

# “Are global Exchange Traded Fund pretentious on exchange rate fluctuation? A study using GARCH model”

## AUTHORS

Geetha E.  <https://orcid.org/0000-0002-1346-7641>  
Iqbal Thonse Hawaldar  <https://orcid.org/0000-0001-7181-2493>  
 <https://publons.com/researcher/1456475/iqbal-thonse-hawaldar/>  
Vidya Bai G  <https://orcid.org/0000-0001-8785-0152>  
Suhan Mendon  <https://orcid.org/0000-0002-9184-6663>  
Rajेशha Thekkekutt Mathukutti  <https://orcid.org/0000-0001-6214-0509>  
 <https://publons.com/researcher/1710646/rajेशha-t-m/>

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Vidya Bai G, Suhan Mendon, Rajesha  
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Geetha E, Associate Professor,  
Department of Commerce, Manipal  
Academy of Higher Education,  
Manipal, India.

Iqbal Thonse Hawaldar, Professor,  
Department of Accounting and  
Finance, College of Business  
Administration, Kingdom University,  
Bahrain. (Corresponding author)

Vidya Bai G, Associate Professor,  
Department of Commerce, Manipal  
Academy of Higher Education,  
Manipal, India.

Suhan Mendon, Associate Professor,  
Manipal Institute of Management,  
Manipal Academy of Higher Education,  
Manipal, India.

Rajesha T M, Institutional Assessment  
Administrator, Accreditation and  
Quality Assurance Centre, Kingdom  
University, Bahrain.



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Geetha E (India), Iqbal Thonse Hawaldar (Bahrain), Vidya Bai G (India),  
Suhan Mendon (India), Rajesha T M (Bahrain)

# ARE GLOBAL EXCHANGE TRADED FUND PRETENTIOUS ON EXCHANGE RATE FLUCTUATION? A STUDY USING GARCH MODEL

## Abstract

Investors invest in a foreign market to reap the benefits of currency differences. The change in the value of underlying assets affects these hedged funds and, at the same time, restricts investors from higher return possible in unhedged funds. This study aims to examine the performance of most actively traded shares in Exchange Traded Fund and any influence, along with tracking the information from the index. This study also analyzes the currency fluctuation and its impact on returns and volatility of ETF and index. The equity ETF, which tracks NASDAQ (NDX 100), is chosen for the study, and the data analysis is carried out using statistical methods such as correlation, regression, and GARCH model. The study utilizes the currency rate data from 2013 to 2018 of USD, GBP, and INR and examines its effect on the NDX (NASDAQ). The study emphasizes whether the ETF as a basket of securities is insensitive to currency rate fluctuations. It is found that the response of ETF to the currency movements is likely due to its underlying index. The study concludes that Motilal Oswal shares in NASDAQ 100 ETF are highly sensitive to the NDX 100 movements; thus, there is no direct impact between ETF and index performance through exchange rate fluctuation.

## Keywords

ETFs, global ETF, exchange rate, equity ETF,  
macroeconomy, financial investment in India

## JEL Classification

E44, F31, G11, G12

## INTRODUCTION

Exchange-traded funds are the basket of securities that are traded on an exchange like a single stock. These are the combination of mutual funds and stocks, which replicate the stock, bonds, and commodities (market index) and offer diversified investment. Unlike the mutual funds, the ETF prices keep changing or traded throughout the day (Anderson et al., 2010). Its shares are portfolio shares that track the yield and return of their indigenous index. ETFs are different from other index funds mainly because it seeks to replicate the performance of their corresponding index rather than outperforming it. Since its launch (the first ETF SPDR in 1993), it has attracted many investors as it gives the benefit of both diversified and liquid investment. The price signal of ETFs was most reliable in the case of certain fixed income securities as discussed by (Hill et al., 2015), where both equity and debt were highly volatile during the 2008–2009 financial crises. Although it is considered comparatively safer and liquid, the liquidity criteria depend on its underlying securities. If it consists of highly liquid and tradable securities, the liquidity of ETF will also be high and vice versa. Other advantages it gives to the investors are transparency and cost-efficiency. As it consists of the securities like the securities of indexes that it tracks, the information related to the price and portfolio is easily available to the investors. The costs incurred by managing these funds are lower than the cost involved in actively managed mutual funds.

Though the focus of most of the investment vehicles is to gain a higher return with minimum risk, the macro factors still have a vulnerable impact on their performance. The issue related to any financial instrument is the risk of negative performance (or losing money). There are innumerable factors from micro to macro, which affects their performance. One of the macro factors is the exchange rate, which is considered for the analysis. Nowadays, investors are trying to approach the global market for better returns and varied options. When there is a global exposure, the rates of foreign to the domestic currency will have a greater impact on the investment. The current study analyzes the impact of exchange rate fluctuations on global ETF.

## 1. LITERATURE REVIEW

ETFs, since the time of their investment, have gained wider acceptance from investors and researchers. It is one of the most successful investment channels. ETF has survived the financial crisis and gained more appreciation after the crisis for its low risk and high liquidity profile. The research area covered in the Indian context is mostly related to performance analysis. The paper highlights selected literature categorized into the performance of ETF, price efficiency of ETF, exchange rate fluctuation, and its impact on the stock market.

