Sectoral Differences in Comovement betweenETFs and Underlying Assets in Indian Emerging Market

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Introduction

Exchange traded funds or ETFs are gaining increasing popularity amongst investors in developed as well as emerging markets including India. These products in financial markets are emerging as substitute for individual portfolios that are difficult to monitor and finance due to limited resources at the disposal of retail investors in particular.They are considered better than traditional mutual funds due to their low costs and tradability on stock exchanges.

In an ETF a sponsor designs an ETF scheme and get it approved from regulator. Upon approval, the sponsor invites institutional investors such as mutual funds, insurance companies to buy the creation units of ETF. These institutional investors are referred to as Authorised Participants or APs. The APs contribute their portfolio of shares for buying creation units of an ETF. The creation units thus comprise of block of shares depositedby APs and cash component for the difference between the value of creation units and market value of shares deposited. One creation unit may have a block of 50000 shares. ETF units are then derived from these creation units and made available by APs to retail investors through stock exchanges. ETF units or simply ETFs offer advantage of diversification to the investorsat low cost as one ETF unit represents a portion of underlying portfolio of securities. Besides, ETFs are not actively managed and hence no fund management fees deducted. The prices of ETFs on stock exchanges are expected to move according to the price movements in underlying portfolio of stocks. Hence, ETFs are passive investment strategy vehicles.

ETFs came into existence in US financial markets in 1993. Since their introduction, ETFs have gained significant position in investment portfolios of investors globally. The ETF assets under management (AUM) have grown from $417 billion in 2005 to $4.4 trillion by end of September 2017 showing CAGR of 21% during the period (Global ETF Research Report, 2017). In India, ETFs were introduced in the year 2001 but gained popularity only after 2008 sub-prime crisis. The Indian ETF market corpus stands at Rs.77,897 crore as of December 2017 and has shown a growth rate of 40% since 2012. Several different types of ETFs with varied underlying s such as Nifty 50 index, sectoral indices and bullion have been introduced in India. Since investment in ETFs requires tracking of underlying index, investors find it convenient to invest in ETFs to earn returns commensurate to underlying index at low risk.

Literature Review

The relationship between ETFs and underlying assets has been examined in various studies from different perspectives. Much of the literature in ETFs, however, is available in the context of developed countries since the product is relatively mature in these countries. Elton, Gruber, Komer and Li (2002) examined one of the most popular ETFs in US, SPDR and provided evidence that the ETF underperformed in relation to its underlying asset S&P Index by 28 basis points and low cost index funds by 18 points. This underperformance according to the authors was on account of replicating strategy, tracking error and holding of dividends received in underlying shares in cash.DeFusco, Ivanov and Karels (2011) examine the performance of three popular ETFs in US viz. Spider, Diamonds and Cubes and find that Spider's price is 29 cents higher on average than the S&P500 index price, theDiamonds' price is 8 cents higher on average than the price of the DJIA, and the Cubesis the only ETF that has a price below the index price with an average of 25 cents. The evidence of DeFusco et.al. (2011) indicate that there is deviation in the comovement between ETFs and their underlying assets. Ivanov (2013) also finds evidence of comovement between gold, silver and oil ETFs and their underlying commodities by using intraday data. In Indian context, Khanapuri (2012) finds that index based ETF Niftybees has significantly higher comovement with its underlying Nifty 50 index and investors can monitor the underlying to take their investment decision. However, the author finds that same is not true in commodity ETF where the underlying gold explains 62-68% of forecast error variance in Goldbees ETF and therefore, passive strategy of following the prices of underlying would not yield good returns to investors. A few studies have also examined if ETFs contribute to the price movements of the underlying assets.Da and Shive (2017) study large panel of 549 US equity ETFs and 4,887 stocks and conclude that ETFs contribute to

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equity return comovement which implies that ETFs impact the underlying assets. The ETF level analysis by Da and Shive (2017) indicate that more the turnover in ETF, greater is the comovement between its component stocks at monthly frequency. Staer (2014) finds a strong positive relation between daily ETF flows and the contemporaneous underlying index returns for US market across several specifications, subperiods and aggregation levels.

