

## **Persistence of Volatility Spillovers in Indian Equity Exchange Traded Funds**

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### **ABSTRACT**

*This study adopted the GARCH(1,1) model to estimate the volatility spillover of equity Exchange Traded Fund (ETF) daily returns with their underlying benchmark daily returns. Augmented Dicky Filler (ADF) Unit root has employed to examine the stationarity of the time series data. A rapid growth occurred in the ETFs in India, ETFs have become an important factor in volatility generating process of their underlying benchmark indices, as it is found in Indian equity ETFs. The study has actually examined that how the volatility transmission occurs in between ETF returns and their underlying benchmark. GARCH reveals that huge volatility is always resulted from huge volatility and low volatility if from low volatility periods. Volatility spillover for the Equity ETFs and Underlying Benchmark indices were found to be significant for all the ETFs traded in Indian stock market. Internal shocks happening in the market will automatically generate an impact in the ETF portfolio. The findings provide interdependence of ETFs and their underlying portfolio. The stock market indices including Nifty 50, S&P BSE Sensex, Nifty Bank, Nifty Infra etc showed high volatility during some time horizons, which automatically generated a volatility transition to the ETF portfolio also.*

**Keywords:** exchange traded funds, volatility spillover, stock market indices, returns.

### **INTRODUCTION:**

An Exchange Traded Fund(ETF) is basically an index fund that is listed and traded on Stock Exchanges like a stock. It represents a basket of stocks through the composition of index. Now ETFs are one of the major financial products which have rapid growth in the global stock market. The first ETF traded on a U.S stock exchange was State Street SPDR (SPY), which was introduced in 1993. SPY tracks the S&P 500 index and is currently the most heavily traded security in the world. This study examines how volatility information flows among equity ETFs in India and their underlying indices. The study mainly deals with the tracking indicators which are contributing to the performance of exchange traded funds in Indian equity ETF segment. Finding the changes in their performance resulted through such kind of volatility seen in the Indian stock market. Through the study researcher would like to bring an observation about the volatility spillover, Alpha, Beta and the relationship of popular equity ETFs traded in the National Stock Exchange (NSE) and their respective underlying benchmark.

It is an attempt to identify the significance and importance to the volatility generating process. The study goes through the various sources of volatility spillover that are closely related with the ETF trading activity. Considering the factors influencing the creation of factor of ETF is contributing a lot to boost the trading volume of ETFs in India.

Exchange traded funds (ETFs) are a remarkable example of financial innovation that facilitates the investors with distinctive features of mutual fund and an ordinary stock. ETF act as the stock because it can be traded in the stock exchange, and at the same time act as mutual funds because they are providing diversified portfolio. Exchange traded funds are functioning just like a stock means the investors can freely purchase and sell ETFs throughout the market hours and the price is determined by demand and supply factors. An exchange traded funds possess a portfolio, at the same time, it can be traded in the stock market. Valle & Beasley (2014) observed that ETF prices vary according to the changes in the price of an underlying portfolio of assets vary in value. The benefits of ETFs over mutual funds are, among other things, lower costs, the possibility of tracking the performance of the whole market rather than investing in single stocks, and potentially better investment results, as active fund Managers tend to underperform the market. ETFs have brought fundamental changes to the construction of portfolio, due to their ease of diversification. Exchange Traded Funds have become gradually more popular among investors in the last Decade. Due to their abundant advantages, ETFs have lured the retail and institutional Investors alike. ETFs are traded daily like stocks on the stock exchanges and they closely track the real time underlying NAVs. The extraordinary progress of ETFs has created the concentration of researchers and investors.

