Investment Performance and Tracking Efficiency of Indian Equity Exchange Traded Funds

L. Alamelu1 · Nisha Goyal2

Accepted: 3 July 2022 / Published online: 17 August 2022
© The Author(s), under exclusive licence to Springer Japan KK, part of Springer Nature 2022

Abstract
Exchange Traded Funds (ETF’s) are one of the beloved passively managed funds that offer both retail and institutional investors an access to highly profitable and wide-range of diversifiable financial assets. The study aims to assess the ability of Indian equity ETF’s in replicating the performance of their benchmark indices using a sample of 27 equity ETF’s traded on the National Stock Exchange of India during the pre-pandemic period from 01/01/2015 to 31/12/2019. Evaluation of the performance of sample ETF’s through risk-return analysis, risk-adjusted performance measures, tracking error analysis and multi-factor regression have revealed that the majority of the sample ETF’s outperformed their tracking indices but with notable tracking errors during the study period. Further, the study also indicates that the returns of the sample ETF’s have a significant and positive relationship with the returns of the index but are inversely related to risk and management fees. The results of this study will have major implications for investors in evaluating the performance of ETF’s and fund managers as well in taking suitable measures to reduce tracking errors that will help in successful replication of the benchmark along with undertaking initiatives that will enable the ETF’s to become price efficient.

Keywords Exchange Traded Funds · Return · Risk · Tracking errors

JEL Classification E44 · G11

1 St. Joseph’s College of Commerce, Bengaluru, Karnataka 560068, India
2 Dayanand Sagar University, Bengaluru, Karnataka 560068, India
1 Introduction

Globally, a substantial shift has been witnessed from active investing towards passive investing by the investment community. The factors contributing to this shift include underperformance of actively managed funds relative to the benchmark index, increased compensation to the fund managers, investable stock index funds and low cost associated with passive investing (Anadu et al., 2020; Sushko & Turner, 2018). Passive investment domain consists of index funds often invested through mutual funds and Exchange Traded Funds (ETF’s), both of which aim to mimic the performance of the benchmark index. ETF’s track their respective benchmark index by holding an archetypal sample of securities in the underlying index aiming to replicate the performance and risk levels of specific commodity, index, sector or international indices. The passive investment mechanism and replication technique of ETF’s offer considerable level of risk diversification and lower administrative expenses as the fund manager follows the tracking index, sector or a commodity and does not develop any high-cost investing strategies like mutual funds. The special technique of ‘redemption in kind’ of ETF’s substantially mitigate or altogether eliminate the tax burden on realized capital gains unlike traditional equity mutual funds (Poterba & Shoven, 2002).

India launched its first ETF in the year 2001 and since then they are favored as the most innovative passive financial market instrument in the country. They are gaining popularity in the Indian investment industry and are challenging the dominance of long-established mutual funds due to their unique creation/redemption process, transparency and real-time trading flexibility (Purohit & Malhotra, 2015). As per the monthly reports published by Association of Mutual Fund Industry (AMFI) for the month of December 2021, the Asset under Management of Indian ETF industry is about Rs. 402,619.48 crores comprising of Equity ETF’s, Liquid ETF’s, Commodity ETF’s, Debt ETF’s and World Indices ETF’s. Equity ETF’s dominate the Indian ETF landscape in terms of both number of ETF’s and the total AUM as they have gained popularity and acceptance from all sectors of investors.

Indian Equity ETFs’ are growing in leaps and bounds since their inception in the country. They have become very popular among the investors who are risk-averse and among investors interested to invest in passively managed funds. Even though, there has been a great deal of attention drawn towards the popularity and benefits offered by ETF’s to its investors, there is a need for a more comprehensive and critical evaluation of these investment vehicles. In this context, it is indispensable and imperative to evaluate the return generating capacity of ETF’s relative to their benchmarks, their tracking efficiency and the factors that critically influence the returns earned by the investors who invest in Indian equity ETF’s. The rest of the study is organized as follows: The second section includes the extensive literature review followed by the research methodology in section three. The fourth section of the study describes the data employed whereas section five presents the detailed analysis and empirical findings. In the last section, the summary of the findings and conclusion are presented along with the areas of scope for future research.
2 Literature Review

The growth and popularity of ETF’s makes it imperative to understand the potential returns that ETF’s can generate to the investors as they have captured their attention and have attracted billions of dollars in investments (Gastineau, 2008). The benefits and advantages that are offered by ETF’s when compared with Index funds (or similar funds) are analyzed in an array of studies (Aber et al., 2009; Dellva, 2001; Narend & Thenmozhi, 2016; Prather et al., 2009; Rompotis, 2009; Schizas, 2014; Svetina, 2010). They find that their ability to trade like a corporate stock, tax efficiency obtained due to redemption in kind, lower management fees and risk diversification features enable ETF’s to be a successful and profitable addendum to the available investment products in the market.

While there has been a great deal of attention drawn towards the popularity and benefits offered by ETF’s to its investors, a number of other studies have concentrated on performance, trading characteristics and pricing of ETF’s across the world. Elton et al. (2000) examined the annual performance of SPDR along with S & P 500 Index, the results of which indicate that Spiders underperform S & P Index and the cause of this shortfall can be attributed to existence of management fees, loss of return from non – reinvestment of dividends. Rompotis (2011) uses a sample of 50 iShares to assess whether the ETF’s can beat the Standard and Poor (S&P) 500 index and the results indicated that majority of the sample iShares beat the S&P Index both at the aggregate and annual levels but the return superiority persisted only at the short-term level. Defusco et al. (2011) used pricing deviation as the performance metric to evaluate the ETF’s for which, the sample of Spiders, Cubes and Diamonds were chosen and the author explains the price deviation of the sample is non-zero, predictable that can be attributed to stationarity, accumulation and distribution of dividends and specific price discovery process. Sethi (2016) studied ETF’s listed on NSE, India to examine their performance with respect to risk, return, expenses and trading characteristics. The study concluded that ETF’s have underperformed the benchmark indices and have loaded investors with an extra amount of risk.

Thorough analysis of the academic literature related to ETF’s indicate that in most cases ETF’s underperform their benchmark indices by inducing a significant amount of risk to the investors due to tracking errors. This underperformance of ETF’s can be attributed to the presence of illiquid securities in benchmark, cash flows changes in the composition of target index, transaction costs, volatility of the underlying index, loss of return from non – reinvestment of dividends, reluctance of ETF managers to adjust the portfolio prior to the official index adjustment, management fees, and replication strategy adopted (Aber et al., 2009; Charupat & Miu, 2013; Elton et al., 2005; Frino & Gallagher, 2001, 2002; Malhotra et al., 2016; Rompotis, 2011).

Several studies conducted on ETF’s focus on evaluation of operational characteristics and performance of US and European ETF’s while some cover Asian ETF’s (Henderson & Buetow, 2014; Kanuri, 2016; Rompotis, 2013). But, academic literature on ETF’s in emerging economies like India is very limited.
disregarding its presence in the country for nearly two decades. Analysis of the literature related to Indian ETF market has revealed that major attention has been given to gold ETF’s compared to other ETF products available in the country. Even though the aim of ETF’s is to mimic the performance of the benchmark index and not to generate superior returns compared to their competitive funds, it was found that researchers have majorly focused on comparing the performance of equity ETF’s with index funds tracking the same benchmark index and not the benchmark index itself.

Thus, the study aims to fulfil these research gaps as it evaluates the performance of Indian equity ETF’s in comparison with their benchmark indices and assess their ability and accuracy at which they replicate the returns generated by the benchmark index. The study also investigates the impact of various attributes of ETF’s on the returns generated by the sample ETF’s. The results of this study will acquaint and familiarize the investors in considering this financial product while investing their funds and reap the benefits of minimum transaction costs, reduction of tax burden and greater flexibility of diversification in investments.

3 Methodology

Following the existing literature (Rompotis, 2012; Reddy, 2012; Alam, 2013; Narend & Thenmozhi, 2016; Sethi, 2016; Malhotra et al., 2016; Singh & Kaur, 2016) we estimate the performance and tracking efficiency of the sample equity ETF’s.

