rate as a proxy for US interest rate, (4) Bank Indonesia rate as a proxy for Indonesia interest rate, (5) Indonesia Credit Default Swap (CDS) as proxy for Indonesian risk, (6) and Volatility index (VIX) as a proxy for global risk. The sample utilized includes daily basis for the sample period from 2010 to 2014. The order flow data is taken from Bank Indonesia (commercial bank report) which classified into three categories which are foreign order flow, domestic corporations order flow, and domestic customers order flow. The USD/IDR exchange rate data is obtained from Reuters trading system. The interest rate data for Indonesia is obtained from Bank Indonesia. The interest rate data for US, the domestic risk (CDS) and global risk (VIX) are obtained from Bloomberg.

4.2. Methodology

This research applied two model in order to investigate the importance of microstructure factor in Indonesian exchange rate dynamic: (1) Ordinary Least Square and (2) Structural Vector Autoregressive (SVAR).

4.2.1. *Ordinary Least Square Model (OLS)*

In this research, we applied the model that used by Evans and Lyons (2002) for the DM/US\$ and Yen/US\$ exchange rates apply to the Indonesia Rupiah (IDR)/US \$. However, we also adding domestic and global risk variables as suggested by Kohlscheen (2012) in his microstructure model.

In this study, the order flow variable is divided into three participants which are foreign order flow, domestic corporation order flow, and domestic customers order flow, then, described by the following expression:

$$\Delta \text{IDR}_t = \delta_0 + \delta_1 \Delta(i_t - i_t^*) + \delta_2 \text{OFLN}_t + \delta_3 \text{OFKO}_t + \delta_4 \text{OFNA}_t + \delta_5 \text{VIX}_t + \delta_6 \text{CDS}_t + \mu_t \quad (4.1)$$

where, ΔIDR_t is the change of IDR/USD exchange rate from the previous period, i_t represents the foreign interest rates (Fed Funds rate), i_t^* represents domestic interest rates (BI Rate), and OFTO_t, OFLN_t, OFKO_t, OFNA_t are order flow for foreign exchange, domestic corporation, and domestic customers.

4.2.2. Structural Vector Autoregressive (SVAR)

Wu (2012) in his microstructure model uses SVAR model to explore information regarding the type of customer who is trading against the dealer. In this research, we attempted to use the SVAR model in Brazil apply to the Indonesian foreign exchange market. The model is as described by the following expression:

$$A_0 Y_t = \sum_{p=1}^{P} \beta_0 Y_{t-p} + \delta_0 Z_t + \varphi_t \qquad (4.2)$$

where,

$$A_0 = \begin{pmatrix} 1 & \alpha_{12} & \alpha_{13} & \alpha_{14} & \alpha_{15} \\ \alpha_{21} & 1 & \alpha_{23} & \alpha_{24} & \alpha_{25} \\ \alpha_{31} & \alpha_{32} & 1 & \alpha_{34} & \alpha_{35} \\ \alpha_{41} & \alpha_{42} & \alpha_{43} & 1 & \alpha_{45} \\ \alpha_{51} & \alpha_{52} & \alpha_{53} & \alpha_{54} & 1 \end{pmatrix}, \beta 0 = \begin{pmatrix} \beta_{11} & \beta_{12} & \beta_{13} & \beta_{14} & \beta_{15} \\ \beta_{21} & \beta_{22} & \beta_{23} & \beta_{24} & \beta_{25} \\ \beta_{31} & \beta_{32} & \beta_{33} & \beta_{34} & \beta_{35} \\ \beta_{41} & \beta_{42} & \beta_{43} & \beta_{44} & \beta_{45} \\ \beta_{51} & \beta_{52} & \beta_{53} & \beta_{54} & \beta_{55} \end{pmatrix},$$

$$\delta_0 = \begin{pmatrix} \delta_{11} & \delta_{12} \\ \delta_{21} & \delta_{22} \\ \delta_{31} & \delta_{32} \\ \delta_{41} & \delta_{42} \\ \delta_{51} & \delta_{52} \end{pmatrix}$$

where, $Y_t [\Delta IDR_t, OFLN_t, OFKO_t, OFNA_t \Delta(i_t - i_t^*)]'$ represents the endogen variable; and $Z_t = [VIX_t, CDS_t]'$ represents the exogenous variables.

