Management Dynamics

Volume 10 | Number 2 Article 5

December 2010

Interest Rate Futures in India: Future Trading and Spot Market Volatility

Shailesh Rastogi
Jaipuria Institute of Management, Jaipur, India

Recommended Citation

Rastogi, Shailesh (2010) "Interest Rate Futures in India: Future Trading and Spot Market Volatility," *Management Dynamics*: Vol. 10: No. 2, Article 5.
DOI: https://doi.org/10.57198/2583-4932.1152
Available at: https://managementdynamics.researchcommons.org/journal/vol10/iss2/5

INTEREST RATE FUTURES IN INDIA: FUTURE TRADING AND SPOT MARKET VOLATILITY

***Dr. Shailesh Rastogi**

Abstract

The introduction of trading in interest rate futures in the country heralds the beginning of a new era in the fixed income derivatives market. Initial hiccups with regard to the product design and variations from the global standards would settle down over a period of time and the product would emerge as a path breaker, paving the way for many more initiatives on the derivatives front. The introduction of trading in interest rate futures in India is one more step towards integration of the Indian Securities Market with the rest of the world. Globally, interest rate derivatives are the darlings of the market and account for around 70% of the total derivatives transactions across the economies. In India, it may be seen as a path breaking initiative because it is expected to pave the way for various innovations at the derivatives front in the time to come. Although market participants have unanimously appreciated the initiative, there appears to exist certain apprehensions in their mind with regard to the product design and impact upon the volatility of the interest rate. This study attempts to address those issues.

INTRODUCTION

We all are familiar with forward contracts. They are essentially over-the-counter (OTC) contracts traded on one to one basis among the parties involved, for settlement on a future date. The terms of these contracts are decided by the parties mutually at the time of their initiation. If a forward contract is entered into through an exchange, traded on the exchange and settled through the Clearing Corporation/ House of the exchange, it becomes a futures contract. As one of the most important objectives behind bringing the contract to the exchange is to create marketability, futures contracts are standardized contracts so designed by

**Associate Professor, JIM, Jaipur. E-mail: shaileshr@jimj.ac.in*

the exchanges as to ensure participation of a wide range of market participants. In other words, futures contracts are standardized forward contracts traded on the exchanges and settled through their clearing corporation/house. Futures contracts being standardized contracts appeal to a wide range of market participants and are therefore very liquid. On the other hand, the clearing corporation/house, in addition to settling the futures contracts, becomes the counter-party to all such trades or provides unconditional guarantee for their settlement, thereby ensuring financial integrity of the entire system. Therefore, although futures contracts take away the flexibility of the parties in terms of designing the contract, they offer competitive advantages over the forward contracts in terms of better liquidity and risk management.

Products proposed to be launched in the Indian Market are futures on long bond (10 year notional G-secs) and T-bills (91 days notional). This is in line with the international practice on the interest rate derivatives. Reference rate short end products i.e. the futures on Mumbai Inter-bank Offer Rate (MIBOR), Mumbai Implicit Forward Offer Rate (MIFOR) etc. are proposed to be launched after certain legal issues related to these products are resolved. Issues like the coupon of the underlying notional long bond and the maturity of the futures contract (subject to it being maximum of one year) are left to the exchanges to decide upon.

LITERATURE REVIEW

Various studies have been conducted to assess the impact of derivatives trading on the underlying market volatility related to US and other developed countries. It is also ecause in developing economies like India where derivatives have a history of hardly one decade which is not a long period for such studies. Though, there are studies on this topic. The results on the introduction of future on the introduction of futures on underlying asset price volatility, has been mixed and ambiguous. Some suggest that there is no significant changes in the underlying assets price volatility due to introduction of futures like Hodgson and Nicholas (1991), Lattch (1991), and Shenbagaraman (2002) name a few example. There are other set of studies which suggests the increase in the volatility like Maberly et al (1989), Brossen (1991) Lee and Ohk (1992), Antoniou and Holmes (1998) and Gulen and Stewart (2000) report a volatility increases in highly developed markets like US, UK and Japan. Mohan et al (2004) has also reported increase

in volatility after studying the Indian markets. On the other hand Antoniou et al (1998) and Gulen and Stewart (2000) find evidence that volatility decreased with future listing in many countries. Some Indian studies like Thenmozhi (2002) and Hetamsaria and Deb (2004) have also given the similar results of reduction in the volatility. Vipul (2006) also found increase in the volatility of the equity market due to the introduction of the futures market.