3.1 Statistical Characteristics

The return performance of ETF’s in the secondary market is driven by their daily price dynamics (Buetow & Henderson, 2012) and hence the first variable estimated is the average daily percentage return of the sample ETF’s along with their corresponding indices (Rompotis, 2012). In order to determine if there are significant differences between the returns of ETF’s and their corresponding index, standard deviation on the daily returns of each pair of funds are estimated (Aber et al., 2009). The estimated standard deviation of returns of ETF and index explain the deviation from expected returns based on their historical performance. This deviation indicates the amount of risk to be borne by the investors in the process of investing in ETF’s. Further, risk/return ratio is estimated to help the investors in comparing the performance of ETF’s.

3.2 Risk Adjusted Performance

The risk taken by the investor commensurate the return earned through the investment (Athma and Mamatha, 2013). For the purpose of evaluation of the performance of ETF’s after consideration of the return earned for risk incurred by the investor, various risk adjusted performance parameters such as Sharpe Ratio, Sortino Ratio and Treynor’s Ratio are employed.
3.2.1 Sharpe Ratio

Sharpe Ratio indicates the reward earned per unit of risk incurred (Chang and Kruegar, 2011). Daily returns of ETF and their corresponding index are averaged over the 5-year period to obtain the average return. Average interest of 90-day Treasury Bill of India is taken as the risk-free return. Sharpe Ratio is calculated using the below mentioned formula where \( R_i \) is the mean return of ETF or the index, \( R_f \) is the risk free return and \( \sigma_i \) = standard deviation of returns for ETF or Index:

\[
\text{Sharpe ratio} = \frac{R_i - R_f}{\sigma_i}
\]  

(1)

3.2.2 Sortino Ratio

Unlike Sharpe ratio, Sortino Ratio incorporates only the negative variation or downside deviation of periodic returns of the mean as they are unfavourable (Chang et al., 2015). Investment risk can be measured using downside risk when the returns of the portfolio are not normally distributed (Alam, 2013). Hence Sortino Ratio replaces standard deviation with downside risk using the following formula where \( R_i \) and \( R_f \) are defined as above, whereas \( \sigma_{i,d} \) is the standard deviation of index’s or ETF’s negative returns:

\[
\text{Sortino ratio} = \frac{R_i - R_f}{\sigma_{i,d}}
\]  

(2)

3.2.3 Treynor’s Ratio

Treynor’s Ratio takes into consideration only the systematic risk unlike Sharpe Ratio which considers the total risk incurred by the investor. \( R_i \) and \( R_f \) are same as that of the Sharpe Ratio whereas the mean excess return is divided by the systematic risk calculated using beta to obtain Treynor’s Ratio using the following formula where \( R_i \) and \( R_f \) are defined as above whereas \( \beta_i \) indicates the systematic risk obtained from simple regression equation of the ETF or index:

\[
\text{Treynor’s ratio} = \frac{R_i - R_f}{\beta_i}
\]  

(3)

3.3 Regression Analysis

An Ordinary Least Square (OLS) regression is performed to resolve a set a of gripping issues (Prather et al., 2009; Rompotis, 2010, 2012; Charupat & Miu, 2013; Sethi, 2016). As the results of Augumented Dickey Fuller test indicated that the returns of ETF’s and Indexes are stationary, OLS regression model can be carried out using the following equation:
where \( R_{pt} \) denote the sample ETF’s average raw return on day \( t \), \( R_{bt} \) represents average raw return of the underling benchmark on day \( t \) and residual error is denoted by \( \varepsilon_{pt} \). The alpha coefficient in general indicate the excess return obtained by the ETF relative to the tracking index but due to the passive investment nature of the ETF, the results of alpha estimates are not expected to generate any statistically significant result. Beta coefficient is used as an estimate to measure variety of factors such as the replication strategy of ETF relative to its corresponding index, the exposed systematic risk and aggressiveness of management strategies adopted by the Asset Management Companies. A beta estimate equal to 1 indicates that the replication mechanism of the ETF is same as that of the benchmark index. A beta coefficient greater than 1 indicates active management strategies adopted by the ETF manager to outperform the benchmark index whereas a beta coefficient lower than 1 represents difference in the composition of ETF’s from that of it’s tracking index.

### 3.4 Tracking Error

Active error or tracking error is ascertained by enumerating the return difference between the fund and its tracking index. Due to the passive investment mechanism of ETF’s, estimation of tracking error helps in quantifying the deviation in performance of ETF’s from its corresponding benchmark indices (Reddy, 2013). Aber et al. (2009) described that the benchmark index is measured as a ‘paper’ portfolio which is free of market frictions such as transaction costs unlike index funds.

Rompotis (2012) in his attempt to understand the trading behavior of Swiss ETF’s stated that a typical reason for existence of tracking error in passively managed funds can be attributed to the failure of managers to replicate the returns of the corresponding indices. Whereas, Buetow and Henderson (2012) explain that tracking error tends to be larger for the ETF’s that track less liquid indexes and they exhibit significantly lower correlation with the returns from the index. Singh and Kaur (2016) revealed that volume traded and Assets under Management of ETF’s positively affect the tracking efficiency of the ETF whereas volatility negatively influence the tracking ability of ETF. Sethi (2016) found that management expenses and risks positively impact the tracking error of the ETF. Other factors that can impact the level of tracking error of an ETF include the differences in investment styles, market capitalization, number of securities and index volatility in the ETF portfolio (Aber et al., 2009; Rompotis, 2010, 2011, 2012; Bello, 2012; Buetow & Henderson, 2012; Charupat & Miu, 2013; Reddy, 2013; Bas & Sarioolu, 2015; Narend & Thenmozhi, 2016; Sethi, 2016; Singh & Kaur, 2016). In this study, we follow three most frequently adopted methodologies of estimating tracking error (Frino & Gallagher, 2001; Charupat & Miu, 2013; Narend and Thenmozhi, 2014, 2016; Rompotis, 2010, 2012) which are as follows.

The first method of calculating tracking error (TE₁) is the standard error obtained from the results of the following regression equation: 

\[
R_{pt} = \alpha_i + \beta_i R_{bt} + \varepsilon_{pt} \tag{4}
\]

The second method of tracking error (TE₂) is estimated by finding the average absolute
difference between the returns of ETF and the benchmark index. The absolute value of the return differences is taken into consideration as both positive and negative difference indicate performance deviation of ETF’s return relative to its benchmark index.

\[
|TE_{2,P}| = \frac{1}{n} \sum_{t=1}^{n} |e_{pt}|
\]  

The third and final method of measuring tracking error (TE3) is by calculating the standard deviation of the difference between benchmark and funds return overtime. The results of this method would be same as that of the first method in case of full replication strategy adopted by the ETF fund managers and beta is equal to unity in Eq. 4.

\[
|TE_{3,P}| = \sqrt{\frac{1}{n-1} \sum_{t=1}^{n} (e_{pt} - \overline{e}_{p})^2}
\]  

### 3.5 Multi factor Regression Analysis

The trigger for shifting of investors from traditional actively managed open-ended mutual funds to passively managed ETF’s can be attributed to the ability of ETF’s to track the index as closely as possible at a significantly lower cost (Pinheiro & Varela, 2018). The gaining momentum of ETF’s among the investor community makes it inherent to understand the accuracy at which the sample ETF’s can track the benchmark index and the factors that influence the return generating capacity of the ETF’s.

Since the main aim of ETF’s are to mirror or replicate the performance of the index, the first independent variable considered for this purpose include returns generated by the benchmark index. Persistence of market frictions that affect only the ETF’s lead to underperformance of ETF’s. This underperformance and inefficient tracking is termed as ‘tracking error’ which exposes the investors to a component of risk that is absent while investing in the indexes (Frino and Gallagher, 2001; Rompotis, 2010; Chu, 2011; Drenovak et al., 2014; Fassas, 2014; Singh & Kaur, 2016). Since tracking errors are persistent in the returns generated by the ETF’s during the process of replication of the index, it also becomes necessary to understand the magnitude of its influence in the returns earned by the ETF’s.

