CHAPTER 7

SUMMARY, SUGGESTION
AND CONCLUSION
**CHAPTER OUTLINE**

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7.1. Introduction

This chapter presents the summary of the study, and also brings at the suggestions following from its main findings. It also contains concluding results as well as avenue for future research on the area. Firstly, this chapter reviews briefly the entire study presented in this thesis. Secondly, summarizes the main findings and supportive evidence for the hypothesis. Thirdly, the suggestions and the implications of the findings for policy purposes are also presented in this chapter. Then, this chapter discusses the limitations of this study. Lastly, recommendations for further study and conclusion are addressed in the end of this chapter.

7.2. A Preview of the Study

Measuring the co-movement and volatility spillover among Indian financial markets including currency, commodity, bond, and stock markets are the two main purposes of this study which have been presented in six chapters.

Chapter 1 is an introduction consisting of the background and application for the research, need for the study, statement of the problem, research gaps, objectives, and hypotheses for the study. A proper definition of research problem is very important and it is a prerequisite for any study. From the literature of the study mainly two definitions of financial market interdependence have been inferred comprising the market co-movement and market influences from one another. Investigation of financial markets’ co-movement can be statistically accomplished by employing the correlation and integration analysis, while, measuring the influences of one market on the others is done by using the causality
and volatility spillover analysis. In this study, thirteen-year equal to 678 weekly observation data for the period from 2000 to 2012 have been used to investigate interdependence among the stock, bond, commodity and currency markets in India.

Financial system plays a critical role in the allocation of resources in the economy. The impact of development financial system on economic growth through facilitating mobilization of capital has also been studied by several empirical studies. India has got a financial system regulated by independent bodies which facilitate the operation of different sectors such as banking, capital markets, insurance, and other various service sectors. In India like other countries, government plays the role of regulator and takes care of the financial sectors.

Chapter 2 has devoted to an overview on Indian financial system. This chapter has taken a glance at the Indian financial system consisting of: Importance of Financial System, Role of Financial System, Indian Financial System, Indian Financial markets, Indian Financial Market Development Rank, and Indian Financial System’s Stability Assessment by International Monetary Fund (IMF).

Chapter 3 includes conceptual framework of financial market relationship. In this chapter the theoretical concepts and models of financial market relationship in both internal and international aspects have been reviewed. These models attempt to identify the linkages between financial markets including: currency–commodity, currency–bond, currency–stock, commodity–bond, commodity - stock, and bond–stock linkage. Contrary to the theories of natural sciences, theories in social sciences are not precise, permanent and consistent enough to be almost always meaningful and applicable. Due to the many
varieties of the human behavior, first of all, the formulated theories cover merely a small part of social science subjects. Secondly, the theorized behaviors are also almost always not justifiable in the framework of the related theories. In other words, the human behavior which also includes the financial and economic decisions are different under different conditions and do not necessarily follow the respective theories. These behaviors, in practice, are under the influence of numerous factors not all of which are controllable for accomplishing the objectives of research. That is the reason why the findings of the research in these areas are not much in accordance with the extant models and theories on one hand, and they are different from one another even with regard to similar subject on the other. In some cases they are even contradictory to each other. This is the reason why researchers call the financial markets relationship as paradoxical, puzzling, and mysterious. For instance, Maslov and Roehner (2004) employed the term “conundrum” to explain the stock price behavior versus bond price.

Theoretical concepts specified in literature regarding the relationship among the currency, commodity, bond, and stock markets which have been presented in chapter five are summarized in Table 7-1 as follows.

<table>
<thead>
<tr>
<th>Markets</th>
<th>Theories</th>
<th>Expected Relationship</th>
</tr>
</thead>
<tbody>
<tr>
<td>Currency-Commodity</td>
<td>Sticky Price Model</td>
<td>Negative relationship</td>
</tr>
<tr>
<td></td>
<td>Portfolio Balance Model</td>
<td>Positive relationship</td>
</tr>
<tr>
<td></td>
<td>Exogenous Shocks Model</td>
<td>Negative or positive relationship</td>
</tr>
</tbody>
</table>
Table 7.1 (CONT)
Summary of theoretical concepts regarding the relationship among financial markets