Through the, tracking indicators of equity exchange traded funds are analysed. Elton et al (2002) observed that SPDRs performance was poor comparing to its benchmark. Underperforming the benchmark indicates the portfolio return for the Exchange Traded Fund (ETFs) was less over the benchmark. Harpper (2002) did a comparison over the risk and return performance of ETFs for foreign market and closed end country funds. The result brought from their study is tracking errors are uniform but none of them are negative. It shows that ETFs were followed their benchmark. Bernstein (2009) has opined that important changes have occurred in the underlying asset because of the influence of ETF. Krause, T., Ehsani, S., & Lien, D. (2014) found that ETFs are playing a major role in volatility generating process to their underlying assets, i.e., to the largest component stock. Blitz & Huji (2012) opined that the tracking errors the equity ETFs in the developed markets are substantially higher. At the same time, they could not find any convincing evidence that the funds have a higher return over the ETFs that rely on full-replication techniques. Buetow, G. W., & Henderson, B. J. (2012) found that ETFs exhibit little tracking error in connection with their underlying indexes, particularly when the portfolio is constituted with highly liquid securities. Tracking errors in fixed income ETFs were directly related to the three proxies for illiquidity and transaction cost, Houweling (2012). ETFs performance is highly influenced by the bench market in every emerging market. Harper, J. T., Madura, J., & Schnusenberg, O. (2006) studied about the performance of the ETFs and their benchmark; they have considered tracking errors for the study. It was calculated from the difference between the ETF return and their benchmark return. Milonas, N. T., & Rompotis, G. G. (2006) estimated tracking errors from the average absolute differences, standard errors through regression analysis and standard deviation of return differences. Jensen (1968), observed that a negative alpha for the mutual fund indicates the underperformance and it may generate more and more expensive. Here in the study, we are trying to bring knowledge about risk-return performance ETFs over their benchmark through the indicators of alpha and beta. Baker, Bradely & Taliaferro (2014) found that the low risk variance by molding it into micro and macro effects and find that industry betas establish a significant part of the outperformance of low beta of stocks.

As per the financial theory and law of one price the price of the securities like derivatives, ETFs etc. should be priced in a way that is closely related to the value of the underlying securities. Hasbrouck, J. (2003) observed that sometimes even Derivative prices also lead spot prices. Here in the study, we are looking for how the volatility generating process happened for the ETFs with their underlying benchmark indices. Krause, T., Ehsani, S., & Lien, D. (2014) probed that volatility spillovers from ETFs to their largest stock are increasing in liquidity, the proportion of each stock held by the fund, deviations from net asset value. Kyle (1985) and Admati, A. R., & Pfleiderer, P. (1988) found that a theoretical relation between volatility and intensity of information is eminent.

The study explores the knowledge about Indian Equity ETFs and their underlying benchmark in terms of volatility and returns spillovers with their underlying benchmark.

**DATA:**

The study utilizes daily Exchange Traded Funds and underlying benchmark return and price data for each equity ETF s traded in National stock exchange. Collected data from Bloomberg Database since it is published till of 27<sup>th</sup> December 2017. Summary statistics for ETFs and Underlying Benchmark

**SUMMARY STATISTICS OF DAILY RETURNS FOR ETFs AND BENCHMARK INDICES:**

Equity ETFs	N	Mean	Median	Max	Min	S.D
BIRLA ETF	1659	0.070759	0.000000	13.26000	-13.90000	2.541561
CPSE ETF	938	0.048742	0.000000	9.210000	-7.930000	1.211164
ICICI CNX 100 ETF	1111	0.106157	0.000000	18.82000	-21.62000	2.768528
ICICI SENSEX ETF	1446	0.253783	0.000000	23.48000	-20.17000	4.162593
KOTAK BANK ETF	762	0.050551	0.000000	5.270000	-6.220000	1.168592
KOTAK PSU BANK ETF	1150	0.067487	0.000000	18.80000	-19.66000	2.766985
MOTILAL MIDCAP EFT	1033	0.041539	0.000000	8.100000	-6.790000	1.241697
QNIFTY ETF	2404	0.040616	0.000000	16.31000	-12.09000	1.429172
RELIANCE CONSUMPTION	938	0.128390	0.000000	29.71000	-17.79000	3.468833
RELIANCE DIV OPP ETF	916	0.085349	0.000000	18.91000	-17.74000	2.807179
RELIANCE BANK BEES	1325	0.113464	0.000000	9.260000	-7.330000	1.515318
RELIANCE NIFTY 100 ETF	1174	0.084702	0.000000	19.38000	-12.99000	2.069803
RELIANCE NIFTY BEES	1968	0.071575	0.010000	14.63000	-10.09000	1.294380
RELIANCE INFRA ETF	1119	-0.000188	0.000000	9.390000	-8.840000	1.618512
RELIANCE JUNIOR BEES	873	0.224559	0.000000	18.40000	-17.61000	2.658183
SBI BANK ETF	698	0.061862	0.000000	17.32000	-12.71000	1.679433
SBI NEXT 50 ETF	698	0.079771	0.000000	19.49000	-16.80000	1.799772
SETFNIFTY ETF	610	0.039754	0.000000	10.07000	-9.740000	1.141114
UTINIFTY ETF	567	0.057178	0.000000	3.080000	-3.560000	0.830558