### 1.1. Performance of ETFs in comparison with and without index funds

Based on the tracking error, active returns, and Jensen's alpha, the performance of exchange-traded funds is better than the index funds (Narend, 2014). The study covers the period from the inception date of the respective ETFs till 2013. The ETFs and Index funds considered for the study track underlying indexes, which are either S&P BSE SENSEX or the CNX NIFTY. As per the analysis, ETFs outperformed their underlying index, whereas only a few index funds could outperform their underlying index-tracking CNX NIFTY. However, the growth of the ETF in India is slow. The researcher believes that if ETF is actively managed, it will gain more attention from the investors. From 2006 to 2011, the returns generated by these funds were more than its underlying index, which was 3% p.a. against CNX NIFTY index (Prasanna, 2012). The co-movements between prices of Indian equity ETFs and their underlying assets are stronger, and the same is not visible in the commodity-based ETFs using vector autoregression (Khanapuri, 2012). According

to Ackert and Tian (2000), the respective country's ETFs are priced better and closer to the US ETFs. Elton et al. (2002) explained that discounts are premiums with very less impact on the economy. A positive risk-free interest rate deviates the pictured returns for ETFs to investors, and future market position does not give the required return as pictured (Haga & Lindset, 2012). Narend (2014) made the study by comparing index funds and ETFs in India. Based on Jensen's alpha, both types of funds show negative, which means excess returns not happened than the market returns. The arbitrage mechanism allows authorized participants to create their portfolios and redeem shares; despite this mechanism, the prices of ETFs can considerably deviate from their net asset values (Petajisto, 2017).

### 1.2. Price efficiency of ETF

Price efficiency holds the meaning that the trading securities reflect all the available market information, enabling the investors to gain any excess returns (Kumar et al., 2020; Iqbal & Mallikarjunappa, 2010, 2011). In the case of ETF, it does not fully replicate its underlying assets. The differences in trading price and NAV of the ETFs show the price inefficiency (Purohit & Malhotra, 2015). The researcher considers the equity ETFs which followed indices like BSE, NSE, and CNX NIFTY Junior from 2002 to 2013. The price efficiency reflects the presence of premium/discount, which in the Indian market persists for three days on average. When the funds are traded at either premium or discount, the arbitrage process takes place. The arbitraging process continues till it matches the NAV. Therefore, NSE equity ETFs prove their price efficiency (Swathy, 2015). The absence of premiums and discounts reflects the perfect market and the alignment of trading price with the NAV of ETFs.

As compared to Indian ETFs, the US ETF is more price-efficient where any price deviations get adjusted in a day (Tripathi & Garg, 2016). The US funds that hold liquid domestic securities showed price efficiency. On the other hand, international or illiquid funds show the significant persistence of premiums concerning NAVs (Petajisto, 2017). The researcher proposes a new approach for detecting price inefficiency or mispricing in ETFs. The study suggests measuring the ETF prices related to the prevailing market prices of other peer groups, which have similar ETF funds. This approach reduces the premiums on funds holding international or illiquid funds. Further, it says that there is a price fluctuation within a price band of 100-200 bps and indicates the presence of mispricing.

When it comes to measuring or tracking the performance of ETFs, tracking differences, or tracking error is most used. Based on the comparison of 1 year, three years, five years of tracking difference, the tracking difference of all the exchange-traded funds are positive. The tracking error in the bearish market is relatively high, which also shows the high volatility and high average premium (Shanmugham & Zabiulla, 2012). In the bullish market, it is vice versa. The arbitrage strategy corrects the trading price. As mentioned earlier, price differences persist for three days. Thus, the trading price and NAV of the fund gets aligned within three days. Negative serial correlation induced by high-frequency data which shows the difference between portfolio return and benchmark returns (Pope & Yadav, 1994). Systematic rebalancing is not superior to static factor exposure, which is the key driver of smart beta performance was demonstrated by performance attribution analysis (Glushkov, 2016). Rubesam and Hwang (2019) found that long only-restriction is the primary factor to hinder the ability of smart beta ETFs to achieve the factor exposures.

### 1.3. Currency fluctuation and its impact on the stock market

Currency rate/exchange rate is the value of one nation's currency against another. It varies or fluctuates for the economies following floating exchange rate systems. Many factors are contributing to the currency fluctuation, namely interest rates, inflation,

trade relationship, current account deficit, terms of trade, political stability, economic growth, etc.

Currency fluctuations have a significant impact on stock returns (Bai & Koong, 2018). The higher the global exposure of the domestic industry, which is measured by the trade balance, the higher the sensitivity to the exchange rate risk. In such a situation, investors require a risk premium to mitigate this risk. Indian stock market is more sensitive to the currency market (USD) (Vandana, 2013). Investors should consider international information rather than depending only on the domestic news to understand the effect of spillover in ETF returns between countries. The study was conducted in Brazil, India, Mexico, Indonesia, South Korea, Turkey, and the USA (Dheeriyaa et al., 2014).

Foreign Institutional Investments (FIIs) and Foreign Direct Investments (FDIs) have a significant impact on the stock market (Kumar & Devi, 2012). The study shows the positive correlation between FDI and market (SENSEX and NIFTY) and FII and market (SENSEX and NIFTY). Positive returns are produced by the emerging ETF market rather than negative returns (Chen & Diaz, 2015). A viable long-term investment strategy will help ordinary investors earn positive returns in the long term; the ETF and index return have bidirectional volatility spillover (Chandrasekaran & Acharya, 2019). Leveraged ETF provides feasibility for accessing financial and bank stock, confirmed by Markov switching model (Gutierrez et al., 2009). The model ARMA-GARCH was used to identify the spillover effect on return and volatility between the underlying index and leverage ETF (Rompotis, 2016). Mahapatra and Bhaduri (2019) found that the exchange rate risk factor acts as a critical factor for stock returns as Indian investors mounting their expectation for risk premium on their investment due to the added exposure to the exchange rate risk.

