The Effect of the Interaction between US Dollar and Euro Exchange Rates on Indonesia's National Income

LD SAIDI[1,4)], M. KAMALUDDIN [1,2)], ROSTIN [1,3)], P. ADAM[4)], E. CAHYONO[4)]
[1)] Graduate Program in Economics
[2)] Department of Management FEB
[3)] Department of Economics FEB
[4)] Department of Mathematics FMIPA
Universitas Halu Oleo
Kampus Bumi Tridharma Anduonohu Kendari 93232
INDONESIA
Email for Correspondence: edi.cahyono@uho.ac.id, edi_cahyono@innov-center.org

Abstract: - Globalization has caused Indonesia's national income, calculated in Indonesian Rupiah (IDR), cannot be separated from the strong exchange rate of the US dollar (USD) and euro (EUR). This study discussed the effect of the interaction between the USA currency exchange rate (IDR / USD) and the European exchange rate (IDR / EUR) on the Indonesia's national income from 2004 to 2013. The data of national income were available in the form of quarterly time series (every 3 months). As for the US and European currencies exchange rates, the data were available, in the form of daily time series, except Saturdays, Sundays and national holidays. Data analysis used was causal model lagged variable auto-regression (LVAR). The results showed that there was a negative effect of IDR/USD exchange rate on the national income, there was a positive effect of IDR/EUR exchange rate on the national income, and there was a negative effect of the interaction of both exchange rate IDR/USD and IDR/EUR against the national income. This information is important for the government to consider in its economic policy decision making.

Key-Words: - exchange rate, national income, auto-regression, time-series.

1 Introduction

Currency exchange rate plays an important role in the global economy. In the international trade, the currency becomes a mean of transaction, where the exchange rate, as the price of a currency, is the reference in the calculation of the value of the trade. The high activity of the global economy, both in the real sector and in the financial sector, can lead to an increase in the demand for foreign currency. This can be potential to increase foreign exchange rates.

The increase in the exchange rate can affect the global economy. An exchange rate appreciation makes home products and services become relatively expensive against foreign goods and services. This causes global demand for goods and services will shift to foreign goods and services. As a result, exports decrease, and imports increases. Decrease in exports and increase in imports can cause a decline in the trade balance. As a consequence, the contribution of the trade balance to the growth of Gross Domestic Product (GDP) fells [10]. When the domestic currency depreciates, the price of imported goods becomes more expensive, which can raise the price and inflation level [21]. An increase in the price of imported goods like industrial raw materials can increase the production cost of domestic enterprises. This can potentially motivate an increase in prices and inflation. As a result, household consumption may decrease, which in turn will reduce GDP. The increase in the price of goods can also affect the rate of investment, which in turn can affect GDP.

United States currency exchange rate (USD), and European countries (EUR) currency exchange rate were considered strong exchange rates in Indonesian economy. Considering the data trend over 2004 to 2013, the trend of exchange rates of these two fluctuated. USD exchange rate rose from IDR 8,570 per dollar at the beginning of the first quarter of 2004 to IDR 11,575 in the first quarter of 2009. However, from the first quarter of 2009 to the first quarter of 2011 it drastically dropped at IDR 8,500. The trend of EUR exchange rate showed an increase from IDR 10,486 per euro in the first quarter of 2004 to IDR 16,821 in the fourth quarter of 2013 (www.bi.go.id). Meanwhile, Indonesia's GDP also increased since the first quarter of 2004 to 536,605.30 2,367,928.70 in the fourth quarter 2013.

The dynamics of USD and EUR relative to IDR, and the relation of these two dynamics have been studied by Cahyono *et al*. [6] and Saidi *et al*. [25] which are based on the method of linear relation of signals in [5]. In the year 2005 and 2013 the two dynamics are in good agreement. A number of studies on the effect of exchange rate on GDP have been carried out, among others are: [23], and [11], yet there is still no consensus on the effect of the exchange rate on GDP.

No previous research has so far paid attention to the effect of rate interaction on GDP. This research aimed to examine the effect of the interaction between the exchange rate of IDR/USD and IDR/EUR on GDP.

