W P S (DEPR) : 1 / 2011

RBI WORKING PAPER SERIES

An Empirical Analysis of the Relationship Between Currency Futures And Exchange Rates Volatility In India

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MARCH 2011

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AN EMPIRICAL ANALYSIS OF THE RELATIONSHIP BETWEEN CURRENCY FUTURES AND EXCHANGE RATES VOLATILITY IN INDIA

Somnath Sharma[1]

Abstract

India moved away from pegged exchange rate to the Liberalized Exchange Rate Management System (LERMS) in 1992 and the market determined exchange rate regime in 1993 which is considered as an important structural change in the exchange rate market. With increased volatility in exchange rate and to mitigate the risk arising out of excess volatility, currency futures were introduced in India in 2008 which is considered as second important structural change. It is believed that the currency futures will help in hedging the exposures of exchange rate to unfavorable movements in exchange rate. The role of derivatives for risk taking and risk management cannot be understated by any means and it has increased significantly in recent times. This paper focuses at the relation between volatility in the exchange rate in the spot market and trading activity in the currency futures. The results show that there is a two-way causality between the volatility in the spot exchange rate and the trading activity in the currency futures market.

JEL Classification Code: F31, F39
Keywords: Currency futures, exchange rate volatility, trading

INTRODUCTION

[1] Somnath Sharma is a Research Officer in the Department of Economic and Policy Research (DEPR), Reserve Bank of India. The author is grateful to Smt. Rekha Mishra, Director, DEPR and anonymous referees for their valuable suggestions towards the successful completion of this paper. The views expressed here are strictly those of the author and not of RBI. Comments may be forwarded to the author.

During the early 1990s, India embarked on a series of structural reforms in the foreign exchange market. The movement away from pegged exchange rate regime to partially floated in 1992 and fully floated in 1993 was instrumental in developing a market-determined exchange rate of the rupee and was a significant step in the progress towards total current account convertibility.

In order to advance Indian foreign exchange market to international standards, a well developed foreign exchange derivative market was essential which started in 2008. The exchange rate policy does not aim at a fixed target or a pre-announced target or a band but is supported by the ability of Reserve Bank to intervene in the markets, if and when necessary, only to smoothen any undue volatilities or disorderly market behaviour, while allowing the underlying demand and supply conditions to determine the exchange rate movements over a period in an orderly manner.

Currency futures trading in INR-US$ started on August 29, 2008. Till January 2010, exchange rate futures was available only for US $ vis-à-vis Indian Rupee. Exchange-traded currency futures have now been expanded to the euro, pound and yen pairing. At the time of introduction of currency futures in India, it was thought that the currency futures market in India would make a notable contribution towards improving the menu of options available for currency risk management. International experience of the emerging markets with the introduction of currency futures is a mixed one. In several cases, the volatility is found to be reduced following the constitution of currency futures market, though empirical evidence to the contrary also exists. The transaction volumes in currency futures in these countries have remained too small to put any significant upward pressure on exchange rate volatility. Also, there is no clear

evidence to prove that futures contracts traded on exchanges result in increased volatility in the prices for the underlying commodity. In the light of the above, it will be interesting to observe and analyze the effect of introduction of currency futures on spot market for exchange rate. This paper looks into this aspect and attempts to find out whether introduction of currency futures and currency future trading activity has increased due to the volatility in spot market or not. Paper will also try to find out if there is any causality between exchange rate and futures trading. The paper is divided into three sections Section I of this paper discusses in brief the relevant literature. Section II discusses the Derivatives markets in India and the rationale for introduction of currency futures in India. Section III discusses the methodology and conclusions.

Section I

1. Literature Review

Despite the popular opinion that increased volatility in numerous financial markets was enhanced by trading in derivatives, the empirical evidence regarding this issue is far from conclusive. Some studies provide empirical results that support the opinion that trading in futures can destabilize the spot market. For example, Figlewski (1980) investigates the futures contracts for Treasury Bills (GNMA pass-through certificates) and provides evidence that futures market activity increases the volatility of cash prices. More recent study by Bae, Kwon and Park (2004) focuses on the effect of the introduction of index futures trading in the Korean markets on spot price volatility. The authors concluded that introducing the futures and options trading on the Korean stock exchange resulted in both larger spot price volatility and greater market efficiency