Equity ETFFs	N	Mean	Median	Max	Min	S.D
BIRLA BENCH MARK	1659	0.045521	0.000000	3.810000	-5.920000	0.952564
CPSE BENCH MARK	938	0.041194	0.010000	9.380000	-8.540000	1.238638
ICICI CNX 100 BENCH MARK	1111	0.067219	0.040000	3.650000	-6.300000	0.875121
ICICI SENSEX BENCH MARK	1446	0.181881	0.150000	10.52000	-11.14000	1.517305
KOTAK BANK BENCH MARK	762	0.048727	0.000000	4.890000	-6.900000	1.170430
KOTAK PSU BANK BENCH MARK	1150	0.058757	0.000000	29.63000	-11.91000	2.550809
MOTILAL MIDCAP BENCH MARK	1033	0.041297	0.070000	3.530000	-3.79	1.020801
QNIFTY BENCH MARK	2404	0.040874	0.000000	17.74000	-12.2	1.311686
RELIANCE CONSUMPTION BENCH MARK	938	0.067463	0.040000	3.680000	-5.98	0.830960
RELIANCE DIV OPP BENCH MARK	916	0.030153	0.030000	3.540000	-7.04	0.896400
RELIANCE BANK BEES BENCH MARK	1325	0.109404	0.050000	5.360000	-7.12	1.400890
RELIANCE NIFTY 100 BENCH MARK	1174	0.067760	0.040000	3.650000	-6.3	0.886809
RELIANCE NIFTY BEES BENCH MARK	1968	0.073918	0.000000	17.74000	-12.2	1.354425

Equity ETFFs	N	Mean	Median	Max	Min	S.D
RELIANCE INFRA BENCH MARK	1119	-0.00816	0.000000	4.570000	-4.52	1.210987
RELIANCE JUNIOR BEES BENCH MARK	873	0.189301	0.260000	8.560000	-12.21	1.638712
SBI BANK BENCH MARK	698	0.056289	0.025000	4.710000	-6.9	1.134283
SBI NEXT 50 BENCH MARK	698	0.073352	0.120000	3.380000	-8.23	1.022639
SETF NIFTY BENCH MARK	610	0.038230	0.015000	3.370000	-5.92	0.825867
UTI NIFTY BENCH MARK	567	0.052610	0.020000	3.370000	-3.32	0.765567

Table 1 presents summary statistics of returns for the Indian equity ETFs and their underlying benchmark indices. Return and risk characteristics of Exchange Traded Funds (ETFs) and their underlying security. Here in the study we considered equity ETFs and their benchmark indices and comparing the performance of ETFs with the underlying benchmark indices.

**METHODOLOGY AND RESULT:**

Since the data used for the study is time series data, the stationarity of the data is examined using the Augmented Dickey-Fuller unit root test. To examine the volatility transmission of Equity ETFs with their underlying benchmark indices we used GARCH (1,1) model. The presence of heteroscedasticity or unequal variance in different observations is tested in the GARCH model.

**Unit root test:**

Augmented Dickey-Fuller unit root test has performed to see the stationarity of the data for the requirement of further analysis. Since the data is the return of ETFs and the underlying benchmark in the first level itself data was stationary for all the selected ETFs. The null hypothesis for the unit root is “time series has unit root”. As the calculated p-value is lesser than the significance level alpha =0,1, the null hypothesis can’t be accepted. Here in the study, we found p values for the selected ETFs are significant. So it can be assumed that Data is stationary in nature.

