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Econometric Analysis between Spot and Futures Market in Indian Derivative Segment

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Abstract

Johansen's Co-integration technique followed by the Granger Causality test was employed to examine the relationship between NSE spot and futures market for selected scrip of Nifty of NSE. An empirical analysis was conducted for the closing price of near month prices from 9th November 2001 to 31st March 2012 and it is collected from National Stock Exchange (NSE) website. The analysis revealed that there exists a bi-directional causal relationship between spot and futures derivative market. Also an existence of co-integration between spot and futures market is also implied.

Keywords: *Derivatives, Futures, Nifty, Spot Market*

I. Introduction

Derivative markets contribute to the development of the financial infrastructureof a country by making links among cash markets, hedgers, and speculators. Local derivativemarkets have grown rapidly over the 1990s in emerging economies, especially in large emerging economies that have removed capital controls and developed their own underlying securities markets. The increasing use of derivative products offer alternatives for efficientriskmanagement, facilitate capital flows into emerging economies, and create conditions for raising system risk and magnifying negative effects during episodes of financial crisis.

Financial derivatives are important to hedging and risk management because they facilitate capital flows to developing economies. However, they also create the possibility of raising risk in financial systems, generating more unpredictable crisis dynamics, and providing a transmitting channel for contagion. Studies of emerging market crises revealed that financial derivatives can play both positive and negative roles.

The future market trading in Indian financial markets was introduced in June 2000 and options index was commenced from June 2001 and subsequently the options and futures on individual securities trading was commenced from July 2001 and November 2001, respectively. The future derivative trading on stock indexes has grown rapidly since inception and provides important economic functions such as price discovery, portfolio diversification and opportunity for market participants to hedge against the risk of adverse price movements. Hence, the movements of spot market price have been largely influenced by the speculation, hedging and arbitrage activity of futures markets. Thus, understanding the influence of one market on the other and role of each market segment in

price discovery is the central question in market microstructure design and has become increasingly important research issue among academicians, regulators and practitioners alike as it provides an idea about the market efficiency, volatility, hedging effectiveness and arbitrage opportunities, if any. Price discovery is the process of revealing information about future spot prices through the future markets. The essence of the price discovery function hinges on whether new information is reflected first in changes of future prices or changes of spot prices. Hence, there exists lead-lag relationship between spot and futures market by information dissemination. All the information available in the market place is immediately incorporated in the prices of assets in an efficient market. So, new information disseminating into the market should be reflected immediately in spot and futures prices simultaneously.

Accordingly, there exist diversified theoretical arguments pertaining to the causal relationship between spot and futures markets by information dissemination. The main arguments in favour of futures market leading the spot market are mainly due to the advantages provided by the former which includes higher liquidity, lower transaction costs, lower margins, easy leverage positions, rapid execution and greater flexibility for short positions. Such advantages attract larger informed traders and make the futures market to react first when market-wide information or major stock-specific information arrives. Thus, the future prices lead the spot market prices.

On the other hand, the low cost contingent strategies and high degree of leverage benefits in futures market attracts larger speculative traders from a spot market to a more regulated futures market segments. Hence, this ultimately reduces 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 first when market-wide information or major stock-specific information arrives. Hence, spot market leads the futures market. Besides, there exists a bidirectional relationship between the futures and spot markets through price discovery process. Both the spot and future markets are said have informational efficiency and reacts more quickly to each other.

The above diversified theoretical arguments raises the major question that which market price reacts first whether (a) futures prices tend to influence spot prices or (b) spot prices tend to lead futures prices or (c) a bidirectional feedback relationship exists between spot and futures prices. An overwhelming number of studies have examined the price discovery process involving well established United States, European and Asian futures markets providing different results.

II. Statement of the Problem

The study of the relation between stock market index and index future prices has attracted theattention of researchers, financial analysts and traders since last two decades. The investigationof the Co-integration and causal relation between futures and spot prices is very significantespecially in an emerging market economy like India. Indian capital market has witnessedsignificant transformations and structural changes due to implementation of financial sectorreform measures by the Govt. of India since early 1990s. In this process, index futures tradingwere launched on June 9, 2000 at BSE and on June 12, 2000 at NSE and India started trading inderivative products. The introduction of stock index futures has profoundly changed the nature oftrading on stock exchanges.

Futures market offer investors flexibility in altering the composition of their portfolios and

alsoprovide opportunities to hedge the risks involved with holding diversified equity portfolios. As aconsequence, significant portion of cash market equity transactions are tied to futures marketactivity.

