A Study of the Relation Between Market Index, Index Futures and Index ETFs: A Case Study of India

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ABSTRACT

The efficiency of trading in securities market is a matter of serious concern for investors as well as regulators. Innovations in securities market environment can adversely affect market efficiency. Index futures and index ETFs are two such innovations in the securities market. Both these instruments have the stock market index as their underlying asset. All the three instruments together constitute a group of informationally linked instruments traded simultaneously and continuously in the securities market. This paper analyses empirically the price behavior of stock market index, index futures and index ETFs in the Indian securities market. The price data for one year (April 2011 to March 2012) have been used for the analysis. The objective of the analysis is to identify market inefficiencies or distortions in the trading of these instruments which are conceptually linked to each other. The daily return and volatility of daily return are the principal variables used in the study. The results indicate that the instruments exhibit generally consistent price behavior. However, some distortions due to speculative influence and operational inefficiency are also seen presumably because of the innovative nature of the instruments as far as the Indian securities market is concerned.

Key words: basis, ETF premium, daily return, volatility

1.1.Introduction

A *stock market index* is a number computed to measure and track the value of a portfolio of stocks used to represent the stock market. It is created by selecting a group of stocks that are capable of representing the whole market or a specified sector or segment of the market. As trading progresses in the market, the market index value gets updated continuously. The stock market index is now being used as an underlying asset to create a futures contract known as *index futures*. "It is an agreement to buy or sell the portfolio of stocks included in the stock market index within a specified future period at a predetermined rate. The rate, thus, agreed upon for the future transaction is referred to as the *futures price*. In any futures contract, the futures price depends upon the spot price, also known as the cash price, of the underlying asset and varies with changes in the cash price of the underlying asset. In index futures, the cash price of the underlying asset is the value of the underlying stock market index or the monetary value assigned to the stock market index" (Kevin, 2010). Investors may use the index futures for hedging or managing their risk exposure in the stock market, while speculators may use them for making gains from the movement of the underlying stock index.

An Exchange-traded Fund (ETF) is a new form of investment where units of the Fund are traded in stock exchanges, just like stocks. It is similar to a mutual fund in that the ETF invests its corpus fund in specific assets such as gold, commodities, bonds, shares or stock index. But, unlike mutual funds whose units are bought and sold by the Fund at the end of each trading day for its NAV (Net Asset Value), the ETF units are traded continuously in the stock exchanges at market determined prices. An Index ETF invests in securities that are part of a stock market index and attempts to replicate the performance of a stock market index. This is done by investing its funds proportionately in the securities included in an index.

Continuous trading takes place simultaneously in the shares included in the stock market index, the index futures and the index ETFs. As the three are informationally linked instruments, the price movements of the three instruments should reflect identical patterns in an efficient market. Any deviation would be a reflection of market inefficiency or 'noise trading' in the market.

This study attempts to analyse the price movements of the stock market index, index futures and index ETFs in the Indian context. The results would be a pointer to the extent of efficiency or inefficiency in the Indian securities market.

1.2.Literature review

The introduction of futures trading may affect the market for the underlying asset, and a body of literature has evolved that attempts to validate the nature of this relationship empirically (Faff and McKenzie, 2002). One major area of this literature has considered the impact of futures trading on spot market volatility. However, in general, the studies provide mixed evidence as to the volatility impact of futures trading. The authors state that this empirical ambiguity is not surprising since there are two contrary hypotheses regarding the impact; a 'destabilizing forces' hypothesis which predicts increased volatility due to the inflow and existence of speculators in the futures market and a 'market completion' hypothesis in which volatility is said to decrease as the introduction of futures trading leads to more complete markets, enhancing information flows and thus improving investment choices facing investors.

Chan, Chan and Karolyi (1991) examined the intraday relationship between returns and returns volatility in the stock index and stock index futures markets. Their results indicate a strong inter market dependence in the volatility of the index returns and the futures returns. It is seen that price innovations that originate in either the stock or futures market can predict the future volatility in the other market. The authors state that their results have implications for understanding the pattern of information flows between the two markets.

