



## A COMPARATIVE ANALYSIS OF THE TRACKING EFFICIENCY OF INDIAN INDEX AND EXCHANGE-TRADED FUNDS THAT TRACK THE NIFTY 50 INDEX

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**Abstract:** Passive forms of investment aim to mimic benchmark index returns by mimicking the index's portfolio composition. The purpose of this study is to compare the ability of index funds and exchange-traded funds in generating the same returns as their benchmark index. Since the two investment instruments have different characteristics and method of functioning, they incur different costs and generate different returns. The study analyses the tracking efficiency of 8 index funds and 8 ETFs that track the Nifty 50 index for the 5-year period between 1<sup>st</sup> January 2016 and 31<sup>st</sup> December 2020. Three tracking error measures as well as three correlation measures were used to analyze the fund returns against index returns. The study found that there is no significant difference in the tracking error of the two groups of funds. However, ETFs have a greater Beta than index funds, indicating higher volatility.

**Index Terms – Index Funds, Exchange-Traded Funds, Tracking error, Nifty 50.**

### 1 INTRODUCTION

#### 1.1 Introduction to the Topic

The efficient market theory proves that the market reflects all available information at all times, and hence, market behaviour cannot be consistently predicted to outperform the market. Due to this, there has been a growing trend of preference of passively managed rather than actively managed investments over the past few decades. A recent report by **AMFI (2020)** stated that 47% of the total equity funds inflow in India over the past year till June 2020 consisted of passively managed funds such as index and exchange-traded funds. This is a huge spike compared to 15.2% share two years prior.

The growth in passively managed instruments of index and exchange-traded funds necessitates a study in their performance and ability to meet their objective. Since both index and exchange-traded funds aim to mirror the returns of the benchmark market index by implementing an appropriate buy and hold strategy, theoretically, the returns of the fund should be exactly equal to that of the index. However, in reality, this does not happen as the fund is a "real" portfolio that experiences market frictions, unlike the "paper" portfolio of the benchmark index. The delays and costs of mirroring a change in portfolio in the index reduces the actual returns of the fund (**Frino, Alex; Gallagher, David R, 2000**).

Due to the various challenges faced by the fund houses in replicating the index portfolio, a tracking error arises. Tracking error refers to the difference between the returns generated by the benchmark index and the returns generated by a specific fund. A perfectly efficient fund would have a tracking error of 0. As the costs and inefficiencies rise, so does the error.

This study focuses on the performance of index and exchange-traded funds in India. Since the two investment instruments have different characteristics and method of functioning, they incur different costs and also generate different returns. The study aims to measure and analyse the tracking efficiency of the top funds in the country. By comparing the performance of both types of funds, investors will be able to make a better-informed decision when it comes to passively managed funds.

## 1.2 Index Investing

Index investing is a form of passively managed investment. It is an investment strategy that aims to yield returns equal to that of the benchmark index. Investors hold a portfolio of securities whose composition must be the same as the selected market index. As a result of holding securities in the same proportion of the market index, the investor is able to generate returns equal or almost equal to the market index.

It is different from the active management style of investment. The sole purpose of active management strategies is to “beat the market” These investors constantly use their expertise and knowledge of the market to outperform or generate higher returns than that of the market index. Active managers selectively choose each security in the portfolio based on a forecast of future performance. Index investing makes no such forecast of the future, but simply follows the index composition while selecting the portfolio.

The risk of active management factors in when investors lose out on returns that they could have earned when they implemented this strategy. These investors may outperform the market in the short-run; however, it is challenging to do it in the long-run. Passive management, on the other hand, focuses on identifying sources of risk and developing appropriate strategies to compensate for it and generate adequate returns. Studies have shown that in the long run, proper portfolio mix selected by considering risk exposure level, proves to be more productive than constantly aiming to outperform the market (**Wellington, 1997**).

Efficient market hypothesis states that markets incorporate as well as reflect all available information at all times. It suggests that beating the market happens by chance as it is not possible to predict market behaviour, and hence, consistently doing so through active management cannot happen as market prices will only reflect new information. Studies have shown that active investments, when grouped together in the long run generate lower returns than the average index. Since outperformance happens by chance, investors should hedge against this risk by combining active and passive instruments in their portfolio. (**Kjetsaa, 2004**).

As active management involves expertise of fund managers, transaction and management costs, investors are charged high fees when compared to passive funds. Active investment also results in a larger amount of capital gains tax charged annually. For these managers to outperform the market consistently, they must generate enough returns to cover their expenses. **William Sharpe's** research showed that active managers underperform the market by the average amount of their fees.

There are different investment instruments that originated from this index investment style. The two that are studied in this research paper are Index Funds and Exchange-Traded Funds.

## 1.3 Index Funds

The shortcomings of actively managed mutual funds led to the creation of index funds. To understand the working of an index fund, mutual funds must be defined.

A mutual fund is a professionally managed financial vehicle that pools money from numerous investors to then invest in stocks, bonds, and other financial instruments. These funds give small investors the opportunity to diversify their risk by investing in a portfolio of securities. Depending on the investment objectives of risk and return, these fund houses select their portfolio accordingly. Buying a unit of a fund means buying a part of the portfolio's value. Investors earn returns through different means: income from dividends, interest of the security holding, capital gains on selling a security in the portfolio, and capital appreciation of the value of the portfolio.

An index fund is a type of mutual fund that tracks a specific market index by matching its portfolio to the components of the benchmark index. This is done by the fund to replicate the returns earned by the index. Maintaining a portfolio that mirrors the index means that fund managers only make a change to the portfolio when there is a change in the index composition. This concept hedges investors against potential losses that could arise when funds constantly try to outperform the index. As such, these funds are suitable for risk-averse investors who do not wish to constantly outperform the market, but rather get a steady return in line with the index. These are often used in an individual investor's portfolio along with actively managed investments to reduce the portfolio risk.

The first ever index fund was launched in 1976, John C. Bogle, the founder of Vanguard. The fund tracked the S&P 500 index and was called the First Index Investment (later renamed Vanguard 500 Index Fund). Even though it failed in its early years, it began to gain traction in the 1990s as passive management became more popular. The fund is now worth \$500 billion in assets which is bigger than the entire Indian Mutual Fund Industry which has assets worth \$350 billion.

## 1.4 Exchange-traded Funds

An exchange-traded fund, or an ETF, uses the same concept of an index fund, however, its defining characteristic is that units of it can be traded on a stock exchange. Thus, it is a financial vehicle that pools money from investors in exchange for units of the fund, and this money is collectively invested in a diversified portfolio of financial assets. The units of the ETF can be bought and sold on the stock exchange, similar to trading of shares of a company. Similar to index funds, it aims to replicate the returns of a benchmark index.

When a mutual fund is bought, an investor pays the AMC in exchange for units of the fund. Similarly, when selling units, the money is returned by the AMC. In the case of ETFs, investors do not deal with the AMC as units are traded on a stock exchange.

Like other mutual funds, ETFs also have a NAV, which measures the value of total assets held by the fund on a given day divided by the number of units. This value is disclosed at the end of each day. However, since ETFs are traded in real time, a pricing mechanism has been developed. When ETFs are mispriced, i.e., not similar to NAV, then it gives rise to arbitrage opportunities.

