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INTRODUCTION

REVIEW OF LITERATURE

NEED/IMPORTANCE OF THE STUDY

STATEMENT OF THE PROBLEM

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HYPOTHESES

RESEARCH METHODOLOGY

RESULTS & DISCUSSION

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RECOMMENDATIONS/SUGGESTIONS

CONCLUSIONS

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APPENDIX/ANNEXURE

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CONTRIBUTIONS TO BOOKS

- Sharma T., Kwatra, G. (2008) Effectiveness of Social Advertising: A Study of Selected Campaigns, Corporate Social Responsibility, Edited by David Crowther & Nicholas Capaldi, Ashgate Research Companion to Corporate Social Responsibility, Chapter 15, pp 287-303.

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- Schemenner, R.W., Huber, J.C. and Cook, R.L. (1987), "Geographic Differences and the Location of New Manufacturing Facilities," Journal of Urban Economics, Vol. 21, No. 1, pp. 83-104.

CONFERENCE PAPERS

- Garg, Sambhav (2011): "Business Ethics" Paper presented at the Annual International Conference for the All India Management Association, New Delhi, India, 19–22 June.

UNPUBLISHED DISSERTATIONS AND THESES

- Kumar S. (2011): "Customer Value: A Comparative Study of Rural and Urban Customers," Thesis, Kurukshetra University, Kurukshetra.

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WEBSITES

- Garg, Bhavet (2011): Towards a New Natural Gas Policy, Political Weekly, Viewed on January 01, 2012 http://epw.in/user/viewabstract.jsp

TRANSMISSION OF INFORMATION BETWEEN INDIAN FUTURES AND CASH MARKETS

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ABSTRACT

The proportion of transmission of information from futures market to cash market in India is analysed with the help of VAR variance Decomposition model by using the daily data from S&P CNX Nifty and its underlying asset Nifty-50 for the period of 12th June 2000 – 30th June 2011. Open Interest, Trade Volume, Number of Contract, Volatility series of futures return, spot return and futures return are the variables considered for the analysis. Basic behavior of the variables are estimated through descriptive statistics, line graphs and unit root tests and the final estimation is made with VAR- Variance decomposition model. This study fills the literature gap of the proportion of transmission of information from one variable to another variable in futures and cash market in India. Further it gives and prediction efficiency of the different component in Indian Futures market. Spot from spot behavior of Cash market and Spot to futures market behavior of Futures market are proved by the study. The minor role of trade volume and open interest to predict the movement of the futures market is also revealed here.

KEYWORDS

Information transmission, Shocks and responses, Time Lags, VAR- Variance Decomposition.

INTRODUCTION

Primarily derivatives markets are identified for price discovery, arbitrage and risk protection or risk reduction. Futures market is the market which basically depends on the spot market. Theoretically, both the spot and futures market must move together and adjust or respond to the information and events in a similar manner. According to the empirical result of the studies, Indian spot market and future market are integrated and hence there is a possibility of hedging between Indian spot and futures markets. The futures price is determined by many factors such as the market price of the underlying asset, the money market rate and expected dividend on the underlying asset during the life of the future Supply or demand, movement of futures market and the other aspects of futures market like number of contract and trade volume of futures contract. The movement of the futures market can be predicted with the help of other factors from the futures market and spot market. Vipul (2008) made an attempt to investigate the role of some variable from the futures market that can predict others. Each variable from the futures market and variable from the spot market also can predict the movement of other variables in the futures market. The relationship between variables like open interest, trading volume, turnover, volatility and futures return can be taken as the way in which the movement of one variable is related to another variable, then this relationship can be used to predict the movement of another variables. If some of the variables are able to predict the movement of another variable, it can be said that it is the determinant of that variable. The positive and contemporaneous relationship between price volatility and trading volume are found by Clerk (1973), Lawrence and Harris (1986).

