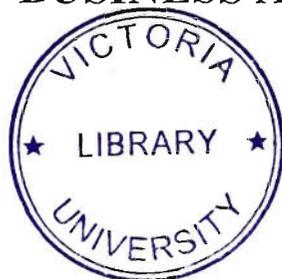


EXCHANGE RATE DETERMINATION IN INDONESIA

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A dissertation submitted in partial fulfillment of the requirement for the degree of

DOCTOR OF BUSINESS ADMINISTRATION



Victoria Graduate School of Business

Faculty of Business and Law

Victoria University

Melbourne

2006

WER THESIS
332.45609598 RUS
30001008800130
Rusydi, Mohammad
Exchange rate determination
in Indonesia

ACKNOWLEDGEMENTS

First of all I would like to thank God, the Supreme Being for His blessing and permission enabling me to complete this doctoral thesis.

I would like to acknowledge my supervisor, Professor Sardar Islam for his continuous support, attention and commitment to this thesis. It is also important to mention my sincere appreciation to my co-supervisor Professor Ray Anderson, Dr. Nick Billington, Margarita Kumnick, Natalie Sciberras, all staff of the Faculty of Business and Law as well as the CSES, Victoria University.

Finally I need to express my special thanks to Lisa, Zaza, Rara and my parents.

DOCTOR OF BUSINESS ADMINISTRATION PROFORMA

I, **Mohammad Rusydi**, declare that the DBA thesis entitled, **Exchange Rate Determination in Indonesia**, is no more than 65,000 words in length, exclusive of tables, figures, appendices, references and footnotes. This thesis contains no material that has been submitted previously, in whole or in part, for the award of any other academic degree or diploma. Except where otherwise indicated, this thesis is my own work.

Signature:



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LIST OF PUBLICATIONS FROM THIS THESIS

Exchange Rate Economics in Developing Countries, Palgrave MacMillan, UK (with Prof. S. Islam), forthcoming.

‘Time Series Econometric Study of Exchange Rate Behavior in Indonesia’, AAAB International Conference, Padang, July 2005 (with Prof. S. Islam).

‘The Determination of the Exchange Rate: A Developing Country Perspective’, IBB Conference, Kota Kinabalu, Malaysia, December 2004 (with Prof. S. Islam).

‘Market Models for the Determination of the Exchange Rate: Empirical Evidence from Emerging Financial Markets – The Case of Indonesia’, IBM Conference, Kuantan, Malaysia, December 2004 (with Prof. S. Islam).

ABSTRACT

This thesis examines the options for adopting normative and prescriptive models of exchange rate determination suitable for developed and developing countries. It also develops a new modeling approach for the determination of the exchange rate, which is suitable especially for developing countries, with the Indonesian case study.

To achieve these objectives, this thesis (1) examines the exchange rate issues in a typical developing country - Indonesia, (2) develops and tests market based and shadow price of exchange rate models for Indonesia, (3) discusses the issues and mechanism for choosing an exchange rate regime for a country, and (4) suggests an approach which is based on the consideration of all these three types of models and the choice of an appropriate exchange rate regime suitable for developing economy such as Indonesia.

This thesis discusses the exchange rate policies adopted prior to the 1997 currency crisis in connection to the previously adopted currency regime as well as the current one and other policies post 1997 in Indonesia. The analysis shows that a credible exchange rate regime and policy, which reduces uncertainty in the exchange rate market, may mitigate the flight to currency from broad money, and ensure the stability for private sectors especially in term of the export competitiveness.

A set of market based and the shadow price exchange rate models are developed and tested in this thesis. Econometric time series analyses show that both models do not perform well in explaining the determination of the exchange rate of the Indonesian currency, rupiah. Since none of these models separately performs well in econometric tests, an approach which considers some elements of each of these models in determining the exchange rate for a developing country such as Indonesia is advocated. This necessitates the development, testing and application of a shadow price of exchange rate model.

This thesis argues that the choice of a model depends on the choice of an appropriate exchange rate regime for a country. For Indonesia, the exchange rate policy of the government is an attempt to make the Indonesian currency rupiah more market driven, though previously on many occasions, the Indonesian central bank, Bank Indonesia, intervened in the foreign exchange market in order to maintain the stability of rupiah.

This thesis also reviews the possibility of an alternative currency regime namely a currency board system and a managed floating regime that still remain as viable alternatives to the freely floating exchange rate regime currently adopted by the Indonesian government. This exchange rate regime is justified by the historical and institutional nature of the Indonesian economy that shows the existence of market failures, non-existence of some financial markets, under-developed financial, regulatory systems and controls. In fact, Indonesia has had a major financial crisis in 1997, thus there is a real need for investors' confidence, macroeconomic stability etc.

CHAPTER 1

INTRODUCTION

1.1. Introduction

Exchange rate is the single, most vital relative price in the financial world. In a more open economy, monetary transmission operates through exchange-rate effects on net exports and interest rates that affect the financial portfolio. In this respect, a nominal exchange rate is the rate at which the currency of a country is traded against that of another currency.

The level of the nominal exchange rate is directly associated with the quantity theory of money printed by central bank, which is one of the key determinants of the exchange rate (Dornbusch, 1988). Therefore in this thesis, exchange rate is being defined as the price in which it can be affected immediately by the demand and supply of the currencies involved.

However, instead of nominal exchange rate, the level of a country's economic activity depends more on its real or inflation-adjusted exchange rate. It is the price at which goods and services produced locally can be exchanged for those produced abroad. In the short run, the nominal exchange rate depends primarily on financial market variables and expectations. If prices of goods and services are slow to adjust, the nominal exchange rate movements will be reflected immediately in the real exchange rate changes (Obstfeld and Rogoff, 1996).

Economic theory suggests that real-side variables come more into play in affecting the exchange rate. In particular, assuming that financial capital is relatively free to move

internationally, and that trade in goods is relatively unhindered by tariffs and quotas, a country's exchange rate is determined by efficient labor and capital in producing tradable goods, as compared to producing non-tradable goods (Batra, 1980).

An appropriate exchange rate policy in Indonesia, jointly with other financial policies, can be implemented to eradicate distortions in the domestic economy and to help protect international competitiveness. To formulate appropriate exchange rate policies, an understanding of the foreign exchange rate market and its behavior is essential.

Historically, even though the Bretton Wood system collapsed in 1973, the Indonesian government decided to maintain a fixed exchange rate regime, later applying the so-called managed floating exchange rate regime due to the concern that the floating regime could generate instability and deter economic development.

In terms of economic growth, international trade and general economic performance, the managed floating rates worked well despite a series of devaluations imposed by Bank Indonesia prior to August 1997 in order to achieve the desired exchange rate which was necessary to maintain the export competitiveness.

Although the devaluations did negatively affect debts denominated in foreign currencies, this was considered less important than the expected boost on exports which would yield more profit in terms of foreign currency earnings. In fact there was not a significant amount of private sector debt denominated in foreign currency prior to 1988. Thus the effect of any devaluation would not have had a systemic impact on the Indonesian rupiah (Kim, 1998).

In August 1997, the Indonesian government finally decided to abandon the managed floating exchange rate regime for the Indonesian rupiah. This followed the Thai bath currency crisis in Thailand and later became part of the financial crisis in the Southeast Asian region. Subsequently, the Indonesian government could not maintain the managed floating regime that was in practice similar to a fixed exchange rate regime, due to the

collapsing foreign exchange reserves held by Bank Indonesia. At present Indonesia is following a freely floating exchange rate regime.

Given the serious financial and economic crisis generated by the problems associated with the policies for management of the exchange rate in Indonesia since mid 1997, this thesis attempts to pursue a comprehensive study of the choice of the exchange rate policy for Indonesia. This thesis also investigates the issues of the appropriate exchange rate regime for Indonesia and the associated model that can be adopted.

Even though at present there are few comprehensive studies on the exchange rate of Indonesia, this research is specifically focused on the determination of an appropriate exchange rate and its application to Indonesia. By applying the econometric methods, this research undertakes comprehensive investigations on these issues with a number of different applied mathematical models are used for this purpose.

1.2. The Indonesian Exchange Rate Prior to 1997

1973 – 1984 Period

The move to a floating exchange rate regime in 1973 was essential if the world economy was to cope with any problems arising from the substantial differences in inflation and growth rates (Ballie and McMahon, 1989). It is debatable that the desirability of flexible exchange rates hinged on whether private speculation would stabilize or destabilize foreign exchange markets.

McKinnon (1984) noted that such a phenomenon was completely unanticipated in the move to a floating exchange rate in 1973. At that time it was argued that the short-term volatility might be a problem, but over a longer period, market forces would move exchange rates so as to produce balance of payment equilibrium and offset any inflation differentials in the major industrialized countries.

Bank Indonesia has been playing an important role in smoothing the foreign exchange rate by undertaking a number of monetary policies including the devaluation of rupiah targeted at maintaining competitiveness in the export market. A crucial policy action was taken in 1978 when the Indonesian government devalued rupiah by 33.6 per cent. This period was also marked by the official adoption of the so-called effective exchange rate on a controlled, managed floating regime (IMF, 1984a).

Furthermore, in 1983 the effective rate for rupiah was devalued by 27.6 per cent and in 1986 it was devalued again by 31 per cent in terms of USD when the Indonesian government announced that they would continue the policy of a managed floating rate and would consider a broader set of foreign currencies in determining the exchange rate of rupiah (IMF, 1997). The major argument against the government's policy at that time focused on the need to adopt a freely floating exchange rate regime so that Bank Indonesia would not need to devalue rupiah. At the same time, IMF reaffirmed its classification for Indonesia as a managed floating regime.

The argument on the effectiveness of this policy continued and from 1985 onwards the trend reversed when USD depreciated against all other major currencies. This changed in direction and the level of exchange rate movements had significant implications for world trade, especially for developing economies. The Indonesian government also started issuing a series of deregulation decrees aimed at smoothing the process of incoming capital movement to Indonesia.

1985 – 1997 Period

In the period of 1985-1991, Indonesia started experiencing a balance of payment deficit on reserve transactions, mainly due to huge subsidies to general public services. Oil sector is still the largest recipient of government subsidies thus affecting the annual budget of Indonesia. The resulting deficit was generally financed by new borrowings from overseas lenders that were not matched by a sufficient amount of export earnings. Although the Indonesian government's decision to devalue rupiah was aimed at

boosting the Indonesian export competitiveness, earnings were lagging far behind the expected amount (Cole and Betty, 1998).

However, being alerted that the economy would be overheated, the Indonesian government conducted a contractionary monetary policy in the early 1990s that resulted in declining economic growth between 1990 and 1992. The GDP again grew sharply from 1993 to 1995 due to the liberalization of investment regulations. In reality, Indonesia achieved approximately 7.8 per cent GDP growth in 1996 and around 7.7 per cent in 1997.

The period of 1991-1996 was marked by a huge number of foreign currencies denominated borrowings, mainly in USD where funds were invested mostly in non-export projects. These projects were proven unsustainable in the long run as well as creating a huge domestic consumption. The newly built hotels and other non-export investments were in fact the beginning of the government losing its primary focus and objective in the achievement of increased export earnings (Corden, 2002).

In 1994, Bank Indonesia was still observing a loose monetary policy. The combination of fiscal and monetary policies seemed to be moving in the right direction in controlling the money supply. The 1996 economic growth was resulting from the high level of investment from capital inflow attracted by high interest rates and high export demand. This rapid Indonesian economic growth threatened the basis of macroeconomic stability reflected in the widening saving-investment gap and a drastic worsening of the balance of payments (Nasution, 1999).

Two years prior to the financial crisis that started in August 1997, the Indonesian macroeconomic indicators had highlighted critical issues such as:

- a weak financial system in the form of a weak banking system including Bank Indonesia, and a less developed financial and securities market, coupled with inadequate legal, regulatory, and supervisory structures;

- the absence of a real perception of the exchange rate risks that had increased unhedged short-term offshore debts; and
- moral hazard as the Indonesian government encouraged more financial flows in the form of foreign borrowings.

1.3. Issues and Debates on the 1997 Indonesian Currency Crisis

Historically, Bank Indonesia had devalued the currency in order to have a necessary adjustment on the expected real exchange rate. This policy was abandoned in August 1997 when Bank Indonesia decided to float rupiah on the market so the rate would move freely. As soon as this policy was implemented rupiah started depreciating rapidly putting the financial sector on the brink of a major currency collapse (Cosetti, Pesenti and Roubini, 1999).

This situation not only made it very difficult for both the Indonesian government and private sectors to make the scheduled repayments of the huge external debts, but also pushed rupiah into a level of uncertainty never been seen before. In addition to the global impact of the outflow of foreign capital from Indonesia during the first year of the financial crisis, the Indonesian government insisted on maintaining full responsibility for the implementation of the new exchange rate regime in Indonesia.

The critical situation for the Indonesian government, having intervened several times in smoothing rupiah to be within a specified band of managed rate, was in 1997 when the intervention band was widened from 8 per cent to 12 per cent. The managed floating exchange regime was replaced the following month by a freely floating exchange rate regime (IMF, 1998a). With this policy change, rupiah experienced major currency volatility in the foreign exchange market where rupiah overshot to the rate of Rp. 17,300 per USD in February 1998.

The issue of the exchange rate determination under the freely floating rupiah is still under debate with the currency itself, which in fact has no intrinsic value, has become such as a commodity like others traded in markets. At the same time Bank Indonesia is still to determine the most efficient rate for the market by intervening as necessary in the exchange rate market. However, Enoch (2001) stated that central bank interventions are not only for the purpose of smoothing daily exchange rate fluctuation but also to achieve a particular exchange rate target.

The Indonesian exchange rate policy and the real appreciation of rupiah from 1990 to 1996 were incompatible with the realities of the Indonesian government's fiscal situation that contributed to a widening current account deficit and an unprecedented increase in external debts, particularly short-term borrowings from foreign lenders.

Finally, the Indonesian government abandoned the managed exchange rate regime in August 1997 and shifted to a freely floating exchange rate regime, because it was not supported by proper fiscal and monetary policies and a healthy banking system. The economic costs of this change have been to be massive because of the sharp depreciation of rupiah, surge in interest rates, plunge in share prices, and an acute liquidity crisis.

1.4. Issues Post 1997 Indonesian Financial Crisis

Over-investment in non-export oriented industries and a weak financial system were the primary roots of the Indonesian financial crisis. Investment was funded mainly by massive capital inflows that resulted in a growing current account deficit and mounting external debts. With over-investment in less efficient investment projects, so fewer resources were being devoted to increasing Indonesian productive capacity and hence affecting its ability to serve and reduce its external liabilities (Nasution, 1999).

Part of the trouble stems from weaknesses in the banking system. Financial reforms ended financial market segmentation and improved competition, but the combination of

relaxing restrictions on bank lending and asset portfolios, lowering reserve requirements, opening markets, privatization, and granting greater access to offshore markets, encouraged rapid credit expansion.

Despite the financial reform, the Indonesian banking system had several critical problems including: the growing maturity and currency mismatches of bank liabilities; the fragile financial position of banks and highly concentrated loans; strong government involvement in directing credits; deficiencies in financial sector governance; and Bank Indonesia's role as the lender of last resort to distressed banks and politically connected institutions (Kenward, 1999).

In January 1998, the Indonesian government formally signed a conditional financial assistance agreement with the International Monetary Fund (IMF). Originally, the objective of the fiscal policy relating to this assistance package was to achieve a budget surplus of about 1 per cent of the GDP (Sabirin, 2000). However due to the uncertainty of the value of rupiah, the financial reform, as a main condition to this package was designed to maintain output, limit inflation to about 20 per cent, and achieve a surplus current account in 1998-1999.

The Indonesian government had also planned to peg rupiah to a fixed rate under a currency board regime in February 1998. It was argued that it would stabilize rupiah and avert any further decline of the economy. Under a fixed exchange rate, Indonesian companies would be able to fulfill their debt commitments, and sharply rising inflation could be controlled. The other side argued that the system would create a more devastating effect on the economy, such as high interest rates needed to back the currency rate.

In this context, Irwin (2004) also mentioned that the existing responses of the Indonesian government and IMF to the crisis were ineffective because central banking, which was the real problem, was not properly addressed, and therefore a currency board was the answer to the problems. But Indonesia had been facing mounting pressures from IMF to

abandon the plan to establish it. In late March 1998, it was announced that Indonesia would not establish a currency board because of the lack of foreign reserves to support the fixed rupiah.

The following measures had also been implemented as a direct effort to restore the value of rupiah and were part of the financial assistance package requirements by IMF (Goldstein, 2000):

- tightening of liquidity conditions;
- rearrangement of major projects and low priority development programs;
- extension of the coverage of luxury sales tax;
- reduction of import tariffs on over 150 items;
- abolishment of 49 per cent limit on foreign holdings of listed shares; and
- removal of monopoly restrictions on agricultural imports.

Between 1998 and 2000 the Indonesian exchange rate's movements were significantly influenced by the political development in Indonesia. The downfall of President Suharto in May 1998 marked the beginning of consistent but regular exchange rate volatility in the market. This kind of volatility appeared to have a considerable effect on Indonesian business by creating a negative sentiment toward rupiah. Furthermore, the decision in the beginning of 1998 to lift the official interest rate up to 63 per cent was ineffective and in fact did not help to stabilize rupiah.

Moreover, the Indonesian government was unable to lower the official interest rate for a longer period because there was no sustainable result on the stronger rupiah. In reality, general public had emerged as major players in determining the direction of rupiah simply due to a desire to only generate profit, by taking different positions on rupiah in the market. As soon as the official interest rate was lowered, the heavy selling of rupiah

made it difficult for the Indonesian government to use this type of financial instrument in the long run.

It is clear that the volatility of rupiah was greater than expected during the currency crisis in 1997. The essential use of rupiah as a medium of exchange changed completely due to the perception of profiteering of the general public in Indonesia; this also applied to USD as well as other major currencies. People started trading rupiah as if it were a commodity, like any other that is openly traded in the financial market.

The above analyses show the need for determining the exchange rate appropriateness in Indonesia. This task involves the choice of an appropriate exchange rate model and its corresponding regime.

1.5. Exchange Rate Determination: Models and Regimes

Empirical studies applying various models of exchange rate determination on a country by-country basis over the modern exchange rate period, have been of enormous importance in formulating appropriate exchange rate policies since such studies can provide useful information about the exchange rate to be adopted by a country. The choice of an appropriate model depends on the underlying exchange rate regime practiced by a country.

In general, there are two types of exchange rate regimes in the world's financial systems: floating and fixed. Under a floating exchange rate regime, foreign exchange rate is determined in markets by constant interaction of supply and demand where rates vary in response to changes of demand and supply in the market (Lewis, 1989). On the contrary, under a fixed regime, the monetary authorities control the exchange rate according to their desired target. The choice of the regime is essential in order to find a model which can be applied to determine an exchange rate for a country.

In order to investigate the exchange rate behavior and its determinants a number of econometric methods are used, including: unit root test. Univariate time series as well as Augmented Dicky Fueller (ADF) methods are also used for modeling the market based and shadow price exchange rate model with the presented case. The aim of modeling this exchange rate determination is to find out the appropriate exchange rate for rupiah and its corresponding regime.

1.6. Limitations of the Existing Literature

The relevant literature on the determination of foreign exchange rate in developing countries like Indonesia has two key limitations. Firstly, in a developing economy like Indonesia, it is necessary to determine quantitatively the appropriate exchange rate by applying mathematical models and its associated regime that can be implemented and managed by the government in order to have a stable rate for the economy. In related studies, this has not been done as there is no extensive and in-depth analysis on the particular issue of an integrated analysis of the choice of a model and regime necessary for determining the exchange rate.

Secondly, most of the literature analyses a number of different issues on the exchange rate determination but this research produces a number of different models by applying econometric and other quantitative methods. This modeling approach requires addressing the issues of efficient determinants based on the shadow price model.

1.7. Aims of the Research

The main aim of this research is to develop a framework for choosing the appropriate exchange rate for a country such as Indonesia. The framework involves the application of a number of different exchange rate models in order to investigate the issues and choice of a regime for exchange rate determination of rupiah. Based on the outcome of this

research, an appropriate exchange rate model is produced and its corresponding exchange rate regime is discussed. In addition to this, other aims are as follows:

- 1) to undertake a comprehensive review of the issues in exchange rate determination in developing countries like Indonesia. The sample period of this study will be divided into two main groups according to the two different exchange rate regimes in Indonesia and focused primarily on before and after the 1997 currency crisis;
- 2) to test foreign exchange rate determination models for Indonesia by using mathematical models including financial econometric methods such as univariate time series methods and shadow price model in order to choose an appropriate model;
- 3) to validate the appropriate model developed by comparing it with the historical rate of misalignments;
- 4) to develop a new approach and a model that can determine an appropriate exchange rate for Indonesia by considering the issue of exchange rate determination in an integrated way; and
- 5) to evaluate the current government's policies in relation to the exchange rate determination in Indonesia and to develop a new framework for analyzing and choosing policies toward its associated exchange rate regime.

1.8. Research Contribution

This research makes the following contributions to the existing literature by developing a new framework for the determination of the exchange rate in less developed countries such as Indonesia. Furthermore:

1. this is a comprehensive study which undertakes an evaluation of all relevant models, and uses a shadow price model for the determination of an appropriate exchange rate for Indonesia;
2. this research develops a new framework for the choice of a model and its associated regime that is suitable for developing countries such as Indonesia. Thus

this provides a benchmark for an appropriate exchange rate determination of rupiah for policy makers of Bank Indonesia;

3. the associated regime with the chosen shadow-pricing model is also analyzed and recommended; and
4. the results of this study are generic and are applicable to other developing countries with similar circumstances to Indonesia.

1.9. Methodologies

This research will adopt the quantitative method approach and it is aimed at the collection, processing, observation and analysis of the historical data using computer programs for determining an appropriate model and its associated regime for exchange rate determination in Indonesia. This approach can be summarized as follows:

1. in order to have a comprehensive understanding of the characteristics of the Indonesian exchange rate prior and post 1997 financial crisis, the market and shadow price exchange rate models are applied to investigate the issues of exchange rate determination for Indonesia;
2. time series analyses are undertaken to analyze the behavior of the Indonesian rupiah;
3. a unit root test is applied to determine the accuracy of the model by using the cointegration, Engle Granger and Augmented Dickey Fuller, as well as the regression method; and
4. models for determining misalignments are applied to investigate the extent of the rupiah's divergence from its official rate when the managed floating regime was officially used in Indonesia prior to the 1997 currency crisis.

1.10. Data and Computer Programs

The relevant data of rupiah is collected and used as the main source of data. It is differentiated into the periods before and after the 1997 currency crisis. The general economic and financial data of Indonesia is derived from IMF, World Bank, IFS, Indonesian Bureau of Statistics and Indonesian Ministry of Finance. SPSS, Matlab, EViews and Excel are also used for processing that relevant data.

1.11. Structure of the Thesis

Chapter 2 presents a critical literature review of the concepts, issues and methods for the determination of an exchange rate. It reviews different concepts for exchange rate models, the nature of the exchange rate and the management of the exchange rate by government. It also examines the principal purpose of an exchange rate in relation to international trade.

Chapter 3 reviews the case of Indonesia, in terms of the exchange rate determination issues. The characteristics of the Indonesian financial system are also discussed in order to have a better understanding of the nature of exchange rate policies in Indonesia, prior and post the 1997 currency crisis.

Chapter 4 overviews the market models and its application in relation to the exchange rate determination in Indonesia. Testing of those models is also conducted, including the purchasing power parity and monetary models.

Chapter 5 introduces the shadow price of exchange rate model and its use in producing the standard conversion rate of rupiah when the official exchange rate regime was a managed floating one and Bank Indonesia actively intervened in the market for a desired target rate. The nature by which the shadow price of exchange rate model is perceived also presented in this chapter.

Chapter 6 discusses modeling time series analysis and misalignment of rupiah in order to better understand its behavior. It also analyses the exchange rate overshooting. The chapter also presents the misalignment estimation conducted in this study.

Chapter 7 analyses the policy options and implications available in terms of the implementation of the chosen exchange rate model. It begins with the concept of different exchange rate regimes, the exchange rate policies of Bank Indonesia and other relevant issues. It also discusses the possibility of introducing new alternatives in managing the currency in Indonesia as well as the introduction of a new currency that fits into the shadow price of exchange rate model.

Chapter 8 concludes the research with limitations and areas for further research.

CHAPTER 2

EXCHANGE RATE ISSUES, MODEL AND REGIME

2.1. Introduction

The issues of exchange rate determination have long been a subject of research and policy making, especially since the collapse of the Bretton Woods arrangement. Today the foreign exchange rate markets are extremely unpredictable and susceptible both to fundamental economic factors and market sentiments. The high degree of unpredictability and uncertainty of exchange rate movements since the introduction of the flexible exchange rate in 1973 have led policy makers and researchers to investigate the nature and degree of the impact of such movements on the exchange rate determination.

Many empirical studies support the hypothesis that an increase in exchange rate volatility leads to a decrease in the volume of international trade. This is because in most international transactions, goods are delivered after a time gap and the contracts are denominated in terms of the currency of either the exporting or the importing country, and unanticipated variation in exchange rates adversely affects the volume of trade through their effects on income (Asseery and Peel, 1991)

Kenen and Rodrik (1986) provided empirical evidence for developed economies and argued that exchange rate volatility imposes costs on risk averse-market participants who generally respond by favoring domestic to foreign trade. Arguably, empirical outcomes in the developing economies related to this area do not generally agree with this negative relationship between exchange rate volatility and trade flow.

2.2. Exchange Rate Concept

The level of the nominal exchange rate is directly associated with the quantity theory of money printed by the central bank, which is one of the key determinants of the exchange rate (Dornbusch, 1988). Therefore the exchange rate can be defined as the price which allows it to be affected immediately by the demand for and supply of the currencies involved. It is then formulated as:

$$E = D / F \quad (2.1)$$

where:

E = the prevailing exchange rate (or the spot rate) in the foreign exchange market;

F = the foreign currency;

D = the domestic currency traded in the foreign exchange market;

and in this case:

$$M_d = k P Y \quad (2.2)$$

where:

Y = real income;

M_d = money holdings;

P = the price level;

k = fraction.

Hence $m_d = M_d/P$ denotes the demand for real money balances. The quantity theory of money then maintains that m_d is determined by non-monetary or real factors such as aggregate output and the degree of technological advancement. M_s denotes the nominal money supply, thus it represents the quantity of bills and coins in circulation plus

checking deposits (Cushman, 1983). Equilibrium in the money market requires that money demand be equal to money supply, so:

$$M_s P = m_d \quad (2.3)$$

where:

M_s = the foreign nominal money supply; and

P = the foreign price level.

According to the quantity theory of money, both E and M (M_s and M_d) are determined by non-monetary factors because the quantity of money depends on the exchange rate regime maintained by the respective central banks.

Generally speaking, there are two types of exchange rate regimes: flexible and fixed. Under a flexible exchange rate regime, the foreign exchange rate is determined in markets by the constant interaction of, and varies in response to, changes in demand and supply in the market (Lewis, 1989).

The principal non-price determinants of foreign demand for domestic currency are foreign income, foreign preferences, relative rates of inflation, comparative interest rates, and trade barriers. On the other hand, the principal non-price determinants of the domestic supply of domestic currency to foreign exchange market are domestic income, domestic preferences, relative rates of inflation, comparative interest rates, and trade barriers (Frankel, 1992).

Any increase (decrease) in the foreign demand for the domestic currency will in the long run lead to an appreciation (depreciation) of the domestic currency while on the other hand an increase (decrease) in the domestic supply of the domestic currency will in the long run lead to depreciation (appreciation) of the domestic currency (Barro and Gordon, 1983). In reality, short-run changes of exchange rates are random, unpredictable and happen within a trading day, or within a trading week.

Furthermore, an increase (decrease) of domestic incomes, *ceteris paribus*, will in the long run likely lead to depreciation (appreciation) of the domestic currency. On the other hand an increase (decrease) of foreign incomes, *ceteris paribus*, will in the long run likely lead to appreciation (depreciation) of the domestic currency (Moosa, 2002).

An improving (deteriorating) preference for domestic goods, *ceteris paribus*, will in the long run likely lead to an appreciation (depreciation) of the domestic currency. Therefore an improving (deteriorating) preference for foreign goods, *ceteris paribus*, will in the long run likely lead to depreciation (appreciation) of the domestic currency (Arize and Osang, 2000).

