CHAPTER 6

FINDINGS AND CONCLUSIONS
Chapter 6

Findings and Conclusions

6.1 INTRODUCTION

The liberalisation, privatisation, globalisation together with reforms in the financial sector has resulted in the greater integration of Indian financial markets with the world financial markets. This has also exerted greater influence on the Indian exchange rate. There exists differences of opinion whether the Indian financial markets are efficient or not. A market is said to be efficient if it provides all the information to the investors. Efficient market helps in predicting the returns. Further, the volatility prevailing in the market also influences the ability to predict returns. ‘Standard Deviation of a sample is the simplest measure of volatility. The risk of the instruments in portfolio can be quantified by using standard deviation. Thus, volatility can be defined as the extent to which the changes in the financial markets cannot be predicted (Roy, 2011). In financial risk management, VaR is used as a measure of market risk for predicting maximum possible losses. The study makes an empirical attempt to select the suitable VaR model for Indian financial markets. The experience from the empirical literature suggests that there is no one universal application of a particular VaR model across the financial markets either in emerging or developed financial markets. However the study concludes that Historical Simulation asymmetric GARCH model best suits to Indian financial markets for assessing market risk.

6.2 CONTRIBUTIONS OF THE STUDY

The main contributions of the study are two fold:

First, relatively less number of studies are carried out with respect to application of Value at Risk models in Indian Financial markets. The present study has employed and compared the predictive performance of various VaR models in different financial markets namely, equity market, forex market and derivative market.
Second, immense studies has been conducted to study the extent of volatility and volatility spillover between the markets using time series models like GARCH family of models and Granger Causality in mean. As such the study tries to test existence of risk spillover between the Indian Equity and Forex spot and future markets.

6.3 MAJOR FINDINGS OF THE STUDY

6.3.1: Evaluating the predictive performance of VaR models in Indian Financial markets

The study employs HS, HS-GARCH, HS A-GARCH, MCS, EWMA and ETL VaR models to assess the market risk in NSR, NFR, USR, UFR, GSR, GFR, ESR and EFR data series. The VaR is calculate at 99%, 95% and 90% confidence interval for one-day time horizon. All the model has to undergo accuracy test through backtesting models. If the failure rate is less than the significance level, the model is accepted and considered as good for predicting market risk. The purpose was to identify the appropriate VaR model for the data series considered for the study. The findings are given below:

- It is observed that as the confidence level increases the VaR estimates also increases. This is evident in case of all the VaR models and all data series used for the study. With the increase in confidence interval the model is able to consider more bad events or the extreme outliers in the financial markets. The increase in VaR estimates with falling significance level gives an indication to the investors’ high probability of maximum possible losses in the financial markets.

- It is observed that from VaR estimates under different models, the VaR of equity markets are high compared to the forex markets at all CI. This points out that Indian equity markets exhibit more volatility than the foreign exchange market. HS provides high VaR estimates at 99% CI compared to other models.
- A very basic method of testing the reliability of the VaR models is assessing the failure rates. If the failure percentage is less than the expected number of losses we accept the model. In that case, HS VaR is underestimated for NSR, USR, UFR, GSR and GFR at all CI. MCS VaR is underestimated at 95% and 90% CI for NFR, NSR, USR, UFR, GSR, GFR, ESR and EFR. ETL VaR is underestimated at 95% and 90% CI for NSR, NFR, GSR, GFR, EFR and ESR.

- The study implement six VaR models for two equity market indices and 6 currency pairs for spot and future. The VaR models are backtested and the accuracy tests results are intriguing. The LR unconditional coverage, LR test of independence and LR conditional coverage results suggest that HS VaR estimates failed to pass the accuracy test. HS A-GARCH model perform better at 99% CI for all the data series.

- We observe that asymmetric GARCH perform better in forecasting VaR. Asymmetric GARCH VaR is calculated on the basis of volatility adjusted returns. Infact the performance of VaR models does not depend on whether the models are parametric, non-parametric or semi parametric. Rather the models should be able to accommodate the asymmetric behaviours inherent in the data (Emrah et al, 2012).2

- It is to be noted that stock market returns and foreign exchange returns usually show the presence of volatility and high kurtosis. Volatility is nothing but conditional standard deviation. These two important elements form part of GARCH model proposed by Bollerslev (1986).3 However traditional GARCH models are not able to explain skewness or asymmetries and the leverage effect. Hence asymmetric GARCH models tests the presence of these two effects in the financial markets. From the back testing results it is clear that Indian financial markets have high skewness with extreme downside risk and having fat tail distribution. It can also be concluded
that Indian financial markets future volatility are greatly influenced by negative returns than the positive returns. In short, Indian financial markets are characterised by heavy tails and leverage effect.

