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LONG RUN RELATIONSHIP BETWEEN SPOT AND FUTURES CURRENCY RATES: AN EMPIRICAL STUDY ON CURRENCY MARKETS OF INDIA

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Abstract

The paper examines the long term relationship between Spot and Futures (started in August 2008) exchange rate between Indian Rupee and US Dollars for the period January 2010 to December 2011, by using the Johansen Cointegration Analysis. Cointegration Analysis shows that there is a long run relation between Spot and Futures currency rates and according to Granger Causality, Futures Returns lead the Spot Returns.

JEL Classification: G13,G14

***Key Words :** Currency Futures, Spot Exchange Rates, Cointegration, Causality*

1.Introduction

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. This 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 and hence it was started in 2008.

Currency Futures trading in INR-US$ started on August 29, 2008. Till January2010, 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.

Price discovery and risk transfer (i.e. Hedging) have been considered as the pivot functions of the futures market in all the economies (Telser (1981)). As we know, futures are the standardized forward contracts which are traded on stock exchanges. Cost-of-Carry Model is followed to determine the price of the futures contract, which implies that futures represent the prospective price of the underlying asset in the cash market (Garbade and Sibler (1983)). For example, if the futures is traded at 2500 and the cash market at 2450 (if cost-of-carry model holds good), it implies that the futures will direct the next price move in the cash market and thus the next price of the underlying asset will be approximately 2500.

Price Discovery is a function of the Cost-of-Carry Model, which implies that Price Discovery will be true only if Cost-of-Carry Model holds good (Turkington and Walsh (1999)). In other words, if at any time the futures are mispriced, then lead-lag relationship between futures and cash market may be disturbed, which will result in wrong decisions because traders decide in the cash market on the basis of the price movement in the futures market. In addition, if the futures are mispriced, then hedging through arbitrage positions in the cash and the futures market will not work in the interest of the traders.

In addition, an efficient cost-of-carry relationship between the futures and cash market results in the co movement of price series in two markets. Co movement of price series of both markets is an evidence that price movement in both markets is cointegrated but evidence of cointegration does not tell anything regarding the speed of price discovery in the market. Rather it conveys very significant information regarding the strength of the basis (i.e. Futures Price – Cash Price) (Booth et al., (1999)). If on the date of the maturity of the contract, price series in two markets converge (see **Figure -1**), it implies that cost-of-carry model holds good and both the series have long run relationship. If reverse holds, then it implies that the futures are mispriced and may not be an efficient price discovery vehicle (Garbade and Sibler (1983)). For an efficient convergence on the maturity date, the basis is required to be predictable but predictable basis does not necessarily imply that speedier price discovery takes place in the futures market (Fortenbery and Zapata (1997)). The paper is divided into five sections in the order of Literature Review, Data Description and Methodology, Results and Discussion, and Conclusion.

2.Literature Review

Investigation of causal relationship between futures and cash prices is not a new phenomenon. At the international as well as at the national level, significant efforts have been made to evaluate the price discovery efficiency of different futures markets (viz; commodity futures, currency futures, equity futures, etc.). Stensis (1983), Garbade and Sibler (1983), Protopapadakis and Stoll (1983), French (1986), Kawaller (1987), Mohd. Fatimah (1994), Cheung and Fung (1997), Hall (2001), Yang Jian (2001), Singh (2001),Thomas and Karande (2001), Sahadevan (2002), Campbell and Diebold (2002), Zhong (2004), and Isabel and Gilbert (2004) investigated the price discovery efficiency of commodity futures market in different countries viz; America, United Kingdom, Malaysia, India, Mexico etc. All researchers (except for Sahadevan (2002)) found strong lead-lag relationship between the futures and spot prices.

Granger et al., (1998), Covrig and Melvin (2001), Anderson et al., (2002) and Yan and Zivot (2004) examined the price discovery efficiency of currency futures market in various economies like Hong Kong, Indonesia, Japan, South Korea, Malaysia, Philippines, Singapore,Thailand, Taiwan, America and they observed strong bilateral causality between both markets. Moreover, they found that futures market is efficient for underlying currencies, in the sense that it leads the cash market. Chan (1992), Hasbrouck (1995), Jong and Donders (1998), Booth (1999), Turkington and Walsh (1999), Menkveld (2003), Chuang (2003), Raju and Karande (2003), Barclay and Hendershott (2004), Sharma and Gupta (2005), So and Tse (2005) and Gupta and Singh (2006) evaluated the price discovery efficiency of equity futures in different countries like America, Netherlands, Germany, Australia, Taiwan, India, Hong Kong. Except for Barclay and Hendershott (2004), all researchers observed significant evidence of efficient price discovery through equity futures market. They all found that equity and futures prices were cointegrated and the causality of futures to cash market was significant as compared to the causality from the reverse side.

