

Relationship between Price and Open Interest in Indian Futures Market : An Empirical Study

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An increase in open interest along with an increase in price is said to confirm an upward trend, while an increase in open interest along with a decrease in price confirms a downward trend. This paper is an attempt to examine the relationship between closing price and open interest in Indian stock index futures market. The study investigated the relationship between futures closing price and open interest for the indices BANKNIFTY, MINIFTY, CNXIT, NIFTY and NIFTYMIDCAP50. The evidence of Granger Causality shows that the information of open interest can be used to predict future prices in the long run. Moreover, the long-run information role of open interest is a good indicator for the usefulness of a technical analysis in future markets. Thus, the study provides the financial managers in Indian futures market some very useful input.

JEL: G13, G15

Keywords: Open interest, Futures market, Closing Price, Granger Causality, NIFTY.

Background and Literature Review

A futures contract is an agreement between two parties to buy or sell an asset at a certain time in the future at a certain price. Open interest is the total number of options and/or futures contracts that are not closed or delivered on a particular day. Open interest is a calculation of the number of active trades for a particular market. Here we are concerned about the open interest for futures and it has been evaluated against daily index future closing prices for the sample indices. It is most often used as an indication of the strength behind the market. It is a common belief that the amount of open interest in a particular contract has a bearing on the behavior of the price of the futures contract. This popular perception is put to test in the following research by using Granger causality for change in open interest in futures and the change in the futures prices. Study of future closing indices and open interest is important to determine future price trends. Increasing open interest means that new money is flowing in the market, while declining open interest means that the market is

liquidating and implies that the prevailing price trend is coming to an end. So, knowledge of open interest can prove useful in determining the moves of the market. The use of this analysis can help a trader confirm the trades to be done.

Ever since the introduction of index futures in the Indian markets, there have been a lot of studies that have analyzed the impact of futures trading on the volatility of spot prices. Previous empirical studies show evidence of strong correlations between price volatility and open interest. Christos Floros (2007) examines the relation between price and open interest in Greek stock index futures market. Study focus on the GARCH effects and the long-run information role of open interest. Stephen P Ferris, Hun Y Park and Kwangwoo Park (2002) studies by using a vector autoregressive (VAR) approach, the dynamic interactions and causal relationships among volatility, open interest, trading volume and arbitrage opportunities in the S&P 500 index futures market is examined. It is found that increased

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volatility lowers pricing error. This implies that as market volatility increases, investors sell off their equity and futures positions with relatively larger drops in futures prices. Watanabe, Toshiaki (2001) in his paper examines the relation between price volatility, trading volume and open interest for the Nikkei 225 stock index futures traded on the Osaka Securities Exchange (OSE) using the method developed by Bessembinder and Seguin (1993). Bessembinder and Seguin (1993) study this relationship for eight futures markets and report a negative impact of expected open interest to volatility. They suggest that variations in open interest reflect changes in market depth, while greater market depth leads to lower volatility.

There are also some studies which have been conducted in the Indian context. Nath (2003) studied the behaviour of volatility of twenty stocks and two benchmark indexes in the pre and post derivatives period in India using both static and conditional variance. Shenbagaraman (2003) and Bandivadekar and Ghosh (2003) adopt the univariate GARCH (1, 1) model to examine the impact of introduction of index futures on spot index. Tenmozhi (2002) analyses the volume of spot market volatility before and after the introduction of stock index futures and also studies the lead-lag relation between the futures and the spot returns.

Research Methodology

Objective

The objective of the study is to find out the two way relationship between closing future prices and open interest. Open interest is evaluated against daily index future closing prices.

Hypothesis

- Null hypothesis (H_{01}); futures closing price does not granger causes open interest.
- Second null hypothesis (H_{02}); open interest does not granger cause future closing price.

Sample Size: Collected 2 years data of 5 indices- BANKNIFTY, MINIFTY, CNXIT, NIFTY, NIFTYMIDCAP50. Data includes open interest and index closing price.

Data Collection: Data has been collected from National stock exchange site (<http://www.nseindia.com>). Open interest and closing prices for closing futures price has been taken from historical data of contract wise volume data for futures and options data available on NSE site.

Statistical Tool Applied

In this study Granger Causality test has been used to develop a two way relationship between closing futures prices and open interest.

According to the results obtained if significance level is greater than 0.05 than null hypothesis is not rejected else alternative hypothesis is accepted.