**Volatility spillover:**

The study tries to measure the volatility transmission happened in the Indian Equity ETFs return with their underlying benchmark return. Since the autocorrelation is found serial correlations exist in the model, so it can be assumed that ARCH effect is there. So it is mandatory to employ GRACH(1,1) model to see the volatility spillover. Diebold and Yilmaz (2009, 2012) proposed spillover model to measure the transmission of volatility. Chen & Huang (2008) used GARCH-ARMA (Generalised AutoRegressive Conditional Heteroscedasticity – Auto-Regressive Moving Average) model to examine the impact of spillover effect on returns and volatilities of component stock and ETFs for the developed and emerging stock market. The study is keeping the null hypothesis (H0) states that there is no spillover effects of volatility against the alternative hypothesis (H1) states that there is spillover effect for the volatility among ETFs and their underlying benchmark.

GARCH can be estimated as follows,

$$R_i^e = \alpha_0 + \sum_{i=1}^g \alpha_i R_{i,t-i}^e + \varepsilon_{i,t}^e + \sum_{i=1}^s \phi_i \varepsilon_{i,t-i}^e + t - i$$

**Table 2: Garch Result**

ETF	ARCH		GARCH	
	Co-efficient	P – VALUE	Co-efficient	P – VALUE
BIRLA ETF	0.086786	0	0.878929	0
CPSE ETF	0.642543	0	0.431145	0
ICICI CNX 100	0.199508	0	0.854412	0
ICICI SENSEX	0.270847	0	0.81439	0
KOTAK BANK	0.238676	0	0.695081	0
KOTAK PSU BANK	0.199901	0	0.833976	0
MOTILAL MIDCAP100	0.295001	0	0.956112	0