The domestic inflation factor growing at a faster rate (slower rate) than that of foreign inflation will in the long run result in a depreciation (appreciation) of the domestic currency. The final factor considered here is domestic interest rates, if these are higher (lower) than foreign interest rates, they will in the long run likely result in an appreciation (depreciation) of the domestic currency (Giovannini, 1988).

2.3. Real Exchange Rate in Macroeconomic Adjustment

The real exchange rate affects the consumption and resource allocation decisions across non-tradable and tradable goods (Dornbusch and Kuenzler, 1993). It is defined as the price of foreign goods in a domestic currency relative to the price of domestic goods. Thus the real exchange rate plays a key role in the relative pricing associated with international trade and foreign investment and it is therefore important to examine its determination.

Furthermore, an accurate determination is essential because an overvalued exchange rate adversely affects the balance of payments of a country and may require some reversal of

liberal trade policies. On the other hand, an undervalued exchange rate can contribute to inflationary pressures and may require a reversal of domestic price liberalization.

Implementing sound exchange rate policies that avert these risks and support currency convertibility requires proper knowledge of the equilibrium real exchange rate. In a market economy, where prices are relatively flexible, market pressures tend to correct deviations of the real exchange rate from its equilibrium value. Under a flexible exchange rate regime, both the nominal exchange rates and domestic prices are considered tools of economic and financial adjustment.

Conversely, under a pegged or fixed exchange rate regime, the endogenous change of the real exchange rate toward its equilibrium value depends primarily on variations in domestic prices. Adjustment of the real exchange rate through changes in the nominal exchange rate is deemed as a policy decision concerning exchange rate management (McKinnon, 1984). It is argued that when the real interest differentials are greater, the real exchange rate appreciates greatly. However, Meese and Rogoff (1988) were unable to establish a long-run relationship between these variables, using cointegration techniques.

2.4. Real Exchange Rate and Trade

Two important sources of relative price changes in any economy are the real exchange rate and international trade. There are many theoretical linkages between these two factors, although they are not theoretically established in all models. In addition to this there is an observed empirical regularity between changes in terms of international trade and changes in real exchange rate for many small but open economies.

However, the empirical literature produces very mixed results on the relationship between those two variables, ranging from modest empirical relationship to strong and considerable correlations as mentioned by Devereux and Connolly (1996). Using a panel

of 26 less developed countries including Indonesia, it was found that those countries experience smaller exchange rate effects from international trade than that of developed markets.

However, Mendoza (1995) using 30 countries of which 23 were developing, found that international trade effects were slightly larger in developing economies than in developed markets. He also divided 75 developing economies into fixed and flexible exchange rate regimes and found that the contribution of international trade to real exchange rate volatility was larger in developing countries with a more flexible exchange rate regime.

The relative size of that contribution in developing countries varies enormously. The study also found that up to 49 per cent of total real exchange rate volatility is due to trade volatility. It reported an average of a 13 per cent contribution for fixed exchange rate countries, and up to 43 per cent in those with floating rate regimes.

Despite the sample of countries being small but open economies, it is recognized that in these countries other macroeconomic conditions are not completely independent of changes in terms of international trade. For example, production may vary in relation to trade in export-oriented economies such as in the case of Southeast Asian countries including Indonesia. When the trade factor is retained as cited by Mendoza (1995), the results generally understated the extent of the contribution of country-specific events which depends on the level of correlation between trade and the country-specific economic factors.

2.4.1. Capital Mobility

The occurrence of a high degree of capital mobility not only affects the independence of domestic monetary and fiscal policies, but it also increases the complexity of managing a country's saving and investment problems. This has been of particular interest to the Asia-Pacific countries that embarked upon large-scale financial market liberalizations in the early 1980s.

Even with the lack of capital and foreign exchange rate controls, there are periods when capital flows are smoother than others. From a policy perspective, it is important to know whether capital markets have indeed become more closely linked across other countries. Increased capital mobility not only reflects the influence of various liberalization measures taken in each country, but also provides insights into the management of the exchange rate in general. The immense problems experienced by Asian countries during the 1997 financial crisis indicate a policy deadlock in relation to exchange rate management in financially open economies (Bordo and Schwartz, 1999).

2.4.2. Export and Import Factors

There are two primary determinants of export and import demand (Dornbusch, 1988). One is the foreign income variable that measures the economic activity and the purchasing power of the trading partner (income effect) and the second is the relative price or trade variable (price effect).

The volume of exports (imports) to a foreign country (domestic country) should increase as the real income of the trading partner (domestic economy) rises, and vice versa (Stiglitz, 2003). It is found that for exchange rates in which USD is one of the currencies, not only is the forward premium not an efficient forecaster of the subsequent change in the exchange rate, its correlation with that subsequent change is actually negative.

Any changes to the non-price determinants of demand or supply in the foreign exchange market will cause the domestic currency to appreciate so to take advantage of the higher foreign interest rates, which are however repatriated after the interest is earned. If this happens, the foreign interest rate's advantage will be partially offset by the domestic currency appreciation since the foreign currency will now buy fewer units of the domestic currency (Velasco, 1997).

When a domestic currency depreciates in the short term, investors' foreign interest earnings will be greater than before in terms of currency exchange, thus the investor will gain both on the interest earned and on the currency exchange. In either case, an increase in the supply of loans abroad, *ceteris paribus*, will have a tendency to decrease the foreign interest rate, and thereby eliminate the foreign interests' advantage (Taylor, 1995).

2.5. Exchange Rate Behavior

Although exchange rate behavior in the short run seems to be closely approximated by a random walk process, it does not mean that exchange rates actually follow random-walk processes (Moosa, 2004). On the other hand, expectations about future exchange rates have not been formed rationally (De Grauwe and Dewachter, 1993). One well documented empirical observation of the recent floating exchange rate system is the fact that exchange rates have been volatile, with irregular large jumps in the short run.

Meese and Singleton (1982) demonstrated that the out-of-sample forecasting performance of some structural models, including the sticky-price monetary model, was inferior to a simple random walk model for a time horizon of up to 12 months. This definitely supports empirical studies, simply because the explanation validates the empirical models formulated to estimate the exchange rate using only exogenous and predetermined variables.

Moreover, this is superior to the corresponding continuous overshooting model because its solutions neither exhibit the empirically unfounded overshooting behavior of the exchange rate, nor have load point stability which causes the model unstable. There is also another reason for this in which the exchange rate movement seems to replicate the actual movement that is closely approximated by a random-walk process (Mahieu and Schotman, 1994).

Monetary authorities may at times try to manipulate the direction of exchange rate change by purchasing other currencies (such as supplying the domestic currency) to stimulate depreciation or prevent appreciation of the domestic currency, or selling other currencies (such as demanding the domestic currency) to stimulate appreciation or prevent depreciation of the domestic currency (Dewachter, 1993). If they do so they lose control over monetary policy for domestic purposes.

Foreign interest rates that are higher than domestic rates will induce an outflow of capital to earn a greater interest income than in the domestic market. This outflow increases the domestic supply of the domestic currency and the domestic demand for foreign currency, thereby inducing depreciation of the domestic currency. However, when the principal plus interest is returned, the increased foreign demand for the domestic currency results from the increased foreign supply of the foreign currency will likely stimulate appreciation of the domestic currency (Lothian and Taylor, 1996).

Arguably, investors will continue to send funds abroad in order to earn higher foreign interest rates until appreciation of the domestic currency fully offsets the foreign interest advantage. When sending funds abroad to take advantage of higher foreign interest rates, the strategy is to continue doing so as long as the foreign interest rate minus the expected percentage appreciation of the domestic currency is greater than the domestic interest rate.

Today, forward exchange markets have emerged for heavily traded currencies with spot exchange trading for immediate or next day delivery. For currencies in which forward markets have emerged, it is possible to purchase or sell quantities of exchange. Risk of adverse changes of exchange rate can be managed by hedging, such as entering into forward contracts to buy or sell quantities of exchange needed or expected to offset the adverse positions.

A quantity of exchange may be purchased spot where the domestic currency is supplied and sold forward when the domestic currency is demanded. A domestic exporter who

sends goods to a foreign importer with the expectation of receipt in foreign currency at a future date can hedge the open position by contracting for the forward sale of the quantity of exchange (De Grauwe, 2000).

2.6. Issues of the Exchange Rate Regime

Mussa (1986) provided evidence of non-neutrality of nominal exchange rate regimes. It shows that the distribution of the price level is different across fixed versus floating exchange rate regimes. It tests the changes in the mean and standard deviation of macroeconomic time series including the price level in different countries and across different exchange rate regimes.

Baxter and Stockman (1989) also studied the statistical behavior of macroeconomic time series for twenty-one OECD countries under the Bretton-Woods and the floating exchange rate regime, but found no systematic evidence of differences in the behavior of exchange rate regime. Clearly, there is evidence that the behavior of the general price level depends on the exchange rate regime. Klein and Shambaugh (2004) also argued that the formation of price expectations depends on the prevalent type of monetary regime.

Nadal De Simone (1997) showed that the behavior of the price level and the nominal exchange rate is different in an inflation-targeting regime than in a monetary targeting regime. Furthermore, it affects exchange rate determination that are related to the prevailing monetary arrangement such as different nominal exchange rate regimes that also affects international trade as it varies across countries.

2.6.1. Fixed Exchange Rate Regime

In a fixed exchange rate regime, the sole responsibility of the monetary authority is to control the exchange rate within a target rate. In this situation, monetary policy cannot be

directed toward domestic problems, and the interests of the domestic economy are subordinated to the need to stabilize the exchange rate (Garber and Taylor, 1995).

Under a fixed exchange rate regime, the government intervenes in the foreign exchange market in order to keep the exchange rate at a fixed level. If fixed level is E then:

$$E_t = E \text{ for all time } (t) \quad (2.4)$$

When the government pegs the exchange rate, the money supply becomes an endogenous variable because the central bank must be ready to exchange domestic for foreign currency at the fixed rate E . In this case, the nominal exchange rate E implies that the price level is also constant and equal to E for all time (t). Therefore, because the nominal exchange rate is constant, the expected rate of devaluation is zero.

In the interest parity condition, the domestic nominal interest rate is constant and equal to the world interest rate $r\alpha$. It follows from the liquidity preference equation that the demand for nominal balances is also constant and equal to $EL(\lambda C, r\alpha)$, where λC denotes consumption. Since in equilibrium money demand (M_d) must be equal to money supply (M_s) and also constant over time, thus:

$$M_d = M_s = EL(\lambda C, r\alpha) \quad (2.5)$$

As a logical consequence when the government pegs the exchange rate the fiscal deficits must be entirely financed through the sale of interest bearing assets. An alternative is to limit trading of the domestic currency through capital controls. This was the solution adopted by the Malaysian government in September 1998 to protect itself from the contagion effect of the Asian currencies crises.

2.6.2. Floating Exchange Rate Regime

Under a floating exchange rate regime, the nominal exchange rate is determined by the market, in which it is an endogenous variable. Therefore, this exchange rate regime is applicable when central bank initially determines the nominal exchange rate and then allows the money supply to be market or endogenously determined (Kaminsky and Reinhart, 2000). Arguably one of the advantages of flexible exchange rates is that countries become independent in terms of their ability to implement domestic monetary policies.

In this kind of regime, the exchange rate will merely change over time in order to adjust to the inflation differentials. This freedom of domestic policy under flexible exchange rates may be reduced if there is an international demand for currencies. In a region with substitutable currencies, shifts in money demand between currencies will provide an additional component of exchange rate inconsistency (Frankel, 1995).

With a specific monetary policy in which a central bank expands the money supply constantly, the positive rate (μ) for each period is defined as:

$$M_s = (1 + \mu)M_{s-1} \quad (2.6)$$

$$E_t = 1 + \mu \quad (2.7)$$

Due to the fact that foreign price level is 1 ($P_f = E_t$), the domestic price level (P_t) must also increase at the rate of monetary expansion μ , so:

$$P_t = 1 + \mu \quad (2.8)$$

In this case, the domestic nominal interest rate (i_d) using the interest parity condition is:

$$1 + i_d = (1 + r\alpha) E_t + 1 \quad (2.9)$$

$$E_t = (1+r\alpha)(1 + \mu) \quad (2.10)$$

which implies that the nominal interest rate is stable and rising in μ . When μ is positive, the domestic nominal interest rate exceeds the real interest rate $r\alpha$ because the domestic currency is depreciating over time. Therefore:

$$i_d = i(\mu) \quad (2.11)$$

Here $i(\mu)$ indicates that it is a function of μ and it is increasing in μ . With a floating rate, the central bank allows the market to determine the exchange rate for their currencies while also allowing prices to adjust to market pressures, thus protecting reserves, and eliminating the prospect of a currency speculative attack.

2.6.3. Determinants for Exchange Rate

In the 1980s, some developments relating to exchange rate modeling were observed, including a portfolio balance model, which explicitly takes financial assets other than money into account and assumes partial substitution among them. Frankel (1992) revealed that almost all empirical exchange rate models, including portfolio balance models and monetary approach models are unsuccessful in forecasting exchange rate progress in a consistent way.

Rogoff (1996) found that each theoretical model for the exchange rate does not bring any better ex post forecast results than a random walk model. Furthermore, it shows that it is impossible to reject the random walk hypothesis for the real exchange rates, which implies that the real exchange rates under the floating system in developed countries are subject to a random walk process.

Generally speaking, a nominal exchange rate is the rate at which the currency of one country trades against that of another. The level of a country's economic activity,

however, depends more on its real or inflation-adjusted exchange rate. It is the price at which goods and services produced locally can be exchanged for those produced abroad. In the short run, the nominal exchange rate depends primarily on financial market variables and expectations. If the prices of goods and services are slow to adjust, nominal exchange rate movements will be reflected immediately in real exchange rate changes (Obstfeld, and Rogoff, 1996).

Economic theory suggests real-side variables come more into play in affecting the real exchange rate. In particular, assuming that financial capital is relatively free to move internationally, and that trade in goods is relatively unhindered by tariffs and quotas, a country's real exchange rate is determined by how efficient labor and capital are in producing the tradable goods compared with producing non-tradable goods (Batra, 1980).

According to the Balassa-Samuelson model, if the productivity of a country's workers in producing manufactured goods relative to their productivity in producing services grows faster than abroad, then the country's currency will appreciate in real terms. On the other hand, if the relative productivity growth of workers manufacturing goods is lower than abroad, the currency depreciates.

The assumptions are: firstly, domestic workers' salaries are equalized by competition between the tradable and non-tradable sectors. This implies that if the productivity of workers and capital in the sector producing the traded goods grows faster than that producing non-traded goods, then the price of non-traded goods relative to traded goods should rise (Asseery and Peel, 1991).

Secondly, traded commodities prices in different countries are tied together by international arbitrage activities. Since a country's overall price level consists of the prices of both the traded and the non-traded commodities, so the prices of the traded commodities are equalized across countries.

The overall price level will tend to rise faster in countries where the non-traded commodities prices are rising faster. This implies that countries with relatively high manufacturing productivity growth will have growing real purchasing power over foreign commodities, and their currencies will appreciate in real terms (Cosetti, Pesenti and Roubini, 1999).

2.7. Monetary Model

MacDonald and Taylor (1994) tested the monetary model (MM) which is better at forecasting the future path of exchange rate than a random walk process. The general view is that exchange rates approximate a random walk in the short run but are systematically related to economic fundamentals over the longer term. The flexible price assumption is undesirable on both theoretical and empirical grounds.

The response of the exchange rate to an interest rate decrease is an immediate depreciation of the currency. Therefore, the more rigid the prices are, the larger the overshooting effects. Meese and Rogoff (1983) found robust evidence of long run relationships where exchange rates do appear to be related to monetary fundamentals over long horizons. While extending this finding to monetary model, Mark (1995) also found that monetary factors affect exchange rates.

2.8. Purchasing Power Parity (PPP) Model

The equilibrium exchange rate is often linked with an international version of the law of one price (LOP) (Engel, 1996). Identical goods in different countries have the same price, when expressed in common currency terms. An arbitrage argument is typically presented to explain why this condition should hold. Normally, there are no prices for identical goods; but rather price indices for bundles of goods. It is argued that when productivity

disparities are greater in the production of traded goods between two countries, the real exchange rate appreciates.

By employing cointegration analysis, Bahmani-Oskoei (1993) showed that real exchange rates and productivity disparities are cointegrated and thus have a long run relationship. It explains that the deviation from interest rate parity reflects both the exchange risk when financial assets are denominated in different currencies; and the political risk when the financial assets are issued in different countries.

Since some of the items in a typical consumption or production bundle are not tradable and not subject to international price pressures from international trade, this result is not completely expected. On the other hand, since consumer bundles might be more similar across countries than producer or wholesale bundles, consumer price indices (CPIs) may present a more consistent measure of price levels and thus of real exchange rates.

This implies that there is a permanent change in the price level across countries that the exchange rate should not respond to. Market structures might change, and thus the equilibrium exchange rate. Indeed, there are a few cases in which PPP holds in the short run. When it holds, it is usually in economies with very high inflation rates where domestic currency has influence on the determination of prices.

Finally, if countries of interest are primarily exporting to third country's markets, then the export price index may be the more appropriate deflator. In practice, export unit value indices are subject to measurement error. Moreover, the composition of the bundles of exports is likely to vary even more widely across countries than the corresponding CPI bundles (Breuer, 1994).

2.9. Uncovered Interest Parity Model

The uncovered interest parity (UIP) model follows the assumption of arbitrage between spot and forward foreign exchange markets (Alexius, 2001). If the conditions for risk free arbitrage exist, then the spot exchange rate will be equal to the interest differential between assets. In this case, the UIP model is expressed as:

$$F_{(t, t+1)} / S_t = I_{t,t} / I^*_{t,t} \quad (2.12)$$

where:

- S_t = the price of foreign currency in units of domestic currency at time t;
- $F_{t,t+1}$ = the forward value of S for a contract expiring 1 period in the future;
- $I_{t,t}$ = one period ahead interest rate on domestic bond; and
- $I^*_{t,t}$ = the corresponding interest rate on the foreign bond.

Thus,

$$F_{t,t+1} - S_t = I_{t,t} - I^*_{t,t} \quad (2.13)$$

with logarithms denoted by lower-case letters. It is a risk-free arbitrage condition that holds independently from the investor's preferences. However, if investors are risk averse, the forward rate can differ from the expected future spot rate by a premium that compensates them for the perceived risk of holding domestic versus foreign assets.

Mussa (1979) modeled the UIP model that in the presence of perfect capital mobility with no capital controls, transaction costs or risk premium, the expected rate of change of the spot exchange rate will be equal to the nominal interest differential. This condition is on perfectly comparable financial assets denominated in different currencies where:

$$(1 + I_t) = (1 + \beta S_{et}) (1 + I^*_t) \quad (2.14)$$

and βS_{et} is the expected rate of change of the spot exchange rate. Thus:

$$S_{et} = F^* \quad (2.15)$$

where:

$$F^* = S[(1+I)/(1+I^*)] \quad (2.16)$$

It is the interest parity forward rate which is equal to the forward exchange rate F . Furthermore:

$$S_{e\ t+1} = F^*_t \quad (2.17)$$

where S_{et} is the logarithm of the expected spot rate and F^*_t is the logarithm of the interest parity forward rate. By allowing the behavior of the risk premium and incorporating the rational expectations hypothesis, then the model is written as:

$$S_{t+1} = \beta_0 \beta_t f^*_t + \beta_{t+1} \quad (2.18)$$

where β_{t+1} is an error term reflecting the impact of news, and β_0 is a constant term reflecting the value of risk premium as well as other factors such as transaction cost. Assuming that this condition holds, and then the equation becomes:

$$s_{t+1} = f^*_t + \beta_{t+1} \quad (2.19)$$

However, when capital is not perfectly mobile because of capital and foreign exchange control, the UIP model will not hold as in the case of the Asian developing countries. The deviation from UIP is defined as:

$$DUIP_t = S_{(t+1)} F^*_t + \beta_{t+1} \quad (2.20)$$

where $DUIP_t$ is a deviation from the UIP and this value will vary over time and can be used as a measure of dynamic capital mobility. The larger the deviation from the UIP then the higher the capital or foreign exchange controls in that country and the lower the capital mobility.

2.10. Currency Substitution Model

Under the fixed exchange rate regime, central banks make currencies perfect substitutes on the supply side. They modify the supplies of currency in order to maintain the exchange rate peg. The issue of currency substitution deals with the substitutability among currencies on the demand side of the market. If currencies were perfect substitutes to money traders, then all currencies would have to have the same inflation rates, or demand for the high-inflation currency would fall to zero (Sarno and Taylor, 2002b).

For example, if Indonesia has a 10 per cent annual inflation rate, while Australia has a 5 per cent rate and with no currency substitution, then it is expected that rupiah will depreciate against AUD on a PPP basis, if Indonesians hold AUD because it is a good substitute for rupiah. The higher inflation rate on rupiah means that stocks of rupiah held will lose value more quickly than AUD so there is an increased demand for AUD. This effort to exchange the rupiah for AUD results in a further depreciation of rupiah.

Any shifts in demand between currencies can result in unstable exchange rates and can be very disturbing to central banks desiring exchange rate stability. Therefore, one repercussion of a high degree of currency substitution is a need for international management of monetary policy. If money traders substitute between currencies to force each currency to follow a similar inflation rate, then the supposed freedom of monetary policy under flexible exchange rate regime is largely misleading (Dumas, 1992).

Although central banks may attempt to follow independent monetary policies, money traders will adjust their portfolio holdings away from high inflation currencies to low-

inflation currencies (Black, 1994). This currency substitution leads to more volatile exchange rates, because not only does the exchange rate adjust to compensate for the original inflation differential, but it also adjusts as currency portfolios are changed.

Conclusion

The need for the determination of the appropriate exchange rate, choice of regime and its associated model especially for developing countries has been made evident repeatedly by the history of the financial system many times, particularly by the real experience of the Asian financial crisis.

Following the financial turmoil in Mexico, Southeast Asia, Russia and most recently Brazil, the question is whether globalization has gone too far (Rodrik, 1998). Even if apparently well planned macroeconomic, trade and structural policies were being put in place, massive inflows of foreign capital often created severe macroeconomic imbalances in liberalizing economies that eventually proved unsustainable, thereby jeopardizing the entire reform process.

The Asian financial crisis of 1997 forced the rapid depreciation of five major Asian currencies including rupiah, and subjected several others to severe pressure. Many countries had their exchange rate policies reset by external forces, as monetary authorities were forced to allow the markets to determine exchange rates once stocks of foreign reserves were depleted. As Asia recovers, governments and central banks will regain the independence to establish their own policies, and the region will face the challenge of setting up post-crisis monetary and exchange rate regimes (Mishkin, 1999).

Arguably, beliefs about the manner in which exchange rates function and the actual behavior of exchange rates drive each other in endless circles. In other words, the idea of investor rationality is challenged by the lack of a practical and useful understanding of the foreign exchange world, leaving investors to be guided in varying degrees by beliefs and opinions. This discussion on the concepts and issues of the exchange rate in this chapter has provided the background to undertake an analysis of these issues in Indonesia as they have evolved historically culminating in the late 1990s during the financial crisis and which are still ongoing until now. This analysis is undertaken in the next chapter.

CHAPTER 3

INDONESIAN EXCHANGE RATE ANALYSIS

3.1. Introduction

Generally speaking, the Indonesian currency crisis in 1997 provides an interesting case study, due to the fact that the subsequent financial contraction was deeper than in any of the other crisis-afflicted countries in Asia. The Indonesian real GDP fell by an overwhelming 13.7 per cent in 1998, followed by a further small decline in 1999. Major indicators of macroeconomic discrepancy were worse in neighboring Thailand leading up to the crisis, where both Korea and Thailand shared the financial sector weaknesses that made Indonesia defenseless.

Initially when the crisis hit the Indonesian economy, the monetary authority tried to protect the domestic currency, rupiah, while maintaining the managed floating regime by widening the intervention band from 5 to 8 per cent in June 1997. When the currency crisis hit Thailand, the band was then widened to 12 per cent in July 1997. After resisting strong pressure for a short period of time, rupiah fell by 6 per cent against USD in July 1997, the biggest one-day fall in ten years (IMF, 2000).

At the end, the Indonesian monetary authority realized that the system could not cope with the continuing pressure on the currency, as the risk of losing all foreign exchange reserves to maintain rupiah was too high. In August 1997, Bank Indonesia decided to adopt a freely floating exchange rate regime. As a result rupiah fell much further because of strong demand for USD.

As rupiah weakened, international lenders refused to refinance maturing loans and then reversed the flow of funds, where borrowers tried to obtain USD before rupiah fell further. Individuals then joined to buy USD that contributed to the much-unanticipated appreciation of USD. From Rp. 4,950 to USD at the end of December 1997, the exchange rate fell to more than Rp. 15,000 at the height of the crisis in June 1998, although it later stabilized at around Rp. 9,000. At that exchange rate, it is estimated that half of the Indonesian corporations became technically bankrupt.

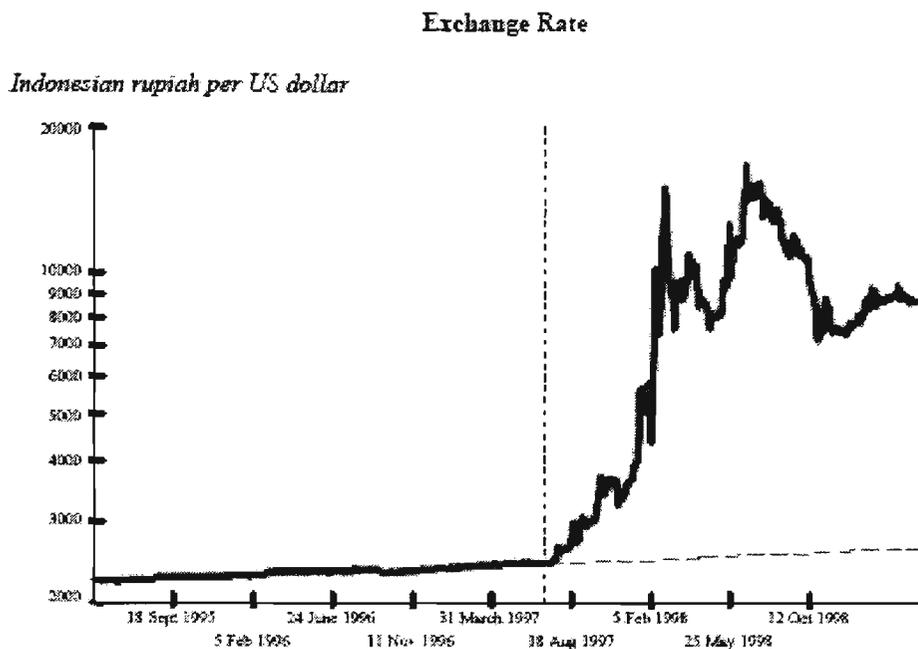
3.2. Exchange Rate Crisis in Indonesia

Indonesia was hit hardest by the 1997 currency crisis in Asia. To defend its external reserve position, Bank Indonesia abandoned the exchange rate intervention band and moved to the floating exchange rate regime. As the result, the external value of rupiah depreciated by over 80 per cent in the end of 1997 when it was initially trading at around Rp. 2,400 to 1 USD (Figure 3.1).

The fear of the further rupiah's depreciation put the exchange rate and interest rate under more pressure. The fact that Bank Indonesia moved, in mid August 1997, to the floating exchange rate regime suggests that it had limited external reserves to defend rupiah (McLeod, 1998). Indeed, the currency crisis devastated the Indonesian economy and in 1998, GDP contracted by 13 per cent with the inflation rate reaching 58.5 per cent. All sectors, except utilities, posted negative growth as the intensity of the currency crisis exposed weaknesses in the corporate sectors.

Prior to the currency crisis, the Indonesian economy seemed to be in generally good condition. Economic growth reached more than 7 per cent per year and the inflation rate was kept at single digit levels. However, the currency composition and term structure of corporate foreign debts were causes for concern as it exceeded more than 100 billion USD (Table 3.1).

Figure 3.1:
The Indonesian Exchange Rate, 1995-1998



Source: Bank Indonesia.