Very strong relationship between futures index trading and the liquidity of its underlying market shows that the trading of stock index futures enhances the liquidity of the underlying stocks (Tina. M. Galloway and Miller 1997). The trading between futures and its spot market also enhances the liquidity of its trading. The role of arbitrage process in the index futures helps to increase the trading volume and its liquidity. Danthin (2003) and Edward (2006) argued that index related trading strategies like index arbitrage will increase liquidity. Trading between spot and futures market enhances the trading volume and liquidity of the index trading. Variables from the futures market can also be used as the element which may predict the movement of futures return. Open interests, turn over and number of contract are the representatives of trading volume of the futures market in quality and quantity manner.

The relationship between different variables in the futures market reveals the ability of each variable to reflect the information flow to the market and its role in determining the futures markets movement. Information flow, measured by trading volume has a positive relationship with volatility while market depth measured by open interest has an inverse relationship with volatility (Bessembinder and Seguin 1992, P. Sakthivel and B.Kamaiah 2009). The importance of trading volume in the form of number of contract or turn over can be traced from many studies in the literature. The level of flow of information to the market can be traced and it may be used as the proxy for the liquidity of the market. Volatility and trading volumes are inter related which will provide lot of information on the market movement. Trading volume is proxy for the flow of information in to the market, trading volume and return volatility are driven by the same factors (Lastrapes 1990, P. Sakthivel 2009). Literature proves the point those variables both from spot and futures markets play the role of passing information and their relationship helps to provide one with another. Therefore in order to identify the role of each variable on the futures return and find the level of influence of each one to the futures return, the VAR system is used. The literature found that open interest, trading volume and volatility are playing their own role in the futures market (Cambell et al (1993) Gwilym et al (1999), Spyrou (2005), Julio 2008, Puja Padhi (2009), and Pratap Chandra Pati (2010).

A lead-lag effect describes the situation where one variable that is leading variable correlated with the values of another variable that is lagging at later time. The analysis of lead lag relationship between these prices reveals the chances of making profit or loss. Volatility, trading volume and the seasonality are the factors which may affect the leading variable effectively. The proportion of shocks reflected by the same variable and transmitted to other variables is shown through the variance decomposition function. Impulse responses and variance decomposition analysis explain economic significance in addition to statistical significance (Brajesh Kumar and P.Singh 2009). The interrelationship between futures return, spot return, open interest, turn over, number of contract and futures market volatility are discussed by this study with the help of variance decomposition methodology. This study provides information on the proportion of transmission of information from futures market to cash market and the same from one indicator to another indicator in the futures market itself in India.

REVIEW OF LITERATURE

The role of different aspects from futures market and its impact on the movement of the market are analysed by the researchers in different periods and in various markets. Hoa Nguyen and Robert Faff (2002) made a study on the determinants of derivatives by Australian companies and found a positive relationship between firm's size and the likely hood of derivatives usage. In the same year Stephen P.Ferris,Hun Y.Park and Kwangwoo Park made an investigation on volatility, open interest ,volume and arbitrage by using evidence from the S&P 500 futures market. The informational content of open interest was empirically investigated by the researchers by applying different econometrics models with data from various markets. Yang, David a. Bessler and Hung-Gay Fung (2004)

investigated the informational role of open interest in futures markets by using Johansen Cointegration and Error Correction Model then revealed the common long-run information of open interest with the futures price. Jian Christos Floros (2007) found open interest as a proxy in the Greece Stock index Futures Market by applying Johansen model.

Informational content of trading volume and open interest was empirically estimated in Indian market by Sandeep Srivastave (2003) and Kedar Nath Mukherjee and R.K. Mishra (2004) then confirmed the prediction power of open interest in predicting the spot price index. Volatility content of futures market and its impact on other content like open interest, trade volume and price movements were studied by Hongyi Chen, Laurence Fung and Jim Wong (2005) and found that open interest and cash market turnover are positively correlated. Stephane. M. Yen and Ming. Hsiang Chen (2010) studied the relationship between open interest, volume and volatility in Taiwan futures markets and IGARCH models results explained that the significance of in sample relationship among the futures daily volatilities, the lagged total volume. Suchismita Bose (2007) attempted to understand the volatility characteristics and transmission effects in the Indian stock index and index futures markets by using daily data. Vipul (2008) results revealed that any increase or decrease in mispricing did not lead to the significant change in volatility, volume or open interest for any of the futures or the underlying shares. A positive and highly statistically significant result of GJRGARCH model was reveled from the Indian market on futures trading and volatility by P.Sakthivel and B.Kamaiah (2009). J. Lucia and Angel Pardo (2010) found that the ratio of volume to absolute change in open interest. Pratap Chandra Pati and Prabina Rajib (2010) revealed the evidence of time varying volatility which exhibits clustering high resistance and predictability in the Indian futures markets.

