

FOREIGN HOLDING COMPOSITION AND EXCHANGE RATES IN INDONESIA

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Abstract

This paper contributes to the portfolio investment and exchange rates dynamics literature in a small open economy, the Indonesia market, by investigating the joint dynamics of foreign holding composition and exchange rates that is considered as a vital issue for investors and policy maker. Indonesia Central Securities Depository (KSEI) classifies foreign holding composition into nine categories—corporation, individual, mutual fund, securities company, insurance, pension fund, financial institution, fondation, and others. For this purpose, Vector Error Correction model, Vector Autoregression (VAR) framework, and granger causality are used to assess the dynamic relationships among foreign short-term portfolio ownership, in equity, local currency corporate and government bonds, and exchange rates. The analyzed time-span is 2009-2016 and this paper employs monthly data of foreign holding of Indonesia financial assets and the exchange rate. The results show that there exists a unidirectional causality that runs from foreign corporate, mutual fund, insurance, and pension fund ownership to exchange rates, in the long-term. In the short-term, there is a unidirectional causality that runs from foreign ownership under corporate, mutual fund, and other categories to current exchange rates. In general, the results show that foreign institutional ownership of Indonesia financial assets affect exchange rates both in the long and short term, which is the first time this has been investigated.

Keywords: Foreign holding composition, exchange rates, Vector Error Correction Model, Vector Autoregression, Granger Causality

JEL Classifications: E49, G32



INTRODUCTION

International capital flows play an important role as a source of capital, technology, and managerial expertise for small open economies like Indonesia. However, a sudden large capital inflow causes domestic currency to appreciate which, in turn, can decrease a country's net exports performance (Bakardzhieva et al, 2010). Therefore, extreme inflows of capital have posed challenges for policy makers in emerging markets (Calvo, 1998; Edwards, 2000). In recent years, many emerging markets have experienced a rise in foreign capital inflows since the global financial crisis in 2008. In response to the crisis, throughout 2008-2014, several developed markets implemented quantitative easing and zero lower bound as a policy rates which led capital to flow to emerging markets with higher returns. Indonesia is one of the emerging markets that has been favored by short-term foreign investors. As seen in below charts, starting from 2001 to 2016, there is a significant increase in the amount of FPI (Foreign Portfolio Investment) in Indonesia. In consequence, foreign ownership accounted for the largest portion of portfolio investment in Indonesia.

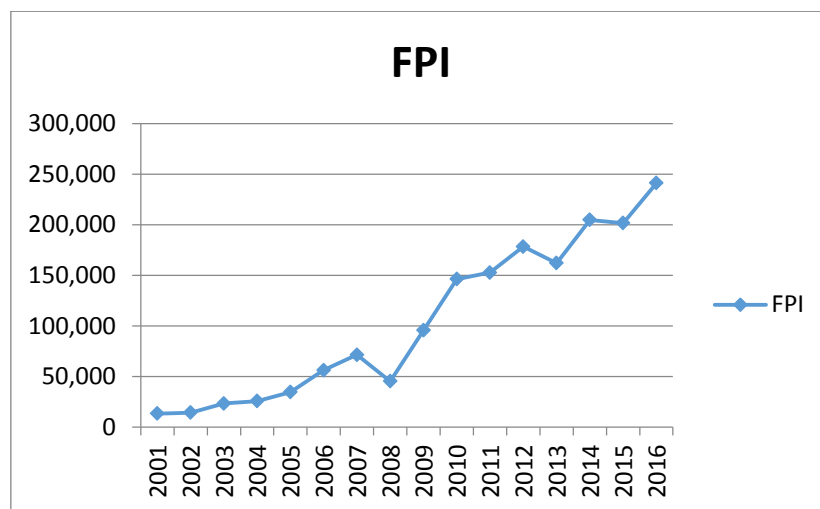


Figure 1. FPI in Indonesia in million USD (Bank Indonesia, 2001-2016)

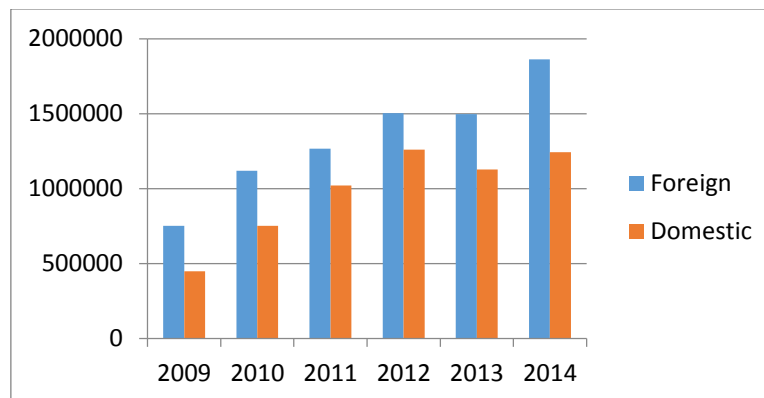


Figure 2. Composition of foreign and domestic holding of Indonesia financial assets in billion IDR (KSEI, 2009-2014)

The increasing amount of foreign capital inflows to Indonesia can be traced back to 1980s when Indonesia first liberalized its financial sector in order to spur economic growth. In 1980s, FDI (Foreign Direct Investment) was the largest type of capital inflows in Indonesia. However, after Asian crisis in 1998, foreign investors shifted their preference into portfolio investment. FPI increases domestic capital markets liquidity and facilitates the use of new instruments for diversification. However, on the other hands, this type of capital flows is volatile since it has short-term investment horizon characteristic. Some studies have found that portfolio investment is the most volatile type of capital flows with direct investment is the least volatile (Sarno and Taylor, 1999a, 1999b; Bird and Rajan, 2000).

Empirically, many studies have found the relationship between portfolio investment and exchange rates in emerging markets (Edwards, 1998; Kim and Singal, 2000; Jongwanich, 2010). FPI (Foreign Portfolio Investment) has experienced a significant increase in which foreign holding of Indonesia financial assets, chiefly in stocks, corporate and government bonds, have become more significant. Also, there has been a concern pertaining the effects of the growing foreign ownership of Indonesia financial assets, mainly by foreign institutions. According Dornbusch (1980), it is known that there is an equilibrium relationship between foreign holding of a country's assets and the price of assets in different currencies. Hence, it can be intuitively said that assets held by foreign investors determine exchange rates. In other words, it seems reasonable to assume that the foreign holding of Indonesia financial assets should affect exchange rates.