Pinheiro and Varela (2018) in their study of Portuguese ETF’s ability to outperform the index explain that existence of management expenses, transaction costs incurred by the fund manager and costs incurred during the creation and redemption of securities in the portfolio prevents the ETF’s ability to out-perform the index. Fassas (2014) stated that the most important determinant of tracking error is the presence of transaction cost which is absent in the index. Transactions costs include fees for trustee, custodian and portfolio manager, rebalancing costs and bid-ask spread of underlying securities of the index. Expense Ratio can be defined as the aggregate amount charged by the fund house for managing the funds on behalf of investors.
Hence, it becomes inherent to find out the role of expense ratio in the return generating process of ETF’s.

Rompotis (2012) studied the interactions between various operating characteristics of ETF’s and concluded that ETF’s load investors with greater risk (measured as standard deviation) when compared to the benchmark index. One of the major factor that leads to tracking error is the risk associated with the ETF’s and there exists a positive correlation between expenses and risk. Rompotis (2011) proved that risk, expenses and age of the ETF’s cause tracking error. Rompotis (2009) using a sample 73 ishares arrived at similar conclusion about risk and expenses positively impacting the tracking errors.

The independent factors considered for multiple regression include risk of ETF, return of Index, management fees and average tracking error. In this final section of the study, we thus examine the impact of the above factors identified through the academic literature on the performance of the sample ETF’s chosen for this study.

4 Data

The objective of this study is to examine the investment performance and tracking ability of the Indian equity ETF’s. In order to do so, the sample of 27 equity ETF’s traded on National Stock Exchange of India along with their corresponding indices are studied from 01-01-2015 to 31-12-2019 for a duration of 5 years forming part of the pre-pandemic period. The study period is restricted to 5 calendar years belonging to the pre-pandemic period, which was spared from the threat of novel Corona Virus (COVID -19) that led the stock markets operating under a constant fear of uncertainty. The daily adjusted closing prices of the sample and their corresponding indexes [Rompotis, 2012; Narend and Thenmozhi, 2014; Swathy, 2016] for the present study is obtained from the official websites of NSE and finance.yahoo. The published expense ratio of sample ETF’s which are considered as the proxy for Management expenses (Rompotis, 2010) were obtained from the official websites of the Asset Management Companies (AMC’s) of ETF’s and Moneycontrol website. To rank the equity ETF’s based on their risk adjusted returns, the average monthly 91-day Treasury bill rate obtained from the RBI website has been used as the risk – free rate.

5 Analysis and Empirical Results

5.1 Profile of ETF’s

Table 1 contains list of the sample ETF’s, their symbol, the underlying benchmark index, date of inception, number of observations and the management fee details. Management fees or expense ratios are the explicit costs calculated on the average daily Net Asset Values of the ETF’s levied for managing the ETF’s by the fund managers (Charupat & Miu, 2013). The mean management fees of the sample ETF’s is equal to 24 b.p. The lowest expense ratios belong to BHARAT 22 ETF that tracks
### Table 1: Profile of ETF's

| ETF no. | ETF Name | Symbol | Benchmark index | Inception date (dd-mm-yy) | No. of Obs | Management fees (%) |
|---------|----------|--------|-----------------|---------------------------|-----------|-------------------|
| ETF 1  | EDELWEISS EXCHANGE TRADED SCHEME – NIFTY | NIFTYEES | NIFTY 50 Index | 08-05-15 | 1042 | 0.07 |
| ETF 2  | ICICI PRUDENTIAL NIFTY ETF | INIFTY / ICICINIFTY | NIFTY 50 Index | 20-03-13 | 1180 | 0.05 |
| ETF 3  | KOTAK NIFTY ETF | KOTAKNIFTY | NIFTY 50 Index | 02-02-10 | 1174 | 0.14 |
| ETF 4  | MOST SHARES M50 | M50 | NIFTY 50 Index | 28-07-10 | 1021 | 0.05 |
| ETF 5  | QUANTUM INDEX FUND – GROWTH | QNIFTY | NIFTY 50 Index | 10-07-08 | 1071 | 0.09 |
| ETF 6  | RELIGARE INVEESCO NIFTY ETF | RELGRNIFTY/IVZINNIFTY | NIFTY 50 Index | 13-06-11 | 1220 | 0.10 |
| ETF 7  | SBI ETF NIFTY | SETFNIFTY | NIFTY 50 Index | 23-07-15 | 615 | 0.20 |
| ETF 8  | UTI NIFTY ETF | UTINIFTETF | NIFTY 50 Index | 03-09-15 | 1016 | 0.07 |
| ETF 9  | BIRLA SUN LIFE NIFTY ETF | BSLNIFTY | NIFTY 50 Index | 21-07-11 | 1141 | 0.54 |
| ETF 10 | ICICI PRUDENTIAL CNX 100 ETF | ICNX10 / ICICINF100 | NIFTY 100 | 20-08-13 | 892 | 0.46 |
| ETF 11 | KOTAK BANKING ETF | KOTAKBKETF | NIFTY Bank | 04-12-14 | 952 | 0.18 |
| ETF 12 | MOST SHARES M100 | M100 | NIFTY Midcap 100 | 31-01-11 | 1184 | 0.20 |
| ETF 13 | KOTAK PSU BANK ETF | KOTAKPSUBK | NIFTY PSU BANK | 08-11-07 | 1226 | 0.49 |
| ETF 14 | ICICI SENSEX PRUDENTIAL EXCHANGE TRADED FUND | ISENSEX / ICICISensex | S&P BSE Sensex | 10-01-03 | 789 | 0.08 |
| ETF 15 | UTI SENSEX ETF | UTISENSEETF | S&P BSE Sensex | 03-09-15 | 993 | 0.07 |
| ETF 16 | RELIANCE ETFNIFTY BEES | NIFTYBEES | NIFTY 50 Index | 28-12-01 | 1221 | 0.05 |
| ETF 17 | RELIANCE ETF NIFTY 100 / NIPPON ETF NIFTY 100 | RELCNX100/NETFNIFI100 | NIFTY 100 | 22-03-13 | 888 | 0.97 |
| ETF 18 | RELIANCE ETF BANK BEES | BANKBEES | NIFTY Bank | 27-05-04 | 907 | 0.19 |
| ETF 19 | CPSF ETF | CPSFETF | NIFTY CPSE Index | 28-03-14 | 1205 | 0.01 |
| ETF 20 | RELIANCE ETF DIVIDEND OPPORTUNITIES | RELDIVOPP / NETFDIVOPP | NIFTY Dividend Opportunities 50 | 15-04-14 | 1040 | 0.16 |
| ETF 21 | RELIANCE ETF CONSUMPTION | RELCONS / NETFCONSUM | NIFTY India Consumption | 03-04-14 | 1132 | 0.13 |
| ETF no. | ETF Name                   | Symbol         | Benchmark index         | Inception date (dd-mm-yy) | No. of Obs | Management fees (%) |
|---------|---------------------------|----------------|-------------------------|---------------------------|------------|---------------------|
| ETF 22  | RELIANCE ETF INFRA BEES   | INFRABEES      | NIFTY Infrastructure     | 29-09-10                  | 1227       | 1.10                |
| ETF 23  | RELIANCE ETF JUNIOR BEES  | JUNIORBEES     | NIFTY Next 50            | 21-02-03                  | 1174       | 0.15                |
| ETF 24  | RELIANCE ETF PSU BANK BEES| PSUBNKBEES     | NIFTY PSU BANK           | 25-10-07                  | 1227       | 0.49                |
| ETF 25  | BHARAT 22 ETF             | ICICIB22       | S&P BSE BHARAT 22 index  | 28-11-17                  | 512        | 0.01                |
| ETF 26  | SBI ETF BANKING           | SETFBANK       | NIFTY Bank               | 20-03-15                  | 900        | 0.20                |
| ETF 27  | SBI ETF NIFTY JUNIOR      | SETFNIFJR      | NIFTY Next 50            | 20-03-15                  | 1172       | 0.15                |

This table presents the profiles of sample ETF’s such as the symbol, benchmark index, inception date, number of observations (the column of the number of observations implies the availability of ETFs data varies, reflecting the different inception day and trading activity of each one) and management fees.
S & P BSE BHARAT 22 Index and the highest fee ratio is associated with Reliance ETF Infra Bees, which tracks NIFTY Infrastructure index.