Instruments with a similar concept to the ETF were in development in the late 1980s but officially, the first ETF was launched on 22<sup>nd</sup> January, 1993 in the US. The S&P 500 Trust ETF called the SPDR was released by the State Street Global Investors. This industry has grown tremendously, and in May 2020, it was reported that there were more than 7100 ETFs trading across the globe (**ETFGI, 2020**).

In India, the first ETF to be introduced was NiftyBeES, which tracked the Nifty 50 index. It was launched in 2000 by Benchmark AMC, which is now owned by Nippon India Mutual Fund. Today, there exists several types of ETFs such as Equity ETFs, Debt ETFs, and Commodity ETFs.

## 1.5 The Indian Mutual Funds Industry

### History:

- The Indian Mutual Fund Industry was established in 1963 with the launching of the Unit Trust of India. This was a joint initiative taken by the government and the RBI to develop capital markets by offering low risk options through diversified investments to a risk-averse population.
- The first Non-UTI fund was launched by SBI in 1987.
- The year 1993 saw the entry of private companies into the mutual fund market. Soon after, this industry grew exponentially.
- After the SEBI Act 1992 was passed, mutual fund regulations were developed and were then implemented in 1996.
- AMFI, a non-profit organization formed in 1995 to promote healthy investing practices in this industry. SEBI has mandated that any company that wishes to offer or market any mutual fund product must have a certificate of AMFI.

### Size:

The total assets managed by the Indian Mutual Fund Industry has grown by 12.97% from 2020 to 2021, valuing it at Rs.31.84 trillion in January 2021. As of 31<sup>st</sup> January 2021, there were 9.52 crore folios in the market.

### Scheme-wise composition:

This mutual fund market offers different types of schemes to investors. The current scheme-wise break-up of assets in the market is as follows:

Table 1.5.1: Scheme-wise composition of Indian Mutual Funds Industry

Scheme	Composition (%)
Equity Oriented Schemes	40.70%
Debt Oriented Schemes	33.10%
ETFs/FoF	9.00%
Liquid/ Money Market	17.20%

### Investor break-up:

Investors could be either retail or institutional. Individual investors hold 52.30% share of industry assets while institutional investors (corporates, banks, Indian and foreign financial institutions) hold a 47.7% share of assets.

### Regulatory authority:

The Securities and Exchange Board of India is the regulatory authority that monitors all activity taking place in the Indian stock market, which includes the Indian mutual fund market. With the purpose of protecting investor interests and developing capital markets, SEBI formulates policies and monitors all trading activity that takes place in the country.

### Growth Factors:

The growth of this industry can be attributed to a key aspect: digital penetration. Using internet and mobile banking, investment in MF schemes have become very accessible to retail investors.

Digital access to investment plans, development of smart cities and improved internet connectivity have spread investments to smaller towns in the country. There has been a rise in the SIPs by retail investors due to these factors. There are currently 3.56 crore SIP accounts being operated in the Indian market.

### (AMFI, 2021)

### Index Fund Market:

Index funds made its way to India in 1999, when IDBI Principal, an asset management company, launched the first index fund in the country which tracked the Nifty index. This fund later came to be known as Principal Nifty 100 Equal-Weight fund.

Today, NSE indices have 29 while BSE SENSEX has 10 index funds that track it.

### ETF Market:

As of August 2020, the total AUM of all ETFs in the country was valued at Rs. 2.07 lakh crore. Most of the ETFs within the country are benchmarked to the Nifty 50 index. AUM for all ETFs based on Nifty 50 was valued at Rs. 1.02 lakh crore. 17 AMCs have introduced ETFs linked to Nifty 50. BSE SENSEX has 9 ETFs with an AUM of Rs 41,276 crore.

### ETF Growth:

ETF AUM has grown at a rapid rate of 65% per annum ever since 2015. The primary reason for this is that it is one of the main investments of the Employees' Provident Fund Organization. Over the past decade, the growth in ETF AUM has been predominantly due to the following:

- Investments made by Employees' Provident Fund Organization
- Disinvestment of government entities using Bharat 22 ETF and CPSE ETF.
- Establishment of the Bharat Bond Debt ETFs. In this case, the assets are not in the retail investment segment.

### Challenges faced by the market:

A major issue in the ETF market in India is the lack of variety. Approximately 85% of the ETFs in India are based on equity indices. This might stray investors away from using this as an investment alternative. More options such as debt funds should be introduced to provide options to investors.

After the successful launch of Bharat Bond ETF in 2020 which now already has an AUM over Rs. 25,500 crores, there may be a trend of introducing more debt-based ETFs as this suits the investment objectives of the average Indian investor, who is looking for predictability and stability.

Another basic issue is the lack of financial education amongst a large section of the Indian population. Lack of awareness makes them reluctant to invest in such instruments. AMFI and SEBI have set up initiatives to improve the financial literacy in semi-urban and rural parts of the country.

## 1.6 SWOT Analysis of the Industry

A SWOT analysis of the Indian Mutual Funds Industry is as follows:

### Strengths:

- **Diversity:** The Asset Management Industry provides investors a wide array of investment alternatives in terms of product offering as well as sector. Traditional and alternative products exist, which draw in a broad base of investors. Ex: Insurance funds, Sovereign Wealth Funds, high net worth individuals, and retail investors.
- **Well-regulated:** All activity in this market is monitored and regulated by SEBI. This ensures that fraudulent practices do not take place, increases investor awareness, and protects the interests of the investors at large.
- **Diversification:** India has a large population of financially illiterate people who are slowly beginning to invest in the capital market. Due to the poor level of financial expertise, they are naturally risk-averse. Mutual Funds offers them a way to diversify their risk in comparison to traditional stocks, as the fund encompasses various other securities.
- **Expert management:** Most retail investors may not have the time or the expertise to research about different securities and the market performance, to manage their investments efficiently. AMCs offer a solution to that problem by managing all the investments in the fund, to achieve their objectives, for a small fee.
- **Historical data:** As the Indian MF Market has been around for several decades, there is a strong database of historical information of prices, NAVs etc. of different funds which could be studied and analysed by investors. This helps them in making their investment decisions.

### Weaknesses:

- **High management fees:** In exchange for their expertise on managing the fund, the AMC charges its investors a certain fee. Depending on the type of fund (active or passive) and the involvement of the fund managers, the fees could increase drastically.
- **No guaranteed return:** Unlike fixed income securities that offer a guaranteed fixed income periodically, mutual funds do not provide such guarantees. This is because even though it is diversified, there is still risk in investing in such funds.
- **Lack of variety:** Even though different types of schemes exist, the majority of the market is dominated by a particular type of scheme. Example: In the ETF market, very few debt options exist, it is predominantly dominated by equity options.

