The Short Run and Long Run Impact of Changes in Interest Rate and Exchange Rate on Stock Prices: Empirical Evidence in Indonesia (2000:1 – 2010:4)

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The present study investigates the role of exchange rate and interest rate in stock price discovery in Indonesia. Indonesia is experiencing a kind of bubble which is indicated by surplus of current account accompanied by high capital inflow. Capital inflow simustaneusly influences exchange rate, and interest rate, and thus sequently affects stock prices. Employing cointegration approach and Engle Granger Error Corection Model (ECM), covering monthly time series data from January 2000 to April 2010, both short run and long run relationships are investigated. It is found out that there is cointegration relationship between stock price as dependent variable and exchange rate and interest rate, as independent variables. In the long run and in the short run, interest rate statisticaly significant negatively influences the stock prices. The impact of exchange rate on stock price is statistically significant, and changes in sign from negative in the short run effect to positive in the long run effect. In the long run, stock price is elastic to the changes in interest rate, and exchange rate. In the short run, the elasticity of stock price is decreasing in responding to the change in interest rate and exchange rate.

Keywords : Cointegration, ECM, stock price, economic model

1.Introduction

Indonesia was one of a few countries in the world which was experiencing positive economic growth. It had been for a long time that domestic interest rate of Indonesia was higher than its neigbouring countries. The high domestic interest rate and the positif economic growth have attracted short run foreign capital inflow. Then, an interesting phenomenon occured. In one side the current account is surplus, but on the other side capital account is also surplus. The surplus of balance of payment is not accompanied by a significant appreciation of domestic currencies (rupiah), and sizeable decrease in interest rate, so the capital inflow has sustained.

According to open market theory, capital inflow effects the price of stock trough the change in the exchange rate and interest rate (Mankiw, 2004; Alhayky, 2009). The capital inflow raises supply of foreign currencies and appreciates the domestic currency. The appreciation of domestic currency, in turn, decreases the competitiveness of domestic production in foreign market. Competitiveness of domestic production weakens the price of stock. In the mean time, the capital inflow causes the supply of domestic fund swells up, and squeezes the interest rate down. The interest rate decrease tends to raise the demand for stock, and in turn move up the price of stock.

There are so many articles which investigating the influences of exchange rate and interest rate on stock prices. Most of them are investigating bivariatly between exchange rate and price of stock and between interest rate and price of stock (Alhayky, 2009; Rjoub et.all., 2009; Kettering, 2009; Aliyu, 2009). Since some studies assume that there is interrelationship between the two sets of variables, causality tests between the two sets (Alhayky, 2009; Aliyu, 2009) is done. This study runs cointegration tests between the two independent variables and the dependent variable. The two independent variables are exchange rate and interest rate, and the dependent variable is stock price. Confirming the cointegration test among them implies the theory, and in turn supports the perfect market condition.

2.Literature Review

Most of the studies investigate the relationship between exchange rate and stock price; and between interest rate and stock price separately, in various contries. This study focuses on the relationship between the independent variables which are exchange rate and interest rate, and the dependent variable which is stock price. Cointegration between the independent variables and the dependent variable implies that the supporting theory is held.

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The previous studies which examine the relationship between exchange rate and stock prices were done by Ahmed Alhayky and nDambendia Houdou (2009); Ronald C. Kattering (2009); Shehu Usman Rano Aliyu (2009). Most of them run the relationship between stock price and several exchange rates. Ahmed Alhayky and nDambendia Houdou (2009), employing monthly data from June 2001 to December 2008, examined the relationship between exchange rate and stock price in Kuwait. Using cointegration test, and causality test, it is concluded that there is cointegration between Kuwait stock price and US Dollar, Japan Yen, and British Pound. There is no cointegration between Kuwait stock price and European Euro. Based on the Granger causality test, it is found out that in the long run, there is a bilateral causality between Kuwait stock price and British Pound, Kuwait stock price and Japanese Yen, and Kuwait Stock price and US Dollar. Moreover, it is observed that in the short run, Kuwait Stock Price has no unidirectional or bidirectional causality with British Pound.

A similar study is done by Shehu Usman Rano Aliyu in Nigeria (2009). Aliyu examined the long run and short run relationship between exchange rate and stock prices in Nigeria, using daily basis data from February 1 2001 to December 31, 2008. Employing Johansen and Julius Cointegration Procedure and Causality Test, Aliyu found out that there are cointegration between US Dollar exchange rate and Nigerian Stock Prices. Causality test reveals that there is long run bidirectional relationship between US Dollar exchange rate and Nigerian Stock Prices.

