

Relationship between Futures Price and Open Interest in Stock and Index futures in the Indian Stock Markets: Empirical Analysis

Prof. Anilkumar Garag
Belgaum Institute of Management Studies
15/2, Bhuttramanahatti
Belgaum, India
e-mail: anilgarag@airtelmail.in

Dr. B Ramesh
Department of Commerce
Goa University
Goa, India
e-mail: brames@rediffmail.com

Abstract—The study is an attempt to find a relation between the change in the prices of futures contracts of specific stocks and the change in Open Interest. Participants in the stock markets believe that the amount of open interest in a particular contract has a bearing on the behavior of the price of the contract. This popular perception is put to test in the following research by correlating the change in open interest in stock futures with the change in the futures prices.

Empirical data has been collected from bhav copies published by the National Stock Exchange, India and then the data is subjected to correlation analysis to find out the significance of these parameters. The daily price data and open interest data is collected for sixteen stocks and the index (NIFTY) for a period of 4 years. The correlation between the change in futures price and the change in open interest is calculated for near month contracts of these seventeen futures contracts.

Keywords-Futures, Derivatives, Open Interest, Indian Stock Markets.

I. THEORETICAL BACKGROUND

When a futures contract is traded it creates a contract between a seller of the contract and the buyer of the contract. This also means that the buyer and the seller have a contract open in the market or they have an open position in the market. These open positions can be closed by way of expiry of the contract or by closing out a position in the market. Open interest is defined as the number of contracts existing in a futures market that have not yet been closed out. It is reported as the number of outstanding contracts at the end of a trading day. Open interest increases from zero when a contract is first listed for trading, falling back to zero on the maturity date of the underlying contract when trading ceases. The number of open positions in the market is measured in terms of open interest thus, the open interest in a contract tells us about the popularity of the said contract in the market. Futures markets differ from equity markets in many respects. One specific element of difference has to do with open interest, as there is no directly comparable measure in equity markets. In the latter, there are a number of outstanding shares that may be traded, in which case the trading volume captures the number of shares traded by market participants. Of specific note is the fact that trading volume does not

affect the number of outstanding shares, which is determined by a policy decision of the corporate board, thus increasing or decreasing infrequently.

In the futures markets, however, there is no set number of outstanding contracts to be traded. Contracts come into existence simply by two parties who are interested in buying and selling a contract. There is no direct link between trading volume and open interest, which are effectively stock and flow measures of activity, respectively. For any given trading volume, the open interest for a contract may rise, fall, or remain unchanged.

Participants in the stock markets believe that the amount of open interest in a particular contract has a bearing on the behavior of the price of the contract. This popular perception is put to test in the following research by correlating the change in open interest in stock futures with the change in the futures prices.

II. LITERATURE REVIEW

Sharon Jose (2005) explains in detail, the complete theoretical framework of index futures. The complexities involved in the trading mechanism of such products are also discussed at length. This article captures the pros and cons involved in index futures and their application.

Sandeep Srivastava (2003): has examined the role of certain non-price variables, namely open interest and trading volume, from the stock option market in determining the price of underlying shares in cash market. The article provides support to the view that presence of option market improves the price discovery in underlying asset market.

In the literature studied and further readings it is observed that in depth research in the behavior of futures prices with respect to open interest is lacking and therefore this study is an attempt in filling this gap.

III. RESEARCH PROBLEM DEFINITION

“To find out the relationship between the changes in future prices of stocks and change in open interest on the National Stock Exchange”

IV. OBJECTIVES

To understand the relation between the changes in Open Interest in individual futures contracts to the change in price of futures contract.

To understand the relation between the change in the price of NIFTY to the change in Open Interest in NIFTY Futures contract.

V. HYPOTHESES

- There is a strong and positive correlation between the change in open interest and change in futures price in single stock futures
- There is a strong and positive correlation between the change in open interest and NIFTY futures.

VI. METHOD OF STUDY

A. Data Collection:

- Sixteen liquid stocks were selected on a random basis from the universe of the S&P CNX NIFTY along with the NIFTY itself. The futures prices for the months of the contract expiring in July 2002 to June 2006 were considered for computing the cost of carry in the stock on a daily basis.
- The data collected for the sixteen stocks and NIFTY consisted of 48 files each for each stock. Each file contained the OPEN, HIGH, LOW, CLOSE, Last Traded Price, Settlement Price, Number of Contracts Traded, open interest and Change in Open Interest for the specified Contract. The data was available on an average for about 90 days per contract, from the day of introduction of the contract to the expiry of the contract. It was observed that these contracts were traded thinly until they became near-month contracts. Therefore only the data pertaining to the near month contracts was selected and a single data set of near month contract prices was prepared for each of these stocks. The data for the day of expiry was omitted and data for the next contract was included for the day of contract expiry as the cost of carry is expected to be zero on the contract expiry date for a specific contract.
- The stocks selected were:
 - ACC
 - BAJAJ AUTO
 - BHARTI AIRTEL
 - BHEL
 - CIPLA
 - GAIL
 - HDFC
 - HERO HONDA
 - INFOSYS
 - ITC
 - NALCO
 - RELIANCE
 - STATE BANK OF INDIA
 - TATAMOTORS
 - TATASTEEL
 - TATATEA and
 - NIFTY

B. Limitations of the study

The study is limited to the 17 futures contracts selected for a period of June 2002 to June 2006. The underlying dynamics of the economy were changing fast and the popularity of futures trading were just picking up in these years and therefore this study would at best describe the phase of evolution of futures market in India.