2 Review Literature

Trade balance (*NX*) is defined as export (*EX*) minus import (*IM*), or *NX=EX-IM*. *EX* and *IM* values are calculated using foreign currency exchange rate. In general, foreign currency rate used internationally, including Indonesia, is USD exchange rate (IDR/USD). Therefore, trade balance is considered as function and exchange rate, ceteris paribus. Further, form the point of view of expenditure, GDP is the total of all domestics household consumption (C), company expenditure in the form of investment (I), Government expenditure (G) and Trade balanced (NX), or

$$GDP=C+I+G+NX \quad (1)$$

As for Indonesian national income, GDP was calculated in IDR. Since NX was the mathematical function of exchange rate, the Indonesia national income (GDP) could be considered as the function of the exchange rate, ceteris paribus. From equation (1) it was known that NX contributed to calculation of National income (GDP). On the basis of this, a number of researchers studied the relationship between exchange rate and GDP.

In term of investment, GDP cannot be independent from financial market, especially form investors where the investors' preferences play an important role. Lozza *et al*. [19] studied the dominance among financial market and related to the investor preferences. Li *et al*. [18] studied optimal investment problem. This may be considered to increase GDP by optimizing investment.

Carrera and Vergara [8] developed a model of the effect of exchange rate devaluation policy on Debt Valuation, interest rate, and GDP growth. Based on the calibration, the model they developed using data from five Latin American countries: Brazil, Chile, Columbia, Mexico, and Peru in the time interval of first quarter of 1999 to fourth quarter of 2007 showed that exchange rate shock affected interest rate and GDP growth.

Mahmood *et al.* [20] studied the relationship between exchange rate and macroeconomic variables: GDP, FDI, Economic growth and trade openness. This study was conducted during the period of 1975-2005 in Pakistan. Analysis tool used was simple linear regression. The result indicated that exchange rate had positive effect on all the macroeconomic variables.

Azeez *et al.* [4] studied the effect of macroeconomic performance: exchange rate, payment balance, level of inflation, and state's oil profit against GDP Nigeria during the interval of 1986 to 2010. Results of the analysis showed that the oil profit and payment balance had negative effect on GDP, whereas exchange rate had positive effect on GDP. The analysis employed multiple regressions.

Tabas *et al.* [26] studied the correlation between exchange rate shock and macroeconomic variable performance: GDP, inflation, and money supply in Iran during 1973-2007. Using VECM model, the test result showed that there was a negative correlation between exchange rate shock and GDP, yet this correlation was only one direction from exchange rate to GDP. Similarly, there was a negative correlation between money supply and GDP. On the other hand, there was a positive correlation between inflation and GDP.

Musyoki *et al.* [22] studied the effect of vitality of domestic real exchange rate on Kenya economy in the period of January 1993 to December 2009. Statistical analysis using the Generalized Autoregressive Condition of Hetero-scedasticity (GARCH) indicated that Kenya's Real exchange rate had negative effect on GDP growth.

Cang [7] examined asymmetric co- integration relationship between three currencies: Japanese Yen, Korean Won, and Singaporean dollar during the period of January 1990 October 2006. ECM test of monthly data showed that in the long term there was a stable relationship among the three currencies. The exchange rates of Korean Won and Singaporean Dollar responded to the change of the exchange rate of Japanese Yen. In the short term, the exchange rate of Japanese Yen also responded to the shock of the exchange rates of Singaporean Dollar and Korean Won.

Kang [16] studied co-integration relationship of the exchange rates of the currencies of all members

of G7 (Japanese yen, German mark, British pound, French franc, Italian lira, and Canadian dollar) against US dollar between March 1973 and December 2001, but Japanese yen, British pound, and Canadian dollar, until 2004. Employing OLS and MLE methods, the study concluded that all G7 members' currencies exchange rates had long term co-integrative relationship.

