DETERMINANT FACTORS OF REAL EXCHANGE RATES: THE BEHAVIORAL EQUILIBRIUM EXCHANGE RATES MODEL (THE BEER MODEL)

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The objectives of the research were: (1) to know the fundamental factor of macroeconomic which determine real exchange rates; and to know the effect of the global economic crisis of the 2007-2008 on real exchange rates in Indonesia during the period of 2004-2008, and (2) to examine the stability of real exchange rates model in Indonesia during the period of 2004.1-2008.4.

By using the econometric approach (the time series analysis), the study found that real exchange rates in Indonesia during the period of 2004-2008 were determined by the fundamental factors of macroeconomic as follows: (a) real exchange rates at the one quarterly lag (positive correlation; It implies that an increase of real exchange rates at the one quarterly lag could be perceived by the next quarterly as well, (b) real interest rates differentials (positive correlation, i.e. the degree of openness affected real exchange rates), (c) net foreign assets (negative correlation, i.e. the increase of the net foreign assets caused appreciation of rupiah against the USA dollar), and (d) the global economic crisis during the period of 2007-2008 (positive correlation, i.e. the crisis tended to depreciate real exchange rates).

Employing the CUSUMSQ Test (the Cumulative Sum of Squares of Recursive Residuals) for the stability of real exchange rates model, the study provided evidence which supported the idea that the function (model) of real exchange rates was stable (the parameters of the regression during the period of 2004-2008 significantly remain unchanged).

Keywords: the fundamental factors of macroeconomic, the stability of real exchange rates, and the global economic crisis.

Introduction

One of the prominent monetary variables which have direct and indirect pass-through effect on inflation rates is exchange rates. The change of exchange rates can directly influence the inflation expectation, the pattern of price formation, especially for goods and services imported. On the other hand, the change of exchange rates is indirectly influences inflation rates through the component of aggregate demand (export and import). If aggregate demand exceed than aggregate supply (there is output gap in economy), then inflation pressure will take place.

There are some of the macroeconomic variables and other social variables can reduce the increase of inflation rates, such as a protecting of inflation expectation, good political circumstances and keeping of state security, restrained of the administered prices by the government, and the stability of exchange rates. The stability of real exchange rates is also influenced by the exchange rate system which is implemented by the country. Some of business cycle studies of open economy showed that the change of an exchange rates system influences on real exchange rates of that country. Even in the fixed exchange rates system, the volatility of exchange rates remains happen. It was proved when European Countries applies The Breton Wood's Fixed Exchange Rates. Therefore, the hypothesis of non-neutrality of the exchange rate system gets stronger (*Kurniati & Hardiyanto* 2002: 28-30).

Calderon (2004) has carried out the study concerning the relation between trade openness with volatility of real exchange rates in 82 developing and developed countries, during the period of 1974-2003. One of the study findings stated that there was positive relation between the volatility of output growth (GDP), base money growth, and terms of trade with the volatility of real exchange rates.

The bitter experiences on the 1998 proved that the major causes of the economic crisis were unstable of the exchange rate. The impact of the crisis was not only perceived by economic sectors, but it was also perceived by the other sectors (education, healthy and so on). The various of policies has implemented to escape from crises, such as : to increase the SBI rate, intervention to the foreign exchange market, renegotiating loans with the international creditors, and merging and liquidating ailing banks. The success of those policies is not only depending on the fundamental factors of economic, but it is also depending on non-economic factors, especially the government credibility and the holder monetary authority (Central Bank). It leads to the implication that the restrain of the exchange rate is needed. And, it is also as the government obligation, because the stability of exchange rates influences on various sectors.

As we know, that during the period of 2007 and 2008 the global economic crisis was happened, in which an impact of the crisis perceived to around of the world, especially to Indonesian economy as well. This situation interesting to be observed more in detail, because the change of global economic circumstances are normally affect to the economy of other countries. By using the time series analysis, the study wants to know an effect of the global economic crisis on real exchange rates.

Based on the background mentioned above, the study formulates the research problems as follows:

1. What are the fundamental factors of macroeconomic which determine real exchange rates in Indonesia during the period of 2004-2008, and is there an effect of the global economic crisis of the 2007-2008 on real exchange rates;
2. How does the stability of real exchange rates models in Indonesia during the period of 2004-2008.