Alexakis (2007) investigated the effect of the introduction of stock index futures on the volatility of the spot equity market. The results of the study indicate that the index futures trading exerts a stabilizing effect in the spot market, reducing volatility asymmetries and improves the quality and speed of the flow of information. The introduction of derivatives trading did not lead

to detrimental effects on the underlying market, but an improvement in the transmission of news into prices.

Debasish (2009) has examined whether the index futures trading in India has caused a significant change in the spot market volatility of the underlying stocks and how the index futures trading has affected market/ trading efficiency in the Indian futures and stock markets. The study covers an extended period from June 1995 to May 2009. The results of the study show that the introduction of Nifty index futures trading in India is associated with both reduction in spot price volatility and reduced trading efficiency in the underlying stock market. Thus index futures trading seems to have brought about market stabilization but along with loss of market efficiency.

There is a lively debate in academic literature concerning the competition between the traditional open-ended mutual funds and the exchange traded funds or ETFs and the impact of the emergence of ETFs on traditional mutual funds (Rompotis, 2011). In a study using data from the emerging Greek ETF market, he has examined the return, risk and expense features of these competitive investment vehicles. The results indicate that the classical mutual funds are more expensive than the ETFs but they perform better and are less volatile. The performance of the ETF in relation to the return of the underlying index is better than the corresponding performance of the mutual funds.

Mei-Maun Hseu (2007) examined the relative price efficiencies of three American stock market indices (S & P 500, Nasdaq-100 and DJIA) in the spot, futures, E-mini futures and ETF markets for the periods both before and after the Nasdaq market crash between March 2000 and March 2001. The study found that a co-integrating relationship existed between the three indices during the period after the crash.

Schlusche (2009) has examined the price behavior of index futures and exchange traded funds with the German stock market index DAX as the underlying asset. The study has shown that the influence of the DAX futures is about three times greater than the influence of the DAX ETF.
Agapova (2011) has examined the substitutability of two similar investment vehicles: conventional index mutual funds and exchange-traded funds both of which offer a claim on the same underlying index return process but have distinctly different organizational structures. The results show that conventional mutual funds and ETFs are substitutes, but not perfect substitutes for one another.

Rajappa and Madegowda (2012) has studied the nature and degree of association between the stock market and the derivatives market in India with an emphasis on understanding how the performance of the two markets are related. The study finds that the derivatives market in India

is supplementing the performance of the stock market by creating better liquidity platforms to investors.

2. Conceptual framework

2.1.Variables of the study

Stock market index is used to indicate and measure the movements of the stock market as a whole. The value of the index is directly related to the prices of the shares included in the index. The extent and direction of variation in the index value is an indication of the market movement. The *index value* is spontaneously calculated by the price movements of the underlying stocks.

Index futures is a separate contract to buy or sell the market index in the future. The *futures price*, that is the price at which the market index is agreed to be traded, is determined by the demand and supply for the market index. This demand/ supply is based on expectations regarding the future movements of the index. Thus the futures price is expected to give an indication of the future movements in the stock market.

Index ETF is constituted as a substitute for the market index and its objective is to enable market participants to trade in the market index constituents effortlessly. The index *ETF unit prices* are expected to mirror the index value, even though the ETF unit prices are determined by demand and supply for such units. Any deviation of the ETF unit prices from the index values would represent information asymmetry in the securities market or operational inefficiency on the part of the ETF managers.

An empirical analysis of the movements of the index values, index futures prices and the index ETF unit prices is necessary to understand the behavior of the securities market where the three instruments co-exist. The difference between the index value (the spot price or cash price of the index) and the index futures price is known as *basis*. The relation between market index prices and index futures prices can be studied by tracking and analyzing 'basis'.

In the case of index ETF, the ETF unit prices may be at a premium or discount to the index values. The ETF '*discount/ premium ratio*' measures the discount or premium of the ETF with respect to the underlying market index. This ratio can be tracked and analysed to study the relation between the market index prices and index ETF prices.