Coudhry *et al.* [9] studied the interaction of the currency exchange rate of eight countries in Asia and Australia: Australian dollar, Singaporean dollar, Malaysian ringgit, Thai bath, Indonesian rupiah, Philippine peso, South Korean won and Taiwanese Taiwan in the interval of 1990 to 2002 which was divided into two sub-periods: 1990-1997, and 1997-2002. The purpose of the division was to investigate the changes in the structure of the relationship between exchange rates. All exchange rates were expressed in US dollars. The analysis tool used was Johansen co-integration test and spectrum regression (band spectrum regression). The test results showed that there was a change in the structure of the relationship between exchange rates.

Farooq *et al.* [12] investigated factors affecting the GDP of Pakistan for the interval of 1975-2011. Some variables identified potential to affect the GDP were: trade openness, industry, service sector output, and exchange rate. VAR analysis results indicated that the GDP was affected by those identified variables.

3 Data and Methods

2.1 Data

The present study of the effect of the interaction between us dollar and euro exchange rates on Indonesia's national income was conducted within an interval of the first quarter of 2004 to the fourth quarter of 2013. National income variable was measured with Indonesia's GDP. The data of GDP were obtained from the Central Bureau of Statistics of Indonesia via http://www.bps.go.id; whereas the data of the exchange rates of IDR/USD and IDR/EURO were obtain from the Central Bank of Indonesia via http://www.bi.go.id.

For analysis purpose, the data of the three were converse in to growth data using the following formula.

$$y(t) = \frac{y^o(t) - y^o(t-1)}{y^o(t-1)} \times 100\% \qquad (2)$$

where $y^0(t)$ is data at time t before transformation, $y^0(t\text{-}1)$ is data at time t-1, and $y(t)$ is transformed data. Data $y(t)$ for the first quarter of 2004 until the fourth quarter of 2013 were calculated using Microsoft Office Excel application program. Then, y is the national income (GDP), x_1 is exchange rate of IDR / USD, and x_2 is the exchange rate of IDR/ EUR. All variables: x_1, x_2, and y are transformed variables resulted from the application of transformation (2).

2.2 Methods

Three hypotheses were tested in the present study: (a) "There is an effect of the exchange rate of IDR/USD on the national income"; (b) "There is an effect of the exchange rate of IDR/EUR on the national income", and (c) "There is an effect of interaction between the exchange rate EUR/USD and the exchange rate of USD / EUR on the national income". For testing purpose, two econometric testing tools were used: lagged variable auto-regression LVAR (p, q) both the linear and non-linear [2], where p and q are time lag. Linear LVAR was used to test hypothesis (a) and (b), while non-linear LVAR was used to test hypothesis (c). Linear LVAR testing hypothesis (a) and (b) was stated by causal model (3), and non-linear LVAR testing hypothesis (c) was stated by causal model (4), as follows.

$$y_t = a_0 + \sum_{i=1}^{p} a_i y_i + \sum_{j=1}^{q} b_j x_{1(t-j)} + \epsilon_t \qquad (3)$$

$$y_t = a_0 + \sum_{i=1}^{p} a_i y_i + \sum_{j=0}^{q} b_j x_{1(t-j)} x_{2(t-j)} + \epsilon_t \qquad (4)$$

where $a_i (i = 0, 1, \dots, p)$, $b_j (j = 0, 1, \dots, q)$, are regression parameters, p, q time lag, $x_{1(t-j)}x_{2(t-j)}$ interaction rate, and ϵ_t error term. Adam *et al.* in [1] used causal model (3) in their study to examine the dynamics of one direction relationship between the world crude oil and Indonesian trade balance, and they found a relational dynamics causal model with the formula

$$\begin{aligned} d\big(y(t)\big) = &-0.660368D\big(y(t-1)\big) \\ &- 0.327563D\big(y(t-2)\big) \\ &- 25880617D(x(t-3)) \end{aligned} \qquad (5)$$

where the $D(x(t\text{-}3))$ of (4) is pressure process of crude oil prices on Indonesia's trade balance.