Anadrew W. Alford and James R. Boatsman (1995) predicted long term stock return volatility for accounting and valuation of equity derivatives. No significant effect on volatility following the introduction of futures trading was found by Spyros.I.Spyrou (2005) in Athens stock Exchange. Epaminontas Katsikas (2007) made a study on volatility and autocorrelation in European futures markets. Evidence suggested that index futures return in Europe markets behave similarly. Paul Dawson and Sotiris. K. Staikouras (2009) used GARCH (1, 1) estimation to find normal market conditions volatility derivatives trading under lowering the underlying assets. The GARCH model result of Jinliang Li (2010) from U.S market indicated that the quarterly innovation to turn over does not possess explanatory power to the daily volatility of the futures. Claudio Albanese and Adel Osseiran (2007) found that volatility derivatives were particularly well suited to be treated with moment methods. Lech.A.Grzelak, Cornelis.W.Dosterlee and Sacha Van Weeren (2009) made extension of Stochastic Volatility Equity Models with Hull- White Interest Rate Process.

About Indian Market, M. Thenmozhi (2002) made a study on futures trading, information and spot price volatility of futures contracts by using GARCH model. Ash Narayan Sah and G. Omkarnath (2005) studied the significant changes in the volatility after the introduction of derivatives trading by applying ARCH model. GJR- GARCH and EGARCH model were applied to find the asymmetric response of volatility to news in Indian stock market by Puja Padhi (2007). Vasilieios Kallinterakis and Shikha Khurana (2008) identified Volatility as the factor which maintains significant asymmetries in Indian Market. .S. Bhaumik, M.Karanasos and A. Kartsaklas (2008) had conducted a study on derivative trading and the volume volatility link in the Indian stock market with AR-FI –GARCH Model. Mayank Joshipura (2010) showed the effect of introduction of derivatives trading on average daily excess return of underlying stocks and portfolios in India.

STATEMENT OF THE PROBLEM

It is found that almost all studies have considered only one or two variables to assess the futures market for a particular period. Conclusions were drawn based on that variable alone without including other important variables from futures market. It is not found that the study which aims to make a depth analysis on the transmission of information from one variable to another variable by using VAR Variance decomposition model.

OBJECTIVES OF THE STUDY

To estimate the proportion of transmission of information from futures market to cash market in India.

HYPOTHESIS OF THE STUDY

H_o1 : There is no enough level of transmission of information from spot market to futures market.

H_o2: Determinants of Futures market such as Open interest, Turn Over, Number of Contract and Volatility of futures market are not having enough level of information transmission from one to another.

IMPORTANCE OF THE STUDY

On the basis of review of literature, it is found that lot of studies have been done on the futures market in India. Each study clearly analyzed and examined different aspects of futures market in depth. While comparing the studies from abroad and India lot of differences are seen in the movement of market, link between futures market and its underlying market and in the basic structure of variables used. This study makes an attempt to fill the research gap by considering more number of variables such as futures return, spot return, open interest, trading volume, number of contracts. This research work provides basic knowledge on the movement of Indian futures market and its underlying market with the transmission of information from one component to another.

DATA OF THE STUDY

In order to access the relationship between spot and futures market in India, daily closing indices of Nifty spot and Nifty futures from 12th June 2000 to 30th June 2011 are included. Variables from futures markets are futures market return (FUT) is the representative of futures market, number of contract (CONT) , turnover (TURN), both are considered as a proxy for trading volume, open interest (OI) which is the indicator of market depth and hedging efficiency of the market, volatility of the futures return (VOL) and spot market return (SPOT). Variables are taken from S&P CNX Nifty daily closing values and volatility series of futures return which is estimated through GARCH (1,1) methodology. Spot return is obtained from the closing index of the underlying value of Nifty -50.