Thus, the evidence of price comovement between ETFs and their underlying assets is largely available for developed markets and is at best mixed. It can be observed that nature of comovement between ETF and underlying assets differ across different categories of ETFs. Several sectoral ETFs have been introduced in Indian capital markets. It is very important for investors to examine if such difference in comovement of prices exists between different sectoral ETFs.

Research Methodology

This study applies empirical methodology of research based on secondary data. The data for the study consists of daily closing prices of two prominent sectoral ETFs in India – Bankbees for banking sector and Infrabees for infrastructure sector. Both the ETFs are listed on National Stock Exchange (NSE). Bankbees tracks NSE Bank Index while Infrabees has NSE Infrastructure Index as its underlying asset. We use Total Return Index (TRI) of Nifty Bank and Nifty Infrastructure for the purpose of this study as both the ETFs benchmark against TRI instead of price indices. An important reason to consider TRI is also because it factors dividend reinvestment of stocks in underlying indices whereas normal price indices consider only the stock prices ignoring the dividend earned. The daily data of both ETFs and the two TRIs is collected for the period of five years from December 3, 2012 to November 28, 2018. All the required data is collected from the website of National Stock Exchange.

For each of the ETFs and underlying asset first logarithmic returns have been computed as follows:

lnRt = lnPt - lnPt-1   (1)

Where P is the daily closing price of given ETF/underlying asset.

The return variables on ETFs are denoted as LRBANKBEES and LRINFRABEES while the variables of underlying are denoted as LRBANKTRI and LRINFRATRI.

The study applies methodology of Vector Autoregression (VAR) developed by Sims (1980). The VAR technique has become well established methodology to examine dynamic interaction between variables under study. VAR model is ideal in this situation as it provides a multivariate framework where changes in particular variable are related to changes in its own lags and to changes in other variables and the lags of those variables. The model thus can help in identifying main channels of interactions and simulates the responses of a given market to innovations in other markets. The VAR model can be expresses in its standard form as:

$$\mathbf{lnR_t = C + \sum_{k=0}^{p} A_k R_{t-k} + \varepsilon_t} \qquad (2)$$

Where lnRt is the m x 1 column vector of daily returns on the ETF/underlying at time t, C is the m x 1 column vector of constant terms, A_k are m x m matrices of coefficients such that the (i, j)th component of A_k measures the effect of change in the jth market on the ith market after k periods,   is an m x 1 column vector of unobserved disturbances assumed to satisfy the usual assumptions of the errors from an OLS regression. Eq. (2) assumes a return generating process where the return of each market (ETF and underlying) is a function of a constant term, its own lagged returns, the lagged returns of other variables in the system, plus an error term, which is serially uncorrelated but can be contemporaneously correlated. In other words, the returns of a market incorporates not only its own past information, but also the past information of other markets.

Using VAR model two important questions related to comovement between the two markets can be answered – one, how fast are the price movements in one market transmitted to other markets; two, how much of movements in one market can be explained by innovations in other market. The first question can be answered by generating impulse response functions (IRFs) which measures the response of different markets to shock of 1 standard error in a particular market; and the second by computing forecast error variance decompositions (FEVD). Before implementing VAR methodology it is necessary to test for stationarity of return variables to avoid the problem of spurious regression (Granger and Newbold, 1974; Phillips 1986). The popular Augmented Dickey-Fuller (Dickey and Fuller, 1979) test is used to test the stationarity of the variables.

Results and Discussion
Stationarity of variables
The results of ADF test for presence of unit root in time series of variables are presented in Table 1 below. The test results indicate that all the return series are stationary at levels or integrated of order zero i.e. I(0).

Table 1. Results of Stationarity Test Using ADF Test
Notes: (a) Lag selection for ADF test is automatic based on SIC (Schwartz Information Criterion).
(b) MacKinnon (1996) one-sided p values use for rejection of hypothesis of unit root.
(c) * indicated significance at 1% level.