5.2 Descriptive Statistics

Table 2 presents the risk and return characteristics of the 27 sample equity ETF’s. Estimation of returns generated by the ETF’s is an important parameter of performance evaluation of any investment as the investors invest their funds with an objective to earn superior returns from the investment. Results indicate that the mean price based on daily percentage returns of the sample ETF’s are positive and equal to 4 basis points which is statistically insignificant and is greater than the mean percentage returns of the corresponding index that equals to 3 basis points for the sample period. This comparison indicates that the average performance of the sample ETF’s outperform their average corresponding indexes by 1 basis point during the study period.

The lowest return relates to RELIANCE ETF PSU BANK BEeS and it accounts for −0.10%, while the corresponding index for the same period accounts for −0.02% indicating a huge difference in returns and existence of significant tracking error. However, the leading average returns during the sample period were obtained by Edelweiss Exchange Traded Fund that tracks the Nifty 50 Index with 0.14% which outperformed its corresponding index by 0.10%.

The variability in returns when compared to the returns of the benchmark index is called risk and is measured using standard deviation. Higher standard deviation indicate the volatility of the stock and gives an insight about the deviation of returns of the stock. With respect to the risk of sample ETF’s measured using Standard Deviation, the average daily standard deviation of the sample ETF’s stood at 1.97% while the indices presented an average daily risk of 1.15%. The difference in the average daily risk can be attributed to existence of tracking error, non–replication strategy adopted by fund managers and presence of management fees. The ETF with least risk among the sample ETF’s is Quantum Index Fund – Growth that tracks NIFTY 50 and KOTAK NIFTY ETF. Highest risk can be attributed to Edelweiss Exchange Traded Fund that tracks the Nifty 50 Index which is also the one with highest performance. In this case, the general belief that high risk is recouped with higher return holds good.

The average ETF risk/return ratio is valued at 38.11 while the range between the maximum and minimum values is large. The highest risk/return ratio belongs to CPSE ETF and is equal to 759.12 obtained when the average risk of CPSE ETF is 1.18% which is divided by a very minimal positive return of 0.001553% which is closer to zero. The lowest risk return ratio concerns with Reliance ETF Bank Bees that tracks the NIFTY Bank Index.

The results of testing normality of sample data using skewness and kurtosis present interesting results. Table 3 shows that the sample data does not suffer from skewness rather it suffers from presence of kurtosis that results in non-normal distribution of data. The presence of more values in the tails and more values closer to the mean called as leptokurtic distribution (sharply peaked with
heavy tails) results in rejection of the hypothesis namely the returns of ETF’s and their corresponding indexes are normally distributed. All the return distribution of the sample ETF’s and their indexes departed from the kurtosis value of 3 indicating the distribution to be not normal. The results of kurtosis is same as
| ETF Name                                                                 | Skewness | Kurtosis | Jarque–Bera Probability | ADF Test for testing Unit Root |
|-------------------------------------------------------------------------|----------|----------|--------------------------|--------------------------------|
| EDELWEISS EXCHANGE TRADED SCHEME – NIFTY                                | 8.99     | 180.69   | 0.00*                    | 0.00*                          |
| ICICI PRUDENTIAL NIFTY ETF                                              | 4.12     | 98.03    | 0.00*                    | 0.00*                          |
| KOTAK NIFTY ETF                                                         | 0.41     | 13.43    | 0.00*                    | 0.00*                          |
| MOST SHARES M50                                                         | 0.42     | 19.44    | 0.00*                    | 0.00*                          |
| QUANTUM INDEX FUND – GROWTH                                              | 0.41     | 13.43    | 0.00*                    | 0.00*                          |
| RELIGARE INVESCO NIFTY ETF                                              | 0.42     | 19.44    | 0.00*                    | 0.00*                          |
| SBI ETF NIFTY                                                           | 19.79    | 455.24   | 0.00*                    | 0.00*                          |
| UTI NIFTY ETF                                                           | 0.56     | 12.29    | 0.00*                    | 0.00*                          |
| BIRLA SUN LIFE NIFTY ETF                                               | 0.01     | 6.06     | 0.00*                    | 0.00*                          |
| ICICI PRUDENTIAL CNX 100 ETF                                           | 2.45     | 44.57    | 0.00*                    | 0.00*                          |
| KOTAK BANKING ETF                                                       | 2.43     | 37.41    | 0.00*                    | 0.00*                          |
| MOST SHARES M100                                                        | −0.13    | 7.25     | 0.00*                    | 0.00*                          |
| KOTAK PSU BANK ETF                                                      | 0.66     | 7.11     | 0.00*                    | 0.00*                          |
| ICICI SENSEX PRUDENTIAL EXCHANGE TRADED FUND                           | 0.15     | 24.06    | 0.00*                    | 0.00*                          |
| UTI SENSEX ETF                                                          | 0.54     | 25.19    | 0.00*                    | 0.00*                          |
| RELIANCE ETF NIFTY BEES                                                | −30.22   | 1005.77  | 0.00*                    | 0.00*                          |
| RELIANCE ETF NIFTY 100 / NIPPON ETF NIFTY 100                           | −0.27    | 46.57    | 0.00*                    | 0.00*                          |
| RELIANCE ETF BANK BEES                                                  | −21.37   | 584.86   | 0.00*                    | 0.00*                          |
| CPSE ETF RELIANCE ETF DIVIDEND OPPORTUNITIES                            | −0.77    | 10.05    | 0.00*                    | 0.00*                          |
| RELIANCE ETF CONSUMPTION                                               | −0.18    | 15.50    | 0.00*                    | 0.00*                          |
| RELIANCE ETF INFRA BEES                                                 | −0.40    | 8.94     | 0.00*                    | 0.00*                          |
| RELIANCE ETF JUNIOR BEES                                                | −16.88   | 471.50   | 0.00*                    | 0.00*                          |
Table 3 (continued)

| ETF Name                   | Skewness | Kurtosis | Jarque–Bera Probability | ADF Test for testing Unit Root |
|----------------------------|----------|----------|--------------------------|-------------------------------|
|                            | ETF      | Index    | ETF                      | Index                         |
| BHARAT 22 ETF              | 0.17     | 0.13     | 5.60                     | 5.63                          |
| SBI ETF BANKING            | 3.02     | 2.46     | 41.85                    | 33.77                         |
| SBI ETF NIFTY JUNIOR       | 9.94     | −0.39    | 233.14                   | 9.11                          |
| AVERAGE                    | −0.57    | 0.89     | 126.3                    | 21.28                         |
| MAX                        | 19.79    | 11.65    | 1005.8                   | 228.10                        |
| MIN                        | −30.22   | −1.05    | 5.6                      | 5.63                          |

This table presents the value of skewness and Kurtosis, statistics of Jarque Bera probability test and Augmented Dickey-Fuller (ADF) Test to check unit root in returns of ETF and Index.

*Numbers in italics show significance at the 0.05 level
the results of Jarque-Bera test performed to test the normality of return distributions of ETF’s and their indexes. Regression estimates will be time variant and efficient only if the variables are stationary over a period. To check the cointegration between the ETF and Index and to ascertain if the variables have unit root or not Augmented Dickey Fuller Test is performed. The results of this test indicate that the returns of the sample and index are not affected with the presence of unit root.

5.3 Risk – Adjusted Performance Evaluation

Various performance evaluation parameters such as average daily percentage returns, standard deviation to estimate risk, Systematic Risk (beta) and R square values to estimate replication strategy are used to analyze and evaluate the performance of ETF’s and their benchmarks. In addition to these evaluations, parameters such as Sharpe, Sortino and Treynor’s Ratios are applied to obtain a fair view of returns generated by the sample ETF’s after taking into consideration the risk associated with it.