A special attention is given by Ronald Kettering (2009) to investigate the relationship between non US Currencies and stock prices which are reflected by the Dow Jones Industrial Average and Poor's 500 Standard Stock Index. Employing monthly data for 8 year period, 1999-2006, the relationship between the stock prices and the non US Dollar exchange rates are examined. The period of investigation is chosen in order to cover the period of European Euro in effect. The result is that various currencies exhibit significant relationship, but the impact is limited. Additional finding is that there are changing relationships between pair of currencies, but the pair of currencies from the same economic area tends to be positively related. Pair of Euro, British Pound, and France Frank is positively related.

A slightly different approach was done by Husam Rjoub, Turgut Tursoy, and Nil Gunsel (2009) which research was situated in Turkey. Ordinary Least Squares (OLS) approach to examine the impact of six pre-specified macroeconomic variables to stock prices was employed. The variables were the term structure of interest rate, unanticipated inflation, risk premium, exchange rate, and money supply. The samples used for their research were 259 company's stocks listed in Turkey Stock Market in the period of 1 January 2001 to September 2005. The 57 time series monthly data were used to run the linear six independent variables model. The result was generally the pre-specified macroeconomic variables statistically could explain the prices of portfolios in Turkey.

Mohammad Shabri Abdul Madjid, and Roslin Mohammad Yusof (2009), using monthly data from May 1999 to February 2006, investigated the relationship between macroeconomic variables and the Islamic stock returns in Malaysia (2009). The macroeconomic variables are treasury bill rate (TBR), federal fund rate (FDR), money supply (M2), and real exchange rate (REER). Employing Autoregressive Distributed Lag Model Approach to Co-integration, it investigated the long run and short run relationship between the macroeconomics variables and the stock return. It found out that the higher the treasury bill rate and US federal fund rate, the more people buy Syariah stock, and so escalating the price of the stocks. In line to the theory, it was confirmed that there was a relationship between exchange rate and the syariah stock return. The higher the exchange rate, the less syariah stocks demanded, and so the price of syariah stock was deflated.

Mohammad Akbar and Omar Kundi (2009), employing monthly data for period of Januari 2000 to April 2008, investigated the influences of monetary variables on stock price in Pakistan. The monetary variables were inflation, money supply (M2), interest rate, and industrial production. Cointegration and Vector Error Correction Model were used to investigate the relationship between the monetary variables and the stock price. It is concluded that all monetary variables lead to the stock price. The interest rate positively influences the stock price. The conclusion on the influence of interest rate to stock price is similar to the finding of Abdul Madjid research on similar topic in Malaysia.

Utilizing not very long quarterly time series data, which was only 38 observations, M Shabri Abdul Madjid (2009) explored the relationship between Money Demand on Stock Prices in Indonesia. The data spread from the second quarter of 1997, which was on the period of economic crisis for Indonesia, to the fourth quarter of 2008. Cointegration and Engle Granger Causality approaches were employed. Quarterly data from second quarter of 1998

to fourth quarter of 2007 were applied. It is concluded that there is cointegration between narrow money, M1, with the price of stock. There is bidirectional causality between M1 and stock price. This further implies that in designing economic policies pertaining to the stock market, the Indonesian government through the Central Bank of Indonesia may also use money balance as opposed to the current practice of adopting interest rates, as their monetary policy. On the contrary, controlling the stability of money balance in the long run can be achieved indirectly by regulating the stock market.

It is quite interesting that most researches who investigate the relationship between interest rate and stock price conclude that there is positive correlation between both variables (Rjoub et.all, 2009; Shabri and Roslin, 2009; Akbar and Kundi, 2009; Shabri, 2009; Erdem, Arslan and Erdem, 2005). Erdem, Arslan and Erdem (2005) suggested that changes in interest rate cause an investor to change his portfolio of bonds and stocks. When interest rates fall, investor shifts investment from bonds to stocks and vice versa.

Theoretically the relationship between both variables is negative. The higher the interest rate the more expensive the cost of the capital, the less investment is. In the long run, capital inflow increases money supply, and tends to lower the interest rate. The lowering of the interest rate causes the cost of capital is cheaper, and in turn drive the demand for stock swell up, thus finally boost the price of stock escalates.

Rjoub et.all, (2009), Shabri and Roslin, (2009), Akbar and Kundi, (2009), Shabri, (2009) did their researches in the developing countries. The researches consecutively were situated in Turkey, Malaysia, Pakistan, and Indonesia. The developing countries are considered as small open countries, and are more sensitive to foreign countries influences. If the interest differential increases, the capital inflow increases, the demand for stocks rises, and in turn the price of stocks are inflated.