The study aims to find out whether open interest and the change in open interest in a stock futures contract and index contract have any effect on the change in the prices of the contract. There are not many articles written on this subject available in the public domain so this attempt is only to prove a point. The popular market premonition is being tested with limited period data of Indian markets.

C. Data Consolidation

The futures Price data collected from the NSE website (www.nseindia.com) was available in the form of contract wise price volume data for the specific contract. The data for the above said stocks and the NIFTY was downloaded from the NSE website. Data for each stock was contained in a contract-wise file making it upto 48 files per stock. These 48 files were further pruned to one month or near month contract data and then merged into a single data set containing the one month or near month contract price data for the period of 28 June 2002 to 29 June 2006.

The spot prices for all the stocks for the period from 28 June 2002 to 29 June 2006 were downloaded from the NSE website and placed alongside the futures data for the purpose of consolidation.

Thus each data set had the following fields: SYMBOL, EXPIRY DATA, DATE OF TRADE, DAYS TO EXPIRY, FUTURES CLOSE, SPOT CLOSE and OPEN INTEREST.

VII. DATA ANALYSIS

A. Correlation

The following equation of correlation was used to measure the linear correlation between the change in open interest in the near month futures contract and the change in the futures price of the same contract. This statistic is denoted by the roman letter *r* and is given by the following equation.

$$r = \frac{\sum xy - \frac{(\sum x)(\sum y)}{n}}{\sqrt{\left(\sum x^2 - \frac{(\sum x)^2}{n}\right)\left(\sum y^2 - \frac{(\sum y)^2}{n}\right)}} \quad (1.1)$$

In our analysis when *x* denotes CHANGE IN OPEN INTEREST, *y* denotes CHANGE IN FUTURES PRICE.

B. Determination of Change in FUTURES PRICE

The Change in futures price is found by using the following simple equation

$$\Delta F = \frac{F_t - F_{t-1}}{F_{t-1}} \quad (1.2)$$

Where

ΔF is the change in futures price.
 F_t is the closing futures price of the day.
 F_{t-1} is the closing futures price of the previous day.

C. *Determination of change in OPEN INTEREST*

The change in open interest is found by using the following simple equation

$$\Delta OI = \frac{OI_t - OI_{t-1}}{OI_{t-1}} \quad (1.3)$$

Where

ΔOI is the change in Open Interest
 OI_t is the open interest for the day
 OI_{t-1} is the Open Interest for the previous day

D. *Procedure*

- We determine change in Open Interest (x) as given by equation (1.3) for each of the stocks selected.
- We determine change in Futures Price (y) as given by equation (1.2) for each of the stocks selected.
- For each of the stocks we have x as change in Open Interest and y as change in Futures price
- We determine coefficient of correlation r using equation (1.1)

E. *DATA Interpretation and Inferences:*

Table 1.1 shows the correlation between the change in futures price and the change in the open interest in the seventeen stocks selected for the time period of July 2002 to June 2006. We describe the extreme cases and the central case in the following lines. We observe that the highest correlation happens to be in SBI and the lowest happens to be in Cipla. A correlation of 1 would have meant that the change in open interest has a direct relationship with the change in futures price. This does not seem to happen here, the data on SBI whose change in price has a correlation of 0.1806, suggests that 18% of the change in price of SBI can be explained by the change in open interest. In case of Cipla, the correlation is -0.2344 meaning that the change in futures contract price of Cipla is inversely proportional to the change in open interest and 23.44% of this change in the price of futures contract of Cipla can be explained by the change in open interest.

In the case of NALCO the change in futures price has very small correlation with the change in the open interest and suggests a meaning that the change in futures contract price of NALCO is nearly independent of the change in open interest in NALCO futures contracts.

In the case of NIFTY, which is the most liquid of all the futures contracts, the change in open interest and change in futures price have a correlation of -0.0611, which suggests that the change in futures price changes independent of the change in open interest in the NIFTY contract. This also suggests that only 6.11% of the price behavior of NIFTY contracts can be explained by the changes in open interest and that too, in the inverse proportion, meaning that we do not need to monitor changes in open interest to predict/

foretell/ expect changes in prices of futures contracts of the NIFTY.

We subjected the data to a T-Test where

H0: The correlation between change in futures prices and change in Open Interest is ZERO.

The acceptance or rejection of hypothesis is depicted in the table. It suggests that out of the 18 cases (futures contracts) the hypothesis stands accepted for 12 cases (futures contracts) meaning that for these cases the change in open interest and change in futures prices have a correlation of ZERO.