The testing of effect using causal model (3) and (4) was done by first testing data stationarity as the prerequisite of the application of causal model (3) and (4). The stationarity testing used was Augmented Dickey-Fuller (ADF) Statistics. For

instance, to test coefficient of significance ρ of equation

$$d(y_t) = \alpha + \beta t + \rho y_{t-1} + \sum_i^n \theta_i d(y_{t-i}) + \varepsilon(t) \quad (6)$$

The testing criteria of (6) is that *y* is stationary if ρ is significant at α level (1%, 5%, or 10%). Widarjono's criteria for the testing [27] is that if the statistic absolute value of the ADF is greater than the critical absolute value of ADF at level of significance α, then y is stationary at level α. As for other cases, they were not stationary. It is also important to test the co-integrations of: the trend of IDR / USD exchange rate and the trend of national income, the trend of IDR / EUR exchange rate and the trend of national income, and the trend under the interaction of the exchange rates of the two currencies and the trend of national income. This is of necessity to make sure the variables under study co-move. For such a purpose, the testing tool used is a two-way Engle-Granger co-integration test. For instance, in testing the co-integration of variables *x* and *y*, first of all, estimate the linear regression equation between *x* and *y*. Secondly, give error estimation by the names of other variables, say Residual. Test Residual error variable whether it is stationary or not. If the result of the test shows the Residual variable is stationary, *x* (independent variable) and *y* (dependent variable) co-integrate.

The next step is to test effect by estimating significance test of the parameter of causal model (3) and (4), based on the following hypotheses

H_o: all $b_j = 0$, for $j = 0, 1, \dots, q$ (There exists an effect)

H_1: there exists $b_j \neq 0$, for at least one of $j = 0, 1, \dots, q$ (There is no effects)

In the estimation of model (3) and (4) residual error variable should be included if there is co-integration. In this test, the criteria used is p-value of statistics-t and statistics-F. If statistic value of p is smaller than its critical value (1%, 5%), it means that there is an effect, and for other cases, there is no effect. It is also concluded that there is an affect when statistic determinant R^2 is bigger than statistics Durbin Watson (DW), and time lag optimum based on Akaike Information Criterion (AIC) or Schwarz Criterion (SC) [24]. Heiij *et al.* [14] point out that when the two variables *x* and *y* are in balance, the significance of long term effect of variable *x* on variable *y* for causal model (3) and (4) is determined by

$$\gamma = \frac{\sum_{j=0}^{q} b_j}{1 - \sum_{i=0}^{p} a_i} \quad (7)$$

All estimations of the two types of testing, stationary testing and effect testing, used Eview .6 application program. Output of the application program also involves the value: coefficient of determination R^2. All determination, DW value, and AIC value and SC.

4 Results

4.1 Stasionary test (Unit root test)

Estimation result of ADF-statistics and ADF-crit for testing the stationarity of the four variables exchange rate of IDR/USD (x_1), exchange rate of IDR/EURO (x_2), variable interaction of the two exchange rates (x_1*x_2), and GDP (y) at the first difference is summarized in Table-1. The absolut value of *y* is larger than the absolute value of ADF-crit at the the level of significance 1%. This means that the two variables: exchange rate of IDR/USD and exchange rate of IDR/EURO, variable interaction between the two, and GDP are stationary at the first difference level. Estimation result at the level of the three variables: exchange rate IDR/USD (x_1), exchange rate IDR/EUR (x_2), and national income (y) is not stationary and is not presented in Table-1.

Table 1 ADF statistical results

Variable	ADF-Statistics	ADF-critics (1%)
x_1	-7.356035	-3.621023
x_2	-8.946674	-3.621023
y	-11.78212	-3.626784
x_1*x_2	-6.182982	-3.610453

4.2 Co-integration Test

In this co-integration test, the estimation error result of regression equation between the exchange rate of IDR/USD and national income is Residual1, that of estimation of equation regression between the exchange rate of IDR/EUR and national income is residual2, and error estimation of the equation regression between the interaction of the two exchange rates and national income is Redisual3. Estimation result of the stationary test of the three variables, Residual1, Residual2, and Residual3 is presented in Tabel-2 below.

Table 2 ADF statistical results on residual variables.

