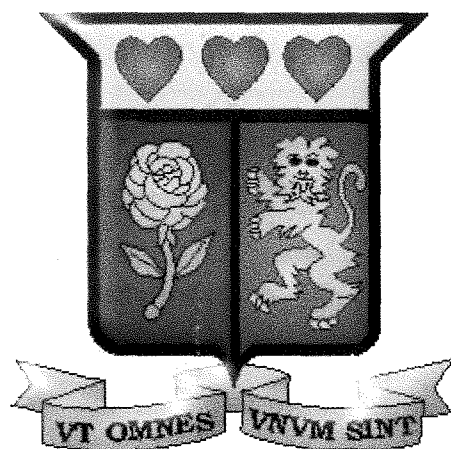


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DETERMINANTS OF EXCHANGE RATES AND FOREIGN EXCHANGE  
VOLATILITY: A COMPARATIVE STUDY OF SELECTED COUNTRIES

SUBMITTED BY: WAIGURU KARANJA

JULY 2010

A THESIS SUBMITTED TO STRATHMORE UNIVERSITY IN PARTIAL  
FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF MASTER OF  
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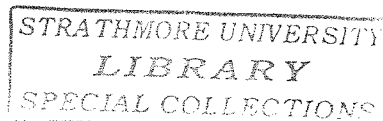
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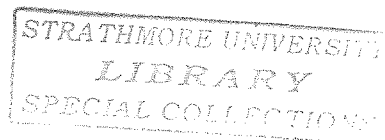
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## ABSTRACT

Explaining the movements in the exchange rate is still a puzzle to economists particularly since the break down of the Bretton Wood system in the early 1970's, when many countries introduced a floating system. This paper tries to deepen our understanding of this puzzle by using a model that makes use of data from Singapore, the UK and Kenya. The period covered is January 1993 and December 2008. The variables in the model money supply, current account balance, capital account balance, official reserves balance, interest rate and inflation differential. The dependent variable is exchange rate. The model has purchasing power parity and uncovered interest parity as underlying theoretical assumptions, two main building blocks of open macro economics. A linear regression model was used to analyze the data. In addition Cointegration and Granger-Simms causality tests were used to gain further insights into the research problem.

The results show that most of the variables have an inverse relationship with the exchange rate. In emerging and developing countries (Singapore and Kenya) it is the exchange rate which influence the movement of economic fundamentals in question and not the other way round, although interest rate differential constitutes a significant explanatory variable for exchange rate movements in all the three countries included in the model. Both Singapore and the UK have also, in accordance with the RID model, the expected negative sign on the coefficient. The results regarding the other variables are mixed among the countries.



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## CHAPTER ONE

### 1.1 INTRODUCTION

Exchange rate risk plays a major role in international portfolio diversification and investment, several aspects of economic policy, including the assessment of uncertainty surrounding prices of exports and imports, the value of international reserves and open positions in foreign currency, and the domestic currency value of debt payments and workers' remittances which, in turn, may affect domestic wages, prices, output and employment. In international financial markets, expectations of future exchange rates affect agents' decisions in a number of aspects, including their investment, hedging, and borrowing and lending decisions. It is not surprising; therefore, that an enormous empirical literature has been developed which focuses on modeling and forecasting nominal exchange rates(William,2007).

Since the collapse of the Bretton Woods system in 1973 the exchange rates have shown much volatility. Since then a lot of research has been undertaken to understand the behaviour of exchange rate movements. Some of the perennial questions that were raised are, for example: what are the determinants of exchange rate? , Do exchange rates follow a specific pattern?, Is there any theory that can help us in predicting the exchange rate movements?. Many approaches developed in the area of open economy macroeconomics have tried to address these questions. However, these approaches have had some success in explaining exchange rate movements only in the medium and the long-term,(Peterson, 2005). But these macro fundamental theories however, could offer explanation for the short run exchange rate movements in the market.

The vast majority of the empirical literature on forecasting exchange rates has centered on forecasting the level of nominal exchange rates. This literature is highly influenced by the seminal work of Meese and Rogoff (1983), who first documented that empirical exchange rate models, based on conventional macroeconomic fundamentals suggested by international macroeconomics theory, cannot outperform a simple no-

change or random walk forecast of exchange rates in terms of standard measures of point forecast accuracy. After over twenty years of research since the publication of the Meese-Rogoff studies, their findings remain, with a few exceptions, very robust (Mark, 1995; Neely and Sarno, 2002; Williamson, 2007).

While macroeconomic fundamentals do not appear to be useful in forecasting exchange rates, however, models which exploit the information in the term structure of forward exchange rates and forward premia have produced satisfactory results. Clarida and Taylor (2003) first argued that, although the forward exchange rate is not an optimal predictor of the future spot exchange rate, forward rates may still contain valuable information for forecasting future spot exchange rates. Though, only interest rates are taken into account when calculating the forward exchange rate by commercial banks.

In the modern system of floating exchange rates, the price of one currency relative to another is determined by supply and demand. This supply and demand balance reflects the expectations of thousands of investors worldwide, and fluctuates constantly in response to an endless array of economic and geopolitical events. More demand for a currency results in appreciation; less demand causes a fall in its value or depreciation. The experience of floating exchange rates since 1971 has led to a radical reconsideration of how exchange rate determination may be best understood. The fundamental proposition that the determination of exchange rates is best viewed as being akin to the determination of prices of financial assets (Rose, 2006).

Fluctuations in exchange rates are continual and often defy explanation, at least in the short run. In the long run, however, there are linkages between domestic and foreign inflation, and between interest rates and foreign exchange rates. These relationships provide an underlying theory of international product and financial market equilibrium. While current interest rates and expected inflation rates have strong links to expected changes in exchange rates, they cannot reliably predict actual changes. These relationships are reflected in the concepts of purchasing power parity, covered interest rate parity and uncovered interest rate parity.

In a world of continuously growing foreign exchange trade, where the search for an arbitrage opportunity is more intense than ever and the amount of capital and export flow larger than ever before, it is of interest to investigate which factors really are affecting movements in the exchange rate. To truly understand the mechanisms behind exchange rate movements has always been of great interest for economists around the world, and as a consequence, many studies have been conducted in the area. One of the most famous ones originates from a model developed by Frankel (1979).

Notwithstanding this evidence, it seems hard to believe that broad knowledge of the state of the economy at a point in time is useless information to forecast exchange rate movements. It may be that exchange rate models perform poorly not only because the information in the fundamentals is deficient, but because volatile expectations and departures from rationality are likely to account for the failure of exchange rate models. There has been an ongoing debate on the appropriate exchange rate policy in developing countries. The debate focuses on the degree of fluctuations in the exchange rate in the face of internal and external shocks. Exchange rate fluctuations are likely, in turn, to determine economic performance. In judging the desirability of exchange rate fluctuations, it becomes, therefore, necessary to evaluate the exchange rate.

## 1.2 BACKGROUND INFORMATION

In Kenya, exchange rate regimes have evolved along the general macroeconomic policies adopted since independence. Kenya's economy in the 1960s and 1970s was predominantly characterized by controls in virtually all key sectors. There were controls on domestic prices, foreign exchange transactions, interest rates and import licensing, among others. This approach seemed to have served the economy well as evidenced by the remarkable economic growth witnessed in the first decade after independence—with an average GDP growth rate of 6.6% during the period from 1964 to 1973.

However, when a series of external shocks emerged, this approach to macroeconomic management proved inadequate. This was because adjustment, especially to external shocks, was through the exchange rate and other prices and was delayed, and this worsened the economic performance. There have been several of those shocks. For example, in 1971, Kenya experienced a severe deterioration in trade, which led to the first balance of payments crisis. This was accompanied by an expansionary fiscal and monetary policy. Another major shock came from the oil price hike in 1973/74. This time the economy was so hard hit that signs of instability were quite evident. In the period from 1973 to 1975, inflation rose from 9.3% to 19.2%, domestic credit increased by over 60% and government's external and internal borrowing also increased (Ndung'u 1993).

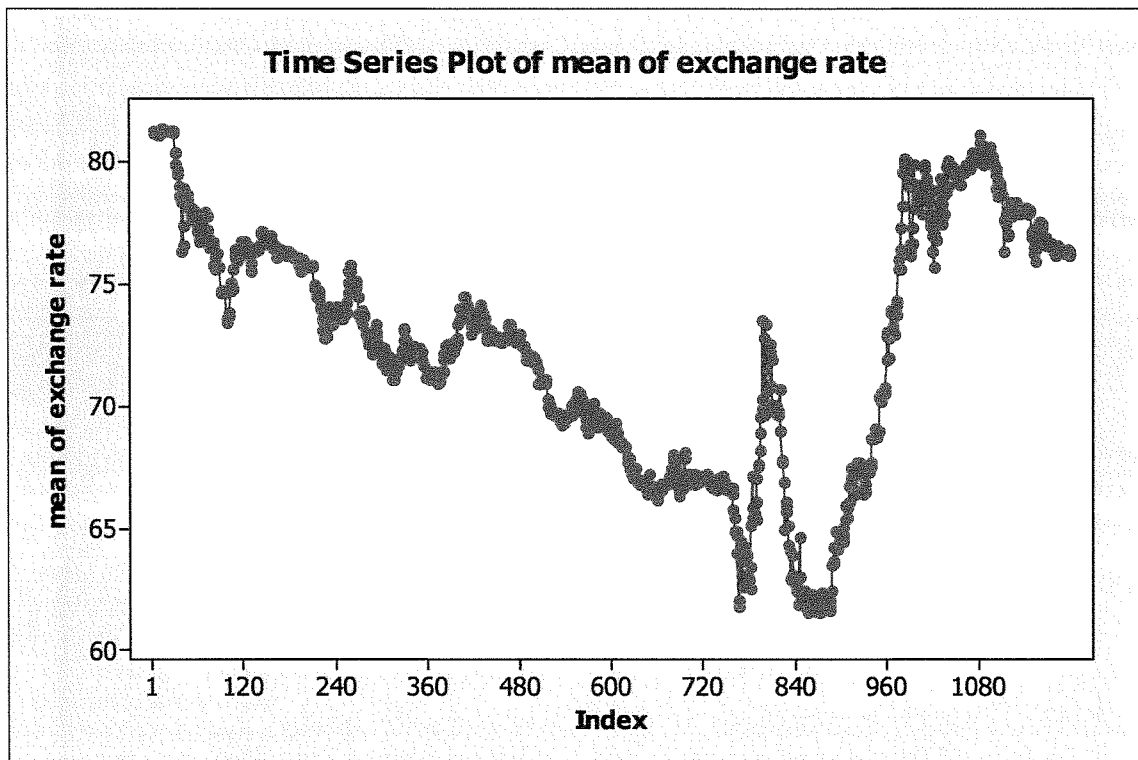


Fig 1 .Exchange rate movements volatility since January 2004 to October 2009

Source: Central Bank of Kenya

This led to a devaluation of the Kenya shilling in 1975. This was followed by a positive shock in the form of a commodity boom in 1977, but the second oil crisis of 1978/79 compounded the problems and exposed the country's vulnerability to external factors. Relying heavily on the benefits of the coffee boom, the government did not undertake the necessary reforms that would have helped the economy to withstand the second oil shock. The trade and current account deficits that had remained relatively low in the 1960s and 1970s reached unprecedented levels during 1978 to 1981. By 1982, it was clear that the macroeconomic policies pursued had glaring loopholes and were unsustainable, forcing the government to change course.

Consequently, the government started to liberalize the economy, following typical structural adjustment policies. As an intermediate step, the exchange rate policy was changed to a crawling one. Even though this policy is associated with inflationary accommodation, it did not lead to a high inflation regime as such. Analysis seems to point to the fact that the inflation profile changed because of a loss of nominal anchor, but that only inflation inertia increased. The adjustment process was slow and marked by reluctance to undertake reforms, and thus it worsened the situation. Even with these experiences, the control regimes were still firmly placed, preventing adjustment through prices and exports and encouraging a curbside market to develop,(Ndung'u 2000).

In the 1990s, liberalization was intensified in both financial and goods markets. Prices in the goods market were decontrolled; interest rates were liberalized. Foreign exchange controls were gradually relaxed. In fact, the exchange rate regime operated under a dual system in 1992 since there was an 'official' exchange rate and a 'market' rate. The latter operated on the basis of Foreign Exchange Bearer Certificates, which could be purchased at the official exchange rate from the Central Bank in foreign exchange, without having to declare the source of the foreign exchange, and then marketed as any other paper asset (Ndung'u and Ngugi 1999). This facility was a major relief in the foreign exchange market as it entitled the bearer to some liberalization. When the certificates were suspended in January 1993, exporters were allowed to retain specified proportions of their foreign exchange earnings, while importers were required to purchase their foreign

exchange from commercial banks (Ndung'u 2000) amount of foreign exchange without going through the tedious and time-consuming foreign exchange licensing process.

By March 1993, however, speculation in the foreign exchange market was prevalent. Kenya was in great danger of capital flight. The market was also characterized by uncertainty, especially in regard to future exchange rate transactions such as importation on trade credit. In an attempt to avert the ensuing crisis, the official exchange rate was devalued three times in the first half of the year. Meanwhile, the amount of money in circulation increased.

The Kenya shilling exchange rate has gone through various cycles. The shilling depreciated by 78.2% in January 1995 to October 2000 followed by a period of relative stability (October 2000 to November 2004). Recently however, the shilling has experienced a strong appreciation. The large swings in the shilling exchange rate are also associated with varying degrees of volatility. Volatility was highest during the period just after liberalization, that is, January 1995 to October 2000 and lowest in the period from October 2000 to November 2004. Since then, however, the shilling experienced prolonged appreciation in nominal and real terms up to the end of June 2008. The fluctuation in the exchange rate has attracted public attention especially from exporters who have argued that the strengthening shilling is eroding their competitiveness.

### 1.3 STATEMENT OF THE PROBLEM

There is no consensus in the literature on the factors affecting exchange rates and their volatility. This absence of agreement reflects basic difficulties in modeling and predicting exchange rates. Much of the existing work focuses on the levels of exchange rates, but also has implications for exchange rate volatility (the standard deviation or second moment). In the literature, three principal views have emerged, at least over short time horizons and for countries without high inflation, exchange rate models that include macroeconomic fundamentals do not perform better than a random walk in out-of-sample forecasting (Meese 1995). The considerable volatility of exchange rates since the end of the system of Bretton Woods apparently cannot be explained by fundamentals like differences in inflation. The role of fundamentals is either insignificant or is tending to be so in recent years. The problems of policy inconsistency and the so-called good news and bad news effects seem to be playing a more dynamic role in the exchange market behavior today .

Macroeconomic fundamentals, on the other hand, play an important role in explaining the behavior of exchange rates. Some authors hold that these fundamentals are important only in the long run but have little to offer in explaining short-run movements, while others believe that macroeconomic fundamentals have explanatory power both in the long run and the short run, (Engel et al., 2008). Neither macroeconomic fundamentals nor the random walk model adequately account for exchange rate behavior at short horizons. Rather, short-run exchange rate movements are attributed to market microstructure factors, including inventory management and information aggregation by foreign exchange dealers. Specifically, the microstructure approach suggests that non dealers learn about fundamentals affecting the exchange rate, and this knowledge is reflected in the orders they place with dealers. Dealers in turn learn about fundamentals from order flow (Evans and Lyons, 2002). The outcome of this two-stage learning process results in the formation of a price.

The long run fundamental variables changes relatively little in the short run, have only a minor influence on the short run exchange rate. It is difficult to claim that short run movements in exchange rates are based upon a wide set of fundamental variables, with irrationality of market participants, bubbles, herd behaviour etc., i.e. factors which are hard to capture in econometric models. (Neely and Sarno 2002) argue that instead of forecasting exchange rates through fundamentals, the agents can directly predict output, inflation and uncovered interest rate parity (UIP).

Monetary policy and macroeconomic fundamentals are indeed an important driving force behind exchange rate movements (Hong, et al., 2007) .But as a matter of concern; in emerging and developing economies, the scenario looks different since it is the exchange rate which influences monetary policy. Moreover, as a result of globalization, exchange rates are determined the same way throughout the world, hence emerging and frontier economies are price takers and their macroeconomic fundamentals plays a major role in the determination of exchange in the economy in the short run, since most of their macro fundamentals are influenced by what is happening in the global arena.

As a result exchange rate influences inflation in most of these economies. Hence, higher than expected inflation raises the expectations of monetary policy tightening, entailing an immediate appreciation of the home currency. On the other hand, higher inflation implies an appreciation of the real exchange rate. Exchange rate movements have effects on inflation but may in turn also be affected by inflation. If purchasing power parity were to hold, a rise in inflation would require a depreciation of the nominal exchange rate.

Exchange rates influences inflation through the prices of traded final goods and imported intermediate goods, and through their impact on inflation expectations. In this sense, the exchange rate could be potentially important under any policy regime that to some extent cares about inflation.

Previous empirical literature have focused much on the theory of purchasing power parity exchange rate volatility in the global economy(Chortareas and Driver 2001).Factors which include capital flows,GDP output, money supply, trade balance and interest rate also play a vital role in the determination of exchange rate . Short-term exchange rate volatility and market functioning are certainly not new as a practical concern of central bankers or as an area of research. However, these issues have thus far received relatively little attention in the line of research that seeks to explain why some economies appear reluctant to see large exchange rate fluctuations. Most research has focused on medium to long run since they believe that economic fundamentals have little to offer in the short run. However ,since economies experience different economic conditions , economic fundamentals have a role to play in the short run in emerging and developing economies ,in exchange rate determination.

In the short run, where transactions tend to occur in a very short time span, it is easily understandable that practitioners do not consider these macro variables at the moment of forming their expectations; e.g. market participants do not in fact all use a common agreed-upon model for thinking about the foreign exchange market and do not all share the same expectations at any point of time. The present study questions the relevance of macro theories in explaining and predicting day to day movements in the foreign exchange market. It is implicitly acknowledged that fads and/or speculation are the most important aspects of intra day/day-to-day transactions in the foreign exchange markets rather than fundamentals. This is because the speculative agents' role may be an important factor on influencing the short-term behaviour of the market.

Excessive capital inflows into countries with shallow capital markets have contributed to excess volatility. Fast credit growth, asset price bubbles and overinvestment have emerged, which have cumulated, have led to a fast reversal of international capital flows and sharp depreciations of the domestic currency. The short-term gains in economic growth are eroded by crisis and recession leaving the long-term growth effect of floating exchange rate regimes indeterminate (Molodtsova, et al., 2008). While current interest

rates and expected inflation rates have strong links to expected changes in exchange rates, they cannot reliably predict actual changes.

