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Determinants of Equilibrium Real Exchange Rate and Its Misalignment in Indonesia
(Post Crisis Era)

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Abstract

After applied the free floating exchange rate regime, the rupiah exchange rate was determined by the mechanism of market. The Central Bank did not have the obligation again to determine the rupiah exchange rate in certain level. It means that the movement of exchange rate in the money market is only influenced by fundamental factors for both economic and non economic.

In this research paper, we determine equilibrium real exchange rate of rupiah in order to see the influence of fundamental factors toward rupiah exchange rate, and to understand the appropriate level or sustainability long term trend. Furthermore, we figure out the misalignment for real exchange rate of rupiah. The period of this research paper covers the post crisis era from 1999 until 2006 (quarterly).

Using co-integrating regression, we find that variable of tnt and nfa have significant influence to real exchange rate. In contrary, variable of tot, openness, and fg do not influence significantly to real exchange rate of rupiah. Misalignment episode give us four patterns of situation during this period which are undervaluation during 2000Q2-2002Q1 period and 2004Q2-2005Q3 period, and also overvaluation during 2002Q2-2004Q1 period and 2005Q4-2006Q4.

Chapter 1
Introduction

1.1 Introduction

The objective of this research paper is to understand the appropriate level that represents the sustainable of equilibrium real exchange rate. This appropriate/sustainable level is needed to observe its misalignment. For this purpose, we determine equilibrium real exchange rate of rupiah by using the behavioral equilibrium exchange rate model in order to see the influence of fundamental factors toward rupiah exchange rate, and to understand the appropriate level or sustainability long term trend. Then we analyze some data with econometric model and estimating them by using ordinary least square (OLS) method with time series data. Furthermore, we figure out the misalignment for real exchange rate of rupiah. The period of this research paper covers the post crisis era from 1999 until 2006 (quarterly).

1.2. Background, Indication of Problem and Justification of the Study

The weak fundamental of economy and the uncertainty politic situation led Indonesia to a difficult condition to overcome the economic crisis. Many market sentiments have urged the government to stop the controlling of the equilibrium of rupiah exchange rates in money market. Therefore the monetary authority stopped undertaking the managed floating exchange rate regime and started to use the free floating exchange rate in August 1997. In term of adopting the free floating exchange rate, in August 1998, rupiah was traded at Rp.17.000 per US dollar in the spot market and the depreciation reached the highest point of 599.3% compared to situation before the crisis.

The drastic drop and fluctuation of rupiah exchange rate reflect the accumulation of the economic problem, both for banking/monetary sector and the real sector. In order to attain the exchange rate stabilization, it is required some efforts to rearrange the economy sector.

Since 1970, Indonesia has applied three of exchange rate regimes, they are fixed exchange rate regime (1970 – 1978), managed floating exchange rate regime (15 November 1978 – 13 August 1997), and free floating exchange rate regime (14 August

1997 – present). However, after using the free floating regime, the market power and its factors could change the demand and supply of currency. In accordance with the applied exchange rate system, the level of the exchange rate control will affect the behavior of the exchange rate. The higher the level of the exchange rate flexibility (the lower in the level of the exchange rate control) leads to the difficulty in predicting the movement of the real exchange rate. The value of exchange rate is actually determined by the strength of demand and supply on the market. This is strongly affected by the market expectation. Nevertheless, the exchange rate in the market does not fully reflect the strength of demand and supply to fulfill the underlying transaction. The uncertainty on the market is caused by either economic factors or non economic factors which are significantly affect the rupiah exchange rate. Therefore, the stability of the real exchange rate plays an important role to maintain the competitiveness of Indonesia external sector. The exchange rate has a significant role for achieving monetary stability and for supporting the economic activities. The stability of the exchange rate is required to achieve the conducive situation which encourages business activities. The adoption of the real exchange rate concept based on purchasing power parity (PPP) generates the adoption of the depreciation of real exchange rate in many developing countries in order to maintain the real exchange rate in its constant level. However, this concept will fail to maintain the equilibrium exchange rate if the relative price of tradable goods to non tradable goods consistently follows the trend of the equilibrium of internal and external exchange rate. If the shock toward the economy exists then it causes the depreciation of the equilibrium real exchange rate. Or it can cause the opposite condition which the real exchange rate continued to be maintained in the constant level. In this case, the actual real exchange rate will be under the equilibrium exchange rate.

It indicates that the actual real exchange rate will be appreciated relatively to its equilibrium. This condition results the misalignment of real exchange rate which means that the actual real exchange rate is not in its equilibrium. Then this will weaken the competitiveness of the particular country. Based on that case, this research is purposed to evaluate determinants and misalignment of exchange rate movement in term of post crisis era when the free floating regime has been applied.

1.3 Research Objectives and Possible Research Question

1.3.1 Research Objectives:

The objective of this research paper is to understand the appropriate level that represents the sustainable of equilibrium real exchange rate. The equilibrium real exchange rate can be obtained from the behavioral equilibrium exchange rate. By using estimation of regression model, it will acquire the level of equilibrium real exchange rate. After comparing to the actual real exchange rate, then the misalignment of exchange rate will also be obtained. The misalignment of exchange rate is defined as the deviation of real exchange rate from its equilibrium.

1.3.2 Main Question:

- What is the appropriate level of equilibrium real exchange rate (rupiah)?.

1.3.3 Possible Research Questions:

- What is the equilibrium real exchange rate?
- How large do the economic factors give an effect for the exchange rate movement from its equilibrium (misalignment)?

1.4 A Short Theoretical Background of Real Exchange Rate

Referring to the economic literatures, the real exchange rate can be defined in two principle ways that are the purchasing power parity (PPP) based on real exchange rate and the dependent economy model or tradable and non tradable goods real exchange rate.

The PPP exchange rate equalizes the price of the same bundle of goods between countries. By this definition, the nominal exchange rate adjusted for the difference in price level between countries. The nominal exchange rate will be adjusted to make the real exchange rate constant between countries when the price level changes in one of the countries.

The dependent economy which reflects the model of the tradable and non tradable goods is formerly introduced by Salter Swan in late 1950s and early 1960s. Basically the dependent economy model is the model that emphasizes on a country that produces and consumes both tradable and non-tradable goods. The price of tradable goods which is

determined by international market is exogenous for a dependent country. Then the real exchange rate can be defined as the ratio of the relative price of tradable and non-tradable goods. Economically, the real exchange rate concept are relating with the resource allocation of tradable and non-tradable goods. Increasing in price of tradable goods will substitute the resources allocation from non-tradable to tradable goods in both production and expenditure allocation, and vice versa.

1.5 Methodological Approach for Modeling the ERER

There are many approaches for estimating the equilibrium real exchange rate (ERER). They are, first the relative purchasing power parity (PPP) which can be use as a method of estimating the long-run equilibrium real exchange rate (LRER) if the real exchange rate (RER) is shown to be stationary in a time series observations. Second, the trade equation approach which allows the estimation LRER by using the values taken by fundamentals. Third, the structural general equilibrium approach which is known as macroeconomic balance proposed by John Williamson (1994). As a fundamental equilibrium exchange rate (FEER), it permits the estimated LRER to show the full range of macroeconomic interactions in the economy. This concept also was mentioned by Bayoumi et al (1994) as the desired equilibrium exchange rate (DEER). Fourth, the reduced-form general equilibrium approach. This approach is similar to the structural general equilibrium approach which incorporates the full general equilibrium interaction of the fundamentals in a dynamic structure that generates a time series rather than just a point estimate for the LRER. Furthermore this approach was developed as the natural real exchange rate (NATREX) approach proposed by Stein (1994) and Faruqee (1995). The other development of the reduce form approach is the behavior equilibrium exchange rate (BEER) approach which has been studied by Edward (1989, 1994) and fundamentals exclusive of real interest differential (FERID) by MacDonald (1997). The basic of the BEER approach is that the equilibrium real exchange rate is determined by fundamental factors that influence equilibrium real exchange rate in the traded sector and the shock factors which influence the real exchange rate. Since the topic relates with the economic fundamental factors, then the BEER approach will be used as a theoretical model in this research. BEER approach will be used to estimate the equilibrium exchange rate of rupiah, since this method is well suited to developing countries in which

large and complex models are often not feasible because of data limitations (Zhang, 2001). The discussion about this approach is based on Clark and Macdonald (1998).

1.6 Scope and Limitation of the Study

This paper will observe the period of post crisis when the free floating exchange rate regime has been used by Indonesian government. It covers a periods from 1999 to 2006 (quarterly) and it will cover the real exchange rate data and their variables that affect the equilibrium. However there is a problem due to the unavailability of certain variables, of which the proxies have been used in order to avoid their omission. So the limitation of this study is about the unavailability of the data. Then we will use the similar/closely related variable which can represent the real variables instead of the exact variables.

1.7 Organization of the Study

This paper is organized as follows: Chapter one is an introduction part. This chapter describes the background of the research, problem identification, research objectives, research methodology, scope and limitations of the study and organization of the study. Chapter two provides theoretical framework which consist of the concept of real exchange rate and equilibrium real exchange rate, their determinants and also several methods to estimate them. This chapter will also provide some previous research concerning the object study. Chapter three presents Indonesia Exchange Rate Policy and Macroeconomic Features. Chapter four deals with the estimation model of ERER. This chapter contains result of hypothesis testing and descriptive analysis. Chapter five is conclusion and policy recommendation. This chapter contains conclusion, some limitation, and policy implication of the results and also suggestion for the further research.

Chapter 2
Theoretical Framework

2.1. Introduction

This chapter provides theoretical framework which consist of the concept of real exchange rate and equilibrium real exchange rate, their determinants and also several methods to estimate them. This chapter also describes some theories and previous research concerning the object study.

2.2. The Concept of Real Exchange Rate and Equilibrium real Exchange rate

The real exchange rate (*RER*) can be defined as the wide measure of the prices of one country relative to the prices of another country, both expressed in a similar currency. The increasing in the RER value reveals that foreign goods become more expensive relatively to domestic goods, and it causes the improvement of the international competitiveness. An increase (decrease) in the value of *RER* is referred to as depreciation (appreciation). Basically RER can be expressed as:

$$RER = S\frac{P^*}{P} = \prod_{i=1}^{I}\left[S_i\frac{P_i^*}{P_i}\right]^{W^i} \qquad (1)$$

Where S is the nominal exchange rate, which is defined as units of home currency to a unit of foreign currency, P^* denotes for the foreign (world market) price level, P is the domestic price level, wi is the weight ($\Sigma wi=1$).

The point for estimating the long run equilibrium real exchange rate (LRER) is the measurement of the actual real exchange rate (RER). However this is difficult to determine in both conceptual and empirical matter since there are many conceptual definitions of the real exchange rate which are used for different analytical frameworks and different usage. It also has different application for the case of the developing country although it is generally based on the concept for industrialized countries.

The real exchange rate is basically defined in two principle ways: *external RER and internal RER* (Montiel and Hinkle, 1990). The external RER is defined as a ratio of the relative prices of baskets of goods produced (or consumed) in different countries. While the external real exchange rate measures examined the relative expenditure based RER, the aggregate production cost RER, unit labor cost in manufacturing, wholesale price indices, value-added deflator for manufacturing, and export unit value.

The *RER* is also usually used to determine the internal relative price incentive for producing or consuming tradable as opposition to non-tradable goods. According to Hinkle and Nsengiyumva (1999) the *RER* in this case is defined as the relative prices of tradable to non-tradable goods and it is referred to the *internal RER*. The domestic currency internal RER for home economy can also be written as:

$$R = \frac{P_T}{P_N} \qquad (2)$$

Where R = Real exchange rate, P_T = Price of tradable goods, P_N = Price of non-tradable goods. Basically the resources of each country divided into two sector, tradable and non-tradable goods, and there is a trade off for allocating between them. It means that produce more one resource will lessen the other one. However the real exchange rate which is defined by using the tradable and non-tradable goods is the good tools for allocating resources in a country. For example, if there is an increasing in the *internal RER* (a real depreciation), then we may say that the tradable sector has become more competitive compare to the non-tradable sector. In this case, countries prefer to substitute the allocation of resources for production from non-tradable to tradable, and demand will move from tradable to non-tradable goods.

However, the movement of the *internal RER* could not be happen if the restrictive assumption of the "law of one price" does not hold for tradable goods. If this assumption holds, then the domestic tradable price will set by international markets adjusted by a nominal exchange rate. In this situation incentives and profitability in domestic production of the non-tradable goods will determine the ability of the internal RER to improve a country's international competitiveness position. On the other side, if the "law of one price" does not hold, the country's international competitiveness position may not be reflected by using the internal real exchange rate (Little et al. 1993,

Hinkle and Nsengiyumva 1999). In order to construct the RER, two main issues should be involved. They are choice of prices and country weights.

The consumer price index (CPI) is the most commonly price series in conjunction with the choice of prices, which is used as a variable to construct the *RER* for measuring international price competitiveness. Many advantages can be gained for using this variable such as it occurred at a fitting time, usually constructed across countries and available for a wide range of countries over a long time period. Nevertheless, measuring the RER using CPI tends to give a good reflection of the purchasing power of the domestic currency instead of a country's international price competitiveness due to the fact that CPI contain a high proportion of non-tradable goods. This condition sometimes makes a CPI-based *RER* less than ideal for assessing competitiveness (Little et al. 1993, 262; Dornbush and Vogelsang 1991, 4). Therefore, for assessing the international competitiveness it would be better to use costs of production instead of CPI. In this case, the producer price index (PPI) would be superior to a CPI-based *RER*, since it contains a high proportion of tradable goods and has a strong relation with the costs of production.