In implementing the estimation of equation 4.2, there is a restriction to eliminate the contemporaneous effect from the order flow demand by foreign participant, domestic corporation participant, and domestic customer participant. The restriction coefficients $\alpha_{23}^0, \alpha_{24}^0, \alpha_{32}^0, \alpha_{34}^0, \alpha_{42}^0$ and α_{43}^0 are set to zero. Furthermore, the restriction also adds that the order flow of foreign participant, domestic corporation, and domestic customer do not influence interest rate (set to zero). The matrix is able to be illustrated as the following:

$$A_o = \begin{pmatrix} 1 & \alpha_{12} & \alpha_{13} & \alpha_{14} & \alpha_{15} \\ 0 & 1 & 0 & 0 & \alpha_{25} \\ 0 & 0 & 1 & 0 & \alpha_{35} \\ 0 & 0 & 0 & 1 & \alpha_{45} \\ 0 & 0 & 0 & 0 & 1 \end{pmatrix}$$

5. RESULTS AND DISCUSSION

5.1. Influence of Order Flow to Exchange Rate

Estimation results with the OLS model shows all estimated coefficients are significant and positive. The result is consistent with the microstructure theory and previous microstructure empirical research which

states that order flow demand will resulted in a depreciation of the exchange rate. Estimation results of other variables such as the change of interest rate difference, domestic risk (CDS) and global risk (VIX) are also significant and positive, in line with the previous research (Table 5.1).

There are several lessons which can be learn from estimation output. First, the foreign participant order flow shows that for every increase of net demand as large as USD 1 billion, foreign participant will cause a Rupiah to depreciate around 0.62% per day. Second, when the demand from domestic corporation increases as large as USD 1 billion, rupiah would depreciate around 0.19%. Third, when the demand from customers increases as large as USD 1 billion, rupiah would depreciate around 0.19%. This finding is in line with previous research by Evans and Lyons (2002) and Berger (2008), who find a positive coefficient between order flow and the exchange rate (0.4% and 0.45% respectively as a cause of demand net increase of 1 billion USD).

Observing from each type of participants, the results of the three findings above show that the foreign order flow has the largest impact compared with other order flow variables. This implies that foreign participant has a larger role in influencing rupiah exchange rate movement. Meanwhile, comparing the other participants (domestic corporate and customer order flow variable), the domestic corporate order flow has larger impact compare to domestic customer order flow. This implies that domestic corporation also need special attention due to their influence to exchange rate movement.

Furthermore, estimation output suggests that interest rate differential also influence the exchange rate movement: a 0.51% depreciation of Indonesian Rupiah is associated with interest rate increase as large as 1%. While an increase of 1% in domestic and global variable risk would cause a depreciation of rupiah exchange rate as large as 2.09% and 0.25%.

Table 5.1
Estimation Results of Equation 4.1: Influence of the Order Flow Variable to Exchange Rate

	Order Flow			$\Delta(i_t - i_t^*)$	DCDS	DVIX	R^2 Adj.	AIC/SIC
	Foreign	*Corporate[1]*	*Customer[1]*					
Coefficient	0.62***	0.19**	0.04*	0.51**	2.09***	0.25**	0.21	0.43/0.46
	(0.06)	(0.08)	(0.02)	(0.23)	(0.39)	(0.12)		

Remarks: Standard error in parenthesis, *Significant at 90%, **Significant at 95%, ***Significant at 99%, 1 is lag 1.

5.2. Asymmetric Influence of the Order Flow Transaction

This paper also aims to test the asymmetric influence from the three-participants foreign exchange demand during the depreciation period compared to the appreciation period. The test is implemented using two different data samples which are order flow transactions in the appreciation and depreciation periods using equation 4.1.

The asymmetrical influence from the participants in the foreign exchange market is shown from larger impact to Rupiah from foreign exchange purchase during the depreciation period compared with the appreciation period. In this case, the order flow coefficient in depreciation period is 0.66%, where in appreciation period is only 0.17%. It means that the purchase of foreign exchange from foreign participant in depreciation period gives more than four times downward pressure to Rupiah (depreciation) as purchase

in appreciation period. The domestic customer order flow behavior also show similar asymmetrical behavior, consistent with foreign participant behavior. The coefficient in depreciation period is 0.11, where coefficient in appreciation period is only 0. 06 (Table 5.2).