### Opportunities:

- **Digital penetration:** With the rise in digital banking through financial inclusion initiatives, specifically in rural areas of the country, it is becoming easier for lower income section to save and make investments. With this, comes an increase in financial knowledge. The government and AMCs should harness this opportunity to show MF as a diversified method of investments that provide greater returns than savings bank account, FD etc.
- **Distribution channel:** Developing the infrastructure for online and mobile distribution channels as investment avenues could prove to be beneficial. Strategic alliances could be made with banks, AMCs, the government etc. to improve the existing infrastructure.
- **Growth Potential:** In the U.S., the total AUM is the size of 103% of its GDP. Since India is a developing country, this figure is only 11%. The average across the globe is 55%. The AMCs in India could create more products and schemes as there is huge growth potential in the market. Fund houses must try to strengthen their asset base to face any growing competition in the future.
- **Private Wealth Management:** Between 2011 and 2017, there has been a CAGR of 18.67% in the number of HNIs in the country. This has increased the demand for asset management and tax planning. AMCs and fund houses should harness this opportunity to increase their investor base (IBEF, 2020).

### Threats:

- **Lack of awareness amongst distributors:** Due to the expense involved in expanding distribution channels, many mutual funds have been unable to penetrate rural markets. As of 2019, only 3% of the rural population in India invested in mutual funds. Any absence of disclosure from distributors will lead to difficulties in selling these funds to rural investors.
- **Substitute investment avenues:** Substitute investment avenues such as fixed deposit, government bonds, etc are more popular in India, as they are more traditional. If these investment sectors grow, it may impede the growth of the mutual fund industry in the country.
- **Bias towards physical assets:** Similar to the previous point, there is a huge popularity of investing in physical assets such as gold and real-estate. As of 2019, the share of investments in physical assets was approximately 40%. Improving investor knowledge is imperative to increase the share of investments in this industry.

## 1.7 Stock Indices

A stock market index can be described as a financial barometer of market behaviour. It is a statistical measure that tracks the performance and changes taking place in a particular stock exchange. A set of stocks is selected based on specific criteria such as market capitalization, size, sector etc. This set is meant to be a representative sample of either the entire exchange or a certain section of it. The daily price and return fluctuations of these stocks are reflected in the stock index.

The value of the index is based on the value of the set of stocks it represents. If there is an overall increase in the value of the set of stocks, then the value of the index rises; and vice-versa. This way, it is able to capture the overall sentiment of the market at a given point of time. Due to this property, the market index acts as a benchmark indicator for how well a specific security is performing. Since the index is a representative sample of the market, if a stock is outperforming the index, it is beating the average of the market. Stock indices are important for the following reasons:

- It helps investors decide which stocks to invest in as these indices classify securities based on size, market capitalization, sector etc.
- By providing a benchmark for performance, an investor can compare the returns of multiple assets against the index to select the optimum asset for portfolio construction.
- As it is representative of a particular industry, sector, market, the financial performance can be studied to identify and forecast trends for the segment.

- The stock index provides a benchmark for passive investment strategies. Instead of researching heavily when many retail investors might not have the time or expertise, replicating the index changes is a safe way to generate adequate returns.
- The stock indices help to gauge investor sentiment at any point of time. Whether the index is displaying an increasing or decreasing trend over time indicates whether the market is bullish or bearish. Investors can use this information to time their investments strategically.

In India, the two main stock exchanges are the National Stock Exchange of India and the Bombay Stock Exchange. These exchanges have their own sets of stock indices based on different criteria.

The two benchmark indices of the Indian Stock Market are:

- **S&P BSE SENSEX:** The BSE was founded in 1875. SENSEX stands for sensitive index. Launched in 1986, it is India's oldest stock index. It tracks the top 30 companies listed and traded on the BSE. It is internationally traded on EUREX as well as in nations of BRICS.
- **CNX NIFTY (NIFTY 50):** This study focuses on funds that track the Nifty 50 index. NSE was founded in 1994 and is the largest stock exchange in the country in terms of the average daily turnover for equity shares.

NIFTY 50 index was created in 1996. It tracks the 50 largest and most frequently traded stocks traded on the NSE. It is owned by India Index Services & Products Limited, which is a joint venture between CRISIL and NSE.

The index tracks companies in different sectors in different proportions. As of February 2021, the sectoral composition of the index is as follows:

(Table 1.7.1: Sector-wise composition of the Nifty 50 index)

Sector	Weight
Financial Services	39.5
IT	15.73
Oil & Gas	12.81
Consumer Goods	10.01
Automobile	5.63
Pharma	3.21
Construction	2.78
Metals	2.77
Cement & Cement Products	2.44
Telecom	2.13
Power	1.71
Services	0.79
Fertilisers & Pesticides	0.49

Other stock indices in India include Nifty 100, Nifty 200, Nifty Midcap 100, Nifty Smallcap 100, S&P BSE – 100, BSE MidCap, BSE SmallCap etc.

## 2 LITERATURE REVIEW

### Wellington, Weston J. (Feb 1997)

The authors studied in detail the case for passive management of investments, at a time when passive instruments were gaining popularity. He states that active management is the traditional method of building a portfolio, by selectively purchasing specific securities based on forecast of future performance. Passive strategies make no forecast about the future and base the portfolio on the benchmark index composition. The case for passive management includes lower trading and management fees for investors, as well as uncertainty of returns owing to the efficient market hypothesis. Active managers aiming to beat the market may cheat themselves out of possible returns they could have earned. Index funds focus on identifying sources of risk and develop strategies that compensate risk with appropriate return. He states that a portfolio should be constructed knowing that market corrections are a certainty. Thus, instead of switching composition when the markets turn bearish, proper portfolio mix with stated exposure level is more productive in the long run.

### Alex Frino and David R. Gallagher (2000)

This paper investigated the theoretical and practical challenges of passive management of investments by analysing index funds in Australia. The authors associate the lack of empirical research on passive management with the common investors' misperception that index performance is easily attainable, without considering potential difficulties faced by managers. The market index is a "paper portfolio" that does not experience market friction. However, index funds being "real portfolios", do face friction and hence may cause delay, incur costs while trying to mimic the change in portfolio of the index.

### Kostovetsky, Leonard (2003)

This study explores the differences in ETFs and traditional index funds by building models to compare costs and ascertain which types of investors would prefer ETFs over index funds. It was found that small investors are drawn to index funds due to simplicity in investing, compared to ETF investment. An important qualitative advantage of ETFs is its convenience they can be traded at any time, not just at the end of the day as it is for index funds. Single- and multiple-period model analysis suggests that can be an important and useful tool for larger investors and long-term retail investors.

**Kjetsaa, Richard (Jan 2004)**

The study analysed the performance of actively managed mutual funds in relation to appropriate benchmark market indexes in the United States of America. Different categories of mutual funds were considered to determine which funds have been able to outperform the category benchmark. The comparisons were done for 12-month, 3-year, 5-year, 10-year, and 15-year time periods. The study found that actively managed funds, when grouped together and analysed on average, provide lower returns than the average index returns. Efficient market hypothesis suggests that outperformance happens by chance and is unpredictable. Hence, investors should build a portfolio with both actively managed and index funds to hedge against the risk of underperformance.

**Gastineau, Gary L (2004)**

This study analyses the problems that cause ETFs to underperform more competitive mutual funds. It attributes the underperformance to the modest structure followed by ETF managers. Other funds employ a more aggressive strategy which is how they beat the market or at least average out to market returns while making up for costs. The traditional "trade as soon as index change announcement is made" approach might not be ideal. Instead, ETFs should try analysing and predicting future changes in the index, which is followed by index funds, in order to match portfolios.