### 1.4. Research gap

There are various researches done on the Indian ETF market. Compared with the growth of worldwide ETFs and other developing countries, the acceptance and growth of ETFs in the Indian market are comparatively less. The availability of ETF product, investors' attitude, and the slow start of this instrument give incomplete data to do an ef-

fective analysis. Therefore, based on the available literature, it is observed that the research area for Indian ETFs is more focused on its performance compared with other index funds and analyzing its price efficiency. The research is not being done on the impact of currency exchange rate on the ETF returns (Narend, 2014), exposed to the foreign market.

## 2. AIMS

The paper aims to analyze the effect of exchange rates volatility on Indian ETF tracking international indices (global ETF).

## 3. RESEARCH METHODOLOGY

The study relies on the secondary data source collected from the website. The analysis is divided into two sections. The first section shows the performance of the ETF for over five years (2013–2018). Next, it uses the statistical model for the analysis of the said objective. As there are various methods or models to measure the impact of one variable on another, the first study considers the performance of ETF (MOST shares) and its index (NDX 100) by taking their annual returns and correlation. To know that MOST shares fully track its index, which is NDX 100, the tracking error is calculated and presented in the form of a chart. Further, the analysis relies on GARCH model to know volatility in ETF, NDX, and currency rates. Then, the study used linear regression to analyze the impact of currency rates on the ETF performance (MOST shares).

## 4. DATA, ANALYSIS AND HYPOTHESES

- The ETF tracking NASDAQ 100 (MOST shares NASDAQ 100) is considered for the analysis. These data are collected from NSE for five years, starting from 2013 to 2018.
- USD-INR, GBP-INR, GBP-USD, and GBP effect on the NDX (NASDAQ) are taken for the analysis. The data of currency rate is collected from IMF and investing.com.

### 4.1. Analysis I: performance measurement

The performance of exchange-traded funds (MOST shares NASDAQ 100 over five years is analyzed by calculating annual returns, tracking error, and ETF correlation with NDX 100 (underlying index). The annual return is presented through a line chart in Figure 1. It indicates the downfall of MOST shares NASDAQ 100 (ETF) and NDX 100 over five years. There is an absolute decrease of 51% in ETF and 26% fall in its underlying index. In 2018, ETF had a negative return of  $-6.33\%$ , where NDX was as low as  $0.8\%$ . From the graph, it is evident that the ETF return is deviating from the NDX return.

Figure 2 shows the tracking error of MOST shares NASDAQ 100 is 0, which means the ETF performance is close to or the same as the performance of its underlying index. The annualized tracking error of MOST shares NASDAQ for five years is 0.1.

Further, the correlation coefficient was determined using Pearson product moment correlation

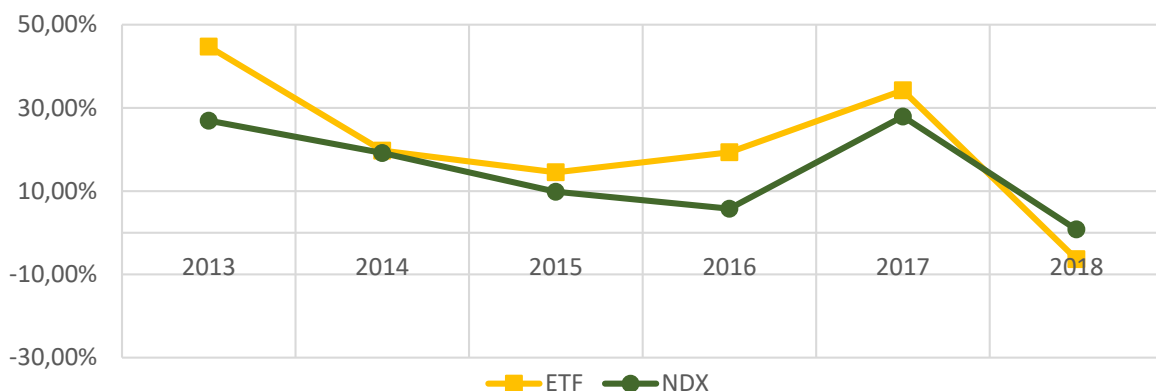
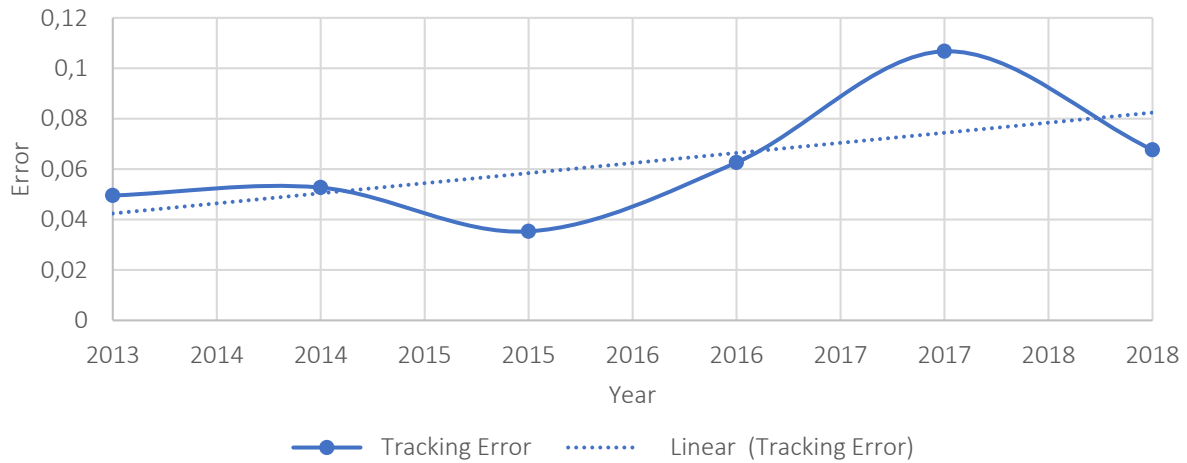