E-Views 7 software is used for the analysis purpose.

Granger Causality: Granger causality is tested in the context of linear regression models. For illustration, consider a bivariate linear autoregressive model of two variables X_1 and X_2 .

$$X_1(t) = \sum_{j=1}^p A_{11,j} X_1(t-j) + \sum_{j=1}^p A_{12,j} X_2(t-j) + E_1(t)$$

$$X_2(t) = \sum_{j=1}^p A_{21,j} X_1(t-j) + \sum_{j=1}^p A_{22,j} X_2(t-j) + E_2(t)$$

The test for Granger causality works by first doing a regression of ΔY on lagged values of ΔY . (Here ΔY is the first difference of the variable Y - that is, Y minus its one-period-prior value. The regressions are performed in terms of ΔY rather than Y if Y is not stationary but ΔY is.) Once the set of significant lagged values for ΔY is found (via t-statistics or p-values), the

regression is augmented with lagged levels of X . Any particular lagged value of X is retained in the regression if (1) it is significant according to a t-test, and (2) it and the other lagged values of X jointly add explanatory power to the model according to an F-test. Then the null hypothesis of no Granger causality is retained if and only if no lagged values of X have been retained in the regression.

Let y and x be stationary time series. To test the null hypothesis that x does not Granger-cause y , one first finds the proper lagged values of y to include in a univariate auto-regression of y :

$$y_t = a_0 + a_1 y_{t-1} + a_2 y_{t-2} + \dots + a_m y_{t-m} + \text{residual}_t$$

Here y_{t-j} is retained in the regression if and only if it has a significant t-statistic; m is the greatest lag length for which the lagged dependent variable is significant.

Next, the auto-regression is augmented by including lagged values of x :

$$y_t = a_0 + a_1 y_{t-1} + a_2 y_{t-2} + \dots + a_m y_{t-m} + b_p x_{t-p} + \dots + b_q x_{t-q} + \text{residual}_t$$

One retains in this regression all lagged values of x that are individually significant according to their t-statistics, provided that collectively they add explanatory power to the regression according to an F-test (whose null hypothesis is no explanatory power jointly added by the x 's). In the notation of the above augmented regression, p is the shortest, and q is the longest, lag length for which the lagged value of x is significant.

The null hypothesis that x does not Granger-cause y is accepted if and only if no lagged values of x are retained in the regression.

III. Empirical Analysis and Results

TABLE 1: Granger Causality Result for BANKNIFTY

Pairwise Granger Causality Tests

Date: 04/20/11 Time: 10:59

Sample: 3/23/2009 5/23/2011

Lags: 2

Null Hypothesis:	Obs	F-Statistic	Prob.
CLOSE does not Granger Cause OPEN_INT	465	20.6447	3.E-09
OPEN_INT does not Granger Cause	CLOSE	0.31200	0.7321

Table 1 presents the results from Granger Causality tests for BANKNIFTY. For BANKNIFTY we do reject the null hypothesis (H01) that a futures closing price does not cause open interest. While the second

null hypothesis (H02) is not rejected, that open interest does not cause future closing price. Therefore, it appears that Granger Causality runs one-way from future closing price to open interest.

TABLE 2: Descriptive Statistics for BANKNIFTY

Close price		Open interest	
Mean	9125.524537	Mean	475939.0528
Standard Error	57.02322931	Standard Error	17380.12437
Median	9220.6	Median	56100

Mode	7098	Mode	50
Standard Deviation	2176.614832	Standard Deviation	663410.981
Sample Variance	4737652.127	Sample Variance	4.40114E+11
Kurtosis	0.113593655	Kurtosis	2.125880752
Skewness	-0.494887851	Skewness	1.53518446
Range	9995.85	Range	3196975
Minimum	3296	Minimum	25
Maximum	13291.85	Maximum	3197000
Sum	13295889.25	Sum	693443200
Count	1457	Count	1457

In Table 2:

- Mean of closing price is 9125.52 and of open interest are 475939.05.
- Standard Error of closing price is 57.023 and of open interest are 17380.12.
- Standard Deviation of closing price is 2176.61 and of open interest are 663410.98.
- Kurtosis of closing price is 0.1135 and of open interest are 2.125.
- Skewness of closing price is 0.494 and of open interest is 1.535.