Literature Reviews

The Behavioral Equilibrium Exchange Rates Model (The BEER Model)

There are two alternatives of the models for analyzing exchange rates, namely The Fundamental Equilibrium Exchange Rates Model (FEER Model) and The Behavioral Equilibrium Exchange Rate Model (The BEER Model). The BEER Model was introduced by *Clark* and *MacDonald* (1998). The BEER Model is actually the reduced form equation of the fundamental factors which determines of real exchange rates (q). Generally, the BEER Model formulated as follows (MacDonald & Dias 2007: 5-8; *Kurniati & Hardiyanto* 2002: 43):

$$q_t = \beta_1' Z_{1t} + \beta_2' Z_{2t} + \tau' T_t + \varepsilon \quad \text{.....(1)}$$

where:

Z_1 = vector of fundamental factors of economic which is expected has persistent effect on the exchange rate in the long run;

Z_2 = vector of fundamental factors of economic which is expected has effect on the exchange rate in the short run;

T = transitory factors which is expected has effect on the exchange rate in the short run;

ε = random *disturbance terms*

β_1, β_2 and τ are *vectors of reduced-form coefficients*

In the long run, the BEER Model correlates with the adjusted interest parity condition. It can be econometrically formulated with:

$$E_t[\Delta s_{t+k}] = -(i_t - i_t^{\bullet}) + \pi_t \quad \text{..... (2)}$$

where s_t is the value of the foreign currency which is expressed by the domestic currency; i_t is the domestic of nominal interest rates; $i_t^{\bullet}$ is the foreign of nominal interest rates; π_t is risk premium; Δ is the first difference operator.

The equation (2) can be expressed by the real value: i.e. by deducting that equation with the expected inflation differentials: $E_t(\Delta p_{t+k} - \Delta p_{t+k}^{\bullet})$ After rearranging, finally we get the equation as follows:

$$q_t = E_t[q_{t+k}] + (r_t - r_t^{\bullet}) - \pi_t \quad \text{..... (3)}$$

where $r_t = i - E_t(\Delta p_{t+k})$ is the real interest rate?

The last equation (i.e. the equation 3) states that the real exchange rate is determined by the three important components, namely: (1) expectation of the real exchange rate, $E_t[q_{t+k}]$; (2) differential of real interest rate, $(r_t - r_t^{*})$, and (3) risk premium, (π).

In order to the equation (3) can be more easy implemented, we assume that the exchange rate in the long run is only influenced by the persistent factors of the fundamental economic. Therefore, the long run equilibrium of exchange rate can be formulated as follows:

$$\hat{q}_t = E[q_{t+k}] = E[\beta_1' Z_1] = \beta_t' Z_{1t}. \quad \text{..... (4)}$$

If risk premium is also formulated with,

$$\pi_t = g(gdebt_t / gdebt_t^{\bullet}),$$

so, the BEER equation can be completely formulated (MacDonald-Dias 2007; *Cheung, Chinn & Pascual* 2005) as:

$$\underset{+}{BEER} = f\ (\underset{+}{r\text{-}r^{*}},\ \underset{+}{gdebt/gdebt^{*}},\ \underset{+}{tot},\ \underset{+}{tnt},\ \underset{+}{nfa}) \quad \text{..... (5)}$$

where (*gdebt/gdebt**) is the ratio of the domestic debt with the foreign debt as the risk premium; while *r-r*, tot, tnt,* and *nfa* are the fundamental factors of economic.The *r-r** is the real interest rate differentials; *tot* is the terms of trade; *tnt* is the productivity and *nfa* is net foreign asset. We see from the equation (5) that the relation between all of the independent variables on the real exchange rate are positive. The positive relations mean that the increase of the fundamental factors of economic will be the caused of appreciation of real exchange rates (*q*). Otherwise for the negative relations.

Empirical Studies

The summary of the empirical studies of exchange rates determination are listed in the following table 1:

Table 1
The Summary of Empirical Studies for Exchange Rates

Author and year	Title and country	Model and Variable	Results
***1.Siregar-Walker* (2000)**	**Title:** *Monetary Shocks and the Fundamental Determinants of the Real Exchange Rate under the Hong Kong Currency Board.* **Country :** Hong Kong	**Model :** $rer = \beta_1 k_t + \beta_2 g_t + \beta_3 tot_t + \beta_4 r_t^* + u_t$ **Dependent Variable :** ***rer*** is real exchange rates, which is determined by the formula : $rer = S_{\$/HK}(\frac{P}{P^*})$ where ***S*** is the nominal exchange rate of the dollar against the Hong Kong Currency **Independent Variables :** ***k*** is real capital stock ***g*** is real government expenditures; ***tot*** is *terms of trade;* ***r**** is world real interest rate. It is determined by the formula : *LIBOR* – inflation of USA	By using the co integration test, the equation of the real exchange rate (in the long run : 1984:I–1998:IV) was expressed by : rer = **-25.09 + 1.4154** k **+ 0.3422** g **+ 1.66** tot **– 0.1363** r^***– 0.0285** t^{**} (t^{**} time trend) All of the parameters were significant at the levels of 5 %.
***2.Khoon-Mithani* (2000)**	**Title :** *Deviation from Purchasing Parity:Evidence from Malaysia. 1973-1997.* **Country :** Malaysia	**Model :** $r_t = \beta_o + \beta_1(g_t - g^*_t) + \beta_2 CA + \mu_t$ **Dependent variable :** ***r*** is real exchange rates **Independent variables :** ***g*** is the nominal government expenditure (Malaysia) for non-tradable goods; ***g**** is the nominal government expenditure (USA) for non-tradable goods; ***CA*** is current accounts.	There was no the significant effect of all variables used in the model on the real exchange rate. The findings were consistent with the previous research, i.e. the real exchange rate for Malaysia follows the random walk (non-stationary time series).
***3.Clostermann-Schnatz* (2000)**	**Title :** *The Determinants of The Euro-Dollar Exchange Rate : Synthetic Fundamentals and a Non-Existing Currency* **Country** : European	**Model :** $q_t = f(raze, tent, Oil, Fish)$ **Dependent variable :** i_t is real exchange rate; **Independent variables :** ***rze*** is the real interest rate differentials between the European Countries and the real interest rate of USA ***tnt*** is productivity which is proxied by the ratio between the GDP and the labor force; ***Oil*** is world oil price; ***Fisc*** is the fiscal policy variable which is stated by the ratio between the government expenditure and the GDP.	All of the variables used in the model were significant at the levels of 1 %, 5 % and 10 %. By using the CUSUM test and the CUSUMSQ test, the research concluded that the model of exchange rate was stable.
***4.Drine-Raulty* (2003)**	**Title :** *On The Long-run Determinants of Real Exchange Rates for Developing Countries: Evidence from Africa, Latin America and Asia* **Country :** *Afrika, Latin Amerika and Asia*	**Model :** $e_{it} = f(inv_{it}, g_{it}, ouv_{it}, pib_{it}, ide_{it}, te_{it})$ **Dependent variable :** ***e*** is exchange rate; **Independent variables :** ***inv*** is domestic investment; ***g*** is the ratio between the government expenditure and the GDP; ***ouv*** is the international trade policy. It is proxied by the ratio between the import and the GDP; ***pub*** is the GDP percapita; ***Idea*** is the net foreign asset. It is proxies by the foreign direct investment; ***Tee*** is terms of trade.	By using the panel data during the period of 1980-1996, the research concluded: Almost all of the variables used in the model were significant. And it was also has the long-run equilibrium relationship. The object of the research was the 45 developing countries, which was divided by the three categories, namely : (a) the 21 countries in Africa, (b) the 17 countries in Latin America , (c) The 7 countries in Asia.

Sources: The summary of empirical studies.

Model

The thinking of *Siregar and Walker* (2000), *Khoon and Mithani* (2000), *Clostermann and Schnatz* (2000) and *Drine and Raulty* (2003) be accordance when they analyze the determinant factors of real exchange rates. It was showed in using of the independent variables. The variable employed by them almost the same and quite relates with the BEER Model. Using all of the variables into the single equation and add on it the dummy variable, finally, the research model can be written down as follows:

$rq = f\ (k,\ CA,\ tot,\ rze, Fisc,\ nfa,\ D)$

or, specifically can be written in the logarithmic model as

$$Ln\ rq = b_o + b_1 Ln\ k_t + b_2\ Ln\ CA_t + b_3 (tot)_t + b_4\ (rze)_t + b_5\ (Fisc)_t + b_6\ Ln\ (nfa)_t + b_7 D + ¼ \quad \text{..... (6)}$$

Where:

rq is real exchange rates of rupiah against the dollar USA. It is formulated by:

$rq = ner_{Rp/\$} (\frac{CPI_{USA}}{CPI_{IND}})$ (*Krugman & Obstfeld* 2003: 414; *Siregar & Walker* 2000: 8), where $ner_{Rp/\$}$ is nominal exchange rates of rupiah against the dollar of USA. The positive growth of *rq* means that the rupiah depreciates against the dollar of USA, otherwise, the real appreciation of the USA dollar against rupiah;