Figure 1. Annual return (%)





**Figure 2.** Tracking error

method. It considers the covariance and standard deviation of the selected variables. The calculation is done using the equation given as follows:

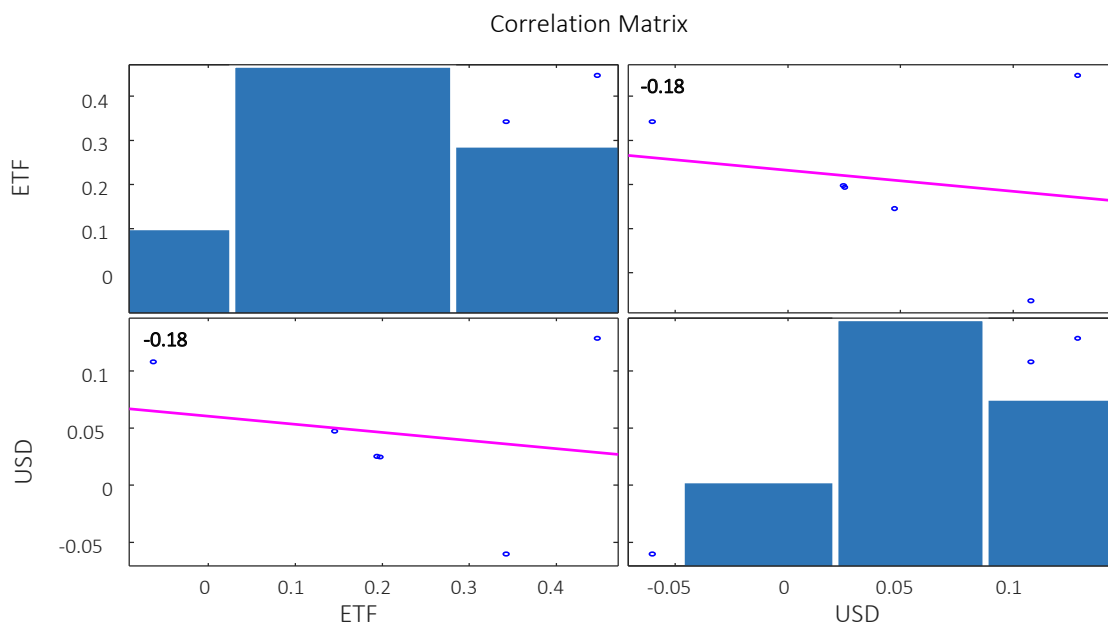
$$r = \frac{1}{n-1} \sum_{i=1}^n \frac{(x_i - \bar{x})(y_i - \bar{y})}{\sqrt{\sigma^2} \sqrt{\sigma^2}}, \quad (2)$$

where  $n$  – number of periods,  $x_i$  – return of the variable 1,  $\bar{x}$  and  $\bar{y}$  – mean of the  $x_i$  and mean of the  $y_i$ ,  $y_i$  – return of the variable 2,  $\sqrt{\sigma^2}$  – standard deviation.

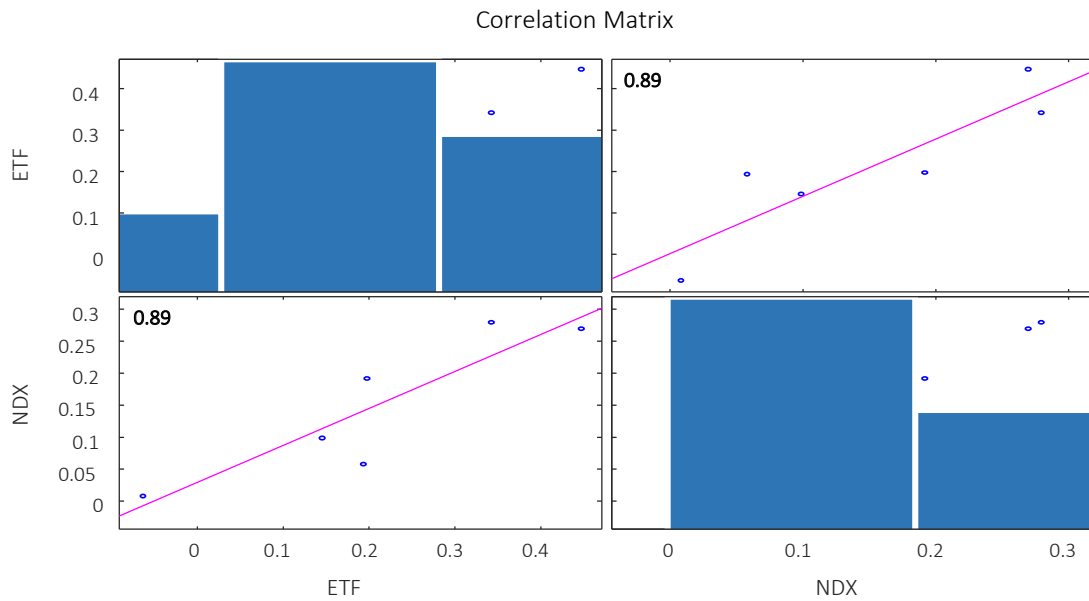
Figures 3, 4, and 5 represent the correlation between the variables. The correlation between

MOST shares NASDAQ 100 and NDX is +0.89, which means both move in the same direction. NDX has a strong positive influence on the ETF. The positive, strong linear relationship between the variables means that if one is increasing positively, the other will follow the same and vice versa. Since the dependent variable,  $y$  (ETF), replicates the independent variable,  $x$  (NDX), the movement is likely to be the same.