**Manuel Ammann and Michael Steiner (Jan 2009)**

The authors studied and compared the performance of actively and passively managed equity funds in Switzerland. Risk adjusted performance of 160 equity funds between 1989 and 2007 were considered. By studying sub-groups in the fund market, they found that actively managed Small and Mid-Cap funds perform better than passive funds. This is due to the developing nature of the market and low efficiency. However, in the Swiss large-cap segment, passive funds may be more suitable due to high market efficiency.

**Svetina, Marko (2010)**

In this paper, the growth and development of exchange traded funds from its inception till 2007 was studied. The author described ETFs as a financial instrument that represents an interest in a security portfolio that tracks a specific market index. He found that ETFs that compete directly with index funds perform better than retail index funds but at par with institutional index funds. Since competitive ETFs provide immediacy in trading while also tracking the same benchmark as existing index funds, its introduction has led to a reduction in net cash flows to index funds.

**Rompotis, Gerasimos G (2011)**

The author studied whether ETFs could beat the market index S&P 500, analysed tracking error persistence, and tried to find any patterns of predictability in the returns of the ETFs. Sharpe ratio, Sortino ratio, regression and tracking error models were used. It was found that tracking error persists in the short term. Expenses charged, age, risk are factors that result in tracking error persistence in ETFs. The analysis of the sample indicated that there are patterns of predictability in ETF performance, and hence, historic returns may be used to forecast future returns.

**Vijayakumar, N; Muruganandan, S; Rao, Chandra Sekhara K. (April 2012)**

The relationship between a mutual fund's characteristics and its performance, in the context of the Indian market was studied. Fund return is considered for performance while standard deviation, fund size, turnover ratio, income ratio, and expense ratio were considered for characteristics. By examining data of equity and debt-linked open-ended funds for 14 schemes over a 5-year period 2004-2008, the study found that fund performance is positively related to its volatility, size, and expense ratio. It also found that on average, the returns generated by fund managers are insufficient compared to the investment fees and related costs.

**Sharifzadeh, Mohammad; Hojat, Simin (June 2012)**

An analytical performance comparison of ETFs against index funds in the US from the period between 2002-2010 was conducted. They matched ETFs with index funds according to inception date and investment style to create a sample of 230 pairs. They used Sharpe ratio and risk adjusted buy and hold returns, and Wilcoxon signed rank test to determine whether ETFs had a better performance than the index funds. The study found that there is no significant difference between the performance of the two and that the investor should base his choice on factors such as product characteristics and tax advantages.

**Bello, Zakri. (Sep 2012)**

The author investigated the performance and tracking error of small-cap ETFs by comparing returns with that of similar index funds. Using a risk-adjusted return model, Jensen and Sharpe ratio, he found that the index funds, on average, outperformed the ETFs in this segment. The tracking error of ETFs were greater than that of the index funds.

**Bas, Nazli Kalfa; Sarioglu, Serra Eren (2015)**

Through their study, the authors analysed the performance and pricing efficiency of ETFs in Turkish markets between 2005-2013. Arithmetic mean, absolute mean, and quadratic tracking error methods are used to measure tracking efficiency against the benchmark index. It was found that the ETFs here have a higher tracking error than those in developed markets, which is line with the literature reviewed. Absolute premium and discount method was used to find that the ETFs are priced efficiently in Turkish markets and as such, no arbitrage opportunities exist because of this.

**Diego Víctor de MingoLópez and Juan Carlos MatallínSáez (2018)**

They studied the difference in US domestic equity active and index funds according to the level of portfolio turnover to find which option provides a higher risk-adjusted return to investors. They found that active funds that have a low portfolio turnover ratio achieve similar or better returns than index funds. On the contrary, active funds with high portfolio turnover ratio could produce either similar or worse returns than index funds. This occurrence is frequent in a volatile market. Hence turnover ratio is an important factor to be considered when making an investment decision.

**Sethi, Aakanksha; Tripathi, Vanita (July 2019)**

The authors studied the trading characteristics of index ETFs and their pricing efficiency in India. By analysing daily price and NAV data to find deviations and premiums, the arbitrage mechanism in the country was checked. It was found that due to an acute liquidity problem in the fund market, the ETFs suffer from large mispricing. The mispricing is not arbitrated soon, thus indicating inefficient markets. The low trading volume of ETFs result in large trading costs. Less informed investors could suffer losses by trading "mispriced" securities. Thus, the authors recommend investing in frequently traded, low-risk, price-efficient funds.

**Steyn, Johan (2019)**

The ETFs listed on the Johannesburg Stock Exchange was studied in depth to measure their tracking performance. It used 3 metrics of tracking error including absolute mean, standard deviation of index and ETF returns. Correlation was also used to quantify the link between ETFs and their benchmark indexes. The study also compared the tracking performance of local and international

funds. It was found that there is high dispersion in the tracking error of local and international ETF samples. This indicated that some were able to track the benchmark efficiently, while others had a very low correlation with the index. They emphasised the importance of investors considering tracking error before making investment decision.

### **Rahul Bhatia and Bhanu Sireesha (Oct 2020)**

The study compared the performance of index and mutual funds in India and USA, relative to their respective benchmark indexes. They found that over a long period, index funds outperform most mutual funds in the US as the markets are mature. Shorter periods observe exceptions to this. In India, which has developing or unmaturing markets, there is scope for better performance of mutual funds compared to index funds. In times of stock market crashes or depressions, index funds have done better. Thus, they concluded that the performance of funds is affected by the maturity and development of the market it is present in.

## **3 RESEARCH DESIGN**

### **3.1 Problem Statement**

The Indian Mutual Fund market includes both actively and passively managed fund. Several studies have shown that in the long run, these actively managed mutual funds tend to underperform the benchmark index. This is due to the efficient market hypothesis that market returns are unpredictable, along with other factors such as high operating costs, management fees etc (Kjetsaa, 2004). On average in the long run, it is seen that the returns generated by mutual funds are insufficient compared to the investment fees and related costs incurred (Vijayakumar; Muruganandan; Rao, 2012). Hence, it is essential to study the performance of passively managed funds from an investor's perspective.

The two passive investment fund options are index and exchange-traded funds. Both of these instruments track the same indices within the country. Theoretically they should generate the same returns, however, as they have fundamentally different characteristics as products, they incur different expenses and hence generate different returns. Investors must be aware of how well these funds are able to achieve their objective of tracking the market index.

Several studies exist that analyse the tracking performance of such passively managed funds. However, most of these studies took place in the context of developed markets such as the USA, Australia etc. A study in the USA found that there is no significant difference in the tracking performance of index funds and ETFs and hence investors should decide based on product characteristics (Sharifzadeh; Hojat, 2012).

Since India is a developing market, the performance of such funds may differ based on the principles of efficient market theory. This study aims to bridge the gap to understand how efficient the two types of funds are in tracking their benchmark indices to aid investors in making a well-informed decision based on their investment objectives.