The relationship between exchange rate and stock prices is quite ambiguous. Some researches revealed that there were no significant statistical relationship between exchange rate and stock prices (Rjoub, 2009; Alhayky and Houdou, 2009; Kettering, 2009). Several researches concluded that there was positive relationship between exchange rate and stock prices (Rjoub, 2009; Kettering, 2009; Aliyu, 2009). Several other researches uncovered that the statistical relationship between both variables was negative (Rjoub, 2009; Alhayky and Houdou, 2009; Kettering, 2009; Shabri and Roslin, 2009). Kettering (2009) concluded that the ambiguous statistical relation between stock prices and exchange rate was mixed and weak. The statistical test revealed that the impact of exchange rate to stock prices over the period of sample was weak.

Aliyu (2009) explained that the positive relationship between stock prices and exchange rate was bidirectional. It means that exchange rate determined stock prices, and stock prices influences exchange rate in Nigeria. If there is capital inflow, the demand for stock increases, and the price of stock rises. Otherwise, if performance of stock market is good, there will be capital inflow, and the exchange rate is strengthened. According to Aliyu (2009), the bidirectional relationship is advantageous for Nigeria. Stock market supports the balance of payments position, and improves the stabilization of exchange rate. In turn, foreign exchange market strengthens the stock market. This evidence implies that Nigeria is a small open economy.

Alhayky (2009), clarified the negative or positive sign on the relationship between exchange rate and stock price. It is argued that there are two approaches on the relationship between both variables. The approaches are flow and stock oriented. First, the effect of the exchange rate on the stock market (flow oriented) approach states that depreciation of exchange rate will increase competitiveness which leads to increase in domestic output (expansion), which in turn is an indicator of an expansion economy and boost or influence the stock price. Second, the effect of the stock prices on exchange rate (stock oriented) states that an increase in stock price leads to capital inflow, which in turn leads to increasing the demand for domestic currency and cause the exchange rate to appreciate. The flow oriented approach shows the negative relationship between exchange rate and stock price, since the stock oriented approach reveals the positive relationship between exchange rate and stock price.

3. Research Model

It is assumed that all agents optimize their return or profit from trading stocks domestically. The economic agents get profit from capital gain and from dividend. The agents have two sources of fund for buying stocks. They could borrow money domestically and internationally. Domestically, they have to pay domestic interest rate for every fund they borrow. For foreign fund, they have to pay foreign interest rate. For the later, the investors have to consider the exchange rate risk. The profit function could be formulated as Lagrange Multiplier Function as follows.

$$Max..\pi\ Q) = \lambda\ (Q) * Q + \varsigma * Q - d(Qd, Qf) * Qd - f * E(Qf) * Qf + \lambda\ Q - \eta d - \eta f) \quad (1)$$

The sources of return are capital gain {ΔP(Q)*Q}, and dividend (R*Q), where ΔP is the the change in price of stock, Q is quantity of stock traded, R is the rate of dividend. For simplicity, the rate of dividend (R) and foreign interest rate (rf) are exogenous. Price of stock is determined by demand (and supply) for stocks. The cost of stocks holding is interest paid for domestic loan {rd(Qd, Qf)*Qd} and interest paid for international loan {rf*E(Qf)*Qf}, where Qd is domestically source of fund, and Qf is foreign source of fund. Total fund for buying stock domestically is Q, where Q is composed of Qf and Qd (Q = Qf + Qd). The international loan contains risk of change in exchange rate. Since Indonesia is a small country, capital inflow (Qf) does not influence the foreign interest rate (rf), but determines the domestic interest rate {rd(Qf)}, and exchange rate {E(Qf)} simultaneously.

Agents maximize the profit by determining the number of funds to be allocated for buying stocks. The sources of funds for buying stocks are domestic and international source of funds. The First Order Condition (FOC) is as follows.

$$\frac{\partial\pi}{\partial Qd} = \frac{\partial\{\partial P(Q)\}}{\partial Qd} Qd + \lambda P(Qd) + R - \frac{\partial rd}{\partial Qd} Qd - rd - \lambda = \lambda \quad (2)$$

$$\frac{\partial\pi}{\partial Qf} = \frac{\partial\{\partial P(Q)\}}{\partial Qf} Qf + \lambda P(Qf) + R - \frac{\partial rd}{\partial Qf} Qd - \frac{\partial E}{\partial Qf} rf * Qf - rfE - \lambda = \lambda \quad (3)$$

$$\frac{\partial\pi}{\partial\lambda} = Q - Qd - Qf = \lambda \quad (4)$$

The first FOC (equation 2) implies that the change in domestic source of fund influences the stock prices and domestic interest rate. The increase in domestic demand for stocks tends to raise the price of stocks, (∂P/∂Q)>0. The increase of stocks traded stimulates the increase of domestic interest rate, (∂rd/∂Q)>0, and increase the cost of stock holding. The first FOC, or second equation could be reformulated as follows.

$$\frac{\partial\{\partial \lambda(Q)\}}{\partial \eta d} Qd + \lambda \lambda(Qd) + \varsigma = \frac{\partial\ d}{\partial \eta d} + \iota d \quad (5)$$

The above condition implies that if the change in profitability of holding stock is higher than the domestic cost of holding stock, the demand for stocks increase. If the domestic cost of holding stocks is higher than the profitability of holding stocks, the demand for stocks decreases. If the domestic cost and the profitability of holding stocks are equal, the equilibrium condition is achieved. The first FOC is hold.