The introduction of futures enables traders to transact large volume at much lower transaction costs relative to the cash market. The consequence of this increase in order flow to future market is still unresolved.

The empirical techniques used are different for different studies. But the basic approach of all the methods consider spot rate volatility before and after the period beginning of futures markets. The methods used ranged from cross-sectional analysis (Harris, 1989), simple static regression, univariate Box-Jenkings analysis and causality test to multivariate time series analysis. More recently ARCH models have been used for doing the same (Simpson and Ireland (1982). In the Indian analysis too , ARCH/GARCH models have been used for the same (Shenbagaraman, 2002).

The study on the interest rate volatility has been less. Though, some initial studies were done by Edward (1988) to study the impact of IRF on spot rate volatility. Brown (2002) has done the study to find out the relationship between Volatility and Activity though in the currency futures market. Chatrath, Ramchander and Song (1996) have done a similar study on currency future trading activity and volatility in the underlying exchange rates. They suggested that future trading activity impacts positively the conditional volatility of the exchange rates.

OBJECTIVE OF THE STUDY

The study has following objectives.

1. The first objective of the study is to determine whether the introduction of Interest future in Indian securities market has impacted the spot interest volatility or not. This objective is there to validate that futures market increases speculative activities and this leads to an increase in the volatility of the market.
2. The second objective of the study is to compare the volatilities before and

after the IRF. This objective is there to understand the level of change in volatility in the period before and after the introduction of the interest rate futures.

3. The third objective of the study is to analyze the relationship between volatility in the spot interest rates and Interest Rate Future (IRF) trading activity. This objective helps in establishing the fact whether increase in trading in the futures market impacts the volatility of underlying asset or not and in this study we have this here we have used IRFs in India.

DATA AND METHODOLOGY

The interest rates are subject to change. We do not have any benchmark as such to use it for interest rates as we have in case of equity or commodity. But and index which covers the change in the interest rates can be used for the same. NSE calculates ZCYC and using ZCYC the traded bonds are valued and such indices have been calculated. The index number is available from Jan 1991 and the base year value of the index is 100. The index is available for composite debt securities, 1-3 year, 3-8 year, 8 year + government bonds, treasury bills and government security. Out of six indices we have used composite index and treasury bills index for out purpose. The data of indices has been taken from January, 1 2005 to July 31 2010.

To serve the objective one and two, we have used GARCH (1, 1) model proposed by Bollerslev (1986) which was an extension of the basic ARCH model developed by Engle (1982). For interest rates index we did not get examples but GARCH process has shown to effectively describe the non linearity in currency data Milhoj (1987), in financial data Akgivay (1989). We have used plain vanilla GARCH (1,1) model because of simplicity and this suffices our purpose. Besides this GARCH (1,1) model has been found to be appropriate model for wide range of financial data (Bollerslev er al., 1992).