The asymmetrical influence is also reflected from the behavior of domestic corporations. During the depreciation period, the order flow coefficient of domestic corporations is positive whereas in the appreciation period the coefficient becomes negative, suggesting a difference in behavior compared to the two other participants (foreign and customer) which have positive coefficients during the depreciation and appreciation periods. The asymmetrical influence of the corporation illustrates that during the depreciation period, the exchange rate demand from corporation increases pressure to the Rupiah while during the appreciation period, the foreign exchange demand of the corporation does not provide pressure to the exchange rate.

There are two explanations why the order flow coefficient of domestic corporations is negative in the appreciation period. First, during appreciation period, demand of corporate foreign exchange decreases. It is estimated that corporations tend to sell foreign exchange during appreciation period. Second, the behavior could be associated with feedback trading. Corporate will sell foreign exchange when the Rupiah appreciates due to the expected further appreciation of Rupiah. During appreciation period, domestic corporate participant act as a supplier of foreign exchange to the market (liquidity provider).

Table 5.2
Estimation Results of Equation 4.1: Influence of the Order Flow Variable to
Appreciation and Depreciation Period

	Order Flow			$\Delta(i_t - i_t^*)$	DCDS	DVIX	R^2 Adj	AIC/SIC
	Foreign	*Corporate[1]*	*Customer[1]*					
Appreciation Period	0.17[*] (0.10)	−0.55[***] (0.20)	0.11[**] (0.05)	−0.26 (0.25)	2.29[***] (0.34)	0.43[*] (0.23)	0.16	0.30/0.41
Depreciation Period	0.66[*] (0.06)	0.19[***] (0.09)	0.05[**] (0.03)	0.51[**] (0.23)	2.21[***] (0.43)	0.29[***] (0.14)	0.20	0.61/0.64

Remarks: Standard error in parenthesis, [*]Significant at 90%, [**]Significant at 95%, [***]Significant at 99%, 1 is lag 1.

5.3. Structural Vector Autoregressive (SVAR) Model Estimation

5.3.1. Impulse Response Function Analysis (IRF)

Graph 5.1 provides impulse response function (IRF) result from the exchange rate value to shock from the foreign, corporation, and customer order flows.

From the IRF results above, several explanations could be drawn. First, in every presence of shock, as reflecting in an increase in foreign exchange demand from foreign, domestic corporations, and domestic customers, will give a downward pressure (depreciation) to Rupiah. It consistent to microstructure theory where there is a positive relationship between order flow and exchange rate. Second, the shock of the foreign order flow variable causes a larger exchange rate depreciation compare to the domestic order flow variables (corporates and customers). The shock of foreign order flow gives exchange rate depreciation of 0.019%, compared to domestic corporate order flow of 0.010%. Third, the order flow shock variable impact is only temporary and will end on the fifth day to the seventh day.
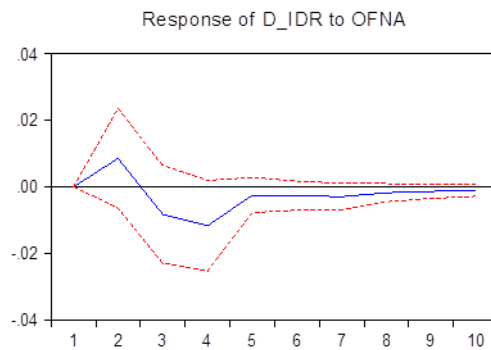
Response to Cholesky One S.D. Innovations ± 2 S.E.

Response of D_IDR to OFKO
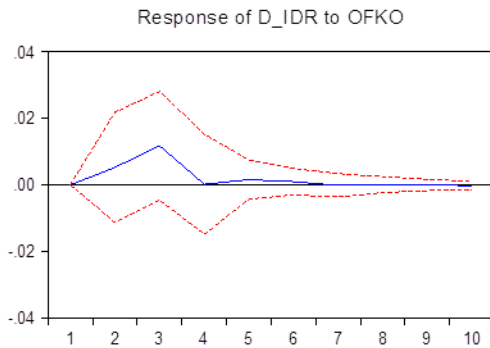
(a) Exchange Rate Response Caused by Foreign Participant

Response to Cholesky One S.D. Innovations ± 2 S.E.