Majority of the studies have suggested the leading role of the futures market while the spot market rarely leads the futures market. While explaining the causes behind such relation, Kawaller et al. (1987) attribute the stronger leading role of the futures market to the infrequent trading of component stocks. At the same time, Stoll & Whaley (1990), Chan(1992) etc. proved the existence of such relation even in the case of highly traded stocks or after adjusting for infrequent trading of component stocks. Again, Chan (1992), Frino (2000), Simpson (2004) suggest that informed traders should trade in the futures market around the release of macroeconomic announcements when the leading role of futures market weakens through the discovery of stock specific information. Recent evidence, however, suggests that the currency futures market might play a big role in price discovery compared with the spot market. Using interdealer direct spot transactions market data from the Reuters Dealing2000-1 system and the futures data from the regular floors trading on the Chicago Mercantile Exchange (CME) for three months in 1996, Rosenbergand Traub (2007) found the currency futures market can have Information Shares (ISs), averaging between 80 and 90%, based on the methodology in Hasbrouck (1995). The currencies they examined were the Deutsche Mark, the British Pound, the Japanese Yen, and the Swiss Franc.

3.Data Description and Methodology

This empirical study was based on daily futures settlement rates of NSE of near month contract and spot rates (from RBI) for the period January 2010 to December 2011. In this study we have employed tests like Co Integration Tests and Granger Causality Test for testing the long run relationship and flow of information.

Co-intergration Analysis requires that time series of the same order should be integrated. Stationarity of time series was examined by using unit root tests(Augmented Dickey-Fuller Test). The Augumented Dickey Fuller Test examines the presence of unit root in an autoregressive model. A simple AR(1) model is $yt= \rho yt- 1 + ut$, where yt is the variable of interest, t is the time index, ñ is a coefficient, and ut is the disturbance term. The regression model can be written as

$$\Delta yt = (\rho\text{-}1)yt\text{-}1+ ut = \delta yt\text{-}1+ut$$

where Δ is the first difference operator.

A financial time series is said to be integrated of one order i.e, I (1), if it becomes stationary after differencing once. If two series are integrated of order one, there may be a linear combination that may be stationary without differencing. If the said condition fulfils, then these are called cointegrated.

Co Integration Analysis can be conducted by using residual based Engle-Granger (1987) Test, or maximum likelihood based Johansen (1988; 1991) and Johansen-Juselius (1990) tests. The Johansen (1988) and Johansen and Juselius (1990) Procedure tests the presence of long run relationship between the variables. Johansen and Juselius propose two likelihood ratio tests for the determination of the number of cointegrated vectors. One is the maximal Eigen Value Test which evaluates the null hypothesis that there are at most r cointegrating vectors against the alternative of r +1 cointegrating vectors. The maximum eigen value statistic is given by,

$$\lambda max = -T \ ln\ (1 - \lambda r+1)$$

where λ r+1,…,λn are the n-r smallest squared canonical correlations and T = the number of observations.

The second test is based on the trace statistic which tests the null hypothesis of r cointegrating vectors against the alternative of r or more cointegrating vectors. This statistic is given by

$$\lambda trace = -T \Sigma \ ln\ (1 - \lambda i)$$

In order to apply the Johansen Procedure, a lag length must be selected for the VAR. A lag is selected on the basis of the Akaike Information Criterion (AIC). The Granger Causality Test is used for determining whether one time series is useful in forecasting another. A time series X is said to Granger-cause Y if it can be shown, usually through a series of t-tests and F-tests on lagged values of X (and with lagged values of Y also included), that those X values provide statistically significant information about future values of Y. Granger representation theorem provides that if two variables are cointegrated, then Granger Causality must exist in at least one direction.

4. Results and Discussions

Fig -1 shows the movement of Futures and Spot exchange rates of Rupees vs Dollars for a period January 2010 to December 2011 and we see that Rupee has depreciated since January 2010. **Table - 1** provides the Descriptive Statistics of futures and spot returns. **Table -2** gives the unit root analysis according to which both futures and spot rates are non stationary at levels and become stationary at I(1) level. **Table -3** provides the results of Johansen's Cointegration Test which confirms 2 cointegrating eqn(s) at the 0.05 level which means that there is a long run relationship between futures and spot exchange rates of Indian Rupees and US Dollar. **Table- 4** gives the results of Granger Causality showing that futures returns lead the spot returns.

