Research Paper Management

A Study on Lead-Lag Relationship Between Spot Currency And Futures Currency Market in India

Suratwala Bosky Ashokkumar

ABSTRACT

This paper addresses to the nature of pricing relationship between two markets. The estimation methodology employed in this study is the co-integration and error correction modelling technique. The paper shows the short term and long term relationship between the Indian Rupee-Dollar spot exchange rate and futures market. It also studies the causality between the two markets. The results is obtained by using Johansen Co-integrating Test, Vector Error Correction Model (VECM) and Granger Causality Test. Main finding is that, there exists the long-term relationship between the spot and futures market and this relationship is established by bridging the gap through short run relationship. It is also found that there exists bi-directional causality between the two markets.

KEYWORDS Spot exchange rate, futures currency market, causality

INTRODUCTION

The investigation of the co-integration and the causal relationship between the futures and the spot returns is very significant especially in an emerging market economy like India. Indian currency market has witnessed significant transformations and the structural changes due to implementation of financial sector reform measures by the Govt. of India since early 1990s. In this process futures trading were launched on 28th August 2008 in NSE and India started trading in derivatives currency. The main object behind the introduction of the derivatives market were to control the increasing volatility on the asset prices, and to introduce sophisticated risk management tools leading to higher returns by reducing risks and transaction costs as compared to individual underlying assets. The introduction of the futures market has profoundly changed the nature of trading on the spot exchanges. Futures market offers investors flexibility in altering the composition of their positions in the spot market thus providing the opportunity to hedge their risk. As a consequence the significant portion of the spot currency market are tied to futures currency market activity.

OBJECTIVES OF THE STUDY

(a) To analyze the stationarity in the returns of currency futures and the returns of spot exchange rate.

(b)To study the short run and long run relationship between the spot and futures currency market in India.

(c) To study the lead-lag relationship between the spot and futures currency market in India.

RESEARCH DESIGN

Research Method:
The study follows the descriptive research.

Source of Data:
Data has been obtained from secondary source

(iii) Secondary data:
In the present study daily closing price of the currency under study has been collected from the website of NSE.

(iv) Sample Size:
The study has considered the period from 1-09-2008 to 29-12-2014 for USDINR currency pairing.

JOHNASEN CO-INTEGRATION TEST, VECTOR ERROR CORRECTION MODEL AND GRANGER CAUSALITY TEST: SPOT RETURNS AND FUTURES RETURNS OF USDINR PAIR.

Co-integration analysis is important because if two non-stationary variables are co-integrated, a VAR model in the first difference is mis specified due to the effects of a common trend. If co-integration relationship is identified, the model should include residuals from the vectors (lagged one period) in the dynamic VECM system. In this stage Johansen co-integration test is used to identify co-integrating relationship among the variables. In Johansen framework, the first step is the estimation of an unrestricted, closed P^{th} order VAR in k variables. The VAR model as considered in this study is:

$$R_t = A1R_{t-1} + A2R_{t-2} + \ldots\ldots + A_pR_{t-p} + BX_t + \varepsilon_t$$

Since most economic time series are non-stationary, the above stated VAR model is generally estimated in its first difference form as:

$$\Delta R_t = \pi R_{t-1} + \sum_{i=1}^{p-1} \Gamma_i \Delta R_{t-i} + BX_t + \epsilon_t$$

Here $\Pi = \sum_{i=1}^{p} A_{i-1}$, and $\Gamma_i = -\sum_{j=i+1}^{p} A_j$

In case of no co-integration VECM is no longer required and we directly proceed to Granger Causality Test to establish causal links between variables. The regression equation form for VECM is as follows:

$$\Delta X_t = \alpha_0 + \lambda_1 \varphi_{t-1}^1 + \sum_{i=1}^{m} \alpha_i \Delta X_{t-i} + \sum_{j=1}^{n} \alpha_j \Delta R_{t-j} + \varepsilon_{1t}$$

$$\Delta R_t = \beta_0 + \lambda_2 \varphi_{t-1}^2 + \sum_{i=1}^{m} \beta_i \Delta R_{t-i} + \sum_{j=1}^{n} \beta_j \Delta X_{t-j} + \varepsilon_{2t}$$

Test of Stationarity: Augmented Dickey Fuller Test of Spot Returns
Null Hypothesis: The time series of spot returns is stationary.

