CHAPTER 4

RISK SPILLOVER BETWEEN INDIAN FINANCIAL MARKETS
4.1 INTRODUCTION
Risk may be defined as the probability of the future returns to vary from the expected returns. (Vivek & P.N, 2009)\(^1\) Risks arise from various sources and affect the values of the assets held. Risks can be minimised but cannot be eliminated. As such measuring the risks helps one to understand the level of risk exposure. One such popular measuring tool is Value at risk which has become a benchmark methodology among investors and banks for measuring market risk. Market risk is the risk of losses due to adverse movements in financial market variables. (Crouchy, Galai, & Mark, 2001)\(^2\) The Bank of International Settlements (BIS) defines market risk as the “the risk that the value of ‘on’ or ‘off’ balance sheet positions will be adversely affected by movements in equity and interest rate markets, currency exchange rates and commodity prices”. (Sinem & Unal, 2012)\(^3\) Market risk for future indices is more complex compared to market risk of the underlying stock indices. While stock index is related to the possibility of rise and fall of equity prices, future market risk is related to changes in the underlying assets due to other speculative trades. (Köseoğlu & Ünal, 2012)\(^4\) Future market instruments are used both for hedging and speculative purposes. This feature of Future Markets makes it very risky more than the Equity market. In this regard, the study’s main intention is to is to measure and compare the market risk of these two different markets which are inter related and inter dependent.

Several research on risk measures has been carried out even in futures stock market of late. Huang & Lin (2004)\(^5\) investigated the forecasting performance of EWMA, Normal APARCH and Student APARCH models for VaR estimations of two stock index futures contracts in Taiwan namely TAIFEX and SGX-DT, in which all the three stock index futures prices showed long memory characteristics. Tang and Shieh (2006)\(^6\) showed that HYGARCH models with student-t distributions performed well for S&P500 and Nasdaq100
futures. Kasman (2009) calculated VaR estimations of Turkish stock index futures contracts by using the FIGARCH model with normal, student-t, and skewed student-t distributions for the period between 2005 and 2008 and the findings supported an evidence of long memory in volatility in Turkish stock index futures. A comparative study of market risk of Stock index and the index futures was done by Sinem and Unal (2012) in ISE30, DAX30, S&P500, Nikkei225 and FTSE100 indices through various VaR methods, in which they demonstrated that futures market risk is higher than the underlying stock market risk for Nikkei 225 and S&P 500. Oscar & others (2009), estimated one day VaR ahead in the spot and future equity markets for three stock indices Viz., S&P 500, DAX 30 and Nikkie 225 using ARMA GARCH CTS Models. They have introduced trading volume in the CTS model and found that lagged trading volume relative change helps in predicting one day ahead VaR for the stock index futures contracts. The number of violations is also less in the future market in case of CTS model with trading volume considered. Cotter & Dowd (2006), estimate VaR and Expected Shortfall for 5 prominent equity futures contract. They find that all risk measures increase dramatically and their estimators deteriorate in precision when their respective conditioning parameter increases. Results also suggest that estimates of spectral risk measures and their precision levels are of comparable orders of magnitude as those of more conventional risk measures.

The study tries to observe the risk spillover between spot and future of equity and forex market. The study employs Granger Causality in Risk (GCR). In time series econometrics, the most commonly used Granger causality concept is Granger causality in mean, which was first introduced in Granger (1969). Granger et al. (1986, p.2) also introduce a concept of Granger causality in variance, which can be used to investigate volatility spillover between financial markets (Engle et al. 1990), (Cheung and Ng 1996), or between macroeconomic time series (Granger et al. 1986). Here, the concept of Granger causality
in risk focuses on the comovements between the left tails of two distributions, which is more suitable than the concept of Granger causality in variance in characterizing extreme downside risk spillover between financial markets, because as pointed out earlier volatility is a two-sided risk measure and it cannot capture heavy tails due to jumps. Granger causality in risk can arise not only from comovements in mean and in variance, but also from the comovements in higher order conditional moments (e.g., skewness and kurtosis). Therefore, it may rise even in the absence of Granger causality in mean and in variance.\textsuperscript{15}

Estimating GCR is not as same and simple as Granger Causality in Mean and Variance. For Granger Causality in Risk first we have to calculate VaR, validate the data series through backtesting models and arrive at the risk indicator. The risk variables take the value of one when the return goes below the VaR level, otherwise zero. These binary processes are commonly called as hits. Testing for risk spillover is based on cross correlations of these risk variables.\textsuperscript{16}

\textbf{4.2 EMPirical ANALYSIS}

The empirical results tries to get the answer for the following questions:

- Is Future Market riskier than spot market?
- Is there risk spillover between financial markets?