(allowing for quicker adjustment of market prices to information). Still, many other studies find some evidence for the stabilizing effect of futures trading on the spot market or no evidence for any casual relationship between futures trading and the cash market volatility. Darrat, Rahman and Zhong (2002) find that index futures trading cannot be blamed for increased volatility in the spot market. On the contrary, their empirical results suggest that the volatility in the futures market is itself an outgrowth of a turbulent spot market. A study by Bessembinder and Seguin (1992) examines whether greater S&P 500 futures-trading activity is associated with greater equity volatility. Their evidence indicates that equity volatility is positively related to spot-trading activity and to contemporaneous futures-trading shocks. Moreover, they argue that equity volatility is actually mitigated when the background futures activity is high. These findings contrast significantly with other empirical studies that suggest positive relation between futures trading and spot market variability. Gulen and Mayhew (2000) provide mixed evidence in their study on 25 countries. Their results indicate that after the listing of stock index futures, spot volatility may have increased in the largest two markets, the United States and Japan, while it decreased or stayed roughly the same in the remainder. Furthermore, in most countries volatility tends to be lower in periods when open interest in stock index futures is high (the only two cases of the opposite results are again the United States and Japan). In some cases, volatility is higher in periods when futures volume is high, but this is driven by the unexpected component of volume, not the expected component. Board, Sandmann and Sutcliffe (2001) critiqued the traditional econometric tests (GARCH, ARIMA etc.) for being inconclusive and misleading and instead used elaborate stochastic volatility models that provided no evidence for

hypothesis that FTSE 100 futures trading instantly destabilizes the spot market. There are relatively few studies that analyze the trading volume versus price volatility in the context of currency futures. Despite the size of the currency market and the fact that futures contracts are only one of three popular means with which speculators and hedgers can assume positions on future exchange rates (the other two being currency forwards and options), there are some indications that the level of futures trading may affect currency price volatility. Some of the studies provide evidence on the increase in the spot exchange rate volatility due the trading in currency futures. For instance, the study by Chatrath, Ramchander and Song (1996) explicitly examines the relationship between level of currency futures trading and the volatility in the spot rates of the British pound, Canadian dollar, Japanese yen, Swiss franc and Deutsche mark. The researchers provide strong evidence on the causality between futures trading volume exchange rate volatility, as it is found out that the trading activity in futures has a positive impact on conditional volatility in the exchange rate changes, with a weaker feedback from the exchange rate fluctuations to the futures volatility. Moreover, futures trading activity is found to decline on the day following increased volatility in spot exchange rates. Grammatikos and Saunders (1986) studied the same foreign currency futures traded on the International Monetary Market over the period of 1978-1983. After using numerous causality tests, the researchers could not reject the null hypothesis that volume (price variability) causes price variability (volume) – a finding that is consistent with the presence of significant bidirectional causality in futures market transactions. Many researchers studied also the particular effect that different groups of investors in futures can have on the cash market. According to Adrangi and Chatrath (1998) the

overall growth in currency futures commitments has not caused exchange rates to be more volatile, but the surges in the participation of large speculators and small traders do destabilize the markets. Moreover the conclusion is drawn that margin requirements that “penalize” speculators and small savers may serve to promote stability in the market. The recent study by Bhargava and Malhotra (2007) focuses on trading in futures on four currencies over the time period of 1982-2000. The authors find evidence that day traders and speculators destabilize the market for futures. Furthermore it is inconclusive whether hedgers stabilize or destabilize the market. Exchange rate movements affect expected future cash flow by changing the home currency value of foreign cash inflows and outflows and the terms of trade and competition. Hence, the usage of currency derivatives for hedging the unexpected movement of currency becomes more important and essential and its importance is heightened. Literature has established that currency risk can be minimized through futures/forward hedging (Solnik (1974), Black (1990), Glen and Jorion (1993), and Chang and Wong (2003)). Early research illustrated the benefits of conventional hedging strategies (Ederington (1979) and Hill and Schneeweis (1982), among many others). Recent research recognizes the time varying nature of exchange risk and adopts GARCH (generalized autoregressive conditional heteroskedasticity) models to generate dynamic hedging strategies (Kroner and Sultan (1993), Lien, Tse, and Tsui (2002), Guo (2003)).

However there is no direct evidence that derivatives are actually used to hedge. Hentchel and Kothari (1997) and Simkins and Laux (1997) examine directly firm’s use of currency derivatives. The former doesn’t find any evidence and latter finds only weak evidence that their use influence exposure. Derivatives can also be used for speculative

purposes. The debacle story of Metallgesellschaft and its reasons are well known to everyone. This speculation can also increase the manipulation of market by big players and hence can increase the volatility in spot market (Kumar and Seppi (1992), Jarrow (1992)). So there can be the case that currency future trading activity increases the spot volatility.