ECONOMETRICS MODELS USED IN THE STUDY

VAR MODEL

$$Y_t = C_0 + \sum_{k=1}^{p} A_k Y_{t-k} + \varepsilon_t \quad , \; E(\varepsilon_t, \varepsilon_t^1) = \Omega$$

Where Y_{t-k} is a $nx1$ column vector of n stationary variables at time t-k, $C0$ is a $nx1$ column vector of constants, A_k is an nxn matrix of coefficients, p is the number of lags, and ε_t is a $nx1$ column vector of white noise innovation terms with symmetric and positive definite variance- covariance matrix Ω. VAR models were popularized in econometrics by Sims (1980) as a natural generalization of univariate autoregressive models. VAR is a systems regression model that can be considered a kind of hybrid between the univariate time series models and the simultaneous equation models. The simplest case that can be entertained is a bivariate VAR where there are only two variables y_{1t} and y_{2t}, each of whose current values depend on different combinations of the previous k values of both variables and error terms. This could be written as

$$y_{1t} = \beta_{10} + \beta_{11} y_{1y-1} + \alpha_{11} y_{2t-1} + u_{1t} \quad (3)$$

$$y_{2t} = \beta_{20} + \beta_{21} y_{2t-1} + \alpha_{21} y_{1t-1} + u_{2t} \quad (4)$$

There are g=2 variables in the system. Extending the model to the case where there are k lags of each variable in each equation is also easily accomplished.

VARIANCE DECOMPOSITION

Variance decompositions model a slightly different method for examining VAR system dynamics. They give the proportion of the movements in the dependent variables that are due to their own shocks, versus shocks to the other variables. A shock to their i^{th} variable will directly affect that variable of course, but it will also be transmitted to all the other variables in the system through the dynamic structure of the VAR. Variance decomposition determine how much of the s-step head fore cast error variance of a given variable is explained by innovations to each explanatory variables for s=1, 2, 3,.... in practice, it is usually observed that own series shocks explain most of the errors variances of the series in a VAR. Runkle (1987) argues that confidence bands around the impulses response and variance decomposition should always be constructed. Since unrestricted VARs are overparameterized, they are not particularly useful for short term forecast. However, understanding the properties of the forecast errors is exceeding helpful uncovering interrelationships among the variables in the system. The coefficients of A_0 and A_1 and wanted to forecast the various values of x_{t-i} conditional on the observed value of x_t taking the conditional expectations of *xt+1*, we can obtain

$$E_t x_{t+1} = A_0 + A_1 x_t$$

It is noted that one step ahead forecast error is $x_{t+1} - E_t x_{t+1} = e_{t+1}$. If we take conditional expectations, the two steps ahead forecast error is $e_{t+2} + A_1 e_{t+1}$ more generally, it is easily verified that the *n*-step-ahead forecast is

$$E_t x_{t+n} = (I + A_1 + A_1^2 + ... + A_1^{n-1})\, A_0 + A_1^n x_t$$

and that the associated forecast error is

$$e_{t+n} A_1 e_{t+n-1} + A_1^2 e_{t+n-2} + ... + A_1^{n-1} e_{t+1} \qquad (5)$$

The VMA and the VAR models contain exactly the same information but it is convenient to describe the properties of the forecast errors in term of the $\{\varepsilon_t\}$ sequences. If the conditional forecast *xt+1*, the one- step- head the forecast error is $\phi_0 e_{t+1}$. In general,

$$x_{t+n} = \mu + \sum_{i=0}^{\infty} \phi_i \varepsilon_{t+n-i}$$

So that the *n*- period forecast error $x_{t+n} - E_t x_{t+n}$ is

$$x_{t+n} - E_t x_{t+n} = \sum_{i=0}^{n-1} \phi_i \varepsilon_{t+n-i}$$

Denoting the n-step- ahead forecast error variance of y_{t+n} as $\sigma_y(n)^2$.

$$\sigma_y(n)^2 = \sigma_y^2 [\phi_{11}(0)^2 + \phi_{11}(1)^2 + ... + \phi_{11}(n-1)^2] + \sigma_z^2 [\phi_{12}(0)^2 + \phi_{12}(1)^2 + ... + \phi_{12}(n-1)^2]$$