The proxy for interest rate volatility (calculated by both selected indices) then becomes the conditional variance from the GARCH (1, 1) model for the return on their indices. The daily log returns have been calculated. The GARCH (1, 1) model takes following form

$$R_\tau = \omega + \varepsilon_\tau \qquad 1(a)$$

$$h_\tau = \alpha_0 + \alpha\, \varepsilon^2_{\tau-1} + \beta h_{\tau-1} \qquad 1(b)$$

We introduce the dummy variable in the conditional variance equation so that equation 1(b) becomes equation 2(b) as follows. The dummy variable takes the '0' value before the introduction of IRF and '1' after the introduction of IRF period.

$$h_\tau = \alpha_0 + \alpha\, \varepsilon^2_{\tau-1} + \beta h_{\tau-1} + \gamma D \qquad 2(b)$$

Significance of γ determines the significant impact of the introduction of IRF on the spot interest rates. To serve the second objective regarding whether volatility changed during both the periods (pre and post IRF periods) we have used two measures. First we have used standard close-to-close variance estimator of the percentage change in daily spot prices measure as $\ln(P_t/P_{t-1})$ used to estimate variance before and after the periods (Edward, 1988). F-test has been used to verify the significant change in the variance in both the periods. Besides this the GARCH(1,1) model (Equation 1(a) and 1(b)) has been used to estimate $(\alpha + \beta)$ values to determine the impact on volatility in both the periods (Karmakar).

The data for activity of IRF in India has been taken from NSE's official website from August 2009 to July 2010. Daily levels of volume and open interest are taken from next-to-expire contract until the last trading day prior to the expiration month. This pattern of data has been collected after taking the reference from Brown (2002). In India the IRF contracts can be introduced on any day of the calendar month. The duration of any contract can vary form one month to 12 months and expiry can happen on one of the four specific days of a year specified by SEBI (the capital market regulatory body in India).

The data on daily volume and open interest levels of each IRF contract from the beginning Aug 2009 the July 2010 has been taken official website of NSE. The data has been taken up to the last trading day of the pre-expiration month of the contracts. We have collected data in this pattern because most of the trading I future contracts occur in the nearby month contract (Brown, 2002).

Before further analysis both the time series of volatility and activity have been tested for staitionarity using Augmented Dickey fuller test where acceptance of the no staionarity of null should be rejected to prove the series to be stationary. The relationship between IRF trading and interest rate volatility have been studied

using a VAR (Vector Autoregressive Model). VAR model were popularized by Sims (1980) as a natural generalization of univariate autoregressive models. A VAR is a system regression model (having more than one endogenous variable) that can be considered a king of hybrid model between the univariate time series models and simultaneous equation models. VAR's have often been advocated as an alternative to large scale simultaneous equations structural models. We have used the following methodology similar to that were used by Chatrath,Ramchander and Song (1996) and Brown (2002) to analyze the relationship between future trading activity (IRF's) and spot market interest rate volatility.

$$Vol_{\tau} = \alpha_{1\tau} + \sum_{j=1}^{K} \tau_j \, Vol_{\tau-j} + \sum_{j-1}^{K} \beta_j \, Act_{\tau-1} + \mu_{1\tau} \qquad 3(a)$$

$$Act_{\tau} = \alpha_{2\tau} + \sum_{j-1}^{K} \pi_j \, Act_{\tau-1} + \sum_{j=-1}^{K} b_j \, Vol_{\tau-j} + \mu_{2\tau} \qquad 3(b)$$

Where Vol_t= a vector of conditional variance from the GARCH(1,1) model (equation 1).

Act_t= it is the ln (Vol_t / OI_t)

τ_j and π_j are coefficient of the lagged values of endogenous variables and β_j and b_j are coefficients of the lagged values of the exogenous variables. μ_{1t} and μ_{2t} are the random error terms.

The number of lags to be utilized in a VAR model can be determined by calculating the AIC for different lag periods and choosing the model that minimizes the AIC (Griffitths, Hill, Judge, 1993, pp-343). The VAR model outlined above describes the bi-variate relation between interest future (IRF) trading activity and volatility of the underlying spot rates.

RESULTS

Table1: Augmented Dickey-Fuller Test

Series	t-statistics	Critical value at 5% LoS	p-value
Treasury Bill Index Return Series	-28.40876	-2.863411	.0000
Composite Index Return Series	-31.45253	-2.863410	.0000

The null of not staionarity has been rejected in both the cases (Treasury bill and Composite Inxed) as t-statistics is coming out to be -28.40876 and -31.45254 respectively in treasury bill and composite index cases which are falling in the rejection region (Table-1). This implies that both the series are appropriate for further econometrical analysis.