The second FOC (equation 3) implies that capital inflow strengthens the exchange rate, (∂E/∂Qf)>0 , so the same amount of foreign exchange gets a smaller amount of domestic currencies. Domestic currencies and domestic assets are getting more expensive in term of foreign currencies. The capital inflow triggers the higher supply of money and liquidity, and in turn lowers the domestic interest rate,(∂rd/∂Qf)<0. The lower the domestic interest rate, the cheaper the cost of capital is. The cheaper the cost of capital, the higher the demand for money and stocks are. The capital

inflow also directly stimulates the demand for stocks, and consecutively rises the price of stocks (∂P/∂Qf)>0. The second FOC condition could be restated as follows.

$$\frac{\partial \partial '(Q)\}}{\partial Jf} Qf + \; '(Qf) + \; = \frac{\partial d}{\partial Jf} Qd + \frac{\partial \; '}{\partial Jf} rf * Qf - \; f * E \qquad (6)$$

The above equation (6) states that if profit of holding stocks is higher than the foreign source cost of holding stocks, agents tend to borrow fund from abroad. If the cost is higher than the profit, the demand for stocks decreases. Equilibrium condition is achieved if the profit of holding stocks is equal to the cost of holding stocks. If equation (5) and (6) is combined, the equilibrium condition for open economic completed. If domestic source of fund is cheaper than foreign source of fund, demand for domestic fund increases. The increase in demand for domestic fund drives the domestic interest rate up, and the interest differential disappears. Triggered by capital inflow, domestic money supply increases, and simultaneously strengthens the exchange rate. The increase of domestic money supply drives the interest rate down, and wipes out the interest differential, and stops the capital movement.

From the above model, it is identified that price of stocks, domestic interest rate, and exchange rate are endogenous, while foreign interest rate and dividend rate are exogenous. From the three FOC, it could be solved the three endogenous variable as a function of the exogenous variables. Since the interest of the study is the relationship between price of stocks (P), and the two independent variables which are domestic interest rate(rd), exchange rate (E), it is possible also to construct a general relationship as follows.

$$P = f\left(\underset{(-)}{rd}(rf, R), \underset{(+or-)}{E}(rf, R) \right) \qquad (7)$$

The above equation could be elaborated that price of stock (P) is a function of domestic interest rate (rd), and exchange rate (E). Foreign interest rate (rf), and the rate of dividend (R) directly, and indirectly through domestic interest rate, and Exchange rate affect price of stock (P). If domestic interest rate increases, the cost of borrowing money increases, so the demand for stocks decreases. If the demand for stocks decreases, the price of stocks decreases. The relationship between rd and P is negative. This theoretical conclusion is totally incompatible with all beforehand researches (Rjoub et.all, 2009; Shabri and Roslin, 2009; Akbar and Kundi, 2009; Shabri, 2009).

If the price of domestic currencies (E) increases the cost of foreign borrowing is more expensive, but domestic cost of domestic borrowing is cheaper through the channel of increasing money supply and decreasing domestic interest rate. Foreign demand for domestic stocks decreases, but domestic demand for stocks increases. If the decrease of foreign demand dominates the increase of domestic demand, the price of domestic stocks decreases. If the increase of domestic demand is higher than the decrease in foreign demand for stocks, the price of domestic stocks increases. The relationship between exchange rate and price of stocks is indeterminate. The theoretical conclusion is similar with finding of several previous studies (Rjoub, 2009; Alhayky and Houdou, 2009; Kettering, 2009).

4. Methodology

There are three variables involve in the study. There are price of stock, exchange rate, interest rate. Composite Stock Price Indices (IHSG) is used as a proxy for stock price. Exchange rate is measured by rupiah (Indonesian currency) per US dollar. Federal Reserve Rate of Indonesia, or it is known as Bank Indonesia Rate (BI rate), is employed to represent the interest rate.

One serious problem faced by econometricians when dealing with time series data is spurious regression or spurious correlation problem (Thomas, RL, 1997). There are three ways to avoid the problems. The first possible solution is running all stationary variables in equation. Second solution is using cointegration approach. The third solution is

applying dynamic model. Since the motivation of this study is investigating the long run , or theoretical relationship between the independent variables which are interest rate and exchange rate and the dependent variables which is stock price, so only second and third solution of spurious problem will be attempted.