To proxy international price competitiveness, the PPI-CPI relative price base measuring for the internal RER is sometimes used. For this purpose, the PPI adjusted by the nominal exchange rate is used to reflect prices of tradable goods, while the CPI is used to reflect non-tradable prices. As we mentioned before, the internal real exchange rate can reflect international price competitiveness only if "the law of one price" holds. However, in reality this law is unlikely to hold (Kasa 1992, Faruqee 1995, Corsetti and Dedola 2002).

The prices of tradable goods divergence in terms of a common currency among countries may arise from many sources. Transportation costs, trade restrictions, and taxes may cause the prices of tradable goods to vary across countries. Another source of distortion in measuring the RER is due to the existence of medium-term labor contracts since those contracts keep wages and unit production costs fixed so that producers are often inclined not to adjust prices as a response to the change of exchange rate.

In conjunction with economic weights issue, the chosen weighting scheme actually depends on the purpose for which the *RER* is being formulated. In economies where most trade is covered by official data, import and export weights together are usually

used for determining changes in competitiveness. For some analytical purposes sometimes it is preferable to use either export or import weights instead of average them together especially when imports and exports are significantly different in the inter economy trade pattern.

Long run equilibrium real exchange rate (LRER) can be defined as the value of real exchange rate which in line with both internal and external macroeconomic balance. Edwards (1989), Williamson (1994) and Elbadawi (1994) agreed that the internal balance emerges if the market for non traded goods is in a equilibrium position. The external balance presences if current account deficit can be captured by a sustainable level of capital inflows. In this situation, the sustainable means the condition when all fundamental that determine the internal and external balance reach their steady state level (Montiel, 1999). However, to forecast the transitory fluctuation and to maintain the sustainable values of fundamentals are very difficult.

The internal and external balance concept can also be in terms of macroeconomic balance relation. For this relation, internal balance is reflected by the condition when output (Y) is equal to a full employment level of output (Y^*) in line with non inflationary situation. So that output positively depends on absorption (A) and the real exchange rate (R), and the equation can be written as :

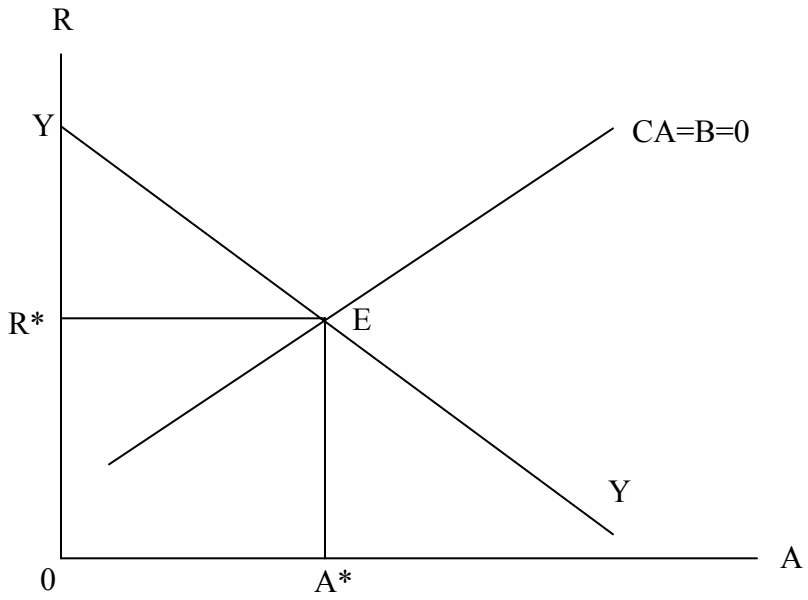
Y = Y (A,R), where Ya > 0 and Yr > 0.

Similarly, current account balance negatively depend on the absorption (A) and positively on the real exchange rate (R), and the equation can be written as :

CA = B = B (A, R), where Ba < 0 and Br > 0

Graphically the internal and external relation can be shown in figure 2.1. Figure 2.1 below shows the absorption of (A) and the real exchange rate (R) which are illustrated in the horizontal and vertical axis respectively. The internal balance schedule (YY) slopes downward as a higher level of expenditure corresponds to a lower RER to recover the equilibrium in the goods market. In the same way, external balance schedule (B) slopes upward since a higher level of absorption creates current account deficit so it needs real depreciation of RER to restore the equilibrium in the goods market.

Figure 2.1
Internal and external balance and the equilibrium RER



The intersection between internal balance schedule and external balance schedule which is noted as point E called as equilibrium point. At this point, internal and external balance is restored correspond with a specific level of absorption and real exchange rate (A^*, R^*). As assumed in the Purchasing Power Parity (PPP) theory, the value of R^* which is known as the long run equilibrium real exchange rate follows the dynamic behavior of its fundamentals instead of being static number.

Another concept of equilibrium real exchange rate determination is purchasing power parity (PPP) concept. By definition, the purchasing power parity exchange rate of the country is that exchange rate which equalizes the price of a given basket of goods and services in two countries. Traditionally there are three concepts of PPP that have been used in many literatures; they are the law of one price, absolute PPP, and relative PPP.

First, the law of one price associates exchange rates to prices of individual homogeneous goods in different countries. This concept can be defined and written as in the equation:

$P_i = S.P_i^*$, where P_i is domestic price level, P_i^* is foreign price level, S is nominal exchange rate

In the law of one price, if there are no transaction costs, no trade barriers (such as tariffs or quotas), then the prices of similar goods sold in different countries should be equal if expressed in a common currency. The law of one price can be hold for homogeneous primary commodities traded on major exchanges, especially when adjustments are made for contract differences and delivery lags. However, the prices of differentiated products, such as manufactured goods, tend to move to a greater degree from the law of one price.

Second, the absolute PPP concept can make the law of one price to an integrated. In this concept, the same basket of goods should cost the same amount in all countries when expressed in a common currency. Then it is expressed as $P_t = S_t.P_t^*$ where $S_t = P_t / P_t^*$ is as expression of exchange rate, P_t is bundle at domestic and P_t^* is bundle foreign.

This absolute PPP concept gives a specific equilibrium concept for the nominal exchange rate which is called the PPP exchange rate. So that PPP exchange rate can be defined as the rate that equalizes the prices of a common basket of goods in two different countries.

The third concept is relative PPP, which on the other hand said that the percentage change in the exchange rate should equal the difference between the inflation at domestic and foreign. To simplify, relative PPP can be expressed in the log form as $\Delta \log S_t = \Delta \log P_t - \Delta \log P_t^*$ or $\hat{s}_t = \hat{p}_t - \hat{p}_t^*$.

Since the real exchange rate was generally defined as the price level of a commodity basket of one country relatively towards the price of the country's other commodity that was stated in the same currency. So, as we mentioned above, the real exchange rate was expressed mathematically as $Q_t = S_t.P_t^* / P_t$ where Q_t is real exchange rate S_t is nominal exchange rate (The price of foreign currency that was stated in domestic currency). By expressing the equation above in the log transformation, we obtain :

$$\log Q_t = \log S_t + \log P_t^* - \log P_t \quad \text{or} \quad q_t \equiv s_t + p_t^* - p_t$$

For this expression, a rise/decline in q_t, indicated the existence of depreciation/appreciation real exchange rate.

There are several approaches for estimating the equilibrium real exchange rate (ERER), such as the relative PPP-based approach, the trade-equation approach, the structural general equilibrium approach and the reduced form general equilibrium.

2.2.1. The Relative PPP-Based Approach

Basically this is the simplest technique which is used to obtain the instrument used for measuring the exchange rate that free from transitory disturbances. The most important thing in this approach is the estimation of the base period/year by using the assumption that shocks may be ignored. For this purpose, the base year of actual exchange rate is considered as the equilibrium real exchange rate.

The changing level of real exchange rate in the relative PPP-based approach can be considered as the summation of the changing level of the nominal exchange rate minus the domestic and foreign inflation rate. The drawbacks of this approach are, first, the identification of a suitable base year, since it is assumed as the year where the actual value of RER close to the value of LRER. Second, the equilibrium real exchange rate (LRER) is usually assumed to be constant and third, this model is less appropriate to determine the RER since the relative price is the only determinant compare to other models which introduce more important determinants to estimates the RER.

2.2.2. The Trade Equation Approach

Actually, this approach is usually used for open economy macroeconomics which approached by the partial equilibrium elasticity technique. This approach is based on the notion that the main macroeconomic role of RER is to influence the resource balance through expenditure-switching mechanism. In this case, the equilibrium exchange rate is not necessarily constant. There are three keys of trade equations approach implementation, (a) to obtain the trade elasticity value estimation for export and import with respect to the real exchange rate and income, (b) it can be applied as a method to explain a particular target o the resource balance equilibrium which is exerted to predict saving-investment equilibrium or sustainable net resource (capital) inflow, (c) it is a suitable technique for estimating the effect of other variables besides the real exchange rate on the initial resource balance before a structural change exist. The weakness of this approach is the difficulty to specify the target resource balance in the empirical

estimation of the LRER. The resource balance may depend on variables other than RER, such as the composition of aggregate demand, the external term of trade and the commercial policy. Therefore it is necessary to determine the structural resource balance related to a particular value of RER by adjusting the actual resource balance in a given year for cyclical, exogenous and policy changes which affect it.

2.2.3. The Structural General Equilibrium Approach

This approach is basically applied for identifying fundamental factors which affect the equilibrium real long run exchange rate (LRER). The general equilibrium approach is known as the fundamental equilibrium exchange rate/FEER (John Williamson, 1994). FEER is defined as the equilibrium real exchange rate. It is a value that consistent with medium run internal and external equilibrium. Medium run in this context is defined as the period needed by output to adjust to its potential level.

The structural general equilibrium approach is a technique that relatively expensive to apply in developing countries since its model needs a huge data which are usually not well available in developing countries. The advantage of this approach is that the model permits a dynamic relation element from various economic variables. Therefore the estimation of the equilibrium real exchange rate will be close to the real world. The structural general equilibrium approach, however, has the limitation in its operational since it strongly depends on the availability and the quality of data.

2.2.4. The Reduced Form General Equilibrium Approach

Basically there is no significant difference between reduce form general equilibrium approach and the structural general equilibrium approach. The difference relies only on the theoretical background and data for estimating economic structure. Reduce form approach focuses more on the data and theory that associated with reduce form equation for short run real exchange rate and it does not need to estimate the economic structure equations. Elbadawi (1994), Baffes, Elbadawi and O'Connel (1999) have shown several reduce form implementations on their works. This approach was developed further by Stein (1994), Fareuqee (1995) and Siregar (1996) as natural real exchange rate approach (NATREX). Another form of reduce form approach is the behavior equilibrium exchange rate (BEER). Basically in this approach, the equilibrium real exchange rate is

determined by fundamental factors which affected the equilibrium real exchange rate on traded sector and the shock factors that affected the real exchange rate.

2.3 The Behaviour Equilibrium Exchange Rate (BEER) Approach

This approach is usually used to estimate the equilibrium exchange rate since BEER method is more suitable for developing countries in which large and complex model are often not feasible because of data limitation. Before implementing this approach, the economic fundamental variables as the determinant of real exchange rate should be chosen. There are five economic fundamentals which will be used in this research, they are the relative price of non-traded to traded goods (the Balassa-Samuelson effect), net foreign assets position, term of trade, commercial policy (degree of openness as the proxy), and financial globalization.

The BEER approach attempts to capture the sources of changes in the capital account that may also affect the current account and the "behavior" of the exchange rate itself. For countries that are experiencing substantial variation in short-term fundamentals (for relatively stable economies operating in the neighborhood of internal and external balance, the BEER would converge toward the FEER) like in several developing countries, this approach is well suited to assess the appropriateness of exchange rate levels.

2.3.1 How Fundamentals Determine the LRER

a) Relative Price of Non-Tradable to Tradable Goods

The variable of relative price of non tradable to tradable goods is commonly recognized as proxy for the Balassa-Samuelson effect. The relative price of non tradable goods and a direct measure of sectoral productivity are two important variables that are usually used to proxy the Balassa-Samuelsson effect. However price of non tradable goods is more appropriate to use since a measure of productivity is difficult to do due to the availability of the data.