Section II

2.1 Derivatives in India

Derivative is a product whose value is derived from the value of one or more basic variables, called bases (underlying asset, index, or reference rate), in a contractual manner. In the Indian context the Securities Contracts (Regulation) Act, 1956 (SC(R)A) defines "derivative" to include-

1. A security derived from a debt instrument, share, loan whether secured or unsecured, risk instrument or contract for differences or any other form of security.
2. A contract which derives its value from the prices, or index of prices, of underlying securities.

Derivatives are securities under the SC(R)A and hence the trading of derivatives is governed by the regulatory framework under the SC(R)A.

The term derivative has also been defined in section 45U(a) of the RBI Act as follows:

An instrument, to be settled at a future date, whose value is derived from change in interest rate, foreign exchange rate, credit rating or credit index, price of securities (also called "underlying"), or a combination of more than one of them and includes interest rate swaps, forward rate agreements, foreign currency swaps, foreign currency-

rupee swaps, foreign currency options, foreign currency-rupee options or such other instruments as may be specified by the Bank from time to time.

Derivative contracts have several variants. The most common variants are forwards, futures, options and swaps.

2.2 Participants in Derivatives Market

The following three broad categories of participants - hedgers, speculators, and arbitrageurs trade in the derivatives market. Hedgers face risk associated with the price of an asset and they use futures or options markets to reduce or eliminate this risk. Speculators wish to bet on future movements in the price of an asset. Futures and options contracts can give them an extra leverage; that is, they can increase both the potential gains and potential losses in a speculative venture. Arbitrageurs are in business to take advantage of a discrepancy between prices in two different markets. If, for example, they see the futures price of an asset getting out of line with the cash price, they will take offsetting positions in the two markets to lock in a profit.

2.3 Economic function of Derivatives Market

In spite of the fear and criticism with which the derivative markets are commonly looked at, these markets perform a number of economic functions.

1. Prices in an organized derivatives market reflect the perception of market participants about the future and lead the prices of underlying to the perceived future level. The prices of derivatives converge with the prices of the underlying at the expiration of the derivative contract. Thus derivatives help in discovery of future as well as current prices.

2. The derivatives market helps to transfer risks from those who have them but may not like them to those who have an appetite for them.

3. Derivatives, due to their inherent nature, are linked to the underlying cash markets. The underlying market witnesses higher trading volumes with the introduction of derivatives, because of participation by more players who would not otherwise participate for lack of an arrangement to transfer risk.

4. Speculative trades shift to a more controlled environment of derivatives market. In the absence of an organized derivatives market, speculators trade in the underlying cash markets.

5. An important incidental benefit that flows from derivatives trading is that it acts as a catalyst for new entrepreneurial activity. They often energize others to create new businesses, new products and new employment opportunities, the benefit of which are immense.

2.4 Currency Futures

Currency futures are a linear product. It means that the losses as well as profits for the buyer and the seller of a futures contract are unlimited.

As the date of expiration comes near, the basis reduces - there is a *convergence* of the futures price towards the spot price. On the date of expiration, the basis is zero. If it is not, then there is an arbitrage opportunity. Arbitrage opportunities can also arise when the basis (difference between spot and futures price) or the spreads (difference between prices of two futures contracts) during the life of a contract are incorrect[2].

[2] Incorrect means if the price is not equal to the 'fair value' of the contract

In determining profits and losses in futures trading, it is essential to know both the contract size (the number of currency units being traded) and also the value of tick. A tick is the minimum trading increment or price differential at which traders are able to enter bids and offers. Tick values differ for different currency pairs and different underlying.

Currency futures can be cash settled or settled by delivering the respective obligation of the seller and buyer. All settlements however, unlike in the case of OTC markets, go through the exchange.

2.5 Rationale for Introducing Currency Futures

Futures markets were designed to solve the problems that exist in forward markets. A futures contract is an agreement between two parties to buy or sell an asset at a certain time in the future at a certain price. But unlike forward contracts, the futures contracts are standardized and exchange traded. To facilitate liquidity in the futures contracts, the exchange specifies certain standard features of the contract. A futures contract is standardized contract with standard underlying instrument, a standard quantity and quality of the underlying instrument that can be delivered, (or which can be used for reference purposes in settlement) and a standard timing of such settlement. A futures contract may be offset prior to maturity by entering into an equal and opposite transaction.