Although as a per cent of GDP the size of outstanding foreign debt owed directly by the private sector was smaller than that of Korea, Malaysia, or Thailand, it left the Indonesian economy totally exposed. When the currency crisis hit, highly leveraged companies, particularly those with large foreign loans, were the ones most affected (Kydland and Prescott, 1990).

Monetary policy can be identified through a short run interest rate equation, while general spending balance shocks can be identified via a real exchange rate equation. The higher interest rate reduces real money balance but this is not the main effect. Instead, the increased short run interest rate correctly appreciates the exchange rate, reducing output in the short run and this is the significant effect. As the interest rate gradually reverses to its pre-shock level, and the asserted sticky prices complete their adjustment, the real exchange rate and output are back to their pre-shock levels (Verbrugge, 1997).

Table 3.1:
Outstanding Loans - Indonesian Banking Sector

The debts were in billion US dollars and for the period of 1992-1997. The debts were growing in the past 5 (five) years leading to the Asian financial crisis. The private/corporate debts exceeded 100 billion USD in 1995, 1996 and 1997 and were the main concerns of the non governmental observers since most of them were structured without proper hedging protection.

Banks	1992	1993	1994	1995	1996	1997
Government	68.2	71.5	80.0	93.5	108.9	153.3
Foreign	9.3	14.7	18.4	24.2	27.6	48.6
Regional	3.0	3.6	4.2	5.2	6.5	7.5
Private	42.3	60.4	86.3	111.6	150.0	168.7
Total	122.9	150.3	188.9	234.6	292.9	378.1

Source: Bank Indonesia.

Although the money contraction correctly appreciates the exchange rate, the forecast error variance decomposition analysis shows that the monetary shock can only explain not more than 6 per cent of fluctuation in the exchange rate. On the other hand, shocks to general spending balances leading to real exchange rate depreciation can explain up to 75 per cent of fluctuation in the interest rate.

Moreover, compared to monetary shocks, which can only explain output fluctuations by less than 3 per cent, these shocks can explain up to 59 per cent of output fluctuations in medium term. Hence, any shocks to the exchange rate play a more significant role than monetary policy shocks in driving macro-economic fluctuations.

These results show that monetary policy alone could not have been used to overcome fluctuations in the Indonesian macro economy due to the Asian currency crisis. Stabilization of the macro economy might have been more effectively achieved if the

monetary policy has been coupled with fiscal policy, as this is believed capable of affecting real exchange rate movements (Brealey, 2001).

3.3. Exchange Rate Behavior in Indonesia

The exchange rate is the single most important relative price in the national economy. In a more open economy, monetary transmission operates through exchange rate effects on net exports and interest rates which, in turn affect the financial portfolio. The exchange rate policy in Indonesia, jointly with other economic policies, had been mainly used to remove distortions in the domestic economy and to help safeguard international competitiveness (Tobin, 2000). Until recently, the Indonesian monetary authorities avoided the use of expanded nominal and real exchange rate overvaluation as a principal instrument for generating fiscal revenues and cutting domestic inflation and interest rates.

The exchange rate policy included devaluation, increasing the depreciation of rupiah and widening the intervention band, and raising transaction costs in foreign exchange markets. In November 1978, Bank Indonesia devalued rupiah by 50 per cent against USD which had been its external benchmark and replaced it with an undisclosed basket of major foreign currencies. The exchange rate policy included devaluation, speeding up depreciation of rupiah and widening the intervention band, and raising transaction costs in the foreign exchange market (Batini and Haldane, 1999)

In fact, rupiah was further devalued by 40 per cent in June 1983 and by another 31 per cent in September 1986. Normally, the monetary authority targeted a nominal depreciation of rupiah against USD between 3 to 5 per cent per annum. Bank Indonesia intervenes in the foreign exchange market by buying and selling rupiah in an intervention band around the central rate. Provided that the system is supported by an active policy to stabilize the real exchange rate, this intervention also helps avoid a major macroeconomic crisis even when the world economic environment proves hostile.

In order to allow market forces a greater role in setting the exchange rate, Bank Indonesia widened intervention the band six times since 1992, being set to 12 per cent effective from July 1997. Theoretically, such a large exchange rate flexibility should introduce uncertainty that may well put off part of the purely speculative capital flows and allow higher degree of freedom for the Indonesian monetary authority to exercise control over monetary aggregates. As it allows temporary, small appreciations of the rupiah, the policy should also reduce the need for intervention against surges in capital inflows (Fischer, 1998).

The floating exchange rate system is the most flexible and realistic for a relatively large developing country like Indonesia with a large non-traded sector in its economy. Depreciation of the domestic currency in a floating exchange rate system is an effective mechanism to achieve the necessary adjustment.

The alternative measure is a combination of a devaluation of a pegged exchange rate and a fall in domestic prices brought about by a domestic recession. The current experience of Indonesia indicates that these policies are painful and damaging in terms of both unemployment and lost output (Stiglitz, 2003).

One view favors the role of a tight monetary policy where an increase in the interest rate raises returns on domestic investment and attracts foreign investors through arbitrage conditions, thereby causing currency appreciation and stabilization of the exchange rate. On the other hand, the possibility of the opposite scenario is argued, where increasing interest burdens on highly leveraged firms can result in a rise in bankruptcy rates that worsens the economic environment and causes further currency depreciation (Wade, 1998).

3.4. Exchange Rate Policies in Indonesia

The adjusting factors of an active management of exchange rate policy have been increasing the domestic inflation rate and interest rate. The rising pressure on the inflation rate has been partly suppressed by the Indonesian government's policy to run a budget surplus or to narrow the budget deficit, the policy to subsidize prices of state-approved products, and to adopt a more influential trade liberalization program (Goldfajn and Gupta, 1999).

The 1997 Asian currency crisis has brought about major macroeconomic fluctuations in several Asian countries causing many central banks to seriously try to reformulate their monetary policy. Being severely affected by the crisis, the Indonesian government gave more independence to Bank Indonesia to play a crucial role in stabilizing economic fluctuations.

One important aspect in undertaking monetary policy is empirical knowledge of the monetary transmission mechanism (MTM), which does not deal with specific issues such as: Bank Indonesia's attempts to reconstruct the Indonesian banking system; its implementations of monetary policy; or with any political dimension of economic instability.

Evaluating the macroeconomic effects of monetary policy has been more successfully conducted in studies using a closed rather than an open economy setting (Evans and Lyons, 2004). Although in an open economy the MTM model tends to present difficulties in its application, there are no strong reasons to model the increasingly more open economy of Indonesia with the closed type.

When a restrictive monetary policy shock causes a significant and persistent appreciation of domestic currency as well as generating a large and persistent effect on the domestic interest rate relative to the foreign rate, there will be a considerable deviation from the uncovered interest parity condition in favor of domestic currency-denominated

investments. In general, the exchange rate dilemma happens when a contractionary foreign monetary policy shock creates an appreciation of the domestic currency (Favero, 2000).

3.5. Monetary Policy Prior to the 1997 Currency Crisis

Confidence in the Indonesian economy arguably led to substantial investment and an associated import flow. The accompanying large capital inflows did not have a big impact on the real exchange rate, though there were some real appreciation pressures (Table 3.2). More important was the rise in short-term debts, though at the time there was little reason to be concerned about the Indonesian exchange rate.

The achievements of the Indonesian economy over the 20 year period before the 1997 financial crisis focus on: an enormous increase in per capital income; inflation down from very high levels to around 10 per cent; a large expansion in food supply; growth in rural incomes together with more stable food prices; a massive structural shift towards industry; a huge expansion in manufacturing exports; and a sharp decline in poverty. A further achievement was the essentially fixed exchange rate due to the apparent predictability of exchange rate economic factors (Sabirin, 2000).

A favorable interest differential encouraged borrowing from abroad. This was done without hedging the exchange rate risk as Indonesia initially had a reasonably sound exchange rate regime, which worked well as long as policy makers could make the necessary adjustments. Ghosh, Gulde and Wolf (1997) held the view that the cause of its vulnerability was the interaction of capital inflows, macro policies and weak financial institutions.

Table 3.2:
Funds Flow - Indonesia

The funds flow is for the period of 1990-1997 and in billion US dollars. The Foreign Direct Investment was at its peak in 1996, a year before the financial crisis hit Indonesia.

Funds Flow	1990	1991	1992	1993	1994	1995	1996	1997
Foreign Direct Investment	1.09	1.48	1.78	2.00	2.11	3.74	5.59	4.50
Net Investment	(0.09)	(0.01)	(0.09)	1.81	3.88	4.10	5.01	(2.63)
Foreign Loans	n.a	n.a	n.a	n.a	n.a	n.a	8.87	7.33

Note : n.a. indicates the correct estimates are not available for these years.

Source : World Bank Statistics on External Debt, 11/2000

In response to reforms and changes in the global markets, the capital inflows rose strongly after 1990. In fact it encouraged unhedged fund inflows and this included a pro-cyclical fiscal policy and a fixed exchange rate. It also contributed to the accumulation of short-term liabilities (Noble, 2000). It is argued that the effectiveness of limits on the resulting external borrowing after 1991 was compromised because these limits applied to the government, central bank, state enterprises and banks, but not to the private sector.

Another argument declares that the 1989 financial liberalization might have been more to blame. Indonesia had a balanced budget rule, but contingent liabilities were building up. There was also a growth in off-budget accounts, leading to a fall in the revenue base. However, that the sequencing issue argues against this view because the initial financial opening had taken place too long ago to be relevant as a cause of the financial crisis (Hernandez and Monteil, 2001).

3.6. Exchange Rate Competitiveness for the Indonesian Economy

The financial turmoil incited by waves of devaluations throughout Southeast Asia led to substantial realignments of relative real exchange rates throughout the region. If limited export markets are indeed a reality for export-oriented nations, a relative increase in a nation's competitiveness should over time serve to divert the export market share towards itself and away from its competitors.

Many previous models of exchange rate management in developing economies fail to capture the importance of relative competitiveness, and its implications for a nation's export performance. This led to the development of a simple partial-equilibrium model of exchange rate competitiveness, and the elasticity of demand for the Indonesian exports with respect to changes in its own real exchange rate and changes in a composite index of competitor countries' exchange rates. A large elasticity would indicate that exchange rate management should be principally motivated by concerns about competitiveness (Corden, 1994).

There is an emerging compromise on the importance of maintaining a realistic real exchange rate to ensure the competitiveness of exports in the world market. It is pointed out that Indonesia has shifted its exchange rate management to address underlying pressures on the foreign exchange market which leads to the conclusion that focusing on the foreign exchange market has cost Indonesia a good deal of competitiveness in the early 1990s (Kamin, 1996).

The conventional approach to competitive exchange rate management is to view it for sensible trade balance management and devaluing the currency when trade deficits become too large to be sustainable. A common method of generating competition in exchange rates is to assume that nations produce exports which are imperfect substitutes, and that purchases of a nation's exports will be partly determined by the relative cost of these exports compared with the exports of a competitor (Krugman, 1991).

The Indonesian government's management of the exchange rate determines the foreign currencies price, and hence the competitiveness of local output at the international level. In addition, other indirect factors affect differentiation at the national level for exports include infrastructure, education levels which affect the accessibility of mid-level managers as well as unskilled workers, and also political stability.

3.7. Indonesian Exchange Rate Issues

In the wake of the mayhem in the Southeast Asian currency markets, Indonesia allowed rupiah to float relatively freely in August 1997. This change represented a substantial move from the previous practice of tightly managing or pegging rupiah against either USD or a basket of currencies. This causes exchange rates to be primarily determined by market forces, and it is increasingly vital to identify what macroeconomic factors systematically move nominal exchange rates (Table 3.3).

Meese and Rogoff (1983) illustrated the deficiencies of the monetary model. Furthermore, it is not clear that currency board arrangements could circumvent the impediments to fixing exchange rates, given the large potential liabilities represented by the continuing ailing banking system in Indonesia. Should it be the case, the Indonesian government will no longer be able to simultaneously control the rate of rupiah and conduct independent monetary policies.

The exchange rate variability will generally increase, as long as central banks are unwilling to subordinate domestic monetary policy to exchange rate targets. Halwood and MacDonald and Taylor (1994) argued that the central banks' ability to drastically change monetary policies and financial regulations grants them a strong capacity to punish speculators. Monetary authorities in the region have some short run latitude in manipulating interest rates while targeting the exchange rates.

Table 3.3:
Characteristics of Rupiah/USD Market, 1992-1997

The exchange rate of the Indonesian rupiah was depreciated substantially in 1997 when a financial crisis hit the Indonesian economy.

Indicators	1992	1993	1994	1995	1996	1997
Average rate of change of the nominal exchange rate(Rp/USD)	1910	2100	2305	2405	2550	5350
<i>Macroeconomic Prices (%)</i>						
Inflation (WPI)	8.6	7.5	8.1	7.1	5.3	5.1
Inflation (CPI)	9.1	9.3	8.7	8.6	6.9	5.9
Real interest rate on GDIs	14.1	13.1	12.1	12.5	13.2	15.1
<i>Real Rate of Growth (%)</i>						
GDP	8.3	8.1	8.6	4.2	-6.1	8.3
Exports	20.6	8.4	14.2	3.8	-2.5	5.6
Imports	54.6	23.3	12.4	-6.5	-12.5	35.1
<i>As Ratio to GNP (%)</i>						
Current account balance	-2.5	-2.4	-2.5	2.1	-1.8	-5.9
Stock of foreign debt	43.9	47.3	48.9	48.3	56.8	60.2
Budget balance	-5.1	-9.4	-8.7	-8.1	-12.7	-11.0

Source: Bank Indonesia

Tseng and Corker (1991) asserted that a stable cointegrating relationship holds for Indonesia. Dekle and Pradhan (1996) updated these results for Southeast Asian countries and concluded that there is no evidence of real money demand cointegration, with the exception of Indonesia. However, the identified breakpoints do not fall within the rupiah's floating period. Most investigations of nominal exchange rate determination rely upon purchasing power parity holding in the long run. Because this hypothesis is grossly violated empirically in this region, it is essential to allow the long run real exchange rate to vary over time.

Before shifting to the present exchange rate regime, Bank Indonesia tried to defend the moving band system from speculative attacks in July 1997 by widening the intervention band and selling foreign exchange both in forward and spot markets (DeGregorio and Wolf, 1994). To support these policies, Bank Indonesia also introduced a wide array of tight monetary policies along with administrative measures to limit external borrowings of commercial banks, and discourage short-term capital inflows while maintaining open access to the economy for long-term capital (Chinn and Miller, 1998). In the end, Bank Indonesia had to abandon the moving band system, adopted in 1992, in order to defend its foreign exchange reserve position.

Finally in August 1997, rupiah was freely floated. It continued to depreciate in following days, weeks and months, sometimes by as much as 10 per cent in a day with virtually no obvious intervention, driven further downwards by desperate attempts of the Indonesian borrowers to buy USD to cover their external debt obligations. Since many Indonesian corporations had many heavy short-term, foreign exchange denominated borrowings, the depreciation of rupiah after the move to a floating rate had a tragic impact on their solvency.

It is unlikely that a country once adjusted to a freely floating regime would find itself defenseless against depreciation in the way that Indonesia did. It can be assumed that people do not accept massive unhedged foreign exchange exposure when they have learned that exchange rates are forever gyrating in ways that are essentially random. An extra level of circumspection is needed before advising a country that is already in trouble to shift to a floating regime (Isard and Symansky, 1996).

Nevertheless, the fact that Indonesia encountered misfortune as a direct result of abandoning the managed float and was not the result of an unambiguous decision, given that the abandonment was due to an overwhelming external force. Many countries previously only had to accept limited depreciations or appreciations, or widening of the managed band, in response to strong market pressure.

It is still argued why the Indonesian authorities so easily and quickly decided to abandon the managed float. At that time the Indonesian government was holding over USD 20 billion in the foreign exchange reserves as of July 1997, of which they used only USD 900 million in August 1997.

Conclusion

Managing the exchange rate has become an overwhelming exercise for central banks including Bank Indonesia. There have been currency crises that have wiped out economic wealth in many countries. For many developing countries like Indonesia, the actual benefits of currency depreciation are less impressive than what conventional wisdom predicts in terms of boosting export competitiveness to raise aggregate economic output.

Though the views vary as to whether, how and to what degree it might be desirable to promote competitive depreciation to suit domestic economic interests, large exchange rate depreciations, including the case of rupiah, also have the potential to increase credit risk and the burden of debt denominated in foreign currencies.

Any downward pressure on exchange rates and downturn in market sentiment can result in higher uncovered exchange rate exposure and financial disorder. Large exchange rate fluctuations in an environment of increased international capital mobility affect the level of inflation predictability and the pricing of financial assets. The fact is that an exposure to foreign exchange risk measures the sensitivity of a firm's value, or the present value of expected future cash flows.

During the last decade, the Indonesian financial system has been subjected to substantial reforms with far reaching positive impacts. The reforms process has concentrated on interest rate as well as exchange rate deregulations. Practically, these helped in dramatic improvement in transparency in all levels of financial markets including the foreign exchange market. Before liberalization, Indonesia had only one official exchange rate that was determined by Bank Indonesia whereby currency market players had only a small role in the determination of the exchange rate.

Since the end of 1997, the increase in currency demand has come at the expense of broad money. The flight from quasi-money into currency was very sudden, an occurrence

which traditional linear or error-correction models did not forecast very well. It turned out that the most important variable for explaining the sudden switch from quasi-money to currency in the out-of-sample forecasts was exchange-rate uncertainty.

Today the market forces of demand and supply determine the exchange rate. In the case of the Indonesian foreign exchange market; there were many spikes in exchange rate behavior not because of real market conditions but due to intervention actions taken by Bank Indonesia over the years. This position needs to be contrasted with the 1980s, when external debts, especially short-term, mounted while the foreign exchange reserves were depleted.

The policy implication is that the monetary authority of Indonesia will have to take realistic and speedy steps to reduce the rupiah's uncertainty and volatility, if it wishes to reverse the continuing demonetization process of the banking sector. If the forecasts of the rupiah's demand are in tandem with forecasts of a fall in quasi-money, Bank Indonesia may be able to forecast this demonetization and formulate appropriate policies for restoring market confidence in the financial sector (Kamin, 1996).

CHAPTER 4

MARKET MODELS AND APPLICATIONS

4.1. Introduction

Exchange rate is the single most vital relative price in the financial world. In a more open economy, monetary transmission operates through exchange-rate effects on net exports and interest rates that affect financial portfolios. The exchange rate policy in Indonesia, jointly with other financial policies, can be used to eradicate distortions in the domestic economy and help protect international competitiveness. To formulate appropriate exchange rate policies, an understanding of the exchange rate market and its behavior is essential.

Empirical studies applying various models of exchange rate determination on a country by-country basis over the modern exchange rate period have been of enormous importance in formulating appropriate exchange rate policies since they can provide useful information about exchange rate market behavior.

The main objective of this chapter is to study the factors that determine the exchange rate in Indonesia. In pursuit of that it applies two common models, the PPP and monetary models. Essentially, this chapter is structured to test foreign exchange rate determination models for Indonesia by applying financial econometric methods.

4.2. Modeling Purchasing Power Parity

The purchasing power parity (PPP) model asserts that the exchange rate between two currencies over any period of time is determined by the change in the two countries price levels. However, an exchange rate in the short run would deviate from PPP mainly due to three disturbances: actual and expected inflation, barriers to trade, and shifts in international movements of capital. A fourth factor, the productivity bias occurring when there is relatively faster productivity growth in the tradable sector than in the non-tradable sector, will also result in a systematic deviation of the domestic prices (Baillie and McMahon, 1989).

The fundamental concept underlying the PPP model is that arbitrage forces will balance the prices of goods globally if they are measured in the identical currency. Basically, there are two forms of the PPP: absolute and relative. In the absolute version of the PPP, the share of domestic and foreign prices determines the nominal exchange rate:

$$S = P/P^* \quad (4.1)$$

where: S is the exchange rate measured as the domestic currency price of a unit of foreign currency. Here, P and P^* are the domestic and the foreign price levels respectively (Bahmani-Oskoe, 1993). By taking logarithms, the absolute PPP model is written as:

$$s_t = p_t - p^*_t \quad (4.2)$$

where the lower case notations represent the logarithms of the variables.

In reality, the absolute version of the PPP model is unlikely to hold because of the existence of transportation costs, imperfect information and the distorting effects of tariffs and protections (Sarno and Taylor, 2002a). Arguably, the relative version of the

PPP model shows that the proportional change in the exchange rate corresponds with the disparity in the inflation rates between the two countries. Hence:

$$\% \Delta S = \% \Delta F - \% \Delta F^* \quad (4.3)$$

where:

$\% \Delta S$ = the percentage change in exchange rate;

$\% \Delta F$ = the percentage change in domestic inflation rate; and

$\% \Delta F^*$ = the percentage change in foreign inflation rate.

Furthermore, it is estimated as:

$$\Delta \varepsilon_t = \alpha + \beta (\Delta f_t - \Delta f^*_t) \quad (4.4)$$

where lower case notation implies logarithms of the variables.

Regardless the disputes on the consistency of the PPP model as a short-run relationship, there seem to hold in the long run. Thus, if a long-run relationship exists, then the logarithms of the nominal exchange rate and the price level indices should move simultaneously over the long run.

The exchange rate and relative prices are said to be stationary, if they have a tendency to constantly return to their mean even though they fluctuate around it (Wu, 1996). The test of the order of integration can be found by the subsequent equation for each of the variables:

$$\Delta X_t = \beta_0 + \beta_1 X_{t-1} + \gamma_{ik} = \sum I_i \Delta X_{t-i} + \mu_t \quad (4.5)$$

where Δ is the first difference operator.

If $\beta_1 < 0$, then X_t is stationary. If $\beta_1 = 0$, then X_t is non-stationary. The proposition is that $\beta_1 = 0$ is tested by a t-ratio. The ratio is an Augmented Dickey-Fuller (ADF) if some lags

are required on the right hand side to make the residuals, μ_t , white noise (i.e. $k \geq 1$). It needs a Dickey-Fuller (DF) test if no lags are required (i.e. $k = 0$).

There would be no equilibrium among variables that are integrated of different orders. In this case as far as the PPP model is concerned, if the exchange rate and relative prices have a long-run relationship then it should have the same order of integration (Granger and Anderson, 1978). Based on the Engle-Granger two-steps method, the dependent variable (exchange rate) is regressed on the independent variables (relative prices). The test of cointegration involves testing to find out whether the residuals from the regression are white noise. Thus, it needs to regress s_t on $(i_t - i^*_t)$ as:

$$s_t = \alpha + \beta(i_t - i^*_t) + \varepsilon_t \quad (4.6)$$

and subject the residuals to a stationarity test of white noise. If the residuals are white noise, then it is stationary. To be cointegrated, a long-run relationship must exist between the exchange rate and relative prices.

In the second step after establishing a long-run relationship, there may be an error correction mechanism (ECM) where short-run dynamics are captured (Table 4.1). It is defined as:

$$\Delta\varepsilon_t = \gamma_0 + \gamma_1(\Delta i_t - \Delta i^*_t) + \gamma_2\varepsilon_{t-1} + \mu_t \quad (4.7)$$

where $\gamma_2\varepsilon_{t-1}$ is the estimated residuals lagged by one period and μ_t is the white noise error (Table 4.5). The coefficient γ_2 measures the pace of correction to the long-run equilibrium. Hence, the ECM is valid, conditional on the existence of cointegration between the exchange rate and relative prices.

Table 4.1:
Deviation from ECM-Derived Rupiah, 1992Q1-1997Q2 (%)

Period	Deviation (%)
1992Q1	13.4
1992Q2	16.8
1992Q3	16.3
1992Q4	14.3
1993Q1	14.4
1993Q2	17.1
1993Q3	19.5
1993Q4	23.9
1994Q1	21.4
1994Q2	23.4
1994Q3	23.2
1994Q4	25.1
1995Q1	23.2
1995Q2	22.1
1995Q3	20.4
1995Q4	21.5
1996Q1	22.4
1996Q2	23.1
1996Q3	22.2
1996Q4	30.4
1997Q1	32.3
1997Q2	35.2

Source: Bank Indonesia and Author's estimates.

Kim (1990) found, using the Engle-Granger method, that in most cases both the CPI and WPI are cointegrated with the exchange rate at the 5 per cent level. McNown and Wallace (1989) also found that the PPP holds in the short run for only four out of twenty-five developing countries. Although there are disputes on the validity of the PPP as a

short-run relationship, there seems to be a common agreement that PPP will hold in the long run.

4.3. Modeling Monetary Factors

The concept of the monetary model of exchange rate determination starts from the assumption of ideal capital mobility (Mark, 1995). The PPP and interest rate parity concepts are used in the models to classify the equilibrium conditions. Both foreign and domestic bonds are assumed to be perfect substitutes. Broadly speaking, the monetary models are focused on the flexible price monetary (FPM) and real interest differential (RID) models.

The logarithm of the demand for money is assumed to depend on the logarithm of real income y and the logarithm of price level p and the level of nominal interest rate r . An identical demand for money can also be assumed for the foreign country, where asterisks represent foreign variables. A monetary equilibrium in the domestic and foreign country is then given as:

$$m_t = p_t + \phi y_t - \lambda r_t \quad (4.8)$$

$$m_t^* = p_t^* + \phi y_t^* - \lambda r_t^* \quad (4.9)$$

where m_t and m_t^* are the domestic money supply and foreign money supply respectively. It is also assumed that purchasing power parity holds constant as:

$$s_t = p_t - p_t^* \quad (4.10)$$

where s is the logarithm of exchange rate defined as the domestic currency units per unit of foreign currency. Another assumption is that foreign and domestic bonds are assumed

to be perfect substitutes, so that the uncovered interest parity (UIP) will hold as (MacDonald, 1995):

$$Ds_t = r_t - r_t^* \quad (4.11)$$

where De_t is the expected rate of depreciation of the domestic currency. It gives:

$$s_t = (m_t - m_t^*) - \phi(y_t - y_t^*) + \lambda(r_t - r_t^*) \quad (4.12)$$

Here, the nominal interest rate is made up of two components of the real interest rate and the expected inflation rate:

$$r_t = i_t + \Pi_t f \quad (4.13)$$

$$r_t^* = i_t^* + \Pi_t f^* \quad (4.14)$$

where i_t and i_t^* are the domestic and foreign real interest rate and $\Pi_t f$ and $\Pi_t f^*$ are the expected rates of domestic and foreign inflation respectively. Assuming that the real interest rates are equalized in both countries, thus:

$$r_t - r_t^* = \Pi_t f - \Pi_t f^* \quad (4.15)$$

where:

$$s_t = (m_t - m_t^*) - \phi(y_t - y_t^*) + \lambda(\Pi_t f - \Pi_t f^*) \quad (4.16)$$

The above equation is defined as the FPM model. The coefficient of the relative money supply is positive and equivalent to one based on the neutrality of money (McCallum, 1994). For any given percentage increase in the money supply, prices will also increase by the same percentage. If the PPP holds continuously, this means that the domestic

currency depreciates (s_t increases) by the same amount, in order to restore a new equilibrium.

In the FPM model, an increase in the domestic real income creates a surplus demand for the domestic currency and this leads to a drop in prices. Then, an appreciation of the domestic currency will make sure that equilibrium is restored. Furthermore, an increase in the expected long-run inflation results in switching from domestic currency to bonds. Thus the demand for domestic currency decreases, causing a depreciation of the domestic currency (an increase in s_t) where the coefficient of the relative expected rate of inflation is positive.

