An empirical evidence of interdependence of index futures market and exchange rates markets

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Abstract

The effect of financial derivatives trading on the underlying spot markets has caught the interest of both academics and practitioners. Studies have been done in the area of linkage between stock market and foreign exchange market and also between respective spot market and futures market. Barely any study has been conducted with regards to combining the two frameworks. This study tries to fill the gap by studying the linkage between equity futures market and foreign exchange market in Indian Context. Study uses daily closing prices of CNX Nifty and Rupee/Dollar exchange rate for a period from January 1, 2005 till December 31, 2013. Granger Causality test, Unit root test and OLS model have been employed to analyze this relationship. And the results have shown that there is a bi-directional relationship between Foreign Exchange market and Stock cash market and Foreign Exchange market and Stock index futures market. There also exists a negative relationship between Stock cash market and Foreign Exchange market.

Keywords: foreign exchange market, nifty futures, nifty, granger causality

Introduction

Foreign exchange market and stock markets are the most sensitive segments of the financial system and are also considered as barometers of the economic growth through which, country's exposure to outer world is felt [1]. Understanding the relationship between stock market and foreign exchange market is of great importance to the working of financial markets and the analysts in formulation of fiscal and monetary policies [2]. Numbers of studies have been conducted in the area of volatility linkage between forex market and stock market [3, 4, 2] concluded that there is a positive relationship between the two variables whereas [1] studied no causal relationship exists, but there exists less degree of positive correlation between stock market and forex market.

Liberalization of Indian economy during 1990s has brought about dramatic changes in the Indian stock market. Due to increased concentration in trading volume with increase in speculative traders and to facilitate fair trading at low cost, L.C. Gupta committee recommended the introduction of derivative instruments so that some of the speculative transactions, which currently takes place in the spot market, can be shifted towards the derivatives market. Moreover, introduction of derivative instruments would also enable investors to choose the level of portfolio risk that they are comfortable with [5]. Derivative market in India is a recent concept; it started with introduction of derivatives in stock market in 2000 – 01, later with currency derivatives in 2008. The effect of financial derivatives trading on the underlying spot markets has caught the interest of both academics and practitioners. Derivative instruments are recently developed innovative instruments for trading in financial markets. A 'derivative' instrument can be defined as a financial instrument whose value depends on the value of the underlying asset. They have been introduced with a view to provide a tool to investors for risk management

and also improve the informational efficiency in the cash market [6].

One of the primary issues investigated by researches since the introduction of derivatives trading is the impact of futures trading on the spot market volatility. Many studies have been conducted [6, 5, 7, 8, 9] in India and concluded that derivatives trading has reduced the volatility in cash market with stock market index as its underlying asset. Also introduction of derivatives have improved the speed and quality of information flow in spot market [7]. A study conducted by [10] after adjusting for major macroeconomic factors, the conditional volatilities of monthly returns in pre and post future periods revealed that volatility in spot equity market has increased after the inception of the futures market (BSE Sensex) and in 2009 in context to NSE Nifty futures he studied that introduction of derivatives trading has resulted in reduction of spot price volatility and has also reduced trading efficiency in the underlying stock market. In the area of forex and currency futures a study done by [11] concluded that the introduction of currency futures have positively impacted the foreign exchange market volatility. Based on the above literature review, studies have been done in the area of linkage between stock market and foreign exchange market and also between spot market and futures market. Barely any study has been conducted with regards to combining the two frameworks.

Theoretical Background

Since the liberalization of Indian economy, the inflow and outflow of capital has increased over a period of time, which has linked the stock market and foreign exchange market strongly. Assumption behind the study is that the decrease in stock prices causes' reduction in the earnings of investors with in turn leads to lower demand for money with lower interest rates. This fall in

interest rates encourages capital outflows leading to increase in exchange rates (depreciation) caused due to increase in supply of rupee and demand for dollar. Here the direction of causality is from stock prices to exchange rates, where stock prices is expected to lead exchange rates with negative correlation and interest rates with positive correlation whereas interest rate is expected to affect exchange rate with negative correlation. On the other hand multinational firms' stock prices are directly affected by change in foreign exchange rates which will affect the value of its firms operation, consequently leading to current account imbalance. In former case stock market leads foreign exchange market with negative correlation and in later case foreign exchange market leads stock market with positive correlation and the relationship between stock market and stock futures market is explained through price discovery function in futures market. The main crust of this paper lies on studying such causal relationship between stock index futures and forex market in Indian context.

There are two channels to understand the relationship between the two markets, direct channel and indirect channel. Direct channel is explained by trading of foreign investors in futures market, which might lead to fluctuation in exchange rate. Indirect channel can be explained by price discovery function between stock futures market and stock cash market and relationship between stock market and foreign exchange market as reported above. Based on such relations, effects of index futures on foreign exchange market might be significant.

Fig 1: Relationship between Nifty Futures and Foreign Exchange Market

Objectives
The main objective of this study is to find out whether there exists any significant relationship between index futures market and foreign exchange market in India and to what extent the fluctuations in foreign exchange rate can be explained by changes in index and index futures trading.