The "Balassa-Samuelson" effect which was formulated by Balassa (1964) and Samuelson (1964), explains the distortion in purchasing power parity (PPP) resulting from the international differences in relative productivity between the tradable goods sector and the non-tradable goods sector. In the the Balassa effect, countries which have relatively

lower productivity in tradable goods than in non-tradable goods should have lower price levels than other opposite countries. However, through the process of development of those countries, productivity can increase more quickly in the tradable goods sector than in the non-tradable sector. As the prices of tradable goods are set by international competition, so an increase in productivity in this tradable goods sector leads to an increase in wages in the general economy. As a consequence, there will be a rise in relative prices in the non-tradable goods sector, where productivity has not grown at the same way. Since the RER is defined as the ratio between tradable goods price to non tradable goods price, then the rise in the relative non tradable good price compared with that of tradable goods will decrease (appreciate) the real exchange rate.

b) Net Foreign Asset

Generally, net foreign assets (NFA) are affected by the determinants of savings and investment, and sometimes by demographics and structural fiscal balances (Clark and MacDonald, 1999). The net foreign asset position can be reduced if there is the current account deficit. On the contrary, the current account deficit may raise the net foreign credit. To balance this condition it requires the future trade surplus which can be generated from the depreciation of real exchange rate. So the decrease of net foreign asset position will cause the depreciation of real exchange rate in the medium or long term. On the other side, an increase in the net foreign asset leads to the appreciation of the equilibrium real exchange rate (decrease in real exchange rate). The other mechanism that has been mentioned by MacDonald and Ricci (2004) is that an increase in net foreign asset will increase aggregate demand leading to an increase in the relative price of non tradable goods and appreciation of the real exchange rate. In this case, the net foreign asset has a negative effect on the real exchange rate. However, empirical evidence suggests that the sign of NFA is still ambiguous.

c) Term of Trade

This variable is strongly associated with the international economic environment factor. In order to understand the way in which the terms of trade influence equilibrium real exchange rate, both income and substitution effects should be analyzed (Edwards, 1989). Therefore, the response of the real exchange rate to the changes in terms of trade can be

seen as the proportional summation of substitution and the income effect to imports. If the substitution effect of term of trade improvement on the demand and supply side dominates the income effect, it will cause real deprecation in real exchange rate (positive effect). The improvement in terms of trade on the contrary will increase national income in terms of imported goods which may increase demand for tradable goods. It will require an appreciation of currency. The terms of trade improvement will give a positive wealth effect. It will cause an increase in aggregate demand and the relative price of non-tradable and, therefore will create an appreciation (negative effect) of the real effective exchange rate (Paya *et al* (2003). Therefore, considering these substitution and income effects, then the effect of terms of trade on the real exchange rate is still ambiguous.

d) Commercial Policy

The equilibrium exchange rate could also be affected by the commercial policy. Many literatures explain that trade deficit may be created by the liberalized trade regime which encourages imports. A measure of variable *Openness* is used to capture distortions in trade policy and the extent of liberalization. A real depreciation of real exchange rate is required in order to restore the equilibrium. A decrease in tariffs then leads to the depreciation of the equilibrium real exchange rate. Or in another word, an increase in openness will cause depreciation in the real exchange rate which is an increase in the real exchange rate index. In this case, the commercial policy has a positive relation with the real exchange rate. Proxy for trade liberalization (commercial policy) could be the level of trade tax (import plus export), import to GDP ratio, and dummy variable.

e) Financial Globalization

In the recent decades, financial globalization becomes one of the most important issues in the world economy. The financial globalization has involved sharply rising foreign asset and liability positions, either scaled by GDP or by domestic financial variables (Lane and Milesi-Ferretti 2003, Obstfeld and Taylor 2004). As a consequence of financial globalization, the international spillovers from asset price and currency movements have been improved. Many researchers have used financial globalization as one of determinants which affect real exchange rate by using different variables. However, Xing and Zhang (2004) have used FDI as a measure of globalization variable. Following them,

FDI (Foreign Direct Investment) as ratio to GDP will also be used in this study to represent financial globalization. Elbadawi (1994) found that an increase in long term inflows tended to appreciate the LRER. Therefore, this variable has a negative effect on the real exchange rate. Elbadawi and Sato (1994, 1995) also found that of short term capital inflow tended to be associated with appreciation of the RER relative to the LRER.

2.3.2 Empirical Approach

BEER approach will be used to estimate the equilibrium exchange rate of rupiah currency as this method is well suited to developing countries in which large and complex models are often not feasible because of data limitations (Zhang, 2001). The discussion about this approach is based on Clark and Macdonald (1999). An estimated reduced form equation is used to explain the behavior of the real effective exchange rate with the associated economic fundamentals:

$$q_t = \beta' Z_t + \tau' T_t + \varepsilon_t \qquad (3)$$

Z_t : a vector of economic fundamentals that are expected to have influence on the real exchange rate over the medium and long run.

T_t : a vector of transitory factors affecting the real exchange rate in the short run.

β, τ : vectors of reduced-form coefficients.

ε_t : random disturbance term.

q_t : actual, observed real effective exchange rate.

Following Clark and MacDonald (1999) ideas, it is very useful to differentiate the actual value of the real exchange rate and the current equilibrium exchange rate, $q_{t'}$. The $q_{t'}$ value is defined for a position where the transitory and random terms are zero:

$$q_t' = \beta' Z_t \qquad (4)$$

Then the related current misalignment, cm, is then given as:

$$cm_t = q_t - q' = \tau' T_t + \varepsilon_t \qquad (5)$$

where *cm* is simply the summation of the transitory and random errors. As the current values of the economic fundamentals can deviate from the sustainable levels, so the total misalignment, *tm*, is defined as the difference between the actual and real rate given by the sustainable, or long-run, values of the economic fundamentals. Therefore, total misalignment can be denoted as :

$$tm_t = q_t - \beta' \overline{Z}_t \qquad (6)$$

The measure of the fundamentals at their desired levels may be achieved through the some judgments on what values the actual variables should have been during the sample time period. This may also be achieved by using statistical filter, such as the Hodrick-Prescott filter. Then by adding and subtracting q_t' from the right hand side of (4) the total misalignment can be written into two components:

$$tm_t = \left(q_t - q'\right) + \beta^t \left(Z_t - \overline{Z}_t\right) \qquad (7)$$

and since $q_t - q' = \tau' T_t + \varepsilon_t$, the total misalignment in equation (5) can be rewritten as:

$$tm_t = \tau' T_t + \varepsilon + \beta' \left(Z_t - \overline{Z}_t\right) \qquad (8)$$

By looking at the equation (8), we can conclude that the total misalignment at any period of time can be divided into three factors, (1) the effect of the transitory factors, (2) the random disturbances, and (3) the extent to which the economic fundamentals depart from their sustainable values.

In conjunction with the objective of this paper, five economic fundamentals have been chosen as the variables in the vector Z_t, or in the other words, we formulated the current equilibrium exchange rate as a function of these variables:

$$\hat{q}_t = f\left(\underset{-}{TNT}, \underset{+/-}{NFA}, \underset{+/-}{TOT}, \underset{+}{OPEN}, \underset{-}{FG}\right) \qquad (9)$$

where $\hat{q}_t$ is real effective exchange rate, TNT is the relative price of non-traded to traded goods, NFA is net foreign assets, TOT is the terms of trade, OPEN is the degree of openness, and FG is financial globalization. All signs above the equation (9) are the expected signs that affect real effective exchange rate (index).

2.3.3 The Construction of Variables

a) Actual Real Exchange Rate Model

To determine the equilibrium real exchange rate, the real effective exchange rate (REER) must be counted first by using the formula in the equation 1. The RER in this study is defined in term of domestic currency per unit of foreign currency, so it is measured in the rupiah currency. In this case, the appreciation in REER means the decrease in the value of REER index.

b) Relative price of non-tradable to tradable goods (TNT)

$$TNT = \frac{CPI / PPI}{\prod_{i=1}^{N=8} (CPI^{i} / PPI^{i})^{W^{i}}}$$

where PPI or PPI^{i} is denoted as the wholesale price index (WPI) or producer price indices (PPI) of Indonesia or the partner country i depend on the data in each country. Because of data availability, we use producer price index (PPI) rather than wholesale price index (WPI) for some foreign countries. The limitation index of PPI is usually seen as index for traded good price while the consumer price index (CPI) includes both traded and non-traded goods. However, the data of the index for non-traded only is not available.

c) Net foreign assets (NFA)

This variable is defined as the stock of net foreign assets, defined as total assets, shown as a ratio to GDP.

$$NFA = \frac{NetForeignAsset}{GDP}$$

This method suggested by Lane and Milesi-Ferretti (2001): one takes an initial value of the stock of net foreign assets and ads up current account balance to determine the time series, as the proxy of NFA.

d) Terms of trade (TOT)

$$TOT = \frac{X_P / M_P}{\prod_{i=1}^{N=8} \left(X_P^i / M_P^i \right)^{w^i}}$$

XP or X^i is the export price index of Indonesia or the trade partner i, M or Mi is the import price index of Indonesia or the trade partner i.

e) Degree of openness (OPEN)

This paper use the total value of export and imports divided by GDP.

$$OPEN = \frac{X + M}{GDP}$$

X is exports, M is imports, GDP is Gross Domestic Product.

f) Financial Globalization (FG)

FDI (Foreign Direct Investment) as ratio to GDP is used to represent financial globalization. This variable also used by Frait and Komarek (2001). Although this variable may be influenced by other factor, but due to data availability the research will use this proxy.

g) Trade Weights

The weights that used in this paper are simple average weights from 1999-2006.

$$W^i = \frac{\left(X^i + M^i \right)}{\sum \left(X^i + M^i \right)}$$

W^i is weight assigned to i^{th} trade partner, X is export value, and M is import value. The trade partners of Indonesia are USA, Japan, Singapore, China, Malaysia, South Korea, Germany, and Australia. The weights of trade partners can be seen in table 2.1.

Table 2.1
Weights of trade partners

Country	Weight
Japan	26%
USA	22%
Singapore	15%
China	12%
Malaysia	7%
South Korea	7%
Germany	6%
Australia	6%

Source: IMF, BPS Statistics Indonesia (Calculated by Author)

2.4 Co-integration Approach

We use co-integration approach as one of econometrics tools in this study to explain the possibility of equilibrium or long run relationship between economic variables as expected by economic theory. However, this approach needs the test of time series behavior or integration as the pre requirement test. Since this approach can also be considered as the theoretical test and the important part in formulating and estimating the dynamic model, then the stationary of time series economic variable is required.

Considering that the time series data often used for forecasting, it is important to know if such forecasting is valid. The common problem of regressing a time series variable on another time series variable is the very high value of goodness of fit (R^2) although there is no meaningful relationship between dependent and independent variables. This situation is commonly known as spurious regression. This problem emerges because the high R^2 is actually due to the existence of the trend which is involved in both time series rather than a true relationship between the two. The Augmented Engle Granger method can be used for unit root and testing for integrated order to check whether the time series economic variables involved are co-integrated or not.

2.4.1 Testing for Unit Root

A time series data is said to be statistically stationary if it's mean, variance, and auto-covariance are constant over time. One of alternative tests of stationary is known as the unit root test. Testing for unit root basically is required to observe whether the

coefficient of autoregressive variable which estimated is equal to one or not. The model is expressed as follows.

$Y_t = \rho Y_{t-1} + u_t$

where u_t is the stochastic error term that follow the classical assumptions, it has zero mean, constant variance σ^2 and is non auto-correlated. If we find that $\rho=1$ then the variable Y_t has a unit root. In this case, the time series variable is not stationary and this is usually known as a random walk. For the stationary test, we compare the computed ADF absolute value of "t" statistic with ADF absolute critical value. If the computed ADF value higher than the ADF table, so the observed variable Y_t is stationary.

2.4.2 Co-integration Test

Co-integration test is used to test the stationary of the residual result and this test is related to both tests above. If we find that the observed variables have the same order, then we can estimate the co-integration regression of the observed variables in order to test whether the residual result is stationary or not.

One of the simple methods in testing co-integration is the ADF test on u_t which is estimated from co-integration regression. This test is commonly known as Augmented Engle-Granger (AEG) test. The co-integration tests are also referring to the ADF table as unit root test do. If the estimated "t" value higher than any of the critical values, then the conclusion would be that the estimated u_i is stationary or we can say that it does not have a unit root. Therefore, the dependent variable and the independent variable are co-integrated, and we may say there is a long-term equilibrium relationship between the two.

2.4.3 Error Correction Mechanism Approach

As we mentioned before, if there is co-integration between dependent variable and independent variable so we may say that there exists long run equilibrium relationship. On the contrary, this condition may not necessarily be happen in the short term which is also known as disequilibrium. Therefore, we need such sort of statistical means to connect this disequilibrium, called the error correction mechanism (ECM) approach. The model for ECM can be written as the following model.

$\Delta Y_t = a_0 + a_1 \Delta X_t + a_2 u_{t-1} + e_t$

where Δ denotes as first difference, u_{t-1} is co-integration error first lag, and e_t is the error term. The ECM model above relates the change in Y (ΔY_t) to the change in X (ΔX_t) and the "equilibrating" error in the previous period. The other advantage of this model is the fact that ΔX can capture the short run error in X while the error correction term u_{t-1} captures the adjustment toward the long run equilibrium. Therefore, if the result indicates that a_2 is statistically significant, then it means that the proportion of the disequilibrium in Y in one period will be corrected in the next period.

Chapter 3
Exchange Rate Policy and Competitiveness of Indonesia

3.1 Introduction

This chapter describes the situation when the exchange rate regime had been used in Indonesia. It also describes the competitiveness of the trading sectors including growth, export-import and financial globalization.

3.2. Indonesia Foreign Exchange Rate Policy Overview

Indonesia has a single currency namely Indonesian rupiah (Rp). As a central bank, The Bank Indonesia (BI) administered all foreign exchange and trade controls in cooperation with the Ministry of Finance, the Ministry of Trade and Cooperatives, authorized banks and the customs authorities. As mentioned before since 1970, Indonesia has applied three exchange rate regimes, they are (1) fixed exchange rate regime (1970 – 1978), (2) managed floating exchange rate regime (15 November 1978 – 13 August 1997), and (3) free floating exchange rate regime (14 August 1997 – present).