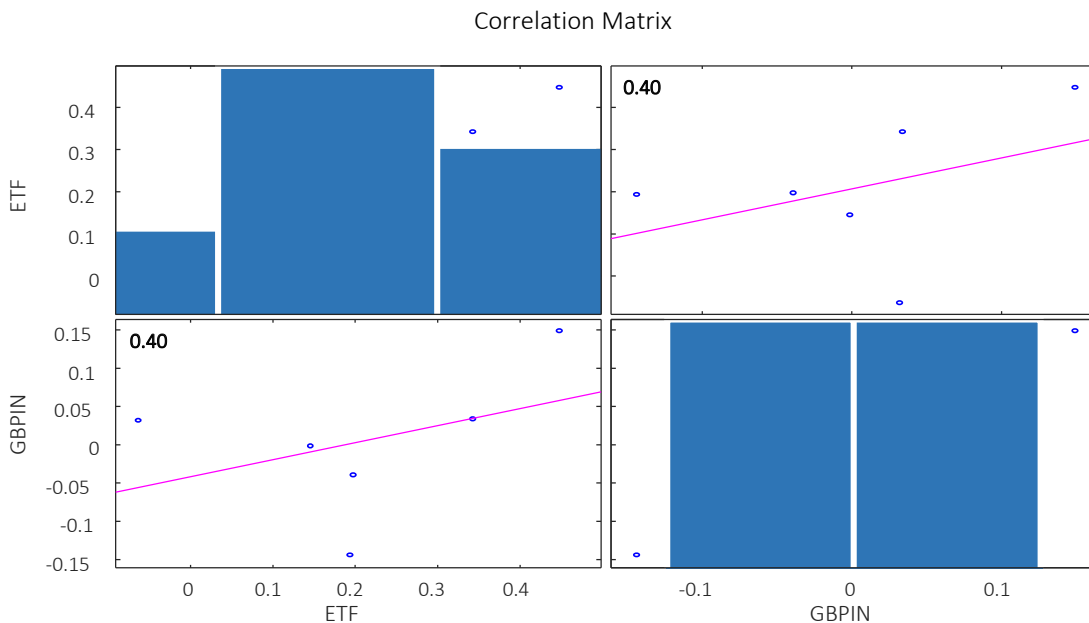
The correlation value between MOST shares NASDAQ 100 and USD is negative. The negative correlation in the case of foreign investment and currency rate means that if the domestic



**Figure 3.** A matrix of plots showing the correlations between variables ETF, NDX



**Figure 4.** A matrix of plots showing the correlations between variables ETF, US



**Figure 5.** A matrix of plots showing the correlations between variables ETF, GBPINR

currency (here, rupee) depreciates concerning the currency in which the investment is made (here, USD), the value of the investment will rise, and the same can fall if the rupee appreciates in relation to USD. In this case, the resulting value of  $-0.18$  proves that the ETF is not influenced by the fluctuation in USD. The two variables are oppositely related but signify a weak relation, approximately near zero, indi-

cating that ETF and USD are not related. Any change in the currency rate is not the cause for ETF to either rise or fall.

The resulting value of  $+0.40$  between MOST shares NASDAQ 100, and GBP\_INR shows that the strength of the relationship between ETF and GBP is weak but positive. GBP does not strongly influence the movement in the ETF.

#### 4.2. Analysis II: Effect of exchange rate on MOST shares NASDAQ 100

Since the data are time series, there is the risk of non-stationarity, which might lead to spurious regression. To avoid this problem, a unit root test is performed. If the data contain unit root or are non-stationary, it implies that the data follow a

random walk and will lead to spurious regression. The test is done on daily log returns of the ETF, NDX, and USD. Log return is calculated using the equation:

$$\ln = \frac{P_{it}}{P_{it-1}}, \quad (3)$$

where  $P_{it}$  – price at time  $t$ ,  $P_{it-1}$  – price at time  $t-1$ , previous price.