5.Conclusion

Currency Futures started in August 2008, are new to India, and that too was started only with Rupees and US Dollar and other major currencies were introduced subsequently. The Study confirms that there is a long run relationship between Futures and Spot Exchange Rates (Rupees and US Dollar) and also lead lag Futures Returns leading the Spot Returns. Hence market players can take the cue from futures market for their positions on Indian Rupee and US Dollar.

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Fig 1

Movement of Future and Spot exchange rate (Rupees and US Dollar)

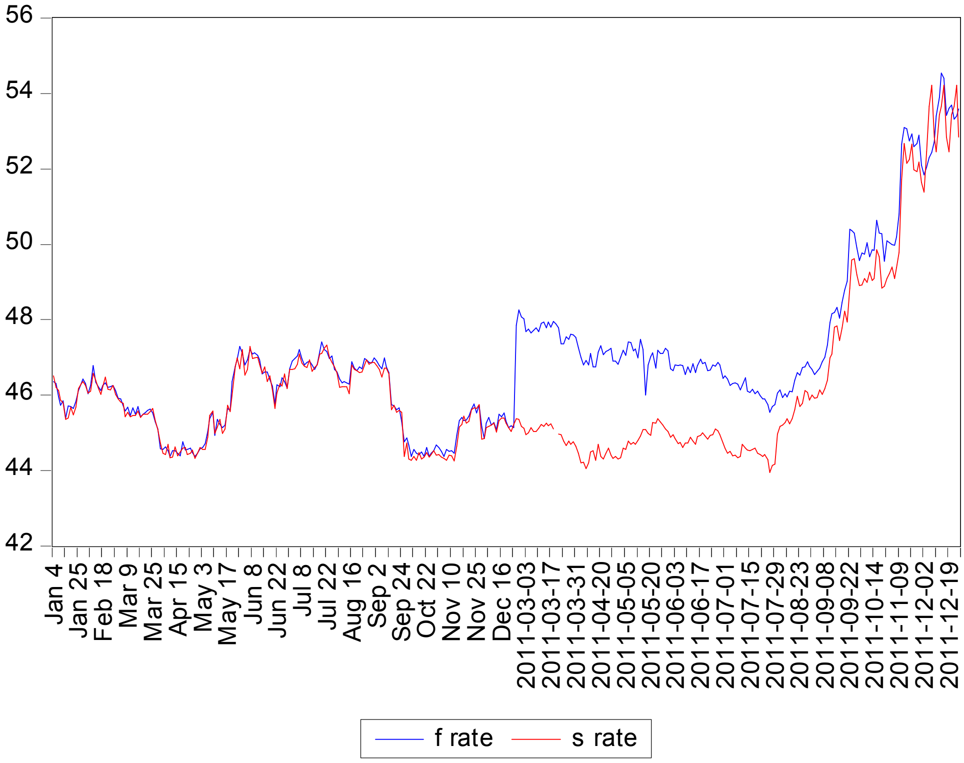

Table 1

Descriptive Statistics

	Future Returns	Spot Returns
Mean	0.019883	0.017818
Median	0	0.01
Maximum	2.7025	1.93
Minimum	-1.2075	-1.39
Std. Dev.	0.315726	0.330404
Skewness	2.195665	0.220257
Kurtosis	20.80996	9.401494
Observations	364	364

Table -2
Unit Root Analysis

	ADF(Level)	ADF(First Difference)
Future Rate	0.3111	-18.0138
Spot Rate	0.7758	-15.679
Critical Values		
1% level	-3.448	-3.448
5% level	-2.869	-2.869
10%level	-2.571	-2.571

Table- 3
Johansen's Cointegration Test

Sample (adjusted): 7 365				
Included observations: 352 after adjustments				
Trend assumption: Linear deterministic trend				
Series: DFR DSR				
Lags interval (in first differences): 1 to 4				
Unrestricted Cointegration Rank Test (Trace)				
Hypothesized		Trace	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None *	0.249806	159.7657	15.49471	0.0001
At most 1 *	0.153340	58.59245	3.841466	0.0000
Trace test indicates 2 cointegrating eqn(s) at the 0.05 level				
* denotes rejection of the hypothesis at the 0.05 level				
**MacKinnon-Haug-Michelis (1999) p-values				

Table –4
Granger Causality Test

Pairwise Granger Causality Tests			
Sample: 1 365			
Lags: 2			
Null Hypothesis:	Obs	F-Statistic	Prob.
Spot Returns does not Granger Cause Future Returns	358	0.68243	0.5061
Future Returns does not Granger Cause Spot Returns		14.1828	1.E-06