Abstract

'RUPEE - DOLLAR EXCHANGE RATE VOLATILITY AND UNCOVERED INTEREST RATE PARITY DOCTRINE - A TIME SERIES ECONOMETRIC STUDY WITH BEVERIDGE – NELSON DECOMPOSITION.'

International Finance centers on two variables – exchange rate and Balance of Payments. Before 1970 fixed exchange rate system did exist. In this period Balance of Payments was a variable and the concern was about the stability of Balance of Payments. During this period various theories of Balance of Payments were developed.

However, in 1970 flexible exchange rate system replaced fixed exchange rate system. Consequently, exchange rate become variable and attention of economists moved from Balance of Payments to exchange rate. Economists wanted to know

(i) how exchange rate is related to domestic interest rate, price level and money supply.

(ii) the nature of variations in exchange rate.

(iii) how exchange is related to Current and Capital A/C of Balance of Payments etc.

Consequently, several exchange rate theories grew up since 1970. Some of important theories are '*Purchasing Power Parity Theory*', Monetary Theory of Exchange Rate, Dornbusch Model of Exchange Rate and Uncovered Interest Parity Theory etc. It may be noted that these theories did not grow up simultaneously. When any existing theory failed to explain exchange rate changes in an economy, another theory was developed. Exchange rate variations do not follow any fixed pattern. For different patterns, different theories were developed.

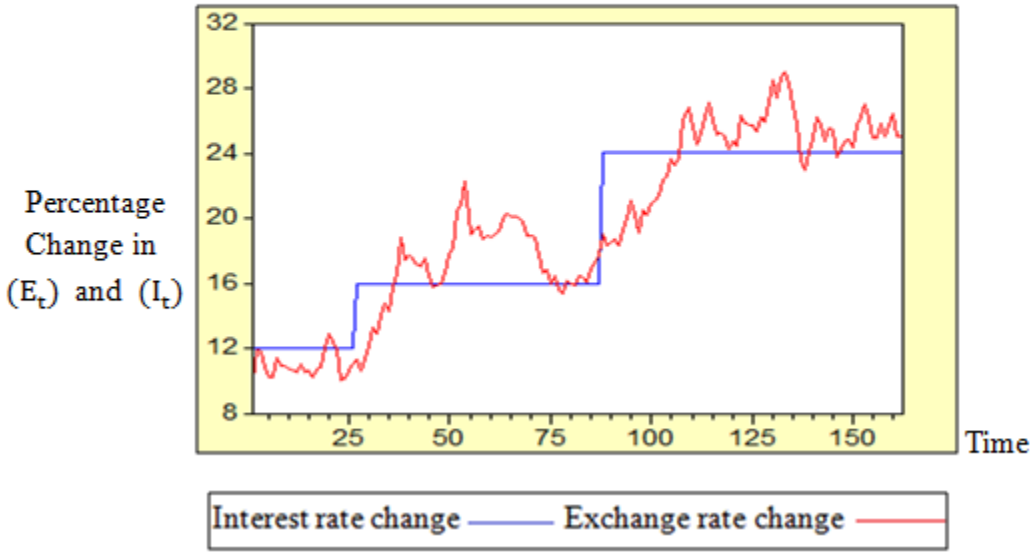
For example, in Indian economy Rupee/Dollar exchange rates underwent changes over time since 1970. Such variations have been studied through different theories. Over some period PPP theory was valid, for some period Monetary Theory was valid. However, since 2011 some variations in exchange rate took place and such variations need explanation. Over the period 2011 until 2015, rupee depreciated almost steadily. Again

such depreciation of rupee against dollar was triggered by rise in interest rates. As rise in interest rate continued, depression of rupee also continued. This feature indicates that depreciation of rupee appears to be positively related to domestic interest rate.

Can this feature of Rupee/Dollar exchange rate depreciation be explained by any of the existing theories? I have shown that under all theories apart from UIRAP theory there exists no direct relationship between exchange rate and interest rate. The percentage change in exchange rates (rupee/dollar) and percentage change in interest rates are being presented through the Figure 1.1 in Chapter-1

Figure: 1.1

Time Plots of the Percentage Change in Exchange Rate (E_t) and Percentage Change in Domestic Term Deposit Interest Rate (I_t) .