The results of Sharpe Ratio found in Table 4 shows the return earned from the ETF when compared to its variability or risk. The general notion of Sharpe Ratio is higher the ratio, better would be the performance of the fund and from the analysis it is found that out of the 27 sample ETF, 19 ETF’s show a positive Sharpe ratio justifying the risk taken by the investor and the remaining 8 ETF’s show a negative Sharpe Ratio. In case of the results obtained for the Sharpe ratio for the corresponding indexes of the sample ETF’s, 21 indexes show a positive ratio while 6 indexes show a negative Sharpe Ratio.

The second method of evaluating risk adjusted performance of ETF’s is using Sortino Ratio that differentiates between upward and downward volatility in the Sharpe Ratio (Rompotis, 2011). This differentiation will help in measuring the risk adjusted return of the ETF’s and their benchmarks without chastising them for any upward price changes. Similar to the results of Sharpe ratio, higher the Sortino Ratio better is the performance of the sample Index or ETF. Through the analysis it is found that 8 ETF’s show negative Sortino Ratios while 19 exhibit positive outputs. In case of the results obtained for the Sortino Ratio of the corresponding indexes of the sample ETF’s, 21 indexes show a positive ratio while 6 indexes show a negative ratio. The highest Sortino Ratio was obtained by UTI NIFTY ETF that tracks NIFTY 50 Index and the highest Sortino Ratio for the index is obtained by S & P BSE SENSEX.

The difference between Sharpe and Treynor’s Ratio is the denominators used in the ratio. Sharpe Ratio considers standard deviation that measures the total risk of a security as the denominator whereas Treynor’s Ratio considers only the systematic risk. Investors who are willing to take higher risk obtaining higher returns. Hence, higher the output of Treynor’s ratio, higher the returns. The highest Treynor’s Ratio was obtained by SETFNIFTY for the sample period. Out of the sample ETF’s, 8 ETF’s have negative Treynor’s Ratio and 19 ETF’s have exhibited a
positive Treynor’s Ratio. With respect to the results obtained for the Treynor’s Ratio of the corresponding indexes of the sample ETF’s, 21 indexes show a positive ratio while 6 indexes show a negative ratio.

Table 4 Performance Evaluation of Sample ETF’s and their corresponding Indexes using different Risk-adjusted Performance Ratio’s

| S. no. | ETF Symbol   | Sharpe Ratio | Sortino Ratio | Treynor Ratio |
|--------|--------------|--------------|---------------|---------------|
|        | ETF          | Index        | ETF           | Index         |
| 1      | NIFTYETF     | 5.77         | 2.85          | 7.33          | 4.02          | 50.22         | 2.77          |
| 2      | ICICINIFTY   | 2.85         | 1.84          | 2.42          | 2.7           | 24.7          | 1.73          |
| 3      | KOTAKNIFTY   | −16.05       | 2.52          | −3.98         | 3.64          | −56.86        | 2.38          |
| 4      | M50          | 1.29         | 2.36          | 3.69          | 3.49          | 7.09          | 2.29          |
| 5      | QNIETF       | 3.3          | 2.12          | 3.73          | 3.21          | 6.47          | 2.12          |
| 6      | IVZINIFTY    | 4.33         | 2.56          | 4.23          | 3.76          | 37.45         | 2.39          |
| 7      | SEFTNIFTY    | 2.37         | 1.88          | 5.87          | 4.02          | 59.25         | 2.95          |
| 8      | UTINIFTETF   | 6.41         | 5.25          | 9.34          | 7.6           | 13.89         | 4.76          |
| 9      | BSLNIFTY     | 2.68         | 2.48          | 3.61          | 3.72          | 32.37         | 2.39          |
| 10     | ICICINF100   | 2.98         | 1.83          | 2.96          | 2.73          | 27.06         | 1.7           |
| 11     | KOTAKBKETF   | 4.61         | 4.42          | 7.05          | 6.86          | 13.07         | 6.47          |
| 12     | M100         | 1.51         | 0.62          | 1.95          | 0.8           | 4.45          | 0.68          |
| 13     | KOTAKPSUBK   | −6.2         | −5.29         | −10.41        | −9.06         | −15.65        | −11.51        |
| 14     | ICICISENSX   | 2.66         | 1.36          | 2.87          | 1.87          | 13.44         | 1.35          |
| 15     | UTSENSETF    | 6.07         | 6.26          | 7.56          | 9.67          | 13.24         | 5.25          |
| 16     | NIFTYETF     | −5.71        | 2.52          | −4.04         | 3.7           | −57.5         | 2.34          |
| 17     | NETFNIF100   | 2.96         | 2.36          | 3.1           | 3.47          | 11.13         | 2.18          |
| 18     | BANKBEES     | −3.57        | 4.3           | −2.71         | 6.49          | −21.78        | 6.3           |
| 19     | CPSEETF      | −5.21        | −8.29         | −7.08         | −11.11        | −7.85         | −10.17        |
| 20     | NETFDIVOPP   | 2.09         | −2.55         | 2.39          | −3.17         | 10.32         | −2.42         |
| 21     | NETFCOMSUM   | 3.9          | 2.44          | 4.75          | 3.74          | 19.01         | 2.31          |
| 22     | INFRABEES    | −1.68        | −3.47         | −2.31         | −5.18         | −3.18         | −3.85         |
| 23     | JUNIORBEES   | 3.43         | 2.86          | 4.56          | 3.77          | 4.61          | 3.03          |
| 24     | PSUBNKBEEES  | −9.24        | −5.29         | −8.14         | −9.07         | −36.17        | −11.52        |
| 25     | ICICIB22     | −11.21       | −10.9         | −17.74        | −17.08        | −13.16        | −11.4         |
| 26     | SETFBANK     | 5.15         | 4.21          | 7.73          | 6.625         | 15.15         | 5.97          |
| 27     | SEFTNIFJR    | 4.41         | 2.7           | 3.92          | 3.64          | 43.67         | 2.78          |
| Average|              | 0.37         | 0.89          | 1.21          | 1.29          | 7.20          | 0.49          |
| Min    | −16.05       | −10.9        | −17.74        | −17.08        | −57.5         | −11.52        |
| Max    | 6.41         | 6.26         | 9.34          | 9.67          | 59.25         | 6.47          |

This table presents the result of different risk- adjusted performance evaluation methods of the sample ETF’s and their corresponding indexes such as Sharpe Ratio, Sortino Ratio and Treynor’s Ratio.
5.4 Regression Analysis

In this segment, the results of time-series regression are performed to evaluate the performance of sample ETF’s with respect to the performance of their underlying index. Table 5 contains the performance regression results. Since ETF’s are designed to mimic the performance of their benchmark index, the results of