Thus, the variables used for the study are market index value, index futures price, index ETF unit price, basis and ETF discount/premium ratio.

2.2.Objectives of the study

The objective of the study is to understand the price behavior of market index value, index futures price and index ETF unit price.
The specific objectives are:

- Analyse the movements of market index values, index futures prices and index ETF unit prices separately

- Compare the movements of index values and index ETF unit prices
- Compare the movements of index values and index futures prices

2.3. Hypotheses

Six hypotheses are stated as null hypotheses for testing the various dimensions regarding the relation between market index, index futures and index ETF.

H_{01} : There is no significant difference in the mean of daily returns of index values and index ETF unit prices.

H_{02} : There is no significant difference in the volatility of daily returns of index values and index ETF unit prices.

H_{03} : There is no significant difference in the mean of daily returns of index values and index futures prices.

H_{04} : There is no significant difference in the volatility of daily returns of index values and index futures prices.

H_{05} : The monthly mean of 'basis' tends to be zero.

H_{06} : The monthly mean of 'ETF discount/premium ratio' tends to be zero.

3. Method

3.1.Sample

3.1.1. Market index

The two prominent national stock exchanges in India are BSE and NSE. Each stock exchange has its own hallmark market index; Sensex for BSE and Nifty for NSE. Sensex includes 30 stocks, while Nifty includes 50 stocks. Most of the actively traded stocks are included in both the indices. Nifty (S & P CNX Nifty) of the NSE is selected as the market index for the study for two reasons: 1. Volume of trade in NSE is higher than that of BSE and 2. Nifty includes 50 shares as against 30 share of Sensex.

3.1.2. Index futures contract

In the Indian derivatives market, three index futures contracts are traded at a time with expiry in the current month, nearby month (next month) and distant month (second month). Since the sample market index selected for the study is Nifty, the index futures with Nifty as the underlying index is selected for study. The futures contracts expiring in the nearby month are selected for the study, as current month expiry contracts may show distortions in prices of account of settlement of the contracts on last Thursday of the month.

3.1.3. Index ETF

There are seven index ETFs with S & P CNX Nifty as the underlying index, listed for trading at NSE. Among these, Goldman Sachs ETF titled Nifty BeES, has the largest volume of trading, indicating its popularity among investors. Nifty BeES was in fact the first ETF introduced in India on Jan. 8, 2002. Each Nifty BeES unit is $1/10^{th}$ of S & P CNX Nifty index value. Nifty BeES, which is managed by the Asset Management Company Benchmark, is selected for the study because of its easy liquidity provided by large volume of trade.

3.2.Materials

The study is related to the price behavior of three informationally linked instruments, namely, market index, index futures and index ETFs. The data required for the study are the price data relating to the three instruments. The materials used for the study are thus the historical prices of the three instruments for one year. The period selected for study is the period from April 1, 2011 to March 31, 2012. The historical price data have been collected from the NSE website: www.nseindia.com.

3.3.Procedures

The prices of the three instruments vary continuously. In order to capture the true nature of price movements, it is necessary to measure the daily price fluctuations. This can be done by calculating the daily return of each instrument. The change in price each day is divided by the previous day's price and converted into a percentage figure. Daily return is the measure that is used in the study for understanding and comparing the price behavior of the three selected instruments. Daily return is calculated as $[(P_1 - P_0)/ P_0] X 100$, where P_1 is the current price and P_0 is the previous day's price.

The statistical tools used for the analysis are mean, standard deviation, coefficient of variation, correlation and t-test. Mean and standard deviation of daily returns are calculated for all the twelve months for the 3 instruments. T-test is used to identify any significant difference in mean and standard deviation (volatility) of daily returns across the three instruments. Correlation is used to understand the covariation between the daily returns of the market index and index ETF. Basis and ETF discount/premium ratio are also used for analysis. Mean, standard deviation and t-test are applied to these values also.

4. Results

4.1.Comparison between market index and index ETF

The month-wise mean and standard deviation of daily returns of the market index (Nifty) and the index ETF (Nifty BeES) for twelve months are presented in table 1.