The forward rate is a poor predictor of the future spot rate. Developing countries have been experiencing periods of high inflation rates, which in theory is believed, to result in depreciation of the domestic currency which has not been the case, as at the same time, due to increased capital flows which result to increased money supply in the domestic economy there has been appreciation of the domestic currency. It seems reasonable to think that high-interest rate currencies should be expected to depreciate, so exchange - rate changes reduce international disparities in total expected returns this hypothesis is known as uncovered interest parity. However, we find that high interest-rate currencies tend to appreciate.

#### 1.4 OBJECTIVES OF THE STUDY:

The main objective of this study is to examine which factors explain the exchange rate between countries and to study the implications of exchange rate volatility.

The following are some of the specific objectives;

1. To determine the magnitude played by the fundamental economic variables, which include interest rate on the 91 treasury bills, inflation differential, current account balance and official reserves, in relation to exchange rate.
2. To examine whether there is any cointegration relationship between the various variables in the exchange rate determination.
3. To find out the predictability of exchange rates in different time horizons.
4. To identify potential fundamental determinants of exchange rate volatility.
5. To assess the effects of exchange rate movement volatility for a developing country on monetary policy.
6. To test the whether there is direct causality between the dependent variable and the independent variables.

## 1.5 HYPOTHESES

H01. Inflation differential is a significant determinant of exchange rate

H02. Capital account balance is a significant determinant of exchange rate.

H03. Interest rate differential is a significant determinant of exchange rate

H04. Change in money supply is a significant determinant of exchange rate.

H05. Current account is a significant determinant of exchange rate.

H06. Change in foreign exchange reserves a significant determinant of related to exchange rate.

H07. Exchange rate,  $s$  is non-stationary. The alternative hypothesis is that,  $s$  is stationary and hence that the real exchange rate exhibits only temporary deviations from purchasing power parity.

## 1.6 SIGNIFICANCE OF THE STUDY

- Central bank; the economic policy implication is to remove exchange rate volatility to foster trade and growth. The impact of exchange rate volatility on trade among two or a group of countries has both a micro- and macroeconomic dimension. Aguirre(2006), from a microeconomic perspective exchange rate volatility for instance measured as day-to-day or week-to-week exchange rate fluctuations is associated with higher transactions costs because uncertainty is high and hedging foreign exchange risk is costly, Ibrahim(2003). When exchange rates are ignored by central banks, they are typically extremely volatile; when exchange rates are managed, much of this volatility vanishes. Fixing the exchange rate fixes the problem of exchange rate volatility. IMF (2004), the objective of policymakers' i.e. monetary authorities is to lead their economies to a stable growth path. In order to avoid fluctuations in the overall economy, it is important to align various policy variables to stabilize the economy.

- Government; if exchange rate volatility is eliminated, international arbitrage enhances efficiency, productivity and welfare, Williamson, (2007). These microeconomic benefits of exchange rate stabilization will have a detrimental effect. Assessing the equilibrium levels of exchange rates is an important responsibility of macroeconomic policymakers. Exchange rates have a major influence on the prices faced by consumers and producers throughout the world, and the consequences of substantial misalignments can be extremely costly. Acosta et al(2007),the currency crises experienced by a number of emerging-market economies over the past decade testify to the large output contractions and extensive economic hardship that can be suffered when exchange rates become badly misaligned and subsequently change abruptly. Eichengreen et al (1998), moreover, there is reasonably strong evidence that the alignment of exchange rates has a critical influence on the rate of growth of per capita output in low income countries.
- Exporters ; if they expect the local currency to appreciate against the dollar they can either buy local currency forward, or call option. On the other hand increasing the levels of local currency cash and marketable securities, relax local currency credit terms, speed up collection of soft currency receivables and reduce local borrowing. Speed up payment of payable and delay dividend and fee remittances to the parent company. And if they expect local currency depreciation they can, sell local currency forward or buy local currency put option, reduce levels of local currency cash and marketable securities, tighten credit, delay collection of hard currency receivables, borrow locally and delay payment of accounts payables and speed up dividend and fee remittances to the parent company, Barrel et al (2007).
- Multinational businesses; are concerned about depreciation of assets held in a foreign currency due solely to adverse foreign exchange movements. They can reduce this financial foreign exchange risk by matching long-term liabilities with assets. If liabilities are denominated in the same currency as assets, foreign

exchange fluctuations that cause asset values to fall also cause liabilities to shrink. A match between assets and liabilities prevents loss of value, at least partially, without the costs and complications of separate financial market transactions, Cheung et al (2001). Multinational business with significant sales in a foreign currency may be concerned that the sales currency will depreciate against their functional currency, causing a sudden reduction in functional-currency earnings.

- Development economists; the exchange rate should be recognized as a decisive link between the internal economy of a country and the international economy, Edwards (1998). Given the very limited flexibility of internal prices, the nominal exchange rate is key to determining the real exchange rate in the short and medium terms. Real exchange rates are in turn key to determining macroeconomic stability and the incentive to engage in trade. Copeland (2005), because of these links, much professional attention has to be devoted to analyzing both what actually determines exchange rates and how a government that is concerned with maximizing its nation's growth rate should approach the issue of exchange rate determination. Taylor (2003), the exchange rate is a forward-looking asset price. Its level has implications for the behavior of the current account of the balance of payments, but the current account influences the exchange rate only insofar as forward-looking agents realize that it will influence future asset stocks. Of course, current account outcomes also depend on saving and investment: Both income flows and exchange rates are determined simultaneously in a general equilibrium setting.

The rest of this thesis is organized as follows chapter two literature review, chapter three methodology, chapter four data analysis and chapter five findings, conclusions and recommendations of the study.

## CHAPTER TWO

### LITERATURE REVIEW

A large number of empirical studies have been conducted about the determinants of exchange rate. In this section, some of these studies will be reviewed.

However, most of these studies dealt with financial markets of developed countries

#### 2.1 OVERVIEW OF THE THEORETICAL LITERATURE

Before going into the actual real interest differential model, underlying theories such as Purchasing Power Parity, (PPP) and Uncovered Interest Rate Parity, (UIRP) are presented. These models characterize two of the main building blocks of international economics and when combined, they can explain a relationship between the exchange rate and the real interest rate differential. This relationship can be derived from both the monetary model and the portfolio model. The monetary model was the first model developed to explain exchange rate variations and has PPP and money demand as the two main building blocks. The portfolio model assumes risk aversion and deals with how individuals choose to allocate their assets depending on the expected return (Copeland, 2005).

The traditional approach to the equilibrium exchange rate departs from the theory of Purchasing Power Parity (PPP). The cornerstone of (PPP) is the law of one price, which states that homogeneous goods should cost the same in all countries when expressed in a common numeraire. The absolute version of the PPP generalizes the law of one price. It relates to the overall price level and postulates that the same basket of goods should cost the same in all countries when expressed in a common numeraire. The absolute form of PPP thus assumes that the equilibrium value of the real exchange rate, defined as the relative price of equivalent basket of goods expressed in a common numeraire, is unity. Although intuitively appealing, the theory of absolute PPP is undermined by trade costs and other impediments to international trade. A weaker, and perhaps more realistic, version is the relative PPP, which states that the rate of change in the nominal exchange rate should equal the difference between the domestic and foreign rates of inflation for equivalent baskets of goods, Rogoff, (1996).

Relative PPP thus maintains that the real exchange rate remains constant over time, but does not impose any restrictions on the absolute price levels. The mechanism behind PPP is that international (free) trade should tend to equate goods prices expressed in a common numeraire across countries (inflation rates in the case of relative PPP). Hence, the theory of PPP is essentially a theory for internationally traded goods, it only goods which can be traded internationally which can be measured, Wang (2003). High transportation costs and other trade impediments may, however, prevent goods from being traded internationally. Moreover, most services are not traded on the international market. For such non-tradables there may be little tendency for arbitrage to equate prices across countries. Moreover, the way inflation is calculated in different countries using the consumer price index varies making it difficult to use the inflation differential when forecasting the future exchange rate value.

From a theoretical standpoint the “sticky-price” model of exchange rates provides one explanation why PPP may fail temporarily. This model suggests that prices of goods react sluggishly in the short run to unanticipated changes in monetary conditions, while nominal exchange rates react much more rapidly. As a consequence, unanticipated changes in monetary conditions may cause fluctuations in real exchange rates.

Dornbusch (1988), even though “sticky-prices” explain why the real exchange rate may deviate from its PPP value temporarily, it does not invalidate PPP as a theory of the equilibrium real exchange rate. A less strict interpretation of PPP is that the real exchange rate is mean-reverting towards its constant equilibrium value, but may differ in the short run due to temporary shocks.

Lewis (1995), Covered Interest Parity (CIP), on the other hand, states that interest rate differences offset forward-spot exchange rate differences. This relates closely to PPP since inflation is a major component of a country’s interest rate, but CIP differs in two ways. First, instead of comparing the present spot exchange rate with the actual future spot exchange rate, CIP compares the present spot and forward exchange rates. The forward rate is the rate at which parties contract today to exchange currency on a

specified future date. Second, instead of comparing inflation rates, CIP compares nominal interest rates. The nominal interest rate includes the inflation rate and the real interest rate. Since real interest rates are thought to be fairly constant over countries with open capital markets, differences in nominal interest rates are largely a result of differences in expected inflation.

### 2.1.1 PURCHASING POWER PARITY

According to the theory of purchasing power parity (PPP), the expected change in the spot exchange rate between two currencies is directly related to the difference in the two currencies inflation rates. The inflation rate difference is offset by opposite movement in the spot exchange rate over time, with the higher inflation currency depreciating versus the lower inflation currency. PPP is closely related to the so called Law of One Price, which states that a commodity will sell for the same price adjusting for differences in transaction costs, regardless of where it is purchased. Kansas (2005), the relationship between PPP and the Law of One Price is complex. This complicates since inflation as it is measured using the consumer price index is computed differently in different countries, making it difficult to equalize exchange rate of currencies between one or many countries.

Rose (1995), the absolute PPP hypothesis states that the exchange rate between the currencies of two countries should equal to the ratio of the price levels of the two countries.

Specifically,

$$S = \frac{P^*}{P} \quad (2.1)$$

Where  $S$  is the nominal exchange rate measured in units of foreign currency per unit of domestic currency,  $P$  is the domestic price level and  $P^*$  is the foreign price level. The relative PPP hypothesis states that the exchange rate should bear a constant proportionate relationship to the ratio of national price levels: in particular,

$$S = \frac{kp^*}{p} \quad (2.2)$$

Where  $k$ , is a constant parameter. In either variant implies a constant real exchange rate

$$R = \frac{sp}{p^*} \quad (2.3)$$

Where  $s, p, p^*$  are the logarithms of  $S, P, P^*$  and  $c = \log(k) = 0$  under absolute PPP.

Under either variant of PPP, a change in the ratio of price levels implies an equal-proportionate change in the nominal exchange rate, such that

$$s = .p^* - .p \quad (2.4)$$

The PPP, which states that the exchange rate is equal to the difference between the domestic and foreign price levels

$$s[t] = p[t] - p^*[t] \quad (2.5)$$

Where  $p$  and  $p^*$  are the domestic and foreign nominal price levels, respectively.

The parity condition means that the domestic and foreign price levels, expressed in a common currency, are equal to each other. Thus, according to PPP, a relative increase (decrease) in the domestic price level not only means that the domestic price of the foreign currency increases(decreases), it also means that the increase (decrease) in the exchange rate is of such a magnitude that the price levels, expressed in a common currency, are still equal to each other.

Empirical evidence indicates that PPP holds better between economies characterized by competitive product markets and mature industries for commodity goods, where demand is highly sensitive to price. Taylor (1994),for countries with newer industries with emerging technology, and countries in which inflation is driven more by non-traded items, such as services, the theory may not hold. It has also been shown that PPP generally gives the correct direction of FX movements over long periods, especially between countries with substantially different inflation rates. However, for two large

countries with stable currencies and low inflation, short-term currency movements seem detached from PPP. (i.e., other volatility factors overwhelm the inflation effect) but even for a developed economy and a frontier there is usually no comparison.

### 2.1.2 INTEREST RATE DIFFERENTIAL

Petersson, (2005) examines the interest rate differential, which is a very interesting variable and has been tested for its relation to the exchange rate many times, as it is mentioned before, it is supposed to have a negative sign. In general, standard macroeconomic theory states that there is a negative tradeoff between the real exchange rate volatility and interest rate differential. By controlling the supply and demand for money through changes in the interest rate, a central bank can stabilize the exchange rate. Uncovered interest parity, states that the expected change of the exchange rate is equal to the difference between the domestic and foreign interest rates

$$se[t + 1] - s[t] = i[t] - i^*[t] \quad (2.6)$$

Where  $s$  is the spot nominal exchange rate, and  $i$  and  $i^*$  are the domestic and foreign nominal interest rates, respectively. Moreover, the exchange rate is defined as the domestic price of the foreign currency, and the superscript  $se$  denotes expectations.

The parity condition is based on the assumption that domestic and foreign assets are perfect substitutes, which only holds if there is perfect capital mobility. Since the latter is assumed, only the slightest difference in expected yields would draw the entire capital into the asset that offers the highest expected yield. Thus, the parity condition is also an equilibrium condition at the international asset market. Then in situations where there is imperfect mobility of capital due to under developed financial markets, which tend to have high risks premiums, which do not necessarily attract capital inflows in such economies. On the other hand, excessive inflow of capital flows in the economy will lead to increased money supply, which in turn fuel inflation in the economy. Financial liberalisation in emerging economies has often been accompanied by increased volatility of macroeconomic variables, with the exchange rate regime prevailing at the onset of the liberalisation being an important factor. Liberalisation in emerging economies can lead to higher variability of consumption and output and provoke asset bubbles.

In Chortareas and Driver's (2001) paper, the relationship between the real exchange rate and the interest rate differential was tested for 18 OECD countries. The test has been split between the G7 economies on one hand and eleven small open economies on the other. The authors use new non-stationarity techniques which they argue are improving the power of the test. They find little support for purchasing power parity (PPP) to hold; in other words, there is no equilibrium long-run exchange rate. However, regarding the eleven small open economies, there is a positive relationship between the exchange rate and the interest rate differential. This cointegration is not found with a panel existing of purely the G7 countries.

The study contrasts with many of the previous tests which fail to show a positive relation, probably because these tests have mainly included the G7 economies. This is because developed countries usually have low interest rates in their economies, making it difficult to attract capital flows from another developed country. Moreover, most of their currencies of the G7 economies are used when making international trade transactions, making it difficult to have a positive relationship between exchange rate and interest differentials.

Cheung, Chinn and Pascual (2003) exploits some other models for exchange rate forecasting. They use models based on interest rate parity, productivity and other economic fundamentals. They perform solid tests of the accuracy of the models, but are not able to prove that any of the models entirely beats the random walk forecast. Rowland (2003) develops three exchange rate models in his paper *Forecasting the USD/COP Exchange Rate: A Random Walk with a Variable Drift*. The models all use the purchasing power parity hypothesis to account for the long term relationship between prices and exchange rates, together with error correction models to correspond to any short-term dynamics (Rowland, 2003). The models are estimated for the USD/COP (US dollar towards Colombian Pound) exchange rate, and their forecasting ability is compared with the forecasts of a simple random walk and a random walk with a variable drift. Two of the models outperformed the simple random walk on a 12 and 14 months horizon.

However, all the models were outperformed on all time horizons by the random walk with a variable drift.

### 2.1.3 COVERED INTEREST PARITY

Lewis(1995)and Engel(1996)state that covered interest parity(CIP) holds very closely in the real world because of the potential for arbitrage that is, the risk less opportunity for profit through simultaneous purchase and sale of nearly identical financial instruments). The so-called International Fisher Effect suggests that differences in interest rates across countries are largely a result of differences in expected inflation.

If CIP holds, interest rate differences should predict future foreign exchange spot rates Under Uncovered Interest Parity, current spot rates and interest rate differences should form an unbiased predictor of future spot rates. Empirical foreign exchange studies do not confirm UCIP. Higher interest rate currencies do depreciate, but to a lesser extent than UCIP predicts.

The scenario is different, because most developing countries experience high interest rates which serve to attract capital inflows in the economy leading to appreciation of the domestic currency.

Covered Interest Rate Parity (CIP) states that interest rate differences offset forward-spot exchange rate differences. This relates closely to PPP since inflation is a major component of a country's interest rate, but CIP differs in two ways. First, instead of comparing the present spot exchange rate with the actual future spot exchange rate, CIP compares the present spot and forward exchange rates. The forward rate is the rate at which parties contract today to exchange currency on a specified future date. Second, instead of comparing inflation rates, CIP compares nominal interest rates (e.g., the rate that a bank would charge for a loan). The nominal interest rate includes the inflation rate and the real interest rate. Since real interest rates are thought to be fairly constant over countries with open capital markets, differences in nominal interest rates are largely a result of differences in expected inflation.

To start with, countries with vastly different macroeconomic environments have different foreign exchange behavior. Secondly, CIP holds very closely, within the limits of transaction costs. Some view the forward discount or premium caused by interest rate differentials to be an expectation of future FX rates, but CIP is probably more related to the arbitrage restriction than to true expectation. Thirdly, UCIP does not seem to predict future spot FX rates well. In fact, empirical evidence shows that actual spot movement's fall short of, countries with high real interest rates; their currencies appreciate as the higher interest rate attracts foreign capital inflows.

Kanas (2005) shows that there is a link between the USD/GBP exchange rate and the real interest differential between the years 1959 and 2002. By allowing for regime Switching, a link can be found between theoretical findings, like Dornbusch's (1976) and empirical findings by Meese and Rogoff, (1988), which have failed to show this link in the past. The two different regimes that Kana's includes are a high exchange rate volatility regime associated with a period of floating exchange rate on one hand, and a low exchange rate volatility regime associated with a fixed exchange rate on the other. Since the research was done between two developed countries where they might not experience large interest rate differentials, the same cannot hold for a developed country and a developing country where there are large interest differentials.