CPI_{IND} = Consumer's Price Index of Indonesia (2002 = 100);
CPI_{USA} = Consumer's Price Index of of USA (1982-84 = 100);
k = Real capital stock (It will be proxied by the real investment expenditure, *Ir*);
CA = Current accounts;
tot = Terms of trade (It is the ratio between the price of export and import);
rze = Real interest rate differentials. It is the different between the domestic real interest rate (SBI rate – Indonesia Inflation) and the foreign real interest rate (LIBOR – USA inflation);
Fisc = Fiscal policy variable which is stated by the ratio between the government expenditure and the 2002 constant price of GDP;
nfa = Net foreign assets;
D = Dummy variables (the global economic crisis during the period of 2007.1-2008.4)
The coefficients of $b_1, b_2, b_3, b_4, b_5, b_6$ are expected negative; while the $b_7 > 0$. It means that the global economic crisis (*dummy variable*) has positive effect on real exchange rates (*rq*) (i.e. It can depreciate the rupiah against the US dollar), and ¼ is an error terms.

The relation between *k* and *rq* can be explained by following mechanism. The increase of real capital stock (*k*) will promote the labor productivity, the wage equilibrium, the price of non-tradable (such as transportations, constructions and health). It is finally influences to the real exchange rate (*Siregar & Walker* 2000: 4-8). Shortly, the increase of real capital stock will appreciate the real domestic currency, and on the contrary ($b_1 < 0$).

The deficit of current accounts (*CA*) is automatically causes the depreciation of real exchange rates, and on the contrary for the surplus of current accounts ($CA > 0$). Therefore the confident of the b_2 is negative (*Khoon & Mithani* 2000:7).

The relation between *tot* and *rq* is negative, because the increase of *tot* caused the capital inflows to the home country for the tradable goods. It is finally generated the real exchange rate to become stronger (the domestic currency appreciations against the USA dollar). Therefore the coefficient of b_3 is negative (*Siregar & Walker* 2000; *Drine & Raulty* 2003).

The forth variable used in the model is the real interest rate differentials (*rze*). If the *rze* more and more high, the investors are attracted by the investment in the country. They expect will get the interesting return on it. Finally, this condition will invite the capital inflow to the country and all at once will promote the position of real exchange rates. Therefore the coefficient of b_4 is negative (*Clostermann & Schnatz*, 2000; *Kurniati & Hardiyanto* 2002).

The relation between the fiscal variable (*Fisc*) and real exchange rates (*rq*) can be explained as follows. The increase of government expenditures will generated the increase the demand for non-tradable goods, the increasing the relative price of non-tradable goods, and finally exchange rates to get stronger ($b_5 < 0$), (*Clostermann & Schnatz* 2000; *Siregar & Walker* 2000).

The last variable used in the study is net foreign asset (*nfa*) variable. It is quite relate to the ability of the country to solve the problem of external shocks and all at once to restraint the speculation of currencies. The impact of that, finally, the exchange rate to get stronger ($b_6 < 0$), (*Kurniati & Hardiyanto* 2002; *Drine & Raulty* 2003).

After analyzing some of the model of real exchange rates, the theoretical framework and tools of the analysis can be formulated by using the flow diagram in the Figure 1:

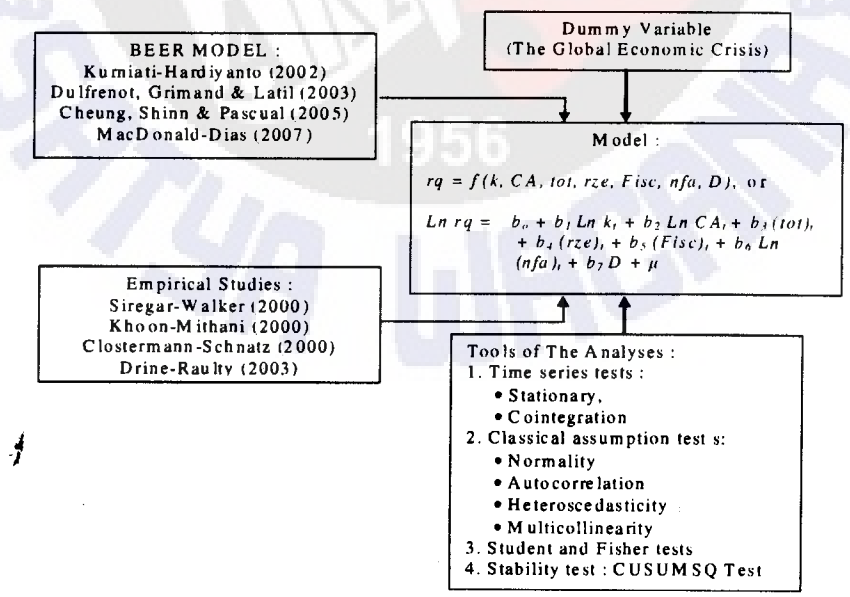


Figure 1
The Flow Diagram of The Theoretical Framework

Based on the literature reviews as mentioned above, the research hypothesis can be formulated as follows : (1) there is negative effect of, current accounts, terms of trade, real interest rates differentials, fiscal policy variable, and net foreign assets on real exchange rates (rupiah appreciation against the USA dollar). Otherwise, the global economic crisis has positive effect on real exchange rates (i.e. It can depreciate the rupiah against the US dollars), and (2) during the period of 2004-2008, the functions of real exchange rates were stable (there were no significance structural changed of the parameters of the models).

Methodology

The data used in the study was time series data (the quarterly data) during the period of 2004-2008. It was taken from *Indonesian Financial Statistic* (Publication of February 2005-April 2009). Therefore, it has to be tested by using the stationary and the co integration tests. It is very important to be observed for detecting the characteristic of time series data. Is it stationary or non stationary data? The error correction model (ECM) was also used to analyze the dynamic variables in the short run.

The tests of deviation from the assumptions of Classical Regression Model were carried out by using standard tests of normality, autocorrelation, multicollinearity, and heteroscedasticity. The aim of the rates.

The F-test (simultaneous test) and t-tests (partial tests) will be used to examine the significance of the regressions parameters. By using the t-test, the sensitivities (elasticities) of real exchange rates on independent variables can be observed.

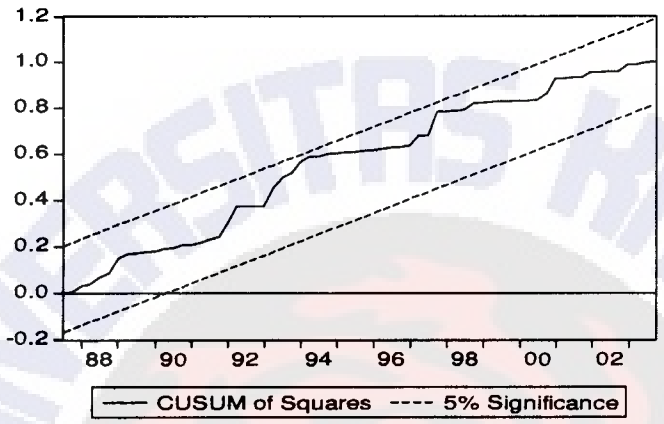
The next step is the stability tests of the models. The aim of the tests is to know the structural stabilities of the model of real exchange rates during the period of 2004-2008. Is the parameter of the regression remains unchanged or changed. The tests of stabilities of the models used in the study are the Cumulative Sum of Squares of Recursive Residuals Test (CUSUMSQ Test). The superiority of this model compared with the Chow's Test is not necessary to known of the point in time when the shifting of the function (model) happened (*Simorangkir* 2002 : 9). The formula used to determine the statistic tests are the ratio between the predicted of the sum squares residuals ($SSR = \sum w_r^2$) by using the beginning of the observation from the $K+1$ till the t period, and the predicted of the sum squares residuals with the $K+1$ till the T period (Greene 1997: 355-359). It is formulated as follows:

$$S_t = \frac{\sum_{r=K+1}^{r=t} w_r^2}{\sum_{r=K+1}^{r=T} w_r^2} \quad \text{.....(7)}$$

where:

w_r = residuals of regression
r = $K+1$, ..., T
T = total of sample size
K = number of independent variables
t = time
$(T - K - 1)$ = degrees of freedom

The test of regression equation (model) was carried out by plotting the value of S_t on the vertical axis and the time (t) on the horizontal axis. The model being observed is stated stable (i.e. the null hypothesis is accepted, namely : $^2_1 = ^2_2 = ^2_3 = \ldots\ldots = ^2_t = ^2$; where the ^{2} is coefficients of the regression) if the expectation value of the S_t or $E(S_t)$ be located between the two border lines (confidence bounds) at the levels of 5 %. In contrary, the model is stated not stable if the value of $E(S_t)$ or the *CUSUMSQ* curve strays from the two border lines. Let see the graph as an example below :



From the Figure 2 seen that the CUSUMSQ Curve be located between the two border lines (confidence level at the levels of 5 percent), therefore the model estimated can be directly stated stable (there is no structural changed on the model).