In short, foreign holding composition is chosen for this analysis for two reasons. First, foreign portfolio investment is more volatile than other types of capital flows because of its temporary nature. Therefore, it is likely to pose some challenges to monetary policy. Second, the relationships between exchange rates and aggregate capital flows have received much research attention, leaving a gap on the role of foreign holding composition, which consists of nine categories of foreign ownership of Indonesia financial assets, on exchange rates fluctuations, and vice versa. Vector Error Correction model, Vector Autoregression (VAR) framework, and granger causality are used to assess the dynamic relationships among foreign short-term portfolio ownership, in equity, local currency corporate and government bonds, and exchange rates. The analyzed time-span is 2009-2016 and this paper employs monthly data of foreign holding of Indonesia financial assets and the exchange rate. The paper finds that there exists a unidirectional causality that runs from foreign corporate, mutual fund, and insurance ownership to exchange rates, in the long-run. In the short-run, there is a unidirectional causality that runs from foreign ownership under other category to current exchange rates.

DATA AND METHODOLOGY

Data

Previous studies have shown that there is a rise in international capital flows to emerging markets during rounds of QE program undertaken by the Fed throughout 2008-2014. Therefore, this paper uses monthly secondary data of foreign holding composition in equity, corporate bonds, and government bonds and exchange rates with the analyzed time-span is 2009-2016, corresponding to all rounds of QE by the Fed. Monthly frequency data are used as to higher data frequency may include too much noise. Sum of reported foreign holding of Indonesia financial assets and nominal exchange rate are derived from KSEI and Datastream, respectively.

The summary statistics is presented in Tabel 1. Some interesting observations can be inferred from the table. Technically, the standard deviation is a measure of dispersion in a series and a large S.D. implies higher volatility. However, in the literature, high volatility has



been associated with conditions in which foreign investors get into a market for short periods of time and withdraw their investments if there is a slight change in the market that is not favorable to them. It can be seen from the table that insurance records as the highest volatility in foreign holding category and financial institution records the lowest. Meanwhile, others hold the largest portion of Indonesia financial assets.

Table 1. Summary Statistics

Stats	Obs	Mean	S.D.	Min.	Max	Exp. Sign	Definition and description
EXC	92	9.27	0.16	9.04	9.59		Nominal exchange rate, expressed as the ratio of IDR to USD. Monthly frequency, end-of-period values—expressed in natural log.
COR	92	12.48	0.59	10.64	12.94	-	Sum of reported corporate foreign holding of Indonesia financial assets(liabilities). Monthly frequency, end-of-period values—expressed in natural log.
IND	92	9.44	1.03	7.33	11.20	-	Sum of reported individual foreign holding of Indonesia financial assets (liabilities). Monthly frequency, end-of-period values—expressed in natural log.
MF	92	12.09	1	7.68	12.83	+	Sum of reported mutual fund foreign holding of Indonesia financial assets (liabilities). Monthly frequency, end-of-period values—expressed in natural log.
SC	92	11.06	0.76	7.29	12.50	+	Sum of reported securities company foreign holding of Indonesia financial assets (liabilities). Monthly frequency, end-of-period values—expressed in natural log.
INS	92	8.94	1.23	5.66	10.15	+	Sum of reported insurance foreign holding of Indonesia financial assets (liabilities). Monthly frequency, end-of-period values—expressed in natural log.
PF	92	10.83	1.15	6.85	11.87	+	Sum of reported pension fund foreign holding of Indonesia financial assets (liabilities). Monthly frequency, end-of-period values—expressed in natural log.
							Sum of reported financial institution foreign holding



FI	92	12.58	0.23	11.55	13.14	-	of Indonesia financial assets (liabilities). Monthly frequency, end-of-period values—expressed in natural log.
FON	92	7.74	0.46	6.91	8.54	+	Sum of reported fondation foreign holding of Indonesia financial assets (liabilities). Monthly frequency, end-of-period values—expressed in natural log.
OTH	92	12.90	0.25	12.37	13.32	+	Sum of reported others foreign holding of Indonesia financial assets (liabilities). Monthly frequency, end-of-period values—expressed in natural log

Table 2 shows the correlations between foreign holding composition and exchange rates. From the result, it can be seen that correlation coefficients between the nine categories of foreign ownership and exchange rates are all positive in values, meaning that foreign ownership of Indonesia financial assets and exchange rates is positively correlated. However, the level of correlation coefficients for some categories of foreign ownership are not strong--the correlations are very weak for individuals and financial institutions.

Table 2. Correlation Matrix for Foreign Holding Composition and Exchange Rates

	EXC	COR	IND	MF	SC	INS	PF	FI	FON	OTH
EXC	1									
COR	0.38	1								
IND	0.02	0.85	1							
MF	0.61	0.93	0.69	1						
SC	0.78	0.41	0.07	0.64	1					
INS	0.56	0.94	0.75	0.97	0.58	1				
PF	0.71	0.89	0.64	0.97	0.68	0.97	1			
FI	0.03	-0.47	-0.68	-0.29	0.06	-0.47	-0.37	1		
FON	0.78	0.7	0.37	0.85	0.7	0.81	0.88	-0.07	1	
OTH	0.70	0.58	0.35	0.69	0.39	0.63	0.73	0.03	0.8	1

Figure 3 Presents a visual display of the basic relationship between monthly foreign holding composition and exchange rates across time, in logs. It also indicates a trend in which foreign holding of Indonesia financial assets is initially sluggish, in 2009, and then gradually become pronounced after 2010.