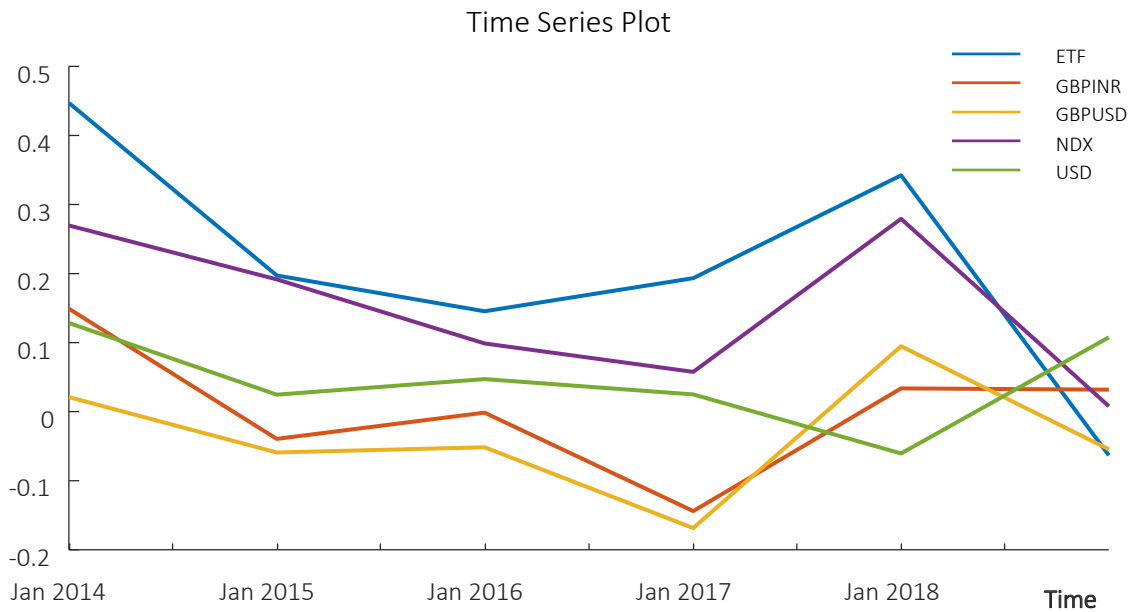


Figure 6. Time series plot of ETF, GBPINR, GBPUSD, NDX, USD

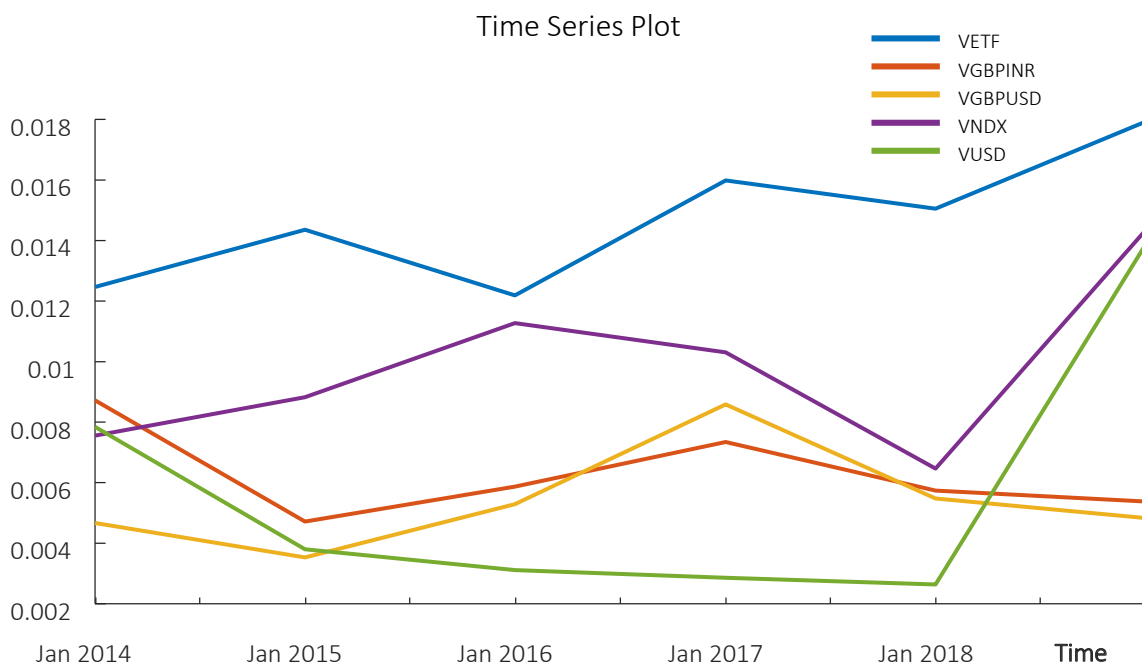


Figure 7. Time series plot of VETF, VGBPINR, VGBPUSD, VNDX, VUSD



Here, two tests are considered: ADF and Phillips-Perron test.

1. Augmented Dickey-Fuller Test (ADF):

$$y_t = c + \delta t + \phi y_{t-1} + \beta_1 \Delta y_{t-1} + \dots + \beta_p \Delta y_{t-p} + \varepsilon_t, \tag{4}$$

$H_0: \phi = 1,$

$H_a: \phi < 1,$

$H_0:$  Null hypothesis: log return contains a unit root.

$H_a:$  There is no unit root for the series. The series is stationary.

2. Phillips-Perron test:

$$y_t = c + \hat{I}t + \alpha y_{t-1} + \varepsilon_t, \tag{5}$$

$H_0: \alpha = 1,$

$H_a: \alpha < 1,$

$H_0:$  Null hypothesis: log return contains a unit root.

$H_a:$  There is no unit root for the series. The series is stationary.

4.3. Test results

As the computed  $p$ -value is lower than the significance level  $\alpha = 0.05$ , one should reject the null hypothesis  $H_0$ , and accept the alternative hypothesis  $H_a$ . Based on both the tests, any of the variables do not have a unit root. These are stationary, and therefore, further analysis can be done.