### **3.2 Objectives of the study**

This paper aims to achieve the following objectives:

1. To study the performance of select Index and Exchange-Traded Funds in India that track the Nifty 50 index.
2. To analyse the tracking efficiency of Index and Exchange-Traded Funds against the benchmark Nifty 50 index.
3. To measure the tracking error of select Index and Exchange-Traded Funds in India
4. To compare the performance of Index and Exchange-Traded Funds as methods of passive investment strategy.

### **3.3 Scope of the study**

Over the past few decades, passive index-investing methods have been gaining traction all over the world, in both developed and developing capital markets. This study will further the research in the performance of such funds in developing capital markets.

This study will be particularly useful to small, retail investors in the country as they will be able to assess whether the performance of these index investments is in line with their investment objectives. This will aid them in their investment decision making process.

There has been a reluctance by retail investors in investing in ETFs. Index funds are a simpler method to generating adequate returns as it has a simple, traditional process. Investing in ETFs means dealing with the hassle of trading in the stock exchange. The average Indian individual investor has a bias against ETFs due to this. An analytical study of the performance and returns comparing the two methods could encourage investors to venture into the world of ETFs.

The study can further facilitate future research comparing the performance of such investment methods in developing and developed capital markets in order to comment on efficient market theory. Studying the tracking error will also enable research on the various factors that result in this error.

Information about the tracking efficiency of these funds could be useful to regulatory bodies as they will be able to assess if these fund houses are able to meet their objectives so that investor interests are protected.

Lastly, this paper will provide insights into the overall performance of the passive segment of the Indian Mutual Funds Industry.

### **3.4 Method of data collection (primary / secondary)**

This study examines the index and exchange traded funds that track the Nifty 50 index in India. The sample selected includes 8 index funds and 8 ETFs that track Nifty 50 index. The tracking error of the funds needs to be calculated against the total returns index of the market which is inclusive of any dividends paid out. For this reason, the sample only includes equity growth funds.

For the purpose of this study, secondary data was collected and analysed. A 5-year period was selected for the study, i.e., from 1<sup>st</sup> January 2016 to 31<sup>st</sup> December 2020. The historical data of daily closing returns of the Nifty 50 index were sourced from the official NSE website. For the selected funds, the daily NAV historical data was obtained from the official website of AMFI.

### **3.5 Sampling Type / size**

#### Sample type

In order to study the ability of passive funds in replicating benchmark index returns, funds that follow a single index, Nifty 50, was chosen for uniform comparison. All the funds that were selected are equity growth funds. Dividend funds could not be selected as the analysis is done against the total returns index of Nifty 50, which includes dividends.

#### Sample Size

The sample has a total of 16 funds: 8 index funds and 8 exchange-traded funds. Daily NAV data of the funds was collected for the 5-year period between 1<sup>st</sup> January 2016 and 31<sup>st</sup> December 2020.

(Table 3.5.1: List of funds selected for study)

Sl. No.	Fund Name	Fund House	Launch Date
<b>Index Funds</b>			
1	Aditya Birla Sun Life Index Fund Growth	Birla Sun Life AMC Ltd.	18-Sep-02
2	HDFC Index Fund Nifty 50 Plan	HDFC AMC Ltd.	17-Jul-02
3	ICICI Prudential Nifty Index Fund	ICICI Prudential Mutual Fund	26-Feb-02
4	IDBI Nifty Index Fund- Direct Growth	IDBI Mutual Fund	01-Jan-13
5	IDFC Nifty Fund-Direct Plan-Growth	IDFC Mutual Fund	30-Apr-10
6	SBI Nifty Index Fund	SBI Mutual Fund	17-Jan-02
7	Tata Index Nifty Fund	Tata Mutual Fund	25-Feb-03
8	Taurus Nifty Index Fund Direct Plan- Growth	Taurus Mutual Fund	19-Jun-10
<b>Exchange Traded Funds</b>			
1	Aditya Birla Sun Life NIFTY ETF	Birla Sun Life AMC ltd.	21-Jul-11
2	Edelweiss ETF - Nifty 50	Edelweiss AMC	08-May-15
3	HDFC Nifty 50 ETF	HDFC AMC ltd.	09-Dec-15
4	ICICI Prudential Nifty ETF	ICICI Prudential AMC	20-Mar-13
5	Kotak NIFTY ETF	Kotak AMC	02-Feb-10
6	LIC MF ETF-Nifty 50	LIC Mutual Fund AMC ltd.	20-Nov-15
7	Quantum Nifty ETF	Quantum Mutual Fund	10-Jul-08
8	UTI Nifty ETF	UTI Mutual Fund	03-Sep-15

### 3.6 Hypothesis

To achieve the stated objectives, the hypotheses to be tested in this study are as follows:

1. To check the stationarity of Nifty 50 returns historical data.

H0: Nifty 50 returns data has a unit root.

H1: Nifty 50 returns data does not have a unit root.

2. To check the stationarity of individual fund returns historical data.

H0: Fund returns data has a unit root.

H1: Fund returns data does not have a unit root.

3. To calculate the tracking error of the funds

H0: Tracking error(i) = 0

H1: Tracking error(i)  $\neq$  0

4. To measure the correlation of the funds against the index

H0: Correlation(i) = 1

H1: Correlation(i)  $\neq$  1

5. To compare the tracking error of index funds and ETFs:

H0: Average Tracking error (index funds) – Average Tracking Error (ETFs) = 0

H1: Average Tracking error (index funds) – Average Tracking Error (ETFs)  $\neq$  0

6. To compare the correlation of index funds and ETFs



H0: Average Correlation (index funds) – Average Correlation (ETFs) = 0

H1: Average Correlation (index funds) – Average Correlation (ETFs)  $\neq$  0

### 3.7 Statistical design

#### Dickey-Fuller Test:

The Dickey-Fuller test was developed by David Dickey and Wayne Fuller in 1979. It is used to determine whether the data set selected is stationary or non-stationary. This is done by checking the presence of a unit root in the data. Presence of unit root can cause problems in statistical analysis and inference. It is essential that the data is stationary as this implies that the time series is not seasonal and does not have specific trends. Stationary data results in accurate modelling.

If the t-stat values are significantly negative on performing the test, then there is no unit root and hence the data is stationary (Davies, 2003). The other indicator to check the stationarity of the data is whether the mean is less than or almost equal to 0.

#### Tracking error:

Tracking error is used to measure the difference in the returns of the selected fund compared to the returns of the benchmark index. For this study, 3 measures of tracking error have been adopted based on the definitions suggested by Pope and Yadav (1994). These metrics have been adopted in several studies ever since. Ex: Frino and Gallagher (2002), Steyn (2019) etc.

- The first measure calculates the mean of the absolute difference in the returns between the fund and the benchmark index for the selected time period.
- The second measure uses the standard deviation of the difference in the returns between the fund and the benchmark index for the selected time period.

The limitation of this measure is that if a fund underperforms and overperforms the index by an equal amount at different points of time, the effect is neutralised which results in standard deviation being 0. If only this measure is considered, results could be unreliable.

- The third measure of tracking error is that of standard error of regression. The returns of the fund are regressed against that of the index and the standard error that arises is an indicator of tracking error of the fund.