The first important step of the solution is running the unit root test and finding the degree of integration of the variables involved in the model. The unit root test employed is Dicky Fuller (DF) and Augmented Dicky Fuller (ADF) Test (Thomas, 1993). The rational of DF and ADF test is as follows. It is assumed that the realization of the time series data follows the first degree of autocorrelation function.

$$Y_t = \rho Y_{t-1} + \varepsilon_t \quad (8)$$

The series will be stationary if rho is about zero to one ($0 < \rho < 1$). If rho is equal to one (or more than one or less than zero) the series is called unit root. Unit means one, and the series is not stationary. The equation (8) is converted into the equation (9) in order to facilitate the test.

$$\Delta Y_t = (\rho - 1) Y_{t-1} + \varepsilon_t$$

$$\Delta Y_t = \Phi Y_{t-1} + \varepsilon_t \quad (9)$$

Where theta $\Phi = (\rho - 1)$.
The series will be unit root if rho is equal one, or theta is equal zero. Unit root or Dicky Fuller test hypothesizes that H null or theta is equal to zero, which is rho (ρ) is equal to one (unit). Dicky Fuller realizes that the residual of equation (9) tend to be autocorrelated. To avoid the autocorrelation problem, the lags of the dependent variables are augmented to the equation. The later test is famous with Augmented Dicky Fuller Test (ADF), which formula is as follows.

$$\Delta \; = \; \beta_0 \; _{t-1} + \beta_1 \sum_{1} \; _{-} + \; \quad (10)$$

The equation (10) above exposes another problem, that is the length of the lag. Akaike and Schwarz criterion are utilized in determining the length of the lag.

Transformation of equation (8) into equation (9) of DF test inspires that differentiating is one possible way to make a non-stationary to be stationary series. The number of time to convert a non-stationary to stationary series is known as degree of integration. The first challenge is finding the stationary series and running the regression of all stationary variables.

The second challenge is revealing that there is a long run relationship between the dependent variable which is price of stock and independent variables which are interest rate and exchange rate. The long run relationship will be implied by the cointegrating regression. The cointegrating static regression will be tested using DF and ADF Test. The residual of cointegrating static regression must be stationary. As suggested by Harris (1995), testing the stationarity of the residual implies testing the cointegrating static regression of the main equation. The cointegrating static regression could be formulated as follows.

$$Y_t = \alpha_0 + \alpha_1 X_{1t} + \alpha_2 X_{2t} + \; \quad (11)$$

Since the long run relationship is not known whether it is linear or non-linear, the McKinnon, White, and Davidson (MWD) test should be completed. The MWD test follows the formula such that (Gudjarati, 2009).

$$Y_t = \alpha \; + \alpha \; X_{1t} + \alpha \; X_{2t} + \alpha \; Z_1 + \; \quad (12)$$

$$\log(Y_t) = \beta + \beta \log(X_{1t}) + \beta \log(X_{2t}) + \beta Z_2 + \varepsilon \quad (13)$$

Z_1 is the different between log of Y_t predicted and $\log(Y_t)$ predicted. Z_2 is the different between antilog of $\log(Y_t)$ predicted and Y_t predicted. If coefficient of Z_1 in equation (12) is statistically significant, and coefficient of Z_2 in equation (13) is statistically not significant, so it could be concluded that the true relationship between dependent and independent variables is non-linear. Otherwise, if coefficient of Z_1 in equation (12) is statistically not significant, and coefficient of Z_2 in equation (13) is statistically significant, so it could be concluded that the true relationship between dependent and independent variables tends to be linear.

Assuming that the second challenge is accomplished, the third challenge to be completed is formulating and running the Engle-Granger Error Correction Model (ECM). As it is stated by Engle and Granger (1991), the ECM is representation of cointegrating regression. There are several advantages of ECM rather than the static cointegrating regression. The first advantage is not only long run but also short run relationship could be revealed. Secondly, it could be brought to light the speed of adjustment to reach the new equilibrium condition. The formulation of ECM could be written as follows.

$$\Delta \; = \beta_1 \Delta \; _{1t} + \beta_2 \Delta \; _{2t} + \lambda \; _{t-1} + \varepsilon \quad (14)$$

Where, Z_{t-1} is the error correction term. Coefficient λ is coefficient of adjustment, which represent the magnitude of dependent variable reaction or adjustment for every unit of disequilibrium.

5. Stock Price In Indonesia: 2000-2010

During the period of study, the price of stock, which is represented by the composite stock price index, was generally always increasing. The slow motion of stock price during the first period of the study (2001-2003) was followed by the fast increase of stock price in the second period (2004-2008), and was interupted by the colapse of stock price which was caused by the economic crisis of 2008 of the third period of the study, and was concluded by high increase of stock price which was influenced by the European crisis which was started by the end of 2009.