The standardized items in a futures contract are:

- Quantity of the underlying
- Quality of the underlying

- The date and the month of delivery
- The units of price quotation and minimum price change
- Location of settlement

The rationale for introducing currency futures in the Indian context has been outlined in the Report of the Internal Working Group on Currency Futures (Reserve Bank of India, April 2008) as follows:

The rationale for establishing the currency futures market is manifold. Both residents and non-residents purchase domestic currency assets. If the exchange rate remains unchanged from the time of purchase of the asset to its sale, no gains and losses are made out of currency exposures. But if domestic currency depreciates (appreciates) against the foreign currency, the exposure would result in gain (loss) for residents purchasing foreign assets and loss (gain) for non residents purchasing domestic assets. In this backdrop, unpredicted movements in exchange rates expose investors to currency risks. Currency futures enable them to hedge these risks. Nominal exchange rates are often random walks with or without drift, while real exchange rates over long run are mean reverting. As such, it is possible that over a long – run, the incentive to hedge currency risk may not be large. However, financial planning horizon is much smaller than the long-run, which is typically inter-generational in the context of exchange rates. As such, there is a strong need to hedge currency risk and this need has grown manifold with fast growth in cross-border trade and investments flows. The argument for hedging currency risks appear to be natural in case of assets, and applies equally to trade in goods and services, which results in income flows with leads and lags and get converted into different currencies at the market rates. Empirically,

changes in exchange rate are found to have very low correlations with foreign equity and bond returns. This in theory should lower portfolio risk. Therefore, sometimes argument is advanced against the need for hedging currency risks. But there is strong empirical evidence to suggest that hedging reduces the volatility of returns and indeed considering the episodic nature of currency returns, there are strong arguments to use instruments to hedge currency risks.

Section III

3.1 Data and Methodology

Till January 2010, RBI had permitted futures only on the USD-INR rates. Exchange-traded currency futures have been expanded to the euro, pound and yen pairing since January 2010.

For the present analysis, we have concentrated on the USD-INR currency futures only. This paper will be using the secondary data. Data on spot exchange rate of Indian Rupee vis-à-vis US Dollar has been collected from National Stock Exchange (NSE). Near month expiry futures data from NSE is used in the analysis as the trading is more for near month expiry futures. A total of 712 observations of exchange rate were taken starting from 02 April, 2007 to 11th February, 2010. Data for exchange rate futures starts from 29 August, 2008 to 10 February, 2010.

Firstly, returns for currency were calculated as following :

$$R_t = 100 * \ln(S_t / S_{t-1})$$

Where, S_t = Spot exchange rate at time‘t’

To identify the lag length and model return series, the SIC information criteria were calculated for lags one to six and lag order of 1 was found appropriate. Ljung-Box

Q stats were checked to check for any heteroscedasticity in the errors series which is complemented by ARCH LM test. Heteroscedasticity is then modeled using ARCH-GARCH models. Conditional volatility is estimated using the regression

$$Rt = \beta 0 + \beta 1 Rt\text{-}1 + \varepsilon_t \qquad (1)$$

$$\varepsilon_t = z_t \sqrt{h_t} \qquad (2)$$

$$h_t = \alpha_0 + \alpha_1 \varepsilon_{t-1}^2 + \alpha_2 h_{t-1} \qquad (3)$$

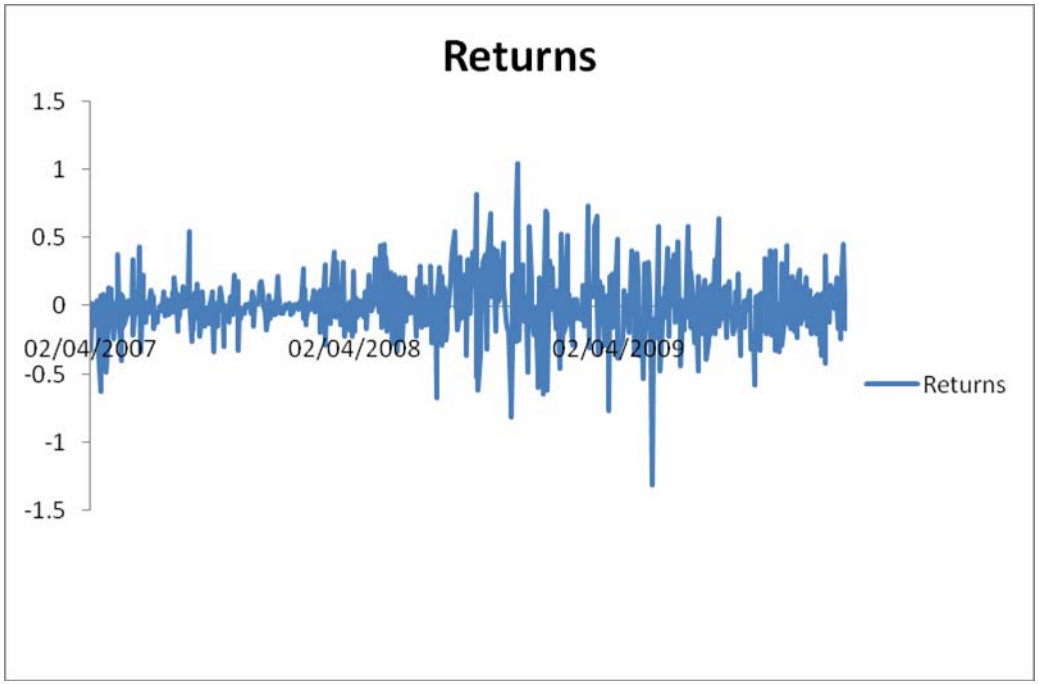
Where, Z_t is white noise i.i.d process with $E(Z_t) = 0$ and $E(Z_t^2) = 1$