4.3.1. Test for volatility [GARCH (1,1)]

4.3.2. Linear regression

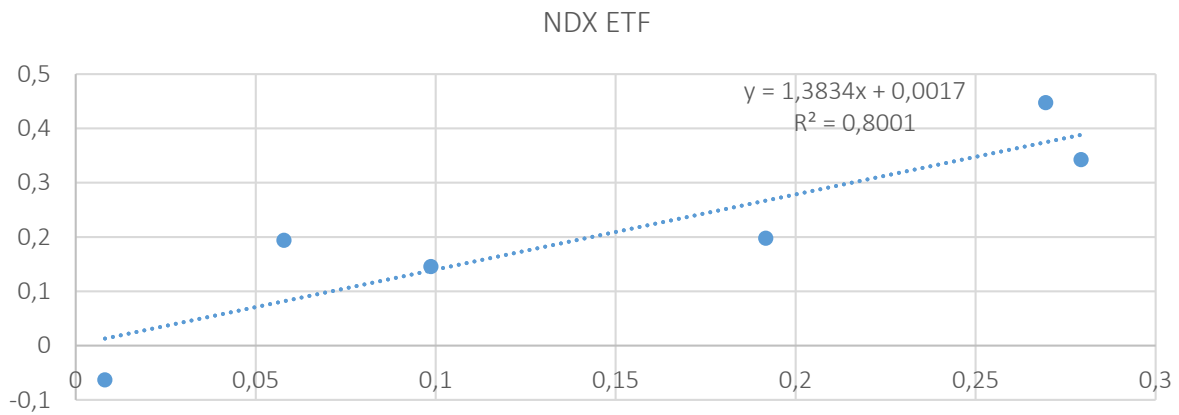
The regression estimation or  $R^2$  value specifies that NDX explains about 80% of the change in the ETF as it is the underlying index of the ETF. Any changes in the NDX will have an impact on the ETF. On the other hand, it is evident from the analysis that there is no impact of currency

**Table 1.** Test results of augmented Dickey-Fuller test and Phillips-Perron test

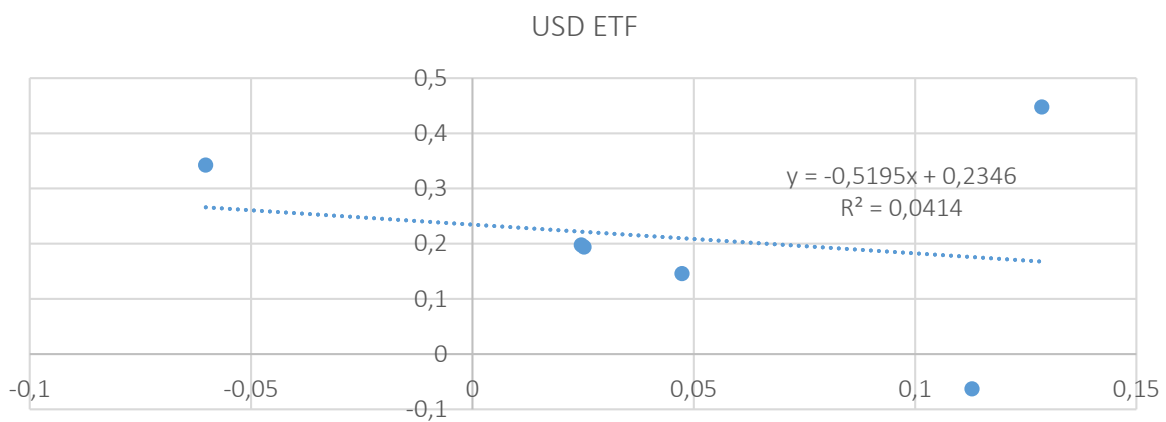
	ADF			PPT		
	Null rejected	p-value	Test statistic	Null rejected	p-value	Test statistic
ETF	True	0.001	-6.4605	True	0.001	-42.1259
NDX	True	0.001	-7.3802	True	0.001	-39.5434
USD	True	0.001	-7.7393	True	0.001	-52.4228
GBP_INR	True	0.001	-8.4698	True	0.001	-42.043
GBP_USD	True	0.001	-8.5595	True	0.001	-40.0451

**Table 2.** Test results of GARCH (1,1)

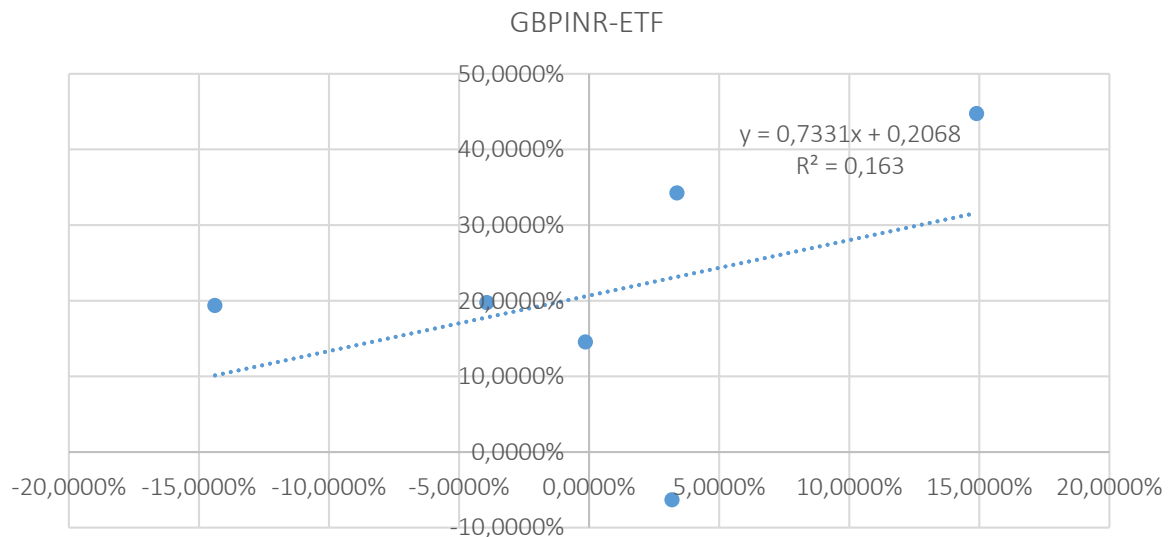
Variables	Parameter	Value	Standard error	t-statistic	p-value
ETF	Constant	2.0397e-05	2.1e-06	9.7132	2.6499e-22
	GARCH {1}	0.76853	0.017604	43.657	0
	ARCH {1}	0.14993	0.013489	11.1152	1.0586e-28
NDX	Constant	6.6528e-06	4.223e-07	15.7536	6.4866e-56
	GARCH {1}	0.79477	0.019644	40.4592	0
	ARCH {1}	0.14015	0.017546	7.9873	1.3793e-15
USD	Constant	2.0956e-06	5.42e-07	3.8664	0.00011047
	GARCH {1}	0.57439	0.02706	21.2264	5.4424e-100
	ARCH {1}	0.4256	0.016842	25.2698	6.8594e-141
GBP_INR	Constant	2.9428e-06	8.993e-07	3.2723	0.0010667
	GARCH {1}	0.80131	0.022586	35.4775	1.0911e-275
	ARCH {1}	0.13041	0.010867	12.0006	3.5256e-33
GBP_USD	Constant	6.9802e-07	4.3529e-07	1.6036	0.10881
	GARCH {1}	0.89299	0.0085281	104.7115	0
	ARCH {1}	0.090893	0.0045378	20.0302	3.003e-89



