CHAPTER 4

CONCLUSIONS AND CONTRIBUTIONS

4.1. Conclusions

We explore the relationship between currency futures rates and realized spot rates for the Indian rupee US dollar exchange rate in the second chapter of the thesis. To our best knowledge this is the first study to use data on spot and futures contracts from NSE where rupee/dollar currency futures trading were introduced only in August 2008. Using futures contracts with maturities of one, two and three months, we examine the unbiasedness of the futures rate as a predictor of the spot exchange rate as well as the nature of realized time-varying risk premiums in this relatively new market.

In the third chapter of the thesis, we explore the term structure of the risk premiums and aim at addressing the issue of forward premium anomaly. We provide the first study to analyze the term structure of currency risk premiums with maturities ranging from one month up to 24 months. For this purpose, we explore the time-series of the realized risk premiums of 13 different maturities and provide a complete schedule of its term structure across time using the factor models for five currency pairs – AUD/USD, CHF/USD, EUR/USD, GBP/USD and JPY/USD.

Like several studies on other currency futures markets, we find that the futures premium cannot be considered as an unbiased predictor of changes in the spot rate for the Indian rupee US dollar exchange rate. The explanatory power of a model using the futures premium as predictors for future changes in the spot rate increases with the maturity of the contract. While we find that the
coefficients deviate significantly from one; our results suggest that the bias is more significant for contracts with longer maturities. In other words, the unbiasedness hypothesis possibly holds for contracts with short maturities but it is unlikely to hold for contracts with longer maturities of two and three months.

Similarly, we establish that the FRUH can be rejected for CHF, EUY and JPY. For these three currencies, our results confirm the usual finding of a strong forward rate bias. Further, we find that the biasedness of the forward rate keep on increasing as the contract maturity increases. That is, for the contracts of 24-month maturity, the forward rate is a more biased predictor of the futures spot rate as compared to the contracts of 12-month expiry. Similarly, the 12-month expiry contracts provide results of more biasedness of the forward rate as compared to the contracts of 11-month and so on. Again as explained above, the unbiasedness hypothesis possibly holds for contracts with short maturities but it is unlikely to hold for contracts with longer maturities. Thus, we confirm results on the relationship between bias and maturity in other currency futures markets, e.g. Kumar and Trueck (2013), who investigate the significance of UIP for the Indian rupee against the US dollar.

Based on our results, we argue that one of the reasons for the poor performance of the futures premium as an unbiased predictor of changes in the spot rate is the presence of a time-varying risk premium in the currency futures market. We suggest that risk premiums start playing a more important role with increasing maturity of the currency futures contracts. To further investigate this assumption empirically, we examine observed risk premiums and conduct tests on their significance for the all maturities. We find that realized risk premiums for the one month futures
contracts are not significant, while risk premiums for the two months and three months contracts are negative and significantly different from zero. Similarly, for the other currencies, we find upward sloping risk premiums which reveals that the risk premium increases and becomes more significantly different from zero as the maturity of the contract gets longer. For example, for the Australian dollar, the risk premiums for one-month maturity are not significantly different from zero. However, for the 2-month contracts, risk premium is different from zero at 10% level of significance, at 5% for 3-month to 5-month maturity contracts and becomes different from zero even at less than 1% level of significance for the longer maturity contracts. The same phenomenon is visible for other currencies as well. For the Japanese yen, though the risk premiums are negative, it marginally becomes large with maturity.

We suggest the following reasons for our results: First, since hedging activities in currency futures markets are mostly concentrated on contracts with longer maturities, the pricing of short-term contracts is less affected by hedging activities. On the other hand, for the longer month’s maturity futures contracts, the risk premium will be an important determinant of the futures rate and can be expected to be more pronounced as the maturity of the contract gets longer. Our second explanation can be related to CIP and the notion that the futures-spot basis is equivalent to the interest rate differential between two countries’ currencies. While the interest rates in the short-term are generally set by central banks and are, therefore, not affected by market risk premiums, interest rates for longer maturities are more related to market forces and expectations. Therefore, for longer maturities, the risk premiums start playing a more significant role in the determination of interest and futures rates. As a consequence, for short maturity contracts UIP and the unbiasedness of the futures rate are more likely to hold while for longer-
term contracts we can expect to find significant risk premiums in currency futures quotes. Furthermore, these risk premiums might be dependent on the behaviour of the currency spot rate, that is, variables such as currency spot returns, realized volatility, skewness and kurtosis of the currency returns.

We also investigate the relationship between observed ex-post risk premiums and explanatory variables such as the currency returns, the basis, as well as measures like realized volatility, skewness and kurtosis of the currency returns. Our results indicate that the currency returns and the basis are significant determinants of the risk premium. **We also find that the explanatory power of these variables increases as the maturity of the contract gets longer.** While the risk premium is also negatively related to the realized skewness of the spot exchange rate, the variable is not significant in our estimated models for the risk premium.