#### 2.1.4 PORTFOLIO /ASSET MARKET APPROACH

Eichengreen ,et al. (1998) states that empirical evidence supports the relevance of the asset market approach. It has been useful, for example, in explaining part of the strong dollar appreciation in the early 1980s, when high real US interest rates drove up the demand for the dollar. The dollar appreciated (and overshot the equilibrium) until the real interest cum expected depreciation equalized expected returns across countries. The asset market approach, however, cannot explain all exchange rate overshooting/volatility in all situations. Market imperfections resulting from information problems may exacerbate volatility, especially in underdeveloped financial markets. In those markets, investors may be unable or unwilling to buy and sell assets denominated in certain currencies

especially in times of crisis, or demand very high risk premiums. Overshooting may then exceed even the amount justified by interest rate differentials.

In light of growing international capital mobility and financial integration, the most important indicator of the adequacy of reserves, is shifting from the traditional import coverage (i.e. reserves in months of imports) to coverage of external financial liabilities, and especially short term foreign liabilities by the central bank.

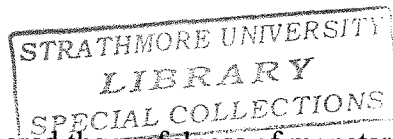
Dornbusch (1976) in his overshooting model emphasized that the exchange rate had to be viewed as an asset price, whose value would be determined in the asset markets at a level that would induce holders to willingly hold the outstanding stock of a currency. An unexpected increase in the stock of a given currency would induce a fall in the own currency rate of interest for traditional reasons, but in order to persuade investors to hold the increased stock of local currency, it would be necessary for the expected yield to continue to be equal to the unchanged world rate of interest.

This condition would be possible only if the currency were in the future expected to appreciate until equilibrium is restored. Such appreciation is in turn possible only if the currency underwent an initial instantaneous depreciation beyond which, would have reestablished the initial money/income ratio. An important alternative came from abandoning the assumption of perfect capital mobility.

## 2.2 EMPIRICAL LITERATURE

Meese and Rogoff (1988) tested the Dornbusch-Frankel as well as Hooper-Morton model for the USD/DM, USD/YEN and USD/GBP from the end of Bretton Woods and up to the end of the 1980's. They found that, the interest rate differential has the expected negative sign for both tests and for all three countries. However, all estimated coefficients for the interest rate differential are insignificant. Meese and Rogoff further found that a pure random walk better forecasts exchange rate movements than any of the models

discussed. Their conclusion is that models aiming to predict exchange rates generally perform badly.



Mark and Choi (1997) compared the usefulness of monetary and real factors in predicting exchange rate changes over long horizons, and found surprisingly that monetary factors had persistent effects on the real exchange rate. Using a different methodology, namely a Structural VAR model, Clarida and Gali (1995) found that monetary and demand side factors dominate in the determination of exchange rates. Also, relying upon a structural (permanent-transitory) decomposition involving the real exchange rate and the current account.

Meese and Rogoff (1983a, 1983b) evaluated the out-of-sample fit of several models of exchange rates, using data from the 1970s. They found that by standard measures of forecast accuracy, such as the mean-squared deviation between predicted and actual exchange rate, accuracy generally increased when one simply forecasts the exchange rate to remain unchanged compared to when one used the predictions from the exchange rate models, when they compared the out of sample forecasting accuracy of various structural and time series exchange rate models. They found that a random walk model performs as well as any estimated model for one to twelve month horizons of the dollar/pound, dollar/mark, dollar/yen and the trade-weighted dollar exchange rate.

While a large number of studies have subsequently claimed to find success for various versions of fundamentals-based models, sometimes at longer horizons, and over different time periods, the success of these models has not proven to be robust. The candidate structural models included the flexible price model, the sticky price monetary model, and the sticky price model that incorporates the current account. A possible reason for the poor performance of these monetary models may be a partial deviation from uncovered interest parity condition, which means that a risk premium may be an important determinant of the exchange rate. Another reason could be an incorrect specification of

the demand for money in either of the two countries, their dynamics, and the restrictions imposed by assuming identical parameters in both money demand functions.

A recent comprehensive study by Cheung, et al., (2002) concludes, the results do not point to any given model/specification combination as being very successful. On the other hand, it may be that one model will do well for one exchange rate, but not for another. Certain other studies found little evidence of cointegration among nominal exchange rates and monetary fundamentals during the post-Bretton Woods float. Sarno (2002), and Kilian and Taylor (2001), states that exchange rates will still predict fundamentals in such models, though a nonlinear forecasting process may be required. , they state that within short time horizons where the exchange rate is near the long run equilibrium, deviations from economic fundamentals will be well approximated by a random walk.

Our suggestion that the exchange rate will nearly follow a random walk when the discount factor is close to unity means that forecasting changes in exchange rate is difficult, but perhaps still possible. Some recent studies have found success at forecasting changes in exchange rates at longer horizons, or using nonlinear methods.

Meese (1995), and MacDonald and Taylor (1994) have all found some success in forecasting exchange rates at longer horizons imposing long-run restrictions from monetary models. Groen (2000) and Mark and Sul (2001) find greater success using panel methods. They tested for cointegration based on the monetary model and for exchange rate predictability in a panel of bilateral exchange rates for 17 OECD countries over the 1973-1997 period. Their results indicated that there exists cointegration based on the monetary model and that monetary fundamentals significantly predict future exchange rates when using panel regression estimates with fixed time effects. Kilian and Taylor (2001) suggest that models that incorporate nonlinear mean-reversion can improve the forecasting accuracy of fundamentals models, though it will be difficult to detect the improvement in out-of-sample forecasting exercises.

Killian and Taylor (2003) uses an ESTAR (exponential smooth threshold autoregressive) model that links non-linear movements in the nominal exchange rate to underlying economic fundamentals. According to the authors recent empirical evidence supports this model. In their empirical analysis they find strong evidence of predictability at horizons of 2 to 3 years but not at shorter horizons. Since most foreign exchange traders are interested in forecasting a horizon shorter than 6 months , this implies that the random walk forecast remains its current interest.

Evans and Lyons (2002) has shown that exchange rates at short horizons are to a significant extent driven by order flow, i.e. excess buyer initiated or seller-initiated trading which reflects a market's information processing mechanism and which may be unrelated to existing macroeconomic fundamentals. However, Evans and Lyons (2003) and Love and Payne (2002) find that much of this order flow is in fact closely linked to news about fundamentals. Bollerslev and Domowitz (1993) studied the intraday-trading activity in a foreign exchange market by considering the quote arrivals and bid-ask spreads recorded for deutsche mark-dollar exchange rate data. The study examines the volatility, news effects and the impact of market activity on the returns. It is found that the intensity of quote arrival, which is taken as a proxy for the volume of transactions, has a negative but economically and statistically negligible effect on conditional volatility. News arrivals in the form of number of transactions have no effect on the conditional variance.

Information in the form of lagged spread provides a powerful positive and strongly statistically significant effect on the conditional variance. It was found that the bid-ask spreads exhibit a non-stationary process. Changes in the spread are highly negatively serially correlated, with an unconditional mean of zero. The study strongly rejects the restriction that trading activity does not affect the conditional mean and variance of the spread. But it is found that variances in trading activity have a highly statistically negligible effect on the conditional mean.

Andersen and Bollerslev (1998) tried to examine the deutsche mark/dollar volatility in the intraday trading activity. With the help of data with five minutes frequency, the study finds that largest returns appear to be strongly linked with the release of public information and, in particular, certain macro economic announcements. But when explaining the volatility of the returns, the study concludes that public information is secondary. The major announcements dominate immediately following the release, but their explanatory power is lesser than that of the intraday pattern at the high frequencies, and much less than that of standard volatility forecasts at the daily level. It was also found that the clustering of public information releases on certain weekdays explains the day-of-week effect.

Diebold and Vega( 2003), Faust,et al.,(2003) , Galati and Ho (2003)found that for the announcements of monetary policy decisions and important macroeconomic variables in the United States, Germany and the euro area, as measures More precisely, exploiting survey data on market participants' expectations of such announcements. Almeida, Good hart and Payne (1998) looked at the DM exchange rate vis-à-vis the US dollar and find significant intra-day effects of macroeconomic announcements. This is in line with some of those authors' earlier work Good hart,et al.,(1993), who found that US and UK macroeconomic news to change the pound-US dollar exchange rate.

Wang and Wright (2003), looked at various currencies vis-à-vis the US dollar for the period 1992 till 1998 and 1987 till 2002, respectively. Using five-minute and 20-minute intervals, they find that various US macro news significantly affect exchange rates, with announcements relating to real activity and forward-looking news exerting the largest, and news about price developments relatively limited effects. An interesting result of the work by Andersen, Bollerslev,et al.,(2003) is that they found some indication for the presence of asymmetries in exchange rate responses to fundamentals, in that, exchange rates tend to react more strongly to large news surprises and to negative news.

Wang and Wright (2003) provides evidence that for several real announcements, stronger than expected releases appreciate the dollar, but the announcement must imply a considerable future expected dollar depreciation. Aguirre and Calderón (2006) find that a given change in the real exchange rate may have a differential effect on growth depending on whether or not it is an equilibrium phenomenon. If the real exchange rate were to appreciate by 10 percent as a result of better (permanent) terms of trade, their results imply that the growth rate would be expected to increase. But if the same appreciation occurred because the government tied the nominal exchange rate to that of some trading partner to provide the economy with a nominal anchor but inflation did not come to an abrupt halt, or the anchor currency appreciated relative to those of the country's other trading partners, then the exchange rate would become misaligned and growth would be expected to decline.

Obstfeld and Rogoff (1995.) shows that, the larger a country's steady-state NIIP/GDP, the larger will be its steady-state current account imbalance (as a percent of GDP). However, assuming that the interest rate exceeds the growth rate in steady state, the higher current account imbalance is more than entirely accounted for by higher interest payments. The trade balance actually moves in the contrary direction: e.g., a debtor country actually has to run a larger trade surplus in steady-state equilibrium if its debt level is higher and therefore its current account deficit is bigger, in order to service the higher level of debt.

Gourinchas and Rey (2005) shows that adding the exchange rate induced change in wealth to the current account outcome permits a degree of short-run forecast ability of the exchange rate. De Grauwe and Grimaldi (2006) contrasts the rollercoaster of the exchange rate between the dollar and the deutsche mark/euro over 1993–2003 with the minimal variation of the rate that might have been expected on the basis of changes in the obvious fundamentals.

### 2.2.1 TAYLOR MODEL

Edwards (1998) developed a theoretical model of the real exchange rate, and gave an estimate of its equilibrium value for a panel of developing countries. He argues that the most important variables affecting the level of the real exchange rate are the terms of trade, the level and composition of public spending, the movement of capital, exchange control and control of asset movement, technical progress and accumulation of capital.

Barrell et al.,( 2007) describing a new conventional macro econometric model, states: It is usual to presume that agents in the foreign exchange markets look forward, and form expectations about interest rates and other events that may affect the evolution of the currency. The arbitrage equation for the bilateral exchange rate  $e_t$ , may be written as

$$e_t = \frac{e_{t+1}(1 + r_{ft})}{(1 + r_{ht})(1 + r_{pt})} \quad (2.7)$$

Where  $r_{ht}$  is the interest rate at home,  $r_{ft}$  is the interest rate in the partner country, and  $r_{pt}$  is a risk premium. It is implicitly being assumed here that the home country is more risky than the partner country. Exchange rates change because one or more of these factors change.

Kouri, (1976). The alternative approach was developed simultaneously on the hypothesis that different currencies are imperfect substitutes. Suppose once again that there is a sudden unexpected increase in the supply of a particular currency. Once again, one knows that the new equilibrium will involve depreciation proportionate to the increase in the money supply. But in the short run the increased supply has to arise from some source, say intervention in the currency markets. If the initial position was one of full equilibrium, then immediately afterwards investors would have too many domestic assets and too few foreign assets in their portfolios to be consistent with equilibrium. So there

would be a depreciation of the domestic currency, which might or might not involve overshooting, but which in either event would create a current account surplus that would rebuild foreign assets toward their initial equilibrium level.

### 2.2.2 MONETARY MODEL

Equilibrium at the domestic and foreign money markets holds when real money supply is equal to real money demand

$$m[t] - p[t] = ay[t] - Bi[t], \quad (2.8)$$

and

$$m^*[t] - p^*[t] = ay^*[t] - Bi^*[t], \quad (2.9)$$

Where  $m$  and  $m^*$  are the domestic and foreign nominal money supplies, and  $y$  and  $y^*$  are the domestic and foreign real incomes, respectively. Thus, real money demand increases (decreases) when real income increases (decreases) or the interest rate decreases (increases). The real income elasticity is assumed to be equal to each other. The same assumption is also made for the interest rate (semi)elasticity. Equilibrium would be restored when the real value of domestic assets had been eroded by inflation to its previous level and the real value of foreign assets be rebuilt by current account surpluses.

Diamandis , et al., (1996) examined the exchange-rate determination of the Canadian-U.S. dollar exchange rate over the floating exchange rate period and he demonstrated through the use of multivariate cointegration methodology that an unrestricted monetary model provides a valid explanation of the long run nominal Canadian-U.S. dollar exchange rate. This suggests that the monetary model, interpreted carefully, might still be usefully applied. In his review paper, MacDonald (1999) concluded that there exist sufficient evidence to support the view that exchange rates are predictable at horizons as

short as one month forward, and he concluded that both short and long run exchange rate modeling is alive and well.

McKinnon and Schnabl, (2004b) found that more exchange rate flexibility will indeed lead to less speculative capital inflows, which may hinge on exchange rate expectations. If the exchange rate follows a random walk, exchange rate flexibility is likely to discourage speculation. If, however, like in emerging market economies in the economic catch-up process, the exchange rate follows a predictable appreciation path, flexible exchange rates can encourage one way bets on the appreciation of the emerging market currency. The consequence would be more, instead of less speculative capital inflows and increased volatility. Diamandis, et al., (2000) examined the long run properties of the monetary exchange rate model by using data on the drachma/dollar and drachma/mark exchange rates based on the hypothesis that the system contains variables that are integrated of order 2 ( $I(2)$ ).

Their analysis resulted in the rejection of the forward-looking version of the monetary model for the drachma/dollar case but not for the drachma/mark case. Finally, they showed that the monetary model outperforms the random walk model in an out-of-sample forecasting contest. Francis, et al., (2001) used Canadian-US dollar data to find out whether recent positive findings with regard to purchasing power parity carry over to the monetary approach to exchange rate determination. By using Johansen's cointegration technique, their research provided support for the long run monetary model of the exchange rate.

They noted that previous studies that use the cointegration approach with single equation methodology as proposed by Engle and Granger (1987) are inefficient because this method fails to fully capture the dynamics of the data and that the substantial depreciation in real U.S. dollar exchange rates in the mid 1980s offset an earlier appreciation, which is fully reflected in their variable set. On the other hand, Groen (2000) did not find evidence of cointegration in the monetary exchange rate model for a large number of OECD

countries. In addition, Groen (2000) found that the use of cross-section regressions for a large number of countries, or tests of cointegration within a fixed individual effect multi-country panel data model, offers empirical evidence in favor of the monetary exchange rate model.

Acosta et al (2007) developed a micro founded dynamic stochastic general equilibrium model that also considers an additional transmission mechanism: the increase in household income results in a decrease in the labor supply. A shrinking labor supply is associated with higher wages (in terms of the price of tradable output), that in turn leads to higher production costs and a further contraction of the tradable sector. Both the real exchange rate and the ratio of tradable to nontradable output therefore serve as summary indicators of Dutch disease effects viz. the spending effect and resource movement effect.

López et al (2007), uses the real effective exchange rate index as a measure of real exchange rate. A nominal effective exchange rate index represents the ratio of an index of a currency's period-average exchange rate to a weighted geometric average of exchange rates for the currencies of selected countries, weighted by each country's trade in both manufactured goods and primary products with its partner countries. A real effective exchange rate (REER) index represents a nominal effective exchange rate index adjusted for relative changes in consumer prices, a proxy of cost indicators of the home country. Since it is defined as the relative price of domestic to foreign goods, an increase in REER imply a real exchange rate appreciation.

Bernhardsen and Holmsen.,(2005)) discusses whether inflation forecasts should be based on technical exchange rate assumptions like a constant exchange rate (random walk) and uncovered interest rate parity (UIP) or on assumptions reflecting the central bank's best prediction of future exchange rate movements. Because of the strong link between the interest rate and the exchange rate, the exchange rate does not principally differ from other variables that are endogenous in inflation projections. For countries with a reasonable low half life of real exchange rate, deviations from purchasing power parity

(PPP) could provide a basis for predicting future exchange rate movements. For Norway, since the beginning of 1999, prediction paths based on deviation from PPP track actual exchange rate movements better than paths implied by random walk and UIP. UIP is also an ingredient of structural macro-econometric models used by several central banks.

Kapur , (2004)) notes how India's recent experience highlighted the increased role of capital flows in determining exchange rates, resulting in higher exchange rate volatility. He argues that in emerging markets, capital flows are often more volatile and driven by sentiment rather than fundamentals. Such volatility imposes substantial risks on market agents, which they may not be able to sustain or manage. Against this background, India's exchange rate policy has focused on managing volatility with no fixed rate target while allowing the underlying demand and supply conditions to determine exchange rate movements. He suggests that monetary policy in India can have its greatest impact on exchange rates at fairly short horizons. His paper provides evidence from a VAR showing that interest rate shocks have their maximal effect on exchange rates after just four months.

### 2.3 CONCEPTUAL FRAMEWORK

A large number of empirical studies have analysed the validity of PPP. Various testing procedures have been applied and the results are quite mixed. More recent studies quite often confirm the mean reversion of real exchange rates, although the half-year life of shocks typically is found to be around 4 years or longer. This high persistence of real exchange rates was labelled the PPP puzzle by Rogoff (1997), since the very slow rate of mean reversion questions the relevance of PPP. An explanation for the puzzle stems from the recognition that there in fact may be real determinants of the real exchange rate. As these real determinants, or fundamentals, change, the real exchange rate and its equilibrium value may change as well.

Moreover, prior research has documented that economic fundamentals do not contain information useful for forecasting exchange rates partly because the behavior of the

virtual fundamentals, that is the fundamentals that would be capable of explaining exchange rate movements, is radically different from the behavior of the fundamentals suggested by exchange rate determination theory. Notably, observing the marked increase in volatility of exchange rates, which occurs when moving from a fixed or pegged exchange rate regime to a floating regime. Baxter and Stockman,(1989) and Flood and Rose,(1995) argue that any tentatively adequate exchange rate model should have fundamentals which are also much more volatile during floating rate regimes. This evidence may be seen as suggesting that there are speculative forces at work in the foreign exchange market which are not reflected in the usual menu of economic fundamentals. These constitute the key elements of the exchange rate disconnect puzzle Obstfeld and Rogoff,(2000).