3.2.1 Fixed (Single Pagged) Exchange Rate System

This system was begun in April 17th 1970. In this system, there was only one spot exchange rate for a kind currency. The simplification was undertaken in order to solve the weakness of the previous system. Following the floating of the US Dollar on 15 August 1971, the rupiah was devaluated about 8.9% in terms of gold, from Rp378.00 to Rp415.00 per US$ unit. The 415 rupiah exchange rate to the US dollar was fixed by government intervention in the currency market, it was actually required the transaction in rupiah currency. Despite the high inflation of the period, the exchange rate, which had essentially been preserved using the country's oil exports, was maintained at 415 rupiah until 15th November 1978.

3.2.2 Managed Floating Exchange Rate System

This system was used in the beginning of November 15th 1978 together with the releasing of monetary policy in the form of devaluation. Since then, until September 12th

1986, rupiah was related to US dollar with one exception that as the central bank, Bank Indonesia, could arrange the exchange rate movement. While in the period afterwards rupiah is not related with either US dollar or the group of other strong world currencies anymore, although the US dollar proportion is still the biggest one.

Besides the history about the foreign exchange rate system, there is also a government policy provided during the period of managed floating exchange rate regime, which will be described here because of its fairly significant influence to the history of rupiah exchange rate fluctuation to the US dollar. Both policies are the devaluation held in 1983 and 1986.

a) Devaluation on March 30th 1983

It was undeniable, until 1984, that oil and gas sectors dominate the export receipt. The decreasing condition is faced to the dilemma of the less beneficial oil price. In the end of 1982/1983 year, raw oil price reduced from US$ 35.00 to US$ 29.53 per barrel in the previous budget year. Because of the oil and gas revenues contributed of 63.74% to total export, then the total export decreased by 23.1% in the budget year. On the other hand, total import in that time increased by 3.3%. As a result, the net foreign exchange reserves decreased drastically, that is 31.7%. Eventually, the condition has forced government to take a shorter way to increase the export and reduce the import in the same time through devaluation on March 30th 1983. The devaluation increased the exchange rate of US dollar to rupiah by 38.89% (from Rp. 698,2 became Rp. 969,7% per US$), so the price of export products became very competitive while the import product price was going to be expensive.

b) Devaluation on September 12th 1986

Similar to the situation in 1983, the devaluation held by Indonesian government on September 12th 1986 which was more based on the decrease of raw oil price drastically in August 1986. Originally, the raw oil price in January 1986 was still about US$ 25.13 per barrel then move into US$ 10.66 in April 1986. Although after devaluation the contribution of oil and gas export of 36.9% to total export in 1986 was not as much as in 1983, but the drastic decrease of raw oil price had brought the very negative impact of balance of payment.

The devaluations of 1983 and 1986 actually had successfully boosted the competitiveness of exports, however the devaluations have a destabilizing effect. The September 1986

devaluation was the last devaluation which carried out by Indonesia. By June 1997, the rupiah had fallen from its post-devaluation rate of Rp.1664 to Rp.2350 (an annualized decline of slightly over 3%).

3.2.3 Free Floating Exchange Rate System

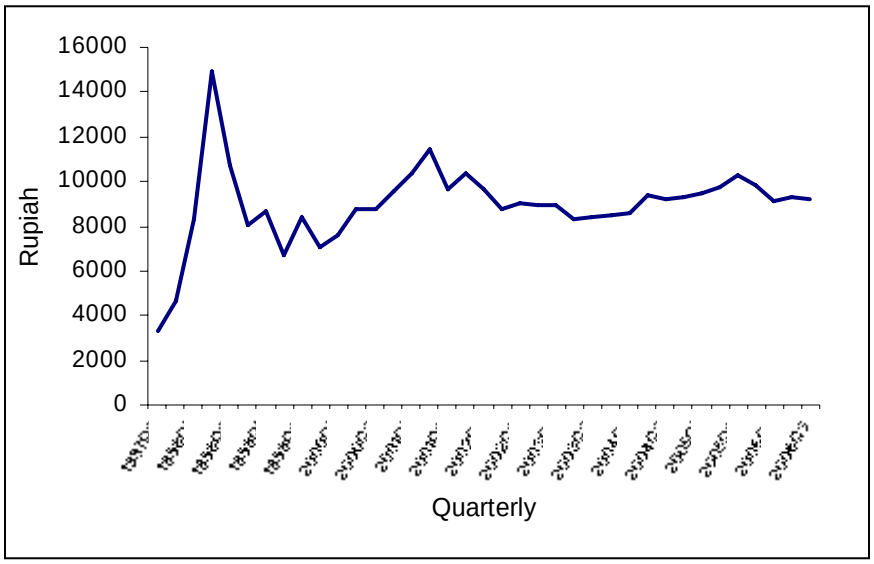
In June 1997, Indonesian economic situation seemed far from crisis. Unlike Thailand, Indonesia had a low inflation rate, a trade surplus captured of more than 900 million dollars, had huge foreign exchange reserves of more than 20 billion dollars, and it noted as country with good banking sector. However a large number of Indonesian corporations had been borrowing money in term of U.S. dollars. During preceding years, as the rupiah had strengthened respective to the dollar, this practice had worked well for those corporations.

In July, when Thailand floated the baht, Indonesia's monetary authorities widened the rupiah trading band from 8 percent to 12 percent. However, the rupiah came under severe attack in August. Then on 14 August 1997, the managed floating exchange regime was replaced by a free-floating exchange rate arrangement. A free floating exchange rate or a flexible exchange rate is a type of exchange rate regime where in a currency's value is allowed to fluctuate according to the foreign exchange market. After the new regime had been applied, the rupiah dropped further as shown in its rate movement, Rp.2436 on July 11th, was Rp.2663 on August 14th and Rp.2955 on August 15th (a 12% fall). Government debt (Bank Indonesia Certificates or SBI) rose from 12% to 30%, and overnight call rates reached 81% (per annum). The rupiah exchange rate has depreciated continually. The inflation and the drastic increase of food price led to chaos throughout the country. Despite the fall of the currency of 70% from June 1997 to December 1998, inflation rate of 60-70% in 1998 indicated that the real exchange rate fell only slightly.

3.3 Exchange rate and Price Index

As mentioned before, Indonesia was noted as the last country in Asia which took the hit from the currency problem when economic crisis happened in 1997. In first half of the free floating exchange rate era, the agitation seemed to happen and then eased up towards the end of the observation period. This can be seen in figure 3.1., which is showing the movement of Rp/USD in the free float era.

Figure 3.1
The movement of Rupiah per USD in 1997-2006 (Quarterly)



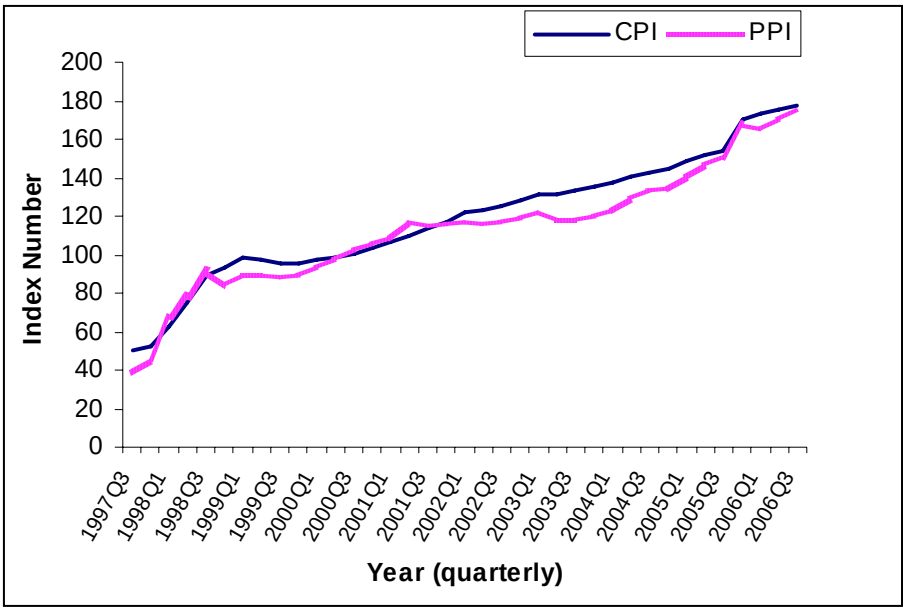
Source: IMF

Nevertheless, the movement of the Rp/USD rate was apparently more volatile since the floating rate regime began. This volatility of Rp/USD had given the opportunities for the foreign exchange traders to speculate and get the benefits from this condition.

Then the stability of banking sector tended to fall systematically as the Rp/USD continued to be speculated heavily. To overcome this situation, the authorities took other measures like administrative sanction. Transactions (non-residence's transaction) in the forward market were restricted to 5 million of USD per customer. At that moment, the authorities also moved the 49 percent limit on foreign ownership on new initial public offerings in the stock market.

It also gave new challenges to economic agents whose assets and wealth are strongly depended on the movement of the Rp per USD rate. The exchange rate risks must be included in their financial deals. Moreover the international market affects the economy with a new dimension. In this new dimension, the market can penalize the economy if the government policies are considered non-optimal or not market friendly.

Figure 3.2
The movement of consumer Price Index and Wholesale Price Index ,2000=100



Source: IMF

3.4 Economic Growth and Inflation

Economic growth and per capita income are usually used as development indicators to measure the economic development of a country. The improvement of economic growth rate after the crisis in 1998 is expressed in increasing real GDP growth. In 1998, real GDP growth tended to increase around 0.8 percent and continuously increase up to 5.1 percent in 2004, as seen in table 3.1.

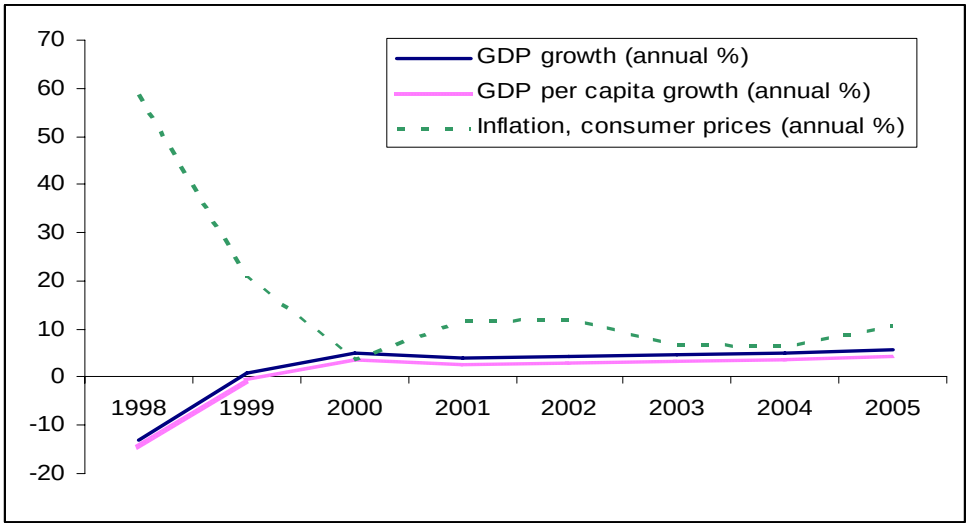
Table 3.1
Some Economic Indicator of Indonesia during 1998-2005

Indicator	1998	1999	2000	2001	2002	2003	2004	2005
GDP Growth (%)	-13,1	0.8	4.9	3.8	4.3	4.9	5.1	5.6
GDP nominal (billion US$)	96	140	166	164	200	239	258	272
GDP per capita (US$)	977	694	742	697	948	1117	1191	1240
Export growth (%)	-8.6	-0.4	27.7	-9.3	5.0	8.4	12.0	10.0
Import growth (%)	-34.4	-12.2	39.6	-7.6	15.1	10.9	27.8	2.7
Trade balance (billion US$)	21.5	24.7	28.6	25.4	23.5	24.6	21.2	17.3
Net Foreign Asset (%change)	85.3	3.8	53.2	28.8	1.9	8.8	-3.6	25.4

Source: Citigroup

Nevertheless, the increase in the real GDP growth and also GDP per capita could apparently be caused by the inflation rather than the aggregate output growth. As shown in the figure 3.3., there is a huge inflation rate (about 58 %) in 1998. It is noted that the inflation rate was still relatively high (20%) in 1999. After that period, it remains slow, and finally become 10 % t in 2005. The real GDP per capita grew positively since 2000, as the nominal growth rate of the GDP was growing faster than the rate of inflation.