The data used in the research obtained from the several of publication of Bank Indonesia, the complete data can be examined in the table below:

Tabel 2
The Complete Data For The Function of Real Exchange Rates (*RQ*)
During The Period of 2004.1-2008.4

Quarterly	*rq* (Rp)	*Ir* (Billion Rp)	*CA* (Million USD)	*Tot* (Ratio = Px/Pm)	*rze* (%)	*Fisc* (%)	*Nfa* (Million USD)
2004 I	15393.187	82,119.0	-2,224	1.4848485	2.91	0.0736813	37,419.16
II	16534.211	84,948.2	2,245	1.5755208	2.35	0.0749638	34,851.00
III	16627.356	92,659.1	2,770	1.6405063	1.69	0.0711668	34,802.19
IV	15887.489	94,835.1	317	1.5505051	1.83	0.0849322	36,320.48
2005 I	14687.79	94,307.1	209	1.6800948	-1.28	0.0628176	36,030.14
II	16100.031	99,222.5	436	1.7206573	-0.47	0.0614836	33,865.41
III	15617.202	102,433.5	-1,165	1.8322148	1.69	0.0772387	30,318.32
IV	14550.928	97,214.8	797	1.6637744	-6.65	0.1010059	34,723.69
2006 I	13697.854	95,608.5	2,949	1.7065217	-6.68	0.0666884	40,081.57
II	14179.216	100,177.6	1,959	1.7668319	-4.08	0.0810495	40,107.10
III	13903.55	103,279.1	3,772	1.7561238	-1.13	0.0741759	42,352.88
IV	12767.948	104,096.7	2,156	1.6385262	0.55	0.0972478	42,586.33
2007 I	12632.447	102,992.5	2,640	1.6236576	-0.05	0.0652357	47,221.16
II	12883.492	107,906.3	2,271	1.6436818	0.04	0.0789346	50,924.44
III	12510.495	113,349.5	2,151	1.6203708	-1.44	0.0741608	52,875.12
IV	12439.406	117,365.8	3,430	1.6050118	0.53	0.0936993	56,920.13
2008 I	11687.09	117,134.0	2,794	1.5936823	-0.46	0.0636245	58,987.30
II	11987.022	120,867.7	-1,022	1.5741792	-2.97	0.0780722	59,452.60
III	11631.059	127,126.1	-943	1.6421804	-4.85	0.079501	57,107.97
IV	12954.93	128,094.6	-223	1.6107476	-2.83	0.1036494	51,639.31

Sources: The BI publications (SEKI) of 2005-2009, and calculated.

Results and Discussions

The discussion will be presented according to the problem identifications which was explained in the previous section, namely: (a) What are the fundamental factors of macroeconomic which determine real exchange rates in Indonesia during the period of 2004.1-2008.4, and is there the effect of the global economic crisis of the 2007-2008 on real exchange rates; (b) How does the stabilities of real exchange rates in Indonesia during the period of 2004-2008.

Based on the unit root test and the co integration test, the variables used in the study has already satisfied to the requirements for the long run equation, and it is also for estimation, except for the variable of Ir (the real investment expenditure). It will be eliminated out from the model, because the data of Ir was not stationary on both of the level and the first level tests of the unit root tests.

The Determinant Factors of Real Exchange Rates (rq) : The Eangle-Granger Cointegration Test

The aim of the co integration test is to know the long run equilibrium (relations) between real exchange rates and the macroeconomic variables : real exchange rates at the one quarterly lag (as the experimental variable, rq_{t-1}), current accounts (*CA*), terms of trade (*tot*), real interest rate differentials (*rze*), net foreign assets (*nfa*) and the global economic crisis (*dummy* variable, *D*).

The co integration test concluded that real exchange rates (*rq*) was co integrated with it's the independent variables at the same order (i.e. at order one). It means that the *rq* has the long run equilibrium (relations) with all of the independent variables used.

The long run parameters which determine real exchange rates (*rq*) were presented in the Table 3. The results of the diagnostic statistic gives the satisfy conclusions, because all of the Classical Assumptions (normality, autocorrelation, multicollinearity, and heteroscedasticity) were fulfilled. It means that the regression equation has the high validity. Therefore, it can be used for the economic analysis and further interpretations.

On the table 3 seen that is only the four variables have the significance effect on real exchange rates, at the level of significance (1 percent, 5 percent and 15 percent), namely : real exchange rates at the one quarterly lag (rq_{t-1}), real interest rate differentials (*rze*), net foreign assets (*nfa*), and the dummy variable (the global economic crisis, *D*).

While, the rest of the variables were current accounts (*CA*), and terms of trade (tot), have not the significance effect on real exchange rates.