| ETF Name                                           | Alpha | p value | Beta  | p value | R²   | Heteroskedasticity |
|----------------------------------------------------|-------|---------|-------|---------|------|--------------------|
| EDELWEISS EXCHANGE TRADED SCHEME—NIFTY             | 0.12  | 0.369   | 0.51  | 0.000   | 0.011| 0.31               |
| ICICI PRUDENTIAL NIFTY ETF                         | 0.04  | 0.405   | 0.20  | 0.000   | 0.011| 0.37               |
| KOTAK NIFTY ETF                                    | −0.05 | 0.546   | 0.27  | 0.001   | 0.008| 0.42               |
| MOST SHARES M50                                    | 0.03  | 0.403   | 0.39  | 0.000   | 0.107| 0.29               |
| QUANTUM INDEX FUND—GROWTH                          | 0.03  | 0.314   | 0.49  | 0.000   | 0.261| 0.43               |
| RELIGARE INVEESCO NIFTY ETF                        | 0.06  | 0.364   | 0.25  | 0.000   | 0.011| 0.96               |
| SBI ETF NIFTY                                      | 0.08  | 0.286   | 0.07  | 0.121   | 0.002| 0.55               |
| UTI NIFTY ETF                                      | 0.03  | 0.245   | 0.46  | 0.000   | 0.174| 0.74               |
| BIRLA SUN LIFE NIFTY ETF                           | 0.05  | 0.508   | 0.21  | 0.007   | 0.005| 0.24               |
| ICICI PRUDENTIAL CNX 100 ETF                       | 0.07  | 0.433   | 0.28  | 0.002   | 0.009| 0.56               |
| KOTAK BANKING ETF                                  | 0.03  | 0.372   | 0.49  | 0.000   | 0.265| 0.00               |
| MOST SHARES M100                                   | 0.02  | 0.616   | 0.53  | 0.000   | 0.138| 0.08               |
| KOTAK PSU BANK ETF                                 | −0.01 | 0.785   | 0.79  | 0.000   | 0.744| 0.00               |
| ICICI SENSEX PRUDENTIAL EXCHANGE TRADED FUND       | 0.06  | 0.530   | 0.55  | 0.000   | 0.038| 0.60               |
| UTI SENSEX ETF                                     | 0.03  | 0.394   | 0.59  | 0.000   | 0.147| 0.67               |
| RELIANCE ETF NIFTY BEES                            | −0.05 | 0.549   | 0.27  | 0.001   | 0.008| 0.86               |
| RELIANCE ETF NIFTY 100 / NIPPON ETF NIFTY 100      | 0.04  | 0.444   | 0.46  | 0.000   | 0.059| 0.24               |
| RELIANCE ETF BANK BEES                             | −0.07 | 0.526   | 0.55  | 0.000   | 0.057| 0.94               |
| CPSE ETF                                           | 0.01  | 0.496   | 0.78  | 0.000   | 0.663| 0.04               |
| RELIANCE ETF DIVIDEND OPPORTUNITIES                | 0.05  | 0.511   | 0.46  | 0.000   | 0.036| 0.12               |
| RELIANCE ETF CONSUMPTION                           | 0.06  | 0.509   | 0.59  | 0.000   | 0.037| 0.49               |
| RELIANCE ETF INFRA BEES                            | 0.01  | 0.778   | 0.73  | 0.000   | 0.340| 0.18               |
| RELIANCE ETF JUNIOR BEES                           | 0.01  | 0.553   | 0.79  | 0.000   | 0.623| 0.07               |
| RELIANCE ETF PSU BANK BEES                         | −0.08 | 0.306   | 0.83  | 0.000   | 0.308| 0.98               |
| BHARAT 22 ETF                                      | 0.01  | 0.725   | 0.87  | 0.000   | 0.792| 0.25               |
| SBI ETF BANKING                                    | 0.04  | 0.418   | 0.55  | 0.000   | 0.233| 0.94               |
| SBI ETF NIFTY JUNIOR                               | 0.04  | 0.355   | 0.17  | 0.000   | 0.010| 0.00               |
| AVERAGE                                           | 0.02  | 0.47    | 0.49  | 0.00    | 0.19 | 0.42               |

This table reports the results of performance regression. ETF’s daily return is regressed on the return of the underlying index.

Numbers in italics show significance at the 0.05 level or higher.
alpha estimates are in tune with the passive investment strategy. The mean alpha of the entire ETF sample is positive and the alpha values of the ETF’s are not statistically significant at 5% level. This is an expected outcome as the ETF’s are passively traded index funds and do not have the material trading flexibility and capability to generate superior returns when compared to that of their underlying indexes.

Beta denotes the aggressiveness of management strategy, systematic risk and replication strategy of the ETF’s (Sethi, 2016). The mean beta values of the sample ETF’s is equal to 0.486 and the betas of all the ETF’s are different from unity indicating the sample ETF’s do not follow a full replication strategy. This explains the underperformance of ETF’s relative to the underlying index and existence of tracking error.

The average R square values which can also be used to examine the replication strategy adopted by the ETF stands at 0.19 which indicates that the Indian equity ETF’s listed on the National Stock Exchange does not fully replicate the corresponding benchmark indexes. The size of the average R square confirms the deviation of the components of the ETF relative to the component of the benchmark indexes. The $R^2$ estimate indicates the ETFs replication policies and any deviation of the $R^2$ estimate from the unity substantiates the idea that the fund is departing from full-replication approach (Rompotis, 2012).

### 5.5 Tracking Error

This section of the study presents the results of three different ways of computation of tracking error. The results of each method of tracking error and the average of all the three methods of tracking error are exhibited using Table 6.

The average tracking error using the first method of estimating tracking error is 1.83, and the results of other two tracking errors are 0.95 and 1.94 respectively. Tracking error estimated using the second method by finding the average absolute difference between the returns of ETF and the benchmark index is slightly lower compared to that of the other two methods. This is in accordance with the results of Singh and Kaur (2016). TE1 estimated using the standard error of regression values varies from 0.46 to 4.38 per cent whereas TE2 varies from 0.32 to 1.88 per cent and TE3 ranges from 0.48 to 4.41 per cent. The mean tracking error using all the three tacking error estimates is 1.57, which reflects the significant deviation in the performance of sample ETF’s when compared with their underlying index.

The presence of large tracking errors can be attributed to the existence of risk, management fees, non – full replication strategy, Asset under Management, volume traded, volatility, fund size, rebalancing events etc. (Frino and Gallaghar, 2001; Buetow & Henderson, 2012; Singh & Kaur, 2016; Dhume & Patil, 2019; Tsalikis and Papadopoulous, 2019; Goel & Ahluwalia, 2021). With regard to individual ETF’s, the minimum tracking error is related to BHARAT 22 ETF that tracks the S & P Bharat 22 Index and the maximum tracking error can be attributed to Edelweiss Exchange Traded Scheme- NIFTY that tracks NIFTY 50 Index.
Table 6  Tracking Errors of ETFs

| ETF Name                                                  | TE₁ | TE₂ | TE₃ | Average TE |
|-----------------------------------------------------------|-----|-----|-----|------------|
| EDELWEISS EXCHANGE TRADED SCHEME – NIFTY                  | 4.38| 1.60| 4.41| 3.46       |
| ICICI PRUDENTIAL NIFTY ETF                                | 1.71| 0.95| 1.87| 1.51       |
| KOTAK NIFTY ETF                                           | 2.74| 0.79| 2.82| 2.12       |
| MOST SHARES M50                                           | 1.09| 0.92| 1.24| 1.08       |
| QUANTUM INDEX FUND – GROWTH                               | 0.83| 0.68| 0.97| 0.83       |
| RELIGARE INVESCO NIFTY ETF                               | 2.15| 1.33| 2.26| 1.91       |
| SBI ETF NIFTY                                            | 1.77| 0.86| 2.29| 1.64       |
| UTI NIFTY ETF                                            | 0.90| 0.75| 1.03| 0.89       |
| BIRLA SUN LIFE NIFTY ETF                                 | 2.57| 1.88| 2.68| 2.38       |
| ICICI PRUDENTIAL CNX 100 ETF                             | 2.50| 1.23| 2.59| 2.11       |
| KOTAK BANKING ETF                                         | 1.19| 1.03| 1.40| 1.21       |
| MOST SHARES M100                                          | 1.46| 1.04| 1.55| 1.35       |
| KOTAK PSU BANK ETF                                        | 1.01| 0.72| 1.11| 0.95       |
| ICICI SENSEX PRUDENTIAL EXCHANGE TRADED FUND              | 2.71| 1.17| 2.74| 2.21       |
| UTI SENSEX ETF                                           | 1.19| 0.74| 1.24| 1.06       |
| RELIANCE ETF NIFTY BEES                                   | 2.69| 0.85| 2.78| 2.11       |
| RELIANCE ETF NIFTY 100 / NIPPON ETF NIFTY 100             | 1.67| 0.97| 1.74| 1.46       |
| RELIANCE ETF BANK BEES                                    | 3.24| 1.16| 3.31| 2.57       |
| CPSE ETF                                                  | 0.68| 0.32| 0.73| 0.58       |
| RELIANCE ETF DIVIDEND OPPORTUNITIES                        | 2.21| 1.22| 2.27| 1.90       |
| RELIANCE ETF CONSUMPTION                                  | 2.81| 1.48| 2.84| 2.38       |
| RELIANCE ETF INFRA BEES                                   | 1.13| 0.72| 1.17| 1.01       |
| RELIANCE ETF JUNIOR BEES                                  | 0.65| 0.40| 0.69| 0.58       |
| RELIANCE ETF PSU BANK BEES                                | 2.71| 0.64| 2.74| 2.03       |
| BHARAT 22 ETF                                             | 0.46| 0.33| 0.48| 0.43       |
| SBI ETF BANKING                                           | 1.42| 1.05| 1.56| 1.34       |
| SBI ETF NIFTY JUNIOR                                      | 1.64| 0.85| 1.85| 1.45       |
| AVERAGE                                                   | 1.83| 0.95| 1.94| 1.57       |
| MAX                                                       | 4.38| 1.88| 4.41| 3.46       |
| MIN                                                       | 0.46| 0.32| 0.48| 0.43       |

This table shows the calculations of Tracking Error, which reveals the deviation between the return of ETFs and their underlying indexes. We apply three different methods in tracking error calculations marking them as TE₁, TE₂, and TE₃.