\textbf{4.2.1 Risky Market}

The study attempts to measure the market risk of Spot and Future Market using various VaR models. Futures are the derivative instruments used to hedge the risk arising from the spot market positions. But we often fail to understand how risky is the hedging instrument itself than its underlying asset. As per the conclusions arrived in chapter 3, asymmetric GARCH VaR is said to provide accurate results to estimate market risk. As such the study uses
asymmetric GARCH VaR estimates to compare the VaR estimates of Spot and Future Market.

Table 4(A) provides the results of A-GARCH VaR for equity and forex spot and future markets at 99% confidence interval. It is observed that NFR is more risky than NSR. USR and GSR are more risky than UFR and GFR respectively. ESR is less risky than ESR. For equity market futures are more risky compared to spot market. For foreign exchange market, the results are inconclusive. The index futures were introduced in order to reduce volatility arising in the spot market. Risk increases provided the market is volatile. But whether the futures are playing an effective role in controlling the risks in spot market? Many studies has been conducted in this regard. But the available literature does not provide any conclusive evidence of effectiveness of futures markets (Xie and Huang, 2014)\(^1\). Bessembinder and Seguin (1992)\(^2\), Lee and Ohk (1992)\(^3\), Bologna and Cavallo (2002)\(^4\) and Chang et al. (1999)\(^5\) find that futures returns are effective and volatility in spot returns have decreased considerable due to the introduction of futures. However, Rubinstien (1987)\(^6\), Damodaran (1990)\(^7\), Harris (1989)\(^8\) and Edwards (1988)\(^9\) have discovered that volatility in the equity spot markets have increased profoundly post to introduction of futures. This may be due to the presence of speculators who wish to take due advantage of the arbitrage opportunities in spot and futures market.

**TABLE 4(A) : A-GARCH VaR at 99% CI**

<table>
<thead>
<tr>
<th>NSR</th>
<th>NFR</th>
<th>USR</th>
<th>UFR</th>
<th>GSR</th>
<th>GFR</th>
<th>ESR</th>
<th>EFR</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.22%</td>
<td>4.50%</td>
<td>1.648%</td>
<td>1.5629%</td>
<td>1.6474%</td>
<td>1.5835%</td>
<td>1.61%</td>
<td>1.76%</td>
</tr>
</tbody>
</table>
4.2.2 Risk Spillover Between Financial Markets

Table 4(B) and Table 4(C) report the test statistics of Granger Causality in Mean (GCM) and Granger Causality in Risk (GCR). The results are tested and interpreted at 5% significance level. The number of lags considered for testing GCM and GCR between the spot and future markets of the data series is two. Table 4(B) shows that there is unidirectional GCM from NSR to NFR and USR to UFR. This implies that Nifty Spot returns and USDINR Spot returns are able to predict the Nifty Future and USDINR future returns. There is bidirectional GCM between GSR and GFR. No GCM detected between spot and futures of EUROINR currency pair.