Sharp depreciations have inflated the liabilities in terms of domestic currency thereby increasing the probability of default and crisis. In debtor country like Kenya, with highly dollarized financial sectors, the incentive to avoid sharp exchange rate fluctuations is even stronger. Maintaining the exchange rate at a constant level, in particular preventing sharp depreciations, is equivalent to maintaining growth,Clarida and Gali.(1995). The adoption of free floating exchange rates system has not eliminated the persistent balance of payments problems. They have been characterized by high volatility and substantial deviations from purchasing power parities to bring exchange rate to equilibrium. The large fluctuations in the real exchange rates have not been adequately explained much by the research on determination of exchange rates.

There is also no clear-cut theoretical prior as to how the exchange rate should react. On the one hand, higher than expected inflation may raise expectations of monetary policy tightening, entailing an immediate appreciation of the home currency. On the other hand, higher inflation implies, *ceteris paribus*, an appreciation of the real exchange rate. If purchasing power parity were to hold, a rise in inflation would require a depreciation of the nominal exchange rate. In essence, the likely effect of price developments on the exchange rate crucially depends on the markets' beliefs about the central bank's

monetary policy reaction function. If a central bank is perceived to give great importance to price stability, then an unexpected rise in inflation is likely to lead to an appreciation of the exchange rate.

By contrast, if a central bank is believed to give less prominence to price developments or is believed not to react to a particular news about prices, then the second argument above may prevail and the exchange rate depreciates. Moreover, it is believed that economic fundamentals influences movement of exchange rate in emerging and developing countries , since most of these countries are price takers in the global economy and their impact is little felt, it is the exchange which influences movement of economic fundamentals ,something which very little empirical research has been carried out.

If this is a problem for developed countries' exchange rates, how much more serious is it for developing countries which have, much less well-defined trade-based fundamentals with no long empirical experience of market-determined exchange rates, rapidly evolving production structures and much larger capital flows, in relation to the size of their domestic capital markets and economies more generally. These flows are also changing rapidly over time. As these countries became more integrated into international financial markets, the amount of foreign capital available expands enormously. These capital flows are simply responding to short-term cyclical interest differentials, hence this capital cannot be invested for a long period due to fluctuations of the interest rates in the economy.

Another reason why the equilibrium real exchange rate may change over time arises when the real exchange rate covers also internationally non-traded goods and services. Differences in total factor productivity (TFP) growth rates between the tradables and non-tradables sectors, and across countries, may then cause the equilibrium real exchange rate to change. The usual explanation assumes a small country, constant returns to scale in production of both tradables and non-tradables, and that the law of one price prevails on the market for tradables and in the capital market. If TFP increases (faster) in the

tradables sector, the marginal productivity of labour will tend to increase (faster) in this sector as well. This will be matched by a (faster) rise in wages so that, with perfect labour mobility across sectors, the price of non-tradables will increase accordingly. In turn, this will lead to an appreciation of the real exchange rate and its equilibrium value.

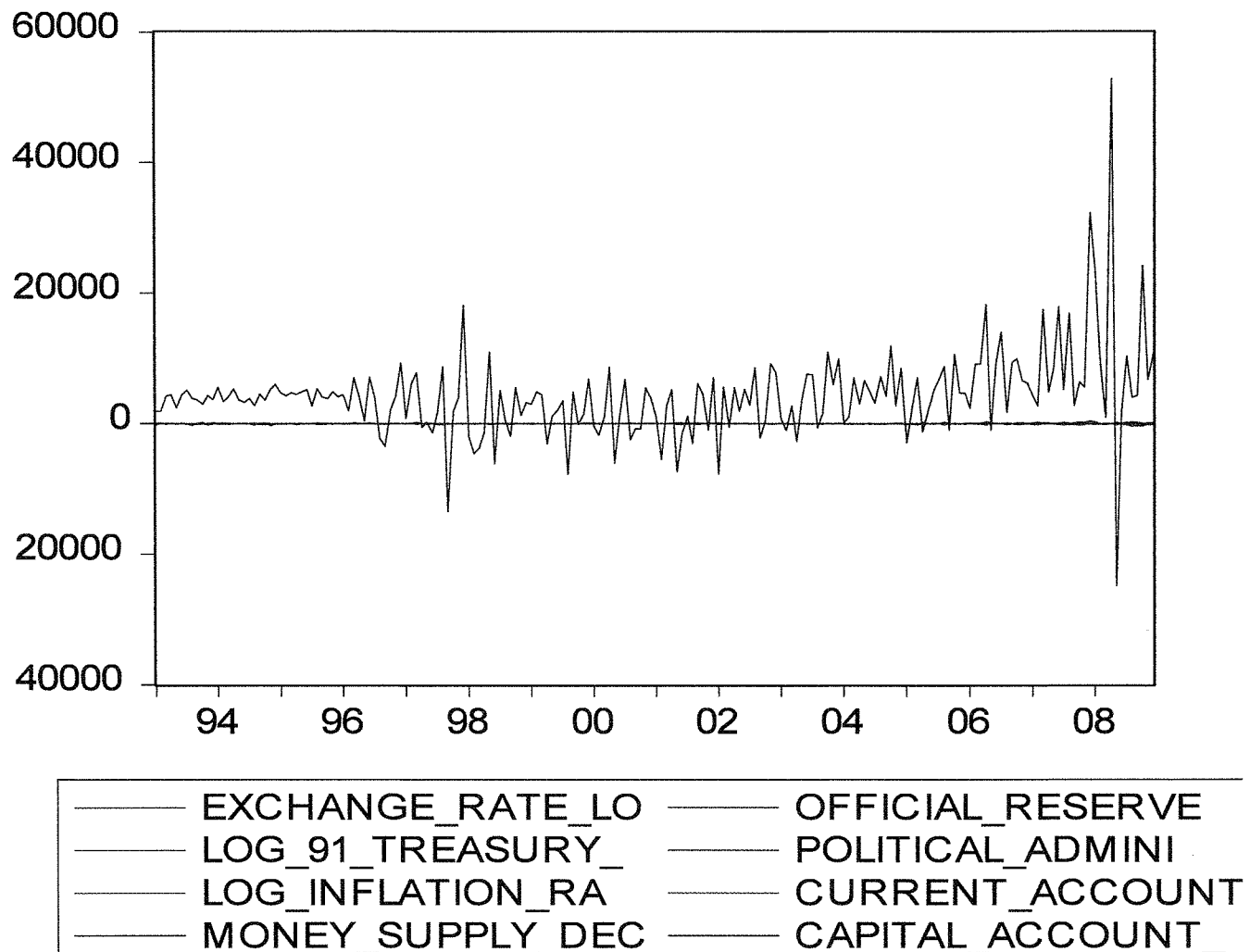


Figure 2 Relationship of exchange rate movement and the various economic variables

Source: Central Bank of Kenya.

## CHAPTER THREE

### RESEARCH METHODOLOGY

#### 3.1 INTRODUCTION

Chapter two focused on theoretical literature related to the problem under study. The review covered an overview of the concept of exchange rate and literature on macro fundamentals uncertainty strategy analysis. This thesis is based on our theoretical findings in Meese and Rogoff (1988). These findings, concerning a random walk model's ability to produce prediction intervals with a specific confidence level, are here tested empirically on exchange rate series. Earlier research on exchange rates' behaviour and different methods to predict future values of them are taken mainly from research papers.

This chapter focuses on the methodology used for this thesis. The main subtopics covered are: research design; data sources and data analysis.

Hussey and Hussey (1997, p.54) notes that research methodology refers to overall approach to the research process, from the theoretical underpinning to the collection and analysis of the data. Silverman, (1994, p.2) as cited by Hussey and Hussey argues that 'like theories, methodologies cannot be true or false, only more or less useful'.

#### 3.2 RESEARCH DESIGN

This research is longitudinal based on time series analysis. The dependent variable is exchange rate, while the independent variables are, money supply (M3), interest rate ( $rs$ ) on the three month treasury bill rates, inflation differential ( $\pi$ ) taken from the consumer price index, net current account balance, change in foreign exchange reserves, net capital account balance, mostly covering the period of free floating exchange regime. USA acted as our bench mark, the study selected them on basis of their exchange

regimes in their economies and compared three different kinds of economies to see if the results tend to differ under different economic situations and circumstances , that is, UK has free floating exchange regime represented the continent of Europe and developed countries. Singapore, on the other hand has a managed floating exchange regime represented the continent of Asia and emerging economies while Kenya which is our point of study has free floating exchange regime which will represent the continent of Africa and a frontier economy.

We build further on the work by Meese and Rogoff (1997), Mark and Sul (2001) among others. Our study improves on these through the application of more recent analytical tools and data sets, by testing on Granger Simms causality test between the dependent and the independent variables and also including data on political administration which is captured as a dummy variable to cater for structural breaks in the economy.

The following model was used to carry out an ordinary least square regression.

Where

$$s = a_0 + a_1(m) + a_2(rs - rs^*) + a_3(\pi e - \pi e^*) + a_4CAB + a_5Cr + a_6Fr + a_7P + u \quad (3.1)$$

$s$  : logarithm of dollar price of foreign currency

$m$  : monthly change of domestic money supply

$rs - rs^*$  : log of short-term interest differential

$\pi e - \pi e^*$  : log of inflation differential

$CAB$  : current account net balance

$Cr$  :Capital account net balance

$Fr$  : change in foreign exchange reserves

$P$  : Political regimes

$u$  :disturbance term.

Data over the three exchange rates on monthly basis , USD/GBP,KES/USD and SIN DOLLAR/USD was collected for the periods 1993:1 to 2008:12.

Political regimes (Democrat vs. Republican) in USA, was captured as a dummy variable of either 0 or 1 to cater for structural breaks associated with political administration. This was a three country model where comparison of regression results between the USA and a developed country i.e. UK, , an emerging economy (Singapore) and a frontier/developing economy (Kenya) were made.

### 3.3 DATA SOURCES

Secondary data was used and was sourced from the electronic data base of international financial statistics , Monetary Authority of Singapore, Federal Reserve Bank of USA, Bank of England and the Central Bank of Kenya.

### 3.4 DATA ANALYSIS

Data was analysed using the Eviews econometric software. Some of the data were transformed in natural logarithms prior to beginning the empirical analysis to yield time series for the nominal exchange rate.

Descriptive statistics were used to test hypothesis , t-test , F test , Adjusted R Squared to test for significance of the regression results, Granger Simms causality test, to test for causality between two pairs among the dependent and the independent variables, arch test, to test for volatility and cointegration test, to test for the long run relationship between the independent variables and construct generalizations

## CHAPTER FOUR

### RESULTS AND DATA ANALYSIS

Data analyzed first for individual countries but comparison is made to identify differences and similarities. The result of regression models in equation 3.1 follows. The results include t-tests, F-test, adjusted R2, and DW test.

#### 4.1KENYAN DATA

Table 4.1.1

Dependent Variable: EXCHANGE\_RATE\_LO

Method: Least Squares

Date: 02/23/10 Time: 05:49

Sample: 1993:01 2008:12

Included observations: 192

| Variable       | Coefficien | Std. Error | t-Statistic | Prob.  |
|----------------|------------|------------|-------------|--------|
|                | t          |            |             |        |
| LOG_91_TREASU  | -0.010317  | 0.015833   | -0.651634   | 0.5155 |
| RY_            |            |            |             |        |
| LOG_INFLATION  | -0.039447  | 0.011554   | -3.413986   | 0.0008 |
| _RA            |            |            |             |        |
| MONEY_SUPPLY   | -1.16E-06  | 5.81E-07   | -1.999488   | 0.0470 |
| _DEC           |            |            |             |        |
| OFFICIAL_RESER | 0.000294   | 0.000101   | 2.898883    | 0.0042 |
| VE             |            |            |             |        |
| POLITICAL_ADM  | 0.088866   | 0.011608   | 7.655435    | 0.0000 |
| INI            |            |            |             |        |
| CURRENT_ACCO   | -0.000273  | 0.000106   | -2.564903   | 0.0111 |
| UNT_           |            |            |             |        |

|                    |           |                       |           |        |
|--------------------|-----------|-----------------------|-----------|--------|
| CAPITAL_ACCO       | -0.000313 | 9.87E-05              | -3.174664 | 0.0018 |
| UNT_               |           |                       |           |        |
| Constant           | 1.838100  | 0.022186              | 82.85031  | 0.0000 |
| R-squared          | 0.489025  | Mean dependent var    | 1.825637  |        |
| Adjusted R-squared | 0.469586  | S.D. dependent var    | 0.072301  |        |
| S.E. of regression | 0.052657  | Akaike info criterion | -         |        |
|                    |           |                       | 3.009271  |        |
| Sum squared resid  | 0.510183  | Schwarz criterion     | -         |        |
|                    |           |                       | 2.873542  |        |
| Log likelihood     | 296.8900  | F-statistic           | 25.15656  |        |
| Durbin-Watson stat | 0.245327  | Prob(F-statistic)     | 0.000000  |        |

The R squared adjusted is .469 implying that 46.9 percent of the variance in the exchange rate is explained by the independent variables included in the model. The R squared adjusted value of about .469 is statistically significant ,since the computed F value of about 25.15 is highly significant as its p value is almost 0.The insignificant relationship between the interest rate differential and the exchange rate movement for Kenya and the US fails to support one of the underlying assumptions of the model, thus, central bank cannot control the volatility in the exchange rate by adjusting the interest rate differential, but this has not been explicitly stated by central bank.

As revealed in table 4.1.1 above, political administration makes a largest contribution standard coefficient, when explaining the volatility in the exchange rate compared to other independent variables. There is a clear indication that different political regimes have impacts on the level of exchange rate value in the economy as a result of market efficiency and political interference. The exchange rate's change with respect to the money supply is -1.16, following that a 1 percent decreases in the money supply causes the Kenyan exchange rate to depreciate by 1.16 percent. By studying the tolerance value, one gets a picture of whether multicollinearity is considered a problem or not. The tolerance value explains how much of variability of the independent variable that is not

explained by the other independent variables. The tolerance value has to be small, less than .10 in order for multicollinearity to exist (Pallant, 2005). In the case of Kenya, no tolerance value is under .50 which indicates that the possibility of multicollinearity is very low.

Looking at the p values, only 91 day Treasury bill rates variable which is not statistically significant at a 5 percent level. There is a negative relationship between the exchange rate with money supply, inflation differential and current account balance and a positive relationship between official reserves and political administration in the economy.

TABLE 4.1.2  
UK DATA

Dependent Variable: EXCHANGE\_RATELOG  
Method: Least Squares  
Date: 04/17/10 Time: 08:26  
Sample: 1993:01 2008:12  
Included observations: 192

| Variable                                 | Coefficient | Std. Error            | t-Statistic | Prob.  |
|------------------------------------------|-------------|-----------------------|-------------|--------|
| LOG_MONTHLY_INF<br>L                     | -0.094971   | 0.069604              | -1.364450   | 0.1741 |
| LOG_TREASURY_BI<br>L                     | 0.146565    | 0.060494              | 2.422798    | 0.0164 |
| MONEY_SUPPLY_C<br>HA                     | 4.70E-07    | 1.05E-06              | 0.447539    | 0.6550 |
| POLITICAL_ADMINI<br>CURRENT_ACCOUN<br>TO | 0.007812    | 0.026761              | 0.291925    | 0.7707 |
| CHANGE_IN_OFFICI<br>CAPITAL_ACCOUNT<br>O | -2.96E-06   | 7.52E-06              | -0.394234   | 0.6939 |
|                                          | 1.23E-06    | 7.24E-06              | 0.169556    | 0.8655 |
|                                          | 3.25E-06    | 5.72E-05              | 0.056894    | 0.9547 |
| Constant                                 | -0.357609   | 0.077225              | -4.630736   | 0.0000 |
| R-squared                                | 0.082524    | Mean dependent var    | -0.233128   |        |
| Adjusted R-squared                       | 0.047620    | S.D. dependent var    | 0.127831    |        |
| S.E. of regression                       | 0.124750    | Akaike info criterion | -1.284241   |        |
| Sum squared resid                        | 2.863499    | Schwarz criterion     | -1.148512   |        |
| Log likelihood                           | 131.2871    | F-statistic           | 2.364328    |        |
| Durbin-Watson stat                       | 2.115595    | Prob(F-statistic)     | 0.024567    |        |

The R squared adjusted is .047 implying that 4.7 percent of the variance in the exchange rate is explained by the independent variables included in the model. Although there is a

positive relationship between the interest rate differential and the exchange rate movement for UK and the US fails to support one of the underlying assumptions of the model, that bank of England can control the volatility in the exchange rate by adjusting the interest rate differential.

As revealed in table 4.1.2 above, only one variable is statistically significant which makes significant contribution to the determination of exchange rate movements in UK, which is interest differential. All the other variables included in the model do not seem to statistically contribute to exchange rate movements in the economy

TABLE 4.1.3

SINGAPORE DATA

Dependent Variable: LOG\_EXCHANGE\_RAT

Method: Least Squares

Sample(adjusted): 1993:02 2008:12

Included observations: 191 after adjusting endpoints

| Variable      | Coefficien | Std. Error | t-Statistic | Prob.  |
|---------------|------------|------------|-------------|--------|
|               | t          |            |             |        |
| LOG_INFLATION | -0.032308  | 0.005269   | -6.132070   | 0.0000 |
| _RA           |            |            |             |        |
| LOG_91_TREASU | -0.028426  | 0.009131   | -3.113121   | 0.0021 |
| RY_           |            |            |             |        |
| INCREASE_DECR | -4.08E-06  | 1.05E-06   | -3.879406   | 0.0001 |
| EAS           |            |            |             |        |
| INCREASE__DEC | -1.31E-06  | 1.30E-06   | -1.010555   | 0.3136 |
| REA           |            |            |             |        |
| CURRENT_ACCO  | -1.45E-06  | 1.79E-06   | -0.810625   | 0.4186 |
| UNT_          |            |            |             |        |

|                    |           |                       |           |        |
|--------------------|-----------|-----------------------|-----------|--------|
| CAPITAL_ACCO       | -5.76E-06 | 1.54E-06              | -3.733747 | 0.0003 |
| UNT_               |           |                       |           |        |
| Constant           | 0.215125  | 0.005166              | 41.63876  | 0.0000 |
| R-squared          | 0.389562  | Mean dependent var    | 0.205541  |        |
| Adjusted R-squared | 0.369657  | S.D. dependent var    | 0.036321  |        |
| S.E. of regression | 0.028837  | Akaike info criterion | -         |        |
|                    |           |                       | 4.218347  |        |
| Sum squared resid  | 0.153010  | Schwarz criterion     | -         |        |
|                    |           |                       | 4.099154  |        |
| Log likelihood     | 409.8522  | F-statistic           | 19.57050  |        |
| Durbin-Watson stat | 0.415634  | Prob(F-statistic)     | 0.000000  |        |

The R squared adjusted is .369 implying that 36.9 percent of the variance in the exchange rate is explained by the independent variables included in the model. The R squared adjusted value of about .369 is statistically significant, since the computed F value of about 19.57 is highly significant as its p value is almost 0. The negative relation between the interest rate differential and the exchange rate movement for Singapore and the US supports one of the underlying assumptions of the model, that monetary authority of Singapore can control the volatility in the exchange rate by adjusting the interest rate differential.