Therefore, VAR model with levels series is constructed.

Correlation Structure
        The correlation structure between the returns of ETF and underlying asset reveals the primary and basic relationship between the ETFs and their underlying indices. Table 2 below presents this correlation structure for log returns on Bankbees and Infrabees with log returns on their respective underlying holdings viz., Nifty Bank and Nifty Infrastructure.

Table 2. Correlation Structure Between ETF and Underlying Assets

Variable	LRBANKTRI	Variable	LRINFRATRI
LRBANKTRI	1.000	LRINFRATRI	1.000
LRBANKBEES	0.938	LRINFRABEES	0.493

It can be seen from Table 2 above that the correlation between returns in banking sector ETF, Bankbees and its underlying Nifty Bank TRI index is much stronger (0.938) as compared to that between returns in infrastructure based ETF, Infrabees and its underlying Nifty Infrasructure TRI index (0.493). Thus correlation between ETF and underlying asset in banking sector is much stronger than that between ETF and underlying asset in infrastructure sector.

Variable	With Intercept	With Intercept and Trend
LRBANKBEES	-35.79120***	-35.77976***
LRBANKTRI	-35.32725***	-35.31569***
LRINFRABEES	-47.85866***	-47.84384***
LRINFRATRI	-34.15370***	-34.14217***

Forecast Error Variance Decomposition (FEVD)
        Table 3 and Table 4 below presents the results of FEVD based on VAR analysis of variables under study. Table 3 presents results of FEVD for bank based ETF while Table 4 presents the same for infrastructure based ETF.
        Table 3 indicates that forecast error variance in Nifty Bank TRI index is not significantly explained by ETF Bankbees. On day 1, 100% of error variance in underlying index BankTRI is explained by innovations in BankTRI itself. On the other days also, the contribution of Bankbees in explaining forecast error variance in the underlying index remains significantly lower at about 0.08%. On the other hand, on day 1, more than 89% of error variance in Bankbees ETF is contributed by the underlying asset, i.e. Bank TRI Index. On the remaining days, even though the contribution of the underlying index declines, it remains significantly higher at 87%. About 12% of error variance in Bankbees ETF is explained by its own innovations, i.e. developments within the ETF market. However, a deviation of 12% error variance in Bankbees to its own innovations is suggestive of the fact that Bankbees ETF generates its own trading signals to a limited extent which the investors will have to factor while investing in bank ETFs. But overall, the impact of the movements in underlying index is substantial on the banking sector ETF.

Table 3. Results of Forecast Error Variance Decomposition (FEVD) for Nifty Bank TRI and Bankbees ETF

Variance Decomposition of LRBANKTRI:			
Period	S.E.	LRBANKTRI	LRBANKBEES
1	0.013093	100.0000	0.000000
2	0.013148	99.95918	0.040824
3	0.013169	99.95308	0.046923
4	0.013177	99.92352	0.076480
5	0.013178	99.91823	0.081775
6	0.013178	99.91810	0.081904
7	0.013178	99.91805	0.081952
8	0.013178	99.91785	0.082146
9	0.013178	99.91784	0.082156
10	0.013178	99.91784	0.082157
Variance Decomposition of LRBANKBEES:			
Period	S.E.	LRBANKTRI	LRBANKBEES
1	0.012469	89.11486	10.88514
2	0.012665	87.91915	12.08085
3	0.012672	87.92802	12.07198
4	0.012704	87.71244	12.28756
5	0.012710	87.62653	12.37347
6	0.012711	87.62562	12.37438
7	0.012711	87.62361	12.37639
8	0.012711	87.62129	12.37871
9	0.012711	87.62098	12.37902
10	0.012711	87.62092	12.37908
Cholesky Ordering: LRBANKTRI LRBANKBEES			

The similar situation, however, does not exist in case of infrastructure sector ETF. As can be seen from Table 4, while forecast error variance in Nifty Infrastructure TRI index is explained largely by its own innovations (from about 99% to 100% on various days), the innovations in Infrabees ETF play a significant role in determining movements in infrastructure ETF market. The innovations in market for underlying asset contributes to maximum of 25.33% of error variance in Infrabees ETF on day 1 which further decreases to 23.28% during subsequent days. On the other hand, its own innovations contribute about 74.66% to 76.71% of error variance in Infrabees. This is in contrast with the observations made in case of ETF based on bank based equity index above where the underlying asset is able to explain significant amount of forecast error variance in dependent ETF.