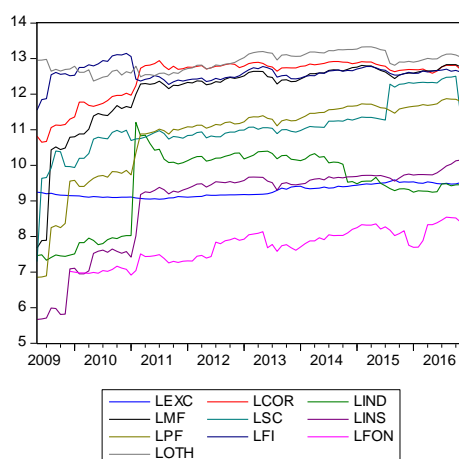


Figure 3. Co-movements Between Foreign Holding Composition and Exchange Rates

In order to investigate whether structural breaks exist in exchange rate data series, the CUSUM test is employed. This test basically a cumulative sum of recursive residuals. The CUSUM test on exchange rates shows that there is variance instability. One-step forecast test is then conducted in order to identify the specific points of break in the data series. The one-step forecast test graph shows that Indonesian nominal exchange rates has multiple breaks over the study period. Results for both tests are shown in the following Figure 4.

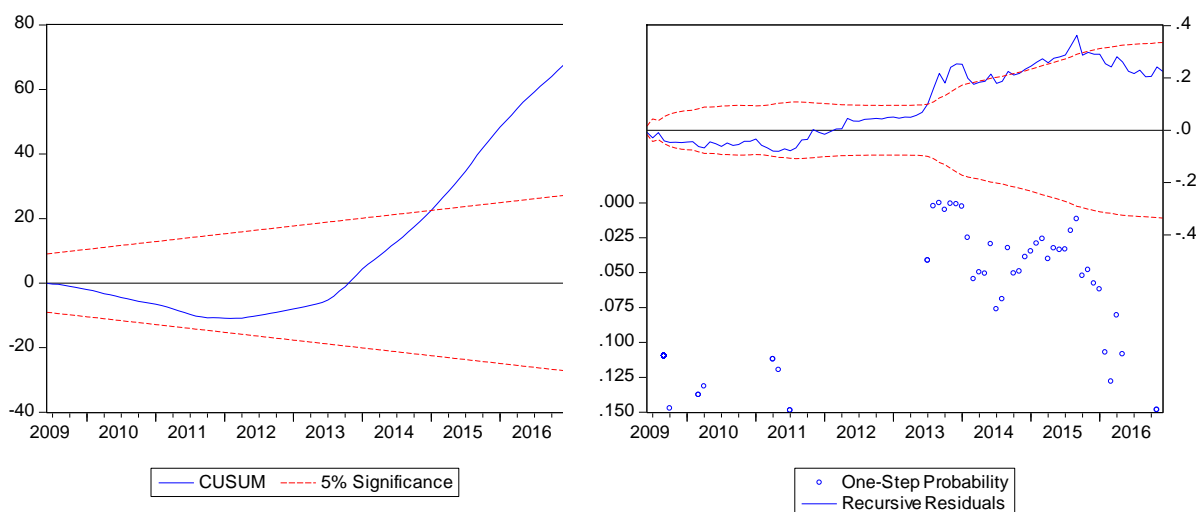


Figure 4. Structural break tests results for monthly nominal exchange rates series

Methodology

Firstly, it is important to test data stationarity using Augmented Dickey-Fuller test (ADF) and Phillip-Perron in order to avoid spurious regression. The following regression is ADF test.

$$\Delta Y_t = \delta_1 + \delta_2 t + \alpha Y_{t-1} + \beta_i \sum_{i=1}^m \Delta Y_{t-1} + \varepsilon_t \quad (2.1.)$$

Where, Δ is the difference operator. δ_1 , δ_2 , and β_i are the coefficients. ε_t is the white noise error term.

The PP test regression:

$$\Delta Y_t = \beta_1 + \beta_2 Y_{t-1} + \varepsilon_t$$

Where, Δ is the difference operator. Y_{t-1} is the first lag of Y.

Secondly, if a set of variables has a stationary linear combination, then it is considered to be a cointegration which shows a long-term relationship between variables. To test cointegration, Johansen cointegration test is used in which it can estimate more than one cointegrating vector between variables.

Thirdly, when there is an absence of any cointegrating vector between variables, the granger causality test is used to find the causal relationship among variables tested. More precisely, this test is used to investigate whether past information of x improves the forecast of y. In order to obtain this kind of link, an unrestricted VAR estimation is used to determine the



dynamic relationships of random disturbances between variables. According to Sims (1980), there are no prior restrictions in determining exogenous and endogenous variables in a VAR model due to minimal assumptions regarding to the underlying structure of the economy. Following Edwards (1998), this paper attempts to investigate the dynamic relationships between foreign holding of Indonesia financial assets and exchange rates using an unrestricted VAR estimations. One might be interested in knowing whether foreign holding of Indonesia financial assets provides any additional information that can explain the fluctuations in exchange rates.

$$\begin{bmatrix} FPI_{it} \\ ER_{it} \end{bmatrix} = \begin{bmatrix} \alpha_{10} \\ \alpha_{20} \end{bmatrix} + \begin{bmatrix} \phi_{11}(L) & \phi_{12}(L) \\ \phi_{21}(L) & \phi_{22}(L) \end{bmatrix} \cdot \begin{bmatrix} FPI_{i,t-1} \\ ER_{i,t-1} \end{bmatrix} + \begin{bmatrix} \varepsilon_{it}^{FPI} \\ \varepsilon_{it}^{ER} \end{bmatrix} \quad (2. 2.)$$

Where FPI_{t-1} represents lagged values of foreign portfolio investment which consists of nine categories of foreign holding of Indonesia financial assets; ER_{t-1} represents lagged values of nominal exchange rates; the error term ϕ_1 and ϕ_2 are parameters to be estimated; the error terms ε_{it}^j ($j= FPI, ER$) are assumed to be normally distributed with mean 0; α_{j0} are foreign ownership categories constants and ϕ_{jk} ($k= 1, 2$) are parameters to be estimated, for all $i=1, \dots, N$; $t=1, \dots, T$; L is the lag operator. For each foreign ownership category i , the variance-covariance matrix is:

$$\Sigma_i = \begin{pmatrix} \sigma_{i,FPI}^2 & \rho\sigma_{i,FPI}\sigma_{i,ER} \\ \rho\sigma_{i,FPI}\sigma_{i,ER} & \sigma_{i,ER}^2 \end{pmatrix} \quad (2. 3.)$$

Where, ρ is the correlation coefficient between the two error terms for each foreign ownership category i . The diagonal coefficients ϕ_{11} and ϕ_{22} capture how far each variable can be predicted by its own lagged values. The off-diagonal coefficients ϕ_{12} and ϕ_{21} capture the dynamic relationships between the two variables, indicating causality. The lag length of the unrestricted VAR is determined by looking at the AIC and SIC.