As revealed in table 4.1.3 above, inflation makes the largest contribution when explaining the volatility in the exchange rate compared to other independent variables. The exchange rate's change with respect to the money supply is -0.000048, following that a 1 percent decreases in the money supply causes the Singapore exchange rate to depreciate by 0.0048 percent.

Looking at the p values, only official reserves and current account balance, variables which are not statistically significant at a 5 percent level. There is an inverse relationship between the exchange rate with money supply, inflation differential, interest rate differential and capital account balance.

## 4.2 JOHANSEN COINTEGRATION TEST

When analysing the relationships between the effective exchange rate and the fundamental variables, Johansen's Maximum Likelihood method of cointegration provides a tractable framework. With this approach it is possible to test for the number of long-run relationships (cointegrating vectors) between the variables in the model and to identify which variables should enter the various relationships. The number of cointegration vectors ( $r$ ) is verified by determining the cointegration rank, using the trace test and the max-eigenvalue test statistic.

According to both the trace test and the max-eigenvalue test suggest two cointegrated relationship for UK and Singapore, i.e. two equilibrium relationship between the nonstationary variables ( $m$ ,  $rs-rs^*$ ,  $\pi e-\pi e^*$ ,  $CAB$ ,  $Cr$ ,  $Fr$ ,  $P$  and *exchange rate*). The trace test indicates three cointegration vectors in the case of Kenya, while the max-eigenvalue test only indicates one. In Kenya there is a long run relationship between the exchange rate, inflation and change in official reserves in the economy, while in UK, capital account balance, current account balance and interest differential have a long run relationship. On the other hand, inflation and current account balance have a long run relationship in Singapore.

### 4.2.1 Kenyan data

Date: 02/23/10 Time: 06:01

Sample: 1993:01 2008:12

Included observations: 187

Test

assumption:

Linear

deterministic

trend in the

data

Series: EXCHANGE\_RATE\_LO LOG\_91\_TREASURY\_ LOG\_INFLATION\_RA MONEY\_SUPPLY\_  
OFFICIAL\_RESERVE POLITICAL\_ADMINI CURRENT\_ACCOUNT\_ CAPITAL\_ACCOUNT\_

Lags interval: 1 to 4

| Eigenvalue | Likelihood<br>Ratio | 5 Percent<br>Critical<br>Value | 1 Percent<br>Critical<br>Value | Hypothesized<br>No. of CE(s) |
|------------|---------------------|--------------------------------|--------------------------------|------------------------------|
| 0.356451   | 218.3310            | 156.00                         | 168.36                         | None **                      |
| 0.201573   | 135.9093            | 124.24                         | 133.57                         | At most 1 **                 |
| 0.169548   | 93.81348            | 94.15                          | 103.18                         | At most 2                    |
| 0.105234   | 59.07167            | 68.52                          | 76.07                          | At most 3                    |
| 0.088679   | 38.27860            | 47.21                          | 54.46                          | At most 4                    |
| 0.075792   | 20.91385            | 29.68                          | 35.65                          | At most 5                    |
| 0.022355   | 6.174815            | 15.41                          | 20.04                          | At most 6                    |
| 0.010358   | 1.946966            | 3.76                           | 6.65                           | At most 7                    |

\*(\*\*) denotes

rejection of  
the  
hypothesis at  
5%(1%)  
significance  
level  
L.R. test  
indicates 2  
cointegrating  
equation(s) at  
5%  
significance  
level

# Unnormalized Cointegrating Coefficients:

| EXCHANGE<br>_RATE_LO | LOG_91_TR<br>EASURY_ | LOG_INFLA<br>TION_RA | MONEY_SU<br>PPLY_DEC | OFFICIAL_<br>RESERVE | POLITICAL<br>_ADMINI | CURRENT_<br>ACCOUNT_ | CA<br>C |
|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|---------|
| 1.008086             | 0.226959             | -0.105621            | 3.92E-05             | -0.002578            | -0.033148            | 0.001922             |         |
| -0.450443            | 0.116428             | -0.114204            | -5.50E-06            | 0.004254             | 0.120707             | -0.003560            | -       |
| -0.680024            | 0.082861             | 0.176476             | -1.13E-05            | -0.001488            | 0.185023             | 0.001242             |         |
| 0.148626             | -0.060341            | -0.055430            | 1.06E-06             | -0.000262            | -0.018358            | -0.002090            | -       |
| 0.364699             | 0.262184             | -0.108616            | -4.68E-06            | -0.001446            | 0.070637             | 0.000695             |         |
| -1.680464            | -0.004268            | -0.153930            | -2.19E-06            | 4.35E-05             | 0.165760             | -0.000146            | -       |
| -0.339662            | -0.027827            | 0.043156             | 2.16E-06             | -1.05E-05            | -0.129093            | -0.000544            | -       |
| 0.001581             | 0.125967             | 0.046103             | 1.03E-05             | 0.000144             | 0.098698             | -0.001623            | -       |

## 4.2.2 UK DATA

Sample: 1993:01 2008:12

Included observations: 187

Test assumption: Linear

deterministic trend in the data

Series: EXCHANGE\_RATELOG CURRENT\_ACCOUNT\_ CAPITAL\_ACCOUNT\_ CHANGE\_IN\_O  
LOG\_MONTHLY\_INFL LOG\_TREASURY\_BIL MONEY\_SUPPLY\_CHA

Lags interval: 1 to 4

| Eigenvalue | Likelihood<br>Ratio | 5 Percent<br>Critical<br>Value | 1 Percent<br>Critical<br>Value | Hypothesized<br>No. of CE(s) |
|------------|---------------------|--------------------------------|--------------------------------|------------------------------|
|------------|---------------------|--------------------------------|--------------------------------|------------------------------|

|          |          |        |        |              |
|----------|----------|--------|--------|--------------|
| 0.320294 | 193.8418 | 124.24 | 133.57 | None **      |
| 0.231759 | 121.6420 | 94.15  | 103.18 | At most 1 ** |
| 0.154142 | 72.33922 | 68.52  | 76.07  | At most 2 *  |
| 0.094913 | 41.03462 | 47.21  | 54.46  | At most 3    |
| 0.081396 | 22.38621 | 29.68  | 35.65  | At most 4    |
| 0.033804 | 6.509912 | 15.41  | 20.04  | At most 5    |
| 0.000423 | 0.079185 | 3.76   | 6.65   | At most 6    |

\*(\*\*) denotes rejection of the  
hypothesis at 5%(1%)  
significance level

L.R. test indicates  
3cointegrating equation(s) at 5%  
significance level

Unnormalized Cointegrating Coefficients:

| EXCHANGE_RATELOG | CURRENT_<br>ACCOUNT_ | CAPITAL_A<br>CCOUNT_ | CHANGE_I<br>N_OFFICI | LOG_MONT<br>HLY_INFL | LOG_TREA<br>SURY_BIL |
|------------------|----------------------|----------------------|----------------------|----------------------|----------------------|
| 0.198700         | 6.15E-05             | 6.04E-05             | 0.000147             | -0.020104            | 0.016285             |
| 1.038762         | -2.20E-05            | 0.000660             | 1.78E-05             | 0.297531             | -0.136195            |
| 0.249881         | -6.10E-05            | -0.000449            | 4.35E-05             | 0.312485             | 0.427715             |
| -0.935588        | -5.58E-05            | 0.000450             | 2.58E-05             | 0.096567             | 0.345258             |
| 0.163685         | 2.25E-06             | 0.000284             | -4.01E-05            | -0.051791            | 0.355293             |
| 0.032938         | -2.93E-05            | -6.64E-05            | 1.50E-06             | -0.317457            | -0.176396            |
| -0.186712        | -1.16E-05            | 5.25E-05             | -6.60E-06            | -0.284371            | 0.150539             |

#### 4.2.3 SINGAPORE DATA

Sample: 1993:01 2008:12

Included observations: 186

Test  
assumption:  
Linear  
deterministic  
trend in the  
data

Series: LOG\_EXCHANGE\_RAT LOG\_INFLATION\_RA LOG\_91\_TREASURY\_INCREASE\_DECR  
INCREASE\_\_DECREA CURRENT\_ACCOUNT\_ CAPITAL\_ACCOUNT\_

Lags interval: 1 to 4

| Eigenvalue | Likelihood<br>Ratio | 5 Percent<br>Critical<br>Value | 1 Percent<br>Critical<br>Value | Hypothesized<br>No. of CE(s) |
|------------|---------------------|--------------------------------|--------------------------------|------------------------------|
| 0.298482   | 170.1642            | 124.24                         | 133.57                         | None **                      |
| 0.199903   | 104.2256            | 94.15                          | 103.18                         | At most 1 **                 |
| 0.156795   | 62.74355            | 68.52                          | 76.07                          | At most 2                    |
| 0.096907   | 31.02225            | 47.21                          | 54.46                          | At most 3                    |
| 0.033689   | 12.06326            | 29.68                          | 35.65                          | At most 4                    |
| 0.023523   | 5.689050            | 15.41                          | 20.04                          | At most 5                    |
| 0.006760   | 1.261556            | 3.76                           | 6.65                           | At most 6                    |

\*(\*\*)  
denotes  
rejection of  
the  
hypothesis at  
5%(1%)  
significance  
level  
L.R. test  
indicates 2

cointegrating  
equation(s) at  
5%  
significance  
level

Unnormalized Cointegrating Coefficients:

| LOG_EXCH<br>ANGE_RAT | LOG_INFLA<br>TION_RA | LOG_91_TR<br>EASURY_ | INCREASE_<br>DECREAS | INCREASE_<br>_DECREA | CURRENT_<br>ACCOUNT_ | CAPITAL_A<br>CCOUNT_ |
|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|
| -0.046900            | -0.062280            | 0.077922             | -5.40E-05            | -5.04E-05            | 9.39E-05             | 6.73E-05             |
| -0.868524            | 0.091889             | 0.152349             | -5.91E-05            | 3.51E-05             | -1.60E-05            | -7.47E-05            |
| 0.612403             | -0.118859            | 0.186381             | -2.31E-05            | 9.73E-05             | -5.14E-06            | 3.74E-05             |
| -2.135805            | -0.220450            | -0.096427            | -1.50E-05            | -2.86E-07            | -2.85E-06            | -3.02E-05            |
| -0.544434            | 0.010209             | -0.284115            | -1.33E-05            | -7.84E-07            | -2.16E-05            | 8.12E-06             |
| -0.350303            | 0.089495             | -0.189576            | -1.32E-05            | 8.34E-06             | 6.78E-05             | -1.90E-05            |
| 2.134880             | 0.002828             | -0.020861            | 3.81E-06             | -1.16E-06            | 2.21E-08             | 1.29E-06             |

#### 4.3 PAIR WISE GRANGER CAUSALITY TESTS

To measure causality between the independent variables and exchange rates, the Granger Causality Model was used. This test is used to determine whether or not one variable is the cause of the other, vice versa, or neither. After eliminating serial correlation, Granger's (1969) GC test provides four possible outcomes to a regression of variables x and y: No causality, X granger causes Y only, Y granger causes X only, and bi-directional causality.

The Granger Causality Test estimates the results of the following regression model

$$s = a_0 + a_1(m) + a_2(rs - rs^*) + a_3(\pi e - \pi e^*) + a_4CAB + a_5Cr + a_6Fr + a_7P + u$$

Where

$s$  : logarithm of dollar price of foreign currency

$m$  : monthly change of domestic money supply

$rs - rs^*$  : log of short-term interest differential

$\pi e - \pi e^*$  : log of inflation differential

$CAB$  : current account net balance

$Cr$  : Capital account net balance

$Fr$  : change in foreign exchange reserves

$P$  : Political regimes

$u$  : disturbance term.

The above equation assumes that the disturbance terms,  $\mu$ , are uncorrelated. The null hypothesis for equation shows that there is direct causality in Kenya. The data shows that dealing with the results of granger causality test it is clearly evident that in Kenya exchange rate determines interest rates on 91 treasury bill rates, money supply, official reserves, political administration and capital account balance in the economy.

In UK These results suggests that .there is direct causality from inflation rate to exchange rate , treasury bill rate to exchange rate , current account balance to official reserves, treasury bill rates to current account, current account to treasury bill rate, money supply to current account, money supply to capital account, inflation to money supply and money supply to treasury bill rate. There bi-directional causality between money supply and 91 bill interest rates and between current account and money supply in the economy.

In Singapore ,these results suggest that the direction of causality is from exchange rate to inflation, exchange rate to capital account, interest differential to official reserves, official reserves to money supply, current account to official reserves, money supply to current

account and official reserves to current account balance. Since their estimated p values are below 5 percent.

#### 4.4 ARCH Test:

Exchange rate volatility is a measure that intends to capture the uncertainty faced by exporters due to unpredictable fluctuations in the exchange rates. Clearly, this is an unobservable variable and thus its measure is a matter of serious contention.

Consequently the literature is not unanimous as to which measure is most appropriate. Recent literature, however, seems to be increasingly adopting the use of Bollerslev's (1986) generalized autoregressive conditional heteroscedasticity (GARCH) models, and the moving average standard deviations<sup>12</sup>, and to a very less extent simple standard deviations. This paper follows recent literature and uses both the moving average standard deviation and the measures derived from the GARCH (1,1) model as measures of exchange rate volatility.

The second measure of exchange rate volatility is the conditional variance of the first difference of the log of exchange rate. We use both the autoregressive conditional heteroscedasticity (ARCH) proposed by Engel (1982) and the generalized conditional heteroscedasticity (GARCH), proposed by Bollerslev (1986), which is the generalization of ARCH model.

Since the study deals with financial time series, the first thing that should be examined is whether the variables used are stationary. A time series is stationary when its mean and variance are constant over time, ie has no trend and the value of the covariance between two time periods depends only on the distance or lag between the two time periods and not on the actual time at which the covariance is computed. (weak stationality).

It is very important to tests if a series is stationary since most statistical models work under the assumption that the time series are stationary. It is also necessary for a capital market to be efficient. The results that come out from an econometric analysis when using non-stationary series are ambiguous Granger and Newbold (1974), (Phillips, 1986). Therefore, the order of integration for the time series of the model should be tested as a first step. The tests

that have been used for the time-series integration have been held by the use of Dickey Fuller (D-F) and augmented Dickey Fuller (ADF) tests in the case where the error term is auto correlated Dickey Fuller (1981), whereas for testing of the number of time lags Akaike (1973) and Schwarz (1978) criteria have been employed.

We assume that, the error term  $\mu$  is normally distributed with mean zero and variance constant . The set of available information at time  $t-1$  is denoted by  $I_{t-1}$ . Engel (1982) allowed for the variance to vary over time and the idea behind the ARCH model is to characterize how this variance changes over time. To ensure that the predicted variance is always positive, the restriction that  $\alpha_i \geq 0$  is necessary. It is important to note here that in equation the current levels of volatility is influenced by the previous levels of volatility and thus high or low periods of volatility will tend to persist. All coefficients need to be positive to make sure that we have a positive variance. This will form the basis of estimation in this paper.