**Figure 8.** Regression line of NDX and ETF



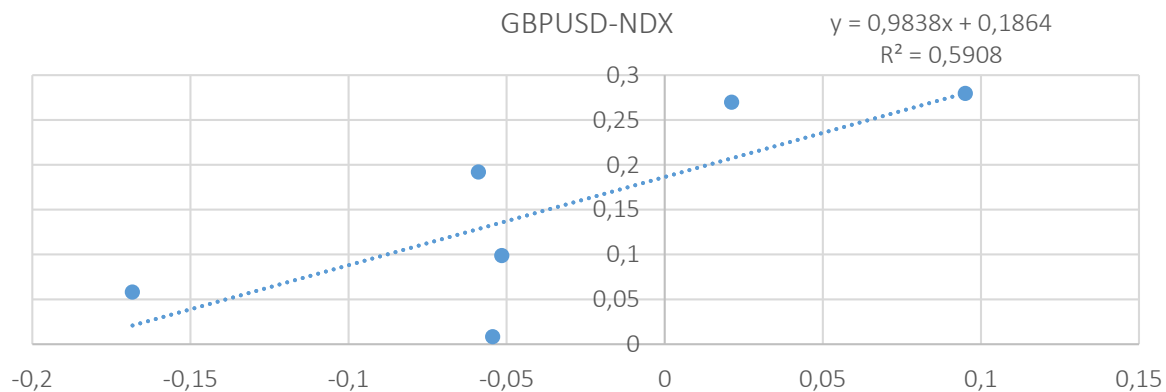
**Figure 9.** Regression line of USD and ETF



**Figure 10.** Regression line of GBPRM and NDX

rate (USD and GBP\_INR) on ETF (MOST shares NASDAQ 100). However, ETF performance is defined by NDX. Any factor affecting NDX will have an impact on the ETF. There is no direct relation

between currency rate and ETF. Next, to know if the currency rate affects the NDX performance, the GBP against USD is considered. Further is the result of the analysis.



**Figure 11.** Regression line of GBPUSD-NDX

NDX is 59% related to the GBP. It is moderately exposed to currency fluctuation. The data analysis in the previous chapter proves that the considered ETF tracks its index very closely. Both the varia-

bles are closely related, so if NDX falls, ETF will too fall. Therefore, there is an indirect impact of currency fluctuation on the ETF if it purely tracks its underlying index.

## CONCLUSION

The results indicate that MOST shares NASDAQ 100 ETF are highly sensitive and volatile to the NDX 100 movements, and it is exposed to high risk as it tends to move in the same direction as its underlying asset moves. It also shows no impact of currency rates on the ETF, but variables like ETF, NDX, USD, GBP-INR, and GBP-USD are volatile. However, NDX is influenced by the exchange rate, and it will influence the ETF. Thus, through this paper, it is proved that the ETF is indirectly influenced by the exchange rate fluctuation, which affects NDX or ETF's underlying index. Since the awareness level for the investment in ETF is rapidly increasing among Indian investors, the results will significantly impact their investment decision in the long run. This study identifies no direct impact between ETF and index performance through exchange rate fluctuation, and the study stresses the need for further studies on exchange-traded funds (ETFs).

## AUTHOR CONTRIBUTIONS

Conceptualization: Geetha E, Iqbal Thonse Hawaldar.

Data curation: Vidya Bai G, Suhan Mendon.

Formal analysis: Suhan Mendon, Rajesha T M.

Investigation: Vidya Bai G, Suhan Mendon.

Methodology: Geetha E, Rajesha T M.

Project administration: Geetha E, Iqbal Thonse Hawaldar.

Supervision: Vidya Bai G, Suhan Mendon.

Validation: Geetha E, Iqbal Thonse Hawaldar.

Visualization: Vidya Bai G, Rajesha T M.

Writing – original draft: Suhan Mendon, Rajesha T M.

Writing – review & editing: Geetha E, Iqbal Thonse Hawaldar.

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