It may be noted that interest rates were changed with some gaps. After a rise, interest rate remained unchanged for some period and again it is raised. Therefore, the figure for percentage change in interest rate displays *'step – like'* shape. On the other hand, exchange rate variation is almost continuous. Consequently, there exists no '*step – like*' shape in the time plot of percentage change in exchange rate. It is observed from the figure that following a rise in interest rate, rupee/dollar exchange rate rises i.e., rupee depreciates. Initially, percentage change in exchange rate was lower than that in interest rate. But with the passage of time, exchange rate time path catches up the time path of interest rate. It may exceed that in interest rate, but it cannot rise above the interest rate

changes for a long time. It comes down and equals the interest rate change time path. It, therefore, appears that in Indian economy over this period rate of depreciation of rupee against dollar was positively related to interest rate change. Again, in equilibrium, rate of depreciation equals the percentage change in interest rate. This testifies for the holding of UIRAP doctrine in Indian economy with respect to the nature of variation in exchange rate. I have sought to study this relation econometrically. The question is, has there really been any long-run relation between exchange rate (E_t) and Interest rate (I_t)? I have studied this relation in Chapter 5. This estimated equation is good fit. However, the regression constant is not statistically different from zero. Again the regression coefficient is significant and it is virtually equal to unity. Thus, this estimated equation can be written as

$$\widehat{E_t} = I_t$$

Consequently, the percentage change in exchange rate is equal to the percentage change in interest rate. This finding confirms the holding of UIRAP in the Indian Economy over the period of study.

International theories indicate that UIRAP holds when the market is efficient and there exists no risk premium in the market. These two features are tested under CIRAP which is a variant of UIRAP. Under CIRAP we deal with three variables namely

(i) Forward exchange rate for period $(t+1)$. This rate is quoted by the RBI at period t. This is actually the official forecast for the spot rate which will exist at (t+1) period. This is written as (tF_{t+1}).

(ii) Market agents' forecast for spot rate at $(t+1)$ period. This is written as (s^e_{t+1}).

(iii) The actual spot rate which exists at time (t+1). It is written as (s_{t+1}).

A time t nobody knows what will be (s_{t+1}) which an unknown quantity. However, RBI forecast for (s_{t+1}) is (tF_{t+1}). RBI thinks that (tF_{t+1}) will be very close to (s_{t+1}) i.e, on average (tF_{t+1}) will be equal to (s_{t+1}) i.e., $E(tF_{t+1}) = (s_{t+1})$. If this really holds, then Forward Exchange Rate is assumed to be the Unbiased Predictor of Spot Rate under CIRAP. Market agents also do not know what will be (s_{t+1}) i.e, spot rate (exchange rate) at period (t+1). Their expectation for (s_{t+1}) is (s^e_{t+1}). Thus there are two forecasts

for (s_{t+1}), one is RBI's forecast (tF_{t+1}) and the other is market forecast (s^e_{t+1}). What is the relation between these two forecasts? CIRAP doctrine holds that the forward exchange rate (tF_{t+1}) must be equal to the market forecast (s^e_{t+1}) for the spot rate at (t+1) period such that

$$tF_{t+1} \cong s^e_{t+1}$$

If this equality holds, then the foreign exchange market is called '*Efficient*'. If (s^e_{t+1}) equals (tF_{t+1}), then market forecasts for spot rate at tome t are considered to be 'rational forecasts'.

Consequently, any tests for

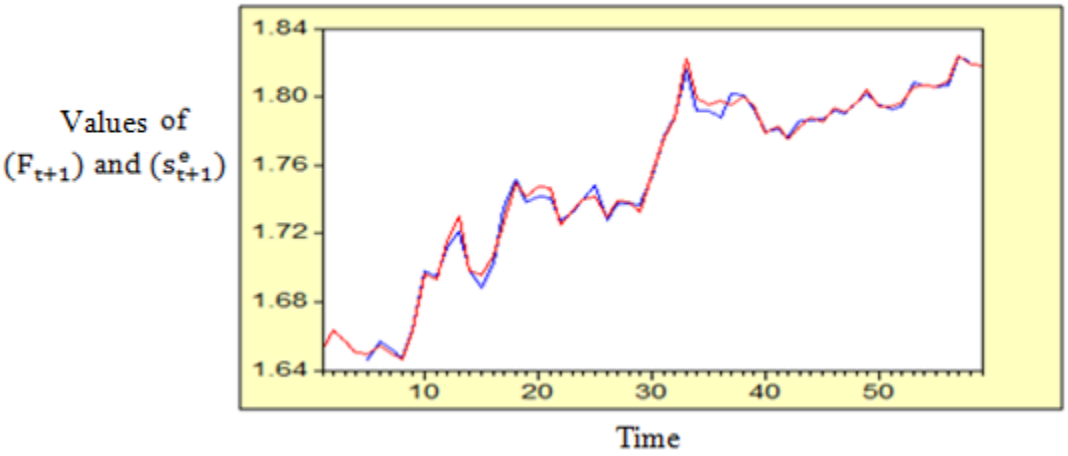
$$tF_{t+1} = s^e_{t+1}$$

entail tests for two hypotheses jointly where one is *'Efficiency'* of market and the other is the hypothesis of 'Rational Expectations'. If these properties of (tF_{t+1}), (s^e_{t+1}) and (s_{t+1}) hold, then CIRAP is valid and UIRAP gets established in the economy.