Variabel	ADF-Statistics	5% critical values
Residual1	-2,1578	-2,948404
Residual2	-2,098374	-2,948404
Residual3	-1,738661	-2,945842

Table-2 shows that the absolute values of ADF-stat of all three estimation error variables: Residual1, Resdual2, and Residual3 are smaller than the absolute value of ADF-crit at the level of significance 5%. It means that the three variables: Residual1, Residual2, and Residual3 are not stationary. This then leads to the conclusion that: (1) exchange rate of IDR/USD and national income do not co-integrate, (2) exchange rate of IDR/EURO and national income do not co-integrate, and (3) interaction between exchange rate of IDR/USD and exchange rate of IDR/EURO does not co-integrate with national income.

4.3 Effect Test

Since there was no co-integration between the two variables under investigation, the estimation of effect did not take in residual error correction variable. Estimation of causal model (3) about the effect of IDR/USD on national income (GDP) resulted in the coefficient of variable D(x1(-10)) -0.226192 with p-value of t- statistics 0.0390 and p-value of F-statistics 0.001442. Estimation result of all regression parameters model (1) is not presented, nevertheless, the result of re-estimation by eliminating variables which were not significant is presented in Tabel-3. This means, there was a significant effect of the exchange rate of IDR/USD on national income. This effect applied when the time lag reached quarter ten. Meaning, from quarter one to nine there was not any significant effect. Further, Table-3 also shows that the effect of the exchange rate of IDR/USD is negative. This indicates that when exchange rate of IDR/USD increased, national income decreased significantly in the following ten quarters. In such a case every increase by 1% of exchange rate of IDR/USD currently, national income decreases by 5.48%.

Table 3 Estimation results of effect test of the exchange rate of IDR/USD (x_1) on national income (y)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(Y(-1))	-0.838129	0.117157	-7.153914	0.0000
D(Y(-2))	-0.812147	0.126674	-6.411317	0.0000
D(Y(-3))	-0.792868	0.117846	-6.727977	0.0000
D(X1(-10))	-0.133810	0.065761	-2.034784	0.0526
R-squared	0.756676	Akaike info criterion		4.677149
Durbin-Watson stat	1.186058	Schwarz criterion		4.865742

Estimation of clausal model (3) about the relationship between the exchange rate of IDR/EUR on national income with the choice of optimum lag time q=4 resulted in p-value of F-statistics 0.000007, coefficient variable $D(x3(-4))$ 0.152211 with p-value 0.0496 which is smaller than 5%, became significant. Estimation result of all parameters of model (1) is not provided. However, re-estimation result after eliminating variables not significant is presented in Table-4 where coefficient and the value of p-value of variable D(x2(-4)) changes. So, there was a significant effect of the exchange rate of IDR/EURO on national income. This effect applied when the time lag reached quarter four. It can be seen in Table-4 that the effect of the exchange rate of IDR/EURO on national income is positive. In such a case, when the exchange rate of IDR/EURO increases at certain time it will be followed by the increase in national income in the following four quarters. Here, every current increase by 1% of exchange rate of IDR/EURO currently, in the following four quarters national income will increase by 10.95%.

Table-4: Estimation result of effect test of the exchange rate of IDR/EURO (x2) on national income (y)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(Y(-1))	-0.831551	0.112234	-7.409072	0.0000
D(Y(-2))	-0.803289	0.119265	-6.735350	0.0000
D(Y(-3))	-0.802406	0.112626	-7.124503	0.0000
D(X2(-4))	0.109453	0.046836	2.336957	0.0261
R-squared	0.721959	Akaike info criterion		4.613598
Durbin-Watson stat	1.578099	Schwarz criterion		4.791352

Estimation result of the effect between the exchange rate of IDR/USD and the exchange rate of IDR/EURO on national income after eliminating variables that were not significant with optimum time lag q=4 is presented in Table-5. Coefficient variable $D(x1)*D(x2)(-2)$ is -0.013930 with p-value 0.0296. This value is smaller than 5%, hence significant at 5%. This leads to the conclusion that there was an effect of the interaction between the

exchange rate of IDR/USD and the exchange rate of IDR/EURO on national income, applicable when time lag reached quarter two. The effect of the interaction between the exchange rate of IDR/USD and the exchange rate of IDR/EURO on national income was negative, meaning that if the interaction between IDR/USD and IDR/EUR increase, national income decreased after two following quarters. In such a case, if the interaction between the exchange rate of IDR/USD and the exchange rate of IDR/EURO increased by 1% currently, in two following quarters, national income would decrease by 0.4%.