Frankel (1995) developed the RID model, which incorporates a short-run interest rate so to capture liquidity effects. Frankel assumed that the expected rate of depreciation of the exchange rate is a positive function of the gap between the current exchange rate, s_t and the long-run equilibrium rate, s_t^* , and the expected long run inflation differential between domestic and foreign countries. This yields:

$$Ds_t = -\theta (s_t - s_t^*) + \Pi_t e - \Pi_t e^* \quad (4.17)$$

where θ is the pace of adjustment to equilibrium. This equation states that the spot exchange rate is expected to return to its long-run equilibrium at the rate of θ . In the long run, $s_t = s_t^*$, so the expected rate of depreciation (shown by minus sign) of the currency will be equal to the discrepancy of domestic and foreign inflation. It gives:

$$s_t - s_t^* = -(1 / \theta [(r_t - \Pi_t e) - (r_t^* - \Pi_t e^*)] \quad (4.18)$$

This equation shows that the gap between the current real exchange rate and its long-run equilibrium exchange rate is relative to the real interest differentials between the two countries. If the foreign real interest rate is higher than the domestic real interest rate, then there will be capital outflows from domestic bonds to foreign bonds until the real

interest rates are equalized (Meese, 1986). Therefore, the long-run PPP relationship in the RID model is defined as:

$$s_t = p_t - p_t^* \quad (4.19)$$

In the long run, the interest differential must be equal to the long-run expected inflation differential:

$$r_t - r_t^* = \Pi_t e - \Pi_t e^* \quad (4.20)$$

Thus:

$$s_t - s_t^* = -(1 / \theta) [(r_t^* - r_t) - (r_t^* - r_t)] \quad (4.21)$$

The above equation states that the exchange rate will overshoot its long-run equilibrium rate whenever the relative nominal interest differential increases above its equilibrium levels. Furthermore:

$$s_t = (m_t - m_t^*) - \phi(y_t - y_t^*) + \lambda(\Pi_t e - \Pi_t e^*) \quad (4.22)$$

This is in fact equal to the reduced equation of the FPM, thus the RID reduces to a FPM in the long run. The short-run dynamics of the RID is stated as:

$$s_t = (m_t - m_t^*) - \phi(y_t - y_t^*) + \theta^{-1}(r_t - r_t^*) + (\theta^{-1} + \lambda)(\Pi_t e - \Pi_t e^*) \quad (4.23)$$

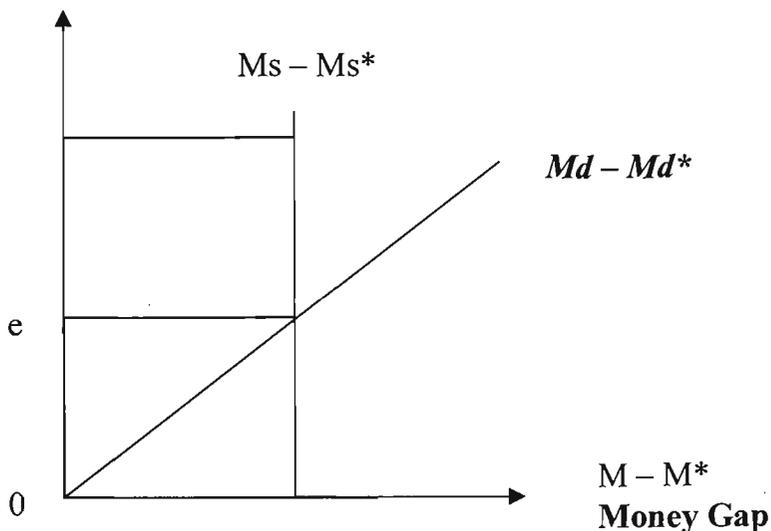
or

$$s_t = \alpha_1(m_t - m_t^*) + \alpha_2(y_t - y_t^*) + \alpha_3(r_t - r_t^*) + \alpha_4(\Pi_t e - \Pi_t e^*) \quad (4.24)$$

The signs of the coefficients of α_1 , α_2 and α_4 are the same as that for the FPM model. The α_3 coefficient is negative where an increase in the domestic interest rate leads to a capital inflow that increases the demand for the domestic currency and as the result is an appreciation of the domestic currency. Hodrick (1978) also drew encouraging empirical evidence for the FPM model. The estimated coefficients are consistent with the FPM model and the regression has a reasonable result in sample diagnostics such as a high R_2 and a reasonable DW statistic.

Figure 4.1:
Nominal Exchange Rate

Nominal exchange rate



This model ignores the effects of trade imbalances on the economy. If there is a trade surplus, then the current account balance reflects that there is a net accumulation of foreign assets by domestic residents, which increases domestic wealth. This increase will also increase consumption and demand for real money. It also assumes that domestic and foreign government bonds are perfect substitutes for global investors.

The real depreciation induces an enhancement in the current account as foreign imports become relatively more expensive (cheaper) for domestic (foreign) residents. The improvement in the current account increases the demand for domestic output and money demand thus restoring the equilibrium. Hence, the nominal and real exchange rates are positively correlated with both goods and money market shocks (Figure 4.1).

In fact, a monetary policy is unproductive under a fixed exchange rate regime as it is endogenous. The nominal and real exchange rates cannot alter output and cannot adjust to guarantee money market equilibrium. Fundamentally, a fixed exchange rate regime implies abandoning an independent monetary policy. Also an increase in the money supply and a fall in the nominal exchange rate are associated with a nominal depreciation (Mark and Sul, 2001).

4.4. Econometric Methodology

Cointegration is a technique to determine whether two or more time series have a long-run relationship. It allows a long run relationship between exchange rates and relative prices to be tested independent of short-run fluctuations. The exchange rate and relative prices are stationary, if they have a tendency to constantly return to their means even though they fluctuate around them. MacDonald and Taylor (1994) attempted to apply cointegration techniques that involved testing for a long-run relationship between variables in the equation and estimating an error correction form if a cointegrating vector can be found.

The current standard in testing for cointegration in time series is the full-system maximum likelihood estimation technique of Johansen (1991). Cheung and Lai (1993b) have shown that finite sample critical values may be more appropriate given the relatively small samples that are generally the case. Moreover, such maximum likelihood techniques require that the ECM for each endogenous variable be sufficiently modeled by the selected measurement.

This approach, which allows for the likelihood of endogenous right hand side variables, is appropriate since many of the Southeast Asian currencies are managed by their central banks. To confirm that the residuals are approximately white noise, lags of first differences are added such that the null of no serial correlation cannot be rejected at the 10 per cent marginal significance level.

Testing for the number of cointegration relationships amongst the variables requires two different tests to determine the number of cointegrating vectors that are the trace and the maximum Eigenvalue tests. In the trace test, the null hypothesis is that there are at most r cointegrating vectors and it is tested against a universal alternative. Johansen cointegration analysis involves estimating the vector error correction model in a reduced form.

In the maximum Eigenvalue test, the null hypothesis of r cointegrating vectors is tested against $r + 1$ cointegrating vectors. Once the number of relationships, r is determined, then the hypothesis will test on both loadings and cointegrating vectors. If there is only one cointegrating vector found, then conclusions about any long-run relationship between the variables can be made, otherwise theoretical restrictions should be used to classify the long run relationships (Johansen and Juselius, 1990).

First, it needs to examine the time series properties of the variables using Augmented Dickey-Fuller (ADF) unit root tests. Test results show that all of the variables are $I(1)$. The implications of the unit root test results are to use the cointegration procedures. Then, the Johansen procedure is used to determine the rank r and to identify a long-run monetary model of exchange rate amongst the cointegrating vectors.

To get the effects of seasonality on the variables requires using a set of monthly centered seasonal dummy variables, a constant term. The diagnostics in the form of vector statistics and single equation statistics point to a close approximation to the actual data generating process, apart from some non-normality of residuals.

Here, an historical data of rupiah is collected from the 1990 to 2000 period and then utilized as the main source of data analysis. The other general economic and financial data of Indonesia are derived from IMF, World Bank, Bank Indonesia and Indonesian Ministry of Finance.

4.5. Testing the PPP and Monetary Models

Quarterly data are extracted from International Financial Statistics (IFS) for a period of 1990Q1 to 2000Q4 with a total of 44 data points. The M2 is used as the proxy for money supply and income is represented by the real GDP of Indonesia and US. The three months time deposit rate and the three months USD London offer rate are used correspondingly to represent the short-term interest rates in Indonesia and US.

The proxy used for the expected long-term inflation rate differential is the one-period lagged inflation differential between Indonesia and US. The exchange rate is the average of monthly data, expressed in rupiah per US dollar unit. For the broad deflator, the consumer price index (CPI) from IFS data is also used. The tradable price deflator is proxied by wholesale price index (WPI) data reported in IFS.

If PPP holds then the long run movement of s_t , p_t and p^*_t are cointegrated (Rogoff, 1996). The Engle-Granger cointegration test will then examine whether μ_t follows a stationary process, whereas the Johansen cointegration test will demonstrate the existence of a cointegration vector in the (s_t, p_t, p^*_t) space with $(1, -1, 1)$ as the expected coefficients for the cointegrating vector. The time series are first examined for stationarity and then followed by the results of the Augmented Dickey-Fuller (ADF) test for a single unit root (Dickey and Fuller, 1979).

The Engle-Granger cointegration test (Table 4.2), uses the OLS in order to get the estimated residuals which are then analysed for stationarity using the ADF test. In

applying the Johansen cointegration test, the deterministic components and the order of the lagged endogenous variables need to be included. The results of the ADF test (Table 4.8) show that there is unit root. The non-stationary exchange rate suggests that a long-run PPP between USD and rupiah does not exist. The availability of the length of the time series allows a better investigation on the two models in a long-run setting, where exchange rates are the average period of market exchange rates. Therefore, in the case of Indonesia, only the regressions with M2 as the proxy for money supply are represented (Figure 4.2).

If time series have different orders of integration, there can be no long-run relationship and no cointegration (Rapach and Wohar, 2002). It is found that first differences of all variables have negative and significant DF statistics (Table 4.2). Thus in order to test the order of integration, the DF test for unit roots is used to test the stationarity (Table 4.8). Following that is the testing for cointegration among variables for the absolute PPP, the relative PPP and the monetary model. Since the RID model incorporates short-run influences, only the FPM model can be tested in a long-run setting.

To test if there is no cointegration, the Engle and Granger two-steps methodology requires the standard tests of unit root be applied to residuals of the cointegrating regression. If there is no integration, all linear combinations of the integrated series will have a unit root. To be cointegrated, the residuals of the cointegrating regression need to be stationary. If it is not stationary, the second order difference must be tested. Thus, cointegration tests are performed on the absolute PPP, the relative PPP and the FPM models as:

$$s_t = \alpha_1 + \alpha_2(p_t - p^*_t) + \mu_t \quad (4.25)$$

$$\Delta s_t = \beta_1 + \beta_2(\Delta f_t - \Delta f^*_t) + \varepsilon_t \quad (4.26)$$

$$s_t = \gamma_1 + \gamma_2(m_t - m^*_t) + \gamma_3(y_t - y^*_t) + \gamma_4(\Pi e_t - \Pi e_t^*) + \eta_t \quad (4.27)$$

Cointegration requires that the residuals in the above equations be stationary where the result supports cointegration for the relative PPP and FPM, but not for the absolute PPP (Johansen, 1991). Since both s_t and $(p_t - p^*_t)$ are integrated to order one, it would normally imply that the error term is white noise.

Therefore, a long-run relationship between the exchange rate and relative prices cannot be concluded. However, the unit roots tests are rejected for the relative PPP and FPM models. The cointegrating regressions yield negative and significant DF test statistics at 10 per cent of significance.

This implies that the relative PPP holds in the long run and there is a long-run relationship between variables of the FPM model. It is found that the estimation of both equations yielded low DW statistics, implying that the two models do not capture the short-run fluctuations well. Since it is cointegrated, the ECM for the relative PPP and FPM models can be used to demonstrate the short run dynamics. The ECMs for both of these models in (I) and (II) (Table 4.5) are statistically significant.

In the case of the ECM for the relative PPP model, it is negatively signed and quite significant (-0.73262) while that of the monetary model is also negatively signed but smaller in magnitude (-0.14788). The R^2 of the ECMs are high: 0.8605 and 0.8621 for the relative PPP and the monetary model respectively. The estimated DW statistic in the ECM for the relative PPP model is 1.7073 . The critical values for 44 observations and 2 explanatory variables are $dL = 1.266$ and $dU = 1.400$ at 1 per cent level of significance, and thus the estimated value of 1.7073 is above 1.401 and therefore it is found that no positive autocorrelation exists.

Likewise, the DW statistics for the ECM of the monetary model is 1.6553 , while the critical values are $dL = 1.204$ and $dU = 1.457$, thus it is found that there is no positive autocorrelation. The DW statistics improved significantly for the ECM as compared to the initial regressions (Table 4.6). The data series for the period 1990-2000 do not correspond to the predictions of the FPM model. It yields negatively signed and

significant coefficients for the relative money supplies and relative income in the OLS assessment (Table 4.5).

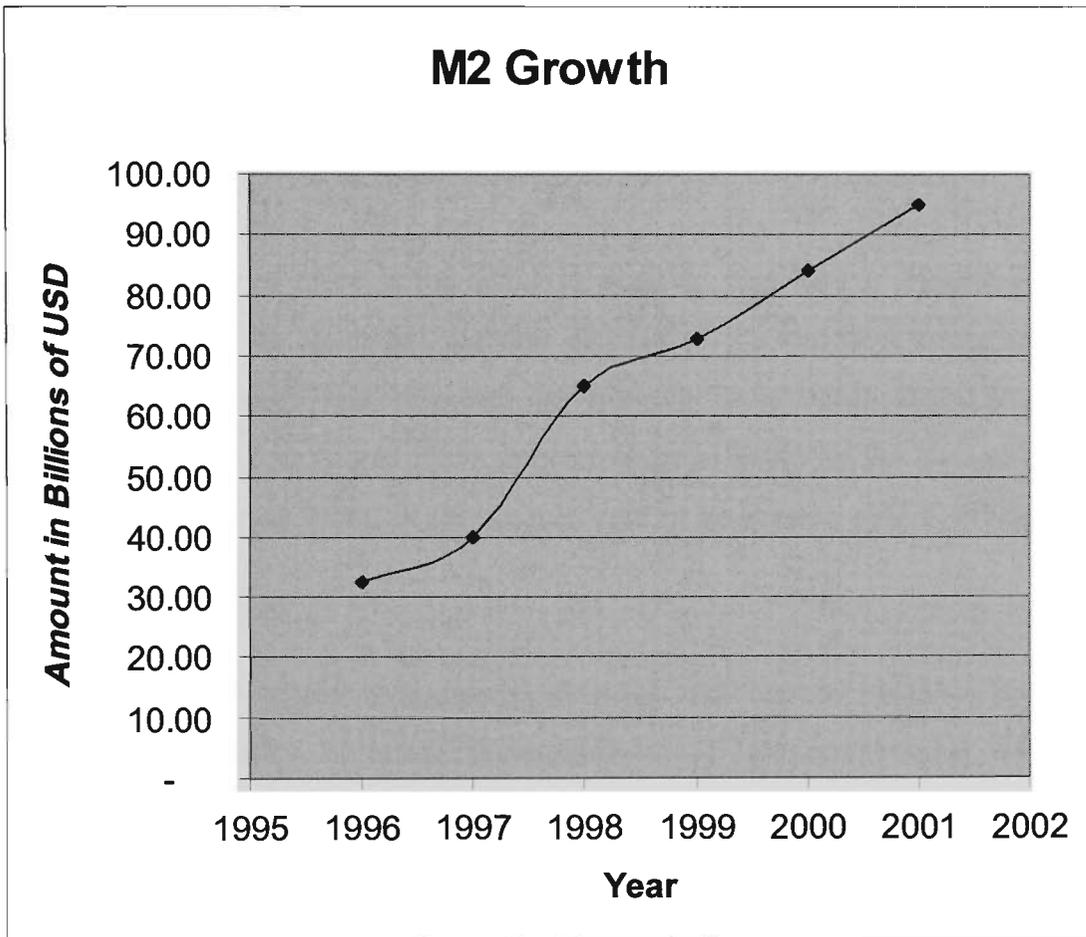
One likely reason for the negatively signed relative money supply is that the money supply in Indonesia may be endogenously determined. This is the case as the Indonesian government decided to target the exchange rate and through Bank Indonesia intervened in the money market by buying USD and selling rupiah in order to bring liquidity back into the system. As a result, Bank Indonesia lost control of the money supply because it is endogenously determined.

Another consideration could be that of lessening the unitary elasticity constraint of the money differential combined with equal and opposite signed elasticity on real output which may in fact progress the estimation results. Nevertheless, empirical evidence on this issue is not encouraging (Radaelli, 1988).

It is also likely that there may be financial shocks that affect the demand for USD during the period 1990-2000, resulting in an unsteady demand for USD that violates the implicit hypothesis of stable money demand in the monetary model. Thus, it seems that even though all variables in the monetary model are cointegrated with the exchange rate, its correlation may not be as straightforward as the monetary model suggests (Mussa, 1986).

Cointegration confirmed long run relationship between the variables in the relative PPP model. Not only are the estimated coefficients correctly signed but also significant with a high R^2 . The ECM of the relative PPP model is correctly signed as well as statistically significant. Thus, the rupiah/USD exchange rate is consistent with the relative version of the PPP. This suggests that the movement of the rupiah/USD has not deviated from the PPP equilibrium.

Figure 4.2:
Money Supply (M2), Indonesia



Source: Bank Indonesia.

To have no cointegration, the Engle and Granger two-step methodology requires that the distinctive tests of the unit root be applied to residuals of the cointegrating regression (Table 4.2). Table 4.6 shows the estimation of the Johansen procedure and typical statistics. In determining the number of cointegrating vectors, it uses the degrees of freedom adjusted version of the maximum Eigenvalue and trace statistics, since for small samples with too many variables or lags, the Johansen procedure tends to over estimate the number of cointegrating vectors (Cheung and Lai, 1993a).

The likelihood ratio test statistics also show the importance of the variables in the long run equilibrium (Table 4.7). The interest differential has a positive sign, which indicates that an increase in the Indonesian interest rate relative to the US interest rate leads to an appreciation of rupiah. This finding implies a very rapid rate of price level correction. The inflation differential has a positive sign, indicating that an increase in the inflation relative to that of US leads to a depreciation of the domestic currency.

Finally, the relative price variable has a positive sign and is statistically significant. Table 4.6 shows the estimated reaction of each of the variables to the error correction terms. The exchange rate responds by moving to decrease the disequilibrium. An adjustment to the conditional mean appears to be affected by the changes in the interest rate. Therefore, an increase in the interest rate is associated with a strengthening of the currency.

When the money supply is increased, domestic real money balances increase as well, since prices are sticky. To restore the equilibrium of the money market, domestic interest rates must fall. Nevertheless, since uncovered interest parity must hold, the exchange rate must be appreciated over time, even though in the long run the exchange rate must be depreciated relative to its initial value (Meese and Rogoff, 1983).

However, MacDonald and Taylor (1994) also mentioned a strong evidence of long run relationship is obtained so that over long horizons, exchange rates appear to be related to monetary fundamentals. It is found that monetary factors affect the exchange rate, out-predicting a random walk at horizons of three years or more. In this case, it is also observed that univariate structural models do not usually out perform a random walk in out of sample simulations.

From Table 4.4, the results support the cointegration for the relative PPP and FPM models, but not for the absolute PPP model. Since both s_t and $(p_t - p^*_t)$ are integrated to order one, it would imply that the error term is white noise. Thus, a long-run relationship between the exchange rate and relative prices cannot be concluded.

However, the unit roots tests are rejected for the relative PPP and FPM models. Thus, it implies that the relative PPP holds in the long run and there is a long-run equilibrium between variables of the FPM model. Also from Table 4.4, the estimation yields low DW statistics, implying that the two models do not accurately capture the short run fluctuations.

Table 4.2:
Engle-Granger Test

$s_t = \alpha_1 + \alpha_2(p_t - p^*_t)$		PPP
α_1		-0.308
α_2		-1.081
DW		0.064
ADF		-1.587
$s_t = \alpha_0 + \alpha_1(p_t - p^*_t)$		FPM
α_0		-6.550*
α_1		1.512
DW		0.084
ADF		-3.003*

Note: * indicates significant constants to be included.

Table 4.3:
Tests for Unit Roots

Variables	I(0)	I(1)
s_t	0.007301	-6.5005*
$p_t - p^*_t$	-0.512161	-5.4062*
$m_t - m^*_t$	-0.80082	-4.7734*
$y_t - y^*_t$	1.4753	-8.7188*
$r_t - r^*_t$	-1.0347	-7.3376*
$\Pi e_t - \Pi e^*_t$	-1.5452	-5.0524*

Note: * indicates that statistic is statistically significant at 10% level (critical value is -2.60)

Table 4.4:
Cointegration; Rupiah and Fundamental Variables

<p>OLS:</p> $s_t = \alpha_1 + \alpha_2(p_t - p^*_t) + \mu_t$ $s_t = 0.50420 + 0.64860(p_t - p^*_t) + \mu_t$ <p style="text-align: center;">(38.766) (9.270)</p>
R² = 0.5236
DW = 0.0886
DF Stat = -1.2852
<p>OLS:</p> $\Delta s_t = \beta_1 + \beta_2 (\Delta f_t - \Delta f^*_t) + \varepsilon_t$ $\Delta s_t = 0.0067605 + 1.1565(\Delta f_t - \Delta f^*_t) + \varepsilon_t$ <p style="text-align: center;">(1.2477) (21.111)</p>
R² = 0.8287
DW = 1.5547
DF Stat = -5.5560*
<p>OLS:</p> $s_t = \gamma_1 + \gamma_2(m_t - m^*_t) + \gamma_3(y_t - y^*_t) + \gamma_4(r_t - r^*_t) + \gamma_5(\Pi e_t - \Pi e_t^*) + \eta_t$ $s_t = -0.52028(m_t - m^*_t) + 0.22812(y_t - y^*_t) + 0.0031057(\Pi e_t - \Pi e_t^*) + \eta_t$ <p style="text-align: center;">(-12.007) (16.411) (1.0277)</p>
R² = 0.8320
DW = 0.7144
DF Stat = -2.8079*

Notes: t-statistics are in parentheses; * indicates that the unit root hypothesis is rejected at 10% significance level (critical value is -2.60).

Table 4.5:
ECM for the Relative PPP and Monetary Models

(I) ECM: Relative PPP Model
Cointegrating Vector:
$\Delta s_t - [0.0067605 + 1.1565 (\Delta f_t - \Delta f_t^*)] = RES_t$
ECM :
$\Delta^2 s_t = 1.1213 \Delta (\Delta f_t - \Delta f_t^*) - 0.73262 RES_{t-1} + \mu_t$ (-0.73262) (-5.5761)
R² = 0.8605 ; DW = 1.7073
(II) ECM :FPM Model
Cointegrating Vector:
$s_t - [-0.52028(m_t - m_t^*) + 0.22812(y_t - y_t^*) + 0.0031057(\Pi e_t - \Pi e_t^*)] = RES_t$
ECM :
$\Delta s_t = -0.0014260 - 0.20020 \Delta (m_t - m_t^*) + 0.081520 \Delta (y_t - y_t^*)$ (-1.0768) (-3.0172) (1.5753)
$- 0.0002415 \Delta (\Pi e_t - \Pi e_t^*) - 0.14878 RES_{t-1} + \mu_t$ (-0.14788) (-1.5784)
R² = 0.8621 ; DW = 1.6553

Note: t-ratios are in parentheses.

Table 4.6:
Cointegration Test Results, 1990Q1–2000Q4

Eigenvalue	Likelihood Ratio	1% Critical Value	Hypothesized Number of Cointegrating Equations
0.3347	84.16	65.06	0
0.1180	35.18	43.35	1
0.1734	14.56	24.54	2
0.0688	7.63	19.03	3
0.0116	1.71	5.54	4

Note: The likelihood ratio test indicates one cointegrating equation at 1% significance level.

Table 4.7:
Johansen Test for Indonesia

$r \leq 2$	$r \leq 1$	$r = 0$	α_1	α_2	p_t	p^*_t
1.748	8.463	34.771	-2.172	1.237	3.0458	12.172
(0.081)	(0.211)	(0.007)*	(0.460)	(0.161)	(0.081)*	(0.001)

Notes: The specified VAR model is accurate, which is verified by stable forecasts, non-appearance of autocorrelation and low variance of the estimated covariance vector. Its value equals to (1, -2.172, and 1.237) with valid symmetry provision. The ADF statistics for cointegration residuals is -3.003. The conclusion is not to reject the null hypothesis of cointegration between the adjusted data on Indonesia.

Table 4.8:
Stationarity

	Level [I(0)]	First-Difference [I(1)]
e	1.0100 (2)	-4.7066 (2)
CPI-INDO	1.1422 (4)	-2.8140 (4)
WPI-US	1.3121 (3)	-2.6685 (3)

Notes: All variables are in log-forms. Numbers in the parentheses capture the number of lags based on the akaike information criteria (AIC). The McKinnon critical values for rejection of hypothesis of a unit root at 10%, 5%, and 1% levels of significance are -1.51, -1.83, and -2.48.

Conclusion

In summary, a long-run relationship between the exchange rate and relative prices cannot be concluded for Indonesia. However, the unit roots tests are rejected for the relative PPP and FPM models. Thus, it implies that for Indonesia, the relative PPP holds in the long run and there is a long-run relationship between variables of the FPM model.

The exchange rate for rupiah, responds to the error correction term by moving to decrease the disequilibrium. Here, any adjustment to the conditional mean appears to be affected by changes in the interest rate. Therefore, an increase in the interest rate is associated with a strengthening of the currency.

When the money supply is increased, domestic real money balances increase as well, since prices are sticky. To restore the equilibrium of the money market, domestic interest rates must fall. However, since uncovered interest parity must hold, the exchange rate must be appreciated over time, even though in the long run the exchange rate must be depreciated relative to its initial value.

The monetary model has been preferred since the end of the Bretton Woods period. The model states the existence of a long-run equilibrium relationship among relative money supplies, relative income levels and the nominal exchange rate although other variables are often included. However, there is no strong evidence beyond reasonable doubt that the nominal exchange rate can be determined and forecast on the basis of monetary fundamentals (Mark and Sul, 2001).

Arguably, many economists have tried without success to capture the fundamentals that lead to fluctuating exchange rates. One such affect is the PPP model which represents the classical monetary case, where national price levels are linked by the nominal exchange rate. Another is the monetary model which seeks to clarify movement of the exchange

rate in relation to relative money supplies while assuming that non-money assets are perfect substitutes (Rogoff, 1996).

The PPP and monetary models are the two most fundamental models of exchange rate determination. Since the exchange rate policy in Indonesia is focused primarily on maintaining low inflation levels, an empirical test of the exchange rate for rupiah with respect to the PPP, will reveal whether deviations from it has occurred during the current instability of rupiah.

The monetary model traces movements in the exchange rate by examining monetary variables, with the critical assumption that PPP is maintained between countries. The question is whether the appreciation of rupiah is mostly related to monetary variables such as money supply. Although it seems usual to assume that all equilibrium interactions are met, it is believed that the monetary model is unlikely to hold at each point in time, and thus should be viewed as a long-run model of exchange rate determination (Mussa, 1986).

The non-stationary exchange rate suggests that a long-run PPP between USD and rupiah should be rejected. The availability of the length of the time series allows a better investigation on the two models in a long-run setting, where exchange rates are the average period of market exchange rates. However, an exchange rate in the short run would deviate from the PPP mainly due to three disturbances that are: actual and expected inflation, barriers to trade, and shifts in international movements of capital.

Empirical tests using the Indonesian data of the well known financial and economic exchange rate models show that neither the monetary model nor the PPP model can explain the exchange rate behavior and its determinants in Indonesia over time. An alternative model, namely the shadow price exchange rate model, will be discussed in the next chapter.

CHAPTER 5

SHADOW PRICE OF EXCHANGE RATE MODEL

5.1. Introduction

The shadow price of exchange rate (SPER) is essential not only because of its relevance to cost-benefit analysis but also because it is critical in determining the full effect of any exogenous change, which equals the impact effect multiplied by the appropriate shadow price of exchange rate factor.

The determination of the SPER requires specification of a model of the monetary economy, in contrast to the real models where foreign exchange plays no role. Corden (1994) developed a monetarized version of the basic exchange model of international trade, largely for the reason of investigating the consequence of the exchange rate variations on the balance of payments position of a country.

Under a fixed exchange rate regime, the SPER is strictly greater than the official exchange rate if quotas or voluntary export restraints are in force, as long as imports are normal and the equilibrium in the economy is steady as mentioned by Bacha and Taylor (1971). This result is shown by developing explicit formulas for the true SPER under tariffs and quotas.

In this case, the SPER is estimated using the parameter estimates obtained by an approximate maximum likelihood procedure. Moreover, the model facilitates a sequential cut, in order to focus on the estimation of the parameters necessary to estimate the shadow price of exchange rate at the various observation dates. After assessing the SPER at the various parameter estimates, then it needs to analyze whether macroeconomic

variables can clarify the observed path of the difference between the shadow exchange rate and the managed exchange rate.