- The study ranks the VaR models based on the backtesting results. As such HS A-GARCH model is more preferred followed by HS GARCH, MCS, ETL, EWMA and HS.

6.3.2 Investigating the risk spillover between spot and future markets.

The study tries to detect the risk spillover between spot and future of equity and forex 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. The study compares the results of Granger Causality in Mean and Granger Causality in Risk for 2 day lags. The findings are below.

- The HS A-GARCH VaR estimates perform better for all data series and hence they form the basis for detecting the risk spillover between spot and future markets. The VaR exceedance of HS A-GARCH are calculated and Granger Causality in Risk is tested.

- Nifty Futures indices VaR is relatively high than Nifty Spot Indices. Hence the equity futures market tends to be more risky than the equity spot market. This implies that the investors in order to cover their positions due to spot market volatility, tries to take too many hedging instruments there by increasing the volume of transactions in the future market. This may result in too much of speculations. Further, the speculators try to exploit arbitrage opportunities due to different prices prevalent in the market. In case of foreign exchange market, EFR is more risky than ESR. USR, GSR are more risky than UFR and GFR.
- The results of Granger Causality in mean reveal that unidirectional causality flows from NSR to NFR and USR to UFR. There is bidirectional causality between GSR and GFR. There is no causal relationship between ESR and EFR. This indicates that Nifty spot returns are able to predict returns in the Nifty Futures. INRUSD spot returns are able to predict returns in INRUSD futures. While INRGBP spot and future are able to predict the returns of each other.

- The results of Granger Causality in Risk disclose that there is unidirectional granger causality in risk flowing from NFR to NSR and USR to UFR (at 10% significance level). However there is bidirectional causality in risk between GSR and GFR and ESR and EFR. This indicate that past history of large losses occurring in Nifty Future and USDINR spot is able to predict the forthcoming occurrence of large risks in Nifty spot and USDINR future market. Similarly, the heavy losses occurring in INRGBP spot, INREuro Spot are able to predict the upcoming loss occurrence in INRGBP future and INREuro Future currency pair and vice versa.

- Hence the forecast of risk spillover effects helps the investors or financial institutions in managing the risks in portfolios / investment diversification. What needs to be noted is that there is a natural time delay in terms of effects to spill over from one market to another market. The effect may be positive or negative (news). The time lag helps the investors to gather necessary information of the changing economic conditions and take appropriate decisions.
6.3.3 Portfolio VaR

Two hypothetical portfolios one domestic and international portfolio are built. The domestic portfolio comprises of NSR, NFR, USR and UFR returns. The international portfolio comprises of eight equity indices of Brazil, Russia, India, China, South Africa, two US equity indices and UK stock market index. The variance-covariance approach is used for calculating VaR of the portfolios. The investors are categorised as risk averse, risk neutral and risk takers. The findings are given below:

- The criteria for selecting assets for a portfolio is based on the correlation results, VaR estimates and Granger Causality in Risk results. The correlation results show that there exists high positive correlation between NSR and NFR and USR and UFR. There is no correlation between NSR and USR, NFR and USR, NSR & UFR, NFR & UFR. High VaR estimates are found for NSR and NFR and comparatively low VaR estimates for USR and UFR as given by HS A-GARCH. The Granger Causality in Risk indicates that losses arising in NFR and USR helps in predicting the losses arising in NSR and UFR respectively. Further, the mean returns of NSR, NFR, USR and UFR are high compared to other currency pairs. These makes a necessary component for building a hypothetical portfolio. There exists a moderate correlation results among the eight international equity markets.

- The variance-covariance VaR estimates increases with the increase in the confidence interval for both domestic and international portfolio for all categories of investors. The VaR estimates for risk averse investors are less compared to the risk neutral and risk takers investors at all confidence intervals. However, the failure rates suggest that the variance-covariance model performs better at 95% and 90% CI.
The utility decreases for each addition of extra returns for risk averse investors. The utility remain same for extra returns in case of risk neutral investors. And there is increasing utility for additional returns for risk takers investors.

6.4 SUGGESTIONS

The study on the other hand suggest that Asymmetric GARCH model is appropriate for the Indian Stock Market to estimate VaR accurately at 99% confidence interval. The present study results are similar to the results of Verma (2009)\(^4\) wherein he suggests that GARCH-GED model does well at all risk levels while the EWMA models do well at the 10% and 5% levels but break down at the 1% risk level. The reason for the success of GARCH models would be that it is able to capture through its parameters the volatility and persistence of volatility and also the response of the markets in a given time. But this is not possible by the EWMA method.

