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REVIEW OF LITERATURE

NEED/IMPORTANCE OF THE STUDY

STATEMENT OF THE PROBLEM

OBJECTIVES

HYPOTHESES

RESEARCH METHODOLOGY

RESULTS & DISCUSSION

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RECOMMENDATIONS/SUGGESTIONS

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- Hunker, H.L. and A.J. Wright (1963), "Factors of Industrial Location in Ohio" Ohio State University, Nigeria.

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- Garg, Bhavet (2011): Towards a New Natural Gas Policy, Political Weekly, Viewed on January 01, 2012 http://epw.in/user/viewabstract.jsp

# TRACKING THE INDEX FUNDS WITH FAMA FRENCH THREE FACTOR MODEL

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**ABSTRACT**

*The objective of this paper is to assess the tracking error and performance of Index Funds which are based on Nifty for the time period 2005-2012. The performance measures used are standard deviation, Beta, Alpha, R-Squared, Sharpe measure, Jensen measure, Treynor measure and Sharpe differential return measure. The results indicate that ICICI prudential index fund has outperformed the rest of the fund in passively managing its portfolio and tracking the benchmark and the analysis also gives a hint that at times of low performance of benchmark index the fund manager tries to balance the returns by superior selection of scrips.*

**KEYWORDS**
Alpha, Beta, Fama French model, Passive funds, Sharpe.

## 1. INTRODUCTION

In the underdeveloped regions savers of moderate means are generally reluctant to invest in corporate securities because of lack of knowledge about complicated investment affairs. Their resources being small, they can at best hold securities of one or two or of few industrial concerns. Investment in securities of mutual funds takes care of both these problems by providing diversification in security units and expert knowledge to provide steady and regular earnings to investors and a share in the general prosperity. Indian mutual fund industry began with establishment of Unit Trust of India in the year 1964, but the major growth of this industry started in the early 1990s when the sector was opened to private and foreign players due to econmic reforms.

## 2. LITERATURE REVIEW

Subha and Bharathi (2007) in their paper examined the investment performance of Indian Mutual funds using Sharpe Ratio, Treynor Ratio and Jensen differential return measure. The study was based on daily NAV for 51 mutual fund schemes for a period of one year from 1st October 2004 to 30thSeptember 2005. On the basis of study Sharpe Ratio indicates good performance by majority of the scheme, while in terms of Treynor ratio only few schemes showed good performance. The study in general revealed that the performance of the Mutual funds during study period were satisfactory. Dhanda, Batra and Anjum (2012) conducted a study to evaluate the performance of selected open ended schemes in terms of risk and return relationship for the period 1st April 2009 to 31st March 2011. For the purpose of study rate of return method, Beta, Standard Deviation, Sharpe ratio and Treynor ratio had been used. BSE-30 has been used as a benchmark to study the performance of mutual funds in India. The findings of the study reveal that only three schemes have performed better than benchmark. Prajapati and Patel (2012) conducted a study to evaluate the performance of Indian mutual funds through relative performance index, risk-return analysis, Treynor's ratio, Sharp's ratio, Sharp's measure, Jensen's measure, and Fama's measure. They used daily closing NAVs, made available from the website of Association of Mutual Funds in India (AMFI). The study period was from 1st January 2007 to 31st December, 2011. The results of performance measures suggested that most of the mutual fund had given positive return during 2007 to 2011. Narayanasamy and Rathnamani (2013) in their study evaluated the performance of selected mutual fund schemes in terms of risk return relationship. The study considered 5 mutual fund scheme launched by private sector for the period Jan 1 2010 to Dec 2012.The findings of study revealed that all the funds have well during study period except in 2011 due to fall in CNX Nifty index.Sharma (2013) conducted a study to analyse the performance of equity mutual funds industry against risk free rate and benchmarks return for the period of five years. The study was based on 10 growth oriented- open ended- equity mutual fund schemes. Risk- return analysis, coefficient of variation, Treynor's ratio, Sharpe's ratio, Jensen's measure, Fama's measure and regression analysis was used for study. The findings of study revealed that market factor effect behaviour of mutual funds returns. The results showed that performance of the majority mutual fund schemes had outperformed the market benchmark indexes in term of Treynor and Sharpe ratio based on historical monthly returns.

## 3. OBJECTIVES OF STUDY

The study is conducted to assess the tracking error and performance of Index Funds which are based on Nifty for the time period 2005-2012. The list of the funds considered for study is given in Table 1.