TE₁ refers to the standard error of simple regression. TE₂ is the average of absolute difference between sample ETF’s and their corresponding indexes while TE₃ is the standard deviation of the difference between ETF’s and the underlying indexes.

5.6 Multiple Regression

In this final section of the study, we examine the impact of most common attributes of ETF’s on their performance. The independent variables considered for this purpose includes risk of ETF, return of Index, management fees and average tracking
error. Figure 1 shows the trend analysis between dependent and all the independent variables of 27 ETFs. It shows that based on regression equation actual returns of ETF are close to the predicted value of returns. Further, it shows that the error is near to zero, which indicates the robustness of the model.

Table 7 presents the results of multiple regression, where the adjusted R square is equal to 0.2893 indicating the return of ETF is collectively impacted only to the extent of 28.93% by the factors considered for this multiple regression which indicates the presence of other operational and non-operational variables along with the common attributes of ETF’s considered in the study collectively determines the performance of the sample ETF’s. Since ETF’s are passively managed funds and are reliant on the benchmark index, we see a positive and significant relationship between the returns of the ETF’s and Index. Risk of the ETF, which is measured as the standard deviation of returns of the ETF, is found to have a negative or inverse relationship with the returns of the ETF indicating increase in risk leads to decrease in returns and thereby affecting the tracking efficiency along with increase in tracking errors (Rompotis, 2009; Rompotis, 2012).

![Fig. 1 Trend analysis between independent and dependent variables](image-url)

**Table 7** Multiple Regression

| Variable                | Coefficient | Std. error | t-statistic | Prob.  |
|-------------------------|-------------|------------|-------------|--------|
| C                       | 0.008259    | 0.023343   | 0.353828    | 0.7268 |
| RETURN_INDEX            | 0.938267    | 0.343841   | 2.72878     | 0.0123 |
| RISK_ETF                | -0.015266   | 0.019821   | -0.77019    | 0.4494 |
| MANAGEMENT_FEES         | -1.18154    | 2.956869   | -0.39959    | 0.6933 |
| AVERAGE_TE              | 0.021571    | 0.024977   | 0.863634    | 0.3971 |
| R-SQUARE                | 0.398677    |            |             |        |
| ADJUSTED R-SQUARE       | 0.289346    |            |             |        |

This table presents the results of multiple regression performed to understand the impact of risk of ETF, return of Index, management fees, average tracking error on the returns of ETF.
Risk and management fees are inversely related with the returns of the ETF that is in consistent with the literature (Rompotis, 2012) as they lead to underperformance of ETF’s when compared to their corresponding index. Though ETF’s are cost-effective when compared to that of index mutual funds, management fees still lead to the performance deviation of ETF’s thereby affecting the returns generated by the ETF’s which is empirically explained through the inverse relationship results obtained the regression analysis (Elton et al., 2000; Fassas, 2014; Pinheiro & Varela, 2018). Various studies have also found a positive and significant relationship between expenses and tracking errors as expenses lead to tracking errors (Frino and Gallagher, 2001; Rompotis, 2009; Chu, 2011; Rompotis, 2011; Rompotis, 2012; Singh & Kaur, 2016; Tsalikis & Papadopoulos, 2019).

Through the previous sections of the analysis, it can be confirmed that the sample ETF’s exhibit significant tracking error while replicating their underlying benchmark indices. Tracking errors are found to be positively impacting the returns generated by ETF’s indicating a positive correlation among the two variables. The returns generated by ETF’s are not free from tracking errors and as and when return increase, there can be an increase in tracking errors as well (Frino and Gallagher, 2001; Rompotis, 2010; Chu, 2011; Drenovak et al., 2014; Fassas, 2014; Singh & Kaur, 2016).

6 Discussion and Conclusions

ETF’s have transformed themselves into one of the successful innovations in the investment sector which was originally a target oriented niche index tracking product (Charupat & Miu, 2013). ETF’s intrigue the investors who are cautious and inept to keep track of the market performance frequently (Mahajan & Saxena, 2014). They also attract petite investors who wish to reduce the expenses to be incurred in his/her investment as they can choose the pre-designed ETF’s that track an index, commodity or currency rather than customized active or passive investment portfolios designed by the fund managers.

Indian equity ETF’s are growing in leaps and bounds by gaining popularity among different sectors of investment community, which makes it imperative to evaluate their performance relative to the benchmark index and their tracking efficiency. The first step of the investigation surrounds the evaluation of average daily percentage returns, risk and tracking errors of the ETF’s along with their underlying benchmark through different methods. In this regard, both simple and multiple regression analysis are performed.

This study focuses on 27 equity ETF’s listed on the NSE, India and most of the ETF’s outperformed their corresponding benchmarks (Kurian, 2020) but loads the investors with increased risk when compared to the index (Goel & Ahluwalia, 2021). The mean output of Sharpe and Sortino Ratio indicate that the ETF’s underperform their benchmark indexes whereas the average results of Treynor’s Ratio indicate ETF’s outperform the corresponding benchmark indices, which can be due to utilization of only systematic risk for the calculation of risk adjusted return. Despite underperformance of few of the sample ETF’s when compared to the tracking index,
they are cost effective when compared to its peers, convenient for the investors to invest in non-tradable securities on a real time basis.

Proficiency of tracking the benchmark index is evaluated by the magnitude of deviation between the earnings of the sample and the index. Through the analysis, the study reveals that on an average, the sample ETF’s exhibit notable tracking error in the process of replicating the performance of their benchmark indices. The average tracking error using three different methods of the sample is 1.57%. Tracking error estimates are found to have a positive relationship with the risk and management fees and expense ratio of ETF’s have a negative impact on the returns generated by the ETF’s. The results are consistent with previous studies (Rompotis, 2012; Singh & Kaur, 2016) and the reason for this can be attributed to non- full replication strategy, changes in the constituents of underlying index, bid- ask spread, lack of liquidity, transaction costs etc. Minimization of tracking errors of ETF’s are inherent for the investors to benefit from this financial innovation that offers varied benefits to the investor community.

Further, the study proceeded with analyzing the impact of most common attributes of ETF’s on the returns generated by them. The results indicate that returns of ETF’s have a significant positive relationship with the returns of the index, as they are fundamentally passive funds. Risk and management fees are inversely related to the returns of the ETF’s as they reduce the returns earned by the investors.

We anticipate a continuous growth in the academic literature of ETF’s as they are being accepted and embraced by the investing community and researchers all over the world. The results of the study will enable financial service providers and regulators to undertake activities that will educate and create awareness about the benefits of investment in equity ETF’s such as exposure to wide variety of stocks through purchase of single unit of an ETF, low expense ratio, tax benefits etc. It will also facilitate Asset Management Companies in taking suitable measures to reduce tracking errors that will help in successful replication of the benchmark and undertake initiatives that enable the ETF to be become price efficient.

The scope of this study is restricted only to the performance evaluation and tracking efficiency of selected equity ETF’s traded on NSE during the pre-pandemic period which can be extended to other categories of ETF’s across different time periods encompassing global uncertainties like pandemic and geo-political distress. Impact of returns of the index, risks, tracking errors and management fees on the returns generated by ETFs are the only variables included in the study which can be extended by including other operational and non-operational variables related to ETF’s such as liquidity, volatility, volume traded etc.