Table 1: Daily return (percent) of Nifty and Nifty BeES

	Mean		Std. deviation	
Month	**Nifty**	**NiftyBeES**	**Nifty**	**NiftyBeES**
Apr-11	-0.072	-0.098	1.077	1.019
May	-0.113	-0.11	1.149	1.056
June	0.052	0.059	0.995	0.927
July	-0.126	-0.063	1.007	0.834
Aug	-0.478	-0.529	1.573	1.533
Sept.	-0.084	-0.13	1.638	1.408
Oct.	0.534	0.46	1.52	1.481
Nov.	-0.436	-0.417	1.306	0.909
Dec.	-0.316	-0.318	1.464	1.425
Jan. 2012	0.553	0.522	1.158	0.945
Feb.	0.155	0.215	1.162	1.127
March	-0.031	-0.1	1.349	1.194
Annual				
Value	**-0.030**	**-0.042**	**1.283**	**1.155**

The market index and the index ETF show negative returns during the period, reflecting the downturn in economic growth during the period. The yearly mean returns for the index and the index ETF are respectively (-) 0.030 percent and (-) 0.042 percent. The volatility of daily returns (measured by standard deviation) has yearly mean values of 1.283 and 1.155 respectively. Pearson's correlation coefficients indicate high positive co-variation between the returns of the two instruments ($r = 0.99$ $p = 0.00$) and also between the volatility of returns ($r = 0.895$ $p = 0.00$).

Further, independent samples t-test shows that there is no significant difference between the returns of the two instruments ($t = 0.09$ $p = 0.9267$) as well as between the volatility of returns of the two instruments ($t = 1.33$ $p = 0.1973$). The null hypotheses H_{01} and H_{02} are accepted. The results are presented in tables 2 and 3.

Table 2 :

Independent Groups (t-test, pooled variance)
Daily return of Nifty and Nifty BeES

Nifty	NiftyBees	
- 0.03017	-0.04242	Mean
0.32572	0.31904	std. dev.
12	12	N

22	Df
0.012250	difference (Nifty - NiftyBees)
0.103940	pooled variance
0.322397	pooled std. dev.
0.131618	standard error of difference
0	hypothesized difference
0.09	T
.9267	p-value (two-tailed)

Table 3

Independent Groups (t-test, pooled variance)
Standard deviation of returns of Nifty and Nifty BeEs

Nifty	NiftyBees	
1.28317	1.15483	Mean
0.22436	0.24796	std. dev.
12	12	N

22	Df
0.128333	difference (Nifty - NiftyBees)
0.055910	pooled variance
0.236454	pooled std. dev.
0.096532	standard error of difference
0	hypothesized difference
1.33	T
.1973	p-value (two-tailed)

The index ETF unit prices depend upon the NAV of the ETF units. The prices vary from the index value on account of expenses incurred for managing the Fund. ETF unit prices are at a premium to the base index values. The premium percentages are calculated on a daily basis,

using the closing prices of ETF units and the market index. The month-wise mean and standard deviation of the ETF premium percentages are presented in table 4. The coefficient of variation has also been calculated.

Table 4 : ETF premium

Month	Mean	SD	CV
Apr-11	0.891	0.341	38.27
May	1.614	0.305	18.89
June	1.601	0.425	26.57
July	1.735	0.463	26.66
Aug.	2.39	0.281	11.74
Sept.	1.619	0.431	26.62
Oct.	1.647	0.336	20.38
Nov.	1.734	0.493	28.42
Dec.	1.993	0.48	24.08
Jan. 2012	1.411	0.472	33.43
Feb.	1.283	0.44	34.25
March	0.853	0.801	93.95
Yearly value	**1.564**	**0.439**	**31.938**

The ETF premium varies from a minimum of 0.853 percent to a maximum of 2.390 percent with an yearly mean value of 1.564 percent. The null hypothesis H_{06} that the monthly mean of ETF premium/discount ratio tends to be zero is rejected; one sample t-test gives a t value of 12.71 with p = 0.000. The intra month volatility of ETF premium, measured by coefficient of variation, also varies widely across different months, from a minimum of 11.74 percent to a maximum of 93.95 percent.