Thus we can conclude that in 66% of cases the hypothesis that change in open interest and change in futures prices have no relation to each other holds good.

TABLE I. CORRELATION BETWEEN CHANGE IN FUTURES PRICE AND CHANGE IN OPEN INTEREST

Company	Correlation	Observations	T	TINV (99%)	H0: p=0
ACC	0.0636	1006	2.02	2.81324	ACCEPT
Bajaj Auto	-0.0481	1006	-1.53	2.81324	ACCEPT
Bharti Airtel	-0.0598	283	-1.00	2.82921	ACCEPT
BHEL	0.0323	1006	1.02	2.81324	ACCEPT
Cipla	-0.2344	1006	-7.64	2.81324	REJECT
GAIL	0.0014	652	0.04	2.81662	ACCEPT
HDFC	-0.1534	951	-4.78	2.81360	REJECT
Hero Honda	-0.1317	812	-3.78	2.81473	REJECT
Infosys	-0.1138	960	-3.55	2.81354	REJECT
ITC	-0.0105	998	-0.33	2.81329	ACCEPT
NALCO	-0.0028	858	-0.08	2.81431	ACCEPT
Reliance	0.0591	1006	1.88	2.81324	ACCEPT
SBI	0.1806	1006	5.82	2.81324	REJECT
Tata Motors	0.0448	1006	1.42	2.81324	ACCEPT
Tata Power	0.0507	1006	1.61	2.81324	ACCEPT
Tata Steel	0.0171	1006	0.54	2.81324	ACCEPT
Tata Tea	0.1518	1006	4.87	2.81324	REJECT
NIFTY	-0.0611	1006	-1.94	2.81324	ACCEPT
				ACCEPT	12
				REJECT	6

VIII. CONCLUSIONS:

The above chart 1.1 and the data in Table 1.1 show that the correlation between the change in Futures Price and the change in Open Interest is between +0.18 and -0.23 and The correlation between the change in open interest in the NIFTY

futures contract and the change in the futures price of the NIFTY futures is -0.0611 suggesting that the correlation is spread around zero meaning that change in Futures Price does not have any correlation with the change in Open Interest.

- Hypothesis 1. There is a strong and positive correlation between the change in open interest and change in futures price in single stock future. The hypothesis stands rejected as the correlations hovers around ZERO. This is substantiated by the T-test where the hypothesis stands accepted for 12 cases out of 17 cases (64.7%)
- Hypothesis 2. There is a strong and positive correlation between the change in open interest and nifty futures. The hypothesis stands rejected as the correlation coefficient is nearly ZERO. This is also substantiated by the T-test.

This relationship or the absence of it suggests that change in open interest in futures contracts is just a phenomenon of the trading volume and it in no way has some directional information. We can conclude from this analysis that open interest changes as and when the number of open positions increase or decrease in a given contract and it has no bearing over the direction of the market. Thus we can also say that a change in open interest will not lead to a change in futures price in any direction. A corollary of the conclusion is that open interest is a measure of liquidity in the futures contract and not a fore bearer of the price direction of the futures contract.

REFERENCES

- [1] Bhuyan Rafiqul and Chaudhury Mo (2001), "Trading on the Information Content of Open Interest: Evidence from the US Equity Options Market" working paper October 04, 2001
- [2] Chance Don M and Ourso E J, "Another look at the forward-futures price differential in LIBOR markets" working paper at College of Business Administration, Louisiana State University,
- [3] Dr. Gupta L.C. "Derivatives in India: A Framework of Economic Purpose" Reserve Bank of India Committee Report Part-I (Draft)
- [4] Heaney Richard (1995) "A Test of the Cost of Carry Relationship using 90-Day Bank Accepted Bills and the All Ordinaries Share Price Index" *Australian Journal of Management*, June 1995; pp 75-104.
- [5] Hong Harrison (2001), "Stochastic Convenience Yield, Optimal Hedging and the Term Structure of Open Interest and Futures Prices" Working paper Graduate School of Business, Stanford University, July 23, 2001.
- [6] http://nseindia.com/content/fo/fobhav_arch.htm (July 2008)
- [7] http://nseindia.com/marketinfo/eod_information/bidbor.jsp (July 2008)
- [8] Hull John C, (2002), *Options, Futures, & other Derivatives*, Pearson Education Asia.
- [9] Jose Sharon (2005), "Components of Cost of Carry for Index Futures", *Treasury Management*, Vol.2
- [10] Levin Richard I & Rubin David S (1992) *Statistics for Management*, Prentice Hall. Asia.
- [11] Ripple Ronald D. and Moosa Imad A "The Effect of Maturity, Trading Volume, and Open Interest on Crude Oil Futures Price Range-Based Volatility", EcoMod Conference on Energy and Environmental Modeling Moscow, Russia, September 13-14, 2007
- [12] Watsham Terry J. (1998), *Futures and Options in Risk Management*, Thompson, Asia.