The slow motion of stock price during the period of 2000-2003 was strongly influenced by the economic crisis, and domestic political torbulence of 1998. The first period of the study was characterized by the presidential succesion from Abdulrahman Wahid to Megawati Sukarnoputri, which previously was the vice president of Abdulrahman Wahid (http://dipi_solo.tripod.com/artikel/ekonomi.htm). Since it was perceived by foreign ivestors that there was no political stability, in the beginning of the first period there was no short run foreign investment. There was no growth of net export. Rupiah depreciated until 17%. Inflation rate reached 8.9%. Bank Indonesia (BI) rate which was used to control domestic interest rate and inflation rate had been set at around 17%. The sheer size of transaction in the stock market generated the slow motion of stock prices. The end of the first period, the economic condition was getting better. The inflation rate could be forced down until 6% to 7%. BI rate could be set at lower rate at 10% to 11%. Even the economic stability was better, but the transaction on stock market and the price of stock was still stucked at the level around 450 point (Bank Indonesia Annual Report).

The period of 2004-2008 was the period of fast increase of stock prices. The period was characterized by the parliamen and presidential sound democratic election of 2004 (www.southasiaanalysis.org). It was the first time in the Indonesian history that one man one vote system was applied for the presidential election. The successful election brough about the political and economic stability. The exchange rate strengthened in 2004 and early of 2005. At the same time the interest rate reached the lowest rate which was around 7%. The doing well financial restructurization was condusive for economic growth. Capital inflow in the period of 2004-2008 was very high. The price of stock increased dramatically from 729 point on January 2004 to 2721 point on February 2008.

The fast increase of stock price during the period of 2004-2008 could be called as a bubble. The price of stock was overvalued. United States Financial crisis triggered the deep fall of stock prices in Indonesia. Almost all short run foreign financial investment was taken away from Indonesia. The exchange rate of rupiah dropped sharply from Rp. 9.021,- per dollar point on February 2008 to the lowest rate at Rp. 12.151,- per dollar on October 2008. At the same time, the index of stock prices fell down from 2721 point on February 2008 to the lowest rate of 1241 point on November 2008. In order to attract foreign short run investment and to lower the inflaation the central bank of Indonesia increased the BI rate from 7.93 % on February 2008 to the highest rate of 11.24% on November 2008.

Indonesia was one of a few countries in the world which was experiencing positive economic growth during the world financial crisis of 2008. The fundamental economic of Indonesia was good. The economic growth was about 6.1% in 2008 and about 4.5% in 2009 (BI Annual Report); and it was expected about 5.% in 2010 (http://bisniskeuangan.kompas.com). The decreasing performance of Indonesian export was one reason for the decreasing Indonesian economic growth in 2010. The slower export growth in 2010 was initiated by the appreciation of rupiah and by the weakening of world economic growth triggered by American and European economic crisis. The appreciation of rupiah in 2010 was set off by the high capital inflow to Indonesia. Bank Indonesia report noted that there was $219 million capital outflow in the last three quarter of 2008; and there was 10 billion dollar dollar capital inflow in 2009; and there was 6.2 billion dollar capital inflow in the first quarter of 2010. Rupiah appreciated from Rp.11.980 per dollar on February of 2009 to Rp 9012 per dollar on March of 2010. In order to lower the cost of domestic investment and to push the economic growth, the central bank of Indonesia set off the BI rate down from 11.24% on November 2008 to 6.20% on April 2010. At the same Capital inflow increased, the demand for stock amplified, and the price of stock reached the peak and breaked through the psychological point of 3000 points on 21st of July 2010 (http://www.tempointeraktif.com/hg/saham/2010/07/21/brk,20100721-265239,id.html).

6. Results and Interpretation

The data used in the study is monthly data from January of 2001 to April of 2010. The data is downloaded from website of Bank Indonesia. The variables involved are composite index price of stock as dependent variable, exchange rate, and domestic federal fund rate as independent variables.

It is assumed that the equation could be linear or non linear. In case for non-linear equation, to make the equation to be linear, all the variables are transformed into linear using logarithmic approach. The linear and logarithmic variables are tested for their stationarity by means of DF and ADF unit root test. The result is reported in table (1).