#### Correlation:

To analyse the correlation between the returns of the fund and index, 3 metrics were used:

- Pearson's correlation: If the fund is tracking the index perfectly, then the correlation measure will be equal to 1.
- Coefficient of determination ( $R^2$ ): Cresson, Cudd, and Lipscomb (2002) suggested that  $R^2$  can be used as an indicator for tracking error of a fund as it indicates the degree to which it is able to replicate the index returns in the regression equation.
- Beta: This is a measure of systematic risk of the fund that shows its volatility against the index. It is used in the Capital asset pricing model. Beta will be equal to 1 if there is a perfectly linear relation upon performing regression.

#### Descriptive Statistics:

Statistical tools such as mean, standard deviation, range etc. are applied to the tracking error and correlation metrics ascertained. This helps to further analyse the difference in said metrics between various funds.

#### F-test:

F-test is used in the study to assess whether the tracking error and correlation metrics of the different fund groups: index funds and ETFs, have equal variances. This is a prerequisite to decide what test to conduct to analyse the difference of tracking efficiency between the two groups of funds.

#### T-test

The study also employs t-test to check the equality of means of the two different groups. Two types: assuming equal variance, and assuming unequal variance, is used depending on results of the F-test. Through this, whether or not there is a significant difference in the tracking efficiency of the two types of funds can be analysed.

### 3.8 Limitations of the Study

One of the limitations of this study is that it does not study the quantitative impact of the product characteristics on the tracking efficiency. For instance, the impact of factors such as the portfolio turnover, expenses etc. on the tracking performance of funds were not analysed.

Another limitation is that this study only considers funds tracking the Nifty 50 Index. Future research could be conducted on the funds of different indices and even a comparative analysis between the funds of different indices.

Further, just as there are studies that show the performance of actively managed funds in the short and long run, tracking performance of passive funds could be analysed according to time period to help investors decide the tenure for which to invest in these funds.

#### 4 RESULTS AND DISCUSSION

The Dickey-Fuller test was conducted on the historical data of the index and all the funds considered in the sample for the 5-year period between 2016 and 2020. The results are as follows:

(Table 4.1: Testing the Stationarity of Data using the Dickey-Fuller Test)

Name	Dickey-Fuller Unit Root Test			Descriptive Statistics	
	Coefficient	Standard Error	T- Stat	Mean	Standard deviation
Nifty 50	-1.057328	0.028437	-37.181470	0.000524	0.000327
Aditya Birla Sun Life Index Fund Growth	-1.062741	0.028427	-37.385272	0.000535	0.000321
HDFC Index Fund Nifty 50 Plan	-1.058275	0.028436	-37.216385	0.000553	0.000326
ICICI Prudential Nifty Index Fund	-1.052991	0.028443	-37.020512	0.000553	0.000324
IDBI Nifty Index Fund- Direct Growth	-1.056137	0.028438	-37.137620	0.000551	0.000326
IDFC Nifty Fund-Direct Plan-Growth	-1.047908	0.028450	-36.833285	0.000565	0.000322
SBI Nifty Index Fund	-1.056656	0.028438	-37.156247	0.000554	0.000326
Tata Index Nifty Fund	-1.052514	0.028443	-37.004203	0.000556	0.000319
Taurus Nifty Index Fund Direct Plan-Growth	-1.058835	0.028433	-37.240103	0.000556	0.000317
Aditya Birla Sun Life NIFTY ETF	-1.056643	0.028440	-37.153003	0.000566	0.000325
Edelweiss ETF - Nifty 50	-1.055924	0.028439	-37.129063	0.000582	0.000327
HDFC Nifty 50 ETF	-1.056121	0.028439	-37.136347	0.000570	0.000327
ICICI Prudential Nifty ETF	-1.054514	0.028442	-37.076381	0.000547	0.000327
Kotak NIFTY ETF	-1.015302	0.028515	-35.606239	-0.000183	0.000801
LIC MF ETF-Nifty 50	-1.056391	0.028439	-37.146222	0.000571	0.000327
Quantum Nifty ETF	-1.072929	0.028409	-37.766604	0.000508	0.000334
UTI Nifty ETF	-1.056478	0.028440	-37.147632	0.000574	0.000327

To check the stationarity of Nifty 50 returns historical data.

H0: Nifty 50 returns data has a unit root.

H1: Nifty 50 returns data does not have a unit root.

The t-stat value of the Nifty 50 index is significantly negative. The mean is 0.000524 which is almost equal to 0. The standard deviation is 0.000327 which is less than 0.5. According to the Dickey-Fuller test, if these criteria are met, the data is stationary. Hence, the null hypothesis that the historical returns data of the Nifty 50 has a unit root is rejected. This data is stationary.

To check the stationarity of individual fund returns historical data.

H0: Fund returns data has a unit root.

H1: Fund returns data does not have a unit root.

All 8 index funds have a t-stat value which is significantly negative, have a mean which is almost equal to 0 and have a standard deviation less than 0.5. In the case of ETFs, all 8 of them also have a t-stat of approx. -37 which is significantly negative. The mean is approx. 0.0005 which is almost equal to 0, and the standard deviation is approx. 0.0003 which is less than 0.5. The similar trend noticed for the values of all the funds in the sample could be due to the fact that they all try to emulate the same returns as the index.

Hence, the null hypothesis that there is a unit root in the historical returns data of each individual fund is rejected. Since there is no unit root, the data is stationary. The results of the analysis are therefore reliable and valid.

To calculate the tracking error of the funds

H0: Tracking error(i) = 0

H1: Tracking error(i) ≠ 0

Tracking error of the index funds was computed using the 3 different metrics.

(Table 4.2: Tracking Error of Index Funds)

Index Fund	TE 1	TE 2	TE 3
Aditya Birla Sun Life Index Fund Growth	0.000247	0.000407	0.000355
HDFC Index Fund Nifty 50 Plan	0.000081	0.000191	0.000189
ICICI Prudential Nifty Index Fund	0.000120	0.000274	0.000244
IDBI Nifty Index Fund- Direct Growth	0.000083	0.000182	0.000178
IDFC Nifty Fund-Direct Plan-Growth	0.000151	0.000363	0.000313
SBI Nifty Index Fund	0.000089	0.000196	0.000193
Tata Index Nifty Fund	0.000157	0.000432	0.000332
Taurus Nifty Index Fund Direct Plan- Growth	0.000523	0.001003	0.000958

As seen in Table 4.2, all the index funds of the sample have a tracking error in between 0% and 1%. The index fund with the highest tracking error is the Taurus Nifty Index Fund. With values of .00523, 0.001003, and 0.000958, it has the highest tracking error by all the metrics. Hence, by these metrics, it has the poorest performance in terms of tracking efficiency. Even though it is the least efficient, it is still considerably good as the error over the 5-year period is still less than 1%.

Using TE 1, the index fund with the lowest tracking error is the HDFC Index Fund with 0.000081, followed by the IDBI Index Fund with 0.000083. Using TE 2 (standard deviation), the fund with the lowest error is the IDBI Index Fund. This is closely followed by HDFC and SBI funds. Using TE 3, which is the standard error of the regression between fund and index returns, the most efficient fund in terms of tracking error is again the IDBI index fund. Similar to TE 2 results, IDBI is followed by HDFC and SBI.