Because all values of $\phi_{jk}(i)^2$ are necessarily non negative, the variance of the forecast error increase as the forecast horizon n increases. Note that it is possible to decompose the *n*-step –ahead forecast error variance into the proportions due to each shock. The proportions of $\sigma_y(n)^2$ due to shocks in the $\{\varepsilon_{yt}\}$ and $\{\varepsilon_{zt}\}$ sequences are

$$\frac{\sigma_y^2 [\phi_{11}(0)^2 + \phi_{11}(1)^2 + ... + \phi_{11}(n-1)^2]}{\sigma_y(n)^2} \quad \text{and} \quad \frac{\sigma_z^2 [\phi_{12}(0)^2 + \phi_{12}(1)^2 + ... + \phi_{12}(n-1)^2}{\sigma_y(n)^2}$$

The forecast error variance decomposition gives the proportion of the movements in a sequence due to its own shocks versus shocks to the other variables. Variance decompositions can be useful tools to examine the relationship among economic variables. If the correlations among the various innovations are small, the identification problem is not likely to be especially important.

RESULTS ANALYSIS AND DISCUSSION

Table 1 shows the summary statistics of variables included in the study periods. Summary statistics provides the basic behavior of variables individually. Nifty SPOTR, FUTR, OI, CONT, TURN and VOL are the variables included in the study. Time series data expected to have variation due to many factors which have an effect on the market.

SUMMARY STATISTICS

TABLE 1: SUMMARY STATISTICS OF VARIABLES

	SPOTR	FUTR	OI	CONT	TURN	VOLA
Mean	0.000497	0.000495	15.79850	11.13658	12.06697	0.000313
Median	0.001346	0.001001	16.65086	12.07817	13.22067	0.000186
Std. Dev.	0.016610	0.017517	1.773199	2.477791	2.503864	0.000414
Skewness	-0.30216	-0.47405	-1.29299	-1.14225	-1.1618	5.424452
Kurtosis	11.08915	12.00970	3.956379	3.311294	3.179561	46.58532
Jarque-Bera	7569.688	9441.874	874.5356	611.5433	624.8307	232082.6
Probability	0.0000	0.0000	0.00000	0.00000	0.00000	0.00000
Observations	2761	2761	2761	2761	2761	2761

Summary statistics reveal that the mean, median and standard deviation of futures returns are positive, indicating that the investors are getting returns and it is negatively skewed (-0.474) and peakedness of the distribution is showed through kurtosis (12.009), which is far from the basic value of 3. Jarque Bera test value (9441.874) shows that the distribution is asymmetric and which is supported by the probability value presented. Other variables included in the study have non normality distribution. The summary statistics of this study shows the asymmetric return in futures and spot market which is supported by the findings of Fama (1965), Stevenson and Bear (1970), Kendull and Hill (1995) Chen (1996) Reddy (1997) Kamath et al. (1998) and Kapil Gupta et al. (2009). Finding of Karpoff (1987) also support the theoretical back ground of this distribution. The risk averse nature of traders in a speculative asset may be a prominent reason for the asymmetric returns (Moolman, 2004). Diagler and Wiley (1999), finds that high degree of volatility in speculative market, both optimistic and pessimistic views of traders to information causes expected variation in prices.

STATIONARITY OF VARIABLES

Variables included in the study have different characteristics. Return from spot and futures market is the first difference price series of S&P CNX Nifty and all other variables are at their level form. The volatility series of futures return is generated through the application of GARCH (1, 1) model. Prior to further using econometrics models there is a need to examine the stationarity of each individual time series as most data are non- stationary. It is important to make sure that the variables are stationary because the assumptions for asymptotic analysis in granger stationarity of variables test will be valid.

TABLE 2: RESULTS OF STATIONARITY TESTS APPLIED ON VARIABLES INCLUDED IN THE STUDY

Variables	Level	
	ADF	PP
Spotr	-12.45741**	-48.67637**
Futr	-12.52330**	-51.13509**
OI	-4.422677**	-6.836442**
Cont	-3.000871**	-6.426959**
Turn	-2.934808**	-5.695540**
Vola	-7.885084**	-11.23244**

*** indicates the significance at 1% level, ** denotes 5% level of significance. AIC criterion is used to select lag length.