There were the positive correlation between the experimental variable (rq_{t-1}) and the real exchange rates. It means that the effect of an increase of real exchange rates at the one quarterly lag (i.e. the depreciation of rupiah against the USA dollar at the one quarterly lag) can be felt by the next quarterly as well. The coefficient of the rq_{t-1} was 0.47. This was an elasticity of real exchange rates (*rq*) on the rq_{t-1}. It means that the increase of the rq_{t-1} by 10 percent caused the increase of the *rq* by 4.7 percent (*ceteris paribus*).

The real interest rate differentials (*rze*) have positive significant effect on real exchange rates at the significance level of 5 percent. It means that the increasing of real interest rate differentials caused the depreciate rupiah against the US dollars (this relation was not appropriate with the hypothesis proposed, and it was also different with the conclusion of *Clostermann and Schnatz* (2000) and *Kurniati and Hardiyanto* (2002). It can be also interpreted that the degree of opens affect on real exchange rates in Indonesia during the period of 2004-2008.

Table 3
Long Run Equation of The Real Exchange Rate (*RQ*)
During The Period of 2004.1-2008.4

Dependent Variable : Log *rq*		
Indep Variables	Coefficients	t-Statistic
Constant (c)	10.50989	2.094314**
Log rq(-1)	0.471710	1.315479*
Log CA	0.015138	0.962974^{n}
Tot	0.394081	0.783998^{n}
Rze	0.010644	2.118167**
Log nfa	-0.544842	-2.912536***
Dummy	0.085575	1.309284*

Summary Statistic :	*Notes* :
$R^2 = 0.92$	***) significant at the level of 1 %, (df = n-k = 13; $t_{table} = 2.650$)
Adj- $R^2 = 0.87$	**) significant at the level of 5 %; (df = n -k = 13; $t_{table} = 1.771$)
F = 15.96	*) significant at the level of 1 5 %; (df = n -k = ; $t_{table} = 1.079$)
DW = 1.61	n) non-**significant** (*one tail test*)
n = 2004.1-2008.4 = 20	

Diagnostic statistic

Classical Assumptions	*Statistical Value*	*Critical Value*	Conclusions	
Normality : Jarque -Bera Statistic (J-B)	J-B Stat = 1.57	$\chi^2 = 9.488$ (5 %, v=4)	J-B Stat < χ^2	The regression fit with the normality assumption
Serial Correlation : Breusch -Godfrey Serial Correlation LM Test	Obs* $R^2 = 0.23$	$\chi^2 = 9.488$ (5 %, v=4)	Obs* R^2 < χ^2	No serial correlatin
Whit Heteroskedasticity Test:	Obs* $R^2 = 13.55$	$\chi^2 = 18.475$ *(1 % ;df = 7)*	Obs* R^2 < χ^2	No heteroscedasticity
Multicollinearity : Correlogram of residuals	The table of correlogram *of residuals* showed that all of the value of *Autocorrelations (AC)* was absolutely less than the 0.5. It means that the model free from the multicollinearity.			No multicollinearity

Sources : The Eviews 4.1 outputs

The net foreign assets (*nfa*) has the negative significance effect on real exchange rates at the significance level of 1 percent (It is appropriate with the hypothesis). The negative relations give the meaning that the increase of the net foreign assets (*nfa*) caused the decrease of real exchange rates (there was appreciation of rupiah against the USA dollar). The relation was appropriate with the hypothesis proposed, as ecpected in hypothesis (see *Drine & Raulty* 2003).

The last variable used in the model was the global economic crisis during the period of 2007-2008 (as dummy variable). Based on the student test (t-test), the global economic crisis has apparently the positive effect on real exchange rates, at the significance level of 15 percent. It means that the crisis tends to depreciate real exchange rates.

It so happens, simultaneously the effect of macroeconomic variables were significant, because F-statistic = 15.96 exceed of the $F_{(0.01;\ df = 13)} = 4.62$. Therefore, the regression equation can be implemented for predicting and the other analyses.