The null hypothesis that tracking error is 0 and the funds are perfectly efficient is rejected. Even though tracking error is present, it is marginal.

(Table 4.3: Tracking error of Exchanged-Traded Funds)

Exchange-Traded Fund	TE 1	TE 2	TE 3
Aditya Birla Sun Life NIFTY ETF	0.000153	0.000259	0.000244
Edelweiss ETF - Nifty 50	0.000093	0.000361	0.000361
HDFC Nifty 50 ETF	0.000069	0.000182	0.000182
ICICI Prudential Nifty ETF	0.000102	0.000794	0.000794
Kotak NIFTY ETF	0.000813	0.025642	0.010477
LIC MF ETF-Nifty 50	0.000082	0.000198	0.000198
Quantum Nifty ETF	0.000166	0.002275	0.002229
UTI Nifty ETF	0.000073	0.000183	0.000182

As seen in Table 4.3, the HDFC Nifty 50 ETF is the most efficient in tracking the index as it has the lowest tracking error according to all the 3 metrics. It is closely followed by the UTI Nifty 50 ETF.

According to all 3 metrics of tracking error, there is one ETF which consistently has the largest tracking value: Kotak Nifty ETF. The range of TE1 for the other ETFs is between 0.000069 - 0.000166 while Kotak has TE 1 of 0.000813. This value is roughly 7 times the average of the rest. Similarly, the range for the other ETFs is between 0.000182 - 0.002275, while Kotak is at 0.025642. For TE 3, the range for the others is between 0.000182 - 0.002229, while Kotak has a value of 0.010477. Thus, the fund is significantly less efficient in tracking the benchmark index than the rest of the ETFs.

Thus, even in the case of ETFs, the null hypothesis that tracking error is 0 is rejected. Even though it is marginal in most cases, it is significant for a few funds based on the tracking error metric used.

To measure the correlation of the funds against the index

H0: Correlation(i) = 1

H1: Correlation(i) ≠ 1

Beta is a measure of volatility of a security, it measures how big or small a change in the fund is in relation to a change in the index return. On the other hand,  $R^2$  measures how closely any change in the return of a fund is correlated to the Nifty 50 returns. It is a calculation of the degree to which the return of a fund is attributed to the Nifty 50 return.

(Table 4.4: Correlation metrics of index funds)

Index Fund	Beta	$R^2$	Correlation
Aditya Birla Sun Life Index Fund Growth	0.98167	0.99904	0.99952
HDFC Index Fund Nifty 50 Plan	0.99721	0.99973	0.99986
ICICI Prudential Nifty Index Fund	0.98870	0.99955	0.99977
IDBI Nifty Index Fund- Direct Growth	0.99635	0.99976	0.99988
IDFC Nifty Fund-Direct Plan-Growth	0.98322	0.99926	0.99963
SBI Nifty Index Fund	0.99674	0.99972	0.99986
Tata Index Nifty Fund	0.97505	0.99916	0.99958
Taurus Nifty Index Fund Direct Plan- Growth	0.96694	0.99305	0.99652

As seen in Table 4.4, the correlation between all the index funds with the Nifty 50 index is very strong. All the funds have a correlation metric value between 0.9 and 1, where 1 would indicate a perfectly linear relationship.

The beta values of all the index funds are also between 0.9 and 1. Thus it is seen that the index funds in the sample are slightly less volatile than the Nifty 50.

In line with the comparison for tracking error metrics, the Taurus Nifty Index Fund is the poorest performer in terms of correlation with the index. The fund has the lowest values amongst all the index funds for all 3 measures of correlation of beta,  $R^2$ , and correlation. In terms of  $R^2$  and correlation, the values of Taurus fund are not significantly lower than the rest of the funds. However, for beta, there is a difference of approximately 0.02 between the average beta of the rest of the funds and the beta of Taurus Index Fund.

The top 3 index funds in terms of the three different correlation metrics are the IDBI, HDFC, and SBI Index Funds. This is also in line with the tracking error analysis.

(Table 4.5: Correlation metrics of exchange-traded funds)

Exchange-Traded Fund	Beta	$R^2$	Correlation
Aditya Birla Sun Life NIFTY ETF	0.99184	0.99955	0.99977
Edelweiss ETF – Nifty 50	0.99794	0.99901	0.99951
HDFC Nifty 50 ETF	0.99884	0.99975	0.99987
ICICI Prudential Nifty ETF	0.99662	0.99522	0.99761
Kotak NIFTY ETF	1.00266	0.16769	0.40951
LIC MF ETF-Nifty 50	0.99867	0.99970	0.99985
Quantum Nifty ETF	1.00165	0.96232	0.98098
UTI Nifty ETF	0.99825	0.99975	0.99987

As seen from Table 4.5, the null hypothesis that correlation equals 1 is rejected as most values are less than 1 and a few are greater than 1. In terms of the correlation statistic, every fund except for the Kotak Nifty ETF has a correlation value between 0.9 and 1 indicating a nearly perfectly linear relationship between the returns of the funds and that of the index. However, the correlation value

of the Kotak Nifty ETF is 0.40951, which is significantly less than the rest of the ETFs that have values above 0.9. This shows that the Kotak Nifty ETF returns are not very heavily correlated with the returns of the index, unlike the rest of the ETFs.

The trend in the  $R^2$  values is similar to that of the correlation values. All ETFs except for Kotak have a  $R^2$  value between 0.9 and 1. However Kotak has a significantly less value of 0.16769. This means that the Kotak ETF is not able to mimic the returns of the Nifty 50 index as accurately as the others.

In terms of volatility measured by beta, most funds are less slightly less volatile than the Nifty 50 index with a value in between 0.9 and 1. However, there are 2 funds that are more volatile than the index. These are Quantum Nifty ETF and the Kotak Nifty ETF with beta values of 1.00165 and 1.00266, respectively.

#### Comparison between Index Funds and ETFs

To compare the tracking efficiency of the two groups, the following hypotheses are tested:

H0: Average Tracking error (index funds) – Average Tracking Error (ETFs) = 0

H1: Average Tracking error (index funds) – Average Tracking Error (ETFs)  $\neq$  0

H0: Average Correlation (index funds) – Average Correlation (ETFs) = 0

H1: Average Correlation (index funds) – Average Correlation (ETFs)  $\neq$  0

In order to compare the means of the different tracking error and correlation metrics, F-test was performed to determine whether the two groups of index funds and ETFs had equal variances or not. The results of the F-test can be found in Table 4.6.

(Table 4.6: Results of F-test for equality of variances)

Particulars	TE 1	TE 2	TE 3	Beta	R <sup>2</sup>	Correlation
F stat	2.888718	1077.583823	192.098823	11.478164	16365.505142	32943.63998
F critical (one-tailed)	3.787044	3.787044	3.787044	3.787044	3.787044	3.787044
F stat < F critical value	TRUE	FALSE	FALSE	FALSE	FALSE	FALSE
Result	Equal Variances	Unequal Variances	Unequal Variances	Unequal Variances	Unequal Variances	Unequal Variances

As seen in Table 4.6, the f stat is greater than the F critical value in all cases except for TE 1. The only measure for which index funds and ETFs had equal variances is in TE1, which uses mean of absolute difference in returns. The test results of the rest of the measures of tracking error TE 2, and TE 3, along with all the correlation metrics indicate that the 2 groups have significantly unequal variances.