From this table, it is clear that variable used for that analysis are stationary in its level form and both unit root test such as ADF and PP test result confirms the result.

VAR LAG ORDER SELECTION CRITERIA

TABLE 3: VAR LAG ORDER SELECTION CRITERIA FOR MODELS USED IN THE STUDY

Lag	LogL	LR	FPE	AIC	SC	HQ
0	28913.94	NA	3.12e-17	-20.97818	-20.96529	-20.97353
1	45414.09	32916.48	2.02e-22	-32.92604	-32.83580	-32.89344
2	45756.67	681.9375	1.62e-22	-33.14853	-32.98094*	-33.08798
3	45873.25	231.5524	1.53e-22	-33.20700	-32.96206	-33.11852
4	45964.37	180.5954	1.47e-22	-33.24701	-32.92472	-33.13058*
5	46029.91	129.6042*	1.44e-22*	-33.26844*	-32.86880	-33.12407

* indicates lag order selected by the criterion at 5% level of Significance.

Table 3 provides result of VAR order selection criteria for models to be used to find the proportion of transmission of information between Indian futures and cash markets. The optimum lag length 5 is selected at 5% level of significance on the basis of Likelihood Ratio, Final Prediction Error and Akaika Information Criterion for the study. This lag length can make the variables in to homogeneous characteristics and to avoid the autocorrelation problem.

PROPORTION AND TRANSMISSION OF SHOCKS BETWEEN INDIAN FUTURES AND CASH MARKETS

The proportion of change in one variable due to the shock of that variable itself and the transmission of proportionate change to other variable can be analyzed with variance decomposition model. It provides more clarity on the proportionate change in each variable due to shocks in the same variable. Variance decomposition or forecast error variance decomposition indicates the amount of information each variable contributes to the other variables in vector auto regression models. It determines how much of the forecast error variance of each of the variable can be explained by exogenous shocks to the other variables.

Table 4 gives the result of transmission of shocks in proportion measured through variance decomposition. On the first day the shock of the spot return is not transmitted to other variables instead the spot return itself reflects the same. While increasing the time lag, it is seen that the proportion of transmission of change in spot return variable to other variables in different time lags. On the 10th day the actual shock in the spot return and its change in spot return itself is around 99%, futures return and other variables from futures market do not have the shock from spot market. This situation is formed as spot on spot. It reveals that underlying spot market do not provide information to the futures market. Shocks are contained spot itself. There is a spot on spot situation prevailing.

TABLE 4: RESULTS OF VARIANCE DECOMPOSITION OF THE VARIABLE SPOTR

Time Lag	SPOTR	FUTR	OI	CONT	TURN	VOLA
1	100.0000	0.000000	0.000000	0.000000	0.000000	0.000000
2	99.92051	0.016000	0.005009	0.001004	0.009389	0.048092
3	99.76280	0.031258	0.054560	0.003301	0.067703	0.080375
4	99.50293	0.044985	0.062811	0.083102	0.183537	0.122637
5	99.27779	0.143454	0.169381	0.085313	0.200258	0.123802
6	99.25263	0.151275	0.172138	0.087475	0.203665	0.132817
7	99.21131	0.179685	0.173493	0.089895	0.203795	0.141818
8	99.20287	0.182497	0.173487	0.090699	0.203952	0.146493
9	99.19067	0.182475	0.174040	0.096191	0.204683	0.151941
10	99.18449	0.183330	0.175256	0.096524	0.205410	0.154993

As against the previous table, table.5 shows that the shock of futures market is transmitted to spot market immediately. On the first day itself around 97% shocks is transmitted to spot and only 2.84% is in futures market. When time lag increases the proportion of transmission of the shocks to spot market is reducing and very nominal level is transmitted to other variables. On the 10th day of time lag, around 4% shock of futures market is reflected by future itself and around 96% is transmitted to spot market return. All other variables get very minimal shocks from futures market. In other words, shocks of futures markets are transmitted to spot and not in the futures market itself. This is termed as futures on spot.