For the impact on the volatility of spot interest rate due to the introduction of the interest rate futures have been analyzed in the Table-2. The coefficient of dummy variable in equation 2(b) is significant for Treasury bill index return series and marginally significant for Composite index return series as the p-values are coming out to be .0099 and .0831 respectively. This implies that the introduction of IRF has significantly impacted the volatility of the interest rate in India.

Table 2: Results of GARCH (1, 1) Model (Conditional Variance equation with dummy Variable)

Series	Coefficient of Dummy Variable	Standard Error	Z-Statistics	p-value
Treasury Bill Index Return Series	3.41×10^{-6}	1.32×10^{-6}	2.57	.0099
Composite Index Return Series	4.70×10^{-8}	2.71×10^{-8}	1.73	.0831

The measures of volatility have been enumerated in Table-3 for both the periods, before the IRF and after the IRF.

Table 3: Values of measures of Volatility in Pre and Post IRF Periods

Standard Deviation	**Pre-IRF**	**Post-IRF**
Treasury Bill Index Return Series	.001833	.009524
Composite Index Return Series	.002427	.01022
$(\alpha+\beta)$ in GARCH(1,1) model	**Pre-IRF**	**Post-IRF**
Treasury Bill Index Return Series	.699125	.995288
Composite Index Return Series	.985689	.261187

Using the standard deviation measure for measuring the volatility in both the periods results convey the same analysis both the indices return series. The TB index return series showed a 419% increase and Composite index return series has shown 321% increase in volatility. Using the GARCH model's $(\alpha+\beta)$ measure which also implies the same result except for the composite index return series

where the (α+β) value has gone significantly down in the post IRF period. The TB index return series has shown 42% increase but the composite index return series has shown a fall of 74%. This discrepancy may have arisen due to having less sample size in the post IRF period as IRF has started in India in August 2009.

The study of systems of equation of Volatility and Activity in the IRF market has given following results.

Table 4(1) and 4(2) reports the VAR results of estimating equation 3(a) and 3(b) using the conditional variance of the daily log returns of Treasury Bill index and Composite Index volatility (Vol) respectively and interest rate future trading activity (Act) as two endogenous variables.

The former part of table 4(1) has volatility (of **Treasury bill** index returns) as endogenous variable where the VAR model specification has been estimated with the lagged values of volatility (Vol) and activity (Act) up to 6 lags. The TB index return volatility has for previous six days (lag 1 through lag 6) significant impact on volatility (Vol). However, the alternate positive and negative values of coefficients of lagged volatility that the market may overreact to the volatility and then compensating the next day. There has been no impact of the lagged trading activity on the volatility. The former part of the table 4(2) has volatility (of **Composite index** return) as endogenous variable where the VAR model specification has been estimated with the lagged values of volatility (Vol) and activity (Act) up to 6 lags. The results of the VAR model is also similar to what TB index return had in the above case (TB index return as endogenous variable) except a change that the 6th lagged volatility is not significantly impacting the volatility. All the lagged activity of previous 6 days is insignificant in its impact on volatility in this case.

The latter part of table 4(1) has activity (of **Treasury bill** index returns) as endogenous variable where the VAR model specification has been estimated with the lagged values of volatility (Vol) and activity (Act) up to 6 lags. The lagged values of volatility have no significant impact on the trading activity. Trading activity has positive and significant impact of t-1 and t-4 days lagged activity. This shows that trading activity increases as the previous days' (-1 and -4) increases in the activity. The latter part of table 4(2) has activity (of **Composite** index returns) as endogenous variable where the VAR model specification has

Table 4 (1): Treasury Bill Index Return Volatility and IRF Trading Activity VAR Results