Table 4. Results of Forecast Error Variance Decomposition (FEVD) for Nifty Infra TRI and Infrabees ETF

Variance Decomposition of LRINFRATRI:			
Period	S.E.	LRINFRATRI	LRINFRABEES
1	0.012357	100.0000	0.000000
2	0.012468	99.65424	0.345763
3	0.012473	99.65446	0.345542
4	0.012475	99.63415	0.365851
5	0.012475	99.63358	0.366421
6	0.012475	99.63174	0.368257
7	0.012475	99.63169	0.368308
8	0.012475	99.63163	0.368367
9	0.012475	99.63162	0.368383
10	0.012475	99.63161	0.368387

Variance Decomposition of LRINFRABEES:			
Period	S.E.	LRINFRATRI	LRINFRABEES
1	0.015608	25.33021	74.66979
2	0.016890	23.08208	76.91792
3	0.016909	23.17069	76.82931
4	0.016935	23.32343	76.67657
5	0.016978	23.28533	76.71467
6	0.016980	23.28000	76.72000
7	0.016980	23.28102	76.71898
8	0.016981	23.28152	76.71848
9	0.016981	23.28127	76.71873
10	0.016981	23.28128	76.71872
Cholesky Ordering: LRINFRATRI LRINFRABEES			

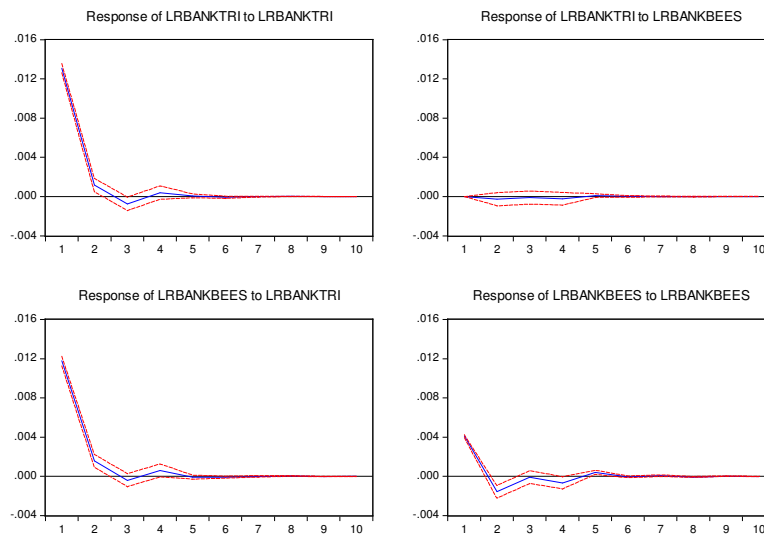**Impulse Response Functions**

VAR framework allows tracing the reactions of one market to shocks originating in other market through impulse response functions (IRFs). Fig.1 and Fig.2 below explain these reactions between market for ETF and market for underlying asset with respect to banking sector ETF and infrastructure sector ETF respectively.

As can be seen from Fig.1, the response of Nifty Bank TRI index to its own shocks is 0.014 on day 1 and is reduced to zero around 4th day. Its response to shocks originating in ETF market is highly insignificant. However, the response of banking sector ETF, Bankbees to shocks in Nifty Bank TRI index is instant and is marginally less than 0.012 on day 1 itself and is reduced to zero around 5th day with significant drop from day 2 onwards. Its response to its own shocks is very low at 0.004 on day 1. Thus shocks originating in Nifty Bank TRI are significant and quickly transmitted in Bankbees ETF market.

