OPEN ACCESS

Manuscript ID:
COM-2022-10014114

Volume: 10

Issue: 1

Month: January

Year: 2022

E-ISSN: 2582-6190

Received: 10.10.2021

Accepted: 11.12.2021

Published: 01.01.2022

Citation:
Sabu, Marvin, and Rajani B. Bhat. "A Theoretical Study on Leverage and Spillover Effects in Indian Equity ETFs." *ComFin Research*, vol. 10, no. 1, 2022, pp. 73–79.

DOI:
https://doi.org/10.34293/commerce.v10i1.4114

A Theoretical Study on Leverage and Spillover Effects in Indian Equity ETFs

Marvin Sabu
Research Scholar, Post Graduate and Research
Department of Commerce, The Cochin College, Kochi, Kerala, India

Rajani B Bhat
Assistant Professor and Research Supervisor
Post Graduate & Research Department of Commerce
The Cochin College, Kochi, Kerala, India

Abstract
Exchange-Traded Funds (ETFs) are innovative financial instrument as it is well-diversified like a mutual fund and listed in a stock exchange. Since the launch of the first ETF (Nifty BeES ETF) in 2001, the Indian ETF market has seen growth in the number of ETF schemes and Asset Under Management (AUM). This study is an overview of previous studies on spillover and leverage effects in the Indian Equity ETF market and related works to tap the research gap in these twin areas. The study found a need for a rigorous evaluation of the strength and nature of leverage effect among different Broader Index ETFs, Sectoral/thematic ETFs and World ETFs in India. The study also identified a research gap for the conduct of a study on the spillover of mean, volatility, risk between Equity ETFs and its benchmark index, and the speed of spillover effect would be immensely useful for investors and other stakeholders in the Indian Equity ETF market.
Keywords: Exchange Traded Funds, Leverage Effect, Spillover Effect, Benchmark Index, Volatility, Returns.

Introduction

Exchange-traded funds have gained wide acceptance as financial instruments whose unique advantages over mutual funds have caught the eye of many investors. Even though it is so, the Indian ETF market is still in its infancy stage. According to the Association of Mutual Funds in India (AMFI), industry trends report February 2021, individual investors hold predominantly onto equity-oriented schemes (69 per cent) and only 2 per cent of holdings in ETFs and Fund of Fund (FOF) schemes. This fact indicates the ignorance of investors ETF as an investment avenue. But the positive side is that there is a significant rise in ETF market share from 7 per cent in February 2020 to 9 per cent in February 2021 (AMFI). From mere ₹1403 crores of Asset Under Management (AUM) in ETFs in 2009 now the ETF market has grown up to ₹1,54,412 crores in 2020. That is, a 110 times growth within 12 years (CAGR of 48 per cent). Figure 1 & 2 in appendix provides the graphical representation of growth in the number of ETF schemes as well as AUM.

There is a dearth in the availability of studies on the Indian ETF market. This article is a brief evaluation of existing research works conducted on the Indian ETF market and the international ETF market by keeping in mind the twin objectives as given below.

- To analyse the spillover effect of return and volatility between Equity ETFs in India and its Benchmark Indices.
- To evaluate the presence of leverage effect in conditional variance Equity ETFs in India.

Spillover Effect

The study of the spillover effect between the benchmark index and ETF returns and volatilities stems from co-integration between returns and volatilities. Many studies are available in the literature that substantiates either unidirectional or bidirectional spillover between various asset classes (including ETFs) return series and volatilities. The spillover effect between ETF and benchmark index reveals whether integration between the markets and such integration (either unidirectional or bidirectional) will be useful at times like financial crisis to check the chances of predicting contagion risk.

Leverage Effect

In simple terms, the leverage effect is the negative correlation between volatility and returns. This is due to the tendency for volatility to rise more following a large price fall than following a price rise of the same magnitude (Brooks). One of the explanations for these negative correlations between past returns and future volatility is leverage. That is, when there is an arrival of bad shocks/news, the price of equity will be get reduced, which in turn increases the financial leverage (debt-equity ratio) of the corresponding company, making the company riskier, and it tends to increase the future volatility (Black; Christie). But this explanation cannot be attributable to ETFs as it is a hybrid instrument and also (Kristoufek) noted that the leverage effect in a modern high-speed market can be of a multitude of forces rather than just expected earnings. Few studies identified leverage effect or asymmetric reaction of volatility to the lagged return of ETFs like (Chandrasekaran and Acharya; Chen, "The Spillover and Leverage Effects of Ethical Exchange Traded Fund").