Table 4(B) : Granger Causality In Mean Results

<table>
<thead>
<tr>
<th>Null Hypothesis:</th>
<th>Obs</th>
<th>Lags</th>
<th>F-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>NSR does not Granger Cause NFR</td>
<td>3595</td>
<td>2</td>
<td>7.79407</td>
<td>0.0004</td>
</tr>
<tr>
<td>NFR does not Granger Cause NSR</td>
<td></td>
<td></td>
<td>0.01604</td>
<td>0.9841</td>
</tr>
<tr>
<td>USR does not Granger Cause UFR</td>
<td>1525</td>
<td>2</td>
<td>20.3183</td>
<td>0.0000</td>
</tr>
<tr>
<td>UFR does not Granger Cause USR</td>
<td></td>
<td></td>
<td>0.00748</td>
<td>0.9925</td>
</tr>
<tr>
<td>GSR does not Granger Cause GFR</td>
<td>1275</td>
<td>2</td>
<td>46.6018</td>
<td>0.0000</td>
</tr>
<tr>
<td>GFR does not Granger Cause GSR</td>
<td></td>
<td></td>
<td>10.4080</td>
<td>0.0000</td>
</tr>
<tr>
<td>ESR does not Granger Cause EFR</td>
<td>1227</td>
<td>2</td>
<td>1.05103</td>
<td>0.3499</td>
</tr>
<tr>
<td>EFR does not Granger Cause ESR</td>
<td></td>
<td></td>
<td>1.19405</td>
<td>0.3033</td>
</tr>
</tbody>
</table>
Table 4(C) provides the information of GCR between spot and futures of equity and currency markets. It summarises the null hypothesis of Granger Causality in Risk. The results are interpreted at 5% significance level. The null hypothesis is rejected if the probability values are less than 0.05. The results show that there is no risk spillover from NSR to NFR. There exists risk spillover from NFR to NSR. There is unidirectional GCR from NFR to NSR. Presence of risk spillover from NF towards NS is reinforced by the fact that NFR A-GARCH VaR is higher than the NSR.

<table>
<thead>
<tr>
<th>Null Hypothesis:</th>
<th>Obs</th>
<th>Lags</th>
<th>F-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>NSR does not Granger Cause NFR</td>
<td>3495</td>
<td>2</td>
<td>0.09253</td>
<td>0.9116</td>
</tr>
<tr>
<td>NFR does not Granger Cause NSR</td>
<td></td>
<td></td>
<td>3.14207</td>
<td>0.0433</td>
</tr>
<tr>
<td>USR does not Granger Cause UFR</td>
<td>1425</td>
<td>2</td>
<td>2.42695</td>
<td>0.0887</td>
</tr>
<tr>
<td>UFR does not Granger Cause USR</td>
<td></td>
<td></td>
<td>0.05644</td>
<td>0.9451</td>
</tr>
<tr>
<td>GSR does not Granger Cause GFR</td>
<td>1175</td>
<td>2</td>
<td>3.46435</td>
<td>0.0316</td>
</tr>
<tr>
<td>GFR does not Granger Cause GSR</td>
<td></td>
<td></td>
<td>4.88661</td>
<td>0.0077</td>
</tr>
<tr>
<td>ESR does not Granger Cause EFR</td>
<td>1127</td>
<td>2</td>
<td>3.56366</td>
<td>0.0287</td>
</tr>
<tr>
<td>EFR does not Granger Cause ESR</td>
<td></td>
<td></td>
<td>5.33240</td>
<td>0.0050</td>
</tr>
</tbody>
</table>

In case of foreign exchange market, there is no risk spillover effects of USR to UFR and UFR to USR. Same time, there is bidirectional GCR from GSR to GFR and GFR to GSR. There is risk spillover from ESR to EFR and EFR to ESR implying that there is bidirectional causality between the spot and future of INREuro currency fair.
4.3 CONCLUSION

The study aimed at investigating the presence of risk spillover between spot and future markets of India. For this purpose we employ granger causality in risk proposed by Hong, Liu and Wang (2009). The results GC in means runs from NSR to NFR and GC in Risk runs from NFR to NSR. This indicate that Nifty spot returns are able to predict the Nifty Future returns. Same time risk spillover from Nifty Future to Nifty Spot. This suggest that joint dynamics of spot and future returns in the left tail of the distribution are different. In other words, changes in the Nifty Futures may tend to have temporary effects on the Nifty Spot indices. While in case of GSR and GFR, due to bidirectional causality in GC in mean and GC in risk, it suggests that the joint dynamics of stock returns and foreign exchange returns in the left tail of the distribution are not likely to be differ.
4.4 REFERENCES


**Other References:**