As proxy for the futures trading activity VOI_t, the futures daily trading volume V_t is standardized by the futures open interest OI_t

$$VOI_t = \frac{V_t}{OI_t} \qquad (4)$$

Chatrath, Ramchander and Song (1996) suggest that VOI_t reflects speculative activity. Open interest largely reflects hedging activity because of its 'longer than- intraday' character. Daily trading volume represents speculation because of its short term character. By standardizing the volume by the open interest, an indicator of the relationship between speculative and hedging activity is constructed. Then Granger causality test were done for ht and VOI_t. A key benefit of using the ratio, according to Garcia et al. (1986), is to avoid the potential expiration effects on trading activities, since daily trading volume and open interest are both functions of time to expiration. Additionally, Bessembinder and Seguin (1993) suggest that the volume-open interest ratio can provide insights into the trading activity generated by either speculators or hedgers in the market. Finally, Luu and Martens (2003) point out that using this ratio to measure trading activities can better capture the information arrival than trading volume or open interest alone.

Reaction of the spot market to the introduction of currency futures is examined by comparing the spot volatility before and after the introduction of futures by taking the window of 366 observations before and after the event.



The above figure presents the graph of spot returns R_t. The augmented Dickey Fuller (ADF) statistics are negative and significant at the 1per cent level; the null hypothesis of non stationarity of the series is rejected. It is interesting to note the low level of mean and high standard error of the returns. This suggests large volatility in the currency exchange rate.

To investigate whether a GARCH model is appropriate for modeling the variability of the exchange rates discussed, several tests are carried out. The residuals of the regression

$$Rt = \beta 0 + \beta 1 Rt\text{-}1 + \varepsilon_t$$

were checked for linear dependencies. To check for the presence of ARCH effect in the data we look at Ljung-Box (LB) Q-stat of the squared residual obtained from the DGP (Data Generating Process) estimated above. LB Q-stat for the various lags are significant, suggesting presence of ARCH effect. More formal test for the presence of ARCH effect is done using ARCH LM test. Null of no ARCH effect is rejected at various lags. To capture this time varying heteroscedasticity we proceed to model it using the most suitable ARCH family of model. In light of all these tests; heteroscedasticity needs to be modeled.

Later on other diagnostic tests were conducted on the standardized residuals Z_t from equation (2)

$$Z_t = \frac{\varepsilon_t}{\sqrt{h_t}} \qquad (4)$$

where ε_t is the residual from equation (1) and h_t is the estimated variance from equation (3). The GARCH model is correctly specified if Z_t has a zero mean and unit variance. Furthermore there should be no autocorrelation in the Z_t series.

GARCH(1,2) models the presence of ARCH effect i.e. it is able to model the varying heteroskedasticity parsimoniously. The estimated equations i.e. mean equation and the variance equation has been given in the Appendix.

After having obtained the measure for exchange rate volatility through the GARCH model which is h_t, and the futures trading activity variable which is VOI_t, the main question is to check whether both variables have an influence on each other. Hence both are put to test for Granger causality to investigate the relationship between spot volatility and futures trading activity. Table 1 in the Appendix presents the Granger causality test statistics. Results indicate that there is a two-way causality between exchange rate volatility and futures trading activity.

Reaction of the spot market to the introduction of currency futures is examined by comparing the spot volatility before and after the introduction of currency futures. Table 2 in the Appendix presents the results. The null hypothesis of volatility of spot exchange rate before the introduction of currency futures to be equal to volatility of spot exchange rate after the introduction of currency futures is rejected at 1per cent level of significance. Alternate hypothesis of volatility of spot exchange rate before the introduction of currency futures not equal to volatility of spot exchange rate after the introduction of currency futures is accepted at 1per cent level of significance. Also the alternate hypothesis of volatility of spot exchange after the introduction of currency futures rate is greater than volatility of spot exchange rate before the introduction of currency futures is accepted at 1 per cent level of significance.