5.2. SPER Model

Indirect taxes and subsidies are not the only reason economic and financial prices diverge. Market structures, with monopolized supplies or monopolized stocks, also have a tendency to maintain national price levels at higher levels than world prices. The extent to which the exchange rate is overvalued is relative to the sum of government and market effects on domestic price levels relative to the level of world prices. To account for these effects on the foreign exchange rate, the economic or the shadow price of exchange rate (SPER) model is essential to be estimated.

The SPER model is the weighted average of the demand price of foreign exchange paid for by importers and the supply price of foreign exchange received by exporters. Import tariffs and subsidies have the same effect on the foreign exchange rate, as would consumption taxes and subsidies on the price of a nontradable. Likewise, export taxes and subsidies have the same effect as production taxes and subsidies (Chao and Yu, 1995).

A further important dissimilarity between economic and financial prices therefore stems from the foreign exchange premium. This premium is given by the percentage difference between the SPER and the official exchange rate (OER). The foreign exchange premium is in effect a tax paid by exporters to importers. Neary (1988b) showed that the SPFE model under the tariffs and/or quotas restrictions is stated as:

$$E_u du/dT = e + (p - ep^*)(dQ/dT) \quad (5.1)$$

where:

- E = the expenditure function
- u = social utility
- T = exogenously determined amount of foreign exchange thru foreign transfer
- E = the official rate of foreign exchange
- p (p*) = the relative domestic (foreign) price of good X
- Q = the import of good X

Apparently, the SPER model differs from the OER by an amount determined by the price discrepancy under a tariff, whereas the two exchange rates coincide under quota as discussed by Bertrand (1974). The preceding standard results are in need of revision in the presence of factor-market distortions, which cause a hold between the relative goods price and the marginal rate of transformation, hence $pdX + dY$. In this case $pdX + dY \neq 0$.

Here the SPER model is modified to be:

$$E \, du/dT = e + (p - ep^*)(dQ/dT) + [p(dX/dT) + dY/dT] \quad (5.2)$$

The formula for calculating the SPER model under tariffs and quotas, using the transformation relation and the budget constraint is stated as:

$$E(p,u) = (pX + Y) + (p - ep^*)Q + eT \quad (5.3)$$

Thus:

$$E_u du = -b_s Q dp + (p - ep^*)dQ + edT \quad (5.4)$$

where $s = (p/Q)(dX/d_p)$ is the substitution in production in reaction to a change in p . For a small open economy, a tariff pins down the domestic relative price of importables, and affects the volume of trade. A quota, likewise, endogenously determines the domestic

relative price of importables. Applying the Neary's stability condition, the price-output response is normal ($dX/dp > 0$) for the case of intersectoral capital mobility.

In this case, by differentiating the market equilibrium condition:

$$Q = E_p(p, u) - X \quad (5.5)$$

yields:

$$E_{pu}du - (c + s)(Q/p)dp = dQ \quad (5.6)$$

where:

$$E_{pu} = \partial E_p / \partial u > 0 \text{ and} \quad (5.7)$$

$$c = (p/Q)(\partial E_p / \partial p) > 0 \quad (5.8)$$

which describes the consumption substitution for a given level of utility. For a given tariff rate, t the domestic price ratio is $p = e(1 + t)p^*$, while it is obvious that $dp/dT = 0$.

As noted by Chao and Yu (1995), the tariff multiplier captures the amplifying effect of a shift in the foreign transfer on the import demand for a given tariff. By contrast, the domestic goods price is endogenously determined under quotas. The induced shift in the goods price affects labor allocation, and hence the labor market distortions play a key part in determining the SPER. For a given quota, the SPER model can be obtained as:

$$E_u(d_u/dT) = e/[l + sm_b/(c+s)] \quad (5.9)$$

When the quota becomes prohibitive ($Q = 0$), the elasticity c and s become infinite. The OER is frequently normalized to be equal to unity and under an import quota; the SPER is greater (smaller) than its OER with sector-specific capital.

In the case of quotas, the receipt of a transfer alters the relative price of importable (X) so that the transfer can stimulate an efficiency gain or loss depending upon the nature of the distortion. The foreign transfer raises the domestic relative price of X and generates an efficiency gain as the output of manufactures rises. This gain is additional to the initial gain due to the receipt of the transfer itself. Here, the SPER is larger than the OER. However, in the case of a quota, it may not be larger than the OER.

The availability of an additional foreign exchange raises the domestic demand for good X by the amount of m . Under a quota restriction, the excess demand pushes up the price of X . Thus, $dp/dT = em/Q[c + s(1 + m_b)] > 0$. The higher price of X leads to more output of X by utilizing previously unemployed workers, thereby generating social benefits where capital is sector-specific.

However, with capital mobility, the increased production of X induces capital to move from agriculture to manufacturing accompanied by labor migration from rural to urban areas. This results in greater unemployment, which works to ease the value of foreign exchange relative to its official rate.

The receipt of a transfer in the presence of a quota raises the relative price of the manufactured good. With a normal output-price response, the transfer causes a further rise in the output of an already overproduced manufactured product; thereby inducing an efficiency loss (Scott, 2002). Hence, the value of a unit of foreign exchange is reduced by the amount of the efficiency loss with the SPER being less than the OER in both cases of quotas. The distortion does not affect the SPER model in the case of tariffs and quotas.

Furthermore, with sector-specific capital, the SPER can be greater with a quota than with a tariff, therefore, it is useful to compare the SPER between tariffs and quotas (Neary,

1988b). The lower the distortion and the greater the substitutability in supply relative to the demand, the more likely the SPER under quotas exceeds that under tariffs. However, with inter sectoral capital mobility; the SPER is unambiguously larger under tariffs than quotas.

In this case, Chao and Yu (1995) showed that in a developing economy such as Indonesia with trade restrictions and labor market distortions, the SPER is greater than the OER in the presence of tariffs. Here the SPER model is shown as:

$$SPER = ae/[1 - ms/(1 + tr)] \quad (5.10)$$

where:

ae = the actual official exchange rate;

tr = the tariff rate; and

ms = the marginal propensity to spend on manufacturing goods, and $0 < ms < 1$.

The consumption function is then specified as:

$$C_t = \alpha_0 + \alpha_1 Y_t + \alpha_2 C_{t-1} \quad (5.11)$$

where:

C_t = the per capita household consumption;

Y_t = the per capita GDP; and

C_{t-1} = the lagged consumption.

According to Chao and Yu the tariff rate tr is computed as the ratio of tariff revenues to imports. The consumption function is then specified as:

$$C_p = \gamma_0 + mY_t + \gamma_1 P_t + \gamma_2 C_{t-1} \quad (5.12)$$

where:

C_p = consumption in constant prices;
 Yn_t = national income in constant prices;
 C_{t-1} = lagged consumption in constant prices; and
 P_t = the price of goods.

It shows that the SPER is greater than the OER in the presence of tariffs, whereas it is greater or smaller than the OER in the presence of quotas, depending upon whether capital is sector-specific or completely mobile. Furthermore, the SPER is clearly smaller than the OER when capital is intersectorally mobile. The rate, however, may be larger than the OER when capital is sector-specific (Naqvi and Wiener, 1991).

Neary (1988b) has also shown that with constant returns to scale, the SPER equals the OER under quotas and is greater (smaller) than the OER in the presence of tariffs. Subsequently, it is found that with increasing returns to scale, the formula for computing the SPER model in the presence of tariffs remains unchanged, whereas the SPER under quotas can be different from the OER.

An important feature of the model is that there is an inverse correlation between the interest rate spread and the SPER given knowledge of all the other state variables in the economy. The interest rate spread is a function of the SPER and hence, it is written as a function of the interest rate spread (Bacha and Taylor, 1971).

5.3. Shadow Price of Exchange Rate Factor

The degree to which the exchange rate is overvalued or undervalued is proportional to the effect of market distortions on the domestic price level relative to the border price level. To take account of the effect of market distortions on the market price for foreign exchange, the shadow price of exchange rate (SPER) factor is estimated. The SPER factor is the ratio of SPER to the official exchange rate (OER), with the SPER has the

weighted average of the demand price of foreign exchange paid by importers and the supply price of foreign exchange received by exporters (Naqvi and Wiener, 1991).

The SPER factor is often estimated as the ratio of the value of traded goods and services at the domestic price level to the value of traded goods and services at the border price level. Where tariff distortions represent the only distortion to trade and there are no distortions in factor or commodity prices, the SPER can be approximated by the demand price given by multiplying the OER by the SPER factor, calculated as one plus the weighted average tariff rate.

For example, if the weighted average tariff is 14 per cent, the SPER factor would be *1.14* and the SPER would be the market exchange rate multiplied by 1.14. Tradables which are valued at the border price level simply are revalued to the domestic price level by multiplying by the SPER factor of *1.14*. Alternatively, if the unit of account for the economic analysis were denominated at the border price level, non-tradable would be converted to the border price level by multiplying by the reciprocal of the SPER factor or the standard conversion factor (SCF).

Traditionally, the SPER factor has been based on the ratio of the value of traded goods and services at domestic prices to their value at border prices. When tariffs represent the main distortion in the market for foreign exchange, the SPER factor is then calculated by the formula of one plus the weighted average tariff rate. These approaches assume that the country's current account is sustainable and this is not always the case.

5.4. Shadow Price of Exchange Rate for Indonesia

Indonesia has long been experiencing trade deficits sustained in the long run by capital inflows such as foreign investment and development aid as well as remittances of overseas contract workers, and draw downs of foreign exchange reserves. The shadow

price of exchange rate has been estimated for Indonesia for illustration purposes, as presented in Table 5.1.

5.5. Data Requirements and Adjustments

5.5.1. Price Responsive Imports

The total import value, converted from USD to rupiah using the average estimation on the official exchange rate (OER), is obtained from Indonesian Ministry of Trade. Adjustments in the total imports' values at price-responsive imports included special transactions and goods on consignment (standard trade commodity classification (STCC)), which are eventually re-exported. To determine what other sectors are non price responsive to the foreign exchange rate, regression analysis was conducted on the seven year data of the USD/rupiah rates and imports by STCC. All sectors show price responsiveness to the USD/rupiah rate movements.

5.5.2. Price Responsive Exports

The relevant deductions from total export included special transactions and goods on consignment, re-exports, and other non-responsive exports. In this case re-exports are defined as exports of imported goods that do not endure physical transformation in Indonesia.

Using regression analysis on seven year data of 1990-1997 on the official USD/rupiah rates and exports, two sector classifications are found not to be unresponsive to the USD/rupiah movements. These are: crude materials, excluding fuel, animal, vegetable oils and fats, while the second sector includes logs, rattan, plywood and veneer in which the exportation of it is fairly regulated, though in some cases the effects of illegal logging and smuggling in Indonesia could have some influence.

5.5.3. Import Tariffs

Any special transactions and goods on consignment are to be considered duty free since the international tariff and customs code (ITCC) allows reimbursement or tax credit on such imports. It is applicable to the duties paid on imported articles used in the manufacture of export products, provided that the exportation is made within one year after the importation of the raw materials. The import tariffs used also include the relevant value added tax on imported goods.

5.5.4. Quantitative Restrictions on Imports

Among the regulated commodities are: the importation of petroleum products; coal and coal derivatives; rice and corn; motor vehicles, spare parts, components; used trucks; and automobile tires. Generally, obtaining import permits is not a restriction to a free importation. For example, on coal and coal derivatives, the tariff equivalent does not deviate very much from the prescribed tariff rate because of a policy linking the domestic price of coal to its import price. Since its tariff equivalent approximates the tariff rate, the effect of quantitative restrictions on its importation is simply ignored.

5.5.5. Export Taxes and Subsidies

Even though an export tax is levied on exports of logs, lumber, veneer and plywood, this is not included in the estimation of the average tax rate since the related export values have already been deducted from total exports.

5.5.6. Quantitative Restrictions on Exports

Furthermore, the estimation of the SPER includes the effects of trade restrictions on the exports of petroleum products (Table 5.2). Any export of petroleum products requires permits from Indonesian Department of Energy to ensure that the exportation will not

lead to any shortages in local supply. Indonesia is an oil producing country, but with a surge in local consumption, petroleum exports have been reduced significantly. Here, the large export tax equivalent is accounted for by the high domestic excise tax rates on related petroleum products.

Table 5.1:
Economic Price of Rupiah/USD, 1997 (monthly average)

Items	Variables/ Equations	Unit	Value (USD'000)
Total imports	I	million	587,017
Special transactions	SI	million	201,783
Other non-responsive imports	NI	million	0
Net Imports	$dI=I-SI-NI$	million	385,234
Total exports	E	million	345,070
Special transactions	ST	million	213,234
Re-exports	RE	million	3,670
Other non-responsive exports	NE	million	23,251
Net exports	$dE=E-SE-RE-NE$	million	104,915
Trade deficit	$dD=dI-dE$	million	281,133
Import tariffs	IT	million	80,304
Net tariff	NR	million	5,762
Import tariff rate	$t_i=(IT+NR)/dI$		0.22
Export taxes	ET	million	0
Net tax	NT	million	26
Export subsidies	ES	million	0
Export tax rate	$t_e = (ET+NT-ES) / dE$		0.00025
Elasticity of supply	e_s		1.78
Elasticity of demand	e_d		-1.74
Weight on supply	$W_s = e_s / [e_s - \{ed*(dI/dE)\}]$		0.22
Weight on demand	$W_d = -\{ed*(dM/dX)\} / [e_s - \{ed*(dM/dX)\}]$		0.68
Official exchange rate	OER (Average)	Rupiah/USD	5225.31
Shadow price of exchange rate	$SER = W_s*OER*(1-t_e) + W_d*OER*(1+t_i)$	Rupiah/USD	6121.68
SPER factor	$SERF = SER/OER$		1.17
Standard conversion factor	$SCF = OER/SER$		0.85

Sources: Indonesian Bureau of Statistic and Author's estimates.

Table 5.2:
Tariffs Equivalent to Quantitative Restrictions, 1990-1997 (average)

Items	CIF USD 000	Imports Volume	Unit	Domestic	Prices (CIF)	Price/unit	Equiv. (%)	Tariff TCC rate (%)	Spec. duty	Tariff equivalent
Coal	40,025	1,002	000 mt	1,199.99	965.26	Price/mt	21.8	19	+ Price/li	1,083.47
Diesel	303,847	13,561	000 bbls	5.35	2.46	Price/li	80.0	19	+ Price/li	181,112.53
Fuel oil	196,608	6,303	000 bbls	1.54	1.31	Price/li	8.6	9	+ Price/li	-395.10
Kerosene	14,130	646	000 bbls	5.36	2.74	Price/li	66.8	19	+ Price/li	3,240.46
Gasoline	37,432	1,321	000 bbls	8.32	3.37	Price/li	109.6	19		25,244.57
Avgas	914	23	000 bbls	12.2	5.39	Price/li	108.0	19		679.06
LPG	66,300	3,204	000 bbls	4.15	1.59	Price/li	101.4	9		35,247.46
Total USD'000	574,813									259,053.19

Source: Indonesian Department of Energy.

Table 5.3:
Export Tax Equivalent to Trade Restrictions

	FOB (USD' 000)	Exports Volume	Unit	Domestic	Prices (FOB)	Price/un it	Export Rate Equiv.	TCC Tax (%)	Net Tax Equiv.
Fuel oil	8,954	914	000 bbls	1.54	1.52	Price/li	61.8	0	570.49
Regular gas	903	40	000 bbls	7.84	2.60	Price/li	130.4	0	57.99
Total, (USD' 000)	9,868								

Source: Indonesian Department of Energy.

5.5.7. Shadow Price of Exchange Rate Estimation

Finally, the result of the shadow price of exchange rate (SPER) estimation for rupiah is shown in the following Table 5.4. Based on the 1997 observation of rupiah, it is found that SPER factor yields 1.17, along with its equivalent SCF of 0.85. In a less developed economy like Indonesia, the distribution of factors on the basis of market prices is defective because of the existence of fundamental disequilibrium in the whole economy. This standard conversion factor will help to minimize the impacts of these trades and tariff distortions that directly affect the financial market, including the foreign exchange rate market.

Table 5.4:
SPER Factor, Rupiah/USD, 1997 (monthly average)

Indonesia	Balanced Trade
Sustainability	99%
Monthly average official exchange rate (1997)	5225.31
Shadow price of exchange rate (SPER)	6121.68
SPER factor	1.17
Standard conversion factor (SCF)	0.85

Source: Author's estimates.

Moreover, in almost all developing countries the factor price distortions resulting in wage rates exceeding the social opportunity cost of labor and interest rates. This could be viewed as under estimating the social opportunity cost of capital resulting in the widespread phenomenon of unemployment, underemployment, and excessive capital intensity of industries and high technologies.

Conclusion

Financial price is different from the economic price. The financial price of an exchange rate is its supply price and the economic price of an exchange rate is its demand price. The major difference between economic and financial prices is therefore made up of indirect taxes and subsidies. Many financial analysts have been calculating what is claimed to be the shadow price of foreign exchange. In fact, it is the social value of the receipt of a unit of goods from abroad, typically obtained from real models.

The shadow price of exchange rate (SPER) is defined as the economic price of a foreign currency. It reflects the price that indicates the intrinsic or true value of a factor or product in the sense of an equilibrium price and may deviate from the market price. In the presence of tariffs, the shadow price of foreign exchange is greater than its official exchange rate (OER) and the formula for its calculation is identical to that of a full employment economy with or without constant returns to scale.

In general, there is a widespread misconception that under a free floating regime for foreign exchange, the SPER is equal to the market exchange rate. That would be the case only: if there are no taxes and subsidies on the demand and supply of tradable goods; if all commodities and factors were priced at their economic value; and if the current account deficit is sustainable.

According to Naqvi and Wiener (1991), the use of the SPER stems from the clear fact that the actual market price does not reflect social benefits and social costs. Some are free, but directly influenced by restrictive practices or monopolies, and there are others that are mostly influenced by quantitative controls.

Using the SPER factor estimation based on the 1997 period of observation, the SPER for Indonesia diverges from the OER due to the fact that it has taken into account trade distortions that normally exist in less developed countries such as Indonesia. In this case

it has been found that the shadow price of rupiah for 1997 (monthly average) was 6121.68 per unit of USD, while the monthly average of the official exchange rate was 5225.31 per unit of USD. This difference is a sign of misalignment on rupiah, which will be discussed in the following chapter.

CHAPTER 6

TIME SERIES ANALYSIS AND MISALIGNMENT

6.1. Introduction

Time series analysis can provide useful information about the behavior of the exchange rate required for its determination in a particular economy. This kind of data can be useful to estimate exchange rate misalignments that can have serious consequences for the financial well being of a country. Any large under valuations can lead to a buildup of foreign debt and an erosion of the inducement to invest in the tradable goods industries, which may make it increasingly more difficult and costly to adjust the balance of payments when the need arises.

Such misalignments can have all the negative effects that were most notably evident in Indonesia in late 1997 and early 1998. Among the consequences are an increased real value of the foreign currency debt and the inflationary effect of high import and export prices in domestic currency (Williamson 1985).

All of the Southeast Asian currencies went through a period of instability shortly after beginning their float. Tobin (2000) mentioned that there is virtually a complete lack of market expectation that the exchange rate will revert toward equilibrium levels within any time horizon relevant to market participants. In general, floating exchange rates have repeatedly led to the emergence of large misalignments.

While exchange rate bands do not normally have full credibility, and sometimes lack any credibility at all, the evidence shows that when a rate moves within a band the forward rate normally changes by less than the spot rate, indicating that the market expects that

the spot rate will be inclined to revert back toward the center of the band (Svensson 1994). This is the primary reason for preferring a band system rather than allowing the exchange rate to float without limits.

Although the lack of statistical data on currencies with a managed floating regime precludes any strong assertions, the managed float is more efficient than the free float in avoiding misalignments, which is usually one of the major objectives of management. On the other hand a fixed exchange rate does not guarantee an absence of misalignments.

Generally, inflation in the country whose currency is being used as a peg can lead to the progressive emergence of over valuation or under valuation, which has been a frequent cause of crises. Any real shocks, such as large and long run changes in terms of trade can also lead to exchange rate misalignments.

6.2. Krugman Analysis

The Krugman model is a continuous time model, and there have been many attempts to fit it to various daily exchange rate series using the simulated method of moment (de Jong, 1994). Another method or model, the discrete-time approach (Bekaert and Gray, 1998), has been designed to model the conditional distribution of the exchange rate within a target zone.

The Krugman model itself has been tested in different ways in many empirical situations, and a general observation shows that it has failed to sufficiently characterize the movements of exchange rates in a target zone. The following continuous-time model for the exchange rate is:

$$s = f + \alpha E\{d_s d_t | F_t\} \quad (6.1)$$

where $f = m + v$ is the so-called fundamental and $E\{d_s d_t | F_t\}$ is the expected change of the exchange rate at time t given the information set F_t . The fundamental consists of two components: m represents the policy instruments that the central bank controls, and v contains all the other factors that affect the exchange rate. If there is no currency band and the currency floats freely, the central bank does not intervene ($m = 0$) and $f = v$.

Krugman (1996) assumed that there exists a target zone, $sL \leq s \leq sU$, and that the authorities intervene through m when the exchange rate reaches either boundary value sL or sU . When the exchange rate lies near either boundary, the probability of the exchange rate moving towards the center is supposed to be higher than the likelihood that it moves even closer to the boundary.

Furthermore, this also shows a joint modeling of the conditional mean and the conditional variance of the exchange rate in a target zone. Thus, it considers the whole conditional distribution of the first difference of the exchange rate. As the result a simplified form of the model of Δs_t has the following form:

$$f(\Delta s_t | F_t) = \Phi \mu \Delta s_t - m_t \quad (6.2)$$

where:

Φ = the cumulative distribution function of a standard normal variable;

m_t = the conditional mean; and

h_t = the conditional variance.

In this case, $\Delta U_{t-1} = sU - x_{t-1}$ is the largest possible change of the exchange rate, and $\Delta L_{t-1} = sL - x_{t-1}$ is the smallest possible change. The conditional mean m_t is a linear function of PB_{t-1} , the position of the exchange rate in the band at $t-1$, and the conditional variance h_t is described by a GARCH(1,1) process augmented by $|PB_{t-1}|$. Density at time t is in fact a density forecast of the change in s_t from $t-1$ to t . Moreover,

Flood and Rose (1999) made an assumption of a perfectly credible zone by allowing a positive likelihood for the exchange rate to be outside the boundaries.

6.3. Estimated Parameters and Empirical Findings

The rest of the world's interest rates do not have a significant contemporaneous effect, either on the Indonesian real exchange rate ($a31$) or on the Indonesian domestic rate ($a51$) equation (Table 6.1). Together with its relatively strong effect on the long run money demand, the insignificance of the contemporaneous relations may suggest that the rest of the world interest rate is affecting the Indonesian macro economy through the long run money demand equation (Calvo, Reinhart and Vegh, 1995).

The estimation of ($a32$) is negative and significant indicating an investment induced output growth which is associated with a real exchange rate appreciation. It is also greater than an output contraction induced by reduced net exports due to the appreciation. Income has a negative sign and it is significant in the money demand equation.

Unexpectedly, ($a43$) is positive and significant, indicating that real exchange rate depreciation is followed by an increase in the holding of rupiah. This contemporaneous relation might however be supported by the situation where in the midst of the Asian currency crisis, when 1 USD had been equal to Rp10,000 or more. Many had in fact attempted to increase the holding of rupiah, speculating that the currency was going to improve soon, hence earning profits. The significance of this estimate might therefore be interpreted as the existence of a speculative motive for holding the currency.

There was a clear leap in currency demand after the start of the currency crisis in July 1997, and the corresponding fall in quasi-money. The time paths of the nominal exchange rate and the nominal exchange rate deflated by the CPI appear in figures 6.1 and 6.2. Both variables appear to be relatively calm for the period before July 1997.

Table 6.1:
Contemporaneous Relations of Rupiah

Parameter	Estimated Coefficient	Standard Error	Significance Level
a31	-0.957	4.2178	0.822
a32	-2.171	0.7095	0.004
a42	-0.697	0.2831	0.018
a43	0.121	0.0482	0.016
a45	-0.128	0.5735	0.824
a51	-0.520	0.3479	0.142
a52	0.087	0.0631	0.176
a53	0.002	0.0109	0.878
b11	0.003	0.0002	0.000
b22	0.016	0.0015	0.000
b33	0.076	0.0078	0.000
b44	0.030	0.0028	0.000
b55	0.007	0.0006	0.000

Source: Bank Indonesia.

Figure 6.1:
Asian Currencies (Demand in Quantity) before and after July 1997

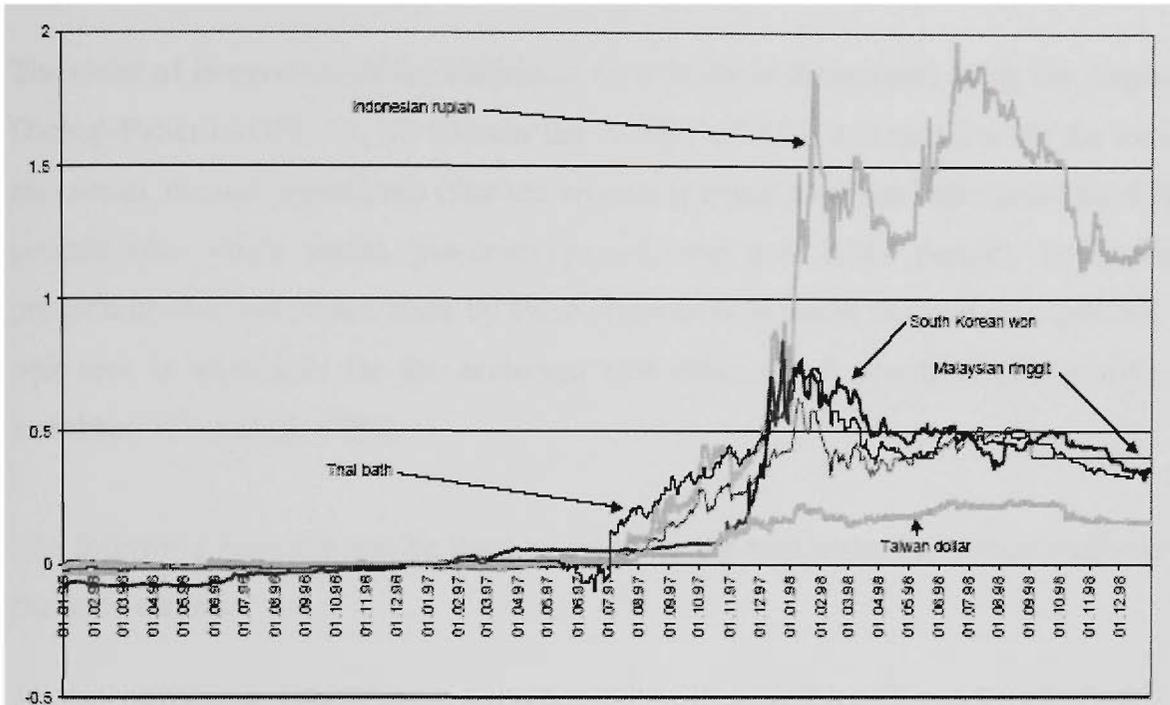
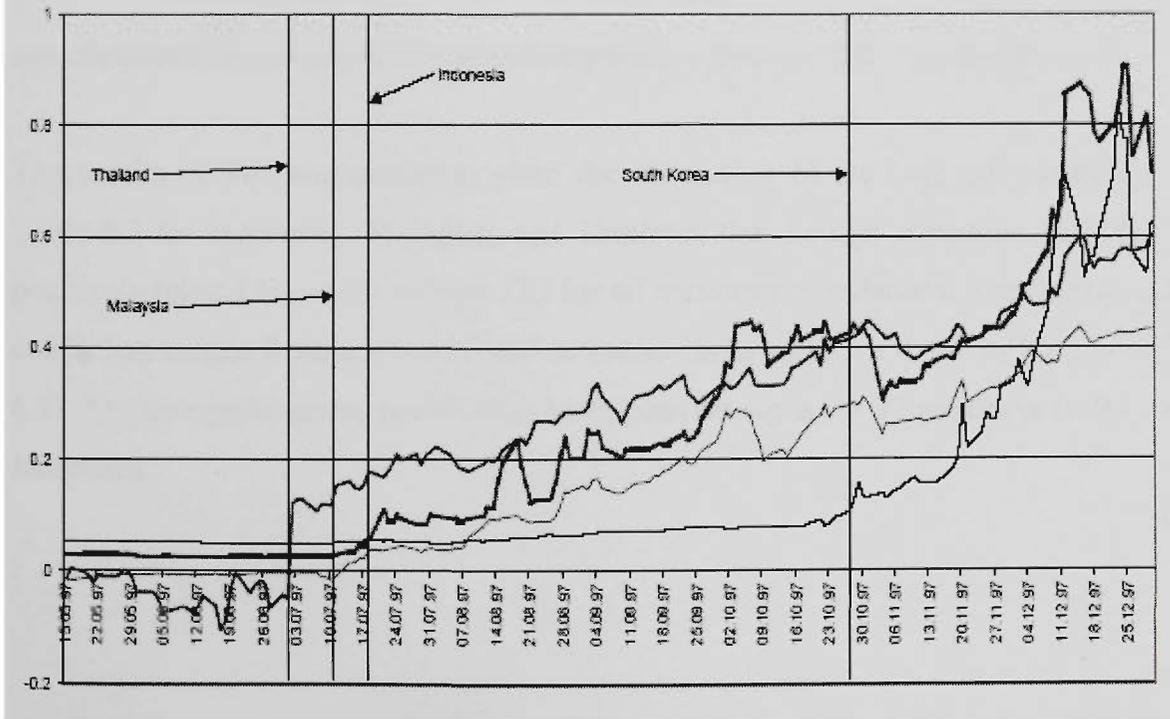


Figure 6.2:
Asian Currency (Demand in Quantity) during the 1997 Crisis



Source: Bank Indonesia.