TABLE 3: Granger Causality Result for MINIFTY

Pairwise Granger Causality Tests

Date: 04/20/11 Time: 11:01

Sample: 3/23/2009 5/23/2011

Lags: 2

Null Hypothesis:	Obs	F-Statistic	Prob.
SERIES05 does not Granger Cause SERIES04	496	3.53635	0.0299
SERIES04 does not Granger Cause SERIES05		79.7078	1.E-30

Table 3 presents the results from Granger Causality tests for MININIFTY. For MININIFTY we do reject the null hypothesis (H02) that a open interest does not causes future closing price and second null hypothesis (H01) is also rejected, that future closing

price does not causes open interest. So, we find that there is a bi-directional effect from open interest to future closing price and future closing price to open interest.

TABLE 4: Descriptive Statistics for MINIFTY

Close price		Open interest	
Mean	5029.52188	Mean	417929.1532
Standard Error	20.6341389	Standard Error	11179.9017
Median	5126.8	Median	188950
Mode	4903.5	Mode	140800
Standard Deviation	795.953718	Standard Deviation	431260.2701
Sample Variance	633542.322	Sample Variance	1.85985E+11
Kurtosis	1.14633684	Kurtosis	-0.75630913
Skewness	-0.9969456	Skewness	0.791260729
Range	3849	Range	1724940
Minimum	2529.7	Minimum	800
Maximum	6378.7	Maximum	1725740
Sum	7483928.55	Sum	621878580
Count	1488	Count	1488

In Table 4:

- Mean of closing price is 5029.52 and of open interest are 417929.15.
- Standard Error of closing price is 20.63 and of open interest are 11179.90.
- Standard Deviation of closing price is 795.95 and of open interest are 431260.27.
- Kurtosis of closing price is 1.1463 and of open interest is -0.7563.
- Skewness of closing price is -0.9969 and of open interest is 0.791260.

TABLE 5: Granger Causality Result for CNXIT

Pairwise Granger Causality Tests

Date: 04/20/11 Time: 10:56

Sample: 3/23/2009 5/23/2011

Lags: 2

Null Hypothesis:	Obs	F-Statistic	Prob.
SERIES05 does not Granger Cause SERIES04	496	8.01152	0.0004
SERIES04 does not Granger Cause SERIES05		1.85528	0.1575

Table 5 presents the results from Granger Causality tests for CNXIT. For CNXIT we do reject the null hypothesis (H02) that open interest does not causes future closing price. While, second null hypothesis

(H01) is not rejected, that future closing price does not cause open interest. Therefore, it appears that Granger Causality runs one-way from open interest to future closing price.

TABLE 6: Descriptive Statistics for CNXIT

Close price		Open interest	
Mean	5342.736	Mean	7243.481
Standard Error	37.23675	Standard Error	324.0605
Median	5819.15	Median	200
Mode	3152.75	Mode	0
Standard Deviation	1436.393	Standard Deviation	12500.51
Sample Variance	2063225	Sample Variance	1.56E+08
Kurtosis	-0.33734	Kurtosis	12.18273
Skewness	-0.81719	Skewness	2.868317
Range	5682.35	Range	107000
Minimum	1991	Minimum	0
Maximum	7673.35	Maximum	107000
Sum	7949992	Sum	10778300
Count	1488	Count	1488

In Table 6:

- Mean of closing price is 5342.73 and of open interest are 7243.48.
- Standard Error of closing price is 37.236 and of open interest are 324.06.
- Standard Deviation of closing price is 1436.39 and of open interest are 12500.51.
- Kurtosis of closing price is -0.3373 and of open interest are 12.182.
- Skewness of closing price is -0.8171 and of open interest are 2.868.

TABLE 7: Granger Causality Result for NIFTY

Pairwise Granger Causality Tests

Date: 04/20/11 Time: 11:02

Sample: 3/23/2009 4/25/2011

Lags: 2

Null Hypothesis:	Obs	F-Statistic	Prob.
OPEN_INT does not Granger Cause CLOSE	437	15.8647	2.E-07
CLOSE does not Granger Cause OPEN_INT		38.2694	5.E-16

Table 7 presents the results from Granger Causality tests for NIFTY. For NIFTY we do reject the null hypothesis (H02) that open interest does not causes future closing price and second null hypothesis (H01)

is also rejected, that future closing price does not causes open interest. So, we find that there is a bi-directional effect from open interest to future closing price and future closing price to open interest.