3.2 Conclusion:

In this paper we have tried to find a relationship between the exchange rate volatility and the trading activity in the currency futures. Trading in currency futures in USD-INR rates was permitted at the time when the financial crisis had hit the advanced economies. The uncertain situation the global economy was going through had a lot of

impact on the exchange rates. In the empirical analysis, this paper does not take into account the effect of the financial crisis. Though accounting for the impact of the crisis will definitely make the results more robust. The Granger causality test is implemented to investigate the relationship between futures trading activity measured by number of contracts and total amount that is trading volume and the spot volatility of exchange rate. The results show that there is a two-way causality between the volatility in the spot exchange rate affects the trading activity in the currency futures market. While the empirical results appear reasonably clear, one needs to take into account the impact of financial crisis to arrive at any general conclusion about impact of currency futures on spot exchange rate. Regarding the fact that developing countries may be vulnerable to self-fulfilling speculative attacks and adverse developments in international financial markets, the significance of this investigation about the potential role of futures trading in Indian exchange rate stability is limited. Additional research is needed to obtain further insights into this issue. Furthermore, the impulse response and variance decomposition models can be used to how shocks in variables are transmitted over time.

Appendix

We fit the Data generating process. AR(1) describes the series well.

Estimation Equation:

RETURNS = C(1)*RETURNS(-1)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
RETURNS(-1)	0.08	0.04	2.14	0.03

To check for the presence of ARCH effect in the data we look at Ljung-Box Q-stat of the squared residual obtained from the DGP estimated above. LB Q-stat for the various lags are significant, suggesting presence of ARCH effect. More formal test for the presence of ARCH effect is done using ARCH LM test. Null of no ARCH effect is rejected at various lags. (see table). To capture this time varying heteroscedasticity we proceed to model it using the most suitable ARCH family of model.

GARCH(1,1) models the presence of ARCH effect i.e is able to model the varying heteroscedasticity parsimoniously. The estimated equation is:

Mean equation:

RETURNS = C(1)*RETURNS(-1)

Variance equation:

GARCH = C(2) + C(3)*RESID(-1)^2 + C(4)*GARCH(-1) + C(5)*GARCH(-2)

Result is presented in the table below:

Variable	Coefficient	Std. Error	z-Statistic	Prob.
R(-1)	0.065481	0.041397	1.581797	0.1137
	Variance Equation			
C	0.000544	0.000171	3.187461	0.0014
RESID(-1)^2	0.106909	0.017675	6.048495	0
GARCH(-1)	0.310342	0.185036	1.677204	0.0935
GARCH(-2)	0.576899	0.176629	3.266164	0.0011
R-squared	0.005832	Mean dependent var		0.004581
Adjusted R-squared	0.000191	S.D. dependent var		0.227258
S.E. of regression	0.227236	Akaike info criterion		-0.338442
Sum squared resid	36.40356	Schwarz criterion		-0.306292
Log likelihood	125.1469	Hannan-Quinn criteria		-0.326022
Durbin-Watson stat	1.972866			

The coefficients in the variance equation are positive and significant also sum of the coefficients associated with the ARCH and GARCH term is less than one. LJUNG BOX Q-stat is insignificant for various lags. Suggseting that the hetrocedasticity has been modeled properly. ARCH LM test for lags 1, 4, 8 and 12 lags also suggests that there is no ARCH effect left in the data.

Plot of the estimated volatility is:

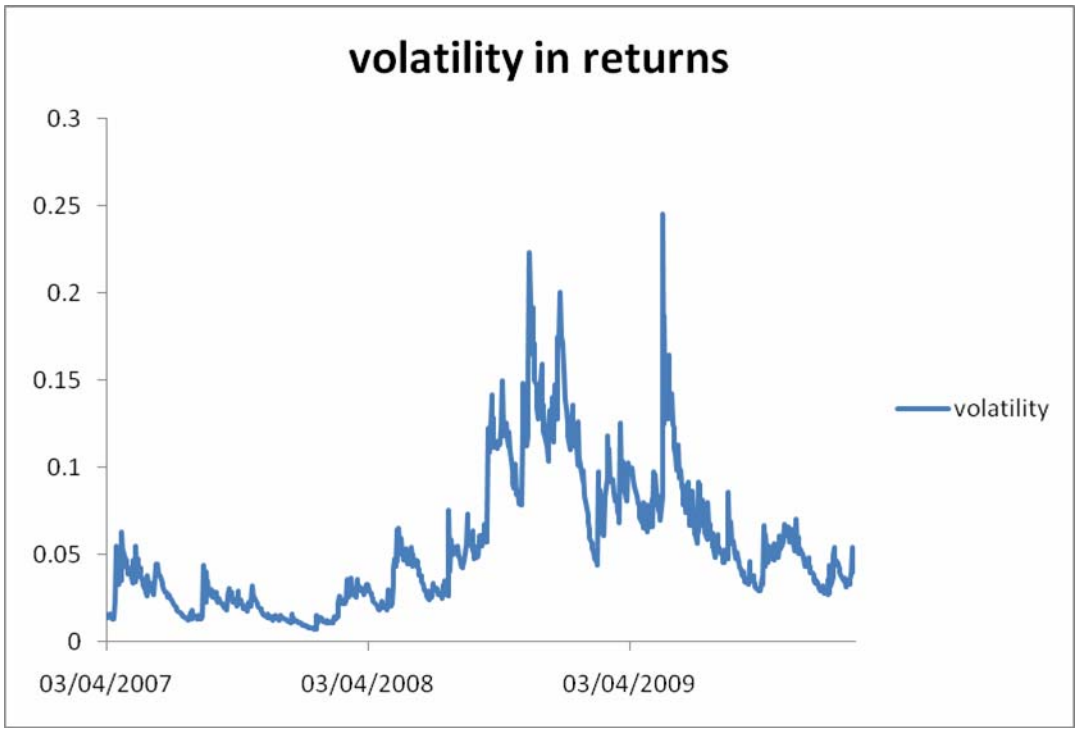


Table: 1 Granger Causality Test

Pairwise Granger Causality Tests			
Lags: 3			
Null Hypothesis:	Obs	F-Statistic	Prob.
VOI does not Granger Cause VOLATILITY	223	2.63	0.05
VOLATILITY does not Granger Cause VOI		2.43	0.07

Table: 2 Difference in Volatility

Method		df	Value	Probability
t-test		708.00	24.11	0.00
Satterthwaite-Welch t-test*		428.21	23.69	0.00
Anova F-test		(1, 708)	581.22	0.00
Welch F-test*		(1, 428.212)	561.19	0.00
*Test allows for unequal cell variances				
Analysis of Variance				
Source of Variation		df	Sum of Sq.	Mean Sq.
Between		1.00	0.49	0.49
Within		708.00	0.60	0.00
Total		709.00	1.09	0.00
Category Statistics				
				Std. Err.
Variable	Count	Mean	Std. Dev.	of Mean
VOLATILITY_Post	347.00	0.08	0.04	0.00
VOLATILITY_Pre	363.00	0.03	0.01	0.00
All	710.00	0.05	0.04	0.00

Product Definition :

Contract Specification for US Dollars – Indian Rupee (USDINR)

Currency Futures

Contract specification :	**USD INR Currency Derivatives**
Underlying	Rate of exchange between one USD and INR
Exchange of trading	National Stock Exchange of India Limited
Security descriptor	FUTCUR USDINR
Contract size	USD 1000

Quotation	Currency futures contract would be quoted in Rupee terms. However, the outstanding positions would be in dollar terms.
Tick size	Re. 0.0025
Price bands	Not applicable
Trading cycle	The futures contracts will have a maximum of twelve months trading cycle. New contract will be introduced following the Expiry of current month contract.
Expiry day	Last working day of the month (subject to holiday calendars)
Last Trading Day	Two working day prior to contract Expiration Date
Settlement basis	Daily mark to market settlement will be on a T +1 basis and final settlement will be cash settled on T+2 basis.
Settlement price	Daily mark to market settlement price will be the closing price of the futures contracts for the trading day and the final settlement price shall be the RBI reference rate on last trading date.
Settlement	Cash settled
Final Settlement Price	The reference rate fixed by RBI two working days prior to the final settlement date will be used.

Limitations of Futures:

- The benefit of standardization which often leads to improving liquidity in futures, works against this product when a client needs to hedge a specific amount to a date for which there is no standard contract

- While margining and daily settlement is a prudent risk management policy, some clients may prefer to not incur this cost in favor of OTC forwards, where collateral is usually not demanded

References

1. Adrangi B., Chatrath A. (1998). Futures commitments and exchange rate volatility. Journal of Business Finance and Accounting, 25(3) & (4), pp. 501-520.
2. Antoniou A., Holmes P. (1995).Futures trading, information and spot price volatility: evidence for the FTSE-100 Stock Index Futures contract using ARCH. Journal of Banking and Finance 19, pp. 117-129.
3. Bae S. C., Kwon T. H., Park J. W. (2004). Futures trading, spot market volatility, and market efficiency: the case of the Korean index futures markets. The Journal of Futures Markets, Vol. 24, No. 12, pp. 1195–1228.
4. Bessembinder H., Seguin P. J. (1993). Price volatility, trading volume, and market depth: evidence from futures markets. The Journal of Financial and Quantitative Analysis, Vol. 28, No. 1, pp. 21-39.
5. Bhargava V., Malhotra D.K. (2007). The relationship between futures trading activity and exchange rate volatility, revisited. Journal of Multinational Financial Management, 17, pp. 95-111.