Figure 3.3
GDP growth, GDP per capita growth and Inflation

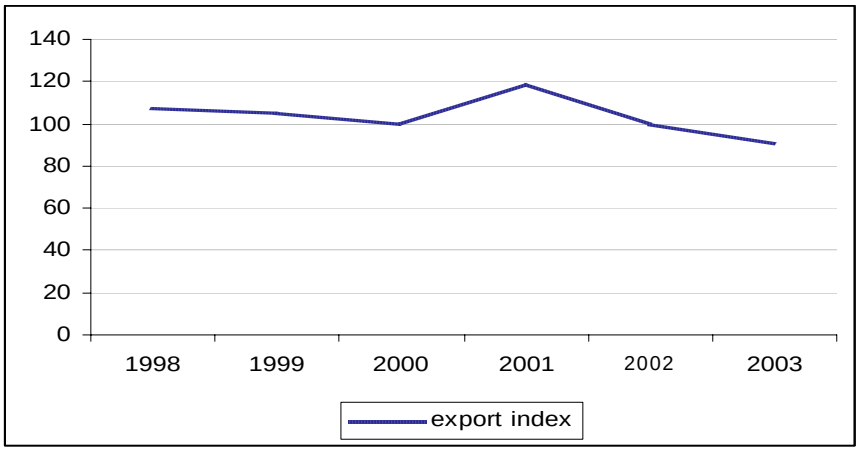


Source : World Bank, 2006

3.5 Trade Performance

When the rupiah over dollar value (Rp/USD) experienced a large depreciation in 1998-1999, the export index tended to decrease as shown in figure 3.4. This is contrary to the theory that depreciation in rupiah should increase the export or price competitiveness of Indonesian products. This paradox could be happened because the total competitiveness (not only price competitiveness but also quality of the product, marketing, etc) of the Indonesian export product indeed worsened. It can also be happened because of the problem in the supply side, for example the limited production capacity or the distortion in the distribution system that reduced the effect of the price from depreciation of rupiah, that made Indonesia could not use this opportunity to expand the export.

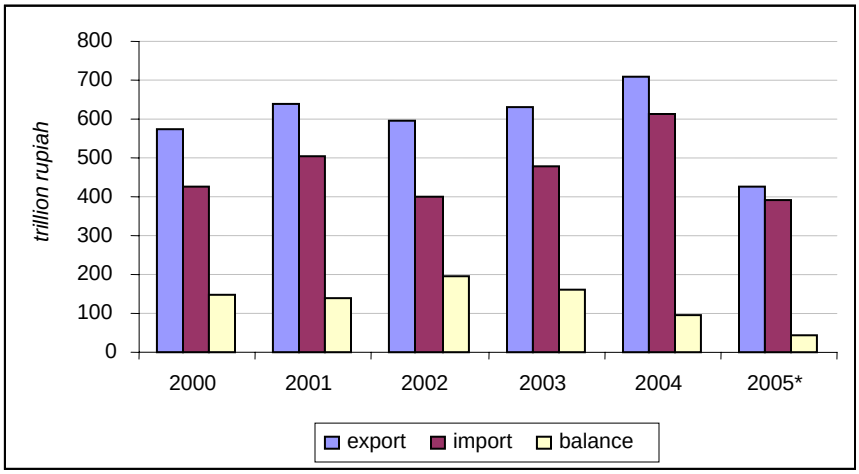
Figure 3.4
Trend of Total Export Growth of Indonesia (2000=100)



Source : BPS-Statistics Indonesia

However, the growth of the export alone could not reflect the strength of the actual export of a country. It needs to combine with the other quantitative indicators. There are several indicators that can illustrate the strength of the export, such as net export or trade surplus (balance), growth rate of relative export to import, contribution of export and import to GDP. The trends of those three indicators are shown in figure 3.5, figure 3.6, and figure 3.7.

Figure 3.5
Export, Import, and Trade Balance



*note: * : semester 1*
Source : BPS-Statistics Indonesia

The trade balance (surplus) from 2000-2005 shown in figure 3.5 was getting smaller over time. This condition can indicate two conditions whether the export decreases or import increases. The large trade balance was noted in the 2002, since the value of export was bigger than the import value. However, in 2005 the trade balance seems to be very small compare to other periods although this is only noted in the first period.

Trade balance between Indonesian and the trading partners can represent the trade performance of Indonesia. Higher export than import led to widened trade surplus. If we look at table 3.2, Japan is noted as one of the country's trade partner that gives a large surplus to Indonesia. The other countries are USA and South Korea which also gave the significant contributions to Indonesian trade surplus.

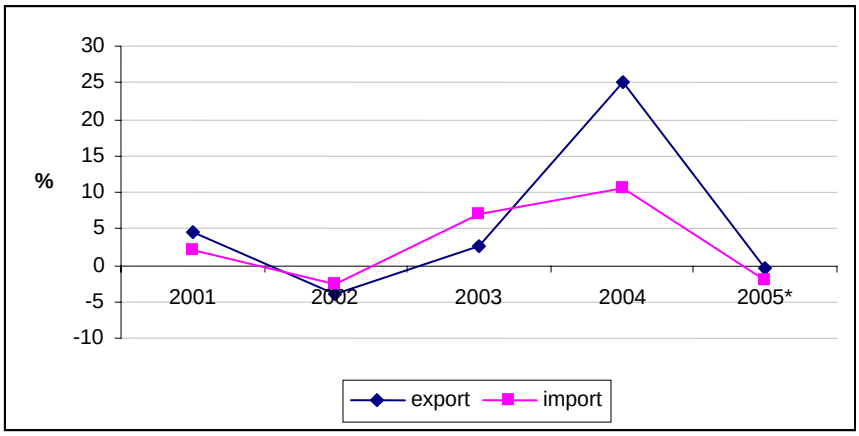
Table 3.2
Trade Balance of Indonesia with Trading Partners

Countries	2003	2004	2005	2006
Japan	9.375.238,0	9.880.501,9	11.142.884,6	16.216.349,3
USA	4.678.924,1	5.541.744,3	5.989.557,4	7.175.571,5
Singapore	1.244.532,3	-84.873,8	-1.635.333,0	-1.104.685,6
China	845.061,4	503.402,0	819.491,3	1.706.676,2
Malaysia	1.225.661,5	1.334.102,4	1.282.773,7	917.423,9
South Korea	2.795.878,4	2.887.600,7	4.216.541,6	4.817.688,3
Germany	235.543,4	-79.438,6	753,6	569.123,1
Australia	143.185,9	-327.557,8	-339.532,2	-214.987,9

Source : BPS-Statistics Indonesia (processed by ministry of trading)

The growth rate of relative export to import can be seen in figure 3.6. From this figure we can see that although the larger trade balance was in the 2002, its growth rate was noted as the smallest one in the period 2001-2005. It means that export and import values were actually decreasing in 2002 compare to the values on 2001. The larger growth rate was on 2004, when the increasing in import value was followed by the huge increasing in the export value.

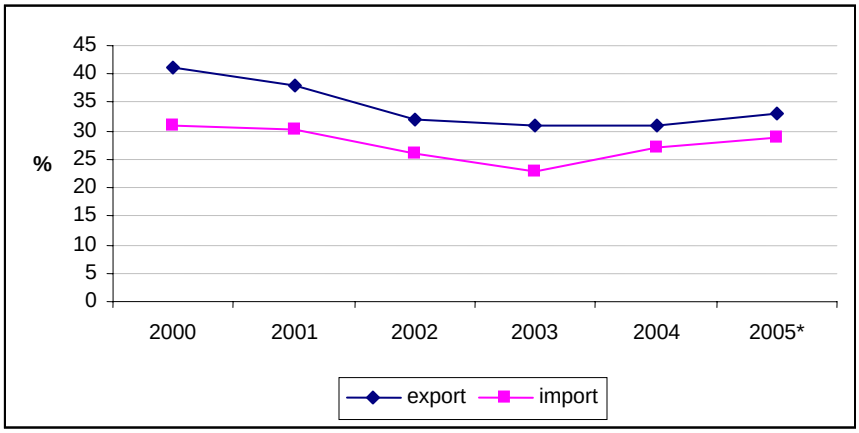
Figure 3.6
Export and Import Growth at constant price 2000 (%)



*note: * : semester 1*
Source : BPS-Statistics Indonesia

The contribution of both export and import to GDP, which can be seen in figure 3.7, tends to decrease since 2000. This tendency is continued up to 2003 and then start to increase up to 2005.

Figure 3.7
Contribution of Export and Import to GDP (%)



*note: * : semester 1*
Source : BPS-Statistics Indonesia

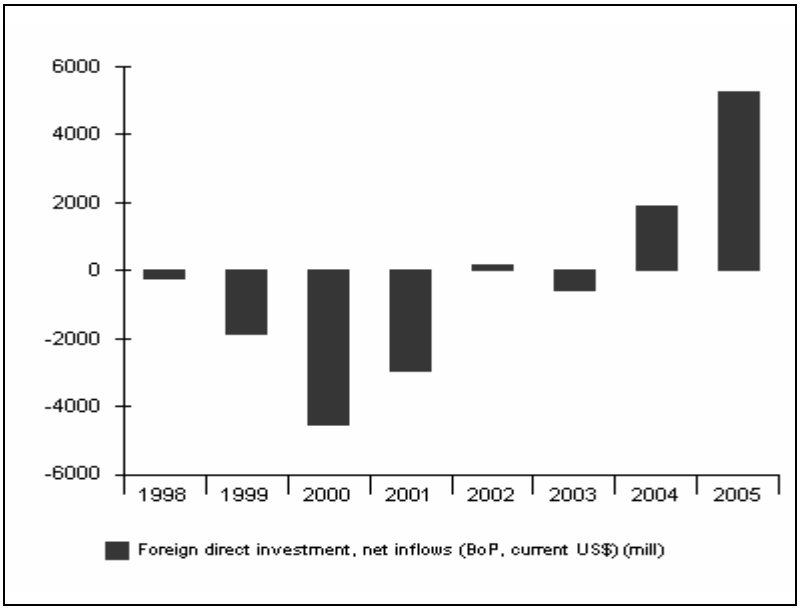
3.6 Foreign Direct Investment

Financial globalization refers to condition where the integration of economies such as the financial connections among countries is growing around the world. In addition, financial globalization can be defined as the growing of integration between local

financial system and the international capital and financial markets. Financial globalization has given the possibility for countries and societies to increase the flow of trade and capital across borders. Based on that definition, the foreign direct investment can be treated as an indicator of financial globalization.

Indonesia, Malaysia, Thailand and Philippines together have collectively been the most important destination of FDI inflows in Asia. Indonesia has firstly introduced the pro-FDI policies to attract more investment since the Repelita I (Indonesian's five years development planning) in 1969. As the results, Indonesia becomes one of the world's fastest growing economies since the FDI inflows increase largely before the 1997 economic crisis. When economic crisis happened, investment including from FDI in Indonesia have been discouraged by the bad and unstable political situation. The FDI inflows tend to decrease over time since the crisis. As reported, before the crisis the average value of FDI inflows in Indonesia was about 3.0 billion USD (UNCTAD, 2003), and then continued to decrease up to 2003, as seen in the figure 3.8. However, it starts to increase then in 2004 as government improves the investment climate such as provides the stable economic and political environment in Indonesia.

Figure 3.8
The movement of FDI net inflows in Indonesia (1998-2005)

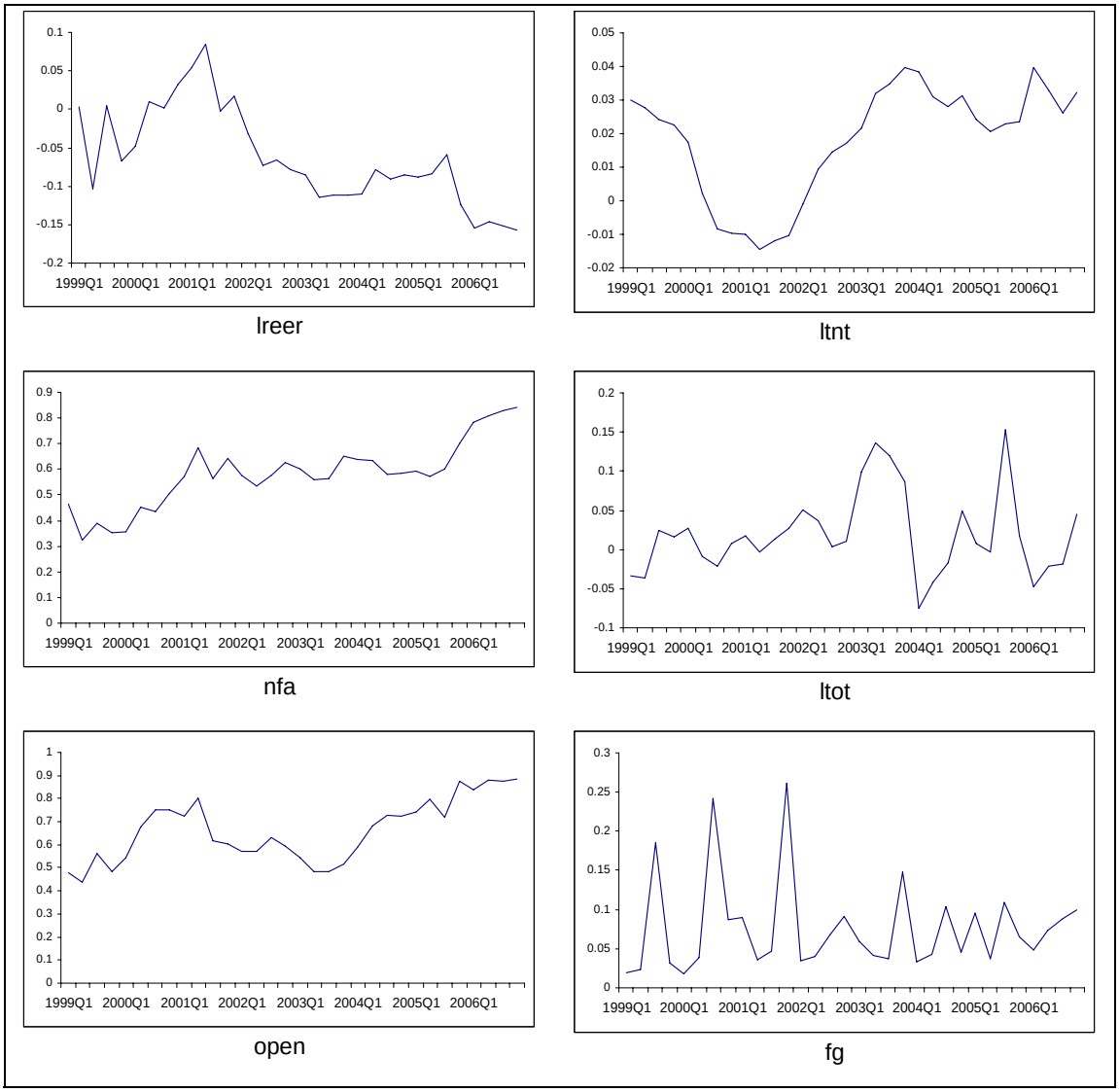


Source : World Bank, 2006

3.7 Dynamics of the Variables

In order to observe the dynamics of the variables that are used in the model, each of them are plotted over period 1999 to 2006 quarterly as shown in the figure 3.9.