Endogenous Variable	Exogenous Variable	Lag	Lagged Volatility	Lagged Activity
Vol	**Act**	**-1**	1.205070*	-1.06E-07
			(0.07180)	(4.6E-07)
			[4.00891]	[-0.23273]
		-2	-0.48417*	-1.19E-07
			(-0.10997)	(4.3E-07)
			[-4.40271]	[-0.27670]
		-3	0.328243*	9.76E-09
			(-0.113)	(4.1E-07)
			[2.90493]	[0.02368]
		-4	-0.34853*	4.49E-07
			(-0.11324)	(4.1E-07)
			[-3.07785]	[1.09318]
		-5	0.371845*	1.92E-07
			(0.11006)	(4.4E-07)
			[.37866]	[0.43719]
		-6	-0.155977*	-1.66E-07
			(0.07124)	(2.2E-07)
			[-2.18933]	[-0.75894]
Act	**Vol**	**-1**	17948.65	0.292208*
			(11190.6)	(0.07164)
			[1.60390]	[4.07892]
		-2	-29881.39	0.063464
			(17234.0)	(0.06720)
			[-1.73386]	[0.94442]
		-3	23057.92	0.029425
			(17708.0)	(0.06460)
			[1.30212]	[0.45548]
		-4	-9651.742	0.222211*
			(17746.2)	(0.06432)
			[-0.54388]	[3.45471]
		-5	-9946.864	-0.019509
			(17247.5)	(0.06880)
			[-0.57671]	[-0.28356]
		-6	10422.23	0.026480
			(11165.0)	(0.03435)
			[0.93348]	[0.77084]

Note: (1)Standard errors are calculated; [2] are the t-statistics
** Significant at 5% level of Significance*

Table 4 (2): Composite Index Return Volatility and IRF Trading Activity VAR Results

Endogenous Variable	Exogenous Variable	Lag	Lagged Volatility	Lagged Activity
Vol	**Act**	**-1**	0.287824*	1.28E-05
			(0.07180)	(2.2E-05)
			[4.00891]	[0.57560]
		-2	-0.217748*	-4.48E-06
			(0.07546)	(2.1E-05)
			[-2.88571]	[-0.21319]
		-3	0.165769*	1.21E-05
			(0.07652)	(2.0E-05)
			[2.16624]	[0.59721]
		-4	-0.158845*	-9.01E-06
			(0.07677)	(2.0E-05)
			[-2.06902]	[-0.44494]
		-5	0.140751*	3.09E-05
			(0.07584)	(2.1E-05)
			[1.85579	[1.44320]
		-6	-0.005523	-1.55E-05
			(0.07271)	(1.1E-05)
			[-0.07597]	[-1.45790]
Act	**Vol**	**-1**	613.8483*	0.303731*
			(231.743)	(0.07186)
			[2.64883]	[4.22648]
		-2	-368.7659	0.044169
			(243.562)	(0.06788)
			[-1.51406]	[0.65069]
		-3	272.2693	0.039252
			(247.004)	(0.06544)
			[1.10229]	[0.59977]
		-4	-149.0521	0.207968*
			(247.808)	(0.06539)
			[-0.60148]	[3.18023]
		-5	-10.08786	-0.002725
			(244.811)	(0.06916)
			[-0.04121]	[-0.03940]
		-6	-94.78293	0.021434
			(234.693)	(0.03439)
			[-0.40386]	[0.62325]

Note: (1)Standard errors are calculated; [2] are the t-statistics
** Significant at 5% level of Significance*

been estimated with the lagged values of volatility (Vol) and activity (Act) up to 6 lags. The lagged values of the volatility variable from day t-1 shows significantly increased trading activity the day following and increase in composite index return volatility. The impact is strong as the significant value of t-1 day volatility coefficient is very high. The trading activity is getting positively and significantly impacting by t-1 and t-4 days lagged values of activity itself. An increase in activity on t-1 and t-4 days leads to an increase in the activity of the coming days.