<table>
<thead>
<tr>
<th>Markets</th>
<th>Theories</th>
<th>Expected Relationship</th>
</tr>
</thead>
<tbody>
<tr>
<td>Currency-Bond</td>
<td>Inflation Expectation Channel</td>
<td>positive relationship</td>
</tr>
<tr>
<td></td>
<td>Monetary Reaction Channel</td>
<td>Positive Relationship</td>
</tr>
<tr>
<td></td>
<td>Risk Premium Notion</td>
<td>Negative relationship</td>
</tr>
<tr>
<td>Currency-Stock</td>
<td>Traditional Approach</td>
<td>Negative or positive relationship</td>
</tr>
<tr>
<td></td>
<td>Portfolio Approach</td>
<td>Negative relationship</td>
</tr>
<tr>
<td>Commodity-Bond</td>
<td>Fisher Effect</td>
<td>Negative Relationship</td>
</tr>
<tr>
<td>Commodity-Stock</td>
<td>Monetary Policy Effects</td>
<td>Negative Relationship</td>
</tr>
<tr>
<td>Bond-Stock</td>
<td>Business Cycle Effects</td>
<td>Negative Relationship</td>
</tr>
<tr>
<td>Currency-Commodity–Bond-Stock</td>
<td>Technical Analysis Approach</td>
<td>Positive relationship (Causality)</td>
</tr>
</tbody>
</table>

Chapter 4 includes review of literature on internal and international financial markets. From the perspective of research field, studies in the context of financial market interdependence can be classified into two groups; the first group of studies has focused on domestic financial markets and the second one has investigated international financial markets or cross-border markets, particularly they have concentrated on the international stock market.
In terms of research methodology, literature of market interdependence can be broadly categorized into three groups: the first group has investigated only the presence of market interdependence. This type of research has demonstrated existence or lack of interdependence among specific variables during the specific time period by using statistical methods and econometric models, for instance, Islami (2011), Sumner, Johnson and Soenen (2010).

The second group consists of some studies which consider the impacts of some special events, such as financial liberalization, regulation and policy changing, financial crisis, and any other event which affect the markets behavior. These types of study investigate the financial market interdependence for pre and post-periods of the events. In this type of study, the researcher may also consider the event as a dummy variable to assess the impact of this variable on the issue of interdependency. For example, Cho and You (2011), Beine and Candelon (2011), Connolly and Wang (2003), Granger, Huangb & Yang (2000)

The third group includes some other studies which attempted to find the determinants and influential factors of financial markets interdependence. Regarding the determinants of cross-border market interdependency, researchers specified a few factors such as macroeconomic interdependency, contagion effect, and the similarities of market characteristics (Pretorius 2002; Brockman, Lieenberg & Schutte 2010)

In chapter 5 the research methodology of the study has been presented. This chapter includes the definition, background and models of cross market correlation, cointegration, Granger causality, and volatility spillover analysis.
The studies on financial interdependence among and within countries as the literature reveals include research under specific title, mostly such as correlation, integration, causality relationship, and spillover of return and volatility. Most studies have concentrated on relationship among international financial markets (cross-border) and some of studies have also focused on the domestic financial markets. Both groups of studies have made use of the combination of more than one type of measurement and analyzing technique such as correlation coefficient analysis, cointegration, causality test, and Vector Auto Regression (VAR) in order to implementation Impulse Response Functions (IRF) as well as Variance Decomposition (VD). Autoregressive Conditional Heteroskedasticity (ARCH) model and its augmentation, i.e. the Generalized Autoregressive Conditional Heteroskedasticity (GARCH) model.

The methodology for measuring the interdependence of financial markets in form of correlation, integration, causality and spillover affects presented in chapter four include the Pearson’s correlation coefficient, Johansen’s cointegration model, Granger causality approach, and Variance Decomposition respectively.

Chapter 6 has been devoted to data analysis and interpretation of results. In this chapter first, the increasing trend of inflation rate in India based on the wholesale price index as well as influences of a major factor namely global financial crisis on the Indian financial market during the period under study, i.e., 2000 to 2012 have been depicted. Then results of data analysis obtained from running the related tests as well as discussion of results based on the hypotheses of the study have been presented.
In this study the markets relationship considered to investigate include currency-commodity, currency-bond, currency-stock, commodity-bond, commodity-stock, and bond-stock markets. The results of data analysis regarding the hypotheses of this study presented in chapter five are summarized in Table 7-2 as follows.