#### 4.4.1 Kenya

Dependent Variable: EXCHANGE\_RATE\_LO

Method: ML – ARCH

Date: 04/02/10 Time: 11:08

Sample: 1993:01 2008:12

Included observations: 192

Convergence achieved after 16 iterations

|                 | Coefficient | Std. Error | z-Statistic | Prob.  |
|-----------------|-------------|------------|-------------|--------|
|                 | t           |            |             |        |
| GARCH           | -0.433107   | 0.876082   | -0.494368   | 0.6210 |
| LOG_91_TREASURY | 0.003307    | 0.002511   | 1.316898    | 0.1879 |
| LOG_INFLATION   | -0.014691   | 0.002842   | -5.168541   | 0.0000 |
| _RA             |             |            |             |        |

|                |           |          |           |        |
|----------------|-----------|----------|-----------|--------|
| MONEY_SUPPLY   | -3.44E-08 | 1.38E-07 | -0.249445 | 0.8030 |
| _DEC           |           |          |           |        |
| OFFICIAL_RESER | 3.16E-05  | 3.37E-05 | 0.939905  | 0.3473 |
| VE             |           |          |           |        |
| POLITICAL_ADM  | 0.107480  | 0.001840 | 58.41539  | 0.0000 |
| INI            |           |          |           |        |
| CURRENT_ACCO   | -7.55E-05 | 3.31E-05 | -2.282646 | 0.0225 |
| UNT_           |           |          |           |        |
| CAPITAL_ACCO   | -5.81E-05 | 3.33E-05 | -1.746930 | 0.0806 |
| UNT_           |           |          |           |        |
| C              | 1.791242  | 0.004538 | 394.7140  | 0.0000 |

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Variance Equation

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|                    |          |                       |          |        |
|--------------------|----------|-----------------------|----------|--------|
| C                  | 1.40E-05 | 6.98E-06              | 2.012062 | 0.0442 |
| ARCH(1)            | 1.116465 | 0.152593              | 7.316620 | 0.0000 |
| GARCH(1)           | 0.016465 | 0.053525              | 0.307604 | 0.7584 |
| R-squared          | 0.424921 | Mean dependent var    | 1.825637 |        |
| Adjusted R-squared | 0.389777 | S.D. dependent var    | 0.072301 |        |
| S.E. of regression | 0.056479 | Akaike info criterion | -        |        |
|                    |          |                       | 4.295829 |        |
| Sum squared resid  | 0.574188 | Schwarz criterion     | -        |        |
|                    |          |                       | 4.092236 |        |
| Log likelihood     | 424.3996 | F-statistic           | 12.09095 |        |
| Durbin-Watson stat | 0.108062 | Prob(F-statistic)     | 0.000000 |        |

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#### 4.4.2 UK Data

Dependent Variable: EXCHANGE\_RATELOG

Method: ML – ARCH

Date: 04/17/10 Time: 08:32

Sample: 1993:01 2008:12

Included observations: 192

Convergence achieved after 59 iterations

|                      | Coefficien<br>t | Std. Error            | z-Statistic | Prob.    |
|----------------------|-----------------|-----------------------|-------------|----------|
| SQR(GARCH)           | -0.456297       | 0.086837              | -5.254620   | 0.0000   |
| LOG_MONTHLY_<br>INFL | -0.096039       | 0.012311              | -7.800966   | 0.0000   |
| LOG_TREASURY_<br>BIL | 0.074832        | 0.011362              | 6.586096    | 0.0000   |
| MONEY_SUPPLY_<br>CHA | 7.54E-07        | 1.39E-07              | 5.408051    | 0.0000   |
| POLITICAL_ADM<br>INI | -0.000158       | 0.004776              | -0.033110   | 0.9736   |
| CURRENT_ACCO<br>UNT0 | 2.26E-06        | 1.18E-06              | 1.924127    | 0.0543   |
| CHANGE_IN_OFF<br>ICI | 1.87E-06        | 1.25E-06              | 1.497371    | 0.1343   |
| CAPITAL_ACCO<br>UNT0 | 6.97E-05        | 1.13E-05              | 6.183766    | 0.0000   |
| C                    | -0.266238       | 0.013999              | -19.01867   | 0.0000   |
| Variance Equation    |                 |                       |             |          |
| C                    | 0.000167        | 6.24E-05              | 2.676381    | 0.0074   |
| ARCH(1)              | 1.293143        | 0.270377              | 4.782733    | 0.0000   |
| GARCH(1)             | 0.026547        | 0.065873              | 0.403001    | 0.6869   |
| R-squared            | -0.237676       | Mean dependent var    | -           | 0.233128 |
| Adjusted R-squared   | -0.313311       | S.D. dependent var    | 0.127831    |          |
| S.E. of regression   | 0.146494        | Akaike info criterion | -           | 2.838903 |
| Sum squared resid    | 3.862863        | Schwarz criterion     | -           | 2.635309 |
| Log likelihood       | 284.5347        | Durbin-Watson stat    | 2.288625    |          |

The p values indicate that inflation, political administration and current account balance are very volatile in the economy which tends to influence much volatility in exchange movement in the Kenyan economy. Arch has a p value of 0.00 and a coefficient of 1.116465 which indicates very high volatility. While in UK ,p values of inflation , interest rate , money supply and capital account are statistically significant with Arch

coefficient of 1.293143 and a p value of 0.000 ,indicating presence of volatility in the above mentioned variables.

#### 4.5 Augmented

##### Dickey Fuller Test

##### Equation

The recent economic developments in econometrics warrant to examining the characteristics of time series. The researchers stated that the application of standard methods of conventional non-stationary data, contain any Unit Root problem, may lead to spurious correlation in the regression analysis. The stationary test commonly known as the unit root test, is conducted to check the order of the integration of each of the variable that is the number of times they must be differenced before attaining stationary. In order to avoid the problem of spurious correlation in the regression analysis, the time series properties of the variables will use in the regression analysis of this study are investigated using the most popular unit root tests proposed to examine the stationary, which are the Augmented Dickey-Fuller (ADF). An Augmented Dickey-Fuller (1979, 1981) (ADF) test was run to investigate if the exchange rates and the differentiated exchange rate series had unit roots, i.e. if they followed a random walk. The ADF test's null hypothesis is that the series tested has a unit root. Thus, if the null is rejected you conclude that the series is stationary. The confidence of the ADF test is affected by how the test equation is specified. To find the "best" model, that is the model with the lowest value of "Akiake Information Criterion" (AIC) and "Schwarz Criterion" (SBC) and significant variables, the test should be performed with different number of lags and variables. The general formula for an ADF test is presented in equation ( below.

$$\Delta y_t = \alpha_0 + \alpha_1 t + \gamma y_{t-1} + v_t \quad (13)$$

where  $\Delta y_t = y_t - y_{t-1} = v_t$

$\alpha_0$  = a constant term

$\alpha_1$  = a trend parameter

$\gamma$  = the parameter tested in the null hypothesis

$t$  = time

The ADF test was first performed with different number of lags, starting with four lags as recommended in Seiler (2004), and with and without trend and intercept for the three exchange rate series. Insignificant lags and variables were removed to receive the most correct model. The test was performed in the same way for the differentiated exchange rate series.

#### 4.5.1

##### Kenya Data

Dependent Variable: D(EXCHANGE\_RATE\_LO,3)

Method: Least Squares

Date: 02/23/10 Time: 06:09

Sample(adjusted): 1993:08 2008:12

Included observations: 185 after adjusting endpoints

| Variable                  | Coefficient |
|---------------------------|-------------|
| D(EXCHANGE_RATE_LO(-1),2) | -2.811156   |
| D(EXCHANGE_RATE_LO(-1),3) | 1.245901    |
| D(EXCHANGE_RATE_LO(-2),3) | 0.713193    |
| D(EXCHANGE_RATE_LO(-3),3) | 0.368582    |
| D(EXCHANGE_RATE_LO(-4),3) | 0.120449    |
| C                         | -0.000384   |
| R-squared                 | 0.730364    |

|                    |          |                    |          |
|--------------------|----------|--------------------|----------|
|                    |          | var                |          |
| Adjusted R-squared | 0.825824 | S.D. dependent var | 0.312663 |
| S.E. of regression | 0.130488 | Akaike info        | -        |
|                    |          | criterion          | 1.198162 |
| Sum squared resid  | 3.047856 | Schwarz criterion  | -        |
|                    |          |                    | 1.076763 |
| Log likelihood     | 118.4291 | F-statistic        | 147.1911 |
| Durbin-Watson stat | 1.998989 | Prob(F-statistic)  | 0.000000 |

Looking at the p values we reject the null hypothesis and accept the alternative hypothesis that the time series of exchange rate is stationary, with a mean and variance which depend on time over the period around a deterministic trend.

## CHAPTER FIVE

### 5.1 DISCUSSION OF FINDINGS

When Frankel tested his model back in the 1970s, he found that the model was very helpful in explaining the changes in the exchange rate between the USD and the DM. However, support for the model after the 1980s has been rather poor. Various researchers believed that economic fundamentals have no role in the short run. Since the collapse of the Bretton Woods system, increasing attention has been given to the problem of exchange rate determination under floating exchange rate. Although many studies have been carried out in the past thirty years, it is fair to say that the problem is still far from resolved. The results of ordinary least squares regression, in this paper confirm that even though all variables included in the model do not contribute to the explanation of changes in the exchange rate, only one of them actually do. UK's variables are significant but only the interest rate differential has got the right sign. Kenya has various variables that make a significant contribution. Most research has focused on medium to long run since they believe that economic fundamentals have little to offer in the short run. However, since economies experience different economic conditions, economic fundamentals have a role to play in the short run in emerging and developing economies, in exchange rate determination.

In the case for Kenya these variables are political administration, inflation, money supply, official reserves, current and capital account, but only political administration and official reserves which have a positive contribution to the exchange rate, and for Singapore inflation differential, interest rate differential, change in official exchange reserves and capital account balance variables seem to make a significant contribution to exchange rate determination and they have an inverse relationship with the nominal exchange rate. The RID model assumes a positive relation between the money supply and the exchange rate, so that when money supply increases, so does the exchange rate, i.e. the country's currency depreciates. What is remarkable with the results in this paper is

that none of the countries show any evidence for this. Instead, Kenya and Singapore whose money supply is statistically significant, have a negative sign for money supply. A negative sign implies that as money supply increases, the exchange rate decreases.

The biggest concern regarding the results is the fact that the coefficient for money supply is negative instead of the expected positive value. Inflation on the other is a major issue of policy concern as high inflation leads to appreciation of the domestic currency, which contradicts with theory. Higher than expected inflation may raise expectations of monetary policy tightening, entailing an immediate appreciation of the home currency. On the other hand, higher inflation implies, *ceteris paribus*, an appreciation of the real exchange rate. If purchasing power parity were to hold, a rise in inflation would require a depreciation of the nominal exchange rate. In essence, the likely effect of price developments on the exchange rate crucially depends on the markets' beliefs about the central bank's monetary policy reaction function.

If a central bank is perceived to give great importance to price stability, then an unexpected rise in inflation is likely to lead to an appreciation of the exchange rate. By contrast, if a central bank is believed to give less prominence to price developments or is believed not to react to a particular news about prices, then the second argument above may prevail and the exchange rate depreciates. The interest rate differential, which is a very interesting variable and has been tested for its relation to the exchange rate many times, is as mentioned before, is supposed to have a negative sign, Petersson, (2005). In general, standard macroeconomic theory states that there is a negative tradeoff between the real exchange rate volatility and interest rate differential.

By controlling the supply and demand for money through changes in the interest rate, a central bank can stabilize the exchange rate. Only Singapore whose interest differential supports this theory, for Kenyan data it is statistically insignificant and for UK is a positive sign, which means that Bank of England cannot stabilize the exchange rate. Chortareas and Drivers (2001) found that small economies have a positive relationship

between exchange rate and interest differential. The relationship between current account and exchange rate is expected to be negative, indicating that when the current account balance improves, exchange rate appreciates. The empirical outcome on this relationship is mixed. Only Kenya supports this, the others are statistically insignificant. Capital account on the other hand should have a negative relationship according to Frankel's model. Kenya and Singapore shows this relationship while UK, it is statistically insignificant. Finally, official reserves are expected to have a negative relationship with exchange rate, as an increase is expected to result to appreciation of exchange rate

The results are however mixed, this clearly indicates that, the level of economic development in the economy plays a significant role in determination of asset prices in the economy. The R squared adjusted values varies 46.9%, 5.2% and 36.9% for Kenya, UK and Singapore respectively. It is clearly evident that efficient market hypothesis, where demand and supply conditions determines asset prices equilibrium, works well in developed countries unlike in emerging and developing economies, which are still integrating into the global economy. On the other hand micro fundamentals, some of which are difficult to quantify, are playing a vital role in exchange rate determination in the economy, which have been captured by the error in our model.

Further insights have been developed, in the short-run, the relatively stable fundamentals do not explain the extreme volatility of the exchange rate, and some analysts have stated that the monetary model postulates a long run relationship. Unfortunately, empirical studies have not generated sufficient and consistent evidence to verify this long run relationship the exchange rate and economic fundamentals in the economy. The results for Johansen cointegration tests have been mixed. Evans and Lyons (2002) has shown that exchange rates at short horizons are to a significant extent driven by order flow, i.e. excess buyer initiated or seller-initiated trading which reflects a market's information processing mechanism and which may be unrelated to existing macroeconomic fundamentals.

Chortareas and Driver (2001) study shows that there is no cointegration relationship between interest rate and exchange rate. Cheung et al. (2002) show no cointegration among nominal exchange rate and monetary fundamentals. On the other hand, Sarno (2002), Taylor (2001) states that exchange rates will predict economic fundamentals, which influences move of economic fundamentals in the economy and where deviations exist, will be approximated by random walk.

The results indicate that in Kenya, inflation and official exchange reserves have a long run relationship with exchange, only two out of the seven variables in the model have a long run relationship. In UK, on the other hand, even though only one variable is statistically significant i.e. interest differential, there are three economic variables in the model which has long run relationship with the exchange rate. These economic variables are interest differential, capital and current account balances. Finally for Singapore inflation and current account have a long run relationship with exchange.

Groen (2000), Mark and Sul (2001), states that there is no cointegration relationship between the exchange rate and money supply in the economy. We have inquired whether the US dollar, as a world currency, presents a special case that tends to reject the monetary model in the long run and hence merits further investigation.

Generally our results support the proposition that the monetary model for the US dollar is a special case. In the case of US dollar, the evidence does not offer support for the monetary model. It is possible that this is due to the unique property of the US dollar as a world currency. Although for the cases of mark/pound, yen/mark and yen/pound, the results provide strong support for the monetary model of exchange rate determination.

Granger Sims causality tests also have mixed results. The results shows that there is direct causality of official exchange rate to money supply, money supply to current account balance and official exchange rate reserves to current account balance in the Kenyan economy. In UK, on the other hand, indicates that there is direct causality of

inflation to exchange rate, interest rate to exchange rate, current account to official exchange reserves, money supply to capital account and inflation to money supply in the economy. Moreover, there is a bi-directional causality between interest and current account balance and between money supply and current account balance in the economy. In Singapore, the results have actually justified our research problem, that exchange rate causes inflation. On the other hand, there is direct causality of exchange rate to capital account, interest rates to money supply in the economy and official exchange reserves to money supply in the economy. Moreover, there is a bi-directional causality between current account balance and official exchange rate reserves in the economy.

Rose, (1995) found that adequate exchange rate model should have fundamentals which are also much more volatile during floating rate regimes, which suggests that there are speculative forces at work in the foreign exchange rate market which are not reflected in the usual menu of economic fundamentals. Arch test shows that exchange rate is very volatile, and inflation, political administration and current account balance have higher magnitudes than other economic variables in exchange rate volatility in the Kenyan and UK economy, inflation, interest rate differential, money supply and capital account are very volatile. On the other hand Augmented Dick Fuller tests for stationarity clearly indicates that the exchange rate is stationary with a mean of 0 and constant variance.

## 5.2 CONCLUSIONS

In the present study we tried to discern the factors that affect the exchange rate movements in different time horizons by using secondary data. From the secondary data analysis, the study finds that in the short run, macro fundamentals, exercise a lesser effect on the exchange rates.

But it was found that fundamentals are more useful in predicting the exchange rates. Moreover, it was found that some economic fundamentals are determined by exchange rate and they have an inverse relationship with the exchange rate value, which contradicts with theory. This is a new finding for any developing countries foreign exchange market.

These results might differ between the countries as it depends on the specific country's market regulations, maturity and the economy itself.

A study of this kind may be of greatly useful not only in predicting the exchange rates near-accurately but also in maintaining orderly movement that helps the risk managers in the market. One of the objections to this conclusion could be that a greater emphasis has been given to the views of the dealers whose objective may be fairly different from that of the Central Bank. Though this may be true to some extent, however one cannot completely ignore the dealers' perception about the established theories in the area of international macroeconomics, as they are the biggest stakeholders in the market.

### 5.3 LIMITATIONS OF THE STUDY

Data used in the regression is collected from various sources which is likely to result to data inconsistency, as methods used to collect data varies from one source to the other for example when computing consumer price index , items included in the consumer basket of goods vary from one country to the other . All three countries involved in the model experience different economic situations and this might explain why the results differ between them.

### 5.4 SUGGESTIONS FOR FURTHER RESEARCH

Given these conclusions, it can be inferred that the studies on exchange rate determination models should concentrate on the short-term forecasting with the help of micro variables like bid-ask spreads, inter bank rates, volume of transaction, order flows, and public & private information, good and bad news, some of which are difficult to quantify as in the regression less than 50 % is explained by the independent variables. On the other this study is for three countries .if the number of countries under study can be increased to about 15.