Figure 3.9
Dynamics of the Variables



Source: IMF, Bank Indonesia, BPS Statistic Indonesia 1998-2006 (Calculated by Author)

Relative price of non-tradable to tradable goods tends to decrease until 2000 and then it increases since the beginning of 2001. The net foreign asset generally has shown the increasing trend. However it significantly increases since the third quarter of 2005. Meanwhile, the sharp increase in terms of trade took place in the third quarter of 2003

and in the third quarter of 2005 but there is also sharp decrease in the first quarter of 2004 and in the first quarter of 2006. After declining since the third quarter of 2001, the degree of openness tended to increase starting in the third quarter of 2003. Finally, the trend of the financial globalization is very fluctuating especially in the first three years (1999-2001) since FDI per GDP is used as a proxy.

CHAPTER 4
Empirical Analysis

4.1 Introduction

This chapter deals mainly to trace empirically the estimation of equilibrium real exchange rate for Indonesia from 1999 to 2006 (quarterly) in order to understand the misalignment episode in the real exchange rate. We start with empirical estimation of equilibrium real exchange rate reflecting the appropriate or sustainable level of the equilibrium real exchange rate, and then we give the results and preliminary analysis. The next step is to discuss the empirical effect of fundamentals on equilibrium real exchange rate (ERER). We also present the error correction model estimation before computing the equilibrium real exchange rate indices. Finally this chapter concludes with the assessment of misalignment episode between actual RER and LRER and qualifies the results along with the policy implications.

4.2 Estimation Result of the Equilibrium Real Exchange Rate

4.2.1 Stationary Analysis

At first, we have to make sure that every variable should be integrated with some order. We test all variables with unity roots to determine whether they are stationary or not. The ADF (Augmented Dickey-Fuller) test is used to check the stationary of all variables for the whole period. The more negative it is, the stronger the rejection of the hypothesis that there is a unit roots at some level of confidence. The test results are presented in table 4.1 and more specifically the figures are presented in the appendix 1 of this paper.

The previous research on the real exchange rate informed that real exchange rate fundamental of major countries follows a random walk in term of floating exchange rates regimes. If the fundamental variables of the real exchange rate come out to be non-stationary, then they indicate a permanent component effect. It implies that stationary variables in the system can not affect the real exchange rate in the long run, thus it can not be defined as fundamental. As presented in table 4.1, based on Augmented Dickey-Fuller (ADF) test, almost all variables (reer, tot, open, fg) appear to be stationary (follow the unit root) in the level form. It has shown that the negative values of variable reer, tot,

open and fg are greater (more negative) than the critical value. For tnt and nfa variables, even in 1%, 5% and 10%, the test is fail to reject the null hypothesis which means non stationary in the level form. However after using difference stationary process (DSP), these test corroborate with the unity root test or in other word both variables then become stationary. Nevertheless, multivariate co-integration analysis variables need not to be integrated in the same order to be co-integrated (Marc Wuyt et al., 1998).

Table 4.1
Unity Root Tests

Variable	ADF test	p-value	Decision
reer	-1.756	0.045	Stationary
tnt	-1.385	0.088	Stationary at 10% (DSP)
nfa	-1.405	0.087	Stationary at 10% (DSP)
tot	-3.673	0.001	Stationary
open	-1.352	0.093	Stationary at 10%
Fg	-6.880	0.000	Stationary

Critical Values:

	1% Critical Value	5% Critical Value	10% Critical Value
ADF test	-2.462	-1.699	-1.311

4.2.2 Empirical Estimation Result

After checking the stationary of the time series variables, we do the empirical estimation of co-integrated regression by using equation (9). The indication behind co-integration noted by economic theory is that it permits us to capture the equilibrium relationship between non-stationary variables within stationary variables. The table 4.2 reports the empirical estimation of the co-integration regression.

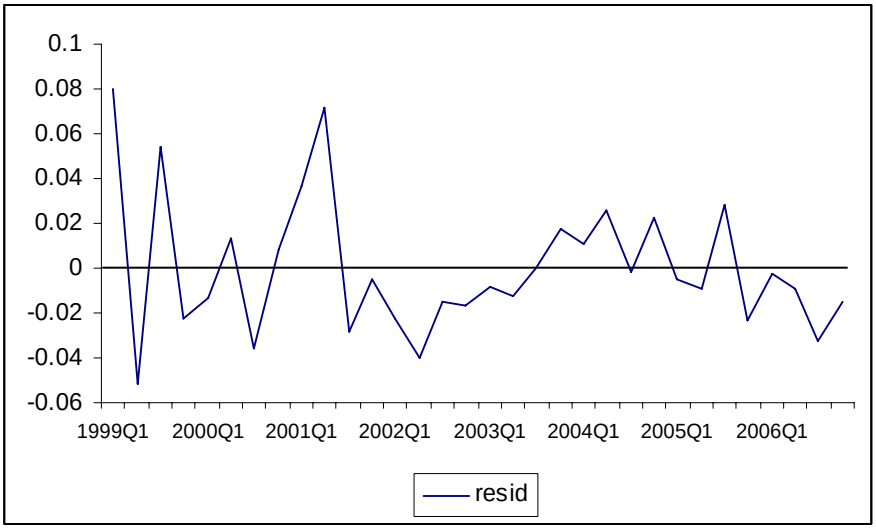
We also test the residuals whether they are stationary or not by using again Augmented Dickey-Fuller test. If they are stationary, then the regression is co-integrated regression. It means that there is the long run relationship between the actual real effective exchange rate and its fundamentals. Using ADF test, the result provides strong support for co-integration that t-statistic of the residual is -7.431 and Engle-Granger D.F critical values are -2.462 at 1%, -1.699 at 5% and -1.31 at 10%. The t-statistic of the residual is greater (more negative) than Engle-Granger D.F critical values in all level of significance. It is shown in figure 4.1 that the residual is fairly stable. This indicates that at those level

linear combination of the variables from regression are stationary and their coefficients (α) is a co-integrating vector. Furthermore, we can say that there is co-integrated regression or long run relationship between the real effective exchange rate and economic fundamentals.

Table 4.2
OLS Estimation for co-integration model

Variables	Coefficient	t-statistic	Probability
constant	0.077318	2.33	0.028
tnt	-2.874041	-7.24	0.000
nfa	-0.115791	-1.67	0.106
tot	-0.062814	-0.51	0.614
open	-0.035269	-0.52	0.610
Fg	0.462411	0.44	0.667
Number of observation is 32 (Range: 1999-2006) R^2 = 0.7695 Adjusted R2 = 0.7252 F(5,26) = 17.36			

Figure 4.1
Residuals of the regression



Based on result (table 4.2), only one variable that is tnt which has an expected sign and significant at 5 percent level of significant. We also find the other variable that is nfa which also has an expected sign and quite significant at 10 percent level of significant. Other variables are not significant in both 5 percent and 10 percent level of significant

although one of them indicate the expected sign. The regression results are also proved by the high value of R^2 (0.7695). It means that approximately 76.9% real effective exchange rate is explained by all fundamental variables collectively and 23.1% are explained by other factors in disturbance error. The F test which tests the significance of R^2 or test the overall significance of the predictability of the regression is fairly high 17.36 (F calculation > F-table at 5% significance) indicating the strong predictability of regressors.

4.3 Empirical Effect of the Fundamentals

Based on table 4.1, the long run equilibrium equation (with t-statistic in parenthesis) can be written as follows.

$$\textit{reer} = 0.077 - 2.874\textit{tnt} - 0.116\textit{nfa} - 0.628\textit{tot} - 0.353\textit{open} + 0.046\textit{fg}$$

(2.33) (-7.24) (-1.67) (-0.51) (-0.52) (0.44)

The overall performance of the regression was not so good. There are only two coefficients of the variables that have expected signs supporting the theoretical notion and both of them are indicated significant. The sign of the trade non traded goods (tnt), net foreign asset (nfa), have supported theoretical predictions. In the same time, other variables have not statistically significant. The sign of the degree of openness (open) and financial globalization (fg) does not support the theoretical prediction. The coefficient value of the terms of trade (tot) has turn to be negative in this estimation. However, since theoretically the sign is ambiguous and the estimation result is not significantly different from zero then we can say that it has no sign. The fact that the coefficient is not statistically different from zero may suggest that the income and substitution effects cancel each other out.

The relative of non traded to traded goods in the regression is used to see the productivity shock or the Balassa Samuelson effect whether there are exist or not in determining the real exchange rate. In this estimation, the relative of non traded to traded goods (tnt) has come out highly significant. This fact implies that an increase in productivity of tradable goods due to the development process in Indonesia leads to the increasing in relative price of the non tradable goods. Then since the real exchange rate is

defined as the ratio between tradable goods price to non tradable goods price, the rise in the relative non tradable good price compared with that of tradable goods will finally decrease (appreciate) the real exchange rate. In other word, we can say that Balassa effect exists in Indonesia.

The ratio of net foreign asset to GDP which is a proxy for net foreign asset has positive effect to the equilibrium real exchange rate. It means that the higher net foreign asset calls for equilibrium real exchange rate appreciation which means the decline in real effective exchange rate.

The theory indicates that an increase in the openness variable as a measure for commercial policy is assumed to be increased from the decline in the tariff rates, thus it leads to a depreciation of the equilibrium real exchange rate or an increasing of real effective exchange rate. In this estimation result, the openness variable comes out with statistically insignificant. This result suggests that the openness variable may not change all that much or that systematically over short period that we are covering (1999 to 2006). Seemingly, with the respect to that effect, this is a wrong signed and a theoretically ambiguous result.

Foreign Direct Investment (FDI) is the largest source of capital inflow for developing countries in recent decades. Here, FDI as a ratio to GDP is used to measure financial globalization variable in the equation model. In our result, it shows that financial globalization variable has wrong expected sign and non-significant elasticity which means inconsistent with the theoretical prediction. In many studies, the relationship between foreign direct investment and real exchange rate varies depending on the sample period, country sample, and method of measuring equilibrium real exchange rate (Katheryn N., 2006). The unexpected result in our study can be happened since FDI is only a partial indicator of financial integration and the chosen period of study was characterized by political instability that may affect FDI. In other words, financial globalization variable failed to explain the Indonesian exchange rate behavior.

Actually there are many studies that observed equilibrium real exchange rate based on trade competitiveness as a fundamental. One of them is the study by Jinzhao Chen (2006) for Renmimbi in China. He used four variables that are tnt, nfa, tot, and open and it covers period from 2004Q1 until 2006Q2. The results show that nfa and open has expected sign and statistically significant. Unlike the results in our observation, the

Balassa-Samuelson effect represented by tnt does not exist in China. It may be happened as Balassa effect is based on some restrictive assumptions and it may not be fulfilled in the case of China.

4.4 Error Correction Model and Short Run Dynamic

As we discussed before, the relevant variables are co-integrated. It means that there is the long term relationship between real effective exchange rate and its fundamentals. However, there may be disequilibrium in short run. The short run impact of the fundamentals on the equilibrium real exchange rate is provided by the error correction estimation which combines long run information with short run adjustment mechanism. The empirical estimation results of short run dynamics model (with t-statistic in parenthesis) are given as follows.

$$\begin{aligned} \textit{Dreer} = {} & -0.009 - 2.462\textit{D1tnt} + 0.2205\textit{D1nfa} + 0.2019\textit{D1tot} + 0.9717\textit{D1open} \\ & (-2.31) \quad (-3.11) \quad (2.76) \quad (2.36) \quad (1.13) \\ & + 0.004\textit{D1fg} - 0.630\textit{L1resid} \\ & (0.09) \quad (-3.40) \end{aligned}$$

Number of observation is 31 (Range: 1998-2006)
$R^2 = 0.8133$
Adjusted $R^2 = 0.7667$
$F(6,24) = 17.43$

The results above indicate that the lagged error correction term (D1resid, t-1) is highly significant showed by t = -3.40. Moreover coefficient of adjustment from short run deviation to the long run captured by coefficient of error correction terms is fairly high (-0.630). It means that there is 63% feedback from the previous period into the short run dynamic process. In other words, the self correction in each period of time of the real exchange rate to its equilibrium level is 63% which means that the real exchange rate converges quickly enough to its equilibrium level.