6.4. Cointegration Analysis

The order of integration of the individual time series is determined using the Augmented Dickey-Fuller (ADF) test. To address the validity of ADF unit root test for the exchange rate series, the null hypothesis (that the series has a unit root) has been tested for different periods (the whole series, pre-crisis period, and post crisis period). Following the procedures that have been done by Pierre Perron, it is found that the conventional ADF unit root is applicable for the exchange rate series of all countries (along with other variables) (Pentocost, 1993).

The following equation can be used to calculate the maximum Eigenvalue statistic from the trace statistic:

$$Q_{max} = -T \log (1 - \lambda_{r+1}) = Q_{r+1} \quad (6.3)$$

where λ_i is the largest Eigenvalue and T is the number of observations. Q_r and Q_{r+1} are calculated for trace statistics at cointegrating equation r and $r+1$ respectively.

The results of this normalization yield the estimation of the long-run elasticity. From Table 6.2 for Indonesia, Malaysia, and Thailand, that foreign economic activity (Y_t) is positively related to export volume (X_t) for all measures of volatility. The foreign activity coefficient ranges from a low of 1.267 in Indonesia to a high of 4.466 in Malaysia (Table 6.2). The competitiveness coefficients have positive signs for all measures in the case of Indonesia.

Table 6.2:
Estimation of the Cointegrating Relationship

Country	Normalized	Cointegrating	Vectors Test
Panel A:			
Indonesia	$X_t = 1.267Y_t$	$+ 0.263 P_t$	- 4.396V1 2.58
Malaysia	$X_t = 3.638Y_t$	$- 4.034 P_t$	- 6.106V1 2.40
Thailand	$X_t = 2.826Y_t$	$- 0.590 P_t$	- 5.466V1 2.77
Panel B:			
Indonesia	$X_t = 1.411Y_t$	$+ 0.279P_t$	- 2.467V2 2.63
Malaysia	$X_t = 3.726Y_t$	$- 4.297P_t$	- 6.170V2 0.39
Thailand	$X_t = 3.424Y_t$	$-1. 228P_t$	- 2.596V2 1.19
Panel C:			
Indonesia	$X_t = 3.434Y_t$	$+ 1.139P_t$	- 0.695V3 0.70
Malaysia	$X_t = 4.466Y_t$	$- 4.053P_t$	- 0.769V3 0.77
Thailand	$X_t = 2.629Y_t$	- 0.947P_t	- 0.658V3 0.20

Note: Panel A, B and C refer to the volatility measures of V1, V2, and V3 respectively.

The long run elasticity appears to be relatively high for V1, and V2, but low for V3. For all measures the Indonesian economy shows relatively lower volatility elasticity than any other countries. The result indicates that the Indonesian exports are less responsive to the change in real effective exchange rates with the currencies of its major trading partners. Moreover, the volatility elasticity indicates consistent values and is found statistically significant for all countries when calculating the moving sample standard deviation of real effective exchange rates.

On average, foreign income coefficients are larger than relative price coefficients indicating a quicker response of export volume to income change. These results can be generalized to argue that risk adverse market participants respond to exchange rate volatility by favoring domestic to foreign trade (Kenen and Rodrik, 1986). Most

importantly, the results also indicate that exchange rate volatility has a substantial short-run effect on export demand.

Cheung and Lai (1993b) applied this approach with evidence for cointegration, but reject the unitary coefficient restriction implied by strict PPP. Since one has prior information on the form of the cointegrating vector, a more influential test of no cointegration against the alternative of cointegration with a pre-specified cointegrating vector can be applied. A rejection of the null hypothesis implies that cointegration, either individually or jointly, reverts back to the conditional mean as defined by the cointegrating vector.

6.5. Exchange Rate Overshooting

Exchange rate overshooting is defined as the case in which the initial short-run depreciation rate is larger than the long-run depreciation rate. In relation to the selection of the peak and end values, it depends mostly on the analysis of the time-series data of exchange rate. The measure for overshooting is defined as a percentage ratio of the peak over the end value, which indicates the degree of excessive depreciation of the exchange rate compared to the post-crisis exchange rate.

The notion of overshooting refers only to the actual time-series movement of an exchange rate, and not to any specific dynamic implications of the exchange rate determination model used such as the overshooting model by Dornbusch (1988). If financial fear plays a major role in a currency crisis, exchange rate overshooting can be a normal observation even in the absence of an increase in the interest rate.

Exchange rate overshooting is a widely observed occurrence in a currency crisis. Dekle and Pradhan (1996) investigated the case of Indonesia, Malaysia and Thailand using time-series data. It is aimed to demonstrate that an increase in the interest rate appreciates the exchange rate. It is also argued that the relationship between the real exchange rate and the real interest rate is unclear in Asian countries.

In the case of the 1997 Asian currency crisis, all countries experienced exchange rate overshooting. Table 6.3 shows the results for three Southeast Asian countries with overshooting larger than 10 per cent: Thailand is 34.8 per cent; Indonesia is 62 per cent and Malaysia is 14 per cent. The size of overshooting is significantly large with the average more than 30 per cent except for Malaysia.

In summary, exchange rate overshooting is frequently found across different currency crisis periods and countries, where the degree of overshooting is diverse. In this case, Indonesia experienced an extremely large long-run depreciation, well in excess of 100 per cent (Goldfajn and Baig, 1998).

Table 6.3:
Overshooting of Southeast Asian Currencies, 1997 (%)

The degree of overshooting for Indonesia was the highest among two other South East Asian countries.

Countries	Short Run Depreciation (%)	Long Run Depreciation (%)	Degree of Overshooting (%)
Thailand	107.9	54.3	34.8
Indonesia	472.0	253.1	62.0
Malaysia	75.6	54.1	14.0

Source: Asian Development Bank.

6.6. Time Series Analysis for Exchange Rate Determination

If a time series exhibits long memory or a random walk with drift, there is persistent sequential reliance even between observations distanced by long time lags. Fama (1984) analyzed the distribution of a large data set where it shows that empirical evidence seems to confirm the random walk hypothesis: a series of price changes has no memory where

the past cannot be used to predict the future. The main theoretical explanation that lies behind this observation is the efficient market hypothesis (EMH). According to the EMH an efficient capital market is one in which security prices adjust quickly to the arrival of new information, and therefore, the current prices of securities reflect all information about the security.

Three sets of assumptions imply an efficient currency market:

- an efficient currency market requires that a large number of competing profit maximizing participants analyze it independently of the others;
- new information regarding currencies comes to the market in a random fashion and the timing of each announcement is generally independent of others; and
- competing investors attempt to adjust security prices quickly to reflect the effect of new information.

Although the price adjustment may be imperfect, it is unbiased. This means that occasionally the market will over-adjust or under-adjust, but an investor cannot predict which will happen at any given time. Hence if a statistically significant serial dependence exists within a time series of financial security prices, the community of financial analysts will immediately exploit it.

Therefore, according to the EMH currency price changes can be only explained by the arrival of new information, and hence cannot be forecast. On the other hand, one of the key observations explained by Patel (1990) is the fact that most financial markets have a long memory; what happens today affects the future without end. In other words, current data is correlated with all past data to varying degrees.

Long memory systems are characterized by their ability to memorize events in the long history of time series data and their ability to make decisions on the basis of such memories. It is assumed that the natural log of the real exchange rate follows a process where it is allowed to be a function of the deviation of the log of the last period's real exchange rate from the PPP value of zero as below (Sarno and Taylor, 2002a):

$$q_t = (1 - \rho_t) + \rho_t q_{t-1} + \varepsilon_t \quad (6.4)$$

The term ρ_t is modeled as a function of q_t , which is not only the log of the real exchange rate, but also its deviation from the PPP. The function $\rho_t = \rho[q_{t-1}]$ should have the following properties:

1) ρ_t needs to be bounded between 0 and 1 regardless of the deviation from the PPP value.

$$0 \leq \rho[q] \leq 1 \quad (6.5)$$

2) ρ_t needs to respond symmetrically.

$$\rho[q] = \rho[-q] \quad (6.6)$$

3) There should be no mean reversion at the PPP value.

$$\rho[0] = 1 \quad (6.7)$$

4) There should be complete mean reversion in the limit as the deviation goes to infinity.

$$\lim_{q \rightarrow \infty} \rho[q] = 0 \quad (6.8)$$

5) ρ_t should be decreasing in the absolute deviation where smaller deviations should yield higher values.

$$\rho[q_1] > \rho[q_2] \quad q_1, q_2 \text{ s.t. } q_1 < q_2 \quad (6.9)$$

While a mixture of all the policy instruments seems to provide a realistically effective way of maintaining exchange rates within a band under most circumstances (provided

that it is not misaligned with respect to the fundamentals) none of the individual policies is overwhelmingly effective. Relevant experience has shown that there are conditions under which they may not be able to hold the rate within the band. In most cases the response of governments that find they cannot defend the band, has been to undertake realignment or to widen the margins (Eichenbaum and Evans, 1995).

Provided that band violating incidents are isolated and that generally changes are reasonably small, so that the gains of the speculators are of limited size, there does not appear to be anything that demolishes the viability of the system. At the same time the government still plays the strategic role to guide where the exchange rate needs to be in the long term. The evidence from Indonesia is that exogenous exchange rate shocks can be greater than the authorities feel comfortable handling with such marginal adjustments (Evans, and Lyons, 2004).

6.7. Stationarity Condition Testing

To use the exchange rate data for analysis, the time series should be subjected to a stationarity condition. To declare that information on the past behavior of an asset's price or returns may be of some value in predicting its future, has the implicit assumption that there is some regularity in the way the random nature of the time series is generated (de Jong, 1994). A time series X_t is said to be weakly stationary if it fulfills three properties:

- the mean is constant over time;
- the variance is constant over time; and
- the covariance between any two values of the series depends only on their distance apart in time (k), not on their absolute location in time (t).

Levels of economic and financial time series are generally non-stationary because they exhibit trends over time. Therefore, standard procedure is to transform the data, in an effective way, so that the result is stationary. If the data appear to lie on a straight line, then first differences of the data ($X_t - X_{t-1}$) are generally stationary. If the data lie on an

exponential curve, then taking logs of the data and first differencing the logs where $x_t = \ln(X_t)$ generally results in a stationary series.

Time series whose levels or log-levels are stationary are said to be integrated of order 0, termed I(0). Time series whose first-differences are stationary are said to be integrated of order 1, termed as I(1). Time series whose k th differences are stationary are integrated of order k , termed as I(k). Most financial time series are either I(0) or I(1). In this case, returns are generally I(0) and asset prices, which under market efficiency follow a *random walk*, are I(1). The DF equation only tests for first order autocorrelation. In this case, if the order is higher, the test is invalid and the DF equation contains residual correlation.

6.8. Univariate Time Series

Evidence that the univariate distributions of many common economic variables are non-normal has been widely reported. Common examples of deviations from normality are excess kurtosis and skewness in univariate distributions. One example of asymmetric dependence is where two returns exhibit greater correlation during market downturns than market upturns. Relatively little attention has been paid to the possibility of asymmetric dependence between exchange rates (Ericsson, 1995).

A natural starting point in the modeling of the joint distribution of two exchange rates might then be a bivariate t distribution. Studies have shown that different exchange rates have different degrees of freedom. One possible source of asymmetric exchange rate dependence was discussed by Favero, (2000), who suggested that central banks may respond in an asymmetric manner to exchange rate movements.

For example, if AUD depreciates against USD, Bank Indonesia may intervene in order to ensure a corresponding depreciation of rupiah against USD, thus maintaining the competitiveness of the Indonesian exports to US. When AUD appreciates against USD,

however, there may be no incentive for Bank Indonesia to look for an appreciation of rupiah against USD. This type of behavior would encourage an asymmetry in the dependence structure between these exchange rates: AUD and rupiah would be more dependent to each other during depreciation against USD than during its appreciation.

6.9. Exchange Rate Misalignment

An exchange rate misalignment (ERM) occurs when a country's actual exchange rate deviates from its desired rate. An exchange rate is labeled undervalued when it depreciates more than this desired rate, and overvalued when it appreciates more than its desired rate. Such misalignments are widely believed to influence the economic and financial behavior of a country.

Conceptually, an exchange rate is misaligned when it deviates from the underlying rate that would have prevailed in the absence of price rigidities, frictions and other short run factors. A more structured definition of misalignment uses the notion of equilibrium rate, hence it could also be defined as the deviation of the actual from the equilibrium rate (Edwards, 1999).

Dornbusch (2001) argued that overvaluation according to some price measure is the key indicator of a subsequent currency crisis. In the wake of the Southeast Asian currency crisis of 1997, the central issue is what caused the declines in the exchange rate. Since all the regional currencies lost value, the argument is that these currencies including the Indonesian rupiah were overvalued on the eve of the crisis.

In order to investigate whether the Southeast Asian currencies were overvalued, one needs to select a useful definition of overvaluation. There are at least three broad definitions in use as cited by Williamson (1994):

- price based criteria, such as purchasing power parity and its variants;
- model based criteria, based on a formal model of nominal exchange rates; and

- solvency and sustainability based criteria, which make reference to trends in the current account and the external debts to the GDP ratio.

Arguably, the conventional approaches do not distinguish properly between two different dimensions of exchange-rate variability: short-run volatility, and long run misalignments. Also, central banks that are managing their currencies have a tendency to limit their short-run volatility quite efficiently, but occasionally make reasonably large changes in reaction to market forces. Any large overvaluation can lead to an increase of foreign debts and a reduction of investments in the tradable goods industries, which may make it more difficult and expensive to adjust the balance of payments (Bayoumi, 1992).

Misalignment, in the sense of large and prolonged departures from the fundamental equilibrium exchange rate (Williamson, 2001), can have serious consequences for the economy as a whole. Any large overvaluation can have all the depressing effects that were evident in Southeast Asia and particularly in Indonesia in late 1997 and early 1998, especially the adverse impact on financial solvency and an increased real value of the foreign currency debts.

Managed and free floating exchange rate regimes have frequently led to the emergence of large misalignments. All the Asian currencies went through a period of severe undervaluation shortly after starting to float their currencies. History suggests that managed floating is more efficient than free floating in avoiding misalignments, which is usually one of the major aims of foreign exchange management. An exchange rate misalignment may be considered the difference between the prevailing nominal exchange rate and the equilibrium exchange rate. The long run equilibrium real exchange rate is defined as the rate that, for sustainable values of other real variables such as trade, taxes, capital flows and technology, results in simultaneous equilibrium (Rose, 1996).

Table 6.4:
OLS Estimation of Long Run Equilibrium: 1992.01-1997.07

Independent variables	Rupiah
Constant	5.609 (224.40)
Term	0.588 (20.380)
CF/1000	0.0393 (4.15)
Adjusted R ²	0.959
DW	0.771
Sample	1992.01-1997.07

Source: Author's estimates.

Table 6.5:
Real Exchange Rate Index: 1992-1997

Year	Indonesia
December 1992	98
June 1993	93
December 1993	100
June 1994	99
December 1994	92
June 1995	88
December 1995	92
June 1996	89
December 1996	80
June 1997	78

Source: Bank Indonesia and Author's estimates.

Note: Based on WPI, Trade-Weighted, June 1992 = 100.

6.10. Empirical Results

The data consist of two parts: micro-based variables and conventional macro variables in which all of the variables are monthly observations. The variables in the analysis include exchange rate volatility as a proxy for the order flow data that Evans and Lyons (2004) used in their research. Others are: short term capital movements, industrial production, inflation based on the consumer price index, the monthly's observations in a month. It is directly affected by the gross volume of capital flows.

The first step in the estimation process is to select the appropriate model to estimate the real exchange rate. For a robustness check, it uses alternative measures for inflation, output and short-term capital movements. Here, the sample period is between January 1992 and July 1997. The Akaike information criteria (AIC) and the Schwarz information criteria (SIC) are used which gave the lowest AIC and SIC values as:

$$\begin{aligned} rer_t = & \beta_{1t}rer_{t-1} + \beta_{2t}rer_{t-12} + \beta_{3t}ervolat_{t-1} + \beta_{4t}ip_t + \beta_{5t}ip_{t-1} + \beta_{6t}ip_{t-12} \\ & + \beta_{7t}icpi_t + \beta_{8t}icpi_{t-12} + \beta_{9t}crednet_{t-1} + \varepsilon_t \end{aligned} \quad (6.10)$$

where:

- rer_t = the real exchange rate at time ; t
- $ervolat$ = the exchange rate volatility;
- ip = the industrial production;
- $icpi$ = the inflation based on consumer price index; and
- $crednet$ = the short-term net capital flows.

The simple OLS estimation for this equation along with the test statistics can be seen in Table 6.6. The first lagged value of the exchange rate volatility determines the real exchange rate such that a rise in volatility in the last period leads to a depreciation of the rupiah in the next period.

Table 6.6:
OLS Estimation January, 1992 – July 1997

Variable	Coefficient	Std. Error	t-stat
rer_{t-1}	0.89	0.0590	16.03
rer_{t-12}	0.275	0.0573	4.66
ervolat_{t-1}	-0.620	0.3370	-3.30
ip_t	0.242	0.0698	3.34
ip_{t-1}	-0.057	0.0586	1.07
ip_{t-12}	-0.222	0.0668	-2.00
icpi	-0.403	0.2258	-4.52
icpi_{t-12}	0.338	0.2279	2.05
crednet_t	0.002	0.0009	2.98

Notes: R – Squared: 0.98; Adjusted R – Square: 0.97; AIC: 6.10; SIC: 6.42;
F – Statistic: 85.09.

Then the next step in the estimation process is to generate an implied real equilibrium exchange rate. This is done simply by multiplying each period's coefficient vector with the regressor vector. In the final part, the difference between the real exchange rate and the implied real exchange rate gives the level of the exchange rate misalignment.

In this case, the ERM is the exchange rate misalignment. If the ERM < 0, it means that the Indonesian rupiah is structurally undervalued. It is structurally overvalued when the ERM > 0. The degree of under valuation was at its peak in July and August 1992. Finally, the rupiah began to appreciate and entered into an overvaluation period late in December 1992. From this time, rupiah remained mostly overvalued until the beginning of the 1997 Asian financial crisis, at which time overvalued currency was targeted by the Indonesian government in order to reduce inflation. In fact prior to the Asian currencies crises in 1997, rupiah was overvalued for five consecutive years (Table 6.8).

The difference between the real exchange rate and the implied rate gives a measure of exchange rate misalignment. However, on average, the overvaluations (based on interest parity forward rates) ranged about 30 to 40 per cent during the later sample period. In the beginning of 1994, interest differentials in Indonesia were much larger than in US, and that disparity increased up leading up to the crisis (Figure 6.3).

Figure 6.3:
ERM of Rupiah, 1992-1997

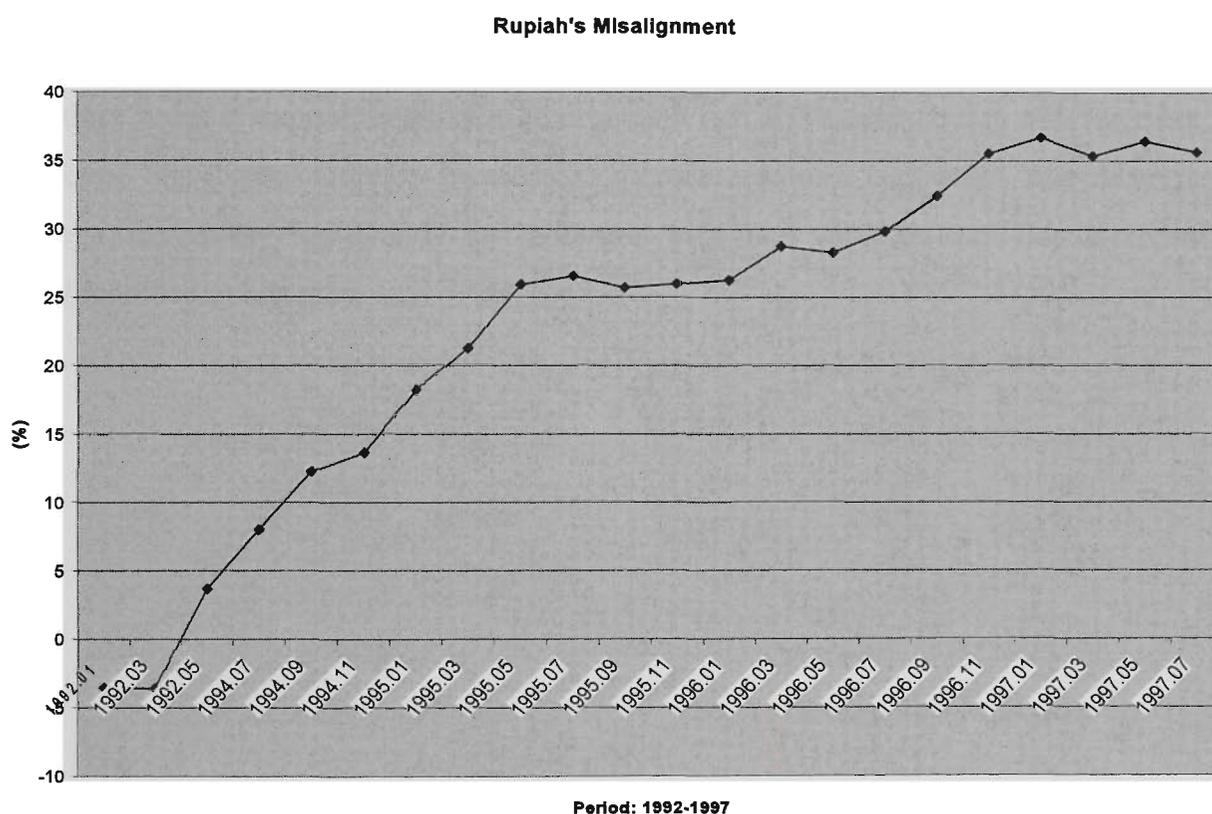


Table 6.7:
Deviations from the PPP by PPI and CPI-Deflated Real Rates

INDONESIA (Rupiah/USD) 1992.01 – 1997.07	
PPI	+20.166
CPI	+23.360

Note: The rupiah overvaluations (+) or undervaluation (-) is relative to USD.

It is argued that the exchange rate misalignments of rupiah against USD are to some extent due to the large interest differential between the two countries. Theoretically, these misalignments could be removed by either increasing the weight of USD in a multiple basket or by revising the exchange rate system so it reflects the relative economic fundamentals, such as productivity, terms of trade, net foreign assets. As financial market integration increases, the issues of capital mobility, capital market risk and exchange rate misalignment may cause more severe and widespread problems in Indonesia.

Current instability in world financial markets has also prompted much investigation into these three areas of capital mobility, capital market risk and exchange rate misalignment. It is found that capital mobility measured by deviations from uncovered interest parity has been decreasing significantly for Indonesia with high volatility implying increased capital mobility in this area.

Table 6.8:
Exchange Rate Misalignments (ERM), 1992.01-1997.07

ERM of Rupiah (%)			
1992.01	-3.53	1992.02	-1.64
1992.03	-3.60	1992.04	-3.09
1992.05	3.70	1992.06	3.46
1994.07	8.01	1994.08	8.95
1994.09	12.24	1994.10	13.87
1994.11	13.64	1994.12	17.40
1995.01	18.18	1995.02	19.98
1995.03	21.27	1995.04	25.23
1995.05	25.91	1995.06	26.37
1995.07	26.54	1995.08	24.39
1995.09	25.69	1995.10	27.86
1995.11	25.97	1995.12	24.24
1996.01	26.26	1996.02	24.19
1996.03	28.71	1996.04	26.48
1996.05	28.30	1996.06	27.10
1996.07	29.82	1996.08	29.17
1996.09	32.42	1996.10	32.12
1996.11	35.51	1996.12	35.82
1997.01	36.70	1997.02	37.59
1997.03	35.36	1997.04	35.38
1997.05	36.42	1997.06	36.06
1997.07	35.63		

Source: Bank Indonesia and Author's estimates.

Conclusion

An exchange rate misalignment (ERM) could in the long run have an adverse impact on economic growth in Indonesia as both theoretical and empirical considerations show. Generally, there are two possible channels through which the misalignments might influence growth. Firstly, it could influence domestic and foreign investment, thereby influencing the capital accumulation process. Capital accumulation is a strong engine of economic growth. Secondly, a rate that is out of line could affect the tradable sector and its competitiveness.

The parameters of the estimated rate equation together with the sources of misalignment can be used to construct a model-based measure of rate misalignment. It is a model where the coefficients of the variables, which decide the equilibrium real exchange rate, are allowed to deviate from their sample mean over time. The difference between the real exchange rate and the implied rate gives a measure of exchange rate misalignment. Once the misalignments are calculated then the model determines whether the currency is overvalued or undervalued and may make statements about the appropriateness of prevailing monetary and fiscal policies and exchange rate regimes.

The calculation of model-based equilibrium values requires the estimation of a much larger number of parameters, thereby increasing the possibility of making considerable errors. In contrast, the PPP based calculations, which are simpler to generate, are suggestive of overvaluation. The use of the PPP application is justified by the finding of real exchange rate mean-stationarity, where real exchange rates are defined using a price index of tradable goods. However, the implied currency overvaluations appear small when placed against the magnitudes of the subsequent currency crashes.

The exchange rate of rupiah remained mostly overvalued until the beginning of the 1997 Asian financial crisis, when an overvalued currency was targeted by the Indonesian government in order to reduce inflation. In fact prior to the currency crisis in 1997,

rupiah was overvalued for five consecutive years. However, on average, the overvaluations ranging from about 30 to 40 per cent during the later sample period. In the beginning of 1994, interest differentials in Indonesia were much larger than in US, and that disparity increased leading up to the currency crisis of 1997. The policy implications of this will be discussed in the next chapter.

CHAPTER 7

POLICY AND IMPLICATIONS

7.1. Introduction

Quantitative determination of the exchange rate requires a model. The choice of a model depends on the empirical relevance and suitability of the model as well as the nature of the underlying exchange rate regime. Modeling exercises in the previous chapters show that market models do not fit well to the Indonesian data, while the shadow price model has some normative application.

As argued in previous chapters the choice of a model is related to the choice of exchange rate regime. It is therefore necessary to discuss which regime is appropriate for Indonesia. The choice of model will help to choose the appropriate regime. The objective of this chapter is to provide a discussion of the available options in choosing an appropriate regime and its related model and this combination will provide a framework for quantitative determination of the exchange rate in Indonesia.

Currency convertibility is a simple concept where any residents and non-residents are able to exchange domestic currency for foreign currency. However, there are many degrees of convertibility, with each denoting the degree to which governments impose controls on the exchange and use of currency. Generally speaking, there are two types of exchange rate regimes: floating and fixed. Each type has different characteristics and produces different results.