Table-5 : Estimation of the effect of interaction between the exchange rate of IDR/USD (x1) and the exchange rate of IDR/EURO (x2) on national income (y)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(Y(-1))	-0.811334	0.107196	-7.568667	0.0000
D(Y(-2))	-0.849994	0.121904	-6.972655	0.0000
D(Y(-3))	-0.837814	0.114594	-7.311172	0.0000
D(x1)*D(x2)(-2)	-0.013930	0.006118	-2.276857	0.0296
R-squared	0.729361	Akaike info criterion		4.591248
Durbin-Watson stat	1.813521	Schwarz criterion		4.767194

5 Conclusion

The interaction tests between the exchange rates of IDR/USD and IDR/EURO from 2004 to 2013 were as follows. The data of the three variables: the exchange rate of IDR/USD, exchange rate of IDR/EURO, and the interaction of the two, and the Indonesian national income were stationary at the level of first difference. The estimation at this difference indicates that:

(1) There was a significant, negative effect of exchange rate of IDR/USD on national income;
(2) There was a significant, positive effect of the exchange rate of IDR/EURO on national income; and
(3) There was a significant, negative effect of the interaction between the exchange rate of IDR/USD and the exchange rate of IDR/EURO on national income.

The effect of the two exchange rates of IDR/USD and IDR/EURO and the interaction between the two of them did not happen by chance, but required certain quarterly time lag to affect national income. The effect of the exchange rate of IDR/USD required ten quarters to affect national income. Meanwhile, the exchange rate of IDR/EURO, and also the interaction of the two exchange rates required four consecutive quarters and two quarters subsequently to have effect on national income. Another important point to mention is that two kinds of effect (positive and negative) of the two exchange rates resulted in negative effect of the interaction of the two on Indonesia's national income.

References:

[1] P. Adam, U. Rianse, E. Cahyono, M. Rahim, M, Syarif and Gamsir, Modelling of the dynamics of relationship between world crude oil prices and Indonesia's trade balance: An LVAR analysis**,** *Journal of Economics and Sustainable Development*, Vol. 6, No. 3, 2015, pp. 156–161.

[2] I.G.N. Agung, *Time series data analysis using eview*, John Wiley & Son, 2009.

[3] P. Ata-Obeng, P. Enu, F. Osei-Gyima and C. D. K. Opoku, An econometric analysis of relationship between GDP growth and exchange rate in Ghana, *Journal of Economic and Sustainable Development*, Vol. 4, No. 9, pp. 1–8.

[4] B. A. Azeez, F. T. Kolapo, and L. B. Ajayi, Effect of exchange rate volatility on macroeconomic performance in Nigeria. *Interdisciplinary Journal of Contemporary research in Business*, Vol. 4, No. 1, 2012, pp. 1097–155.

[5] E. Cahyono, On the linear relation of signals, *WSEAS Transactions on Signal Processing*, Vol. 10, 2014, pp. 555–560.

[6] E. Cahyono, LD. Saidi, R. Raya, and Idris, Linear relation of two discrete signals, *International Journal of Science, Engineering and Sustainable Technologies*, Vol. 1, No. 1, 2014, pp. 46–51.

[7] S-C. Cang, Asymmetric cointegration relationship among Asian exchange rates, *Economic Change Restructuring*, Vol. 41, No. 2, 2008, pp. 125–141.

[8] C. M. Carrera and R. Vergara, Fiscal sustanability: The impact of real exchage rate shocks on debt valuation, interest rates and GDP growth, *World Development*, Vol. 40, No. 9, 2012, pp. 1762–1783.

[9] T. Choudry, E. Ng and K. Peng, Dynamic interaction among Asian exchange rates: Evidence from Asian financial crisis, *Working Paper Series*, Social Science Research Network, 2004, http://papers.ssrn.com.