Table 1 : ADF STATISTICS

Variables	With Intercept	With Intercept and Trends	No Intercept and No Trends	Conclusion
Composite Index (IHSG)	0.085497	-2.284437	1.281499	Unit Root Series
Exchange Rate (KURS)	-3.759088*	-3.668761**	0.062949	Unit Root Series
Federal Fund Rate (SBI)	-1.267095	-2.484059	-0.782013	Unit Root Series
Log IHSG	-0.147512	-2.855180	1.468068	Unit Root Series
Log KURS	-3.848434*	-3.734858**	0.310192	Unit Root Series
Log SBI	-1.269920	-2.544904	-0.690160	Unit Root Series

*Statistically Significant With 1% Critical Value ** Statistically significant with 5% critical value***Statistically Significant With 10% critical value

It is quite interesting to interpret the ADF result for all variables. First of all, all level variables involve first order autocorrelation. To cope with the autocorrelation problem, the lag of the tested variables must be included. To determine the length of the lag, t test accompanied by Akaike and Schwarz Criterion is employed. The first order autocorrelation implies that the length of the lag is one. Since the data is monthly data, the first order autocorrelation of all variables implies that the contemporary data are influenced by the last month data. For example, the current price of stocks is influenced by last month price. Secondly, almost all level variables contain with drift or and trends. Stock Price (IHSG) and Interest Rate (SBI) contain with drift and trend. Since, Exchange Rate (KURS) contain only with drift. Stock Price has been moving upward since March 2001. The value of composite of stock price was 318 point in March 2001, and it reached the peak in April of 2010 with the value of 2971,250 point. Interest Rate has been moving down since August 2001. The highest rate was 17.67 percent in August of 2001, and reached the lowest rate in April 2010 with the rate of 6.2 percent. Exchange Rate, even had a tendency to move up and down randomly, but the average was slightly drifted upward. When the trend and the intercept were removed from the equations, all series are not stationary. It could be concluded that all level variables are unit root series.

To be stationary all variables are differenced. There is no drift and no trend in all first-differenced variables. When the variables are differenced, the drift and trend are diminished. As it is suggested by Pindyck and Rubinfeld (1991), many of the nonstationary time series encountered have the desirable property that if they are differenced one or more times, the resulting series will be stationary. The result is that, after differenced, all variables tend to be free of autocorrelation problems. Basically, the unit root test is simplified from ADF to DF test. It could be concluded that all variables are integrated of degree one.

Table 2 : ADF STATISTICS

Variables	With Intercept	With Intercept and Trends	No Intercept and No Trends	Conclusion
First Different Composite Index (IHSG)			-7.664464*	Stationary
First Different Exchange Rate (KURS)			-9.808982*	Stationary
First Different Federal Fund Rate (SBI)			-5.264705*	Stationary
First Different Log IHSG			-8.756859*	Stationary
First Different Log KURS			-9.556683*	Stationary
First Different Log SBI			-4.861682	Stationary
*Statistically Significant With 1% critical value.				

It is possible to run a non spurious regression, as soon as the degree of integration of all variables is known. Running all the stationary differenced variables is the possibility. The difficulty in interpreting the result of the regression is the reason for leaving behind the possibility. The next step is running cointegrating regression. There are two possible models to construct. The two models are linear and logistic. To choose the better model, McKinnon, White, and Davidson (MWD) test could be employed. The result is that logistic model is more appropriate than the linear model. The term of Z_1 is statistically significant in the linear model, but Z_2 is statistically not significant in the logistic model. Since Z_1 contain with logistic term, it could be concluded that the logistic model is better than the linear model.

Table 3 : MWD Test		
Model	**Regression Result**	**Prob (α)**
Linear	$IHSG_t = 317.87 - 72.35 * SBI_t + 1.05 * KURS_t - 1.59 * Z_1$ (−.87)*	0.06*
Logistic	$lIHSG_t = 2.98 - 1.23 * lSBI_t + 1.37 * lKURS_t - 1.0008 * Z_2$ (−.39)	0.16
*Statistically significant for α = 10%		

Having information that logistic model is better than the linear model, the logistic model could be run for cointegrating static regression. The estimation result of the cointegrating regression is as follows.

Table 4 : COINTEGRATING STATIC REGRESSION
$LISHG_t = -4.088 + .6177 * LKURS - .653 * LSBI$ (−.91129) (3.2751)* (−1.612)*
$F_c = 59.12$ *
*Statistically significant for probability of α =10%

The cointegrating static regression has properties that the error term has zero mean, and constant variance (Hamilton, 1994), or the error term is stationary. As suggested by Harris (1995), testing the stationarity of the error term implies testing the cointegration of the model. Testing the stationarity of the error term could be done using DF, ADF, and Phillip Peron test. The DF, ADF and Phillip Peron test of the error term is as follows.

Table 5: DF, ADF, AND PHILLIP PERON STATISTICS				
Variables	**With Intercept**	**With Intercept and Trends**	**No Intercept and No Trends**	**Conclusion**
ADF TEST	-1.827705	-2.390041	-1.837601*	Stationary
PHILLIP PERRON	-1.614052	-2.289241	-1.620620*	Stationary
*Statistically significant for probability of α =10%				

Since the cointegrating static regression (Table 4) contains autocorrelation problem, not only DF and ADF but also Phillip Peron test are employed. The spirit of ADF and Phillip Peron test is actually similar. Both tests consider the present of autocorrelation problem, so that they include the lag of the dependent variables in the tests. The result tests show that there is cointegration between stock price as dependent variable and interest rate, and exchange rate as independent variables, even with loose probability of wrong decision, α= 10 %.