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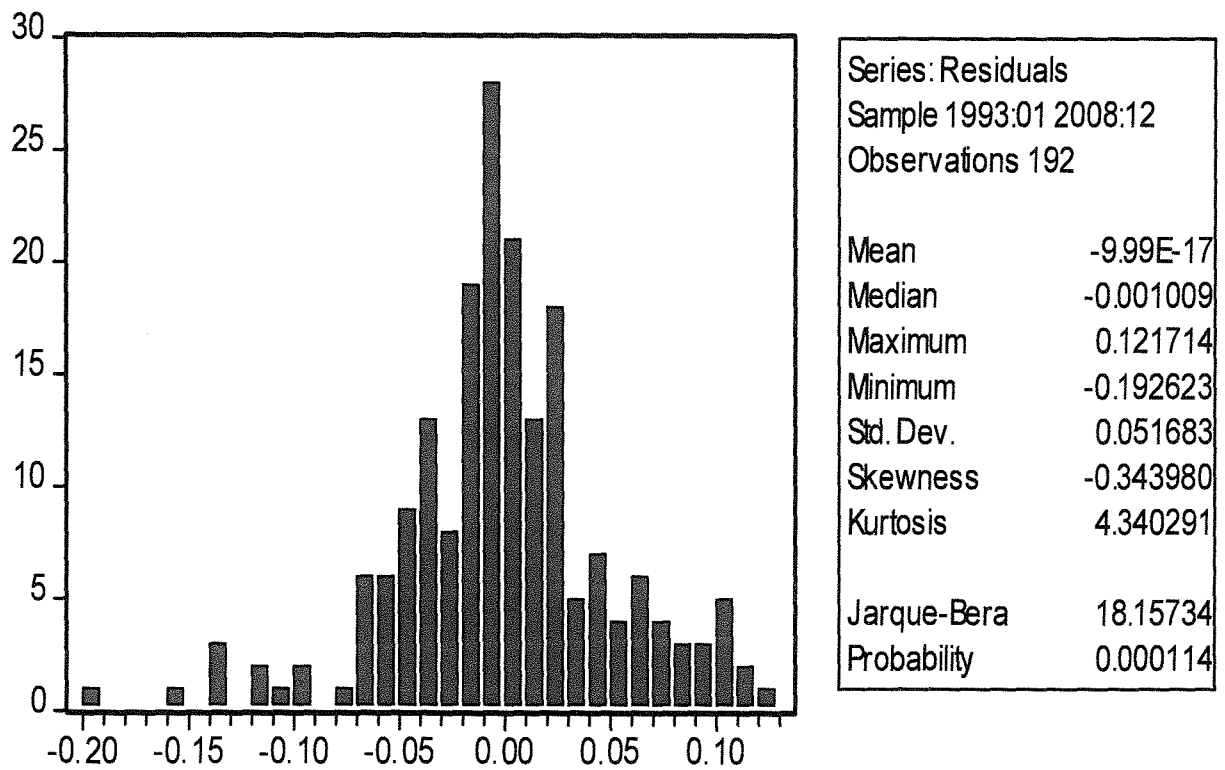
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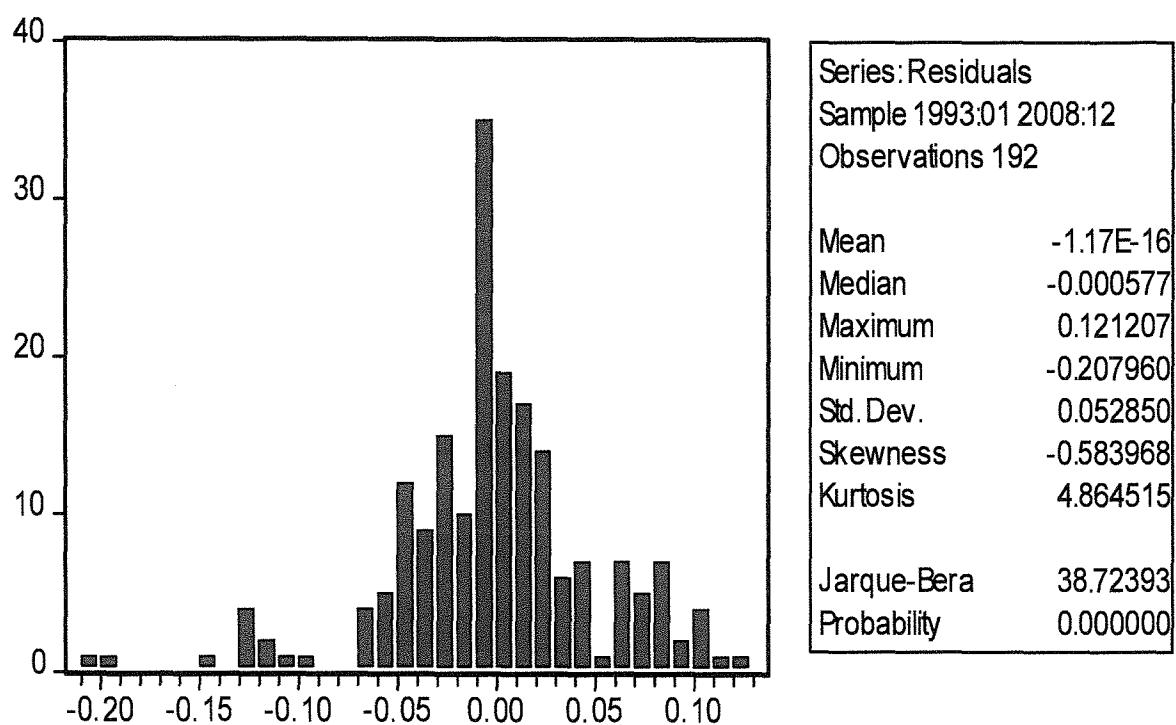
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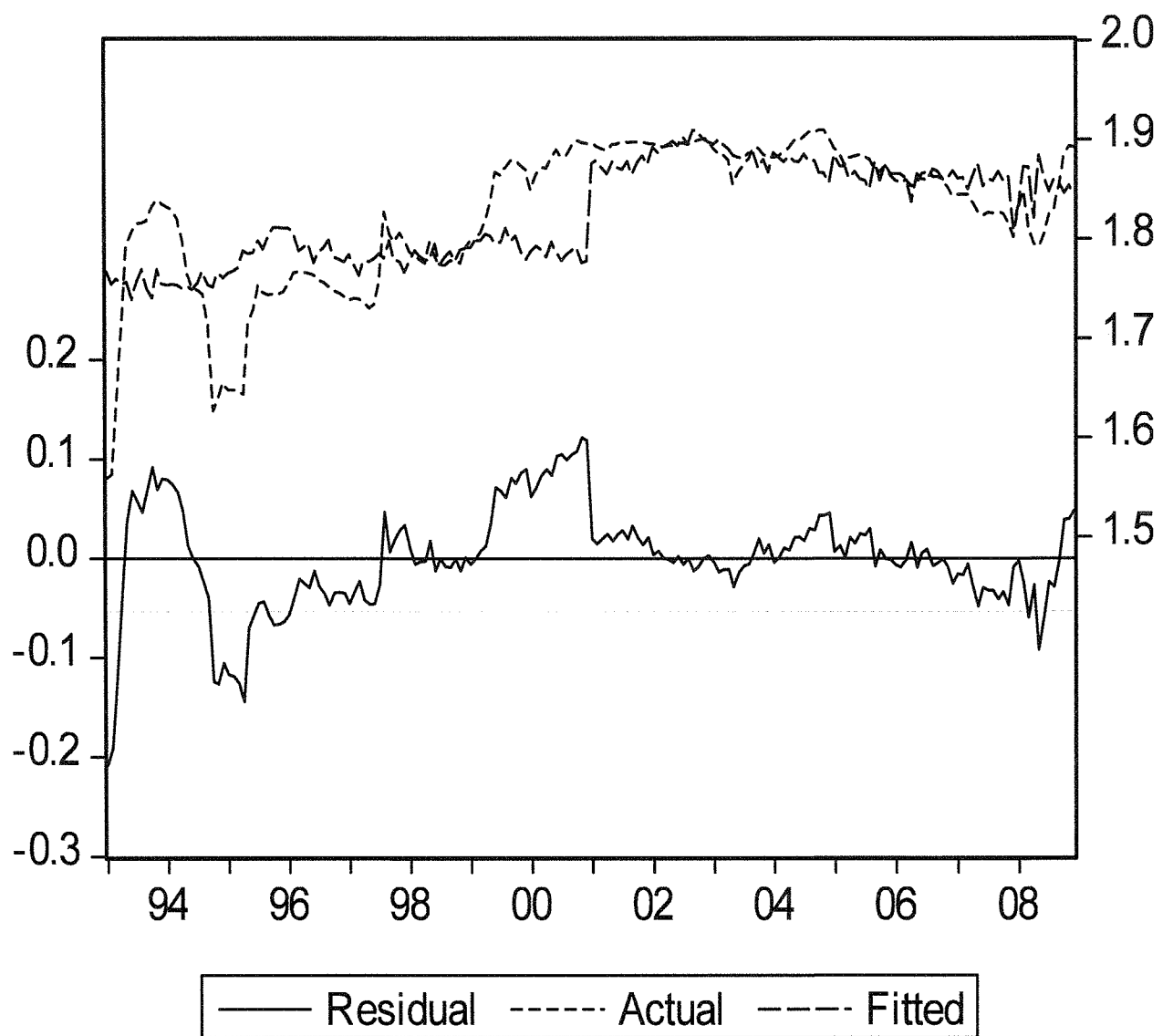
## APPENDICES

### APPENDIX 1

Histogram over monthly changes in exchange rates







## APPENDIX 2 Granger Simms causality tests

### KENYA DATA

Sample: 1993:01 2008:12

Lags: 12

| Null Hypothesis:                  | Obs | F-Statistic | Probability |
|-----------------------------------|-----|-------------|-------------|
| LOG_91_TREASURY_ does not         | 180 | 0.68747     | 0.76176     |
| Granger Cause EXCHANGE_RATE_LO    |     |             |             |
| EXCHANGE_RATE_LO does not Granger |     | 0.94615     | 0.50289     |
| Cause LOG_91_TREASURY_            |     |             |             |
| LOG_INFLATION_RA does not         | 180 | 0.95972     | 0.48975     |
| Granger Cause EXCHANGE_RATE_LO    |     |             |             |
| EXCHANGE_RATE_LO does not Granger |     | 1.57263     | 0.10483     |
| Cause LOG_INFLATION_RA            |     |             |             |
| MONEY_SUPPLY_DEC does not         | 180 | 1.04996     | 0.40649     |
| Granger Cause EXCHANGE_RATE_LO    |     |             |             |
| EXCHANGE_RATE_LO does not Granger |     | 0.89462     | 0.55388     |
| Cause MONEY_SUPPLY_DEC            |     |             |             |
| OFFICIAL_RESERVE does not Granger | 180 | 1.72569     | 0.06609     |
| Cause EXCHANGE_RATE_LO            |     |             |             |
| EXCHANGE_RATE_LO does not Granger |     | 0.54255     | 0.88401     |
| Cause OFFICIAL_RESERVE            |     |             |             |
| POLITICAL_ADMINI does not Granger | 180 | 0.09679     | 0.99996     |
| Cause EXCHANGE_RATE_LO            |     |             |             |
|                                   |     | 0.66431     | 0.78346     |
| EXCHANGE_RATE_LO does not Granger |     |             |             |

|                                   |     |         |         |
|-----------------------------------|-----|---------|---------|
| Cause POLITICAL_ADMINI            |     |         |         |
| CURRENT_ACCOUNT_ does not         | 180 | 0.74567 | 0.70493 |
| Granger Cause EXCHANGE_RATE_LO    |     |         |         |
| EXCHANGE_RATE_LO does not Granger |     | 1.28418 | 0.23290 |
| Cause CURRENT_ACCOUNT_            |     |         |         |
| CAPITAL_ACCOUNT_ does not         | 180 | 0.96515 | 0.48454 |
| Granger Cause EXCHANGE_RATE_LO    |     |         |         |
| EXCHANGE_RATE_LO does not Granger |     | 0.69366 | 0.75587 |
| Cause CAPITAL_ACCOUNT_            |     |         |         |
| LOG_INFLATION_RA does not         | 180 | 0.75937 | 0.69121 |
| Granger Cause LOG_91_TREASURY_    |     |         |         |
| LOG_91_TREASURY_ does not Granger |     | 0.41298 | 0.95683 |
| Cause LOG_INFLATION_RA            |     |         |         |
| MONEY_SUPPLY_DEC does not         | 180 | 0.70487 | 0.74508 |
| Granger Cause LOG_91_TREASURY_    |     |         |         |
| LOG_91_TREASURY_ does not Granger |     | 0.54026 | 0.88563 |
| Cause MONEY_SUPPLY_DEC            |     |         |         |
| OFFICIAL_RESERVE does not Granger | 180 | 0.69421 | 0.75534 |
| Cause LOG_91_TREASURY_            |     |         |         |
| LOG_91_TREASURY_ does not Granger |     | 0.75340 | 0.69720 |
| Cause OFFICIAL_RESERVE            |     |         |         |
| POLITICAL_ADMINI does not Granger | 180 | 1.12080 | 0.34706 |
| Cause LOG_91_TREASURY_            |     |         |         |
| LOG_91_TREASURY_ does not Granger |     | 1.01417 | 0.43859 |
| Cause POLITICAL_ADMINI            |     |         |         |
| CURRENT_ACCOUNT_ does not         | 180 | 0.84379 | 0.60535 |
| Granger Cause LOG_91_TREASURY_    |     |         |         |
| LOG_91_TREASURY_ does not Granger |     | 0.87666 | 0.57197 |

|                                   |     |         |         |
|-----------------------------------|-----|---------|---------|
| Cause CURRENT_ACCOUNT_            |     |         |         |
| CAPITAL_ACCOUNT_ does not         | 180 | 0.54224 | 0.88423 |
| Granger Cause LOG_91_TREASURY_    |     |         |         |
| LOG_91_TREASURY_ does not Granger |     | 1.24441 | 0.25770 |
| Cause CAPITAL_ACCOUNT_            |     |         |         |
| MONEY_SUPPLY_DEC does not         | 180 | 0.72285 | 0.72755 |
| Granger Cause LOG_INFLATION_RA    |     |         |         |
| LOG_INFLATION_RA does not Granger |     | 0.68582 | 0.76333 |
| Cause MONEY_SUPPLY_DEC            |     |         |         |
| OFFICIAL_RESERVE does not Granger | 180 | 1.67594 | 0.07697 |
| Cause LOG_INFLATION_RA            |     |         |         |
| LOG_INFLATION_RA does not Granger |     | 0.99309 | 0.45808 |
| Cause OFFICIAL_RESERVE            |     |         |         |
| POLITICAL_ADMINI does not Granger | 180 | 0.27602 | 0.99219 |
| Cause LOG_INFLATION_RA            |     |         |         |
| LOG_INFLATION_RA does not Granger |     | 0.29036 | 0.99019 |
| Cause POLITICAL_ADMINI            |     |         |         |
| CURRENT_ACCOUNT_ does not         | 180 | 0.34467 | 0.97930 |
| Granger Cause LOG_INFLATION_RA    |     |         |         |
| LOG_INFLATION_RA does not Granger |     | 1.04377 | 0.41194 |
| Cause CURRENT_ACCOUNT_            |     |         |         |
| CAPITAL_ACCOUNT_ does not         | 180 | 0.65725 | 0.78994 |
| Granger Cause LOG_INFLATION_RA    |     |         |         |
| LOG_INFLATION_RA does not Granger |     | 1.20647 | 0.28314 |
| Cause CAPITAL_ACCOUNT_            |     |         |         |
| OFFICIAL_RESERVE does not Granger | 180 | 2.05540 | 0.02295 |
| Cause MONEY_SUPPLY_DEC            |     |         |         |
| MONEY_SUPPLY_DEC does not Granger |     | 1.04911 | 0.40723 |

|                                         |     |         |         |
|-----------------------------------------|-----|---------|---------|
| Cause OFFICIAL_RESERVE                  |     |         |         |
| POLITICAL_ADMINI does not Granger       | 180 | 0.80966 | 0.64017 |
| Cause MONEY_SUPPLY_DEC                  |     |         |         |
| MONEY_SUPPLY_DEC does not Granger       |     | 0.46670 | 0.93147 |
| Cause POLITICAL_ADMINI                  |     |         |         |
| CURRENT_ACCOUNT_ does not               | 180 | 0.69583 | 0.75379 |
| Granger Cause MONEY_SUPPLY_DEC          |     |         |         |
| MONEY_SUPPLY_DEC does not Granger       |     | 2.81081 | 0.00166 |
| Cause CURRENT_ACCOUNT_                  |     |         |         |
| CAPITAL_ACCOUNT_ does not               | 180 | 1.38536 | 0.17817 |
| Granger Cause MONEY_SUPPLY_DEC          |     |         |         |
| MONEY_SUPPLY_DEC does not Granger       |     | 1.08304 | 0.37803 |
| Cause CAPITAL_ACCOUNT_                  |     |         |         |
| POLITICAL_ADMINI does not Granger       | 180 | 0.33606 | 0.98140 |
| Cause OFFICIAL_RESERVE                  |     |         |         |
| OFFICIAL_RESERVE does not Granger Cause |     | 0.11115 | 0.99992 |
| POLITICAL_ADMINI                        |     |         |         |
| CURRENT_ACCOUNT_ does not               | 180 | 1.40718 | 0.16786 |
| Granger Cause OFFICIAL_RESERVE          |     |         |         |
| OFFICIAL_RESERVE does not Granger Cause |     | 2.41512 | 0.00675 |
| CURRENT_ACCOUNT_                        |     |         |         |
| CAPITAL_ACCOUNT_ does not               | 180 | 1.41409 | 0.16470 |
| Granger Cause OFFICIAL_RESERVE          |     |         |         |
| OFFICIAL_RESERVE does not Granger Cause |     | 1.27578 | 0.23798 |
| CAPITAL_ACCOUNT_                        |     |         |         |
| CURRENT_ACCOUNT_ does not               | 180 | 0.55359 | 0.87603 |
| Granger Cause POLITICAL_ADMINI          |     |         |         |
| POLITICAL_ADMINI does not Granger Cause |     | 0.46644 | 0.93161 |

### CURRENT\_ACCOUNT\_

|                                         |         |         |         |
|-----------------------------------------|---------|---------|---------|
| CAPITAL_ACCOUNT_ does not               | 180     | 0.40932 | 0.95831 |
| Granger Cause POLITICAL_ADMINI          |         |         |         |
| POLITICAL_ADMINI does not Granger Cause | 0.50026 | 0.91211 |         |
| CAPITAL_ACCOUNT_                        |         |         |         |
| CAPITAL_ACCOUNT_ does not               | 180     | 1.74874 | 0.06154 |
| Granger Cause CURRENT_ACCOUNT_          |         |         |         |
| CURRENT_ACCOUNT_ does not Granger       | 1.68868 | 0.07404 |         |
| Cause CAPITAL_ACCOUNT_                  |         |         |         |

### UK DATA

Date: 04/17/10 Time: 08:39

Pairwise Granger Causality Tests

Lags: 2

| Null Hypothesis:                                         | Obs | F-Statistic | Probability |
|----------------------------------------------------------|-----|-------------|-------------|
| LOG_MONTHLY_INFL does not Granger Cause EXCHANGE_RATELOG | 190 | 6.97280     | 0.00120     |
| EXCHANGE_RATELOG does not Granger Cause LOG_MONTHLY_INFL |     | 1.04860     | 0.35250     |
| LOG_TREASURY_BIL does not Granger Cause EXCHANGE_RATELOG | 190 | 5.34742     | 0.00552     |
| EXCHANGE_RATELOG does not Granger Cause LOG_TREASURY_BIL |     | 0.00946     | 0.99059     |
| MONEY_SUPPLY_CHA does not Granger Cause EXCHANGE_RATELOG | 190 | 0.49989     | 0.60741     |
| EXCHANGE_RATELOG does not Granger Cause MONEY_SUPPLY_CHA |     | 1.63146     | 0.19845     |
| POLITICAL_ADMINI does not Granger Cause EXCHANGE_RATELOG | 190 | 0.32850     | 0.72042     |

|                                                          |     |         |         |
|----------------------------------------------------------|-----|---------|---------|
| EXCHANGE_RATELOG does not Granger Cause                  | 190 | 0.02588 | 0.97446 |
| POLITICAL_ADMINI                                         |     |         |         |
| CURRENT_ACCOUNT0 does not Granger Cause EXCHANGE_RATELOG | 190 | 0.19536 | 0.82271 |
| EXCHANGE_RATELOG does not Granger Cause                  |     | 0.34759 | 0.70685 |
| CURRENT_ACCOUNT0                                         |     |         |         |
| CHANGE_IN_OFFICI does not Granger Cause EXCHANGE_RATELOG | 190 | 0.05873 | 0.94298 |
| EXCHANGE_RATELOG does not Granger Cause                  |     | 0.00252 | 0.99748 |
| CHANGE_IN_OFFICI                                         |     |         |         |
| CAPITAL_ACCOUNT0 does not Granger Cause EXCHANGE_RATELOG | 190 | 0.18454 | 0.83164 |
| EXCHANGE_RATELOG does not Granger Cause                  |     | 0.82668 | 0.43911 |
| CAPITAL_ACCOUNT0                                         |     |         |         |
| LOG_TREASURY_BIL does not Granger Cause LOG_MONTHLY_INFL | 190 | 1.73038 | 0.18007 |
| LOG_MONTHLY_INFL does not Granger Cause                  |     | 0.90811 | 0.40508 |
| LOG_TREASURY_BIL                                         |     |         |         |
| MONEY_SUPPLY_CHA does not Granger Cause LOG_MONTHLY_INFL | 190 | 0.11204 | 0.89407 |
| LOG_MONTHLY_INFL does not Granger Cause                  |     | 5.53193 | 0.00464 |
| MONEY_SUPPLY_CHA                                         |     |         |         |
| POLITICAL_ADMINI does not Granger Cause LOG_MONTHLY_INFL | 190 | 0.51722 | 0.59703 |
| LOG_MONTHLY_INFL does not Granger Cause                  |     | 0.11667 | 0.88995 |
| POLITICAL_ADMINI                                         |     |         |         |
| CURRENT_ACCOUNT0 does not Granger Cause LOG_MONTHLY_INFL | 190 | 0.00158 | 0.99842 |
| LOG_MONTHLY_INFL does not Granger Cause                  |     | 0.87742 | 0.41758 |
| CURRENT_ACCOUNT0                                         |     |         |         |
| CHANGE_IN_OFFICI does not Granger Cause LOG_MONTHLY_INFL | 190 | 0.40003 | 0.67088 |
| LOG_MONTHLY_INFL does not Granger Cause                  |     | 1.19219 | 0.30588 |