DISCUSSION

Our results of the first objective of impact on the spot rate volatility of the interest rate due to the introduction of the futures market (IRFs in our case) have been consistent with some of the earlier studies on the same area. Maberly et al (1989), Brorsen (1991) , Lee and Ohk (1992), Antonion and Holemes (1995) and Gulen and Stewart (2000) have reported an increase in the spot rate volatility due to the introduction of the futures market. Figlewski (1998) have also found a positive relationship between volatility of Government National Mortgage Association (GNMA) securities prices and open interest in GNMA futures contracts leasing him to conclude that futures market activity increased the volatility of prices. Like our study, many studies like Darrat and Rahman (1995), Bologna and Cavallo (2002), Chiang and Wang (2002), Galloway and Miller (1997) and Pilar and Rafael (2002) showed significant impact of future trading on spot prices in terms of stabilizing the volatility of underlying spot market. In our study too, the TB index return has shown significant stabilizing effect as (á+â) has gone up by 42 % to .995288.

Our results are consistent with the previous studies on debt instruments (Edwards, 1988) where there had been an increase in the volatility of the spot markets after the introduction of the IRFs.

The results of VAR models (equation 3(a) and 3 (b)) on both the interest rate indices (Treasury bills and Composite Index) return volatility and IRF activity are same as expected. Brown (2002) though, has studied on currency futures but the results of IRFs are also coming consistent with that.

CONCLUSION

Though interest rates have just started in India, in our study with the limited period data it has been found that the impact of the introduction of the interest

rate futures on the spot interest rates volatility is significant especially on the short run spot interest rates volatility. The onus for this goes to the existence of growing market of participants including banks and large corporate who deal in interest rate based instruments for various reasons. The impact has an increase in the volatility of the spot interest rate. This result is prominent for both treasury bills and for the composite interest rate index. But for the results in terms of responsiveness and lasting change in the spot rate volatility, it has been found that treasury bills are responsive and showing the market has increased the depth but for composite index the results are contradictory. Besides this, it has been found that spot rate volatility has in general no association with the activity in the IRF markets. The study could not be conclusive in the sense that the duration for such conclusive outcomes need more sample size but in India the IRF market started only in the year 2009 which is a very short span of time for such results. In addition to this in this study addition of a control variable gives an indication for further study on the topic. With the increased data set and introduction of the control variable we can add more value to the topic taken for study in the present paper for further study in the future.

REFERENCES

Akgiray, V (1989). "Conditional Heteroscedasticity in Time Series of Stock Returns: Evidence and Forecast," Journal of Business, Vol 62, No. 1, pp-55-88

Antoniou, A. and P. Holmes (1995). "Future Trading Information and Spot Price Volatility," Evidence for the FTSE 100 Stock Index and Future Contracts using GARCH," *Journal of Banking and Finance,* Vol. 19, pp. 117-129

Bollerslev, T (1986). "Generalized Autoregressive Conditional Heteroscedasticity," *Journal of Econometrics*, Vol 31, No. 3, pp-307-327

Bologna, P. and Cavallo, L. (2002). "Does the Introduction of stock index futures effectively reduce stock market volatility? Evidence from Italian Stock Exchange using GARCH", *Applied Financial Economics*, Vol. 12, pp.183-92

Brown, Cynthia J. (2002). "Mexican Peso Futures and Exchange Rate Volatility," *Latin American Business Review,* Vol. 3, No. 1

Brorsen, B.W. (1991). "Future Trading, transaction costs, and stock market volatility," *Journal of Futures Market,* Vol. 11, pp. 153-63

Chatrath, Arjun, Sanjay Ramchander, and Frank Song (1996). "The Role of Future

Trading Activity in Exchange Rate Volatility," *Journal of Futures Market,* Vol. 16, No. 5, pp.561-584