However, if cointegration exists between foreign holding composition an exchange rates, it means that long-term relationship exists. Therefore, it is suitable to use a VEC model since it captures the causality between variables tested with a long-term relationship.

$$\begin{bmatrix} FPI_{it} \\ ER_{it} \end{bmatrix} = \begin{bmatrix} \alpha_{10} \\ \alpha_{20} \end{bmatrix} + \begin{bmatrix} \phi_{11}(L) & \phi_{12}(L) \\ \phi_{21}(L) & \phi_{22}(L) \end{bmatrix} \cdot \begin{bmatrix} FPI_{i,t-1} \\ ER_{i,t-1} \end{bmatrix} + \begin{bmatrix} k_1 ect_{i,t-1}^{FPI} \\ k_1 ect_{i,t-1}^{ER} \end{bmatrix} \begin{bmatrix} \varepsilon_{it}^{FPI} \\ \varepsilon_{it}^{ER} \end{bmatrix}$$

Where, ect_{it}^j ($j=FPI, ER$) is the error term

EMPIRICAL RESULTS

Unit Root Tests

The following Table 3 presents the results of the ADF and PP tests. The null hypothesis of these tests is that a unit root exists in the data series. At the data levels, the t-Statistics for EXC, IND, FON, and OTH are less negative than their critical values at the 5% level. Therefore, the null hypothesis cannot be rejected. In other words, the data series of these four variables are non-stationary at the data level and they will be stationary using first difference. However, at the data level, the t-Statistics for COR, MF, SC, INS, PF, and FI are more negative than their critical values at 5% level. It means that the null hypothesis can be rejected—the data series are stationary. However, observing the ACF plot is as important as unit root tests for identifying non-stationarity time series. Figure 3 presents ACF plots for all data series. It can be seen that ACF decreases slowly to zero, meaning that all data series is non-stationary and will be stationary using first difference. Corresponding to the ACF plots, it is determined that all data series are non-stationary. Therefore, Johansen cointegration test is suitable to use since the precondition of this test is that variables must be non-stationary at level.

Table 3. ADF Unit Root Test

Variables	ADF			PP		
	Levels	5% Critical Values	First differences	Levels	5% Critical Values	First differences
EXC	0.0006	-2.89	-9.43	-0.09	-2.89	0.94
COR	-4.13	-2.89	-7.63	-3.6	-2.89	-7.6
IND	-2.22	-2.89	-10.43	-2.18	-2.89	-10.42
MF	-5.72	-2.89	-9.18	-7.68	-2.89	-9.18
SC	-5.95	-2.89	-14.9	-5.42	-2.89	-15.4
INS	-3.89	-2.89	-8.37	-4.71	-2.89	-8.3
PF	-4.55	-2.89	-8.83	-8.89	-2.89	-8.83
FI	-4.18	-2.89	-8.48	-4.84	-2.89	-8.47
FON	-1.35	-2.89	-9.19	-1.34	-2.89	-9.2
OTH	-1.67	-2.89	-11.4	-1.53	-2.89	-11.4



Table 4. Correlogram for Monthly Foreign Holding of Indonesia Financial Assets and Exchange Rates

Variables	Level				First Difference			
	Autocorrelation	Partial Correlation	AC	PAC	Autocorrelation	Partial Correlation	AC	PAC
EXC	. |*****	. |*****	0.980	0.980	. |.	. |.	-0.006	-0.006
	. |*****	. |.	0.959	-0.051	. |.	. |.	-0.005	-0.006
	. |*****	. |.	0.940	0.062	. |*	. |*	0.164	0.164
COR	. |*****	. |*****	0.941	0.941	. |**	. |**	0.224	0.224
	. |*****	. |*|.	0.865	-0.175	. |*|.	. |*|.	-0.107	-0.166
	. |*****	. |.	0.791	-0.002	. |.	. |*	0.028	0.101
IND	. |*****	. |*****	0.923	0.923	. |*|.	. |*|.	-0.106	-0.106
	. |*****	. |.	0.857	0.043	. |.	. |.	0.019	0.008
	. |*****	. |*|.	0.780	-0.068	. |.	. |.	-0.045	-0.042
MF	. |*****	. |*****	0.851	0.851	. |.	. |.	0.022	0.022
	. |*****	. |.	0.707	-0.062	. |.	. |.	0.011	0.011
	. |****	. |*|.	0.559	-0.098	. |.	. |.	0.004	0.003



	. |*****	. |**	0.532	0.349	. |*	. |*	0.107	0.107
	. |*****	. |.	0.500	-0.051	. |.	. |.	0.024	0.019
SC	. |*****	. |*****	0.785	0.785	. |.	. |.	0.017	0.017
	. |*****	. |**	0.730	0.296	. |.	. |.	0.042	0.042
	. |*****	. |*	0.663	0.077	. |*	. |*	0.095	0.094
INS	. |*****	. |*****	0.934	0.934	. |*	. |*	0.113	0.113
	. |*****	. |*|.	0.864	-0.071	**|.	**|.	-0.233	-0.249
	. |*****	. |.	0.800	0.018	*|.	. |.	-0.066	-0.006
PF	. |*****	. |*****	0.912	0.912	. |.	. |.	0.060	0.060
	. |*****	. |*|.	0.821	-0.068	*|.	*|.	-0.154	-0.158
	. |*****	. |.	0.733	-0.029	. |.	. |.	0.018	0.039
FI	. |*****	. |*****	0.772	0.772	. |*	. |*	0.132	0.132
	. |*****	. |*|.	0.570	-0.066	. |*	. |*	0.101	0.085
	. |**	. |*|.	0.347	-0.178	. |.	. |.	0.021	-0.003
	. |**	. |*	0.254	0.165	*|.	*|.	-0.116	-0.130
	. |*	. |.	0.202	0.043	. |.	. |.	-0.024	0.004

FON	. |*****	. |*****	0.936	0.936	. |.	. |.	-0.021	-0.021
	. |*****	. |.	0.871	-0.040	. |.	. |.	-0.032	-0.033
	. |*****	. |.	0.802	-0.065	. |.	. |.	-0.055	-0.056
	. |*****	. |.	0.736	-0.019	. |.	. |.	-0.061	-0.065
	. |*****	. |.	0.672	-0.020	. |.	. |.	0.021	0.015
OTH	. |*****	. |*****	0.936	0.936	. *|.	. *|.	-0.193	-0.193
	. |*****	. |*	0.895	0.158	. |.	. |.	0.034	-0.003
	. |*****	. |.	0.849	-0.033	. |.	. |.	0.031	0.039

Johansen Cointegration Test

The result of ADF tests indicate that all data series are integrated in order 1. Therefore, the Johansen cointegration test is used to test whether there is any cointegrating equation between exchange rates and each foreign holding composition category.