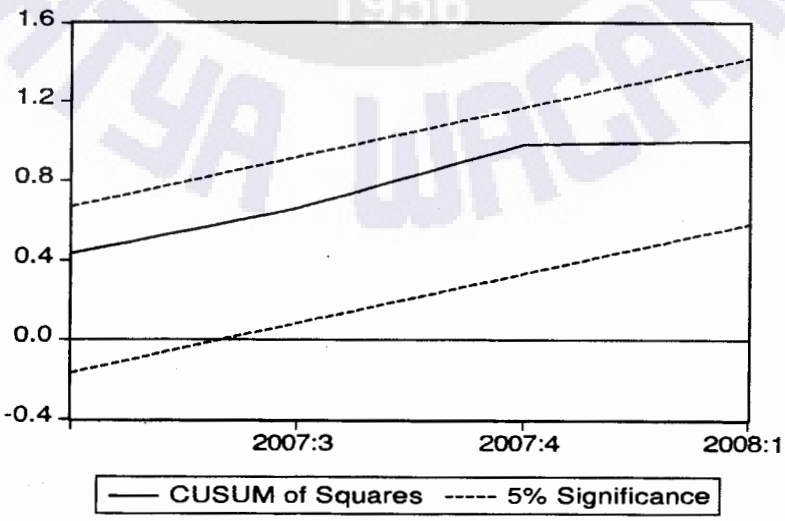
The value of the variances of real exchange rates (*rq*) which can be explained by macroeconomic variables: rq_{t-1}, *CA, tot, rze, nfa* and *dummy* were 92.00 percent , while the rest of 8.00 percent explained by other variables. The high of the determination coefficient and the significance of many variables on the real exchange rate model indicate the coincidentally in choosing of macroeconomic variables which used in the model. So that the regression were very good for predicting and explanations.

The Stability Test of Real Exchange Rates Models

The long run model of real exchange rates function will be tested in this section is the equation presented in the Table 3, namely:

$$Log\ rq_t = 10.510 + 0.471\ Log\ rq_{t-1} + 0.472\ Log\ rq_{t-1} + 0.015\ Log\ CA_t + 0.394\ Log\ tot_t + 0.011\ rze_t - 0.545\ Log\ nfa + 0.086\ Dummy$$

The CUSUMSQ Curve for the equation above as follows:



We see on the Figure 3 that the CUSUMSQ Curve be located between the two border lines (confidence bounds at the levels of 5 percent), therefore the model estimated is stable (there was no structural changed on the model). The conclusion is in accordance with the research conclusion which was found by Kurniati and Hardiyanto (2002).

Conclusions and the Policy Implications

Conclusions

Based on the discussion and the analysis of determinant factors of real exchange rates, the research conclusions were:

1. The real exchange rates in Indonesia during the period of 2004-2008 were determined by the fundamental factors of macroeconomic as follows: (a) real exchange rates at the one quarterly lag (positive correlation). (b) real interest rate differentials (positive correlation, but it was not appropriate with the hypothesis), (c) net foreign assets (negative correlation, as expected in hypothesis), and (d) global economic crisis during the period of 2007-2008 (positive correlation, as expected in hypothesis).
2. During the period of the observation was found that real exchange rates model was stable (as expected in hypothesis). It means that the parameters of the functions of real exchange rates in the period of 2004.1-2008.4 were significantly unchanged.

Policy Implications

The following descriptions are the policy implications which can be implemented by the government (or the monetary authority), and the further of research recommendations:

1. As mentioned in the conclusions, the research found that real exchange rates was influenced by real exchange rates at the one quarterly lag (the experimental variable, rq_{t-1}), real interest differentials, net foreign assets and the global economic crisis during the period of 2007-2008. It means that the increase of those variables (except of net foreign assets) caused the depreciation of rupiah against the USA dollar (the relations were actually not expected). This is the real fact that the non economic factors were apparently still dominant influences to the value of rupiah against the USA dollar (real exchange rates). This condition indicates that the government has to improve its credibility which is represented by the ability to solve the political and social problems, the state securities which are happening in the country.
2. The real interest rate differentials in the short run have the positive significant effect on the value of rupiah. It means that the increase of the interest rate differentials caused the depreciation of rupiah against the USA dollar. This is indication that the investment in Indonesia was not interesting anymore, because the returns which are received to become lower compared with the investment in the origin countries. That signs should be cached by the government that the depreciation of rupiah against the USA dollar is only in the short run (just temporary). It means that the depreciation of rupiah was not only caused by the fundamental factors of economic, because in the fact that the several of fundamental factors of macroeconomic were not significance effect on real exchange rates.
3. The further research still open to be carried out. The research model can be expanded by adding some of the other macroeconomic variables and social variables, such as the variable of security stabilities, political variables (It is normally stated by risk country indexes, *RCI*) and the variable of monetary *syariah*. The research on the variables of monetary syariah is apparently still rare to be performed compared with the other fields. The analysis of macroeconomic behavior will be more

complete if that research started. It will give the big contribution to the treasury of sciences and also to the monetary economic of *syariah* itself.

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