

Empirical Testing of Exchange Rate Volatility with the Introduction of Currency Futures in India

Mr. Santosh Kumar CFA
Lecturer, Finance and Accounts,
Amity Business School, Noida, India
E-mail: santosh.frm@gmail.com

Ms. Tavishi
Lecturer in Economics,
Amity Business School, Noida, India
E-mail: tavu.tavishi@gmail.com

Dr.Raju.G
Professor and Head, Department of Management Studies,
GCET
Greater Noida, U.P, India-201308.
E-mail: drrajug@yahoo.co.in

Mr.Tanveer Shahab
Lecturer, GEMA Institute of Management,
New Delhi, India
E-mail: tanveershabab@gmail.com

Mr. Ashish K Khatua
Senior Manager, Business Analysis,
Tata Steel Ltd, Jamshedpur, India.
e-mail: silu10@gmail.com

Abstract —Indian economy has undergone phenomenal change in terms of currency exposure due to paradigm shift in current and capital account leading to implementation of trading in Currency Futures in August 2008. The present paper documents the impact of currency futures on the volatility of exchange rate before and after its implementation. The volatilities of exchange rate is computed using GARCH, TARCH, EGARCH and Asymmetric Component ARCH using the exchange rate for the two sample periods viz. January 2000 to August 2008 and September 2008 to October 2010. The results of the study reveal that first period has consistent shocks of volatilities having significant ARCH and GARCH influence as compared to moderate ARCH effects in post introduction period. Further it also indicates the significant leverage effects to various behavioral triggers only in pre introduction period. Thus this sort of structural change in volatilities pattern in the post introduction period is attributed to the absorption of information in the currency market on continual basis. On the whole, the results signify the currency futures as optimal hedging tool for the firms having significant exposure in foreign currency.

Key Words: Currency Futures, Volatility, ARCH, GARCH, TARCH, EGARCH and Exchange Rate.

JEL Codes: F31, G15

I. INTRODUCTION

In the early 1990s Indian economy embarked on the path of liberalization by opening its door to the world economy integrating the global financial markets coupled with the

ever increasing capital mobility across borders. Currently India offers a wide array of over the counter products for hedging the currency risk exposure in the Forex market which has seen tremendous vertical and horizontal expansion. In order to meet the growing need to cope better with the market induced currency movements, India has introduced a new derivative product “currency futures”, in August 2008, by relaxing the guidelines governing the external transactions. India has introduced Currency futures with partial convertibility of its currency in the capital account. Currency futures, an important instrument for hedging, has made significant contribution in managing the currency risk exposure by eliminating credit risk, introducing price transparency and easing the accessibility to all market participants.

II. LITERATURE REVIEW

Various studies pertaining to the effect of derivatives on the stock and forex market have provided mixed arguments suggesting case based diagnosis. Several studies are undertaken to examine the effect of Index Futures on the volatility of Stock Market. Edwards(1988) , Harris (1989) , Lasttch(1991) ,Chan et.al.(1992), Rahman(2000) use data from various stock markets and conclude that there is no change on the volatility of these markets. Some scholars like Bessermbinder and Seguin (1992), RobinSon (1993), Kumar , Sarin and Shastri(1995), Thenmozhi (2002), Nath (2003), find that there is a decrease in the volatility while some researchers like Hung , Lee and So(2003) , Bae ,

Kwon and park (2004) , Rao (2007) find that the reverse is true. All of them have used data from different markets in different countries. The impact seems to vary depending upon country and the time period. Alexakis (2007) tests the impact of introduction of stock future contracts by using a modified GARCH model and predicts that that the index futures trading is fully consistent with the efficient market operation. In spite of a large number of studies undertaken, by applying various models, there seems to be little agreement over the issue of effect of index futures on the stock market volatility in various capital markets. Despite the lack of consensus among scholars, the statistical evidence seems to gradually accumulate on the side of reduction or no change in volatility after the introduction of index futures.

Though there are numerous studies on the impact of currency futures on the volatility of stock market, there is a negligible amount of literature that establishes a link between the introduction of currency futures and the volatility of the foreign exchange market in the Indian context. Hence this paper tries to generalize the effect of introducing currency futures on the volatility of the Indian foreign exchange market.

III. OBJECTIVES

This study attempts to explore of presence of systematic memory, leverage effects and degree of volatility of exchange rates before and after the introduction of currency futures in India.