**Table 7.2**
Summary of hypothesis analysis results

<table>
<thead>
<tr>
<th>No.</th>
<th>Hypothesis</th>
<th>It is rejected</th>
<th>It is not rejected</th>
</tr>
</thead>
<tbody>
<tr>
<td>H1</td>
<td>“There is no correlation between stock, bond, currency and commodity markets in India during the period 2000-2012”.</td>
<td>Correlation between currency-stock markets</td>
<td>Correlation between the other variables under study.</td>
</tr>
<tr>
<td>H2</td>
<td>“Stock, bond, commodity and currency market in India are not integrated during the period 2000 – 2012”.</td>
<td>-</td>
<td>Integration among all the variables under study</td>
</tr>
<tr>
<td>H3</td>
<td>“There is no Granger causality relationship between selected financial markets in the period 2000-2012”.</td>
<td>Granger causality between commodity-bond markets</td>
<td>Granger causality among the others variables</td>
</tr>
<tr>
<td>H4</td>
<td>“There is no volatility spillover among selected financial markets during the period from 2000 to 2012”.</td>
<td>Volatility Spillover between currency-stock markets</td>
<td>Volatility spillover among the other variables.</td>
</tr>
</tbody>
</table>
Chapter 7 covers a brief resume of the entire study, the main findings of the study, suggestions and the implications of the findings for policy purposes, limitations and avenues for further study on the subject as well as conclusion of the study.

7.3. Summary of the Main Findings

This study has carefully examined interdependence among financial markets in India including stock, bond, commodity and currency markets in pre- and post-period of global financial crisis 2008. More specifically, this study has attempted to assess the degrees of market linkage through measuring the correlation, integration, Granger causality and volatility spillover among Indian financial markets during the period 2000-2012. Therefore, the main findings of this study are summarized as follows.

7.3.1. Main Findings from the Descriptive Statistics

1) Descriptive statistics of this study show that over the sample period, stock had the highest average variation in terms of standard deviation followed by commodity and bond. In contrary, variation in the currency price was to some extent stable, offering relatively consistent price. Investments in stock and commodity are generally more risky than in bond and currency, but stock and commodity offer relatively higher returns for certain periods, indicated by the higher maximum values of stocks and commodity as opposed to bond and currency.

7.3.2. Main Findings from the Cross Market Correlation Analysis

1. Correlation coefficients obtained based on the non-stationary data (original level of time series data) were not reliable and they didn’t show the real value of correlation.
Contrary, correlation coefficients obtained from the stationary data (first difference level) were devoid of spurious correlation.

2. The correlation coefficient between the bond market and other markets including the commodity, currency as well as stock market were negative during the sub-period 2008 coinciding with the financial crisis period and they were positive during the sub-periods after and before 2008 irrespective of the coefficient determination of them. These negative relationships are consistent with the phenomenon of “flight to quality” which is defined as the act of moving investment away from "risky" assets toward "safer" investments due to uncertainty in economy conditions. Therefore, the stock, commodity, currency prices decreased while bond price has risen due to the investors’ reaction to the financial crisis.

3. Despite of the existing significant correlation coefficients among some variable as presented in above table, there was a modest coefficient of determination ($R^2$) only for the currency and stock markets during all the periods under study and for other variables they were less than 0.10. Therefore, these two markets were only the correlated markets during the all the periods under study.

4. From the theoretical viewpoint, According to the sticky price model, an increase in the non-traded commodities bring about an increase in inflation rate and lead to a decrease in the value of national currency. Additionally, based on the traditional approach a decrease in the currency price causes a decrease in the stock prices of those companies which are consumers of imported products and raw materials. And on the other hand the company’s stock value would directly decrease due to increasing impact of inflation on the companies’ costs of products and services.
Therefore the positive correlation between currency and stock markets can be theoretically justified by the influence of inflation rate during the periods under study.