Methodology
Study uses daily closing prices of CNX Nifty and Rupee/Dollar exchange rate for a period from January 1, 2005 till December 31, 2013. For futures prices, 1 month contract prices are used, with total 2055 observations. Firstly, Unit root test is conducted to see if data included in the study are stationary or not. Next to check whether there exists any causal relationship between the variables, Granger Causality test has been used for determining whether one time series is useful in forecasting another. Then a simple regression model is run using log values of the variables to show the extent of impact of independent variables on dependent variable.

Analysis and Interpretation
The following table gives details of descriptive analysis of dependent and independent variables in the study.

Table 1: Descriptive Statistics

	Forex	**Nifty**	**Nifty Futures**
Mean	47.44383	4524.556	4527.151
Median	45.81000	4899.300	4898.600
Maximum	68.36110	6363.900	6391.750
Minimum	39.27000	1909.000	1891.200
Std. Dev.	5.606718	1231.812	1239.722
Skewness	1.068845	-0.581463	-0.573252
Kurtosis	3.802630	2.146797	2.139705
Jarque-Bera	446.4434	178.1302	175.9233
Probability	0.000000	0.000000	0.000000
Sum	97497.07	9297962.	9303295.
Sum Sq. Dev.	64568.07	3.12E+09	3.16E+09
Observations	2055	2055	2055

Source: Author Compilation

For conducting Granger Causality test data needs to be stationary. As it can be seen from the following charts data becomes stationary at first difference.
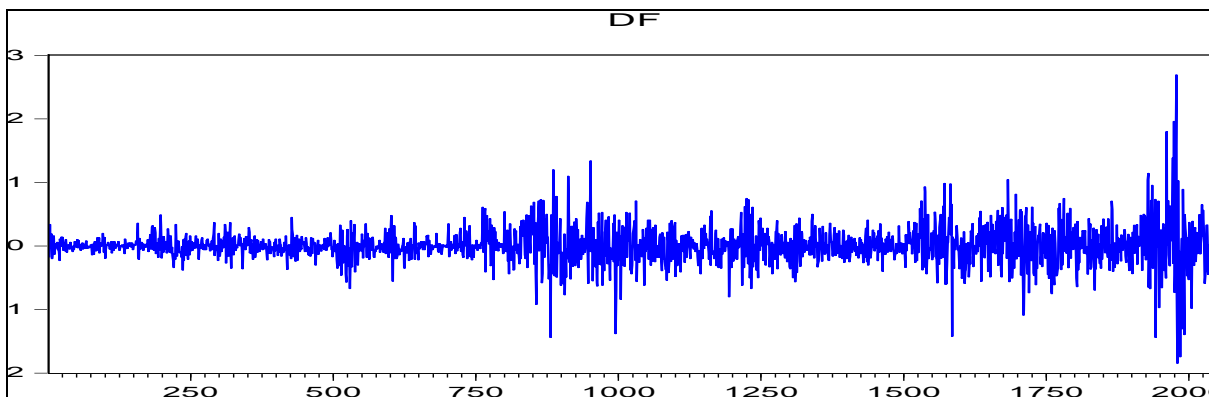

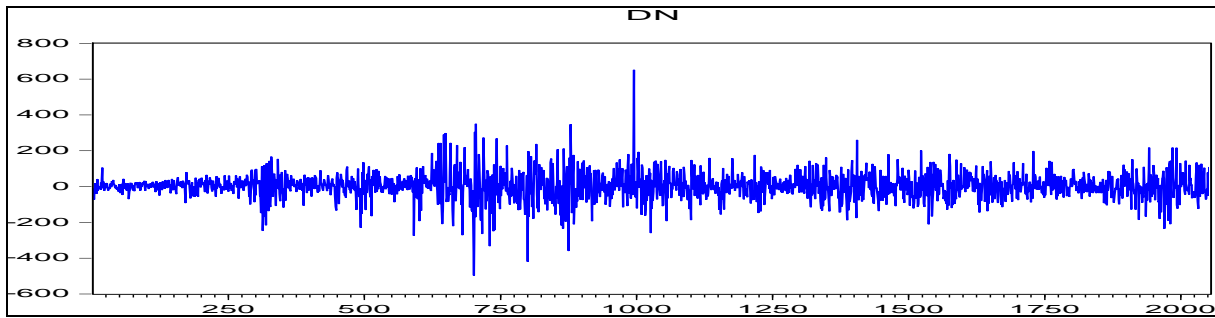**Fig 2:** Differenced Foreign Exchange Rates
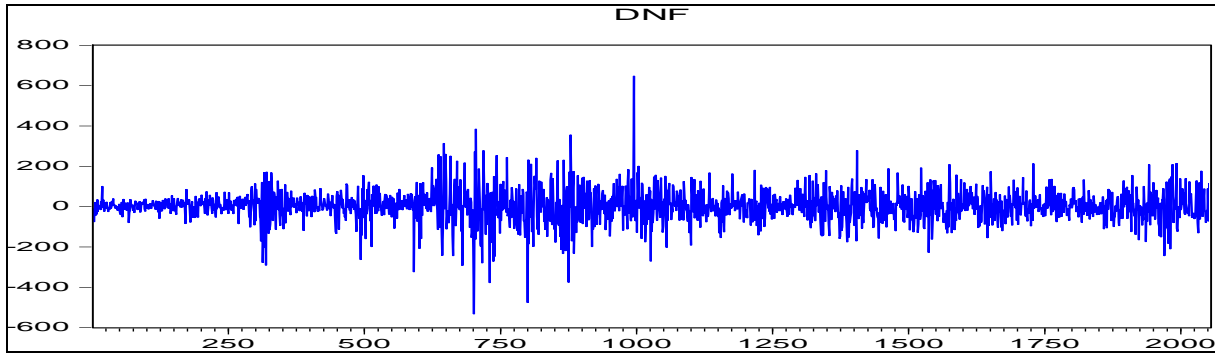
Fig 3: Differenced CNX Nifty prices