The leverage effect in financial data series is widely discussed in many studies internationally. In contrast, when it comes to Indian financial market studies, not many serious studies are done in this regard. Especially as studies were done in ETFs in the Indian market is less, there is a need for conducting a study on leverage effect in ETFs India.

Literature Review

This section is divided into 2 parts, where first section details previous studies related to leverage effect and the second section on spillover effect. Both national and international studies have been evaluated to identify the research gap for future study in Indian Equity ETFs.

Spillover Effect

Kholdy (1995) studied annual Foreign Direct Investment (FDI) of developing countries (Mexico, Brazil, Chile, Singapore and Zambia) from 1970 to 1990 to evaluate the causal relationship between FDI and technical efficiency (labour productivity and capital formation). Multivariate Granger causality tests combined with Akaike's final prediction error (FPE) criterion were performed to find spillover between FDI and technical efficiency. Akaike's final prediction error (FPE) criterion is used to select an optimum lag length. The study finds no evidence of spillover efficiency in higher labour productivity and capital formation in the host developing countries merely due to the presence of foreign direct investment. Only the spillover causality of FDI through capital formation was evident in the study.

Mozumder & Marathe (2007) found unidirectional causality from the per capita GDP of Bangladesh to the capita electricity consumption of Bangladesh. This result was obtained by the researchers by analysing Per capita GDP and Per capita electricity consumption data of Bangladesh from 1971 to 1999. The implication of such relation is that GDP stimulates energy consumption in Bangladesh. The study utilised the Granger Causality test with Vector Error Correction Model (VECM) specification to examine the causality relationship between the per capita electricity consumption and the per capita GDP of Bangladesh. Before conducting the Granger causality test, the study first affirmed the Johansen Cointegration test based on trace statistics.

Liu et al. (2008) found bidirectional spillover risk and information between copper future market and spot market (mean, volatility, risk) of the Chinese market. And it is also empirically validated that spillover from the futures market to the spot market is more substantial. The researchers opined this result indicate futures market in China has a

dominant role in the copper markets. For analysis, the study utilised one-month copper futures closing prices from 10 July 2000 to 30 June 2006. The study also found good news has more impact on market volatility compared to bad news.

The Krause & Tse (2013) study on volatility relationship in US and Canadian ETF markets have proved that there has been a bidirectional-volatility spillover are present in varying amounts at the market level and for the financials and technology sector ETFs. At the same time, a unidirectional volatility spillover was seen from the US to Canada in the energy and basic materials sectors ETFs. The study was based on broad market ETF and 4 sectoral/industrial ETFs of both countries. The Granger causality test has demonstrated that US ETF returns lead to Canada ETF returns in broad market level as well as the r industries taken for study. The combination of negative U.S. return spillovers and asymmetric volatility creates a bidirectional volatility feedback effect.

Du & He (2015) studied four types of risk spillovers such as downside and upside risk spillovers (positive risk relations) and down-to-up and up-to-down risk spillovers (negative risk relations), which described all facets of the risk relationship between crude oil and stock markets. For this study, daily data of the S&P 500 stock index and West Texas Intermediate (WTI) crude oil futures were analysed fromthe 2004 to 2012. Before the financial crisis, there were positive risk spillovers from the stock market to the crude oil market and negative spillovers from the crude oil market to the stock market. After the crisis, the study found bidirectional positive risk spillover between crude oil and the stock market index. The study considered Kernel-based statistical tests to detect negative and positive risk spillover effects in series.

Singh & Kaur (2016) study has been conducted on 12 Indian Equity ETFs to examine their performance efficiency and to identify factors affecting tracking efficiency. The outcome of 15 the research is that on average Equity, ETFs have significant tracking error even though they try to replicate their underlying indices. Another major outcome is that AUM, the volume of trade, intra-day volatility are the factors that have significant effect on tracking efficiency of Equity ETFs. The major implication from this outcome is that beyond expense ratio investors should consider factors like AUM, volume, intra-day volatility etc., before selecting an ETF for investment. The study put forth a further validation of the outcome as the tenor for the work is limited.

Luu Duc Huynh (2019) examined spillover risks among cryptocurrency markets by evaluating 5 cryptocurrencies like bitcoin, ethereum, xrp, litecoin, and stellar. The study examined the data for cryptocurrencies from 2015 to 2019. The study used Vector Autoregression (VAR) Granger causality test and Structural Vector Autoregression (SVAR) Granger causality test to test risk spillover between coins. In contrast, SVAR was used to consider structural break (crash of Bitcoin in 2017) in series. In the study, to eliminate inconsistent results by VAR and SVAR granger causality test, further Copulas approach was used. From these wide set quantitative tests, it is found that there is contagion risk in the cryptocurrency market with the extreme value, which implies a simultaneous downward trend with the arrival of bad news. Ethereum has an independent relationship compared to the other cryptocurrencies, which is an indication of the use of ethereum in a portfolio to hedge risk.