Response of D_IDR to OFLN
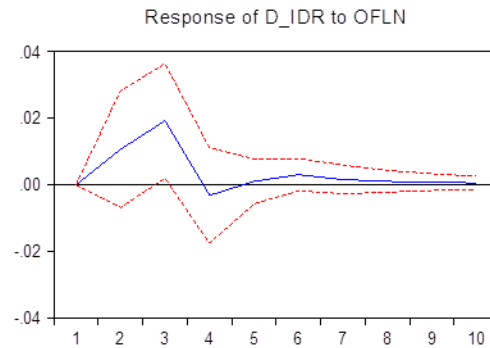
(b) Exchange Rate Response Caused by Domestic Corporate Participant

Response to Cholesky One S.D. Innovations ± 2 S.E.

Response of D_IDR to OFNA

(c) Exchange Rate Response Caused by Shock of Domestic Customers

Graph 5.1: Impulse Response Function (IRF)

5.3.1.1. *Variance Decomposition Analysis (VD)*

Table 5.3 provides estimation from variance decomposition analysis. From the VD results, several findings could be presented. First, all order flow variables (foreign order flow, domestic corporate order flow, and domestic customer order flow) provide contributions in explaining the exchange rate variance. Second, the largest variance component in explaining the exchange rate variance is the foreign order flow, compared with the two other order flow variables.

Table 5.3
Variance Decomposition shock Exchange Rate Results

Period	Exchange Rate	Foreign Order Flow	Corporate Order Flow	Customer Order Flow
1	100.00	0.00	0.00	0.00
2	99.79	0.11	0.03	0.07
3	99.19	0.47	0.16	0.14
4	98.77	0.48	0.16	0.27
5	98.76	0.48	0.16	0.28
6	98.75	0.49	0.16	0.28
10	98.73	0.49	0.16	0.30

This result shows that outside the exchange rate variable itself the foreign order flow variable has the largest contribution compared with other variables both in the short-term and the long-term. This suggests an importance of stabilizing the rupiah exchange rate if there is a shock in the exchange rate caused by demand from foreign participant.

6. CONCLUSION AND POLICY RECOMMENDATIONS

6.1. Conclusion

This study provides strong evidence that the microstructure factor which reflected from order flow variables (foreign, domestic corporations, and domestic customers order flow) has a significant and positive relationship with short term rupiah exchange rate movement.

The empirical results also show that each order flows from foreign, domestic corporations, and domestic customer has different influence to exchange rate movement. In other words, empirical results show the existence of a heterogeneity phenomenon between the three participants.

The empirical results also show that foreign exchange demand has an asymmetrical influence. The downward pressure (depreciation) of foreign exchange demand in the depreciation period is larger compared to the appreciation period.

The significant role of foreign participant in influencing exchange rate is also reflected from the response of the exchange rate to shock from foreign order flow. Demand shock from foreign participant would give more downward pressure to Rupiah compared to shock from domestic order flow.

This research also observes that the shock in the exchange rate from the foreign participant order flow provides the largest contribution and more persistent to the exchange rate movement compared with contribution from domestic participants.

6.1. Policy Recommendations

The main finding of this research shows that foreign participant has a significant role in influencing the short-term exchange rate. Therefore, in order to reduce instability of the Rupiah exchange rate, Bank Indonesia and the Government should introduce capital flow management policy, similar that introduce in China and India. The policy will help to manage the foreign capital inflow to Indonesia and finally will reduce the pressure of Rupiah.

Another important policy that should introduce to increase the Indonesian foreign exchange market resilience is through building a strong infrastructure of the foreign exchange market. In this case, the establishment of Central counterparty clearing house (CCP) in Indonesian foreign exchange market is a must. The CCP will takes on counterparty credit risk between parties which is needed for developing the foreign exchange market. We believe the establishment of CPP will make Indonesian foreign exchange market more efficient and liquid.

Since the Indonesian foreign exchange market is still thin and segmented, the presence of Bank Indonesia on the domestic foreign exchange market to stabilize the rupiah exchange rate through intervention is still needed. However, we propose a unique intervention strategy of the Bank Central Brazil and Mexico

using DNDF (Domestic-Non-Deliverable Forward) can be applied in Indonesia to increase the effectiveness of BI intervention. The DNDF will provide efficient hedging instruments for economic agents in times of reduced capital inflows and foreign exchange volatility. It also provides incentives for commercial banks to bring dollar to domestic and so help finance the current account deficit.

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