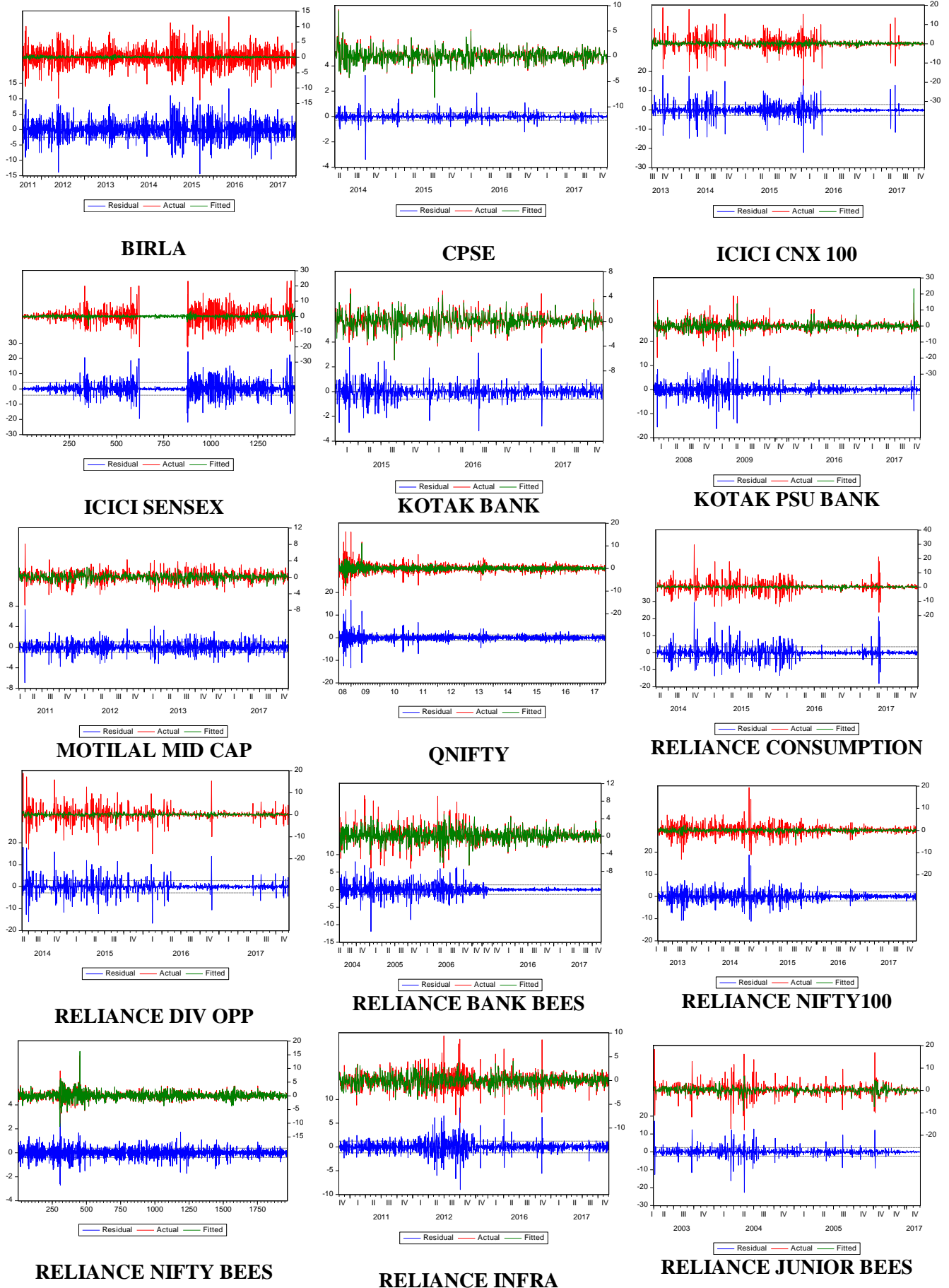
ETF	ARCH		GARCH	
	Co-efficient	P – VALUE	Co-efficient	P – VALUE
QNIFTY	0.142856	0	0.857411	0
RELIANCE_CONSUMPTION	0.146958	0	0.898714	0
RELIANCE_DIVIDEND_OPPORT	0.236389	0	0.832108	0
RELIANCE_BANK_BEES	0.085064	0	0.917448	0
RELIANCE_NIFTY100_CNX100	0.076784	0	0.930221	0
RELIANCE_NIFTY_BESS	0.28651	0	0.643371	0
RELIANCE_INFRA	0.307866	0	0.636511	0
RELIANCE_JUNIOR_BEES	0.293617	0	0.744483	0
SBI_BANK	1.082284	0	0.559574	0
SBI_NEXT_50	0.234623	0	0.875359	0
SETFNIFTY	0.46584	0	0.805625	0
UTI_NIFTY	0.310009	0	0.524984	0