## CHANGE\_IN\_OFFICI

|                                                          |     |         |         |
|----------------------------------------------------------|-----|---------|---------|
| CAPITAL_ACCOUNT0 does not Granger Cause LOG_MONTHLY_INFL | 190 | 1.23539 | 0.29311 |
| LOG_MONTHLY_INFL does not Granger Cause CAPITAL_ACCOUNT0 |     | 0.22048 | 0.80235 |
| MONEY_SUPPLY_CHA does not Granger Cause LOG_TREASURY_BIL | 190 | 3.17555 | 0.04406 |
| LOG_TREASURY_BIL does not Granger Cause MONEY_SUPPLY_CHA |     | 11.8996 | 1.4E-05 |
| POLITICAL_ADMINI does not Granger Cause LOG_TREASURY_BIL | 190 | 1.35462 | 0.26059 |
| LOG_TREASURY_BIL does not Granger Cause POLITICAL_ADMINI |     | 0.31371 | 0.73112 |
| CURRENT_ACCOUNT0 does not Granger Cause LOG_TREASURY_BIL | 190 | 3.88034 | 0.02234 |
| LOG_TREASURY_BIL does not Granger Cause CURRENT_ACCOUNT0 |     | 7.92499 | 0.00050 |
| CHANGE_IN_OFFICI does not Granger Cause LOG_TREASURY_BIL | 190 | 0.53010 | 0.58944 |
| LOG_TREASURY_BIL does not Granger Cause CHANGE_IN_OFFICI |     | 0.20593 | 0.81408 |
| CAPITAL_ACCOUNT0 does not Granger Cause LOG_TREASURY_BIL | 190 | 2.85369 | 0.06017 |
| LOG_TREASURY_BIL does not Granger Cause CAPITAL_ACCOUNT0 |     | 1.19050 | 0.30639 |
| POLITICAL_ADMINI does not Granger Cause MONEY_SUPPLY_CHA | 190 | 3.65783 | 0.02767 |
| MONEY_SUPPLY_CHA does not Granger Cause POLITICAL_ADMINI |     | 0.22379 | 0.79970 |
| CURRENT_ACCOUNT0 does not Granger Cause MONEY_SUPPLY_CHA | 190 | 13.0067 | 5.2E-06 |
| MONEY_SUPPLY_CHA does not Granger Cause CURRENT_ACCOUNT0 |     | 5.95274 | 0.00312 |

|                                                          |     |         |         |
|----------------------------------------------------------|-----|---------|---------|
| CHANGE_IN_OFFICI does not Granger Cause MONEY_SUPPLY_CHA | 190 | 0.01060 | 0.98945 |
| MONEY_SUPPLY_CHA does not Granger Cause CHANGE_IN_OFFICI |     | 1.43694 | 0.24029 |
| CAPITAL_ACCOUNT0 does not Granger Cause MONEY_SUPPLY_CHA | 190 | 2.15044 | 0.11933 |
| MONEY_SUPPLY_CHA does not Granger Cause CAPITAL_ACCOUNT0 |     | 4.56544 | 0.01160 |
| CURRENT_ACCOUNT0 does not Granger Cause POLITICAL_ADMINI | 190 | 0.03504 | 0.96557 |
| POLITICAL_ADMINI does not Granger Cause CURRENT_ACCOUNT0 |     | 5.98998 | 0.00302 |
| CHANGE_IN_OFFICI does not Granger Cause POLITICAL_ADMINI | 190 | 1.18502 | 0.30805 |
| POLITICAL_ADMINI does not Granger Cause CHANGE_IN_OFFICI |     | 1.50996 | 0.22363 |
| CAPITAL_ACCOUNT0 does not Granger Cause POLITICAL_ADMINI | 190 | 0.17396 | 0.84047 |
| POLITICAL_ADMINI does not Granger Cause CAPITAL_ACCOUNT0 |     | 1.41712 | 0.24503 |
| CHANGE_IN_OFFICI does not Granger Cause CURRENT_ACCOUNT0 | 190 | 2.38623 | 0.09480 |
| CURRENT_ACCOUNT0 does not Granger Cause CHANGE_IN_OFFICI |     | 4.38580 | 0.01377 |
| CAPITAL_ACCOUNT0 does not Granger Cause CURRENT_ACCOUNT0 | 190 | 1.03952 | 0.35568 |
| CURRENT_ACCOUNT0 does not Granger Cause CAPITAL_ACCOUNT0 |     | 0.84707 | 0.43033 |
| CAPITAL_ACCOUNT0 does not Granger Cause CHANGE_IN_OFFICI | 190 | 0.06045 | 0.94136 |
| CHANGE_IN_OFFICI does not Granger Cause CAPITAL_ACCOUNT0 |     | 1.43985 | 0.23961 |

# SINGAPORE DATA

Sample: 1993:01 2008:12

Lags: 2

| Null Hypothesis:                  | Obs | F-Statistic | Probability |
|-----------------------------------|-----|-------------|-------------|
| LOG_INFLATION_RA does not         | 189 | 1.40396     | 0.24824     |
| Granger Cause LOG_EXCHANGE_RAT    |     |             |             |
| LOG_EXCHANGE_RAT does not Granger |     | 5.08883     | 0.00706     |
| Cause LOG_INFLATION_RA            |     |             |             |
| LOG_91_TREASURY_ does not         | 189 | 0.46395     | 0.62953     |
| Granger Cause LOG_EXCHANGE_RAT    |     |             |             |
| LOG_EXCHANGE_RAT does not Granger |     | 1.03744     | 0.35642     |
| Cause LOG_91_TREASURY_            |     |             |             |
| INCREASE_DECREAS does not         | 189 | 1.60199     | 0.20429     |
| Granger Cause LOG_EXCHANGE_RAT    |     |             |             |
| LOG_EXCHANGE_RAT does not Granger |     | 2.39683     | 0.09384     |
| Cause INCREASE_DECREAS            |     |             |             |
| INCREASE__DECREA does not         | 189 | 0.63311     | 0.53209     |
| Granger Cause LOG_EXCHANGE_RAT    |     |             |             |
| LOG_EXCHANGE_RAT does not Granger |     | 1.81108     | 0.16638     |
| Cause INCREASE__DECREA            |     |             |             |
| CURRENT_ACCOUNT_ does not         | 189 | 0.15370     | 0.85764     |
| Granger Cause LOG_EXCHANGE_RAT    |     |             |             |
| LOG_EXCHANGE_RAT does not Granger |     | 0.63342     | 0.53193     |
| Cause CURRENT_ACCOUNT_            |     |             |             |
| CAPITAL_ACCOUNT_ does not         | 189 | 0.34046     | 0.71189     |
| Granger Cause LOG_EXCHANGE_RAT    |     |             |             |
| LOG_EXCHANGE_RAT does not Granger |     | 4.39414     | 0.01367     |

Cause CAPITAL\_ACCOUNT\_

|                           |     |         |         |
|---------------------------|-----|---------|---------|
| LOG_91_TREASURY_ does not | 189 | 1.36811 | 0.25716 |
|---------------------------|-----|---------|---------|

Granger Cause LOG\_INFLATION\_RA

|                                   |         |         |
|-----------------------------------|---------|---------|
| LOG_INFLATION_RA does not Granger | 0.19363 | 0.82413 |
|-----------------------------------|---------|---------|

Cause LOG\_91\_TREASURY\_

|                           |     |         |         |
|---------------------------|-----|---------|---------|
| INCREASE_DECREAS does not | 189 | 0.33774 | 0.71382 |
|---------------------------|-----|---------|---------|

Granger Cause LOG\_INFLATION\_RA

|                                   |         |         |
|-----------------------------------|---------|---------|
| LOG_INFLATION_RA does not Granger | 0.33793 | 0.71369 |
|-----------------------------------|---------|---------|

Cause INCREASE\_DECREAS

|                           |     |         |         |
|---------------------------|-----|---------|---------|
| INCREASE__DECREA does not | 189 | 1.68645 | 0.18803 |
|---------------------------|-----|---------|---------|

Granger Cause LOG\_INFLATION\_RA

|                                   |         |         |
|-----------------------------------|---------|---------|
| LOG_INFLATION_RA does not Granger | 1.84329 | 0.16121 |
|-----------------------------------|---------|---------|

Cause INCREASE\_\_DECREA

|                           |     |         |         |
|---------------------------|-----|---------|---------|
| CURRENT_ACCOUNT_ does not | 189 | 1.08592 | 0.33974 |
|---------------------------|-----|---------|---------|

Granger Cause LOG\_INFLATION\_RA

|                                   |         |         |
|-----------------------------------|---------|---------|
| LOG_INFLATION_RA does not Granger | 0.18124 | 0.83439 |
|-----------------------------------|---------|---------|

Cause CURRENT\_ACCOUNT\_

|                           |     |         |         |
|---------------------------|-----|---------|---------|
| CAPITAL_ACCOUNT_ does not | 189 | 2.27612 | 0.10557 |
|---------------------------|-----|---------|---------|

Granger Cause LOG\_INFLATION\_RA

|                                   |         |         |
|-----------------------------------|---------|---------|
| LOG_INFLATION_RA does not Granger | 2.41517 | 0.09218 |
|-----------------------------------|---------|---------|

Cause CAPITAL\_ACCOUNT\_

|                           |     |         |         |
|---------------------------|-----|---------|---------|
| INCREASE_DECREAS does not | 189 | 0.36030 | 0.69796 |
|---------------------------|-----|---------|---------|

Granger Cause LOG\_91\_TREASURY\_

|                                   |         |         |
|-----------------------------------|---------|---------|
| LOG_91_TREASURY_ does not Granger | 3.17771 | 0.04398 |
|-----------------------------------|---------|---------|

Cause INCREASE\_DECREAS

|                           |     |         |         |
|---------------------------|-----|---------|---------|
| INCREASE__DECREA does not | 189 | 0.23800 | 0.78845 |
|---------------------------|-----|---------|---------|

Granger Cause LOG\_91\_TREASURY\_

|                                   |         |         |
|-----------------------------------|---------|---------|
| LOG_91_TREASURY_ does not Granger | 1.52299 | 0.22079 |
|-----------------------------------|---------|---------|

Cause INCREASE\_\_DECREA

|                           |     |         |         |
|---------------------------|-----|---------|---------|
| CURRENT_ACCOUNT_ does not | 189 | 0.33651 | 0.71470 |
|---------------------------|-----|---------|---------|

Granger Cause LOG\_91\_TREASURY\_

|                                   |  |         |         |
|-----------------------------------|--|---------|---------|
| LOG_91_TREASURY_ does not Granger |  | 0.06177 | 0.94012 |
|-----------------------------------|--|---------|---------|

Cause CURRENT\_ACCOUNT\_

|                           |     |         |         |
|---------------------------|-----|---------|---------|
| CAPITAL_ACCOUNT_ does not | 189 | 0.13272 | 0.87579 |
|---------------------------|-----|---------|---------|

Granger Cause LOG\_91\_TREASURY\_

|                                   |  |         |         |
|-----------------------------------|--|---------|---------|
| LOG_91_TREASURY_ does not Granger |  | 0.04338 | 0.95756 |
|-----------------------------------|--|---------|---------|

Cause CAPITAL\_ACCOUNT\_

|                           |     |         |         |
|---------------------------|-----|---------|---------|
| INCREASE__DECREA does not | 189 | 1.92256 | 0.14916 |
|---------------------------|-----|---------|---------|

Granger Cause INCREASE\_DECREAS

|                                   |  |         |         |
|-----------------------------------|--|---------|---------|
| INCREASE_DECREAS does not Granger |  | 4.30007 | 0.01496 |
|-----------------------------------|--|---------|---------|

Cause INCREASE\_\_DECREA

|                           |     |         |         |
|---------------------------|-----|---------|---------|
| CURRENT_ACCOUNT_ does not | 189 | 6.67931 | 0.00158 |
|---------------------------|-----|---------|---------|

Granger Cause INCREASE\_DECREAS

|                                   |  |         |         |
|-----------------------------------|--|---------|---------|
| INCREASE_DECREAS does not Granger |  | 6.24122 | 0.00238 |
|-----------------------------------|--|---------|---------|

Cause CURRENT\_ACCOUNT\_

|                           |     |         |         |
|---------------------------|-----|---------|---------|
| CAPITAL_ACCOUNT_ does not | 189 | 0.00592 | 0.99410 |
|---------------------------|-----|---------|---------|

Granger Cause INCREASE\_DECREAS

|                                   |  |         |         |
|-----------------------------------|--|---------|---------|
| INCREASE_DECREAS does not Granger |  | 0.29272 | 0.74658 |
|-----------------------------------|--|---------|---------|

Cause CAPITAL\_ACCOUNT\_

|                           |     |         |         |
|---------------------------|-----|---------|---------|
| CURRENT_ACCOUNT_ does not | 189 | 3.54738 | 0.03079 |
|---------------------------|-----|---------|---------|

Granger Cause INCREASE\_\_DECREA

|                                   |  |         |         |
|-----------------------------------|--|---------|---------|
| INCREASE__DECREA does not Granger |  | 2.99124 | 0.05267 |
|-----------------------------------|--|---------|---------|

Cause CURRENT\_ACCOUNT\_

|                           |     |         |         |
|---------------------------|-----|---------|---------|
| CAPITAL_ACCOUNT_ does not | 189 | 1.53829 | 0.21750 |
|---------------------------|-----|---------|---------|

Granger Cause INCREASE\_\_DECREA

|                                   |  |         |         |
|-----------------------------------|--|---------|---------|
| INCREASE__DECREA does not Granger |  | 0.63875 | 0.52912 |
|-----------------------------------|--|---------|---------|

Cause CAPITAL\_ACCOUNT\_

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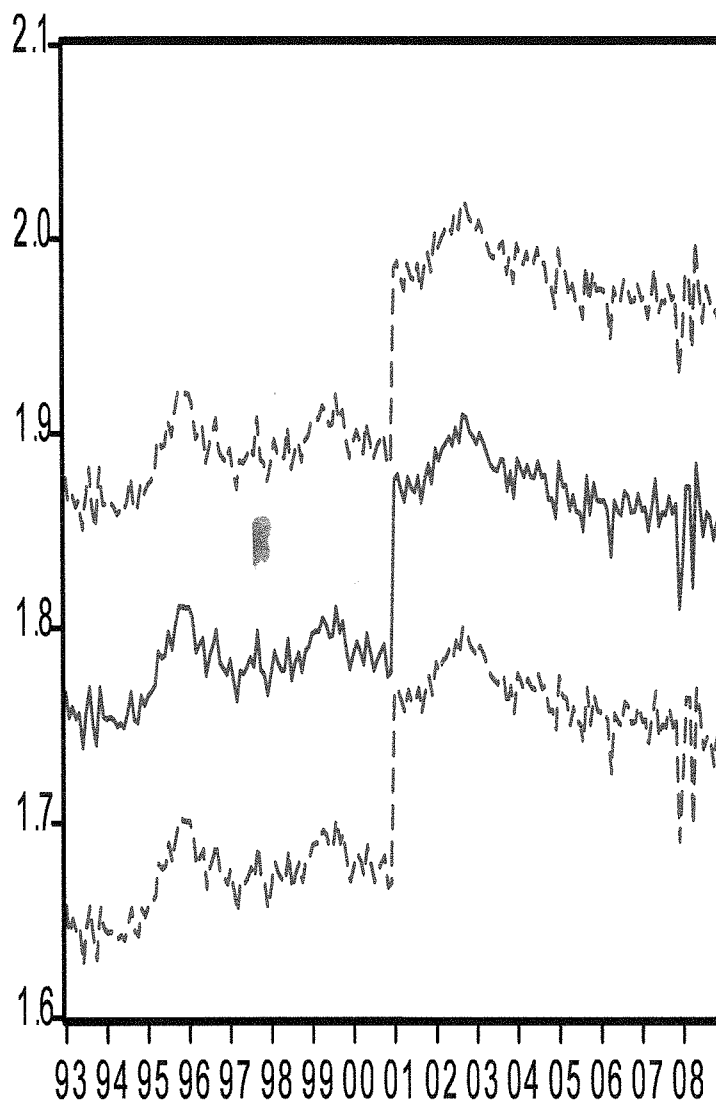
|                           |     |         |         |
|---------------------------|-----|---------|---------|
| CAPITAL_ACCOUNT_ does not | 189 | 2.64323 | 0.07383 |
|---------------------------|-----|---------|---------|

Granger Cause CURRENT\_ACCOUNT\_

|                                   |         |         |
|-----------------------------------|---------|---------|
| CURRENT_ACCOUNT_ does not Granger | 1.71142 | 0.18347 |
|-----------------------------------|---------|---------|

Cause CAPITAL\_ACCOUNT\_

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— EXCHANGE\_RF ---  $\pm 2$  S.E.

Forecast: EXCHANGE\_RF  
 Actual: EXCHANGE\_RATE\_LO  
 Forecasts sample: 1993:01 2008:  
 Included observations: 192

Root Mean Squared Error 0.052712  
 Mean Absolute Error 0.037263  
 Mean Abs. Percent Error 2.086767  
 Theil Inequality Coefficient 0.14428  
 Bias Proportion 0.000000  
 Variance Proportion 0.188768  
 Covariance Proportion 0.11232