6. Black, F. (1990), “Equilibrium Exchange Rate Hedging”. *Journal of Finance*, 43, 899-908.
7. Board J., Sandmann G., Sutcliffe Ch. (2001). The effects of futures market volume on spot market volatility. Journal of Business Finance and Accounting, 28(7) & (8), pp. 799-819.
8. Chang E., Chou R., Nelling E. (2000). Market volatility and the demand for hedging in stock index futures. The Journal of Futures Markets, Vol. 20, No. 2, pp. 105-125.
9. Chang, E. and Wong, P. K. (2003), “Cross-Hedging with Currency Options and Futures”. *Journal of Financial and Quantitative Analysis*, 38, 555-74.
10. Chatrath, A., S. Ramchander and F. Song (1996), “The Role of Futures Trading Activity in Exchange Rate Volatility”. The Journal of Futures Markets, Vol. 16, No. 5, 561-584.
11. Darrat A., Rahman S., Zhong M. (2002). On the role of futures trading in spot market fluctuations: Perpetrator of volatility or victim of regret? The Journal of Financial Research, Vol. XXV, No. 3, pp. 431-444.
12. Ederington, L. H. (1979), “The Hedging Performance of the New Futures Markets”. *Journal of Finance*, 34, 157-70.
13. Figlewski S. (1980). Futures trading and volatility in the GNMA market. The Journal of Finance, Vol. 36, No. 2, pp. 445-456.
14. Garcia, P., Leuthold, R., and Zapata, H., 1986, Lead-lag relationships between trading volume and price variability: New evidence, The Journal of Futures Markets, 6, 1-10.

15. Glen, J. and Jorion, P. (1993), “Currency Hedging for International Portfolios”. *Journal of Finance*, 48, 1865-86.
16. Grammatikos T., Saunders A. (1986). Futures price variability: A test of maturity and volume effects. Journal of Business, Vol. 59, No. 2, pp. 319-330.
17. Gulen H., Mayhew S. (2000). Stock index futures trading and volatility in international equity markets. The Journal of Futures Markets, Vol. 20, No. 7, pp. 661–685.
18. Guo, B. (2003), “Currency Risk Hedging with Time-Varying Correlations”. Working Paper, University of California at Santa Cruz.
19. Luu, J. and Martens, M., 2003, Testing the mixture-of-distributions hypothesis using realized volatility, Journal of Futures Markets, 23, 661-679.
20. Hentschel, L. and S.P.Kothari (1997), “Life insurance or lottery. Are corporations managing or taking risks with derivatives?” Working Paper, University of Rochester, Rochester, NY.
21. Hill, J. and Schneeweis, T. (1982), “The Hedging Effectiveness of Foreign Currency Futures”. *Journal of Financial Research*, 5, 95-104.
22. Jarrow, R.A. (1992), “Market Manipulation, Bubbles, Corners, and Short Squeezes”. Journal of Financial and Quantitative Analysis, Vol. 27, No. 3, September, 311- 336.
23. Kroner, K. F. and Sultan, J. (1993), “Time Varying Distribution and Dynamic Hedging with Foreign Currency Futures”. *Journal of Financial and Quantitative Analysis*, 28, 535-51.

24. Kumar, P. and D.J. Seppi (1992), “Futures Manipulation with Cash Settlement”. The Journal of Finance, Vol. XLVII, No. 4, September, 1485-1501.
25. Lien, D. Tse, Y. K., and Tsui, A. K. C. (2002), “Evaluating the Hedging Performance of the Constant-Correlation GARCH Model”. *Applied Financial Economics*, 12, 791-98.
26. Simkins, B. and Laux, P. (1997), “Derivative use and exchange rate risk of investing in large US corporations”. Working Paper, Case Western Reserve University
27. Solnik, P. (1974). “A Model of International Asset Pricing”. *Journal of Financial Economics*, 9, 383-406.
28. Reserve Bank of India (2008), Report of the Internal Working Group on CurrencyFutures.http://www.rbi.org.in/scripts/PublicationReportDetails.aspx?FromDate=4/28/2008&SECID=21&SUBSECID=0.