Table 8: Descriptive Statistics for NIFTY:

Close price		Open interest	
Mean	5026.507524	Mean	10789221.1
Standard Error	20.61691324	Standard Error	335765.026
Median	5116.85	Median	2393250
Mode	4338.35	Mode	27986150
Standard Deviation	762.8257897	Standard Deviation	12423306
Sample Variance	581903.1854	Sample Variance	1.5434E+14
Kurtosis	1.646949458	Kurtosis	-1.0912558
Skewness	-1.038583032	Skewness	0.70315458
Range	3849.5	Range	44201450
Minimum	2531.25	Minimum	2650
Maximum	6380.75	Maximum	44204100
Sum	6881288.8	Sum	1.477E+10
Count	1369	Count	1369

In Table 8:

- Mean of closing price is 5026.50 and of open interest are 10789221.1.
- Standard Error of closing price is 20.61 and of open interest are 335765.02.
- Standard Deviation of closing price is 762.82 and of open interest are 12423306.
- Kurtosis of closing price is 1.6469 and of open interest is -1.091558.
- Skewness of closing price is -1.03858 and of open interest is 0.70315.

TABLE 9: Granger Causality Result for NIFTYMIDCAP50

Pairwise Granger Causality Tests

Date: 04/20/11 Time: 11:04

Sample: 3/23/2009 5/23/2011

Lags: 2

Null Hypothesis:	Obs	F-Statistic	Prob.
SERIES05 does not Granger Cause SERIES04	496	7.32696	0.0007
SERIES04 does not Granger Cause SERIES05		3.12385	0.0449

Table 9 presents the results from Granger Causality tests for NiftyMidcap50. For NiftyMidcap50 we do reject the null hypothesis (H02) that open interest does not causes future closing price and second null hypothesis (H01) is also rejected, that future closing

price does not causes open interest. So, we find that there is a bi-directional effect from open interest to future closing price and future closing price to open interest.

Table 10: Descriptive Statistics for NIFTYMIDCAP50

Close price		Open interest	
Mean	2447.43763	Mean	13459.375
Standard Error	14.3366761	Standard Error	1082.43738
Median	2600.95	Median	0
Mode	2236.4	Mode	0
Standard Deviation	553.031588	Standard Deviation	41754.5921
Sample Variance	305843.937	Sample Variance	1743445960
Kurtosis	0.7532304	Kurtosis	7.6370568
Skewness	-1.2485042	Skewness	3.02867052
Range	2256.6	Range	202200
Minimum	1010.4	Minimum	0
Maximum	3267	Maximum	202200
Sum	3641787.2	Sum	20027550
Count	1488	Count	1488

In Table 10:

- Mean of closing price is 2447.437 and of open interest are 13459.375.
- Standard Error of closing price is 14.336 and of open interest are 1082.437.
- Standard Deviation of closing price is 553.0315 and of open interest are 41754.59.
- Kurtosis of closing price is 0.7532 and of open interest are 7.6370.
- Skewness of closing price is -1.2485 and of open interest are 3.0286.

Conclusion

There are many reasons that traders pay attention to price and open interest. Open interest, or the total number of open contracts, applies primarily to futures markets. It is often used to confirm trends for futures contracts. An increase in open interest along with an increase in price is said to confirm an upward trend, while an increase in open interest along with a decrease in price confirms a downward trend. This study investigated the relationship between future closing price and open interest for the indices BANKNIFTY, MINIFTY, CNXIT, NIFTY and NIFTYMIDCAP50.

relationship between closing future prices and open interest. The causality test show that in 3 out of 5 indices analyzed future closing prices has an effect on open interest and open interest also affect future closing price. In BANKNIFTY it appears that Granger Causality runs one-way from future closing price to open interest. In CNXIT also there is one-way relationship that Granger Causality runs from open interest to future closing price. And in rest of the indices MINIFTY, NIFTY and NIFTYMIDCAP50 we find that there is a bi-directional effect from open interest to future closing price and future closing price to open interest.

Granger Causality test is used to investigate the

These results are consistent with the previous studies

conducted. Our findings strongly suggest that one can use the information of open interest to predict future prices in the long run. The findings of this study have important implication for Indian futures market efficiency. Also, the long-run information role of open interest is a good indicator for the usefulness of a technical analysis in future markets.

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