Engle and Granger (1991) suggest that cointegrated regression could be presented as Error Correction Model (ECM). The advantage of ECM is that, short run and long run relationship are investigated simultaneously in one model. Employing ECM, the process achieving equilibrium is tractable. The ECM estimation result is presented in table 6.

Estimation of ECM shows that all coefficients partially and simultaneously are statistically significant with α = 1%. Calculated t for coefficient of error correction term (ECT) is (-2.322074). With probability of making wrong decision 1%, t calculated is higher than t table. The test confirms that there is long run relationship between price of stocks and the independent variables which are interest rate, and exchange rate. The coefficient of ECT is negative 0.03063. The coefficient could be interpreted that if there is one unit percent disequilibrium shock in the preceding period, the price of stocks dampens down by 0.03763%. Since the data is monthly data, the new equilibrium is achieved in 32 months or almost three years.

Table 6 : ECM REGRESSION

$$DLIHSG_t = \underset{(5.812958)^*}{-.899326^* DLKURS_t} - \underset{(-.193684)^*}{.494331^* DLSBI_t} - \underset{-2.322074^*}{.030763^* LRES_{t-}}$$

$$F_c = 9.12^*$$

$$DW = .833986$$

*Statistically significant for probability of α =1%

The effect of interest rate on stock price is negative either in the short run and long run. The finding is totally different than that of all previous study conclusions. All previous studies concluded that the relationship between stock price and interest rate is positive (Rjoub et.all, 2009; Shabri and Roslin, 2009; Akbar and Kundi, 2009; Shabri, 2009; Erdem, Arslan and Erdem, 2005). The finding of this study is compatible with the theoretical conclusion of derived model.

The constant negative impact of interest rate on stock price probably could be explained by the dominant effect of short run capital inflow. The capital inflow drives domestic money supply up, and forces domestic interest rate down. The lower the interest rate, the higher the demand for stocks is. The higher demand for stocks escalates the price of stocks. Because the interest rate decreases, the price of stock increases. One of the most rational explanations is that the time period of the study is between January 2000 and April 2010. During the period of study government run a program to improve the efficiency in banking system. The purpose of the program is to dampen the cost of investment by lowering the interest rate. Supported by abundance of capital inflow, the interest rate continuously has been decreasing. At the same time, the abundance of capital inflow drives up the demand for stocks, and in turn the price of stock increases.

The impact of exchange rate on stock price changes in sign from negative in the short run to positive in the long run effect. In the short run, the impact of strengthening domestic currencies is lower than the impact of lowering the interest rate on demand for stock. The net result is that the demand for stock enlarged, and in turn the price of stock increases. In the long run, the impact of strengthening domestic currencies is higher than the impact of lowering interest rate on demand for stock. The net result is that foreign demand for domestic stocks is down, and in turn the price of stocks decreases. This finding is compatible with results of previous researches (Rjoub, 2009; Alhayky and Houdou, 2009; Kettering, 2009) and theoretical conclusion of derived model.

In the long run, stock price is very elastic to the change in interest rate and exchange rate. The elasticity of stock price to the change in interest rate is negative 1.6553%. If interest rate increases by one (1) percent, the stock price decreases by 1.6553%. The elasticity of stock price to the change in exchange rate is positive 1.6177%. If exchange rate increases by one (1) percent, the stock price decreases by 1.6177%. In the short run, the elasticity of stock price decreases by 0.899326%, if exchange rate increases by one (1) percent; and the elasticity of stock price decreases by 0.494331%, if interest rate increases by one percent.

7. Conclusion

This paper investigates the relationship between the dependent variable, Indonesia Composite Stock Price Indices, and the independent variables, which are interest rate, and exchange rate by using cointegration and Error Correction Model for period of January 2000 to April 2010. Cointegration test show that there is long run equilibrium relationship between Indonesia Composite Stock Price Indices as dependent variable, and exchange rate and interest rate as independent variables. Empirical results based on Cointegrating Regression and Error Correction Model estimation show that the coefficient of adjustment is -0.030763. The coefficient implies that if there is a shock, the new equilibrium is achieved for 32 months. The short run and long run impact of interest rate on stock price has equal negative signs. The impact of exchange rate on stock price changes in sign from negative in the short run to positive in the long run effect. In the long run, stock price is very elastic to the change in interest rate and exchange rate. In the short run, in the process of reaching the new equilibrium, the elasticity of stock price in responds to the change in exchange rate and interest rate is decreasing.

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