[10] F. Di Mauro, R. Ruffer, and I. Bunda, The changing role of the exchange rate in a

globalised economy, *ECB Occasional Paper Series,* N0. 94, Social Science Research Network, 2008, http://ssrn.com/abstract_id= 1144484.

[11] K. H. Diviya, and R. Devi, A study on predictor of GDP: Early signals, *Procedi Economics and Finance*, Vol. 10, 2014, pp. 375–382.

[12] M. U. Farooq, H. M. Sabir, S. H. Tahir and M. K. Rashed, Key factor affecting GDP in Pakistan over the period 1975-2011, *Journal of Economic and Sustainable Development*, Vol. 4, No. 1, 2013, pp. 142–149.

[13] D. Eme, and O. Olugboyega, Exchange rate and macroeconomic aggregates in Nigeria, *Journal of Economic and Sustainable Development*, Vol. 3, No. 2, 2012, pp. 93–101.

[14] C. Heiij, P. Boer, P. H. Frances, T. Kloek and H. K. Dijk, (2004) *Econometric Methods with applications in Business and Economics*, Oxford University Press, 2012.

[15] G. Jayachandran, Impact of exchange rate on trade for India : A study of last four decade, *International Journal of Marketing, Financial Services & Management Research*, Vol. 2, No. 9, 2013, pp. 154–170.

[16] H. Kang, The cointegration relationships among G-7 foreign exchange rates, *International Review of Financial Analysis*, Vol. 17, 2008, pp. 446–460.

[17] F. Khanam, S. S. Pirzada and S. Nasreen, Exploring the impact of macro & socio economic variable on GDP of Pakistan and psychological impacts of inflation on poor families, *Journal of Economics and Suastainable Development*, Vol. 5, No. 11, 2014, pp. 83–88.

[18] D. Li, X. Rong and H. Zao, Optimal investment problem with taxes, dividends and transaction costs under the constant elasticity of variance (CEV) model, *WSEAS Transactions on Mathematics*, Vol. 12, Issue 3, 2013, pp. 243–245.

[19] S. O. Lozza, T. Tichy and F. Petronio, Dominance among financial market, *WSEAS Transactions on Business and Economics*, Vol. 11, 2014, pp. 707–717.

[20] I. Mahmood, M. Ehsanullah and A. Habib, Exchange rate volatility & macroeconomic variables in Pakistan, *Business Management Dynamics* , Vol. 1, No. 2, 2011, pp. 11–22.

[21] F. S. Mishkin, *The Economics of Money, Banking, and Financial Markets* (Eight Edition), Pearson Education Inc., 2004.

[22] D. Musyoki, P. Ganesh, G. P. Pokhariyal and M. Pundo, The impact of real exchange rate volatility on economic growth: Kenyan Evidence, *Business and Economic Horizons*, Vol. 7, No. 1, 2012, pp. 59–75.

[23] D. Rodrik, The real exchange rate and economic growth, *Brookings Papers on Economic Activity*, 2008, pp. 365–439.

[24] D. Rosadi, *Ekonometrika dan Analisis Runtun Waktu Terapan dengan Eviews, Aplikasi untuk Bidang Ekonomi, Bisnis dan Keuangan*, Penerbit Andi, 2012.

[25] LD. Saidi, Rostin, M. Kamaluddin, Kartono, and E. Cahyono, Computation of a Linear Relation of Signals: An Application on the Dynamics of United States Dollar and Great Britain Pound Relative to Indonesian Rupiah, *3rd International Conference on Mathematical, Computational and Statistical Sciences* (MCSS '15) Dubai, United Arab Emirates February 22-24, 2015.

[26] H. M. Tabas, M. R. Mirzaeenezhadand T. Mohammadi, The effect of the real effective exchange rate fluctuations on macro-conomic indicators (Gross Domestic Product (GDP), inflation and money supply), *Interdisciplinary Journal of Contemporary research in business*, Vol. 4, No. 6, 2012, 1907-1103.

[27] A. Widarjono, *Ekonometrika pengantar dan aplikasinya dilengkapi aplikasi Eview*, Ekonisia FE UII, 2009.