Table 5

Foreign Ownership Categories	Eigenvalue	Hypothesized No. Of CE(s)	Trace Stats	5% Critical Value	Hypothesized No. Of CE(s)	Max-Eigen Stats	5% Critical Value
Corporate	0.18	None*	20.56	15.49	None*	18.42	14.26
	0.02	At most 1	2.14	3.84	At most 1	2.14	3.84
Individual	0.1	None	11.32	15.49	None	10.45	14.26



Mutual Fund	0.35	None*	40.11	15.49	None*	39.88	14.26
	0.002	At most 1	0.23	3.84	At most 1	0.23	3.84
Securities Company	0.11	None	11	15.49	None	11	14.26
Insurance	0.15	None*	16	15.49	None*	15	14.26
	0.01	At most 1	0.98	3.84	At most 1	0.98	3.84
Pension Fund	0.26	None*	28.58	15.49	None*	27.92	14.26
	0.007	At most 1	0.66	3.84	At most 1	0.66	3.84
Financial Institution	0.22	None*	22.44	15.49	None*	22.44	14.26
	0.00007	At most 1	0.0006	3.84	At most 1	0.0006	3.84
Fondation	0.1	None	8.97	15.49	None	8.95	14.26
Others	0.13	None	13.2	15.49	None	12.48	14.26

Table 5 Trace tests show that there is no cointegrating equation at the 5% level. However, max-eigen tests show that there is 1 cointegrating equation at the 5% level for mutual fund. * denotes rejection of the null hypothesis.

Table 5 shows the result of trace and max-eigen tests for all series. The null hypothesis of the Johansen cointegration test is that there is no cointegrating vector. The null hypothesis can be rejected if trace and max-eigen statistics is more than the 5% critical value. In this case, these tests results for some foreign ownership categories, namely corporate, mutual fund, insurance, pension fund, and financial institution, show that there is 1 cointegrating vector at the 5% level--meaning that there is a long-term relationship between those foreign ownership categories and exchange rates. Since there is a cointegrating vector, VEC estimation is applied to capture the long-term causality between foreign corporate, mutual fund, insurance, pension fund, and financial institution ownerships and exchange rates. On the other hand, the results of foreign ownership categories which are individual, securities company, fondation, and others show that their trace and max-igen statistics are less than the 5% critical value. Therefore, it can be inferred that there is no cointegrating vector, meaning that there is no long-term relationship between those foreign ownership categories and exchange rates. In this case, a VAR model is applied to capture the short-term

relationships between foreign individual, securities company, fondation, and other ownerships and exchange rates.

The Vector Error Correction Model Causality Test

Since there is a contegrating vector in some foreign ownership categories, namely corporate, mutual fund, insurance, pension fund, and financial institution, a VEC model is applied. The first step in using this model is choosing the optimal lag length which is very crucial for the next processing steps. The data level is used in VEC model because it is capable to transform data level automatically to first difference. From table 6, it can be seen that, for all foreign ownership categories, the optimal lag length is 1. Therefore, one lag will be included within the VAR estimation of those five foreign ownership categories.

Table 6. The Number of Optimal Lag Length Using AIC And SIC

Foreign Ownership Categories	Lag	AIC	SIC
Corporate	1	-6.790	6.62
Mutual Fund	1	-6.92	-6.74
Insurance	1	-9.75	-9.5
Pension Fund	1	-6.45	-6.36
Financial Institution	1	-6.57	-6.39

Corporate

After applying VEC model, the following equation are estimated for foreign ownership under corporate category:

$$D(\text{LEXC}) = C(1) * (\text{LEXC}(-1) - 3.16795116837 * \text{LCOR}(-1) + 30.3256675142) + C(2) * D(\text{LEXC}(-1)) + C(3) * D(\text{LCOR}(-1)) + C(4)$$

In this equation, C(1) indicates the long-term coefficient between foreign ownership under corporate category and exchange rates. More clearly, the long term relationship exists if the sign of t-statistics of C(1) is ngative and the its p-value is significant. The above equation is further estimated in order to obtained p-values. The result shows that the C(1) is -



2.66 and the p-value is 0.0091 (shown in appendix). Therefore, a long term granger causality runs from foreign corporate ownership of Indonesia financial assets to exchange rates. The following table 7 presents the results of VEC Granger causality test which is employed to investigate the short-term relationship between foreign corporate ownership and exchange rates. The null hypothesis is that a lag of independent variable does not Granger cause dependent variable. From the results, it can be seen that the foreign corporate ownership has significant p-value 0.031. Therefore, null hypothesis can be rejected at 5% level, meaning that a lag of foreign corporate ownership of Indonesia financial assets Granger causes domestic currency. On the other hand, a lag of exchange rate does not Granger cause foreign corporate ownership since the p-value 0.86 is rejected at the 5% level.