7.3.3. Main Findings from the Cointegration Analysis

1) According to the results of Johansen cointegration test, during the sub-period 2000-2007 the long-run relationships between the stock and bond, stock and commodity and also stock and currency markets were statistically significant, but in the sub-periods 2008 and 2009-2012, only the stock and currency and the bond and currency markets respectively were integrated in the long-run horizon. While, for the whole sample period 2000-2012, the results of co-integrating test showed that there was no significant integration relationship between the variables under study. Therefore, during the sub-period 2000-2007 there were most numbers of long-run relationships between markets under study then the numbers of integration association among the variables have gradually declined.

2) The gradually decline in the integration relationship among the variables under study is in compliance with the findings of other studies which noted that interdependence of financial markets varies over time.

3) Financial Crisis Effects: The results of Johansen cointegration test reveal that the extant (numbers) of integration relationship among the variables under study during the sub-period 2008 has been substantially decreased as compared to the previous period i.e., 2000-2007. Since the literature has found that the financial markets will become more interdependent in the high-volatility periods, thus, from this perspective, there
4) Liberalization Effects: As stated before, integration of stock, bond, commodity, and currency markets in India tended to gradually decline during the period from 2000 to 2012 as the extant (number) of long-run relationships among the variables had weakened over the periods under study. Therefore, it can be inferred that the effects of liberalization in India have gradually faded with regard to financial markets’ integration.

7.3.4. Main Findings from the Granger Causality Analysis

1) From the results of Granger causality test, during the first sub-period under study i.e., 2000-2007 there was a short-run causality relationship between currency and bond markets. In other words, during this period, bond market was under Granger causality effect from the currency market.

2) During the sub-period 2008, there were most Granger causality effects among the variables under study. On the one hand, the bond market has affected the stock and currency markets in terms of Granger causality. On the other, the commodity market has also impacted the bond and currency markets as well.

3) According to the results of Granger causality test, the chi-square probability was statistically significant about the relationship between the commodity and bond markets during the whole sample period 2000-2012. In other words during this period there was Granger causality effect from commodity market to bond market.

4) Financial Crisis Effects: The impact of global financial crisis of 2008 on the variables under study seems to be considerable. The reason is that, based on the
results Granger causality test, there were four Granger causality connections between the variables during the sub-period 2008 coinciding with the financial crisis. On the contrary, during the sub-period 2000-2007 there was only one Granger causality relationship, while during the sub-period 2009-2012, there was no Granger causality relationship between the variables under study.

5) **Liberalization Effects:** Granger causality analysis is a technique for determining the lead-lag association between two sets of time-series data through which one time-series movement can be predicted based on the other. In deed this method is meant to capture spillover effect (spillover of return and volatility) among variables. The lack of causality relationship among financial markets may be attributed to exciting the stability in markets. Therefore, from these findings it **can be concluded that the liberalization** in India has affected financial markets under study from the perspective of markets stability.

7.3.5. **Main Findings from the Volatility Spillover Analysis (Variance Decomposition)**

1) The results of variance decomposition test show that shocks in the **stock** market could contribute to forecast variance in other variables such as **currency**, **commodity** and **bond** markets up to 7.3%, 8.4%, and 13% respectively during the period 2008 which it is 9.5% in average value. However, these are not substantial in magnitude.

2) Volatility in **commodity** market could influence **bond** and **stock** markets in terms of shock transmission during the period 2008. Thus, the forecasted variance of the **bond** and **stock** markets can be explained by the fluctuations in the **commodity** market up to 53.3% and 8.8% respectively. However, the transmission shock from commodity
to bond is moderate in magnitude and is consistent with the results of Granger causality test in this research.

3) The spillover volatility from commodity to bond in the sub-period 2008 (53.3%) is in tune with the technical analysis approach. According to this viewpoint the bond market is under the influence of the commodity market. The negative relationship between the commodity and bond markets can also be substantiated by the Fisher effects theory. According to the Fisher effect theory, there is a negative relationship between the commodity and bond prices. The results of correlation test show that correlation coefficient between these markets is negatively significant.

4) Much of the volatility spillover is found to be from the currency market to the stock market during all the sub-periods as well as during the whole sample period under study. In other words, shocks in currency market could contribute to forecasted variances of the stock market up to 23.9%, 69%, 36.3%, and 27.3% during the sub-periods 2000-2007, 2008, 2009-2012, and the whole sample period 2000-2012 respectively. The transmission shock from the currency to stock market in average value is 39.13%. However this value is quite considerable in magnitude. This finding is consistent with the correlation relationship between currency and stock markets.