Peng et al. (2020) conducted a study on the spillover effect between Brent crude oil (representing international oil market) and Shanghai index (SSE) (representing China's stock market) for a period ranging from 2005 to 2008. The study used the Bivariate empirical mode decomposition (BEMD) scale to study the linear and the nonlinear integrated Granger causality between the international oil market and China's stock market. The study has many interesting results of the spillover effect between markets on various time scales. Especially it is found that for long-time scales, there is a strong bi-directional linear and nonlinear spillover effect between the international oil market and the stock market.

Apart from the above reviews made, there are certain previous studies that utilized EGARCH model to detect leverage effect in series and combined GARCH-ARMA and EGARCH-ARMA models to evaluate spillover effect between

markets (Chandrasekaran and Acharya; Chen and Malinda; Chen and Huang; Chen, "The Spillover and Leverage Effects of Ethical Exchange Traded Fund"). The researchers used variants of GARCH model like EGARCH, GJR-GARCH and TGARCH for modelling asymmetric volatility due to limitation of basic GARCH models which cannot account for leverage effects. However, they can account for volatility clustering and leptokurtosis in a series (Brooks). And note that many studies have widely used Exponential Generalized Autoregressive Conditional Heteroskedasticity (EGARCH) model of Nelson (1991) to model this asymmetric volatility.

Leverage Effect

An empirical study conducted by Bouchaud et al. (2001) on 437 US stocks and 7 major international indices (the US and Europe) have come with an interesting result that the leverage effect i.e. the negative correlation between past returns and future volatility, is moderate for individual stocks and decays or prolong for 50 days. While it was found that there is a stronger leverage effect on stock indices but decays much faster than individual stocks. The leverage effect for stocks has been interpreted within a simple mentally disabled model, where volatility in stock price is not connected to the instantaneous value of price but on moving average of price over the past few months. For stock indices, this retarded model interpret that the "risk-aversion" phenomenon seems to be responsible for the enhanced observed negative correlation between volatility and returns. This study sheds light on how to interpret and estimate the leverage effect for future studies.

Goudarzi & Ramanarayanan (2011) examined the asymmetric volatility BSE500 index as a representative of the Indian stock market. For this purpose, close price data of BSE500 has been collected for the period 2000 to 2009. The study used both TGARCH and EGARCH models to evaluate the asymmetric volatility. The study, with no surprise, identified leverage effect in the conditional variance of BSE500 index. The study empirically found TGARCH (1, 1) model is the most fit compared to the EGARCH model for modelling asymmetric volatility.

Kristoufek (2014) examined the leverage effect and long-term memory of returns on energy futures such as WTI and Brent Crude oils, and Natural gas and heating oil. In this study, the author prefers Range-based estimators of volatility instead of general way estimation of volatility on absolute or squared returns. The study used Detrended cross-correlation and detrending moving-average cross-correlation coefficients to estimate the leverage effect between standardised returns and logarithmic volatility of series. The study found no long-term memory for the returns series of futures while there is a long-term memory for the volatility series. Surprisingly study found an inverse leverage effect for futures of Natural gas even though the rest followed the stylised leverage effect. Inverse leverage effect means positive shocks have a much higher impact on the future volatility of the series than negative shocks. Another interesting part of this study is the researcher used both logarithmic and standardised returns to estimate the leverage effect.

Christensen et al. (2015) empirically studied the daily return series of stock indices of 15 countries, including the U.S. stock index (CRSP value-weighted index) from 1926 through 2010. The study using the Fractionally integrated exponential GARCH-in-mean (FIEGARCH-M) model found out that the negative relation between return and volatility is stronger during a crises period. The researchers attribute such negative relation on either as a leverage effect or volatility feedback, and the study lists various crises for each countries stock index separately. In addition to that risk-return tradeoff is significantly positive only during financial crises and insignificant during non-crisis periods in the US market, and not such a consistent result in the case of risk-return tradeoff is seen in other countries.

Babu et al. (2020) worked on 10-year daily data of the NIFTY Bank index to study asymmetric volatility. By applying EGARCH (1, 1) model, the study found leverage effect in return series of Nifty Bank Index. The study finally concludes that bad surprises cause further volatility to good news in the Nifty Bank Index.