4.2. Comparison between market index and index futures

The month-wise mean and standard deviation of daily returns of the market index (Nifty) and the index futures for twelve months are presented in table 5.

Table 5 : Daily return (percent) of Nifty and Nifty futures

	Mean		**Std. deviation**	
Month	**Nifty**	**Nifty futures**	**Nifty**	**Nifty futures**
Apr-11	-0.072	-0.123	1.077	1.135
May	-0.113	-0.149	1.149	1.231
June	0.052	0.051	0.995	1.062
July	-0.126	-0.144	1.007	1.043
Aug	-0.478	-0.504	1.573	1.624
Sept.	-0.084	-0.1	1.638	1.748
Oct.	0.534	0.53	1.52	1.543
Nov.	-0.436	-0.49	1.306	1.417
Dec.	-0.316	-0.35	1.464	1.538
Jan. 2012	0.553	0.543	1.158	1.134
Feb.	0.155	0.153	1.162	1.173
March	-0.031	-0.075	1.349	1.357
Annual				
value	**-0.030**	**-0.055**	**1.283**	**1.334**

The market index and the index futures show negative returns during the period, reflecting the downturn in economic growth during the period of study. The yearly mean returns for the index and the index futures are (-) 0.030 percent and (-) 0.055 percent respectively. The volatility of daily returns, measured by standard deviation, has yearly mean values of 1.283 and 1.334 respectively. Pearson's correlation coefficient is calculated to find out the extent of co-variation between index returns and index futures returns as well as between the volatility of returns of the two instruments. The results indicate very high positive co-variation between the returns of the two instruments ($r = 0.999$ $p = 0.00$) and also between the volatility of returns ($r = 0.986$ $p = 0.00$).

Independent samples t-test is done to find out whether the difference in the returns of the two instruments as well as the difference in the volatility is statistically significant. The results indicate that there is no statistically significant difference between the returns ($t = 0.18$ $p = 0.8572$) and the volatility of the two instruments ($t = (-)0.54$ $p = 0.5975$). The null hypotheses H_{03} and H_{04} are accepted. The results are presented in tables 6 and 7.

Table 6

Independent Groups (t-test, pooled variance)
Daily return of Nifty and Nifty futures

Nifty	Nifty futures	
-0.03017	-0.05483	Mean
0.32572	0.33791	std. dev.
12	12	N

22	Df
0.024667	difference (Nifty - Nifty futures)
0.110138	pooled variance
0.331871	pooled std. dev.
0.135486	standard error of difference
0	hypothesized difference
0.18	T
.8572	p-value (two-tailed)

Table 7

Independent Groups (t-test, pooled variance)
Standard deviation of return of Nifty and Nifty futures

Nifty	Nifty futures	
1.28317	1.33375	mean
0.22436	0.23799	std. dev.
12	12	N

22	df
-0.050583	difference (Nifty - Nifty futures)
0.053487	pooled variance
0.231274	pooled std. dev.
0.094417	standard error of difference
0	hypothesized difference
-0.54	T
.5975	p-value (two-tailed)

Basis is the difference between the cash price of the underlying instrument and the futures price. The daily basis of the index futures has been calculated for the entire period of study, as the difference between the closing price of the index and the closing price of the index futures contract (nearby month). The month-wise mean and standard deviation of the basis are presented in table 8. The coefficient of variation has also been calculated.