Under a floating rate regime, the monetary authority sets a monetary policy, but has no exchange rate policy. Whereas, under a fixed rate regime, a monetary authority sets the

exchange rate but has no monetary policy. Hence, under a fixed rate regime, the monetary base is determined by the balance of payments. Indeed, under freely floating regime market forces operate to automatically rebalance financial flows and prevent balance of payment crises. While both floating and fixed rates are equally attractive in principle, the floating regime, unlike the fixed one does not perform well in developing countries because those countries usually have weak monetary authorities as well as monetary instabilities (Helpman and Razin, 1982).

In comparison, fixed and pegged rates look to be the same, but they are fundamentally dissimilar. Pegged rates are not free-market mechanisms for international payments and do require a monetary authority to manage both the exchange rate and monetary policy. With a pegged rate, the monetary base contains both domestic and foreign components. Unlike floating and fixed rates, pegged rates consistently result in conflicts between exchange rate and monetary policies.

Even today, Indonesia continues struggling to cope with the effect of the 1997 financial crisis. Unfortunately, the massive depreciation of rupiah that began in mid 1997 and huge liquidity injections into the banking system fueled inflation. The Indonesian monetary authorities tried to reduce pressure on prices and the exchange rate by tightening monetary policy but the money supply has expanded quicker than the targets initially agreed with IMF.

7.2. Choosing an Appropriate Exchange Rate Regime

An exchange rate influences the flow of goods, services, and capital into and out of Indonesia. It exerts strong pressure on the balance of payments, inflation and other macroeconomic variables. Therefore, the choice and management of an exchange rate regime is a vital aspect of economic management to preserve competitiveness, macroeconomic stability, and growth.

The choice of an appropriate exchange rate regime for developing countries such as Indonesia has been a major issue in international finance for a long time. This is an area where valuable lessons can be learned from the experience of other developing countries. This section reviews the main issues in choosing an appropriate regime and examining the lessons learned from recent experience (Flood and Marion, 1991).

The selection process of an exchange rate regime that is most likely to suit a country's financial interest would depend on a range of factors including specific country circumstances such as: size and openness of the country to trade and capital flows; the structure of its production and exports; financial development; inflationary history; political conditions; as well as the credibility of its policy makers and financial institutions (Dereveux and Engel, 1999).

The actual choice from a range of regimes depends on the relative weight given to each of these factors. In addition, an exchange rate regime that is considered as appropriate for a country would change over time with changing country circumstances. Therefore, there is no single ideal exchange rate regime that is always suitable for all countries including Indonesia. A number of emerging market economies integrated into international capital markets with soft peg regimes have experienced severe currency crises and economic disorder in the 1990s. As the result, an increasing number of countries are moving toward the independent floating exchange rates or to dollarization.

For any exchange rate regime in order to maintain a stable and competitive real exchange rate, it will need an accommodating exchange rate policy that includes sensible macroeconomic policies, a strong financial sector, and credible institutions. This kind of policy should be consistent with exchange rate objectives. Failure to establish fiscal discipline would certainly lead a country to crisis under any exchange rate regime.

Empirical evidence shows that overvaluation of the real exchange rate is strongly associated with an unsound balance of payments deficit, currency crisis, and low economic growth. Hence, a key aim of the exchange rate policy is to maintain a steady

and viable real rate that is consistent with the economic fundamentals of the country. However, earlier studies show that pegged exchange rate regimes are associated with lower inflation and slightly lower output growth (Fischer, 1977).

Table 7.1:
Exchange Rate Regimes

	Main Features	Main Advantages	Main Disadvantages
FLOATING REGIMES			
Free Float	The exchange rate is determined freely in the market by demand and supply. The monetary authority does not intervene in the foreign exchange market. Monetary policy is independent of the exchange rate regime and can be used freely to steer the domestic economy.	More easily deflect or absorb adverse shocks. Not prone to currency crisis. High international reserves not required.	High short-term volatility. Discretion in monetary policy may create inflationary bias. Large medium-term swings only weakly related to economic fundamentals. High possibility of misalignment.
Managed Float	The monetary authority intervenes actively in the foreign exchange market without specifying or pre-committing to a Pre-announced path for the exchange rate. Intervention may be direct (sterilized and non-sterilized) or indirect through changes in interest rates, etc. Monetary policy is relatively free to be used to steer the domestic economy.	Limited flexibility permits partial absorption of adverse shocks. Can maintain stability and competitiveness if the regime is credible. Low vulnerability to currency crisis if edges of the band are soft.	Lack of transparency because criterion for intervention is not disclosed in managed float, and broad band regimes are not immediately identifiable. This may lead to uncertainty and lack of credibility. High foreign reserves are required.

**Table 7.1:
Exchange Rate Regimes (continued)**

	Main Features	Main Advantages	Main Disadvantages
FIXED REGIMES			
Crawling Peg	The exchange rate is adjusted periodically according to a set of indicators. The rate of crawl can be set at a pre-announced fixed rate at or below the projected inflation differentials. Maintaining a credible crawling peg imposes constraints on monetary policy.	<p>Can maintain stability and competitiveness if the peg is credible.</p> <p>Lower interest rates.</p> <p>Allows high inflation countries to reduce inflation by moderating inflationary expectations.</p>	<p>Prone to currency crisis if the country is open to international capital markets.</p> <p>Encourages foreign debt. High international reserves are required.</p> <p>Little shock absorptive capacity. Shocks are largely absorbed by changes in the real sector.</p>
Fixed Rate	The exchange rate is pegged at a fixed rate to a major currency or a basket of currencies. The monetary authority is not committed to the peg indefinitely. The peg is adjusted (devaluation) when misalignment becomes unsustainable. The monetary authority stands ready to defend the peg through direct intervention and monetary policy.		

**Table 7.1:
Exchange Rate Regimes (continued)**

	Main Features	Main Advantages	Main Disadvantages
ALTERNATIVE REGIMES			
Currency Board System	Strict exchange rate regime supported by a monetary system based on legislative commitment to exchange domestic currency for a specified foreign currency at a fixed rate. Domestic currency is issued only against foreign exchange. There is almost no scope for independent monetary policy.	Provides maximum credibility for the economic policy regime. Can facilitate disinflation. Not prone to currency crisis. Lack of monetary discretion eliminates inflationary bias.	No shock absorptive capacity. Shocks have to be fully absorbed by changes in economic activity. Central bank loses its role as lender of last resort. Higher probability of liquidity crisis.
Currency Union or Dollarization	Another country's currency is used as the only legal tender, or the country belongs to a currency union in which the same legal tender is shared by all members of the union. Monetary autonomy is fully surrendered. There is no scope for independent monetary policy.	Provides maximum credibility for the economic policy regime. Can facilitate disinflation. Not prone to currency crisis. Low transaction costs, low and stable interest rates.	Exit from dollarization is very difficult. Central bank loses its role as lender of last resort. Higher probability of liquidity crisis.

Source: Frankel (2003).

7.3. Determinants for the Choice of Exchange Rate Regime

The experience with the implementation of exchange rate regimes shows there are some generalizations that can be made about the conditions under which various regimes would function reasonably well, though there are many exceptions. Floating regimes would be a proper choice for medium and large developed countries and some emerging market economies that have import and export sectors that are relatively small compared to GDP, but are fully integrated in the global capital markets and have diversified production and trade, a broad financial sector, as well as strong prudential standards (Bordo, 2003).

The managed floating regime, midway between floating rates and fixed rates, aims to integrate the benefits of both while circumventing their limitations. It is considered better for emerging market economies and some other developing countries with a relatively strong financial sector and well-disciplined macroeconomic policy.

Generally speaking, the major advantage of the floating regime is its immunity to currency crisis, and its capacity to absorb undesirable shocks and freedom to pursue an independent monetary policy. These advantages come with the cost of high short-term exchange rate volatility and large medium-term swings characterized by misalignment. At the other end of the spectrum, the alternative regimes provide maximum stability and credibility for monetary policy, and low transaction costs and interest rates, but suffer from the loss of the lender of last resort role of the central bank (Agenor, 1994).

By giving up some nominal stability for greater flexibility, the intermediate regimes aim to provide a limited nominal anchor for inflationary prospects, but also evade volatility and overvaluation, and reduce the risk of a currency crisis. An imperative compromise on the choice of exchange rate regimes is that no single exchange rate regime is best for all countries or at all times (Frankel, 1999).

Table 7.2:
Trade-Offs in Choosing Exchange Rate Regime

	Floating	Intermediate	Soft peg	Hard peg
Stability	–	+	+	+
Misalignment	+	+	+	+
Vulnerability to currency crisis	+	+	–	+
Vulnerability to shocks	+	+	–	–
Independence of monetary policy	+	+	–	–

Source: Reinhart and Rogoff (2004).

Under a floating regime, the real and nominal exchange rates are endogenous variables determined in the market by demand and supply forces. The monetary authority does not determine what the rate should be and does not make any effort to direct the rate towards the preferred level. In contrast, in all other regimes with the exception of a currency union such as dollarization where the national currency is given up altogether, the government needs to know what the real exchange rate should be so to guarantee that the economy is competitive.

Typically, the long-run equilibrium real exchange rate is estimated based on the economic fundamentals of the country, and a variety of policy and institutional arrangements are made to keep the actual rate adequately close to this over the medium-term. Vibrant management of the exchange rate under these regimes can provide a developing country with an additional tough policy device to correct misalignment and to influence the balance of payments, trade flows, and foreign investment (Sachs, 1980).

7.4. Alternative Choices for Exchange Rate Regime

7.4.1. Currency Unification

One of the few viable options to avoid a serious financial crisis is for developing countries to unify their currencies with stronger ones by establishing a currency board or by totally replacing a national currency with a strong foreign currency such as USD or Euro. A traditional currency board system is a monetary institution that issues notes fully backed by a foreign reserve currency and is convertible into the reserve currency at a fixed exchange rate on demand. In addition, a traditional currency board cannot act, as a lender of last resort and does not standardize reserve requirements for commercial banks (Schuler, 2003).

Similar to the fixed exchange rate regime, currency boards avert governments from setting their own interest rates. If domestic inflation remains higher than that of the country to which the currency is pegged, the currencies of countries with currency boards can also become overvalued. A currency board can also put pressure on banks and other financial institutions if interest rates rise sharply as investors abandon local currency.

A country that introduces a currency board commits itself to converting its domestic currency on demand at a fixed exchange rate. To make this commitment credible, the currency board should hold reserves of foreign currency equal to the fixed rate of exchange to at least 100 per cent of the domestic currency issued.

Unlike a conventional central bank which can print money at any time; a currency board issues domestic notes and coins only when there are adequate foreign exchange reserves to back it. Like any fixed exchange-rate regime, a currency board offers the hope of a stable exchange rate, which can encourage both trade and investment.

7.4.2. Financial Dollarization Issues

The decision on which exchange rate regime is to be adopted has become more complicated as world trade and capital markets have become more integrated. New solutions have emerged, as countries respond to the best exchange regimes set to encourage their development objectives. The latest of these solutions is full dollarization, under which a country officially abandons its own currency and adopts a more stable currency of another country, most commonly USD, as the official tender.

In a fragile economy, once financial dollarization exceeds certain threshold, this currency mismatch is unavoidable. Thus, when financial dollarization is allowed, debtors from the non-tradable sector could end up with debts denominated in tradable, increasing their exchange rate exposure. On the contrary, when not dollarized, a country with a fragile currency displays financial contracts that re-price very repeatedly (Calvo and Reinhart, 2002).

In the case of a loss of confidence, the authorities would be unable to guarantee the full payments system or to fully back bank deposits. Generally, the capacity to print money as needed is what allows a central bank to guarantee beyond any doubt that all claims in domestic currency will be fully met under any circumstances (Calomiris, 2000). A fully dollarized country that has already spent its foreign currency reserves to redeem its reserve of domestic currency might well be short of the financial resources.

With dollarization, the interest premium owing to the devaluation risk would disappear, but not the premium for sovereign risk. Since government and the private sector can decide to borrow in foreign or domestic currency in a dollarized economy, they can eliminate the cost of devaluation risk by borrowing in strong foreign currencies. The key issue is whether full dollarization, by eliminating currency risk can substantially reduce the default risk premium on foreign currencies-denominated debt.

In general, dollarization will not remove the risk of external crisis, since investors may run away because of problems of weakness in a country's budget position or the unreliability of the financial system. Nevertheless, dollarization promises a steadier market response, as the abolition of exchange rate risk would tend to limit the prevalence and extent of crisis and contagion affects (Edwards, 2003).

7.4.3. Full Dollarization

Full dollarization may appear more drastic than using USD or another major currency only a certain extent, particularly in financial contracts. However, the main attraction of full dollarization is the elimination of the risk of an abrupt, sharp devaluation of the country's exchange rate. This may permit a country to reduce the risk premium attached to its international borrowing. A dollarized economy could promote a higher level of confidence among international investors, lower interest rate spreads on their international borrowing, reduced fiscal costs, and boost investment and growth (Eichengreen, 2003).

The term of dollarization applies to the use of any foreign currency by another country. Most developing countries as well as transitional economies already have a limited, unofficial form of dollarization. To some extent, residents already hold foreign currency and foreign currency-denominated deposits at domestic banks. In high inflation countries, dollars or other hard currency may be in common use in daily transactions, alongside the local currency.

Such informal dollarization is a reaction to economic instability and high inflation, and the desire of residents to protect their assets from the risks of devaluation of their own currencies. In currency substitution, foreign assets are used as money, basically as means of payment and unit of account, and this typically arises under conditions of high inflation or hyperinflation when the high cost of using domestic currency for transactions prompts the general public to look for available alternatives (McKinnon, 1982).

In fact, differences exist between informal and full dollarization, presenting transitional problems for governments considering it. All government and private debts under full dollarization are denominated in foreign currencies, and both public and private accounts must be converted to it. Furthermore, if the costs and benefits of a currency board turn out to be at least equivalent to dollarization, a currency board would be a simpler and preferable alternative for a country seeking a firmly pegged exchange regime. While full dollarization eliminates susceptibility of the banking system to the risk of devaluation, it does not eliminate all sources of banking crisis (Berg and Borensztein, 2000).

7.4.4. De facto Dollarization

While de facto dollarization appears to have been fueled by recurrent high inflation, it remains a common characteristic of developing economies around the world. Here, currency substitution refers to the use of a foreign currency as a means of payment, while financial dollarization, refers to the holding by residents of foreign currency-denominated assets and liabilities (Edwards and Magendoza, 2002).

De facto dollarization with high degrees of currency substitution and financial dollarization forms part of an essential aspect of the recent debate on dollarization for various reasons. Generally, because of the implications on inflation and banking sector vulnerability, it limits the range of exchange rate fluctuations that monetary authorities can endure. As a result, it focuses on the dynamics of money demand and in particular, the connection between dollarization and the implications for monetary policy (Edwards, 2003).

While de facto dollarization appears to have been be fueled by recurrent high inflation, it remained a common characteristic of developing economies around the world. Here, currency substitution refers to the use of a foreign currency as a means of payment, while financial dollarization, following the holding by residents of foreign currency-denominated assets and liabilities (Edwards and Magendoza, 2002).

Bird (1979), using a portfolio choice model and considering both sides of the banks' balance sheets, found that financial dollarization depends on the volatility of real returns on assets denominated in each currency. This may lead to a situation where countries that accept foreign currency deposits in the domestic banking sector will obviously create some degree of financial dollarization. In addition policies that target a stable real exchange rate to preserve competitiveness should not be expected to decrease financial dollarization.

7.4.5. Currency Board

A currency board is a monetary authority that issues notes and coins convertible into a foreign anchor currency or commodity at a strictly fixed rate and on demand. Typically, a conventional currency board does not accept deposits. It can also operate in place of a central bank or as a corresponding issuer in conjunction with an existing central bank in any economy.

For its reserves, a currency board holds low-risk, interest-bearing bonds and other assets denominated in the foreign anchor currency. Typically, it equals to 100 per cent or slightly more of its notes and coins in circulation. It remits to the government all profits beyond what it needs to cover its expenses and to maintain its reserves at the level set by law. A conventional currency board has no discretion in monetary policy where market forces alone determine the money supply (Enoch and Gulde, 1997).

Central banks without currency boards often have abandoned pure fixed exchange rate regimes when faced with large capital inflows or outflows. To maintain its exchange rate peg, the central bank has to sell foreign assets and redeem domestic currency. Eventually it either runs out of reserves, or its reserves fall below acceptable levels. With a fully backed currency board investors understand that the central bank would be able to redeem virtually all outstanding currency demands without running out of foreign reserves. Thus a currency board improves to the credibility of a nation's exchange rate peg over a standard fixed exchange rate regime (Connolly, 1998).

Nevertheless, on occasion currency boards are also subject to speculative stress, and this may have adverse local effects, such as increases in domestic interest rates. For example, if a country attempts to maintain an unsustainable overvalued exchange rate, it would face an entire redemption of its currency. While redemption into foreign reserves would be viable, a country may choose instead to abandon the currency board.

Generally speaking, the victims of currency crisis maintain some sort of pegged exchange rate regime. Consequently, exchange rate pegs might themselves draw speculative attacks. The currency board regime, under which the domestic currency is fully backed by international reserves, is the strongest form of the pegged exchange rate option.

7.4.6. Currency Board for Indonesia

Arguably, an Indonesian currency board could be launched with less than full backing of old currency issues, as long as new issues are fully backed by foreign reserves. Nevertheless, if a board is launched with only partial backing, there will be little to distinguish it from a standard pegged exchange rate regime. If the exchange rate peg is set at a slightly undervalued level, there will be little incentive for speculators to attack the board, and in that case, partial backing may succeed (Balino and Enoch, 1997).

In addition, the large net foreign liabilities of the financial system are unlikely to be fully backed by an Indonesian currency board. This implies that under a currency board, Bank Indonesia would not be able to act as lender of last resort in the event of a financial crisis, thus, the restriction on the currency board would further weaken a fragile situation.

Giving up any possibility of devaluation is costly for some countries and they must consider the implications of a reduced national role in providing lender of last resort facilities and backing for their banking systems. An immediate benefit from eliminating the risk of devaluation is reducing the country's risk premium on foreign borrowing and

obtaining lower interest rates for the government and private investors (Furstenberg, 1998).

A currency board can generate base money only to the extent that they accumulate reserves, so it is almost as tightly constrained, as the Indonesian monetary authorities would be in a dollarized economy. In important currency board cases, the financial authorities have allowed themselves some flexibility to create money that is not fully backed on the margin, partly to be able to deal with banking crisis. By temporarily reducing their reserve coverage of the money base, it could increase the issuance of dollar cash and provide the dollar credits the banks needs to continue afloat (Ghosh, Gulde and Wolf, 2002).

Indeed, even without the restrictions imposed by a currency board system, the ability of a central bank to find a way out of a financial crisis by resorting to printing money alone is limited. The injection of liquidity into the banking system to keep it from defaulting on deposits may only lead to greater pressure on foreign reserves or the exchange rate.

7.4.7. Managed Floating Regime

A managed floating regime is supposed to protect economic policies, thus allowing for divergences that require exchange rate flexibility. Managed floating exchange rates in fact provide no alternative to economic interdependence. It may even implicitly encourage coordinated policy outcomes (Calvo, 1999). If prices and wages were fully flexible, the exchange rate would be relevant, as it would affect the real economy. The prevalence of price and wage stickiness gives the exchange rate a crucial role in economic adjustment and as a channel for international economic interdependence.

Generally speaking, a managed floating regime provides flexibility, but it increases both the need for and the cost of adequate domestic economic policies. This regime leaves developing countries with clear relative price signals that will inevitably be favorable to investment and development. For big, open developing countries that rely a great deal on

foreign trade and savings, a managed floating is an attractive alternative. Furthermore a stable exchange rate may serve as a useful precursor of monetary policy in countries where this policy is under developed and has been used in the past mainly to finance public deficits and to feed inflation and hyperinflation. Hence it seems that for a developing country seeking stable macroeconomic policies, floating the exchange rate is suitable.

There are two preconditions for a successful floating exchange rate. First, monetary policy should be credible with an independent central bank. Both the central bank's independence and inflation targeting are a recent development in developed countries and can be interpreted as a response to the increase in international capital mobility. Secondly, it requires well developed financial institutions and so is available only to the more developed emerging countries (Clark and MacDonald, 1998).

7.5. Exchange Rate Policies in Indonesia

Since 1970, Indonesia has implemented three different exchange rate regimes: the fixed rate from 1970 to 1978, the managed floating exchange rate regime from 1978 to August 1997, and the free floating exchange rate regime since August 1997. The implementation of the last regime means that only the market determines the exchange rate of rupiah. Thus, the exchange rate determination is based solely on the interaction of supply and demand in the market (Scott, 2002).

As the monetary authority, Bank Indonesia regulates and implements necessary monetary policies to maintain the stability of rupiah. The monetary policy is implemented by setting a target, the base money, and followed by close monitoring the development of the indicators, which can influence the price and exchange rate determination of rupiah. Any control over the indicators is conducted through indirect monetary tools of the so-called open market operations (OMO), and the minimum reserve requirement (MRR).

7.5.1. Open Market Operation

The OMO is conducted to influence the liquidity of rupiah in the money market, which will in turn manipulate the interest rate. The OMO is implemented either through the sale offering of Bank Indonesia certificates (SBI) or intervention on rupiah. Sale of the SBI is conducted through market auctions so that the discount rate achieved accurately reflects the liquidity situation of the money market. Any intervention by Bank Indonesia is targeted at adjusting money market conditions, either the liquidity or the interest rate.

7.5.2. Minimum Reserve Requirement

This policy requires each bank to maintain cash reserves that are an agreed percentage of its own deposit liabilities. Currently, the MRR is 5 per cent of the bank's third party liability, which must be kept in the respective bank's account in Bank Indonesia. If Bank Indonesia views that there is a need to tighten up monetary policy, it can then boost the MRR and vice versa.

7.5.3. Bank Indonesia as Lender of the Last Resort

Bank Indonesia also acts as the lender of the last resort. In performing this function, it may grant a loan or a financing to solve any short-term liquidity problem of banks due to mismatch of funding management. The loan is of 90 days maximum, inclusive of extensions, and a recipient bank is required to provide liquid, high quality collateral to the value of, at least equal to the amount of the loan (Sabirin, 2000).

7.6. Exchange Rate Stability in Indonesia

In order to avoid excessive price instability and to attract foreign capital, Indonesia tends formally or informally to peg its currency to the dollar or to a basket of foreign currencies. However, a fixed exchange rate is sustainable only if there is no divergence

between the inflation rate in the anchor country and the country with pegged rates. Often this condition is not fulfilled, and the combination of excessive real appreciation and external deficit leads to a crisis and a sharp exchange rate adjustment (IMF, 1997).

As long as the peg is viewed as credible, capital inflows can be enormous and lead to over investment or over consumption, especially if the local banking sector is poorly supervised. An overvaluation of the exchange rate, weak balance sheets, and a large foreign currency denominated debt will leave a country highly vulnerable to a change in sentiment among investors. Not only can the money that came into the country so easily depart as easily, but also the pegged exchange rate can become quite vulnerable to massive speculative outflows of capital.

Indeed, the choice of an exchange rate regime is not unrelated to the search for domestic macroeconomic policy credibility and quality. Exchange rate instability in emerging countries can have a negative impact on the availability of external finance (Goodhart and Illing, 2002).

7.7. Efficiency in the Indonesian Foreign Exchange Market

The leading approach in estimating long-term exchange rate equilibrium focuses on a sustainable current account balance for the medium to long term, and the internal balance of the economy that enables the current account balance to reach its sustainable level. Once the sustainable external balance has been defined, the equilibrium real exchange rate is derived using equations that link indicators such as foreign trade, domestic demand, and external competitiveness (Hoggarth and Soussa, 2001).

Two factors may rationalize regular fluctuations of actual exchange rates around the sustainable long-term equilibrium: discrepancies in real interest rates and risk premiums. A positive real interest rate differential implies a real appreciation of the exchange rate relative to the long-term average. This is because the positive differential increases the

attractiveness of investment in domestic financial assets which can finally lead to a significant exchange rate overvaluation.

The natural link between exchange rates and spreads in different long-term interest rates assumes perfect asset substitutability, and in general is affected by the existence of risk premiums. For example, a nation with a large external debt may have to offer its foreign creditors a return higher than they can get at home. At given interest rates, risk premiums may therefore play a critical role in an exchange rate determination.

A logical consequence of more flexible exchange rate policies is that the international community must be firm in avoiding exchange rate overshooting. A currency free fall generates risks of serious contagion and creates a vicious cycle. Lending massively to defend a rigid exchange rate is just a waste of money, but because it brings some calm to disorderly markets it could be a necessity (Kawai, 1986).

The IMF has considerable expertise on fiscal policies aimed at maintaining public sector solvency, controlling inflation, and maintaining interest rates at a level compatible with a stable exchange rate. After the recent financial turmoil in Southeast Asia, there is widespread agreement that countries such as Indonesia should not peg their currencies to USD. Over the past two decades many developing countries have shifted from a fixed exchange rate regime to more flexible arrangements.

The primary argument in favor of flexible exchange rates is that it makes it easier for an economy to adjust to external shocks, such as a rise in the oil price that widens a country's trade deficit. A flexible exchange rate also allows countries to devote monetary policy to price stability, rather than having to use interest rates to keep the exchange rate on target. The exchange rate can be volatile and grossly misaligned and therefore, the efficiency of the exchange rate market in Indonesia depends on the characteristics of the Indonesian economy embodied in the following factors (IMF, 2000):

- If Indonesia has much higher inflation than its trading partners, its exchange rate needs to be flexible to avoid its products from becoming uncompetitive in world markets;
- The more rigid the wages are, the greater the need for a flexible exchange rate to help the economy respond appropriately to an external shock;
- Indonesia with under developed financial markets, a freely floating exchange rate may not be prudent because a small number of foreign exchange trading can cause large volatility in currencies;
- The weaker the reputation of Bank Indonesia, the stronger the case for pegging the exchange rate in order to build strong confidence that inflation is controlled; and
- The more open the Indonesian economy is to international capital movement, the harder it is to maintain a fixed exchange rate. Therefore, free floating exchange rates are likely not the best option.

7.8. Exchange Rate Policy Cooperation in Asia

7.8.1. Collective Exchange Rate Regime

It is difficult to judge whether Asian countries in particular the Southeast Asian have incentives to cooperate for any kind of monetary integration in the future. However, adoption of a single currency will in the end be dictated not only by economic but also political developments in Asia to the degree that it is an endogenous process.

If Asian countries are firmly committed to establishing a currency union as a long-run objective, they have to design an arrangement for building institutions, developing policy coordination and surveillance, and managing liquidity support during the time before actually adopting a common currency.

The plan should include the choice of a common currency and collective exchange rate regime for Asian countries that will operate during the transition period. For a common currency, there are two alternatives: either adopt the currency of a large country such as USD, Euro, Yen, or to create a new currency altogether like Euro (Brealey, 2001).

Goldstein (2002) proposed dollarization of Asia with the view that currently the world is on a USD standard. Trade in goods and services in Asia are largely invoiced in terms of USD. This means that by fixing their exchange rates to USD, they have a better chance of maintaining price stability through the exchange rate changes into their domestic prices. Arguably, the risk element is important in Asia, because the bulk of the region's external borrowings are short term and denominated in USD.

Bordo (2003) listed a number of criteria including history of inflation, patterns of trade, and variability of relative prices that suggest some Asian economies, such as the Philippines, Hong Kong, China, and Singapore, belong to a dollar area. If joining a dollar bloc or any other currency bloc is not a realistic option, then Asia may imitate the European experience of creating a regional common currency. During the period of preparation for a common currency area, Asian countries could first implement those parts of a plan that facilitate and speed up monetary integration in the region.

Differences in the stages of development and the degree of trade and financial market liberalization suggest that it would be almost unimaginable that ASEAN would be able to negotiate a collective exchange rate regime acceptable to all members. A monetary integration in the Southeast Asia is expected to be an evolutionary development, beginning with a system of policy dialogues and reviews, while maintaining a variety of exchange rate regimes in the region, and then gradually moving on to the final integration.

As far as collective exchange rate regimes are concerned, there are three alternative regimes Southeast Asia could consider. They could imitate the European experience by introducing an Asian version of the European monetary system (EMS) that includes

Japan as a member. Another alternative is pegging to a common basket of currencies as Williamson (1999) suggested. If neither alternative is practical, then they may stabilize rather loosely to similar baskets consisting of major currencies.