By using index derivatives, investors can easily and rapidly carry out strategies on thebasis of their expectations about the general market trends, without having to considertransaction costs (including mainly the bid-ask spread) and specific changes in each stockthat constitutes the index. Long and short positions can be established more easily andless expensively in futures market, more so than in the spot market, trading based on revised expectations can take place more frequently in the futures market. Therefore, futures prices may move first, followed by spot price movements in response to changes in expectations about the stock market.

Differences in liquidity between the spot and futures markets could also induce a lead-lag relationship. If the average time between trades for constituent firms in the index is longer than the average time between trades for the futures contracts, information will beimpounded in futures prices more rapidly than the spot prices, resulting in a lead-lag relationship between spot and futures prices. The lead-lag relationship is a function of the relative liquidity of the two markets rather than their absolute liquidity.

A stronger lead from spot market to futures market may not be inconceivable since the value of the spot index and its more recent changes represent part of the information set used by futures traders. Changes in the spot market may induce changes in the futures market sentiment that would be reflected in subsequent futures price changes, giving rise to a tendency for index futures to lag index spot. The present study examines the robustness of the previous findings about the contribution of derivatives, to the price discovery process, using index securities. It investigates the lead lag relationship between Nifty futures index and Nifty spot index by using high frequency data. Engle and Granger's Co-integration Analysis and Error Correction Model is applied to study the interrelationship between the two markets.

III. Literature Review

There exist a number of studies in India and abroad concerning the investigation of the lead-lagrelation between spot and index futures markets. Abhyankar (1995) observed that there areseveral reasons that why the lead-lag relationship may exist. First, the lead-lag relationshipbetween the spot index and future markets may be caused by infrequent trading of the compositestocks. Second, liquidity difference between these two markets may be the cause for the lead-lag relationship. Third, market frictions can make the future markets more attractive to traders withprivate information to exploit the information advantage.

Sah and Omkarnath (2005) examined the nature and extent of relation between NSE-50 Futuresand volatility of S&P CNX Nifty. This empirical study suggested that futures market activitydestabilized the underlying market. The direction of causation was bi-directional in case of nearmonth; however, causality ran from Nifty Futures to volatility of S&P Nifty in case of far monthcontract.

In India, little work has been done in this area. The lead-lag analysis by Thenmozhi (2002) showed that the returns on futures lead the spot market returns. The study lent credence to the belief that the futures market tends to lead spot market and the index futures market serves as a primary market of price discovery. The study also showed that the cash index does not lead the futures returns. Though the futures lead the spot market returns by one day, the exact time by which the futures lead the spot market returns

was not identified as the study was conducted using daily returns due to lack of data in terms of minute-by-minute or hourly returns.

Mukherjee and Mishra (2006) used intraday data from April to September 2004 to investigate the lead-lag relationship between Nifty spot index and Nifty futures. They found that there was a strong bidirectional relationship among returns in the futures and the spot markets. The spot market was found to play a comparatively stronger leading role in disseminating information available to the market and therefore said to be more efficient. The results relating to the informational effect on the lead-lag relationship exhibit that though the leading role of the futures market wouldn't strengthen even for major market-wide information releases, the role of the futures market in the matter of price discovery tends to weaken and sometimes disappear after the release of major firm specific announcements.

The two studies on the lead lag relationship in the Indian market have come up with diametrically opposing views. According to Thenmozhi, futures markets lead the spot market. Whereas, according to Mukherjee and Mishra the spot market had a major role to play in price discovery and leads over the futures market. The general conclusion of previous research is that the returns in the futures market seem to lead cash market returns and there is some evidence of the predictive ability from cash to futures returns.

A new study of Kasman andKasman (2008) examined the impact of futures on volatility of theunderlying asset (via GARCH model) including the question of whether a co-integrating relationexists between spot prices and futures prices (via ECM model). They concluded that there is along run relation (nearly one-to-one) between spot and futures prices and causality runs fromspot prices to future prices, but not vice-versa.

Debasish and Mishra (2008) examined the lead-lag relationships between the NSE Nifty stockmarket index and its related futures and options contracts, and also the interrelation between thederivatives markets. The study finds that both the index futures and index options contracts leadthe cash index. In a recent work Debasish (2011) examines the long-term relationship betweenspot prices and futures prices. The study finds a single long-term relationship for each of theselected companies across the six sectors.