In Chapter 7 market forecasts for (s_{t+1}) i.e. (s^e_{t+1}) have been generated on the basis of univariate stochastic structure of spot rate (i.e. exchange rate series). Here monthly exchange rate data have been used. (tF_{t+1}) series have been obtained from the RBI Bulletin. The time plots of (s_{t+1}) and (s^e_{t+1}) have been presented in (Figure 6.2). These two series almost coincide. We have found that the forecast error $[(s_{t+1}) - (s^e_{t+1})]$ are white noise. Consequently, the forecasts (s^e_{t+1}) are MMSE Forecasts. Again time plots of (F_{t+1}) and (s^e_{t+1}) series are being presented through the Figure 7.4 in Chapter-7

Figure – 7.4

Time plots of $(s^e_{t+1}$____$)$ series and $(F_{t+1}$____$)$ series



Both the series appear to posses almost the same dynamic texture and these series share the '*Common trend'*. The graphical relation has been verified through Cointegrating analysis. The Cointegrating equation is

$$t\hat{F}_{t+1} = -0.002390 + 1.001737\ s^{e}_{t+1} \qquad (7.6)$$

SE	(0.017858)	(0.010167)
t	[-0.133815]	[98.52650]
Prob	0.841	0.0000

R-squared = 0.9946, $\bar{R}^2$ = 0.9945, DW = 1.8963, AIC = -8.3688,
SIC = -8.2951, F Statistics = 9707.47, Prob (F – Statistics) = 0.0000

It is observed that

(i) the regression constant term is virtually zero since the term is not statistically significant

(ii) the regression coefficient is significant and it is not statistically different from unity.

Consequently, the estimated equation can be written as $t\hat{F}_{t+1} = s^{e}_{t+1}$. Thus, the forecasts ($s^{e}_{t+1}$) are *'rational'* by nature and the market is *'efficient'*. The regression constant in this equation has a meaning. It measures *'risk premium'*. When market agents consider it risky for holding domestic currency (here rupee), he needs a '*premium*' for such risk. This is called *'risk premium'*. In rupee/dollar exchange rate, rupee is the domestic currency and if it is not a good substitute for dollar, then it is risky for market agents to hold it. So market agents need risk premium for holding rupee. In the estimated equation, the regression constant is statistically not different from zero. Consequently, there exists no risk premium in the market. Rupee is considered by the market agents as a good substitute for dollar as an asset of holding. The absence of risk premium also confirms 'Efficitncy' of foreign exchange (Rupee/Dollar) market in India. All these features of the market confirm that UIRAP held good in the Indian foreign exchange market over the period concerned.

In several studies, considered in Survey of Literature, findings varied with variation in the nature of dataset. More, specifically, it has been pointed out that findings on UIRAP

obtained through the use of weekly dataset differed a lot from the findings obtained through the monthly dataset. We have also considered this issue in this thesis. The same study was carried out with weekly exchange rate dataset in Chapter 6. However, we found that findings in this study were completely in conformity with those obtained through the use of monthly datasets in Chapter 7 and 8.

The following inferences may be drawn on the basis of findings in this study:

(i) UIRAP doctrine with respect to the relationship between exchange rate and interest rate holds good in Indian economy. Long run relationship that exchange rate maintained with interest rate is stable. More specifically, exchange rate variations are found to be in '*Homogeneous of Degree One*' relationship with that in interest rate. This finding is in conformity with the doctrine of UIRAP and, therefore, UIRAP doctrine holds good in Indian foreign exchange market over the period of study.

(ii) CIRAP holds good in the Indian foreign exchange (rupee/dollar) market over the period 3rd January, 2011 through 2nd November, 2015. Over this period forward exchange rate (tF_{t+1}) served as the unbiased predictor of spot rate.

(iii) There did exist no '*risk premium'*. There was no scope for reaping arbitrage profit arising out of the differential between forward rate and corresponding spot rate. This testifies for the 'efficiency' of Indian foreign exchange market over the period of study.

(iv) Absence of *'risk premium'* in Indian foreign exchange (rupee/dollar) market indicates that market participants are *'risk neutral'* in view of the fact that rupee serves as a good substitute for dollar as an asset for holding.

(v) In Indian foreign exchange (rupee/dollar) market, Granger Causality runs from spot rate to forward rate. Quoting of forward rate is found to have no effect on future period spot rate. This implies that rupee/dollar foreign exchange market does not get disturbed with interventions from the Reserve Bank. This feature implicitly indicates that Indian foreign exchange (rupee/dollar) market entails the feature of '*freely fluctuating exchange rate system'*. This feature of the foreign

exchange market allows free flow of information taking place so that all inhibiting forces become impossible. Consequently, the foreign exchange (rupee/dollar) becomes an '*efficient*' asset market with respect to the domestic and foreign assets like rupee and dollar respectively.