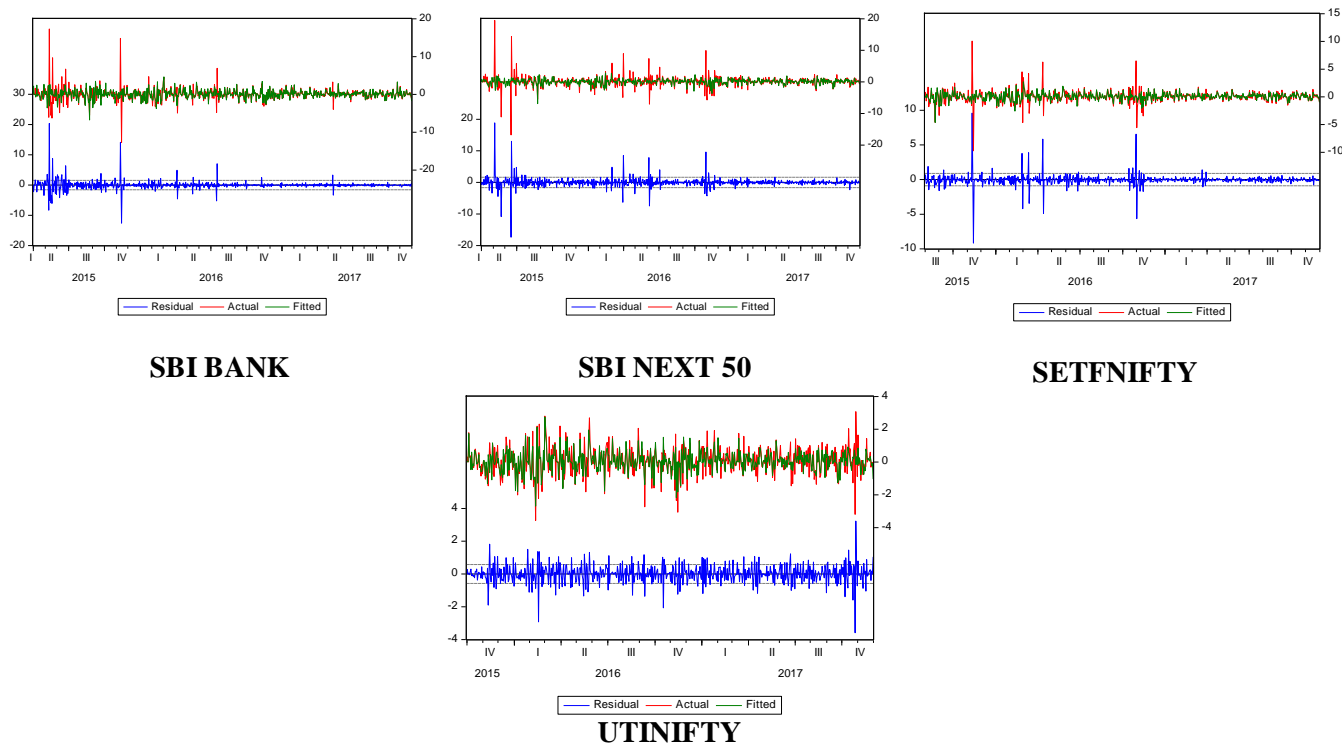
GARCH (1,1) model has employed to see the volatility transmission for the ETFs and underlying. We used equity ETFs traded in India and their underlying benchmark to see the volatility spillover. Here the dependent variable is volatility of ETFs and the independent variable is underlying benchmark volatility. The study goes through how the volatility transmission occurs in between ETF returns and their underlying benchmark. Mean equation of the GARCH represent the variance of the residual, i.e., Dependent variable (Volatility of ETF return), and variance equation represents ARCH and GARCH. Here GARCH reveals that every underlying benchmark in Indian stock market is significant to explain the volatility of ETF return. That means a shock happened in the market will directly create an impact on the Equity ETFs volatility. Koutmos (1994) probed that similar capital market will easily affected by lagged return volatility continuity, which is related to the phenomenon for returns volatility.

The below given graph shows the total volatility spillover for each equity ETFs and their respective underlying benchmark indices. It shows the interaction of volatility spillovers among ETFs and their underlying benchmark indices. The study reveals the result that, low volatility and a prolonged period of high volatility exist in Indian equity ETFs. Simply, periods of high volatility followed by the period's high volatility and the periods of low volatility tend to be followed by periods of low volatility. The spikes of the volatility have clearly observed during the time of financial crisis in 2007. The influence of Himachal and Gujarat election happened in 2017 December also impacted in the volatility in the stock market. As a result of volatility occurrence in the stock market indices, the ETF portfolio also has a significant influence that is observed in the below graph.

**CONCLUSION:**

The volatility spillover for the Indian equity ETFs with their underlying benchmark is examined through the study. For every ETFs traded in the National Stock Exchange is found to be very close to their underlying benchmark in terms of return volatility occurrence. Volatility transmission generated from the underlying benchmark to the Equity ETFs since the portfolio is efficiently following the benchmark. Market shocks happening in the stock market indices including S&P 100, Nifty 50, Nifty Bank etc. will create an impact in the ETF portfolio also. So it can be concluded that internal shocks happening in the market will automatically generate an impact in the ETF portfolio. Most of the time it is observed those periods of high volatility is followed by periods of high volatility and the low volatility to be tended to follow the periods of low volatility.