As such, t-test assuming equal variance was used for TE 1 and t-test assuming unequal variance was used for TE 2, TE 3, Beta, R<sup>2</sup>, and Correlation.

(Table 4.7: Results of t-test for checking the equality of means)

Particulars	TE 1	TE 2	TE 3	Beta	R <sup>2</sup>	Correlation
Mean Difference	-0.001%	-0.336%	-0.149%	-1.258%	10.828%	7.596%
Hypothesised Difference	0	0	0	0	0	0
p value (two-tailed)	0.906509	0.320779	0.276939	0.015343	0.329553	0.335453
Alpha	0.05	0.05	0.05	0.05	0.05	0.05
p value (two-tailed) < alpha	FALSE	FALSE	FALSE	TRUE	FALSE	FALSE
Decision	Accept Null Hypothesis	Accept Null Hypothesis	Accept Null Hypothesis	Reject Null Hypothesis	Accept Null Hypothesis	Accept Null Hypothesis
Conclusion	No significant difference	No significant difference	No significant difference	Significant difference	No significant difference	No significant difference

In terms of the 3 tracking error metrics, the index funds had a lesser mean than the ETFs. However, the difference in means between the two are insignificant as the p value (two-tailed) of 0.907, 0.321, and 0.277 that were derived from the test were greater than the alpha value of 0.05 in all 3 cases. Hence, the tracking error of both index and exchange-traded funds are more or less the same.

In terms of correlation metrics, it is seen that there is no significant difference between the means of index funds and ETFs in the cases of  $R^2$  and correlation. The p values of 0.330 and 0.335 were greater than the alpha value of 0.05 and hence the null hypothesis was accepted. However, in the case of Beta, it is seen that there is a significant difference between the two. The p value of 0.015 is less than alpha 0.05. Hence, it is concluded that the Beta of ETFs is significantly greater than the Beta of index funds.

As seen in Table 4.7, even though the biggest mean difference is in  $R^2$ , it is still concluded that there is no significant difference in means. This is because the Kotak Nifty ETF has an extremely low  $R^2$  value of 0.16769 when every other fund has a value above 0.9. This one value majorly skewed the result of mean. Since the  $R^2$  values of other ETFs are almost equal to those of index funds, the overall mean is not significantly different.

## 5 SUMMARY OF FINDINGS

Amongst the index fund sample, there are a few funds which are top performing in terms of tracking error and correlation metrics: The IDBI, HDFC and SBI Index Funds. All the index funds have a tracking error in between 0% and 1%. The index fund with the highest tracking error is the Taurus Nifty Index Fund, making it the least efficient index fund. It also has the lowest values for the correlation metrics. The difference between  $R^2$  and Correlation values for Taurus compared to the other funds is not very large. However, the difference in beta is large, indicating that it is considerably less volatile than the rest of the funds in relation to the Nifty 50 index.

Amongst the exchange-traded funds, the most efficient funds in terms of tracking error as well as correlation metrics are the HDFC, UTI, and LIC ETFs. The two least efficient ETFs are the Kotak and Quantum ETFs. Comparing the two, it is seen that while Kotak has high beta and low  $R^2$ , Quantum has both a high beta and high  $R^2$ . In the case of Quantum, it is not necessarily a bad trait as it could produce higher returns than the benchmark in the case of increase in index returns. This is so since change in the fund is closely related to change in index and it is more volatile than the index. However, the converse also applies that when the index returns drop, the fund could drop severely.

When the means of the different tracking error and correlation metrics of Index Funds and ETFs were compared, it was found that there is no significant difference between the means for all measures of tracking error including TE1, TE 2, and TE 3. This means that the means of the absolute difference of fund returns against Nifty 50 returns is more or less equal for both groups. It also implies that the standard deviation of the difference in fund and index returns is not significantly different for index and exchange-traded funds. Lastly, it means that the standard error when the returns of the fund are regressed with the returns of Nifty 50 are not significantly different for both these groups.

In terms of correlation metrics, it was found that in terms of  $R^2$  and Pearson's correlation, again there is no significant difference between the means of index funds and ETFs. It implies that for both the groups, the extent to which the fund's performance is attributed to Nifty 50 performance is roughly the same.

The only metric by which there was a significant difference between index and exchange-traded funds was in terms of Beta. On performing t-test, since the p value 0.015 was less than alpha 0.05, it is deduced that the Beta of ETFs is significantly greater than the Beta of index funds.

Beta measures the volatility of a fund against the volatility of the benchmark index. It is a measure of risk. Since ETFs are traded like shares throughout the day, this adds to the volatility, which arises from the speculation of intra-day trading. Index funds cannot be traded, and as such have lower betas compared to the ETFs.

## 6 RECOMMENDATIONS

Since both index funds and ETFs have similarly efficient tracking abilities, investors looking to replicate the benchmark index returns can invest in either of these two types of funds. There has been a reluctance in the minds of retail investors in investing in ETFs due to lack of awareness and uncertainty of returns. This study shows that the tracking efficiency of ETFs are similar to that of index funds. Retail investors should not shy away from ETFs due to lack of faith in the fund to replicate market returns.

Investing in ETFs also allows investors to trade them throughout the day. This combines aspects of active investing with passive. Based on investment and trading objectives, if an investor would like to make indexed investments with the freedom of trading to make a profit when market opportunities occur, then ETFs are suitable for them.

Another advantage of ETF over index fund is in terms of tax. Due to its nature, an investor only has to pay capital gains tax on the sale of ETFs, however if he holds an index fund, there are periodic capital gains payments due to redemptions throughout the year. Considering that ETFs have the same tracking efficiency as index funds, and has tax benefits, investors should include these funds in their portfolio.

The results of this study are based on the tracking efficiency over a period of 5 years between 2016 and 2020. Further studies can be made on the short term versus long term tracking efficiency of such funds. Since this study was limited to funds that track the Nifty 50 index, other studies could be conducted on funds tracking other indices. There is also scope in studying the quantitative impact of product characteristics such as transaction costs, turnover, fees, size etc on the performance of funds.

## 7 CONCLUSION

This study examined the ability of select Indian index and exchange-traded funds in tracking their benchmark index: The Nifty 50 index. It employed six different measures to analyse the efficiency including methods of tracking error and correlation. Comparing the tracking performance of index funds and ETFs, no significant difference was found in the tracking errors of the two groups of funds. The only measure by which a difference is found in the performance of the groups is in terms of Beta. ETFs have a significantly greater beta than index funds and are hence more volatile. Investors should keep in mind the slightly higher risk and volatility of ETFs before making an investment decision.

Since the two types of funds have more or less the same tracking ability, investors must consider individual product characteristics offered by different fund houses such as management fees, transaction costs, size, turnover, and tax benefits to differentiate between the available funds. This is in line with existing literature about developed markets like the U.S. (Sharifzadeh; Hojat, 2012). Investors must ensure the product characteristics align with their personal investment objectives before making investments in passive funds.

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