Table 7. VEC Granger Causality Between Foreign Corporate Ownership and Exchange Rates

Dependent Variable: D(EXC)			
Excluded	Chi-sq	df	Prob.
D(COR)	4.62	1	0.031
Dependent Variable: D(COR)			
Excluded	Chi-sq	df	Prob.
D(EXC)	0.02	1	0.86

Mutual Fund

The following equation are estimated for foreign ownership under mutual fund category:

$$D(LEXC) = C(1) * (LEXC(-1) - 0.678471428925 * LMF(-1) - 1.04337345559) + C(2) * D(LEXC(-1)) + C(3) * D(LMF(-1)) + C(4)$$

In this equation, C(1) indicates the long-term coefficient between foreign ownership under mutual fund category and exchange rates. More clearly, the long term relationship exists if the sign of t-statistics of C(1) is ngative and the its p-value is significant. The above equation is further estimated in order to obtained p-values. The result shows that the C(1) is -1.90 and the p-value is 0.06 (shown in appendix). Therefore, a long term granger causality



runs from foreign mutual fund ownership of Indonesia financial assets to exchange rates. The following table 8 presents the results of VEC Granger causality test which is employed to investigate the short-term relationship between foreign mutual ownership and exchange rates. The null hypothesis is that a lag of independent variable does not Granger cause dependent variable. From the results, it can be seen that the foreign mutual fund ownership has significant p-value 0.057. Therefore, null hypothesis can be rejected at 10% level, meaning that a lag of foreign mutual fund ownership of Indonesia financial assets Granger causes domestic currency. On the other hand, a lag of exchange rate does not Granger cause foreign mutual fund ownership since the p-value of 0.52 is rejected at the 5% level.

Table 8. VEC Granger Causality Between Foreign Mutual Fund Ownership and Exchange Rates

Dependent Variable: D(EXC)			
Excluded	Chi-sq	df	Prob.
D(MF)	3.59	1	0.057
Dependent Variable: D(MF)			
Excluded	Chi-sq	df	Prob.
D(EXC)	0.4	1	0.52

Insurance

The following equation are estimated for foreign ownership under insurance category:

$$D(LEXC) = C(1) * (LEXC(-1) - 4.07883946444 * LINS(-1) - 0.367569057427) + C(2) * D(LEXC(-1)) + C(3) * D(LINS(-1)) + C(4)$$

In this equation, C(1) indicates the long-term coefficient between foreign ownership under insurance category and exchange rates. More clearly, the long term relationship exists if the sign of t-statistics of C(1) is negative and the its p-value is significant. The above equation is further estimated in order to obtained p-values. The result shows that the C(1) is -2.79 and the p-value is 0.0065 (shown in appendix). Therefore, a long term granger causality runs from foreign insurance ownership of Indonesia financial assets to exchange rates. The following table 9 presents the results of VEC Granger causality test which is employed to



investigate the short-term relationship between foreign insurance ownership and exchange rates. The null hypothesis is that a lag of independent variable does not Granger cause dependent variable. From the results, it can be seen that the foreign insurance ownership has a p-value of 0.25. Therefore, null hypothesis cannot be rejected, meaning that a lag of foreign insurance ownership of Indonesia financial assets does not Granger cause domestic currency. Similarly, a lag of exchange rate does not Granger cause foreign insurance ownership since the p-value is 0.74. In other words, there is no short-term relationship between foreign insurance ownership and exchange rates.

Table 9. VEC Granger Causality Between Foreign Insurance Ownership and Exchange Rates

Dependent Variable: D(EXC)			
Excluded	Chi-sq	df	Prob.
D(INS)	1.32	1	0.25
Dependent Variable: D(INS)			
Excluded	Chi-sq	df	Prob.
D(EXC)	0.10	1	0.74

Pension Fund

The following equation are estimated for foreign ownership under pension fund category:

$$D(LEXC) = C(1) * (LEXC(-1) - 0.452157777664 * LPF(-1) - 4.35986076206) + C(2) * D(LEXC(-1)) + C(3) * D(LPF(-1)) + C(4)$$

In this equation, C(1) indicates the long-term coefficient between foreign ownership under pension fund category and exchange rates. More clearly, the long term relationship exists if the sign of t-statistics of C(1) is negative and the its p-value is significant. The above equation is further estimated in order to obtained p-values. The result shows that the C(1) is -2.46 and the p-value is 0.015 (shown in appendix). Therefore, a long term granger causality runs from foreign pension fund ownership of Indonesia financial assets to exchange rates. The following table 10 presents the results of VEC Granger causality test which is employed



to investigate the short-term relationship between foreign pension fund ownership and exchange rates. The null hypothesis is that a lag of independent variable does not Granger cause dependent variable. From the results, it can be seen that the foreign pension fund ownership has a p-value of 0.16. Therefore, null hypothesis cannot be rejected, meaning that a lag of foreign pension fund ownership of Indonesia financial assets does not Granger cause domestic currency. Similarly, a lag of exchange rate does not Granger cause foreign pension fund ownership since the p-value is 0.63. In other words, there is no short-term relationship between foreign pension fun ownership and exchange rates.

Table 10. VEC Granger Causality Between Foreign Pension Fund Ownership and Exchange Rates

Dependent Variable: D(EXC)			
Excluded	Chi-sq	df	Prob.
D(PF)	1.89	1	0.16
Dependent Variable: D(PF)			
Excluded	Chi-sq	df	Prob.
D(EXC)	0.22	1	0.63

Financial Institution

The following equation are estimated for foreign ownership under financial institution category:

$$D(LEXC) = C(1)*(\text{LEXC}(-1) - 11.1284515878*\text{LFI}(-1) + 130.899048078) + C(2)*D(LEXC(-1)) + C(3)*D(LFI(-1)) + C(4)$$

In this equation, C(1) indicates the long-term coefficient between foreign ownership under pension fund category and exchange rates. More clearly, the long term relationship exists if the sign of t-statistics of C(1) is negative and the its p-value is significant. The above equation is further estimated in order to obtained p-values. The result shows that the C(1) is -0.46, but the p-value is 0.64 (shown in appendix). Therefore, it can be inferred that there is no long run causality from foreign financial institution ownership to exchange rates. The following table 11. presents the results of VEC Granger causality test which is employed to



investigate the short-term relationship between foreign financial institution ownership and exchange rates. The null hypothesis is that a lag of independent variable does not Granger cause dependent variable. From the results, it can be seen that the foreign financial institution ownership has a p-value of 0.1063. Therefore, null hypothesis cannot be rejected, meaning that a lag of financial institution ownership of Indonesia financial assets does not Granger cause domestic currency. Similarly, a lag of exchange rate does not Granger cause foreign pension fund ownership since the p-value is 0.21. In other words, there is no short-term relationship between foreign financial institution ownership and exchange rates.