5) The highest transmission shocks were observed from currency market to other markets under study during the sub-periods as well as whole period up to % 41.66 in average value followed by commodity market with the %18.75 in average value. The contribution of the stock and bond markets in fluctuation of other markets under study were %7.78 and % 3.15 respectively in average values.
7.3.6. Main Findings from the Volatility Spillover Index

1. **Financial Crisis Effects:** Volatility spillover indexes for sub-periods 2000-2007, 2008, and 2009-2012 as well as for the whole period 2000-2012 were 8.41, 40.16, 12.34, and 9.06 respectively. As can be seen from the results of Volatility Spillover Index, much volatility transmission among variables has occurred in 2008 coinciding with the global financial crisis. Hence, it can be said that on the whole, the global financial crisis of 2008 has affected the Indian stock, bond, commodity, and currency markets in terms of shocks transmission among the markets.

2. **Liberalization Effects:** As mentioned earlier, volatility spillover index is a technique to measure the transmission shocks among different variables in the specific period. The results of Volatility Spillover Index show that the index for the variables under study was 9.06 during the whole sample period 2000-2012. However, this index is not considerable in magnitude. The relative stability in Indian financial markets including stock, bond, commodity and currency markets in the span of 2000 to 2012 can be inferred as the consequence of liberalization and other related policies under implementation. The stability in the Indian financial system was also confirmed in the International Monetary Fund Report in 2013 (Chapter 2, Section 2.5).

7.3.7. Other findings

1) The figures of financial markets under study show that the stock, commodity, and bond markets on the whole, have experienced an increasing trend during the period under study, versus; the currency market has been faced generally with the decreasing trend in
the same period. This behavior is expected due to the increasing inflation rate in Indian economy.

2) Bond, due to its property i.e., having fixed income, has almost been appeared in opposed direction with the stock, commodity, and currency markets especially during the financial crisis of 2008. Figure of financial market under study show however; there has been a sharp decrease in the stock, commodity, and currency prices starting from the first half of 2008 while bond price has risen sharply in the same period due to the investors’ reaction to the market fluctuation. This finding is consistent with the concept of “flight to quality” which is defined as the act of moving investment away from "risky" assets toward "safer" investments due to uncertainty in economy conditions.

3) The figures of financial market under study show that the financial markets in India have been faced with great changes as a result of global market turbulence, but the effect of this crisis was not too extensive and the markets recovered quickly from crisis after almost one year. This finding is generally consistent with the content of International Monetary Fund report (2013) in which stated:

“The Indian economy and its financial system weathered the global financial crisis well-due to strong balance sheets and profitability entering the crisis, a robust regulatory framework, and timely actions to counter pressures on liquidity, the supply of credit, and aggregate demand”.

7.4. Suggestions

Based on the findings of this study, the following suggestions can be provided to obtain the all advantages derived from the interdependence among financial markets under study.
1) According to the results of descriptive statistics, the stock price has exhibited a great variation followed by commodity, bond and to some extent currency during the period under study. On the one hand, the variation in financial market is regarded as risk of investment and on the other hand, economists have made the assumption that investors are risk-averse, meaning that they are willing to sacrifice some return and accept even less than the expected present value of the future returns to reduce risk (Womack, K. L., & Zhang, Y. (2003). Therefore, for reducing the risk of markets and consequently enhancing the investment in financial assets the variation of market should be declined through developing appropriate policy, regulation codifying, and supervisory control.

2) With respect to data analysis results, correlation between the currency and stock markets were positive and statistically significant for the whole sample period 2000-2012. Based on the portfolio theory, in the negative correlation or uncorrelated linkage between different assets, the risk of investment can be managed by portfolio selection and hedging strategy (Markowitz 1952). Therefore, to achieve the benefits of risk management and diversification investments in Indian financial markets under study especially in the case of stock and currency markets, continued improvements in regulation, and strengthening of supervision will be required.

3) Based on the cointegration test results, the stock, bond, commodity, and currency markets were not fully integrated during the periods under study. In the absence of cognizable integration among different segments of financial markets, it would be difficult to achieve the market efficiency, optimum resource allocation, enhancing transparency, and reducing arbitrage opportunities. As a result, for realization the
purposes of financial reforms and economic liberalization, the financial market under study in terms of policy and institutional reforms should be continued.