Table 8 : Nifty futures basis

Month	Mean	SD	CV
Apr-11	-36.76	11.47	-31.21
May	-7.54	13.98	-185.29
June	-18	6.86	-38.1
July	-23.62	8.21	-34.75
Aug.	-15.07	10.4	-69.05
Sept.	-11.88	9.24	-77.72
Oct.	-24.69	6.26	-25.36
Nov.	-32.56	17.74	-54.48
Dec.	-31.61	10.62	-33.59
Jan. 2012	-29.35	7	-23.86
Feb.	-52.35	8.83	-16.86
March	-65.59	12.55	-19.14
Yearly value	**-29.085**	**10.263**	**-50.784**

The basis values are negative for all the months, varying from a minimum of (-) 7.54 to a maximum of (-) 65.59. The null hypothesis H_{05} that the monthly mean of basis tends to be zero is rejected; one sample t-test gives a t value of (-) 6.02 with p = 0.0001. The intra month variation in basis values varies from (-) 16.86 percent to (-) 185.29 percent across different months.

4.3.Comparison between index futures and index ETF

The yearly mean returns for the index futures and the index ETF are respectively (-)0.055 and (-)0.042 percentages. The volatility of returns, measured by standard deviation, has yearly mean values of 1.334 and 1.155 respectively. Pearson's correlation coefficient shows high positive co-variation between the returns of index futures and index ETF (r = 0.991 p = 0.00). A similar high positive co-variation is seen between the volatility of returns of the two instruments (r = 0.858 p = 0.00).

Independent samples t-test shows that there is no significant difference between the return of index futures and index ETF (t = 0.09 p = 0.9271). Similarly, there seems to be no significant difference between the volatility of return in respect of the two instruments (t = (-)1.80 p = 0.0850). The results of t-test are presented in tables 9 and 10.

Table 9

Independent Groups (t-test, pooled variance)
Daily return of Nifty BeES and Nifty Futures

Nifty BeES	Nifty futures	
-0.04242	-0.05483	Mean
0.31904	0.33791	std. dev.
12	12	N

22	Df
0.012417	difference (Nifty BeES – Nifty futures)
0.107982	pooled variance
0.328607	pooled std. dev.
0.134153	standard error of difference
0	hypothesized difference
0.09	T
.9271	p-value (two-tailed)

Table 10

Independent Groups (t-test, pooled variance)
Standard deviation of returns of Nifty BeES and Nifty Futures

Nifty BeES	Nifty Futures	
1.15483	1.33375	Mean
0.24796	0.23799	std. dev.
12	12	N

22	df
-0.178917	difference (Nifty BeES – Nifty futures)
0.059060	pooled variance
0.243022	pooled std. dev.
0.099213	standard error of difference
0	hypothesized difference
-1.80	t
.0850	p-value (two-tailed)

5. Discussion

Stock market index, index futures and index ETF are three important instruments which are informationally linked to each other. Index futures and index ETFs both have the market index as their underlying asset. In this context, it is important to analyse empirically whether the conceptual relationship between the three instruments is reflected in the market place. The research study was undertaken with this objective.

Daily return of the three instruments was the principal variable used for the study. Supplementary variables used were 'basis' in the case of index futures and 'ETF premium' in the case of index ETFs. The study was conducted for the period from April 1, 2011 to March 31, 2012.

There is a high positive co-variation between the returns of the three instruments. At the same time, there is no significant difference in the returns of the three instruments. The intra month volatility of returns shows a similar pattern with a high positive co-variation and no significant difference between the three instruments. These results show that the market is generally efficient in pricing the three informationally linked instruments. The price behavior of the three instruments is consistent with each other.

However, in the case of index futures, there is inconsistent and irregular volatility in the movement of 'basis' which is the difference between the futures price and the value of the underlying market index. This may be due to the influence of speculative trading in the futures market.

In the case of index ETF, the ETF premium is not consistent across different months. The intra month variation in ETF premium also shows much inconsistency. This is perhaps an indication of the inefficiency in managing the ETF. It could also be due to higher demand for ETF units from speculators.

Hence, even though the three informationally linked instruments (namely, market index, index futures and index ETF) exhibit generally consistent price behavior in the Indian securities market, some distortions due to speculative influence and operational inefficiency are also seen in the market. Index futures and index ETF are new instruments in the Indian securities market. As these instruments become more popular and their trading becomes more stable, the distortions are likely to disappear.

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