TABLE 5: RESULTS OF VARIANCE DECOMPOSITION OF THE VARIABLE FUTR

Time Lag	SPOTR	FUTR	OI	CONT	TURN	VOLA
1	97.15292	2.847076	0.000000	0.000000	0.000000	0.000000
2	96.54143	3.395382	0.013865	0.000227	0.000682	0.048410
3	96.33824	3.460367	0.044283	0.000242	0.080547	0.076324
4	96.08854	3.453724	0.049166	0.059177	0.194335	0.155058
5	95.83446	3.584582	0.126201	0.076525	0.219915	0.158314
6	95.79613	3.588786	0.134797	0.084351	0.222487	0.173445
7	95.72601	3.648415	0.135356	0.085753	0.222694	0.181772
8	95.72002	3.648681	0.135343	0.086313	0.222854	0.186787
9	95.71082	3.648361	0.135540	0.090834	0.223509	0.190933
10	95.70644	3.648967	0.136353	0.090834	0.224210	0.193198

Open interest representing the market depth shows that any shock in it is borne by the market depth itself, it does not pass it to any other variables including to the returns from spot and futures market. This trend is changed when time lag is increased. On the 10th day, it is found that 10% of shocks are transmitted to volume and return from futures market and some proportion to return from spot. Which means that, any event that has effect on market depth of futures market, may have effect on return in the long run, not immediately.

TABLE 6: RESULTS OF VARIANCE DECOMPOSITION OF THE OI

Time Lag	SPOTR	FUTR	OI	CONT	TURN	VOLA
1	0.087065	0.464530	99.44840	0.000000	0.000000	0.000000
2	0.061570	1.239441	98.64759	0.016334	0.003670	0.031392
3	0.079296	1.745264	97.89328	0.163646	0.007076	0.111440
4	0.205147	2.040094	96.64210	0.841023	0.025832	0.245808
5	0.336288	2.369182	95.69051	1.154656	0.077716	0.371643
6	0.680082	2.400990	94.54202	1.795161	0.107435	0.474316
7	0.849030	2.353534	93.60586	2.510732	0.121124	0.559722
8	0.931795	2.303604	92.67432	3.305188	0.125066	0.660022
9	0.991402	2.271873	91.62532	4.235290	0.125674	0.750442
10	1.032196	2.243528	90.61161	5.143561	0.127458	0.841646

TABLE 7: RESULTS OF VARIANCE DECOMPOSITION OF CONT.

TimeLag	SPOTR	FUTR	OI	CONT	TURN	VOLA
1	3.314841	0.112976	2.265682	94.30650	0.000000	0.000000
2	4.973029	0.106544	2.706104	92.00913	0.010987	0.194211
3	4.866744	0.120636	4.518158	90.11531	0.150308	0.228847
4	4.793630	0.119540	6.196900	88.40222	0.273196	0.214511
5	4.662238	0.151940	6.973511	87.64022	0.289589	0.282503
6	4.191872	0.198332	7.653228	87.37082	0.291850	0.293900
7	3.901827	0.188018	8.407043	86.86389	0.317001	0.322218
8	3.695508	0.179577	9.307782	86.13408	0.341838	0.341215
9	3.507252	0.171664	10.22138	85.38370	0.356100	0.359900
10	3.327767	0.166680	11.00083	84.75213	0.365900	0.386689

This may be termed as depth on depth situation during short period, but in the long run it may be depth on others. This result shows that market depth and speculative activities of the trading cannot be separated. Both are interrelated and change in one affects the other.

Table 7 shows the results of variance decomposition of number of contract as dependent variable for the study. It indicates that 94% change is happened in the number of contract variable itself due to the shock from the same variable. On that moment around 3%, 1%and 2% shocks transmitted to spot market, futures market and open interest respectively. If any events happens to have effect on number of contracts, would have changes in the number of contract itself and some proportion is transmitted to return from spot market and futures market. But this slowly gets changed is time lag increases. Market depth is the sole factor while have impact due to shocks from number of contract. It is observed significantly that change in number of contract had increased effect on return from spot market on the second day and after that the effect got reduced over the time. The close relationship of number of contract and open interest during this period can be understood from this study and it their interconnection is revealed.