The short run dynamic effect of the exchange rate fundamentals only played a significant role on the tnt, nfa, and tot variables which have expected signs and all statistically significant. The result of the tnt variable is consistent with the long run influence which

means that increasing the productivity growth will lead to decrease real effective exchange rate (appreciation of equilibrium exchange rate). The net foreign asset (nfa) which has negative effect to the real exchange rate in the long run equilibrium exchange rate shows the positive effect to the real exchange rate in the short run dynamic. The terms of trade (tot) gives positive effect to the real exchange rate (or negative effect to equilibrium real exchange rate). However the overall performance or explanatory power of the regression is good since R^2 is 0.81. The F-statistic is also fairly high indicating that all explanatory variables jointly have significant effect. All variables are stationary meaning there is no time series problem.

4.5 Behavioral Equilibrium Exchange Rate Indices and Misalignment

By using the long run equilibrium equation, we can obtain the current equilibrium rate and current misalignment.

$$cm = [(reer-cbeer)/cbeer]*100 \quad (10)$$

where:

cm is the current misalignment in percentage

cbeer is the current equilibrium exchange rate

Since the economic fundamentals are not always in their long run equilibrium level, then the equilibrium values of those fundamentals have to be identified in order to get the long run equilibrium exchange rate. For this purpose, we can use the Hodrick-Prescott filter to make them smooth. The Hodrick-Prescott filter was firstly introduced by Hodrick and Prescott (1997) who had applied this method to estimate the long term trend or permanent part of a time series, and the framework can be written as a given time series as the following :

$y_t = \tau_t + c_t$, t=1,2,..,T

where:

τ_t is trend component

c_t is cyclical component

According to Hodrick-Prescott, the smoothness of the (τ_t) can be measured as the sum of the squares of its second difference. Meanwhile c_t is the deviations of g, and their

average is usually near the zero value for over the long time periods. After applying the Hodrick-Prescott filter on the original series then we calculate the long run or sustainable equilibrium exchange rate by using the long run equilibrium equation with the equilibrium values of fundamentals. In the similar way the long run misalignment will also be obtained.

Table 4.3
Evolution of Observed, Equilibrium RER, and Misalignment

Year	Observed *Reer*	ERER *Cbeer*	Misalignment *cm*	Sustainable *tbeer*	Misalignment *tm*
1999Q1	1.01	0.84	20.29	0.96	4.61
1999Q2	0.79	0.89	-11.13	0.96	-18.09
1999Q3	1.01	0.96	4.86	0.96	4.86
1999Q4	0.86	0.90	-5.08	0.96	-11.01
2000Q1	0.90	0.92	-2.93	0.96	-6.66
2000Q2	1.02	0.99	3.05	0.96	6.67
2000Q3	1.00	1.09	-7.84	0.96	4.90
2000Q4	1.08	1.06	1.94	0.95	12.88
2001Q1	1.13	1.04	8.78	0.95	19.41
2001Q2	1.22	1.03	17.90	0.94	28.89
2001Q3	0.99	1.06	-6.38	0.94	6.32
2001Q4	1.04	1.05	-1.08	0.93	12.18
2002Q1	0.93	0.98	-5.12	0.92	1.35
2002Q2	0.85	0.93	-8.81	0.91	-6.71
2002Q3	0.86	0.89	-3.43	0.90	-4.17
2002Q4	0.84	0.87	-3.70	0.89	-5.57
2003Q1	0.82	0.84	-1.96	0.87	-6.03
2003Q2	0.77	0.79	-2.75	0.86	-11.01
2003Q3	0.77	0.77	-0.04	0.85	-9.02
2003Q4	0.77	0.74	4.02	0.84	-8.01
2004Q1	0.78	0.76	2.58	0.83	-6.55
2004Q2	0.83	0.79	6.03	0.82	1.81
2004Q3	0.81	0.81	-0.32	0.81	0.03
2004Q4	0.82	0.78	5.32	0.80	2.82
2005Q1	0.82	0.83	-1.14	0.79	3.27
2005Q2	0.82	0.84	-2.10	0.78	5.42
2005Q3	0.87	0.82	6.81	0.77	12.90
2005Q4	0.75	0.79	-5.23	0.76	-1.44
2006Q1	0.70	0.70	-0.61	0.75	-7.15
2006Q2	0.71	0.73	-2.04	0.75	-4.23
2006Q3	0.71	0.76	-7.17	0.74	-4.22
2006Q4	0.70	0.72	-3.36	0.73	-4.38

Source: IMF, Bank Indonesia, BPS Statistic Indonesia 1998-2006 (Calculated by Author)

tm = [(reer – tbeer)/tbeer]*100 (11)

where:

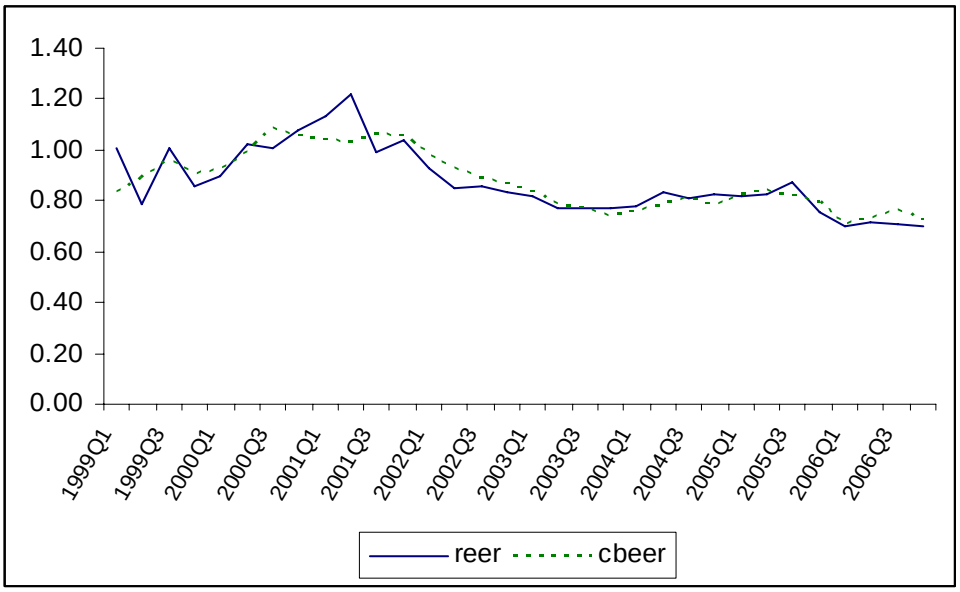
tm is the long run or sustainable misalignment in percentage

tbeer is the long run or sustainable equilibrium exchange rate.

From equation 10 and 11, we can say that if misalignment bigger than zero it indicates that the reer is undervaluation. If misalignment smaller than zero, it means that the reer is overvaluation.

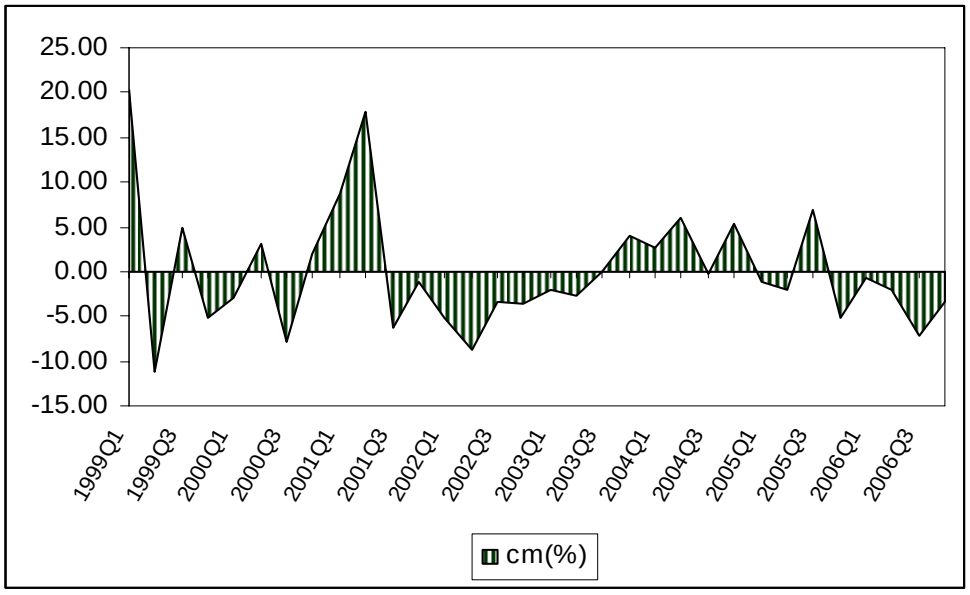
Table 4.4 reports the observed (reer), sustainable equilibrium real exchange rate (tbeer), current equilibrium real exchange rate (cbeer) for Indonesia, acquired from estimation equation. The difference between real effective exchange rate and equilibrium real exchange rate is equal to percentage (overvaluation or undervaluation) since the reer is measured as index. This gap provides a measure of misalignment. We try to compare current misalignment and sustainable misalignment in this table. Their differences can be seen in figure 4.3 and figure 4.5.

Figure 4.2
The reer and current beer



Source: IMF, Bank Indonesia, BPS statistic Indonesia 1998-2006 (Calculated by Author)

Figure 4.3
The current misalignment

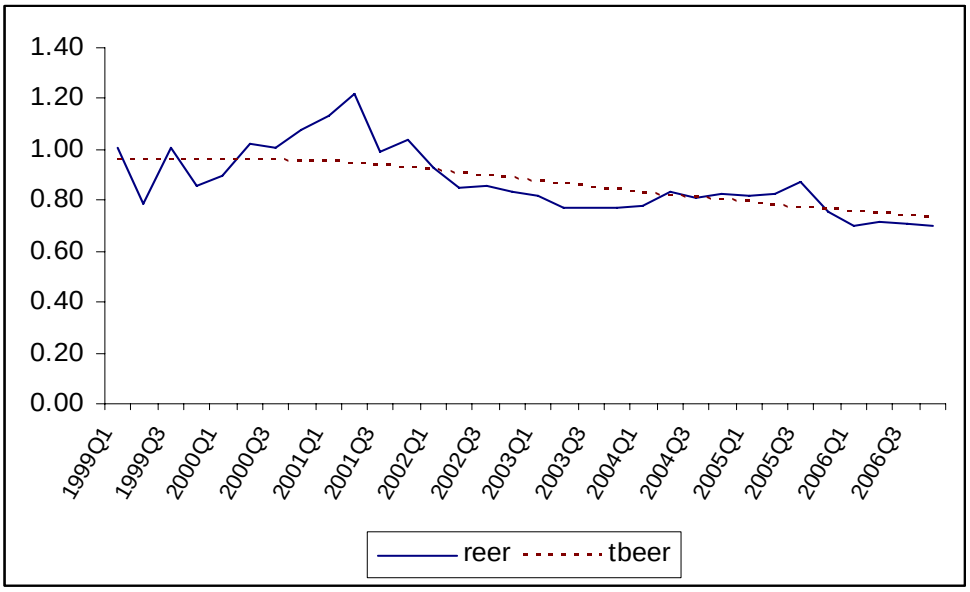


Source: IMF, Bank Indonesia, BPS statistic Indonesia 1998-2006 (Calculated by Author)

The results shown in figure 4.2 and figure 4.3 are basically similar to the figure shown in figure 4.4 and figure 4.5. The equilibrium reported in figure 4.2 and figure 4.4 presents that sustainable equilibrium exchange rate is more stable than current equilibrium exchange rate. The reason is that because current equilibrium is derived from the economic fundamentals in its actual value. This condition perhaps deviate the real effective exchange rate from its estimated equilibrium and causes the fluctuations.

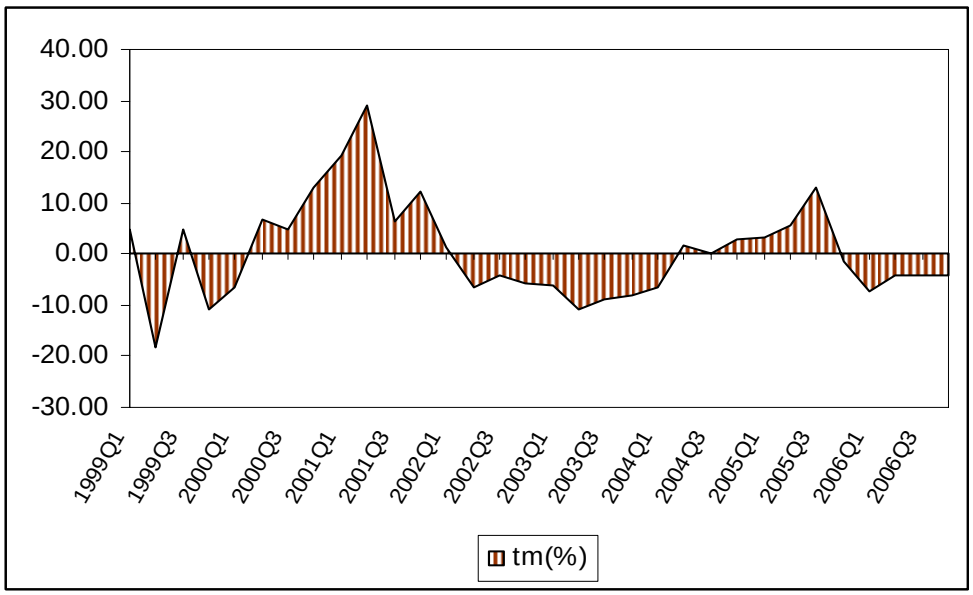
The sustainable misalignment, in figure 4.5, indicates the undervaluation and overvaluation of rupiah exchange rate over time. The figure indicates a misalignment fluctuate in the beginning of the period in 1999. During the 2000Q2-2002Q1 period, the real effective exchange rate (reer) was undervaluation by 11.57 percent on average. The misalignment turned out to be overvaluation by 7.13 percent (on average) in 2002Q2-2004Q1 period. In contrary, it came back to undervaluation condition about 4.38 percent on average in 2004Q2-2005Q3 period. During 2005Q4 until in the end of the observation period, the misalignment turned out to be overvaluation by 4.28 percent on average.