Chiang, M. and Wang, C. (2002). "The Impact of futures trading on Spot index volatility: Evidence for Taiwan index futures", *Applied Economic Letters,* Vol. 9, pp. 381-6

Darrat, A. and Rahman, S. (1995). "Has Future Trading Activity caused stock price Volatility?", *Journal of Futures Market,* Vol. 15, pp. 537-57

Edwards, F.R. (1988), "Futures Trading and Cash market volatility: Stock Index and Interest rate futures", The Journal of Futures Market, Vol. 8, pp-421-439

Enders, Walter (1995). *Applied Econometrics Time Series.* New York: John Wiley and Sons. Inc

Engle, R F (1982). "Autoregressive Conditional Heteroscedasticity with Estimates of the Variance of the United Kingdom Inflation," *Econometrica,* Vol 50, No. 4, pp-987-1007

Figlewski, S. (1984). "Future Trading and Volatility in the GNMA market", *Journal of Finance,* Vol. 36, No. 2, pp. 445-56

Gallowoway, T.M. and Miller, J. M. (1997). "Index Future Trading and Stock return volatility: Evidence from the introduction of MidCap 400 index futures", *Financial Review,* Vol. 32, pp. 845-66

Gulen, H. and Mayhew, Stewart (2000). "Stock Index Futures Trading and Volatility in International Equity Markets," *Journal of Futures Markets,* Vol. 20, pp. 661-685

Hetamsaria, N. and Deb. S.S. (2004). "Impact of Index Futures on Indian Stock Market Volatility: An Application of GARCH Model," *Journal of Applied Finance,* Vol. 10, pp. 51-63

Harris, L. (1989). "S&P 500 cash stock price Volatilities," *Journal of Finance,* Vol. 44, No. 5, pp. 1155-75

Hodgson A Nicholas D (1991). "The Impact of Index Futures on Australian Share Market Volatility," *Journal of Business Accounting,* Vol. 12 pp.645-658

Laatch, F. E. (1991), "A Note on the Effects of the Initiation of Major Market Index Futures on the Daily Returns of the Component Stocks," *Journal of Futures Market,* Vol. 11, pp.313-317

Lee, S. B. and Ohk, K. Y. (1992). "Stock Index Futures Listing and Structural

Change in Time Varying Volatility," *Journal of Futures Market,* Vol. 12, pp. 493-509

Milhoj. A (1987). "A Conditional Variance Model for Daily Observations of an Exchange Rate," *Journal of Business and Economic Statistics,*Vol 60, pp. 93-103

Maberly, E., Allen, D. and Gilbert, R. (1989). "An Analysis of Trading and Non-trading periods returns for the value line composite index; spot versus futures: a note," *Journal of Futures Market,* Vol. 7, No. 5, pp. 497-500

Pawaskar, Vardhana et al (2002). "The NSE-Government Securities Index: Issues in Construction" .http://www.nse-india.com/content/debt/gsec_paper.pdf (Last accessed July 31,2010)

Pilar, C. and Rafael, S. (2002). "Does derivative trading destabilize the underlying assets? Evidence from the Spanish Stock Market", *Applied Economic Letters*, Vol.9, pp.107-10.

Thenmozhi, M. (2002). "Futures Trading , Information and Spot Price Volatility of NSE-50 Index Futures Contract," *National Stock Exchange,* Mumbai

Simpson, W. G. and T.C. Ireland (1985). "The Effect of Futures Trading on Price Volatility of GNMA Securities," *Journal of Futures Market*, Vol. 2, pp. 357-366

Sims, C. A. (1980). "Macroeconomics and Reality," *Econometrica,* Vol. 48, pp. 1-48

Shenbagaraman, P. (2002). "Do Futures and Options Trading on Cash Market Volatility?" National Stock Exchange, Mumbai

Vipul (2006). "Impact of Introduction of Derivatives on Underlying Volatility: Evidence from India," *Applied Financial Economic,* Vol. 16, pp. 687-97