On the other hand, it can be seen from Fig.2 that the response of Infrabees ETF to shocks originating in its own market is higher (0.014) than that for shocks originating in underlying Nifty Infrastructure index (0.008). The shocks originating in underlying index taper off to zero by 6th day. Similarly, the shocks originating in ETF market also take around 6 days to reduce to zero. Thus, shock last longer in infrastructure ETF market as compared to banking sector ETF market.

Conclusion

From the above results and discussion it can be concluded that underlying asset does contribute to movements in prices in ETF market. However, significant difference exists between such contributions with respect to banking sector ETFs and infrastructure sector based ETFs. A morecloser comovement exists between Nifty Bank index and Bankbees ETF as compared to that observed between Nifty Infrastructure index and Infrabees ETF. Thus, returns on Bankbees ETF may move closer to those on Nifty Bank Index itself and therefore passive investment style is advisable for investors dealing in banking sector ETF. On the other hand, investors need to monitor Infrabees ETF market closely since developments in Infrabees ETF market itself rather than the underlying asset market, are found to be more significant in explaining movements in Infrabees ETF. Thus, here active investment style may be more useful. Further research is required to identify factors responsible for such significant mispricing observed in infrastructure ETF.

Fig.1. Results of Impulse Response Function for Nifty Bank TRI and Bankbees ETF

Response to Cholesky One S.D. Innovations ± 2 S.E.

Fig.2. Results of Impulse Response Function for Nifty Infra TRI and Infrabees ETF

Response to Cholesky One S.D. Innovations ± 2 S.E.
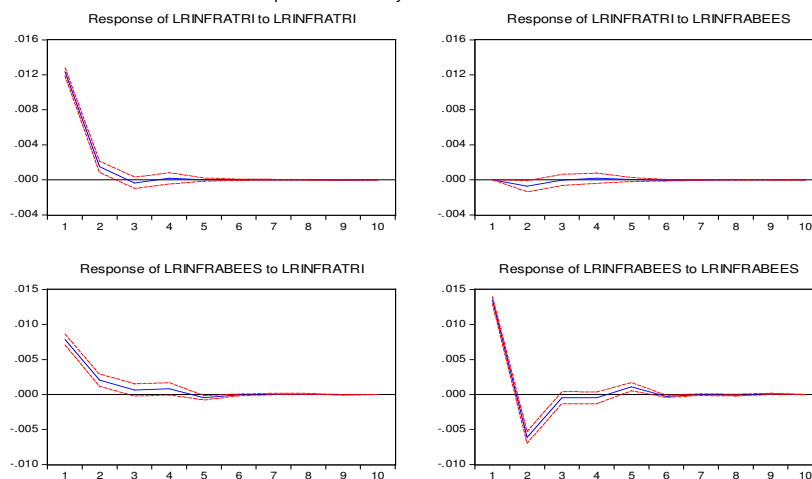
References:

Sims, C.A. (1980). Macroeconomics and Reality. Econometrica, 48, 1-48.

Granger, C.W.J., Newbold, P. (1974). Spurious Regressions in Econometrics. Journal of Econometrics, 2, 111-120.

Elton, M.J., Gruber, M.J., Comer, G., and Li, K. (2002). Spiders: Where are the bugs?. The Journal of Business, 75(3), 453-472.

Da and Shive (2017). Exchange Traded Funds and Asset Return Correlations. European Financial Management, 24, 136-168.

DeFusco, R.A., Ivanov S.I., Karels, G.V. (2011). Journal of Economics and Finance, 35(2), 181-197.

Ivanov, S. I. (2013). The influence of ETFs on the Price Discovery of Gold, Silver and Oil. Journal of Economics and Finance, 37-3, 453-462.

Khanapuri, H. (2012). Examining the Relationship Between ETFs and their Underlying Assets in Indian Capital Market. IPCSIT, IACSIT Press, Singapore, 54,109-114.

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