Table 11. VEC Granger Causality Between Foreign Financial Institution Ownership and Exchange Rates

Dependent Variable: D(EXC)			
Excluded	Chi-sq	df	Prob.
D(FI)	2.6	1	0.1063
Dependent Variable: D(FI)			
Excluded	Chi-sq	df	Prob.
D(EXC)	1.55	1	0.21

Vector Autoregression Granger Causality Test

Since there is no cointegrating vector in the rest of foreign ownership categories, namely individual, securities company, foundation, and other, a VAR model is applied. When employing this model, data series have to be stationary so all series that are non-stationary at level must be transformed to their first difference. From table 12, it can be seen that, for all foreign ownership categories, except other, the optimal lag length is 1. Foreign ownership under other category has an optimal lag length of 2.

Table 12. The Number of Optimal Lag Length Using AIC and SIC

Foreign Ownership Categories	Lag	AIC	SIC
Individual	1	-3.87	-3.7
Securities Company	1	-5.24	-5.07
Fondation	1	-5.8	5.62
Other	2	-6.86	-6.57

Individual

The following tabel 13 presents the results of VAR Granger causality between foreign individual ownership and exchange rates by incorporating one lag,. The null hypothesis is that one lag of a independent variable do not Granger cause a dependent variable, at 5% level. The results show that the p-value of D(IND) is statistically not significant, higher than 5% level. Therefore, the null hypothesis cannot be rejected. In other words, there is no Granger causality running from a lag of foreign individual ownership to current exchange rates, and vice versa.

Table 13. VAR Granger Causality Between Foreign Individual Ownership and Exchange Rates

Dependent Variable: D(EXC)			
Excluded	Chi-sq	df	Prob.
D(IND)	1.08	1	0.29
Dependent Variable: D(IND)			
Excluded	Chi-sq	df	Prob.
D(EXC)	0.006	1	0.93

Securities Company

The following tabel 14 presents the results of VAR Granger causality between foreign securities company ownership and exchange rates by incorporating one lag. The null hypothesis is that one lag of a independent variable do not Granger cause a dependent



variable, at 5% level. The results show that the p-value of D(SC) is statistically not significant. Therefore, the null hypothesis cannot be rejected. In other words, there is no Granger causality running from a lag of foreign securities company ownership to current exchange rates, and vice versa.

Table 14 VAR Granger Causality Between Foreign Securities Company Ownership and Exchange Rates

Dependent Variable: D(EXC)			
Excluded	Chi-sq	df	Prob.
D(SC)	0.31	1	0.57
Dependent Variable: D(SC)			
Excluded	Chi-sq	df	Prob.
D(EXC)	0.0002	1	0.98

Fondation

The following tabel 15 presents the results of VAR Granger causality between foreign fondation ownership and exchange rates by incorporating one lag. The null hypothesis is that one lag of a independent variable do not Granger cause a dependent variable, at 5% level. The results show that the p-value of D(FON) is statistically not significant. Therefore, the null hypothesis cannot be rejected. In other words, there is no Granger causality running from a lag of foreign fondation ownership to current exchange rates. Similarly, there is no Granger causality running from a lag of exchange rates to current foreign fondation ownership.

Table 15. VAR Granger Causality Between Foreign Fondation Ownership and Exchange Rates

Dependent Variable: D(EXC)			
Excluded	Chi-sq	df	Prob.
D(FON)	0.38	1	0.53
Dependent Variable: D(FON)			
Excluded	Chi-sq	df	Prob.
D(EXC)	2.43	1	0.11



Other

The following tabel 16 presents the results of VAR Granger causality between foreign ownership under other category and exchange rates by incorporating two lags. The null hypothesis is that two lags of a independent variable jointly do not Granger cause a dependent variable, at 5% level. The results show that the p-value of D(OTH) is statistically significant at 10%. Therefore, the null hypothesis can be rejected. In other words, the two lags of foreign ownership under other category jointly Granger causes current exchange rates. Conversely, two lags of exchange rates do not jointly Granger cause current foreign ownership under other category. It can be inferred that, there is a unidirectional causal relationship.

Table 16. VAR Granger Causality Between Foreign Ownership Under Other Category and Exchange Rates

Dependent Variable: D(EXC)			
Excluded	Chi-sq	df	Prob.
D(OTH)	5.73	1	0.05
Dependent Variable: D(OTH)			
Excluded	Chi-sq	df	Prob.
D(EXC)	0.74	1	0.68

CONCLUSION

The growth rate of foreign capital flows to Indonesia has increased since the country liberalized its financial system. Among other types of capital inflows, foreign portfolio investment has shown a substantial increase after 1998 when asian financial crisis occurred. The increasing amount FPI has become a concern because foreign ownership takes up the largest portion of Indonesia financial assets. This paper provides new evidence on the dynamic relationships between nominal exchange rates and foreign ownership of Indonesia financial assets, which falls under nine categories—corporate, individual, mutual fund, securities company, insurance, pension fund, financial institution, fondation, and other. Using VECM, VAR estimation, and Granger causality, the results suggest long-term relationships



between some of foreign ownership categories, namely corporate, mutual fund, insurance, and pension fund, to exchange rates. More clearly, there exist a unidirectional causality that runs from foreign corporate, mutual fund, insurance, and pension fund ownership to exchange rates in the long-run. The results also show there is a unidirectional causality that runs from foreign ownership under corporate, mutual fund, and other category to current exchange rates in the short-run. Therefore, it can be said that foreign institutional ownership, such as corporations, mutual funds, insurances, and pension funds, play a significant role in affecting the exchange rate fluctuations, in the long and short term. In sort, this study is consistent with previous studies that have found that portfolio investment affects exchange rates (Edwards, 1998; Kim and Singal, 2000; Jongwanich, 2010). This study proposes novelty in foreign capital flows and exchange rates literature by investigating a gap on the role of foreign holding composition on exchange rates fluctuations, and vice versa. In general, it is found that foreign holding of Indonesia financial assets does matter. This suggests that policy maker should pay more attention to managing foreign ownership because the reversal of inflows poses a potential danger. Another interesting avenue of research would be to deepen the analysis of the effects of foreign institutional ownership of Indonesia financial assets on exchange rates before and during GFC when rounds of QE program, which triggered capital inflows to emerging economies, were not implemented.