Fig 4: Differenced CNX Nifty Future Prices

Following table 2 presents the results of Granger Causality test. The Granger causality (1969) indicates that one time series is useful in forecasting another, in other words that current value of one variable is caused by past value of other variables.

Table 2: Granger Causality Test

Null Hypothesis	Obs	F-Statistic	Prob
NIFTY does not Granger Cause FOREX		24.9847	3.E-20
FOREX does not Granger Cause NIFTY	2051	3.57024	0.0066
FOREX does not Granger Cause NIFTY_FUTURES		26.8854	9.E-22
NIFTY_FUTURES does not Granger Cause FOREX	2051	3.64922	0.0057
NIFTY_FUTURES does not Granger Cause NIFTY		0.68602	0.6016
NIFTY does not Granger Cause NIFTY_FUTURES	2051	3.19598	0.0126

*Source***:** Author Compilation

The results indicate that Nifty and Nifty futures contribute in forecasting the fluctuations in Rupee/ Dollar exchange rate. Also it is significant that fluctuations in exchange rate causes change in Nifty futures and Nifty prices. But there exists no bi directional causality between Nifty and Nifty Futures, only Nifty price change causes change in Nifty futures market. The analysis supports direct channel of linkage between Nifty futures and foreign exchange market. But the indirect channel of linkage does not hold significant because relationship between stock cash market and stock index futures market cannot be explained by a price discovery function in futures market. To analyze the extent of impact of Nifty Futures and Nifty trading on foreign exchange market, following multiple regression model has been run.

Table 3: OLS Model

Dependent Variable: LF			
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	3.250193	0.070088	46.37325	0.0000
LNF	7.076933	0.713138	9.923649	0.0000
LN	-7.004962	0.717378	-9.764674	0.0000
R-squared	0.144019	Mean dependent var		3.852999
Adjusted R-squared	0.143185	S.D. dependent var		0.112780
S.E. of regression	0.104394	Akaike info criterion		-1.679827
Sum squared resid	22.36299	Schwarz criterion		-1.671611
Log likelihood	1729.022	Hannan-Quinn criter.		-1.676814
F-statistic	172.6254	Durbin-Watson stat		0.036997
Prob(F-statistic)	0.000000			

*Source***:** Author Compilation

Since r^2 is just 14%, fluctuations in exchange rates can be better explained by many other factors such as macroeconomic factors. 1% increase in Nifty causes 7% decrease in foreign exchange rates and vice versa. Whereas 1% increases in Nifty Futures causes 7.07% increase in foreign exchange rate. Therefore when stock is lead variable it has negative relationship with foreign exchange market.

Conclusion
Many studies have focused on relationship study between financial markets, especially between bond, stock and foreign exchange market. Especially, due to liberalization stock market and foreign exchange market have become highly integrated. Papers have also examined the linkage between spot and futures market in respective equity and foreign exchange markets. Barely studies have been done by combining the two frameworks. This study tries to fill the gap by studying the linkage between equity futures and foreign exchange market. This linkage may be caused in two ways, one through direct channel, which may be explained by trading of foreign investors in futures market and second is through indirect channel, where the relationship between index futures and foreign exchange market is caused due to price discovery function in futures market and linkage between stock cash market and foreign exchange market. The findings of Granger Causality test say that Nifty Futures causes Nifty and vice versa, which supports the direct channel of relationship existing between the two variables. But, the indirect relationship does not hold significant because nifty futures does not cause nifty, meaning that the relationship between stock cash market and stock index futures market cannot be explained by a price discovery function in futures market. From the OLS model it can be said that Nifty has a negative relationship with Foreign Exchange market, when stock market is a lead variable. And Nifty futures market has a positive relationship with Foreign Exchange market. This study can further be extended by including macroeconomic variables and their impact on the relationship between Nifty Futures market and Foreign Exchange market.

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