Aliyev et al. (2020) investigated the volatility of the Nasdaq-100 daily index return series from January 2000 to March 2019. The researchers were

able to find persistence of shocks and the long-term memory variance of series. GARCH term indicated the long memory of variance, and combination ARCH and GARCH terms indicated the persistence of shocks on return series. The presence of leverage effect (impact of negative shocks on volatility are higher than positive shocks of the same size) in the conditional variance of Nasdaq-100 was substantiated by researchers through EGARCH and GJR-GARCH models. Since the series date range covers the 2001 recession, 2008 financial crisis, 2016 and 2018 stock market decline, the researchers had expected structural breaks and used Fourier ADF Unit Root Test to check whether a structural break in NASDAQ100 return series. The researchers opined that by analysing such characteristics the investors could align their future position in the market.

Identification of Research Gap

There are many previous studies on various international ETF markets like in the US, China etc. When it comes to the studies on the Indian Equity ETF market, the studies are limited. Above all, many Equity ETFs have a track record of fewer than 10 years since their inception. And a study at the current scenario will be more meaningful as the previous studies in India considered ETFs, which have a track record of fewer than 10 years at that time.

The studies conducted on leverage effect in Indian Equity ETFs (Babu et al.; Chandrasekaran and Acharya; Goudarzi and Ramanarayanan) doesn't explicitly provide the reason for a negative correlation between past returns and future volatility. The implication part of such relation or non-relation is very much useful for investors in ETF to take a position. Apart from that, there is a need for evaluating leverage effect in the current time frame. The strength of leverage effect before and during the COVID-19 pandemic period is a possibility to draw the attention of stakeholders as done in previous study by (Christensen et al.) to understand nature volatility in the Indian Equity ETF market during those periods. There is also a possibility for future studies to be conducted to know the spillover of mean, volatility, risk between Equity ETFs and its benchmark index as (Liu et al.) did in his study. It will also be meaningful to know directional causality or linkage between different segments of Equity ETF market like Broader Index ETFs, Sectoral/thematic ETFs and World ETFs.

Conclusion

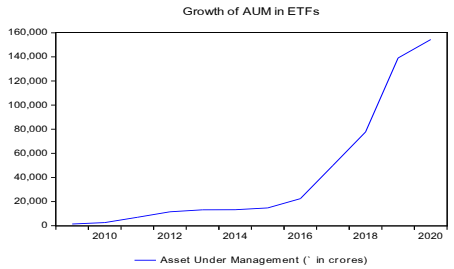
A study is proposed to be undertaken by the researchers in this regard. It is intended to conduct a research study based on the research gap identified as per this article, which mainly focuses on the leverage effect and spillover effect of Indian equity ETFs. The proposed study will be using the Granger Causality test (Engle & Granger, 1987) to explore the spillover of return and volatility between various Indian Equity ETFs and their corresponding benchmark index. This test will also be used evaluate the spillover of return and volatility between various ETF segments, which include Broader Index ETFs, Sectoral/ thematic ETFs and World ETFs listed in National Stock Exchange (NSE). To capture leverage effect in return series of ETFs, the model intended to be used a variant of Generalized Autoregressive Conditional Heteroskedasticity (GARCH) model, developed by Nelson (1991) called exponential generalised autoregressive conditional heteroscedasticity (EGARCH). The mathematical model for EGARCH is provided in the appendix.

Appendix

Conditional variance equation of EGARCH model

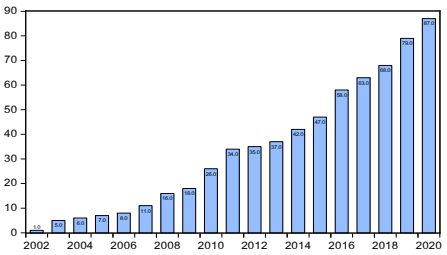
$$\ln(\sigma_t^2) = \omega + \beta \ln(\sigma_{t-1}^2) + \gamma \frac{u_{t-1}}{\sqrt{\sigma_{t-1}^2}} + \alpha \left[\frac{|u_{t-1}|}{\sqrt{\sigma_{t-1}^2}} - \sqrt{\frac{2}{\pi}} \right] \quad (1)$$

where, if the relationship between volatility and returns is negative, γ, will be negative.



Source: Compiled from AMFI's category wise AUM data as of 31st March of the year

Figure 1: Growth of Asset Under Management in ETF schemes (including Gold ETFs) from 2009 to 2020



Source: Compiled from AMFI's monthly report every April from 2002 to 2020.

Figure 2: Number of ETF schemes in India from 2002 to 2020

References

Aliyev, Fuzuli, et al. "Modelling Asymmetric Market Volatility with Univariate GARCH Models: Evidence from Nasdaq-100." *The Journal of Economic Asymmetries*, vol. 22, 2020.