Figure 4.4
The reer and sustainable beer



Source: IMF, Bank Indonesia, BPS statistic Indonesia 1998-2006 (Calculated by Author)

Figure 4.5
Sustainable misalignment



Source: IMF, Bank Indonesia, BPS statistic Indonesia 1998-2006 (Calculated by Author)

4.6 Analysis and Policy Implication of the Results

By looking at the movement of misalignment of RER (figure 4.5), we know that there are four patterns happened. They are an undervaluation (depreciation of RER) in the

period 2000Q2 until 2002Q1, overvaluation (appreciation of RER) in the period of 2002Q2 until 2004Q1, then undervaluation in the period 2004Q2 until 2005Q3 and ended by overvaluation in the period 2005Q4 until 2006Q4. The observation in this period of study can give a clue for us on how misalignment (undervaluation or overvaluation of real exchange rate) happened related to the developments and the policy changes.

In the period of 2000Q2 until 2002Q1, it is undervaluation (depreciation RER) episode. Depreciating real exchange rate happened in this period was caused more by the condition of unstable politics in Indonesia (non economics factor). Incompatibility of the President and the People's Representative Council in taking the policy and the huge demonstrations had taken part in aggravating the political situation. This situation provoked the negative speculation in the money market that was shown by the huge bought actions of dollar by corporate. The government policy related to the rising in fuel oil price about 30% in June 2001 also gave the significant contribution in this real exchange rate depreciation. These were shown by the misalignment that happened about 19.41 percent in 2001Q1 and about 28.89 percent in 2001Q2. When we look at the dynamics of fundamentals as plotted at figure 3.9, the undervaluation or depreciation of real exchange rate seems to be associated with the decrease in relative prices of non tradable to tradable goods (tnt), the increase in net foreign asset (nfa) and degree of openness (open) during that period.

The overvaluation about 7.13% in average that happened in the period 2002Q2 until 2004Q1 can be explained in several ways. The improvement of the export value was marked by the existence of the increasing of its value about 6.30% in the period January until November 2003 against the year before in the same period. Nevertheless the import in the period January until November also showed the increasing value about 4.13% against the same period in the year before. In this period, the growth of the import was especially supported by the rising in the import of consumer goods of 6.34% and the raw material of 7.39%. The increase in the import of consumer goods indicated the higher consumption of the society that was the main contributor in the economic growth in 2003. Inflation tended to experience the decline about 5.06% compare to the previous year. This can be happened as a result of controlling in several foodstuffs prices and the improvement in the expectation of society. NFA is also increasing about 9.4

trillion rupiah that came from the revenue of oil and gas productions, the foreign exchange management and the investment fund and also the purchase of foreign assets by domestic banking. Furthermore the dynamics of the fundamentals indicate that overvaluation is also shown by the increase of both relative prices of non tradable to tradable goods (tnt) and net foreign asset (tot), and the decline of degree of openness (open).

The undervaluation (real exchange rate depreciation) happened in 2004Q2 until 2005Q3 was triggered by internal and external factors. On the internal side, the weak of real exchange rate were resulted by the huge growth of balance of payments. The increasing of this deficit was caused partly by the increasing of the domestic demand for foreign currency in order to fulfill the import needs and foreign debt payment that still could not be captured by the increasing in foreign currency supplies from the export activities and investments (FDI). On the external side, the real exchange rate depreciation was related to the increase in the interest in the international market, the jump of the world oil price (reached about USD 70 per barrel), and the strengthening of dollar due to the continuous tight monetary policy in US. The pressure to rupiah was aggravated by the negative sentiment of the market perception on the sustainability fiscal condition of the government in bearing the size of the fuel oil subsidy resulting from the high oil price. In order to reduce this subsidy, the government carried out the policy by raising fuel oil prices about 30% in March 2005. On the dynamics of fundamentals, the decrease of real exchange rate seems to be associated with the decline of tnt and the increase of open.

In the period 2005Q4 until 2006Q4, the real exchange rate was appreciated stably. This was caused by the improvement of several economic indicators, such as the improvement of the export, the GDP growth, and the rate of inflation. The export of non oil and gas products in August 2006 grew up to 30.97% (y-o-y), which was the highest level in the last 5 years. The increase in the export that was pushed by the increasing price of the Indonesian export products had improved the term of trade. The Bank Indonesia report explained that the achievement of the export continued to increase when in the period in January until October 2006 the export of non oil and gas grew up to 19.4%. In the same period, the import of non oil and gas only grew 0.5% so that it produces the high current account surplus. The achievement of export was also resulted from the government policy in formatting trade cluster to increase the quality of

products and to increase the local and international market accesses. The achievement of inflation rate is shown by the decline of CPI inflation. It was encouraged by minimal impact of inflation in prices that were controlled by the government (administered prices). On the other hand, the overvaluation or appreciation of real exchange rate in this period is also shown by the increase in tnt, nfa, tot and the decrease of open. These fundamentals significantly contributed to the movements of the real exchange rate.

Generally, almost all of the fundamentals used in the models can capture the underlying theory very well except for financial globalization. In this study, the chosen variable FDI per GDP as a proxy of financial globalization may not appropriate to examine the misalignment of real exchange rate as well as the determinant of equilibrium real exchange rate. This can be happened because FDI is only a partial indicator of financial globalization.

By looking at the results in the case of Indonesia, actually there are still other variables that can determine the equilibrium of RER and its misalignment which are not included in our model but may give effects on the RER such as interest rate, government expenditure, oil price, and money supply.

The policy implications related to the overvaluation or undervaluation of real exchange rate in the country developments could be very beneficial for the policymakers and implementers. Many literatures in real exchange rate policy argue that the overvaluation or appreciation of real exchange rate will decrease external competitiveness of a country. It weakens export and increases the import dependence and creates destabilizing outflows in developing countries. Depreciation of currency can increase competitiveness in the export sector, but in the other situations depreciation of currency will result in inflationary shocks. Based on the economic situations in which the overvaluation or undervaluation above happened, we can say that depreciation of rupiah real exchange rate is not beneficial in the long-term development because of the fact that appreciation of rupiah can still raise competitiveness in external sector as experienced in 2006 (last pattern). And also when rupiah real exchange rate appreciates in 2002 and in 2003, the trade balance (surplus) is noted quite large.

CHAPTER 5
Conclusion

The real exchange rate is one of the most important policy variables in last two decades for both developed and developing countries. It links a domestic economy to the rest of the world and come up as a measure of relative competitiveness of a country. Generally, the relative competitiveness can be determined in terms of misalignment of the real exchange rate. Misalignment of real exchange rate represents that the actual real exchange rate is not in its equilibrium (overvaluation or undervaluation). Many studies have been developed in order to explain the behavior of real exchange rate and try to find out a policy in order to keep it close towards its equilibrium.

This paper use the BEER approach which developed from the reduce form approach to estimate the equilibrium exchange rate of rupiah (Indonesia currency). The objective of this research paper is to understand the appropriate level that represents the sustainable of equilibrium real exchange rate. The Hodrick-Prescot filter for permanent components of the fundamentals has been used to estimate the sustainable equilibrium exchange rate in the long term trend. Finally, the paper evaluate misalignment episode of real exchange rate between actual real exchange rate and sustainable equilibrium real exchange rate.

The OLS estimation supported the model specification is based on co-integrating regression. We used five economic fundamental in this research and two of them that is tnt and nfa indicate significant statistically and have expected signs supporting the theoretical notion. The relative of non traded to traded goods (tnt) has come out highly significant. It indicates that the productivity shock or the Balassa-Samuelson effect exists in Indonesia. The net foreign asset which measured by ratio of net foreign asset to GDP is quite significant but only at 10 percent level of significant and has positive effect to the equilibrium real exchange rate (or negative effect to actual real exchange rate). The error correction model is used to capture the short run impact of the economic fundamentals. There are three variables (tnt, nfa, and tot) that have expected signs and statistically significant in short run dynamic. The net foreign asset (nfa) which has negative effect to the real exchange rate in the long run equilibrium exchange rate shows the positive effect to the real exchange rate in the short run dynamic. The terms of trade (tot) gives positive effect to the real exchange rate (or negative effect to equilibrium real exchange rate). It

support the theory since there is an income effect and substitution effect working on the demand side (negative) and on the supply side (positive).

The appropriate level is represented by sustainable equilibrium real exchange rate (long term trend) shown in figure 4.3. The misalignment episode presents four patterns which are undervaluation (depreciation of RER) in the period 2000Q2 until 2002Q1 by 11.57 percent on average, overvaluation (appreciation of RER) in the period of 2002Q2 until 2004Q1 by 7.13 percent on average, then undervaluation in the period 2004Q2 until 2005Q3 by 4.38 percent on average, and ended by overvaluation in the period 2005Q4 until 2006Q4 by 4.28 percent on average. The dynamics of fundamentals that contribute to the misalignment of real exchange rate actually have captured the underlying theory. When the real exchange rate appreciates or overvaluation, the trade balance still shows the quite high surplus. It indicates that stable or more appreciate exchange rate can improve competitiveness in the case of Indonesia external sector.

The policy in export sector, inflation sector, and investment sector has the big contribution towards the appreciation of real exchange rate or strengthening rupiah. The policy in export sector, that had been experienced and still should be continued or improved, is the application of trade cluster in order to give more attentions in the increasing in the product qualities and the market accesses in local and international. The application of inflation targeting framework (ITF) consistently should be carried out to maintain the stability of macroeconomics in order to maintain the continuity of economic growth and stability of rupiah. The investment rules that beneficial for both investor and government which are not changing overtime are really needed to pull more investment from abroad, beside the conducive condition of security and politics.

As we mentioned before, actually there are still other variables that can determine the equilibrium of RER and its misalignment which are not included in our model but may give effects on the RER for instance interest rate, government expenditure, oil price, and money supply. Therefore, for further research we suggest to consider and count them on the model.

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Appendix

Regression Results (Using STATA 10)

1. Regression Result with Engel Procedure

```
      Source |       SS       df       MS              Number of obs =      32
-------------+------------------------------           F(  5,    26) =   17.36
       Model |  .095869723     5  .019173945           Prob > F      =  0.0000
    Residual |   .02870958    26  .001104215           R-squared     =  0.7695
-------------+------------------------------           Adj R-squared =  0.7252
       Total |  .124579303    31  .004018687           Root MSE      =  .03323

------------------------------------------------------------------------------
       lreer |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
        ltnt |  -2.874041   .3967245    -7.24   0.000     -3.68952   -2.058562
         nfa |  -.1157913   .0691589    -1.67   0.106    -.2579494    .0263668
        ltot |  -.0628147   .1230072    -0.51   0.614    -.3156596    .1900303
        open |  -.0352693    .068388    -0.52   0.610    -.1758428    .1053042
         fdi |   .0462411   .1060859     0.44   0.667    -.1718216    .2643037
       _cons |   .0773183   .0332275     2.33   0.028     .0090181    .1456185
------------------------------------------------------------------------------


Dickey-Fuller test for unit root                   Number of obs   =        31

                              ---------- Z(t) has t-distribution ----------
                   Test         1% Critical       5% Critical      10% Critical
                 Statistic           Value             Value             Value
------------------------------------------------------------------------------
 Z(t)             -7.431            -2.462            -1.699            -1.311
------------------------------------------------------------------------------
p-value for Z(t) = 0.0000
```

2. Error Correction Model

```
. reg d1.lreer d1.ltnt d1.nfa d1.ltot d1.open d1.fdi l1.resid_eg

      Source |       SS       df       MS              Number of obs =      31
-------------+------------------------------           F(  6,    24) =   17.43
       Model |  .043358848     6  .007226475           Prob > F      =  0.0000
    Residual |  .009950848    24  .000414619           R-squared     =  0.8133
-------------+------------------------------           Adj R-squared =  0.7667
       Total |  .053309696    30   .00177699           Root MSE      =  .02036

------------------------------------------------------------------------------
     D.lreer |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
        ltnt |
         D1. |  -2.462126   .7922257    -3.11   0.005    -4.097199   -.8270525
         nfa |
         D1. |   .2204797   .0799076     2.76   0.011     .0555584     .385401
        ltot |
         D1. |    .201927   .0857315     2.36   0.027     .0249859    .3788681
        open |
         D1. |   .0971751   .0858697     1.13   0.269    -.0800512    .2744014
         fdi |
         D1. |   .0039459   .0428554     0.09   0.927    -.0845033    .0923952
    resid_eg |
         L1. |  -.6302111   .1854398    -3.40   0.002     -1.01294   -.2474821
       _cons |  -.0091835   .0039824    -2.31   0.030    -.0174027   -.0009643
------------------------------------------------------------------------------
```