4) The spillover index for the variables under study during the whole sample period 2000-2012 was not considerable in magnitude and confirming relative stability in Indian financial markets under study. Stability in the financial market plays an essential role in the saving, investment and economic growth. Although India has taken a remarkable steps toward a stable financial system, but it need to more steady in legal, regulatory, and supervisory framework.

5) Inflation rate in Indian economy has had a continuous increasing trend over the period from 2000 to 2012. This index has witnessed a high fluctuation in 2008 i.e., a sharp increase over the first half of 2008 and then sharp decrease during the second half of 2008. A lot of studies have shown the harmful effects of high inflation rate on economic activities. Several countries (and recently the European Central Bank) have adopted inflation targets as the primary objective of their monetary policy (Yigit, T. M. 1999). In India also an effectiveness policy monetary will be required to control sharp increasing inflation rate.

6) The global financial crisis of 2008 was sparked off in the US economy and flamed in many countries in the world especially the developed countries. The financial markets of India were affected by the crisis to some extent and have experienced fluctuation as a result of global market turbulence. Although the effect of this crisis was not too extensive and the markets recovered quickly from crisis after almost one year (Table 5.1) but, “despite these recent successes, Indian financial sector still confronts longstanding impediments to its ability to support growth as well as new
challenges to stability. Continued improvements in regulation, and strengthening of supervision and the financial stability framework, will be required to avoid a buildup of new vulnerabilities (IMF, 2013).

7) Bond, because of its property i.e., having fixed income usually is regarded as a safe haven asset in the financial market. Based on the “flight to quality” concept, investors will replace their risky investment (for instance stock) to less risky assets (such as bond) during crisis periods. Well advanced bond markets provide useful opportunity to risk management and making appropriate financial strategies by investors. In India corporate bond is underdevelopment. The main bottleneck to the growth of bond market lie in relatively larger costs of financing, inefficient market making, lack of transparency, and illiquidity of the instrument that would lead to low level of bond market development. “A combination of policies include mandatory disclosure of ratings by firms, minimum size of placements of (infrastructure) bonds, establishing stop loss threshold, among others will help breaking the trap and improve quality of issues and would eventually lead to a vibrant bond market with reduced costs of financing investment” (Banerji, Gangopadhyay, Patnaik & Shah 2012).

7.5. Policy Implications

In general, the results of this study provide useful information for Indian policy-makers and regulators to assess the impacts of the financial liberalization and monetary policies on the financial market and the most important issues involving financial markets such as reduction in arbitraging opportunity, optimal allocation of funds, reduction in transaction cost and many other financial activities.
Based on the findings of this study the most important issues which from the perspective of policy implication can be specified are: high variation in stock and commodity markets, lack of markets integration, relatively markets volatilities, increasing trend of inflation, markets vulnerability from crises, and underdevelopment corporate bond market. Improvements in regulation, strengthening of supervision, establishing the financial stability framework India and an effectiveness policy monetary will be required to control all traps in developing financial markets and avoid vulnerabilities.

7.6. Limitations of the Study

Like any empirical research, this study also has some limitations as follows, which can be improved in further research.

Firstly, due to lack of reliable and appropriate data, this thesis has taken the Treasury bond index and RBI exchange rate index as representative of the bond and currency markets. Since, these two indexes are provided by the government authorities they may not be completely regarded as a proxy for free markets.

Secondly, because of non-availability data for commodity market, in this study the wholesale price index (WPI) has been used as a proxy of commodity market during the years from 2000 to 2005.

7.7. Avenues for Furthers Research

Due to constraints of time and resources, the present research could not delve into many cognate areas of the present topic. However these areas are relatively unexplored and
hence they deserve to be taken up for further research. Some of the important areas are listed hereunder.

1) Interdependence among financial markets is under the influence of several factors such as liberalization and financial reforms, inflation and interest rate, monetary policies, business cycles, as well as activities and industries’ structural of companies, advances in information technology, presence of foreign institutions, and even investors’ overreaction. A better understanding of the influence mechanisms and effectiveness of factors on financial market interdependence would be helpful for a better analysis and prediction of future markets’ behaviors. Therefore, investigation of the effects of aforementioned factors on financial market interdependence can be subjects for further researches.