IV. DATA AND METHODOLOGY:

The daily data of exchange rate of dollar with respect to Indian Rupee for a period is collected from January 2000 to October 2010 from the electronic delivery system of Reserve Bank of India. Then we break the entire data into sub periods namely pre introduction period (2000-August2008) and post introduction period (September 2008-2010) to analyze the impact of currency futures on exchange rate on individual basis. In the whole study we frequently use six different notations viz. DDOLLAR, DPREDOLLAR, DPOSTDOLLAR representing change in the value of rupee in terms of dollar, change in the value of rupee in terms of dollar prior to introduction of currency futures, change in the value of rupee in terms of dollar after the introduction of currency futures.

First we perform the Augmented Dickey-Fuller (ADF) (1979) and Phillips Perron (PP) (1988) to determine the integrated level of series. Further we compute and compare various volatility estimates viz. GARCH, TARCH,

EGARCH and Asymmetric Component to explore the degree of volatility shocks, leverage effects, long term systematic memory etc. of the variables for both the sub periods to diagnose the structural changes in the exchange rate volatilities attributed to the implementation of currency futures in India. Moreover the results are also validated by residual test (ARCH LM test, Correlellogram and Q stat and JB statistics) of various volatility models.

V. RESULTS AND DISCUSSION

Results in Table1 and Table 2 show the descriptive statistics and stationary properties of the three variables DDOLLAR, DPREDOLLAR and DPOSTDOLLAR. All the three variables are stationary and don't possess unit root leading to appropriateness of further analysis at first difference level of exchange rate. Moreover they are not supposed to be drawn from normal population with significant p value in JB statistics (Table 1). We further compute and compare the volatility estimates in the two sub periods. The sum of ARCH and GARCH approximately close to one indicates the persistence of volatility shocks in the exchange rate prior to 2008 (Table 3) as compared to moderate persistence of volatility shocks and absence of ARCH effect after introducing currency futures (Table 3). Thus in the second sub period news volatility from previous period is almost insignificant. Then we perform TARCH, EGARCH and Asymmetric Component on DDOLLAR, DPREDOLLAR and DPOSTDOLLAR and find that the leverage effects and long term memory is significant in first sub period as compared to total absence in second period. Thus the comparative volatility estimates lend strong support to the absorption of volatility by the introduction of currency futures in India. Therefore the introduction of currency futures has led to a paradigm shift in exchange rate volatility in India.

VI. CONCLUSION

This paper investigates the volatility pattern in the market for foreign exchange in India and the predictive power and informational content of the currency futures, as a hedging instrument, in managing this volatility. Introduction of Currency futures has fostered cooperation among market participants and other financial and legal agents in India's whole hearted pursuit of monetary and financial stability. It instills a sense of resilience in the economy against exogenous volatility shocks. Currency futures have reduced volatility asymmetries and have led to improvement in the quality and speed of flow of information.

TABLE 1. DESCRIPTIVE STATISTICS

Variable	Mean	median	S.D	J.B	
				t-statistics	p value
DDOLLAR	0.0017	0.0000	0.1625	15163.88	0.00
DPREDOLLAR	-0.0004	0.0000	0.1104	3521.49	0.00

DPOSTDOLLAR	0.0220	0.0100	0.3873	16558.1	0.00
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TABLE 2. TEST OF STATIONARY SERIES (UNIT ROOT)

Particular	Unit Root Tests				Inference
	Augmented Dickey Fuller Test		Phillips Perron Test		
	Test Statistic	Critical value (5%)	Test Statistic	Critical value (5%)	
DDOLLAR	-19.29484	-2.78	-47.03867	-2.86	Rejected
DPREDOLLAR	-18.05676	-2.78	-43.83269	-2.86	Rejected
DPOSTDOLLAR	-6.176593	-2.78	-15.23589	-2.86	Rejected

TABLE 3. VOLATILITY ESTIMATES BEFORE AND AFTER THE INTRODUCTION OF CURRENCY FUTURES

Volatility Estimates	Before the Introduction		After the Introduction	
	coefficient	P values	coefficient	P values
ARCH(1)	0.357935	0.0000	0.137064	0.1265
GARCH(1)	0.730151	0.0000	0.744549	0.0000
(RESID<0)*ARCH(1)	-0.147810	0.0000	-0.048536	0.5950
RES/SQR[GARCH](1)	0.065990	0.0000	0.038283	0.5181
Tran: (RES<0)*[ARCH-Q]	0.002226	0.0000	0.150900	0.1165

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