TABLE 1: RESULTS OF ADF TEST

USD SPOT RETURNS (AT LEVEL)					
Co-efficient	t-statistics	P-values	Test Critical Values		
			1%	5%	10%
-0.004564	0.002593	-1.759839	-3.964646	-3.413040	-3.128523
USD SPOT RETURNS (AT FIRST DIFFERENCE)					
Co-efficient	t-statistics	P-values	Test Critical Values		
			1%	**5%**	**10%**
-1.034646	-38.58401	0.0000	-3.964651	-3.413042	-3.128524

The results of ADF test is reported in table 1. It can be seen that the tau value is 0.002593 which is lower than the critical values a t 1%, 5% and 10% level of significance. Thus it can be said that the time series of spot returns is non-stationary at level but when calculated at first difference the tau value is greater than the DF critical values at 1%, 5% and 10% level of significance.

Test of Stationarity: Augmented Dickey Fuller Test of Futures Returns

Null Hypothesis: The time series of futures returns is stationary (i.e. consists no unit root).

TABLE 2: RESULTS OF ADF TEST

USD FUTURES RETURNS (AT LEVEL)					
Co-efficient	t-statistics	P-values	Test Critical Values		
			1%	5%	10%
-0.004465	1.742781	0.0816	3.964646	3.413040	3.128523
USD FUT URES RETURNS (AT FIRST DIFFERENCE)					
Co-efficient	t-statistics	P-values	Test Critical Values		
			1%	**5%**	**10%**
-0.961480	35.87069	0.0000	3.964651	3.413042	3.128524

From the table 2, it can be seen that the tau value is 1.742781 which is lower than the critical values a t 1%, 5% and 10% level of significance. Thus it can be said that the time series of spot returns is non-stationary at level but when calculated at first difference the tau value is greater than the DF critical values at 1%, 5% and 10% level of significance.

Test of long run relationship: Johansen Co-integration Test.

In order to analyze the co-movement or market efficiency between the spot market and futures market for the USDINR currency pairing the Johansen Co-Integration Test is applied to both the returns.

Null Hypothesis: There is no co-movement in spot returns and futures returns of USDINR pairing.

TABLE 3: RESULTS OF CO-INTEGRATION TEST

No. of Co-integrating Equations	Eigen Value	Trace Statistics	Critical value at **5%**	**p-value**
None*	0.034417	49.12570	15.49471	0.0000
Atmost 1	0.000344	0.478052	3.841466	0.4893

Referring to Table 3, first null hypothesis is 'none' which means that there is no co-integration equation among the variables. The value of the trace-statistics is more than critical value we can reject null hypothesis. Here the value of trace statistics is 49.12570 and critical value at 5% is 15.49471. Thus the trace statistics is more than the critical value means that we can reject the null hypothesis. Here the probability value is very small that is less than 0.05 so we can reject the null hypothesis of 'none'. The second null hypothesis is 'atmost 1'. It means that there is one co-integration model. Here the trace statistics is 0.478052 and the critical value is 3.841466 which is more than the trace value which means that we accept the null hypothesis that there exists one co-integration model. Again the p-value is 0.4893 which is greater than 0.05 which indicates the acceptance of the null hypothesis of 'atmost 1'. Thus the two variables of the study has long run equilibrium relationship between them.

Test of short run relationship: Vector Error Correction Model

Null Hypothesis: There is no short-run causality running from futures returns to spot returns.

TABLE 4: RESULTS OF VECTOR ERROR CORRECTION MODEL (VECM)

Co-integrating Equation	F-statistics	p-value	Df	Chi-square	p-value
Futures Returns	79.84803	0.0000	4	319.3921	0.0000

The p-value of f-statistics and chi-square value is statistically significant at 5% level of significance. This shows that there exists short run relationship between the two markets.

Test of Causality: Estimates for VECM Regression

TABLE 5: ESTIMATES for VECM REGRESSION

Independent Variable	ΔX_t	ΔYt
Constant [t-statistics] (p-value)	0.000188 [1.27553] (0.2023)	0.000227 [1.38924] (0.1650)
$EC_t - 1$ [t-statistics] (p-value)	-0.073983 [-3.22483] (0.0013)	0.063684 [2.50918] (0.0122)
$\Delta Xt - 1$ [t-statistics] (p-value)	-0.480082 [-12.2246] (0.0000)	-0.110448 [-2.54219] (0.0111)
$\Delta X\ t - 2$ [t-statistics] (p-value)	-0.176461 [-4.25598] (0.0000)	-0.013600 [-0.29650] (0.7669)
$\Delta Xt - 3$ [t-statistics] (p-value)	0.018168 [0.45257] (0.6509)	0.093721 [2.11030] (0.0350)
$\Delta X\ t - 4$ [t-statistics] (p-value)	0.042948 [1.33080] (0.1835)	0.006522 [0.18266] (0.8551)
$\Delta Yt - 1$ [t-statistics] (p-value)	0.630911 [17.1998] (0.0000)	0.127247 [3.13569] (0.0018)