The table.8 shows that any shock in turnover is reflected in number of contract and as days pass by market depth is affected. Very negligible effect is seen in the return from spot market. It means that the movement of turnover is predicted by number of contract at that moment. Number of contract is the base for the trading volume and it shows the tendency of the market to response to the new information soon. The inter relationship between turnover and number of contract is seen. Turnover is also taken as the variable which can predict the movement of futures market during the study period.

TABLE 8: RESULTS OF VARIANCE DECOMPOSITION OF TURN.

Time Lag	SPOTR	FUTR	OI	CONT	TURN	VOLA
1	2.181170	0.145222	2.083159	95.22239	0.368061	0.000000
2	2.844747	0.124146	2.528716	93.85457	0.472203	0.175615
3	2.596644	0.149363	4.376952	92.23158	0.436317	0.209140
4	2.389782	0.140549	6.111264	90.75694	0.406288	0.195174
5	2.196794	0.177894	6.912034	90.01739	0.441207	0.254678
6	2.007132	0.224532	7.571891	89.47858	0.455025	0.262842
7	1.871717	0.211184	8.315269	88.85817	0.454178	0.289485
8	1.749948	0.199810	9.209303	88.07959	0.452817	0.308535
9	1.644363	0.189221	10.11286	87.26832	0.456629	0.328609
10	1.561821	0.181427	10.87597	86.56105	0.462238	0.357499

Table 9 explains the result of variance decomposition of volatility as dependent variable during the study period. 99% of shocks in volatility of futures market are explained by the same variable itself. At the same time minimal level of variance of the shock can be predicted by other all variables on happening of that event. As days pass by after the shock, the proportion of predicting variance of the shock is decreasing and more percentage is transmitting to other variables. The shocks in futures market volatility can be predicted by spot market return at 14.97% and the other variables are predicting the shocks in very minimal level. Spot market return will get changed and affected due to volatility in futures market. It means that more speculation in futures market may have effect on the return from spot market. The null hypothesis of the study like there is no enough level of transmission of information from spot market to futures market and determinants of futures market such as Open interest, Turn Over, Number of Contract and Volatility of futures market are not having enough level of information transmission from one to another are rejected on the basis of results of the various decomposition model. This study really gives a picture on the transmission of information from futures and cash market and from cash market to futures market.

TABLE 9: RESULTS OF VARIANCE DECOMPOSITION OF VOLA.

TimeLag	SPOTR	FUTR	OI	CONT	TURN	VOLA
1	0.042328	0.025831	0.170622	0.654221	0.179674	98.92732
2	1.239369	2.371746	0.115349	0.529920	0.117716	95.62590
3	3.490884	2.273988	0.087435	0.475777	0.089578	93.58234
4	6.264057	2.256593	0.073415	0.456744	0.075105	90.87409
5	8.529155	2.328372	0.066815	0.497730	0.072630	88.50530
6	10.81854	2.227328	0.064437	0.517967	0.074066	86.29766
7	12.38084	2.127969	0.065412	0.520124	0.080106	84.82555
8	13.52408	2.071656	0.068523	0.526901	0.085590	83.72325
9	14.32495	2.031407	0.070579	0.536685	0.091635	82.94475
10	14.97685	1.999249	0.073037	0.546676	0.096635	82.30756

CONCLUSION

Variance decomposition result explains the response and shocks of each variable and the proportion of the shock transmitted to the other variables at the moment and one day or within 10 days. This analysis found that spot return, turnover, open interest, futures market volatility and number of contracts are playing a vital role to predict the movement of futures market because of their causal relationship among them. The shock of futures market transmits suddenly to spot market and the spot market bears the shock in itself. The same relation is seen in the case of number of contract and turnover. Around 90% of the reflection of the shock in the turnover comes to the number of contract immediately and the shock of number of contracts is stayed in the same variable itself. All related variables are transmitting their shocks to each other and they are able to predict the movement of other variables up to an extent.

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