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Appendix

Dependent Variable: D(LEXC)

Method: Least Squares

Date: 04/08/17 Time: 19:38

Sample (adjusted): 2009M07 2016M12

Included observations: 90 after adjustments

$$D(LEXC) = C(1)*(LEXC(-1) - 3.16795116837*LCOR(-1) + 30.3256675142) \\ + C(2)*D(LEXC(-1)) + C(3)*D(LCOR(-1)) + C(4)$$

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	-0.003712	0.001391	-2.668774	0.0091
C(2)	-0.136320	0.106991	-1.274122	0.2061
C(3)	-0.052550	0.024426	-2.151422	0.0342
C(4)	0.004488	0.002434	1.844188	0.0686
R-squared	0.132033	Mean dependent var		0.002979
Adjusted R-squared	0.101755	S.D. dependent var		0.023424
S.E. of regression	0.022201	Akaike info criterion		-4.733968
Sum squared resid	0.042387	Schwarz criterion		-4.622865
Log likelihood	217.0285	Hannan-Quinn criter.		-4.689165
F-statistic	4.360707	Durbin-Watson stat		2.025667
Prob(F-statistic)	0.006582			

1.1. Long run relationships between foreign corporate ownership and exchange rates



Dependent Variable: D(LEXC)

Method: Least Squares

Date: 04/08/17 Time: 19:39

Sample (adjusted): 2009M07 2016M12

Included observations: 90 after adjustments

$$D(LEXC) = C(1)*(LEXC(-1) - 0.678471428925*LMF(-1) - 1.04337345559) + C(2)*D(LEXC(-1)) + C(3)*D(LMF(-1)) + C(4)$$

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	-0.008649	0.004550	-1.901022	0.0606
C(2)	-0.066211	0.104850	-0.631482	0.5294
C(3)	-0.016787	0.008850	-1.896854	0.0612
C(4)	0.004128	0.002455	1.680998	0.0964
R-squared	0.100924	Mean dependent var	0.002979	
Adjusted R-squared	0.069561	S.D. dependent var	0.023424	
S.E. of regression	0.022595	Akaike info criterion	-4.698754	
Sum squared resid	0.043906	Schwarz criterion	-4.587651	
Log likelihood	215.4439	Hannan-Quinn criter.	-4.653951	
F-statistic	3.217928	Durbin-Watson stat	2.028043	
Prob(F-statistic)	0.026724			

1.2. Long run relationships between foreign mutual fund ownership and exchange rates

Dependent Variable: D(LEXC)

Method: Least Squares

Date: 04/08/17 Time: 19:40

Sample (adjusted): 2009M07 2016M12

Included observations: 90 after adjustments



$$D(\text{LEXC}) = C(1) * (\text{LEXC}(-1) - 4.07883946444 * \text{LINS}(-1) - 0.367569057427)$$

$$+ C(2) * D(\text{LEXC}(-1)) + C(3) * D(\text{LINS}(-1)) + C(4)$$

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	-0.012419	0.004450	-2.791120	0.0065
C(2)	-0.095277	0.106388	-0.895564	0.3730
C(3)	-0.098560	0.085689	-1.150212	0.2532
C(4)	0.003904	0.002477	1.576400	0.1186
R-squared	0.100742	Mean dependent var	0.002979	
Adjusted R-squared	0.069373	S.D. dependent var	0.023424	
S.E. of regression	0.022597	Akaike info criterion	-4.698551	
Sum squared resid	0.043915	Schwarz criterion	-4.587449	
Log likelihood	215.4348	Hannan-Quinn criter.	-4.653748	
F-statistic	3.211469	Durbin-Watson stat	2.010542	
Prob(F-statistic)	0.026938			

1.3. Long run relationships between foreign insurance ownership and exchange rates

Dependent Variable: D(LEXC)

Method: Least Squares

Date: 04/08/17 Time: 19:43

Sample (adjusted): 2009M07 2016M12

Included observations: 90 after adjustments

$$D(\text{LEXC}) = C(1) * (\text{LEXC}(-1) - 0.452157777664 * \text{LPF}(-1) - 4.35986076206) +$$

$$C(2) * D(\text{LEXC}(-1)) + C(3) * D(\text{LPF}(-1)) + C(4)$$

	Coefficient	Std. Error	t-Statistic	Prob.
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C(1)	-0.014650	0.005954	-2.460811	0.0159
C(2)	-0.089577	0.105586	-0.848374	0.3986
C(3)	-0.016145	0.011733	-1.376014	0.1724
C(4)	0.004136	0.002495	1.657708	0.1010

R-squared	0.103383	Mean dependent var	0.002979
Adjusted R-squared	0.072106	S.D. dependent var	0.023424
S.E. of regression	0.022564	Akaike info criterion	-4.701492
Sum squared resid	0.043786	Schwarz criterion	-4.590390
Log likelihood	215.5672	Hannan-Quinn criter.	-4.656689
F-statistic	3.305361	Durbin-Watson stat	2.014301
Prob(F-statistic)	0.023993		

1.4. Long run relationships between foreign pension fund ownership and exchange rates

Dependent Variable: D(LEXC)

Method: Least Squares

Date: 04/08/17 Time: 19:41

Sample (adjusted): 2009M07 2016M12

Included observations: 90 after adjustments

$$D(LEXC) = C(1) * (LEXC(-1) - 11.1284515878 * LFI(-1) + 130.899048078) + C(2) * D(LEXC(-1)) + C(3) * D(LFI(-1)) + C(4)$$

	Coefficient	Std. Error	t-Statistic	Prob.
C(1)	-0.000487	0.001056	-0.461534	0.6456
C(2)	-0.023880	0.106774	-0.223655	0.8236
C(3)	-0.034221	0.021188	-1.615074	0.1100



C(4)	0.003457	0.002509	1.377725	0.1719
<hr/>				
R-squared	0.031183	Mean dependent var	0.002979	
Adjusted R-squared	-0.002613	S.D. dependent var	0.023424	
S.E. of regression	0.023455	Akaike info criterion	-4.624045	
Sum squared resid	0.047312	Schwarz criterion	-4.512943	
Log likelihood	212.0820	Hannan-Quinn criter.	-4.579242	
F-statistic	0.922680	Durbin-Watson stat	1.991360	
Prob(F-statistic)	0.433447			
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1.1.No long run relationships between foreign financial institution ownership and exchange rates