$\Delta Yt-2$ [t-statistics] (p-value)	0.250653 [6.05237] (0.0000)	0.051347 [1.9212] (0.2360)
$\Delta Yt-3$ [t-statistics] (p-value)	0.083395 [2.02478] (0.0431)	-0.004511 [-0.09900] (0.9212)
$\Delta Yt-2$ [t-statistics] (p-value)	-0.070280 [-1.87037] (0.0616)	-0.045725 [-1.09996] (0.2715)

The number of lags in the model has been determined according to the AIC criteria which is 4. Then an error correction model has been used and the results are reported in table 5.

The estimated co-efficient of error correction term in the ΔX_t equation is statistically significant and has a negative sign, which confirms that there is not only any problem in the long run equilibrium relation between the independent and dependent variables in 5% level of significance, but its relative value (-0.073983) shows the rate of convergence to the equilibrium state per year. Precisely the speed of adjustment of any disequilibrium towards a long run equilibrium is that about 7.40% of the disequilibrium is corrected every year. Furthermore, the negative and statistically significant value of error correction co-efficient indicates the existence of long-run causality between the variables of the study.

The long run causality test from the VECM indicates that the causality runs from futures market to spot market, since the co-efficient of the error term in ΔX_t equation is statistically significant and negative based on the standard t-test which means that the error correction term contributes in explaining the changes in the spot market prices.

The co-efficient of the first difference of the ΔX_t lagged three periods in ΔY_t equation in table 5 is statistically significant which indicates the presence of the short run causality from spot market to futures market based on VECM estimates.

Test of lead-lag Relationship: Granger Causality Test

TABLE 6: RESULTS OF GRANGER CAUSALITY TEST

Null Hypothesis	F-statistics	Probability	Decision
Futures market returns does not Granger Cause spot market returns	119.347	2.E-87	Reject
Spot market returns does not Granger Cause futures market returns	4.50575	0.0013	Reject

The results are tabulated in the table 6. It is revealed from the test that the F-value is 119.347 and the probability value is 0.0287 (2.87%) which shows that spot returns granger causes the futures returns at 5% level of significance. It is also observed that F-statistics value is 4.50575 and its probability value is 0.0013 (0.13%), which indicates that the futures returns granger causes the spot returns. Therefore spot returns leads future returns and future returns lead spot returns.

CONCLUSION

The results shows that exists bi-directional relationship between the futures and spot markets through price discovery process. This may be mainly due to futures market attracts larger informed traders to enjoy the advantages of higher liquidity, lower transaction costs, lower margins and greater flexibility for short positions. Hence these advantages makes futures market to lead the spot markets around the macroeconomic or major currency specific information releases. Consequently, the spot market will lead the futures market under the circumstances that these advantages of futures market attracts larger speculative traders from spot market and reduce informational asymmetries of the spot market through reducing the amount of noise trading and helps in price discovery, improve the overall market depth, enhance market efficiency and increase market liquidity. This makes spot market to react fast when market wide information or major currency specific information arrives. Thus, both spot and futures market are said to be informational efficient and reacts more quickly to each other.

REFERENCES

1. Anuradha Guru (2010), 'Interplay between exchange traded currency futures markets, spot markets and forward markets: A study on India.' Indian Economic Review, New Series, Vol. 45, No.1, pp 111-130.
2. Vivek Bhargava and D.K. Malhotra (2005), 'The relationship between futures trading activity and exchange rate volatility, revisited.' Journal of Multi-national Financial Management.
3. Mr. Brajesh Kumar (2008), 'Effect of future trading on spot market volatility: Evidence from Indian commodities derivatives markets.'
4. Raghvendra R. H. and Velmurugan P.S. (2013), 'A study on causal relationship between spot return and future return of GBP/INR currency pair traded in India.' International Journal of Research in Business Series.
5. Somnath Sharma (2011), 'An empirical analysis of the relationship between currency futures and exchange rates volatility in India.' RBI Working Paper Series.