References

Aber, J. W., Li, D., & Can, L. (2009). Price volatility and tracking ability of ETFs. *Journal of Asset Management, 10*(4), 210–221.

Alam, N. (2013). A comparative performance analysis of conventional and Islamic exchange-traded funds. *Journal of Asset Management, 14*(1), 27–36.
Anadu, K., Kruttli, M., McCabe, P., & Osambela, E. (2020). The shift from active to passive investing: Risks to financial stability? *Financial Analysts Journal, 76*(4), 23–39.

Athma, P., & Mamatha, B. (2013). Performance of index funds in India. *Asian Journal of Research in Business Economics and Management, 3*(6), 21–29.

Bas, N. K., & Sarioglu, S. E. (2015). Tracking ability and pricing efficiency of Exchange Traded Funds: Evidence from Borsa Istanbul. *Business and Economics Research Journal, 6*(1), 19.

Bello, Z. (2012). The investment performance and tracking errors of small-cap ETFs. *Global Journal of Finance and Banking Issues, 6*(6), 12.

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

Chang, C. E., & Krueger, T. M. (2011). Does index investing work in bonds? *Managerial Finance, 37*(5), 451–464.

Chang, C. E., Krueger, T. M., & Witte, H. D. (2015). Do ETFs outperform CEFs in fixed income investing? *American Journal of Business, 30*, 231–246.

Charupat, N., & Miu, P. (2013). Recent developments in exchange-traded fund literature: Pricing efficiency, tracking ability, and effects on underlying securities. *Managerial Finance, 39*(5), 427–443.

Chu, P. K. K. (2011). Study on the tracking errors and their determinants: Evidence from Hong Kong Exchange Traded Funds. *Applied Financial Economics, 21*(5), 309–315.

Dhume, P., & Patil, A. (2019). Performance evaluation of Exchange Traded Funds in India. *International Journal of Economics and Management Studies, 6*, 35–47.

DeFusco, R. A., Ivanov, S. I., & Karels, G. V. (2011). The Exchange Traded Funds’ pricing deviation: Analysis and forecasts. *Journal of Economics and Finance, 35*(2), 181–197.

Delwa, W. L. (2001). Exchange-traded funds not for everyone. *Journal of Financial Planning-Denver*, *14*(4), 110–125.

Drenovak, M., Urošević, B., & Jelic, R. (2014). European bond ETFs: Tracking errors and the sovereign debt crisis. *European Financial Management, 20*(5), 958–994.

Elton, E. J., Gruber, M. J., Commer, G., & Li, K. (2000). Spiders: Where are the bugs. Available at SSRN 307136.

Elton, E. J., Gruber, M. J., Comer, G., & Li, K. (2005). Spiders: Where are the bugs? In E. Hehn (Ed.), Exchange Traded Funds (pp. 37–59). Berlin/Heidelberg: Springer-Verlag. https://doi.org/10.1007/3-540-27637-8_4

Fassas, A. P. (2014). Tracking ability of ETFs: Physical versus synthetic replication. *The Journal of Index Investing, 5*(2), 9–20.

Frino, A., & Gallagher, D. R. (2001). Tracking S&P 500 index funds. *The Journal of Portfolio Management, 28*(1), 44–55.

Frino, A., & Gallagher, D. R. (2002). Is index performance achievable? An analysis of Australian equity index funds. *Abacus, 38*(2), 200–214.

Gastineau, G. L. (2008). The cost of trading transparency: What we know, what we don’t know, and how we will know. *The Journal of Portfolio Management, 35*(1), 72–81.

Goel, G., & Ahluwalia, E. (2021). Do pricing efficiencies in equity ETF market impact its performance? *Global Finance Journal, 49*, 100654.

Henderson, B. J., & Buetow, G. W. (2014). Are flows costly to ETF investors? *The Journal of Portfolio Management, 40*(3), 100–112.

Kanuri, S. (2016). Hedged ETFs: Do they add value?. *Financial Services Review, 25*(2), 181–198.

Kurban, B. C. (2020). Performance of nifty 50 ETFs in India. *Indian Accounting Review, 70*, 25.

Mahajan, P., & Saxena, S. (2014). Performance comparison of index funds and ETFs in India. *The Indian Journal of Commerce, 67*(3), 21.

Malhotra, N., Purohit, H., & Tandon, D. (2016). Price discovery and dynamics of Indian equity Exchange Traded Funds. *International Journal of Business Competition and Growth, 5*(1–3), 91–109.

Narend, S. (2014). Performance of ETFs and Index Funds: A comparative analysis. Performance of ETFs and Index Funds: A comparative analysis, National Stock Exchange of India Ltd., 1–17.

Narend, S., & Thenmozhi, M. (2016). What drives fund flows to index ETFs and mutual funds? A panel analysis of funds in India. *Decision, 43*(1), 17–30.

Pinheiro, C. M., & Varela, H. H. (2018). *Do Exchange Traded Funds (ETFs) Outperform the Market? Evidence from the Portuguese Stock Index* (No. 0109). Gabinete de Estratégia e Estudos, Ministério da Economia, September 2018, 1–26.
Poterba, J. M., & Shoven, J. B. (2002). Exchange-traded funds: A new investment option for taxable investors. *American Economic Review*, 92(2), 422–427.

Prather, L. J., Chu, T. H., Mazumder, M. I., & Topuz, J. C. (2009). Index funds or ETFs: The case of the S&P 500 for individual investors. *Financial Services Review*, 18(3), 213.

Purohit, H., & Malhotra, N. (2015). Pricing efficiency & performance of exchange traded funds in India. *The IUP Journal of Applied Finance, Special Issue*, 21(3), 1–20.

Reddy, T. K. (2012) Analysis of exchange traded funds & mutual funds.

Rompotis, G. G. (2009). Interfamily competition on index tracking: The case of the vanguard ETFs and index funds. *Journal of Asset Management*, 10(4), 263–278.

Rompotis, G. G. (2010). Investing overseas from home: The case of Asian iShares. *Journal of Asset Management*, 11(1), 1–18.

Rompotis, G. G. (2011). Predictable patterns in ETFs’ return and tracking error. *Studies in Economics and Finance*, 28(1), 14–35. https://doi.org/10.1108/10867371111110534

Rompotis, G. G. (2012). An empirical look at Swiss Exchange Traded Funds market. *Aestimatio The IEB International Journal of Finance*, 4, 52–81.

Rompotis, G. G. (2013). Monthly effects on the trading behavior of US Exchange Traded Funds. *Aestimatio*, 7, 2.

Schizas, P. (2014). Active ETFs and their performance vis-à-vis passive ETFs, mutual funds, and hedge funds. *The Journal of Wealth Management*, 17(3), 84–98.

Sethi, N. (2016). Examining the Performance of Indian Exchange Traded Funds (ETFs). *Eurasian Journal of Business and Economics*, 9(18), 61–79.

Singh, J., & Kaur, P. (2016). Tracking efficiency of Exchange Traded Funds (ETFs): Empirical evidence from Indian equity ETFs. *Paradigm*, 20(2), 176–190. https://doi.org/10.1177/0971890716670722

Sushko, V., & Turner, G. (2018). The implications of passive investing for securities markets. *BIS Quarterly Review*, 2018, 113–131.

Svetina, M. (2010). Exchange traded funds: Performance and competition. *Journal of Applied Finance (Formerly Financial Practice and Education)*, 20(2), 130–145.

Swathy, M. (2016). An empirical performance evaluation of NSE NIFTY (vs.) BSE SENSEX ETFs. *IPE Journal of Management*, 6(1), 53.

Tsalikis, G., & Papadopoulos, S. (2019). ETFS—Performance, tracking errors and their determinants in Europe and the USA. *Risk Governance & Control: Financial Markets & Institutions*, 9(4), 67–76.

**Publisher’s Note** Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

Springer Nature or its licensor holds exclusive rights to this article under a publishing agreement with the author(s) or other rightsholder(s); author self-archiving of the accepted manuscript version of this article is solely governed by the terms of such publishing agreement and applicable law.