Pegging to a currency basket is a collective exchange rate regime that may reduce volatility to a high degree in the short run and avert misalignment of the exchange rate in the long run compared to free floating in individual countries. The region as a whole could protect itself from fluctuations in USD vis-à-vis other major currencies. If a South east Asian version of Euro is not a practical solution to exchange rate policy coordination, then pegging to a currency basket is a reliable choice.

Furthermore, exchange rate stability against key international currencies such as USD, Yen and Euro is considered of equal importance to exchange rate stability of the regional currencies (Masson, 2001). In this regard, despite increasing intra regional trade dependence in Southeast Asia, a plan to adopt a common basket peg would be more viable than a Southeast Asian version of the EERM.

There are two versions of basket pegging that are considered appropriate to Southeast Asian countries. One version, a soft basket peg is a collective system in which Southeast Asian countries agree to currency baskets consisting of USD, Euro, and Yen. The second version is the one proposed by Williamson (2000) where the basket of USD, Euro and Yen is chosen as a common peg with almost equal weights. In this format, participating countries essentially use the basket of the three currencies as a common unit of account in their conduct of exchange rate policy. It is argued that many Southeast Asian countries rely as heavily on the US and Europe for export markets as they do on other Asian countries.

From the perspective of building the foundation for monetary integration in Southeast Asia, the serious deficiency of the basket system is that the major currencies are not part of the exchange rate arrangement designed to facilitate financial integration in Southeast Asia. Like US and EU, Japan will remain outside of the Southeast Asian basket

arrangement, and it is not clear whether it is prepared to intervene in sustaining the pegging in other Southeast Asian countries (McKinnon, 1991).

Mendoza (1995) pointed out that failure to build regional collective institutions including a financing system might in the end delay the foundation of a currency union in South east Asia. Even if Southeast Asian countries could be in agreement to a single currency in the future, the system will be vulnerable to speculative attacks. Williamson (1999) favors introducing a system with a reference rate for exchange rate policies of the Southeast Asian countries.

It is argued that this would be a very positive development for monetary integration. It is because the common unit of account could produce an expectation that variation in the bilateral exchange rates of USD, Euro, and Yen would not affect the relative competitive positions of the Southeast Asian countries. These countries joining in region-wide efforts to integrate financial markets may agree to change to a common basket peg in the future.

Differences in patterns of trade make the common pegging impractical, however in the common basket peg scheme, Southeast Asian countries only have to agree on a common unit of account for their exchange rate policy while maintaining a variety of exchange rate arrangements including intermediate regimes and a currency board.

Eichengreen and Bayoumi (1998) also discussed that defending a common peg would be much more difficult than introducing it. It requires an efficient institutional framework which facilitates:

- policy coordination among the participating member countries;
- a financing mechanism that will provide financial resources to the exchange rates of fragile currency members; and
- a surveillance instrument which could impose policy conditionality on the countries receiving the financial supports.

7.8.2. Southeast Asian Monetary System (SAMS)

A single Southeast Asian monetary system (SAMS) may appeal to many policy makers in the region simply because they could be guided by the development and management of the EMS in taking the steps necessary to copy the European exchange rate mechanism (EERM) in Asia. The EERM was a transitional arrangement that eventually led to the advent of Euro. It is argued that the least costly and most practicable option for a collective exchange rate regime for Southeast Asia is an imitation of the EMS (Gilpin, 2001).

One advantage is that the members of the SAMS could manage common dollar and euro exchange rates. The system also fosters cooperation in monetary policy and other financial matters. Most importantly, the SAMS members could make commitments to mutually unlimited support, which could strengthen the system's credibility and facilitate realignment of bilateral exchange rates of the participating countries (Hernandez and Montiel, 2001).

In view of the European experience with Euro, few people would recommend institutionalization of a similar system for Southeast Asia at this stage of the region's economic integration. Although many Southeast Asian countries intervene in their foreign exchange markets, they are generally classified as floaters. Moving from quasi floating or managed floating to a regime in which bilateral exchange rates among the member countries are tightly fixed is not a regime which many Southeast Asian countries would be able to manage (Delgado and Dumas, 1992).

In order to support any Southeast Asian Monetary system, countries in the region should agree on a new monetary unit similar to the Euro whose value will be tied to a basket of the specified Southeast Asian currencies (Kaminsky and Reinhart, 2000). They would also have to set up a Southeast Asian version of the European monetary cooperation fund.

The EMS is sustainable due to the fact that it was supported with unlimited financial support along with capital controls in the fragile currency countries.

7.9. Policy Implications for Indonesia

Arguably, Indonesia needs something in between, with more exchange rate flexibility but without going all the way to a free float exchange rate. Linking to a trade-weighted basket of currencies would provide more flexibility than a foreign currency such as USD peg (Gilpin, 2001). It helps to impose discipline on monetary policy, but still provides flexibility if Indonesia is attacked by huge capital inflows or outflows. Furthermore, the managed exchange rate has been a key ingredient in Indonesia's record 25 years of strong and steady economic growth prior to the 1997 currency crisis.

There is no clear evidence that developing economies with fixed exchange rates have grown any faster over the past two decades than those with flexible exchange rates. Inflation seems to be constantly lower in countries that have pegged their exchange rates. Indeed, there is no necessary relationship at all between the exchange rate regime and economic performance where growth can be high or low under any kind of regime (Schuler, 2003).

Expectation plays a key role in most financial models; including models for the exchange rate determination. For example, one of the main determinants in exchange rate models can include not only current values of the driving variables but also their expected future values. Perhaps the simplest approach to exchange rate modeling expectations is to assume that the expected value of a variable is a weighted combination of its current and recent values.

An alternative approach is to assume that people form their expectations of the future with reference to how Bank Indonesia responds to different pieces of information. Certainly, the policy response has to be convincing for the general public so not to

change the way they view the future. Thus, in any modeling exercise it is also necessary to make an assumption about the consistency of policy responses.

Any interest rate differential will widen with real exchange rate appreciation, and this will trigger capital inflows. Domestic inflation will rise with exchange rate depreciation, and the influence of foreign inflation will decrease with exchange rate appreciation (Kawai, 1986). The policy implications from this research relates to the exchange rate regime and its appropriate model. It is argued that closing the gap in the real interest rate differential is consistent with depreciation of the exchange rate. In order to achieve a low interest rate regime, the monetary authorities must be prepared to live with a relatively depreciated currency.

Should Bank Indonesia decide to maintain the optimal approach on exchange rate issues, it must limit intervention in the foreign exchange market and thus allow capital flows to be stabilized by the exchange rate movements in the medium to long term (Kenward, 1999). Because Indonesia at present has a floating exchange rate regime, it is also best to adopt a policy of doing nothing in the presence of short term capital inflows. This allows the exchange rate to determine the optimal flow of short-term capital and equilibrate the foreign exchange reserves.

The policy implications for Indonesia should relate to the exchange rate regime and the determination of rupiah. The results of the analysis show the effects of short term capital flows. Interventions to stop any adverse movements in the nominal exchange rate will finally lead to high interest rates. Thus, closing the gap in the real interest rate differential would be consistent with depreciating the exchange rate.

7.10. Policy Suggestions

One aspect of the critical exchange rate policy has been the proposal for exchange regimes to bring together the fixed and flexible rates by adding other policy instruments,

such as capital controls. If the foreign exchange market is unreliable and subject to irrational speculative bubbles, then a country will be reluctant to allow the exchange rate to float freely, preferring rather to peg the exchange rate. However, a permanently fixed exchange rate means abandoning the exchange rate flexibility.

Another compromise is an adjustable peg where the exchange rate is normally fixed, but can be adjusted when it seems clear that a change in relative prices is necessary. There is a major problem with such an adjustable peg system in a world of capital mobility where it is subject to massive speculative attacks whenever the market suspects that realignment is probable.

7.10.1. The Appropriate Exchange Rate Regime for Indonesia

Countries, which are primary producers or natural resource intensive exporters, may face inelastic demand for their products. Many developing countries trying to diversify their export base into newly manufactured products face stiff competition in export markets from other developing countries, as well as developed countries. Therefore the choice of exchange rate regime should reflect their actual and potential comparative advantages, and ability to take advantage of rapidly shifting demand and supply conditions.

It is imperative that the exchange rate regime in Indonesia support and sustain the speedy transformation in international trade and payments. It should be capable of handling large and frequent fluctuations in currency movements and provide for adequate financing of temporary imbalances in the overall balance of payments.

More importantly, it should reflect the needs of Indonesia for foreign capital. One of the distinguishing characteristics of capital movements in the 1990s was the increasing need for portfolio diversification by large institutional investors such as pension and mutual funds (Mishkin, 1999). External capital inflows of all types would certainly continue to play a vital role in the exchange rate policies of Indonesia. Any large, unexpected and

volatile inflow and outflow of funds, both temporary and permanent, will challenge the stability and liquidity of the external payments system.

In the past, rupiah would tend to appreciate and depreciate irregularly in quick succession. In addition, investors' perceptions about the impact of the country's domestic fiscal and monetary policies will be reflected in rapid and unstable movements of the exchange rate. The Indonesian exchange rate regime should simultaneously provide incentives for the competitive export of products as well as facilitate orderly inflow of foreign capital denominated in foreign currencies.

In this economic climate, the best compromise between providing for sufficient competitiveness of exports as well as full employment and economic growth, while minimizing the costs of unexpected changes in the external value of rupiah, seems to be a managed floating regime. This regime, provided it includes the required capital controls, will allow the stability of rupiah as the medium of exchange as well as the projected monetary growth.

It also provides a realistic independence for rupiah via a mechanism of devaluation controlled by Bank Indonesia and at the same time, the moving exchange rate reflects the shifting correlation between the purchasing power of the domestic currency and currencies of both the importing countries and other potential competing exporters. Thus rupiah could remain practically stable under different economic climates.

This arrangement will also respond to unexpected pressure of capital movements in an appropriate manner, by either depreciating or appreciating thru the capital controls mechanism taken by Bank Indonesia. The intervention measures are taken temporarily so to ensure the pressures are relieved.

The appropriately chosen rate should reflect the various needs for possible future intervention, except when the rate is continuously moving within the band. Thus foreign exchange reserves can be maintained, and the cost of intervention resulting from

unanticipated capital inflows can be managed economically (Krugman, 1998). As a result, market perceptions about the country's exchange rate policy become obvious, and chances of speculative attacks on rupiah are minimized.

By providing flexibility to maintain the rupiah's stability, one-way speculation about the level of rupiah becomes unprofitable. The tendency for the rate to sustain pressure is counterbalanced by the opposite tendency when outflows or inflows of capital mobility are completely controlled by Bank Indonesia. In this case, the need for long term capital imports to finance Indonesian economic development or the recurring current account deficit is satisfied. Exchange rate policies then must be aimed to stabilizing inflows of long term foreign capital, so it is available to mitigate unwanted exchange rate changes.

7.10.2. The Choice of the Shadow Price of Exchange Rate Model

As stated earlier, for the quantitative determination of the exchange rate requires the choice of a model and a regime. From the discussion in the previous sections of this chapter, it appears that a managed floating regime is appropriate for Indonesia. In the chapter 4 to 6, empirical applications of various foreign exchange models to Indonesia were provided.

The results of empirical analysis show that in comparison with other models, the shadow price model of exchange rate determination is preferable. It reflects the true configuration of financial and economic conditions in Indonesia and the distortions of international trade which have significantly influenced the real value of rupiah.

Capital inflows have been increasingly determining macroeconomic developments resulting in long-term increase in capital outflows and increased volatility of capital flows. There is also the need to evaluate the changes in nominal and real exchange rates under the periods of capital in and outflows as well as the impact of exchange rate policies on the management of these flows.

Nevertheless, the decision of the regime and model will depend on the definition of rupiah and the behavior of the financial related variables. Certainly, a wider definition of rupiah has a larger impact on the exchange rate determination model and regime. In addition to this, monetary variables only partially explain the discrepancy of the forecast error of external variables, trade balance and the exchange rate under the currently used floating exchange rate regime in Indonesia.

7.10.3. Supportive Measures

Indonesia should also increase efforts to attract as much foreign direct investment (FDI) as possible in the short term. Taking into account unfavorable balance of payments prospects, it should refrain from attracting further massive FDI in the non foreign exchange earning sectors for some years in the future. In an environment of large fiscal deficit and shaky foreign exchange reserves, foreign investors are unlikely to increase their contribution. Hence, drastic measures are needed to reduce the fiscal deficit on one hand and raise foreign exchange reserves on the other (Collier and Joshi, 1989).

Certainly, exchange rate policies play a critical role in transition economies such as Indonesia as they influence the outcome and costs of stabilization programs, the speed of structural changes including the shift in the allocation of factors of production between tradable and non-tradable sectors, and the outcome of the financial sector reform.

The major exchange rate policy issues have also changed rapidly, and currently include the contribution of the exchange rate regime to the management of capital flows and adjustment to the speed of opening of the capital account and the degree and timing of the support given by exchange rate policies to reduce inflation. Likewise important is the definition of the path of the equilibrium real exchange rate in a transition economy and the factors that determine its development over time.

Taking into account these priorities of exchange rate policies in advanced transition economies, the research analyses the factors determining the choice of exchange rate

regime under the current institutional and structural circumstances. Any shifts in the macroeconomic environment from high to moderate but persistent inflation, generally improved fiscal stance but rapidly worsening current account balances and increased volatility of capital flows (Noble, 2000).

An essential element in the choice of exchange regime is related to the increased exchange rate flexibility reflected in the growing use of the managed floating regime. The choice should address the experiences of transition economies in adopting exchange rate regimes, in terms of higher flexibility and credibility especially in relation to the competitiveness of tradable sector.

Bank Indonesia must also evaluate how to increase the flexibility and effectiveness of monetary policies related to the likely changes in the adopted monetary regime. This includes the emphasis on monetary and inflation targeting, with exchange rate targeting, and the costs and benefits of alternative exchange rate regimes in Indonesia.

Exchange rate policies should also be solely used as a disinflation tool in the first stage of transition and the widespread use of pegged exchange rate regimes shows this has been changing only gradually. Normally, inflation has been reduced from high and upper moderate levels to low and lower moderate levels that require a new approach of the exchange rate policy. The policy should also address the ways exchange rate policies may influence the speed and costs of disinflation in transition economies (Neely, 1999).

Another related issue is the analysis of the relationship between the choice of the exchange rate regime and monetary arrangements prevailing in advanced transition economies. These economies have so far followed either exchange rate or money supply targeting, with these arrangements modified to fit in the individual economies. The proposed policy should also address the exchange rate implications and the ways they influence the choice and operation of exchange rate regimes.

A further issue is the evaluation of real exchange rate movements in the transition economies such as Indonesia since most of them have experienced continuous and significant real exchange rate appreciation. It is important to determine whether this has been an equilibrium process explained by increased productivity and structural adjustment. This is a short-term policy issue as the current macroeconomic trends predict further real appreciation of rupiah as cited by Nasution (1999).

Finally, Bank Indonesia should assess the viability of the available options including currency board arrangements, euroisation, and dollarization. Apart from the choice of appropriate exchange rate regime, there is also a need to review the issues of real and nominal volatility and their impact on nominal and real appreciation.

As Apergis (2003) empirically demonstrated, changes in the exchange rates have an impact on the diversification of monetary holdings by economic agents. The internationalization of financial markets makes this diversification much stronger, and as a result it becomes more difficult for monetary authorities to implement any efficient exchange rate policy.

Conclusion

Although Bank Indonesia is known for its frequent interventions in the foreign exchange market, they are not likely to shift to either old or new intermediate regimes, officially in the near future. If Indonesia realizes the economic advantages of a currency union, then the variety of exchange rate regimes across the region may not be a real problem.

As Eichengreen (1994) noted, a free floating regime is not inconsistent with the regional efforts to establish a currency union in Southeast Asia, provided that the relevant countries improve the efficiency and stability of their financial systems. This will certainly enhance their foreign exchange markets as well.

One of the standard arguments against fixed exchange rate regimes in general, and full dollarization in particular, emphasizes that a flexible exchange rate is better equipped to protect the real economy from external and real shocks. Indeed, there is evidence that the fixed regime is associated with higher output volatility. Moreover, since price rigidity in a fixed regime tends to be higher when it comes to reducing prices, the sequence of quantity adjustments during recessions, and price adjustment during expansions may result in a smaller growth rate in the long run (Broda, 2002).

There are many reasons why financial dollarization should be considered as a future option for Indonesia. A dollarized Indonesia experiences limited wide fluctuations in the nominal exchange rate of rupiah due to its impact on inflation performance. But some dollarization may hedge the exchange rate risk of tradable producers, widespread financial dollarization inevitably introduces a currency imbalance for the economy as a whole (Chang and Velasco, 2000).

Among the main costs attributed to full dollarization is the loss of the capacity of the domestic central bank to play its lender of last resort function, specifically the ability to provide additional liquidity to the banking sector in the event of a temporary shortage.

While central banks can issue domestic currency at no cost, an excess demand of foreign currency in the market can only be met by the existence of a stock of liquid foreign currency denominated reserves (Kaminsky and Reinhart, 2000).

Similar arguments apply to the dollarization of public debts that Indonesia has denominated in foreign currencies. This has been usually attributed to the country's inability to borrow in rupiah, presumably due to its weaknesses. The dollarization of government debts could be interpreted as the outcome of a stabilizing strategy, simply by reducing the exchange rate exposures naturally (Calvo and Mishkin, 2003).

In contrast, the inability of monetary authorities to fulfill their lender of last resort duties to a troubled financial sector may imply that a currency board would raise investor concerns rather than lower them. In fact, Indonesia has traditionally run a relatively tight fiscal and monetary policy. As a large country in Southeast Asia with strong trade ties to other Asian nations, the reasons for abandoning monetary policy independence and pegging to the major currencies such as USD seem unclear. This is due to the fact that unexpected policy implications will arise with both pegging the exchange rate and choosing USD as the pegged currency.

CHAPTER 8

SUMMARY AND CONCLUSION

8.1. Introduction

Exchange rate determination in developing countries such as Indonesia is a very complex task and a crucial issue in effort to manage the stability of the currency and economy. This choice of an exchange rate regime and model for determining an exchange rate and its associated policy for a country should be done in an integrated way.

In the case of Indonesia, prior to the shocking Asian financial crisis in 1997, the Indonesian rupiah was relatively stable. The Indonesian government played a significant role in the implementation of the managed floating rate regime to achieve the desired exchange rate. Indeed, the situation changed when there was a contagious financial crisis that began in Thailand in 1997. Realizing that there was no reasonable chance in continuing the managed floating regime due to the high cost of foreign exchange reserves, Bank Indonesia finally adopted a freely floating exchange rate regime.

Following the currency crisis, in March 1998 Bank Indonesia raised the interest rate up to 63 per cent when rupiah soared to around 17,000 per USD. The aim was to hold back the strong demand on USD in the domestic market. The strong demand on USD existed because people traded the currency against rupiah to generate a quick profit from its strong appreciation.

At that time USD became a new type of commodity that was openly traded not only on the foreign exchange market but also in public. People believed in the strength of USD

and got a sense of security in holding them, so they began accumulating their cash, term deposits and even savings in USDs. This trend further strengthened USD vis a vis rupiah, though the Indonesian government was able to stabilize this situation by balancing it with a relatively high official interest rate for holding rupiah.

Currently, USD in Indonesia is widely traded in an unofficial market rate band, without regular interventions by Bank Indonesia as it used to be. It is imperative for the policy makers to have sound exchange rate policies along with a well-disciplined implementation both in the adopted exchange rate regime and the appropriate modeling of exchange rate determination.

8.2. Major Findings and Implications

This research has produced results relevant to future research on the foreign exchange determination and its associated regime particularly for developing countries such as Indonesia, where there are significant levels of market distortions that affect the supply and demand in the currency market. The major findings and their implications are summarized below.

8.2.1. Exchange Rate Modeling

Different types of models such as purchasing power parity, monetary, and shadow price models are developed, applied and tested in this study. The exchange rate determination in Indonesia is viewed as being full of market distortions, a common pattern in many developing countries. The models used at present do not reflect the social value of the currency based on its real economic value. The market models also do not take into account the key function of the exchange rate which is representing a rate considered as a fair value in the form of a unit price. On the contrary, the shadow price model offers a solution to the exchange rate determination in Indonesia. Therefore a modeling approach

based on shadow price model adjusted by the considerations of the market factors is proposed and adopted in this thesis.

8.2.2. Exchange Rate Regime

There was a significant shift in the adopted currency regime in Indonesia as a result of the 1997 Asian financial crisis. In the absence of this kind of financial crisis which finally led to a currency crisis, Bank Indonesia perhaps would have continued using the managed floating exchange rate regime that had provided a relatively stable exchange rate for Indonesia.

The USD's position post 1997 has considerably shifted as the result of the financial crisis with a strong and constant demand for holdings from general public. Bank Indonesia is no longer in a position to maintain the targeted rate but sometimes still plays a role similar to other market participants in buying and selling USD, for the purpose of providing a kind of market guidance.

A managed floating regime where Bank Indonesia has the power to monitor the desired exchange rate target is compatible to the associated model which is the shadow price model.

8.2.3. Central Bank's Role

The role of Bank Indonesia as the lender of last resort is still in place. In addition, Bank Indonesia has gained independence as a monetary institution responsible for contractionary and expansionary monetary policies. It is clear that post 1997; Bank Indonesia is somewhat out of the market and will only take an active part when the exchange rate market needs some kind of guidance as to where the rate level should be.

8.2.4. Exchange Rate Volatility

Theoretically, exchange rate volatility is always present in a foreign exchange market and could lead to a major crisis should the market perceive major currency turmoil is imminent. Since there is a need for the government to interfere in the market, it seems that minor volatility has become an integral part of the daily exchange rate in Indonesia as in other similar markets in the globalised financial market. The exchange rate policy implications of the present study are further discussed below.

8.3. Exchange Rate Policy Implications

Empirical evidence indicates that there is a strong correlation between an exchange rate policy and its implications on the whole financial markets. A sound exchange rate policy should take into account three main considerations. Firstly, it should be able to maintain a stable exchange rate in the market. Some volatility may be good if it falls within a certain band rate, generally a rate beyond this could create uncertain condition if not chaos to the whole financial market.

To design a policy that will guarantee a stable rate, policy makers must be able to set a series of effective regulations that will prevent the currency from being traded as a commodity with intrinsic values alongside others in the financial market. A paper currency is not a gold backed one thus should not be regarded as the same in circulation.

Secondly, the exchange rate policy should also facilitate the convertibility of rupiah in the market. Any economic enterprise or person should be able to convert their holdings of rupiah into any foreign currencies easily without any interference from the so-called monetary agents. This will encourage confidence in holding any type of currency including the local one. However the convertibility should not be so unregulated as to create an unexpected major exchange rate crisis should it go out of control.

Finally, there is a strong argument on the role of Bank Indonesia in designing and implementing exchange rate policies. It does require that this role be defined with clear boundaries. The role must be differentiated between policy makers and executors of such policies. Bank Indonesia also cannot become an active player in the market if the government wants the implementation of such a policy to be successful. Therefore, clear-cut guidelines must be in place so as to not produce any mishaps in the market.

Other supporting policies for the successful implementation of the exchange rate policies can also play a crucial role. An efficient exchange rate market is also an integral part of the financial market, where all participants have equal access into the market to buy or to sell any currency. Any sound policies lacking an efficient market in the end will not lead to a successful implementation and will certainly produce instability in the market generally.

A foreign exchange market with an adequate policy and a correct implementation will be the final aim of the whole process and will strengthen the financial market as a whole. Most developing countries including Indonesia are primarily fragile in both market efficiency and sound exchange rate policies.

The adopted currency regime should also correspond with the other macroeconomic, monetary and financial policies undertaken by the policy makers. Any changes in the regime will shift the policies and need correct adjustments to implement it properly. This will also involve the need for reforms within the central bank in many developing countries in order to clarify their roles in day-to-day exchange rate management. Certainly, inflexible exchange rate policies will have an adverse impact on the exchange market as has proven to be the case in Indonesia with the experience of a major currency crisis in 1997.

8.4. Significance

This thesis has developed a new integrated approach to the determination of the exchange rate in Indonesia in relation to the exchange rate model and regime. It is related to two choices – the choice of a regime and an appropriate model for that chosen regime. When a regime is known, an appropriate model responding to that regime can be adopted to determine quantitatively the rate to follow in an economy.

This is a general approach, but it is applicable to all types of economies irrespective of its underlying social organization. It also contributes to some extent to research on the exchange rate determination for developing countries. The main focus is on the associated currency regime and its modeling aspects that give a practical application on exchange rate management.

This certainly will enhance future research on the exchange rate determination in an integrated way especially for Indonesia and other similar developing countries where few studies have been undertaken. It will also demonstrate the need for sound exchange rate policies, an appropriate currency regime and its corresponding model as well as an efficient exchange rate market.

8.5. Limitations

This research focuses on different aspects of currency regimes and models as well as other possible options for the management of exchange rate policies. However, it does not develop a much more detailed study able to capture non-quantitative parameters. To some extent these parameters also play a role in affecting the decision of market players on the demand and supply side of the exchange rate market.

8.6. Future Research

In this study, the different exchange rate regimes and models are discussed and compared. This can be a good basis for any future research which will discuss a more detailed and comprehensive investigation in relation to an advanced modeling approach for identifying an appropriate exchange rate regime. In the future, with more sophisticated computer software and new developed mathematical models, the exchange rate determination using modeling techniques could be a much less complex task.

Other possible future research should focus not only on the modeling aspects, but also on other relevant issues such as regional currency blocs, adoption of gold and silver backed currencies, and the future roles of the central bank and other monetary authorities. Good governance of the monetary authority is also an imperative aspect of future studies.

Conclusion

This research provides analyses of a number of different currency regimes and mathematical modeling approaches for the exchange rate determination particularly in developing countries such as Indonesia. The reviews in this thesis show that the decision to freely float rupiah in Indonesia when the contagious currency crisis in 1997 was in fact neither timely nor appropriate. Major currencies were considered commodities openly traded in, arguably, an inefficient currency market. Indeed, market distortions play a crucial role in the exchange rate determination in developing countries.

In summary, a long-run relationship between the exchange rate and relative prices cannot be concluded for Indonesia. However, the hypotheses of unit roots are rejected for the relative PPP and FPM models. This implies that for the Indonesian case, the relative PPP holds in the long run and there is also a long-run relationship amongst the variables of the FPM model.

The Indonesian rupiah responds to the error correction mechanism (ECM) by moving to decrease the disequilibrium. Here, any adjustment to the conditional mean appears to be affected by changes in the interest rate. Therefore, an increase in the interest rate is associated with a strengthening of the currency.

The shadow price of exchange rate (SPER) is defined as the economic price of foreign currency. There is a common misconception that if the market for foreign exchange is freely floating, the SPER is equal to the market exchange rate. That would be the case only if there were no taxes and subsidies on the demand and supply of tradable goods, if all commodities and factors were priced at their economic value, and if the current account deficit was sustainable. In all cases, the SPER in Indonesia diverges from the market or the official exchange rate (OER).

This thesis shows that under current circumstances in Indonesia, the shadow price of exchange rate (SPER) model with a managed floating regime would provide stability in the day-to-day foreign currencies rates rather than the present freely floating rate regime. A comparison of different models also shows that the SPER model is a more reliable and practical technique able to capture different inefficient parameters such as trade distortions. This kind of inefficiency would be closely taken into account using this type of modeling and regime choice approach developed in this thesis.

An alternative currency bloc similar to the one in Europe would also be another possibility. This exchange rate policy should be fundamentally and properly considered prior to its adoption due to the fact that it would directly involve currency policies of foreign countries. The critical success factors of this alternative depend on how sound the exchange rate policies of a developing country like Indonesia are adjusting to any global changes in the currency markets. Today Indonesia, like any other country in the world, has become an integral part of the globalized financial market.

Hence an appropriate exchange rate policy must involve an inclusive aspect of the exchange rate determination along with the full commitment of policy makers in pursuit of it. Ideally, this should be solely targeted at the stability of the currency and the maintenance of its primary role as a medium of exchange. Therefore any paper backed currency must not be perceived as a real commodity such as what is occurring now in Indonesia and in many other developing countries. Certainly, any exchange rate policies should also take into account this issue seriously.

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