Next, we investigate the term structure of the risk premiums for AUD, CHF, EUR, GBP and JPY. It has already been established in the literature of interest rate term structure that three factors explain almost the entire movement of the yield curve. These three factors – level, slope and curvature – have been clearly identified in the literature of interest rate term structure modelling. However, ours is the first study that explores the dynamics of the risk premium series over different maturities.

Four–factor model accounts for almost 93 percent of total variation in the risk premiums for all the currencies. This disintegration of the matrix in common and specific factor highlights the relative significance of the factors in illustrating the variation in the risk premiums in each of the
currency markets for each maturity. In all the currency markets concerned, the first factor contribute the maximum proportion of the total variance of the risk premium. The first factor is regarded here as the ‘level’ factor because risk premiums of all maturities load heavily and equally on it and that too of an order of around one in majority of the maturities. Further, the first factor is highly correlated with ‘level’ measure of the risk premiums as suggested by Diebold et al. (2006).

The second factor explains the second largest proportion of the total explained variance not accounted for by the first factor. The second factor’s contribution to the explained variation is much larger at the very short end of the curve. The second factor explains much of the variation in the risk premium curve at the very short end as compared the long end of the curve, which leads us to interpret the second factor as the ‘slope’ factor. In other words, the risk premiums of shorter maturities load heavily on the second factor as compared to the risk premiums of the long maturities. A unit shock to the risk premium of shorter maturities changes them more than the same shock to risk premium of longer maturity. Alternatively, an increase in the second factor increases short-term risk premiums more than long-term risk premiums because the short risk premiums load on second factor more heavily, thereby changing the slope of the risk premium curve. Moreover, the second factor is also highly related to the measure of slope provided by Diebold et al. (2006).

The third factor explains small percentage of the total variation not accounted for by the first two factors. One important point to be observed for the third factor is that for all the currencies, the explained variation by factor three is maximum at the shortest end of the curve, then decreases
and after increasing in the middle of the curve, decreases and then again become maximum at the furthest end of the curve. This kind of explained variation gives the third factor a shape like a curve due to which we call it as a curvature factor. Further, the correlations between the third factor and the curvature factor measures given by Diebold et al. (2006) are very high for a number of currencies.

As far as the fourth factor is concerned, it explains the remaining variation not explained by the first three factors. An important observation about the fourth factor is that it is similar to the third factor in the sense that it explains the maximum variation in the risk premium at the shortest and the longest end of the risk premium for all the currencies. However, the contribution of the fourth factor becomes highly significant at the farthest end of the risk premium curve. As the fourth factor behaves similar to the third factor and shows high correlation with the curvature factor, we call it as ‘second curvature’ factor.

Our model is found to be highly fit in-sample. A variety of risk premium curves are easily explained by our four-factor model. Moreover, when it comes to comparing the factors with suitable macroeconomic variables, we find that the first factor is the six-month future change in the realized spot rate for all currencies. However, unfortunately, we could not link any of the other factors to any macroeconomic or financial variables, hence could not find a suitable empirical macroeconomic proxy for the slope and curvature factors.

Next, to test the central idea of the thesis, that is, addressing the forward premium anomaly, we construct the estimated risk premiums using the factors and their respective loadings. We
establish that for CHF and EUR, it is the first factor (level factor) that plays a major role in rejecting the unbiasedness hypothesis. However, for JPY, it takes the elimination of the first and the second factors for the unbiasedness hypothesis to hold true. Overall, our results indicate that it is ‘level’ factor that produces forward premium anomaly in CHF and EUR; for JPY, it is the ‘level’ and ‘slope’ factors which induce forward premium anomaly.

Overall, our results suggest that the relationship between currency spot and futures rates in the Indian rupee US dollar market shows dynamics that are similar to more established currency futures markets. We find that the forward premium anomaly and the risk premium behave more or less in a similar fashion in India and the developed countries studied in this thesis. However, given that this is a relatively new and emerging market, we recommend further research on the nature and dynamics of currency futures risk premiums when more data is available.

4.2. Contributions of the Study

The main contributions of our study can be described as follows:

1. To the best of our knowledge, this is the first study to examine the forward premium anomaly and the risk premiums using the standardized currency futures contracts data from the National Stock Exchange (NSE) of India.

2. The study is one of the first to have incorporated realized skewness and kurtosis of the spot rate as the possible determinants of the risk premium. The use of such measures has been widely ignored in the literature so far.

3. We provide the first study to have undertaken the analysis of the term structure of currency risk premiums.
4. Ours is the first study to address the issue of forward premium anomaly using term-structure of risk premiums.