Time horizon – Rolling window is another essential element crucial in VaR estimation. In Indian financial market only 1 day time horizon for the VaR estimation. Since we come across the investors who hold their investment for more than one day, it is even better to incorporate a maximum of 10 day time horizon for the purpose of VaR estimation.
6.5 CONCLUSIONS
The study aimed at comparing the predictive ability of various Value at Risk models in the Indian Financial Market consisting of Equity, Forex and Derivative market. The study tried to find answers for the following questions:

i. Which VaR model is appropriate for the Indian Financial Market?

ii. Is Future Market riskier than spot market?

iii. Is there risk spillover between spot and future markets?

For the calculation of VaR the window size is the only factor that influences the VaR Value which makes it crucial to the approach. The rolling window size considered in the study is 100 since the data for the derivative instruments is very limited, which can be considered to be a serious limitation.

The study had tested Historical Simulation, Symmetric GARCH, Assymetric GARCH, Monte Carlo Simulation, EWMA and Conditional VaR models. On the basis of backtesting results it was found that Asymmetric GARCH and Monte Carlo Simulation best fits for predicting market risk in Indian Financial markets at 99% confidence interval. The test of independence has shown the presence of volatility clustering in the Indian Financial market. As such, asymmetric GARCH model is considered appropriate model which captures leverage effect, and also presence and persistence of volatility in Indian financial market. India being an emerging market, its financial markets display more sensitiveness to regime switches, especially when financial crisis occurs. This very fact implies the use of those models which is able to incorporate the sudden changes in the markets. Another important feature that is observed through the empirical analysis is that higher the confidence interval
smaller is the number of exceedances to estimate the VaR. The VaR estimate is calculated for both spot and future market. The number of studies with this respect is very limited.

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. 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 aimed to measure and compare the market risk of these two different markets which are inter related and inter dependent. The results arrived are not conclusive. Equity Future Market and EUROINR currency pairs had high VaR values than USDINR Futures and GBP INR futures. This may be due to the fact that the market characteristics differs from one market to another market. Whatsoever, there is risk of loss presence in all the markets. One cannot deny the fact that inter relation and inter dependence between the spot and future market. Hence the study further analyses the risk spillover effect between spot and future market. For studying risk spillover effect the study employs the newly developed concept Granger Causality in Risk which is an extension of traditions Granger Causality in mean and variance. It is noticed that the market where the VaR estimate is higher there is risk spillover from higher VaR estimated market to lower VaR estimated market.

Moreover, in this thesis, we assume that market is efficient. Actually this is not the case for Indian stock market. In future research, we can differentiate the market condition into volatile and non-volatile conditions (using the T-test and the Mann-Whitney U-test) to see how different VaR model works. Intuitively, for EWMA, there might be different lambdas for different market conditions. GARCH model should perform better than EWMA since it can capture the volatility well.
6.6 SCOPE FOR FURTHER RESEARCH

The investment world is flooded with lot of various types of mutual funds. Choice of an appropriate mutual fund depends upon the past performance of the fund and the consistency in ratings. Various studies have revealed that mutual fund return distributions are not normally distributed and hence are leptokurtic and fat tailed. The VaR models as a measure of market risk has great application even in mutual fund industry. As there are very limited research in Indian context the VaR models can be studied to analyse the performance of mutual funds in India.

Options also forms part of derivative instruments for the hedging purposes. The present study considers only futures instruments in order to assess whether the derivative markets are risky than the spot market. As the volume of transactions are increasing for options contract by the hedgers to secure their positions, the VaR models have wide scope of application in options contract with varying maturing periods.

The present study considers a window size of 100 days for estimating VaR. The study can be extended by taking into account various rolling window sizes as less as 50 days to as high as 250 days. Further, the VaR estimates can be meaningfully arrived for different holding days ranging from one day to 30 days. The choice of the horizon or the holding period varies according to the preference of the investors.

The VaR estimates can be done even for the sectoral indices or for the individual stocks of the company which will help the company in enterprise risk management strategies. The financial analyst can develop their own portfolio and use the VaR models to select the appropriate portfolios which would offer maximum return with minimum expected losses.
Chapter 6

Findings and Conclusions

The applicability of the common VaR models can be tested in domestic and international financial markets. Similarly, the suitability and applicability of the VaR models can be tested in different economic conditions. For ex. during normal period, crisis period and post crisis period. The VaR models also has great application in commodity markets too.

6.7 REFERENCES