It is clear from the aforesaid literature review that though the pricing formula for futures derivesthe fair value depending on the spot market prices, the empirical work shows us that futuresprices mostly lead the spot prices. However, the literature is very thin in the sense that there existalmost no studies examining the relation between spot and index futures markets in the aftermathof global financial crisis. Furthermore, there exist only a few such studies in the context ofIndia's capital market. Therefore, the main purpose of this paper is to investigate whether futures'prices lead the spot prices for NSE 50 (Nifty) in India or the other way around.

IV. Data and Methodology

The very objective of this paper is to examine the dynamics of the relation between spot andindex futures markets in India. Precisely, this paper examines the relationship betweenthe Spot and the Futures based on Nifty at the National Stock ExchangeLtd (NSE) of India using daily observations from 9th November 2001 to 31st March 2012. The data is collected from the NSE database for the sampleperiod. The estimation methodology employed in this study is the Co-integration and Granger Causality Tests. The entire estimation procedure consists of three steps: first, unitroot test; second, Co-integration test; third, the Granger Causality Test.

V. Empirical Analysis

At the outset, it is required to determine the order of integration for each of the two series used in the analysis. The Augmented Dickey-Fuller and Phillips-Perronunit root test has been used for this purpose and theresults of such test are reported in Table 1. It is clear that the null hypothesis of no unit roots for both the time series are rejected at their first differences since the ADF and PP test statistic values areless than the critical value at 5 per centlevel of significance. Thus, the variables are stationary and integrated of the same order, i.e., I(1) after rejecting the null hypothesis.

Table 1: Results of Augmented Dickey-FullerandPhillps-PerronUnit Root Test

Variables in their First Differences with no trendand intercept	ADF Statistic	PP Statistic	Critical Values	Decision
Futures	-147.7405	-704.5251	At 1% = -2.565009 At 5% = -1.940831 At 10% = -1.616696	Reject Null hypothesis of no unit root
Spot	-219.7609	-219.7516	At 1% = -2.565009 At 5% = -1.940831 At 10% = -1.616696	Reject Null hypothesis of no unit root

Source: Authors' computation

In the next step, the Co-integration between the stationary variables has been tested by theJohansen's Trace and Maximum Eigen value tests. The results of these tests are shown in Table2. The Trace test indicates the existence of twoco-integrating equation at 5 per cent level ofsignificance. And, the maximum Eigen value test makes the confirmation of this result. Thus, thetwo variables of the study do haveequilibrium relationship between them.

Table 2: Results of Johansen's Co-integration Test

Hypothesized Number of Co-integrating Equations	Eigen Value	Trace Statistics	Critical Value at5% (p-value)	Maximum Eigen statistics	Critical Value at5% (p-value)
None	0.163831	8845.498	15.49471(1.0000)	8817.587	14.26460(1.0000)
At most 1*	0.000566	27.91136	3.841466(0.0000)	27.91136	3.841466(0.0000)
*denotes rejection of the hypothesis at the 0.05 level					

Source: Authors' computation

A pair wise Granger Causality test was done to establish the cause and effect relationship between spot index and futures index. The existence of causality between spot and futures market are tested in the next step using Granger Causality test.

The result in Table 3 indicates spot market price does not Granger Cause the futuresmarket is rejected at the 5 per cent level of significance. In addition, it is inferred that futures market prices does not Granger Cause the spot market prices is accepted at the 5 per cnt level of significance. Thus it can be proved that there exists a bi-directional causality between spot and futures.

Table 3: Result of Granger Causality Test

Null Hypothesis	F-Statistic	Probability	Decision
Spot does not Granger cause Futures	2749.93	0.0000	Reject
Futures does not Granger cause Spot	0.54448	0.7427	Accept

Source: Authors' computation

Based on this causality tests, it can be said that change in the futures prices causes change in spot market prices in the long-run only, but not in the short-run. And, change in the spot market prices causes change in the prices in futures market in the short-run only, but not in the long-run.

VI. Conclusion

This study investigates the relationship between spot and futures series fromNovember 2001 to March 2012. The stationary test results provided evidence that both the selected markets werestationary at first order I(1). Hence, the Granger causality test and Johanson co-integration test werefollowed. From the study we found that, in short term,future price series drive (Granger cause) the spot marketand vice versa for both the markets. Co-integration test suggested that there exists a close liaison between spot and futures market in the Derivative segment of the Indian Market.

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