2) Financial liberalization has two different effects on arbitraging activities and portfolio diversification across markets. On the one hand, financial liberalization through the deregulation of domestic markets will provide a lot of opportunities for greater flow of capital across national boundaries as well as among various segments of domestic markets. In such a condition, arbitraging opportunity and investment diversification will increase. On the other hand, market integration and interdependence can be also increased under the effects of financial liberalization. Therefore, under these conditions the opportunities of arbitrage and portfolio diversification across markets are inclined to decrease. Thus a deeper investigation by further research on the effect of financial liberalization on arbitrage and portfolio diversification opportunities would be useful for policy makers to assess and moderate the adverse impacts of financial liberalization.
7.8. Conclusion

The present study attempted to explore the interdependence among four major Indian financial markets including currency, commodity, bond, and stock markets during the period 2000-2012. To evaluate the impact of recent financial crisis the whole sample period has been divided to three sub-periods including 2000-2007, 2008, and 2009-2012. The time series data employed for these purposes include thirteen-year weekly observation and selected variables are comprised of CNX 500 index, Treasury bond sub-maturity 8+ years, RBI exchange rate, and MCX spot index as representative of the Indian stock, bond, currency, and commodity markets respectively.

Measuring market interdependence has been conducted in the form of market correlation, cointegration, causality and spillover effects analysis which have been common features of the recent literature.

The results of cross-market correlation revealed that correlation coefficients obtained based on the Non-stationary data (original level of time series data) were not reliable and they didn’t show the real value of correlation. In order to avoid the spurious correlation, the analysis was conducted based on the stationary data (first difference level of time series data). Despite of the existing significant correlation coefficients among most of variable based on the first difference level of data, there was a modest coefficient of determination ($R^2$) only for the currency and stock markets. Therefore, these two markets were only the correlated markets during the all the periods under study. The results also showed that the correlation coefficient between the bond market and other markets including the commodity, currency as well as stock markets were negative during the sub-period 2008 coinciding with the financial crisis period, irrespective of the coefficient
determination on them. These negative relationships are consistent with the phenomenon of “flight to quality” which is defined as the act of moving investment away from "risky" assets toward "safer" investments due to uncertainty in economy conditions.

According to the results of Johansen cointegration test, the long-run relationships between the stock and bond, stock and commodity and also stock and currency markets were statistically significant during the sub-period 2000-2007, but during the sub-periods 2008 and 2009-2012, only stock and currency along with the bond and currency markets were respectively integrated in the long-run horizon, and also for the whole sample period 2000-2012, the results of co-integrating test showed that there was no significant integration relationship between the variables under study. Therefore, during the sub-period 2000-2007 there were most numbers of long-run relationships between markets under study. Thereafter the number of integration association among the variables has gradually declined. The gradually decline in the integration relationship among the variables under study is in compliance with the notion which noted that interdependence of financial markets varies over time.

The results of Granger causality test revealed that the chi-square probability was statistically significant only in the relationship between the commodity and bond markets during the whole sample period 2000-2012. In other words during this period there was Granger causality effect from commodity market to bond market. On the whole, the commodity market was found to be most effective in its Granger causality impact on other variables such as bond and currency markets originating from increasing inflation rate during the periods under study.
Variance decomposition test showed that much of the volatility spillover was found to be from the currency market to the stock market during all the sub-periods as well as during the whole sample period under study. The transmission shock from the currency to stock market in average value was 39.13%. However this value is quite considerable in magnitude. Volatility in commodity market could influence bond and stock markets in terms of shock transmission only during the period 2008. Thus, the forecasted variance of the stock and bond markets can be explained by the fluctuations in the commodity market up to 8.79% and 53.30% respectively. However, transmission volatility from the commodity market to the bond market is moderate in magnitude.

The results of calculating the volatility spillover index showed that in the three sub-periods 2000-2007, 2008, and 2009-2012 the indexes of volatility spillover among the variables under study were 8.42, 40.16, and 12.39 respectively, as well as in the whole sample period 2000-2012 this index was 9.06 confirming stability in financial market under study. As it can be seen, the largest volatility spillover index was related to the sub-period 2008 coinciding with the global financial crisis.