**REFERENCES:**

Admati, A. R., & Pfleiderer, P. (1988). A theory of intraday patterns: Volume and price variability. *The Review of Financial Studies*, 1(1), 3-40.

Baker, M., Bradley, B., & Taliaferro, R. (2014). The low-risk anomaly: A decomposition into micro and macro effects. *Financial Analysts Journal*, 70(2), 43-58.

Bansal, V. K., & Marshall, J. F. (2015). Tracking error decomposition and return attribution for leveraged exchange traded funds. *Global Finance Journal*, 28, 84-94.

Bernstein, J. (2009). *Commodities ETFs: Diversification and hedging*. *ETFzone.com*, Published: Thursday, September, 3, 2009.

Bhattacharya, A., & O'Hara, M. (2016). Can etfs increase market fragility? *Effect of information linkages in etf markets*.

Blitz, D., & Huij, J. (2012). Evaluating the performance of global emerging markets equity exchange-traded funds. *Emerging markets review*, 13(2), 149-158.

Brennan, M. J., & Subrahmanyam, A. (1995). Investment analysis and price formation in securities markets. *Journal of Financial Economics*, 38(3), 361-381.

Buetow, G. W., & Henderson, B. J. (2012). An empirical analysis of exchange-traded funds. *The Journal of Portfolio Management*, 38(4), 112-127.

Chen, J. H., & Huang, C. Y. (2010). An analysis of the spillover effects of exchange-traded funds. *Applied Economics*, 42(9), 1155-1168.

Elton, Edwin J., Martin J. Gruber, George Comer, and Kai Li, 2002, Spiders: Where are the bugs? *Journal of Business*, 75, 453-472.

Harper, J. T., Madura, J., & Schnusenberg, O. (2006). Performance comparison between exchange-traded funds and closed-end country funds. *Journal of International Financial Markets, Institutions and Money*, 16(2), 104-122.

Harper, J. T., Madura, J., & Schnusenberg, O. (2006). Performance comparison between exchange-traded funds and closed-end country funds. *Journal of International Financial Markets, Institutions and Money*, 16(2), 104-122.

Hasbrouck, J. (2003). Intraday price formation in US equity index markets. *The Journal of Finance*, 58(6), 2375-2400.

Houweling, P. (2012). On the Performance of Fixed-Income Exchange-Traded Funds. *The Journal of Index Investing*, 3(1), 39-44.

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.

- Jensen, M. C. (1968). The performance of mutual funds in the period 1945–1964. *The Journal of finance*, 23(2), 389-416.
- Krause, T., Ehsani, S., & Lien, D. (2014). Exchange-traded funds, liquidity and volatility. *Applied Financial Economics*, 24(24), 1617-1630.
- Kyle, A. S. (1985). Continuous Auctions and Insider Trading. *Econometrica* 53(6): 1315-1335.
- Madhavan, V. (2014). Investigating the nature of nonlinearity in Indian Exchange Traded Funds (ETFs). *Managerial Finance*, 40(4), 395-415.
- Milonas, N. T., & Rompotis, G. G. (2006). *Investigating European ETFs: The case of the Swiss exchange traded funds*. In Conference of HFAA in Thessaloniki, Greece.
- Peltomäki, J. (2016). Beta as a determinant of investor activity in sector exchange-traded funds. *The Quarterly Review of Economics and Finance*.
- Qadan, M., & Yagil, J. (2012). On the dynamics of tracking indices by exchange traded funds in the presence of high volatility. *Managerial Finance*, 38(9), 804-832.
- Shin, S., & Soydemir, G. (2010). Exchange-traded funds, persistence in tracking errors and information dissemination. *Journal of Multinational Financial Management*, 20(4), 214-234.
- South Carolina Retirement System Investment Commission. (2015). 2014-2015 annual investment report. *South Carolina State Documents Depository*.
- Valle, C., Meade, N., & Beasley, J. (2014). Exchange-traded funds: a market snapshot and performance analysis.

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