AMFI. *Industry Trends 2021*, https://www.amfiindia.com/Themes/Theme1/downloads/home/Industry-Trends.pdf

Babu, P. Raja, et al. "Modeling Asymmetric Volatility: Evidence from India." *Journal of Critical Reviews*, vol. 7, no. 9, 2020, pp. 845-50.

Black, F. "Studies of Stock Price Volatility Changes." American Statistical Association, 1976, pp. 177-81.

Bouchaud, Jean-Philippe, et al. "Leverage Effect in Financial Markets: The Retarded Volatility Model." *Physical Review Letters*, vol. 87, no. 22, 2001.

Brooks, Chris. *Introductory Econometrics for Finance*. Cambridge University Press, 2008.

Chandrasekaran, Buvanesh, and Rajesh H. Acharya. "A Study on Volatility and Return Spillover of Exchange-Traded Funds and Their Benchmark Indices in India." *Managerial Finance*, vol. 46, no. 1, 2019, pp. 19-39.

Chen, J.-H., and C.Y. Huang. "An Analysis of the Spillover Effects of Exchange-Traded Funds." *Applied Economics*, vol. 42, no. 9, 2010, pp. 1155-68.

Chen, Jo-Hui. "The Spillover and Leverage Effects of Ethical Exchange Traded Fund." *Applied Economics Letters*, vol. 18, no. 10, 2011, pp. 983-87.

Chen, Jo-Hui, and Maya Malinda. "The Study of the Spillover and Leverage Effects of Financial Exchange Traded Funds (ETFs)." *Frontiers in Finance and Economics*, vol. 11, 2014, pp. 41-59.

Christensen, Bent Jesper, et al. "The Impact of Financial Crises on the Risk–Return Tradeoff and the Leverage Effect." *Economic Modelling*, vol. 49, 2015, pp. 407-18.

Christie, Andrew A. "The Stochastic Behavior of Common Stock Variances Value, Leverage and Interest Rate Effects." *Journal of Financial Economics*, vol. 10, no. 4, 1982, pp. 407-32.

Du, Limin, and Yanan He. "Extreme Risk Spillovers between Crude Oil and Stock Markets." *Energy Economics*, vol. 51, 2015, pp. 455-65.

Goudarzi, Hojatallah, and C.S. Ramanarayanan. "Modeling Asymmetric Volatility in the Indian Stock Market." *International Journal of Business and Management*, vol. 6, no. 3, 2011, pp. 221-31.

Kholdy, Shady. "Causality between Foreign Investment and Spillover Efficiency." *Applied Economics*, vol. 27, no. 8, 1995, pp. 745-49.

Krause, Timothy, and Yiuman Tse. "Volatility and Return Spillovers in Canadian and U.S. Industry ETFs." *International Review of Economics & Finance*, vol. 25, 2013, pp. 244-59.

Kristoufek, Ladislav. "Leverage Effect in Energy Futures." *Energy Economics*, vol. 45, 2014, pp. 1-9.

Liu, Xiangli, et al. "An Empirical Study on Information Spillover Effects between the Chinese Copper Futures Market and Spot Market." *Physica A: Statistical Mechanics and Its Applications*, vol. 387, 2008, pp. 899-14.

Luu Duc Huynh, Toan. "Spillover Risks on Cryptocurrency Markets: A Look from VAR-SVAR Granger Causality and Student's-t Copulas." *Journal of Risk and Financial Management*, vol. 12, no. 2, 2019.

Mozumder, Pallab, and Achla Marathe. "Causality Relationship between Electricity Consumption and GDP in Bangladesh." *Energy Policy*, vol. 35, no. 1, 2007, pp. 395-402.

Peng, Yufang, et al. "Spillover Effect and Granger Causality Investigation between China's Stock Market and International Oil Market: A Dynamic Multiscale Approach." *Journal of Computational and Applied Mathematics*, vol. 367, 2020.

Singh, Jaspal, and Prabhdeep Kaur. "Tracking Efficiency of Exchange Traded Funds (ETFs): Empirical Evidence from Indian Equity ETFs." *Paradigm*, vol. 20, no. 2, 2016, pp. 176-90.

Author Details

Marvin Sabu, *Research Scholar, Post Graduate & Research Department of Commerce, The Cochin College, Kochi, Kerala, India,* ***Email ID:*** *mrvnsabu7@gmail.com*

Dr. Rajani B Bhat, *Assistant Professor and Research Supervisor, Post Graduate & Research Department of Commerce, The Cochin College, Kochi, & Coordinator: IGNOU Study Centre (14166), The Cochin College, Kochi, Kerala, India.* ***Email ID:*** *rajanispai@gmail.com*