**TABLE 1: LIST OF FUNDS CONSIDERED FOR STUDY**

| Sr.No. | Name of the Fund | Benchmark | Launched On | Asset Management Company. |
|---|---|---|---|---|
| 1 | **Principal Index Fund** | S&P CNX Nifty | Jul-99 | Principal PNB AMC Pvt. Ltd |
| 2 | **UTI Nifty Index Fund** | S&P CNX Nifty | Mar-00 | UTI AMC Pvt. Ltd. |
| 3 | **Franklin India Index Fund** | S&P CNX Nifty | Jun-00 | Franklin Templeton AMC (India) Pvt. Ltd. |
| 4 | **SBI Magnum Index Fund** | S&P CNX Nifty | Dec-01 | SBI Funds Management Ltd. |
| 5 | **ICICI Prudential Index Fund** | S&P CNX Nifty | Feb-02 | ICICI Prudential AMC Ltd. |
| 6 | **HDFC Index Fund – Nifty Plan** | S&P CNX Nifty | Jul-02 | HDFC AMC Ltd. |
| 7 | **Birla Sun Life Index Fund** | S&P CNX Nifty | Sep-02 | Birla Sun Life AMC Ltd. |
| 8 | **LICMF Index Fund – Nifty Plan** | S&P CNX Nifty | Nov-02 | LIC Mutual Fund AMC Ltd |
| 9 | **Tata Index Fund-Nifty Plan** | S&P CNX Nifty | Feb-03 | Tata AMC Pvt. Ltd |
| 10 | **ING Large Cap Equity Fund** | S&P CNX Nifty | Jan-04 | ING Investment Management (I) Ltd. |
| 11 | **Canara Robeco Nifty Index Fund** | S&P CNX Nifty | Sep-04 | Canara Robeco AMC Ltd. |

## 4. RESEARCH METHODOLOGY

The closing NAV on quarterly basis are considered for calculation of buy and hold returns. Only the schemes with 'growth' option are considered for the study. The study is based on the secondary data. The data have been collected from various websites like mutualfundsindia.com, www.amfiindia.com and moneycontrol.com.

**TOOLS**

The Buy and Hold Returns are calculated by taking natural logarithms of current NAV to previous NAV. Return for the portfolio is $R_p = \ln(NAV_t/NAV_{t-1})$ and market's return $R_m = \ln(P_t/P_{t-1})$

where $R_p$ – return of the fund(portfolio) , $NAV_t$ is Net Asset Value at time t, $NAV_{t-1}$ is Net Asset Value at previous period t-1 , $P_t$ is the closing price of the index at period t and $P_{t-1}$ is the closing price of the index at period t-1 or previous period.

For estimation of risk, total risk and beta coefficients are estimated. Total risk is assessed by calculating standard deviation of the returns. Beta coefficient is estimated out of the regression line which is also known as security characteristic line (SCL). Portfolio returns are regressed on the market returns in order to estimate β.

The SCL plays an important role in Modern Portfolio Theory and is exppained as follows:

$R_p = \alpha + \beta * R_m + \varepsilon$

**4.1Sharpe's Measure** was developed as a composite measurement of portfolio performance. It employs standard deviation instead of beta as in Treynor's measure. It uses the capital market line as a benchmark.(i.e. $Sp = (R_p-R_f)/\sigma_p$) The higher the Sharpe's measure the better the performance as each unit of total risk is rewarded with greater excess return.

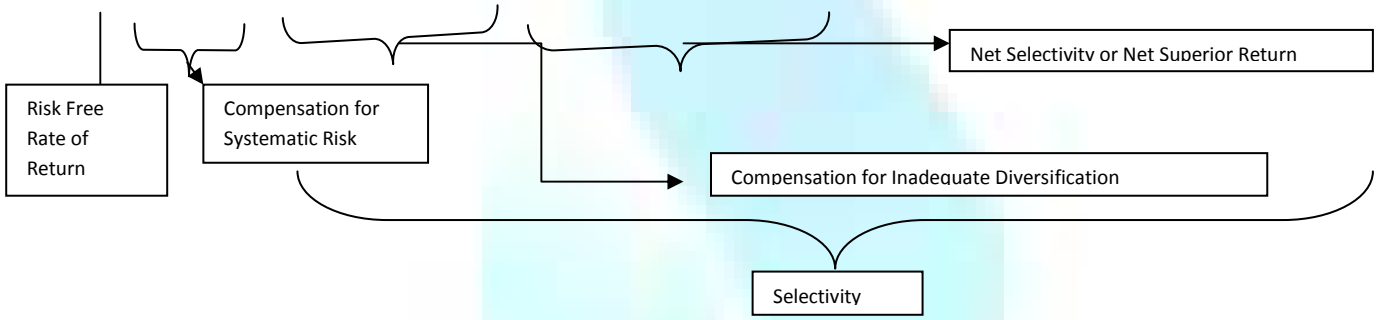
**4.2 Jensen Measure** was first used for evaluation of mutual fund managers in 1970. This measure is used to adjust the level of beta risk, so that riskier securities are expected to have higher returns. It allows the investor to statistically test whether portfolio produces an abnormal return relative to the overall capital market. It is calculated as follows:

$(R_p-R_f)=\alpha+\beta(R_m-R_f) + e_p$

**4.3 Treynor's Measure** computed a measure of the portfolio performance, measures excess portfolio return per unit of risk equal to the portfolio rate of return minus the risk free rate of return, dividing by portfolio beta. This is useful for assessing the excess return, helping investors to evaluate how the structure of the portfolio to different levels of systematic risk will affect the return.(i.e. $T_p=R_p-R_f/\beta_p$) The measure uses the Security market line as a benchmark. It is also known as 'return to volatility ratio'.

**4.4 Fama Decomposition Measure:** Eugene F Fama (1972) developed a portofio performance evaluation measurement technique which decomposes the total return of a portfolio into risk free return, return due to market risk and return due to stock selection of the the fund manager at the specified level of risk.

$R_p=R_f + \beta(R_m-R_f) + (R_m-R_f)/(\sigma_p/\sigma_m-\beta)+( R_m-R_f )-( \sigma_p/\sigma_m )( R_m-R_f )$




**4.5 Tracking Error Estimates:** Tracking error is an estimate of difference between the performance of a fund and the underlying benchmark index(Roll,1992). Pope and Yadav(1994) provided different estimates of measuring the tracking error.

**Estimate 1:** the average of the absolute difference in returns between the fund and the index

(i.e. $Error_{estimate1} = (\sum_{n=1to\,n} | e_p |)/n$

Where $e_p$ = difference between fund return and index return)

**Estimate 2:** the standard deviation of return differences between the fund and the index

(i.e. $Error_{estimate2} = \sqrt{(1/n-1)}*(\sum_{t=1to\,n} (e_p-\bar{e}))$

**Estimate 3:** the standard error of a regression of fund returns on benchmark returns

It makes use of the market model to estimate the tracking error in returns. It regresses Index fund portfolio returns on the benchmark index returns and considers the standard error( volatility around the regression line) as an estimate of the tracking error)

## 5. ANALYSIS AND DISCUSSION

As shown in the Table 2and 3, that the Buy and Hold returns of most of the returns hover around the 4%. The Buy and Hold Return of the ICICI Prudential is the highest and that of HDFC Index Fund is lowest. The total risk of the Birla Sunlife Index Scheme is highest and it also has a high beta while the lowest total risk is shown by LIC Index Mutual fund and the beta value is lowest for the UTI Nifty Index Fund. ICICI Prudential Index fund has shown the preferred excess returns.

**TABLE 2 : DESCRIPTIVE STATISTICS OF THE SCHEMES CONSIDERED**

| Z | Principal Index Fund | UTI Nifty Index Fund | Franklin India Index Fund | SBI Magnum Index Fund | ICICI Prudential Index Fund | HDFC Index Fund Nifty Plan | Birla Sun Life Index Fund | LICMF Index Fund Nifty Plan | Tata Index Fund Nifty Plan | ING Large Cap Equity Fund | Canara Robeco Nifty Index Fund |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Mean** | 3.864 | 4.232 | 4.257 | 3.976 | 4.539 | 3.756 | 4.076 | 3.575 | 4.351 | 4.044 | 4.071 |
| **Standard Error** | 2.545 | 2.514 | 2.573 | 2.551 | 2.578 | 2.529 | 2.582 | 2.434 | 2.573 | 2.488 | 2.521 |
| **Standard Deviation** | 14.170 | 13.995 | 14.327 | 14.204 | 14.353 | 14.081 | 14.374 | 13.553 | 14.328 | 13.852 | 14.036 |
| **Variance** | 200.780 | 195.854 | 205.256 | 201.763 | 206.012 | 198.281 | 206.614 | 183.686 | 205.298 | 191.872 | 196.997 |
| **Kurtosis** | 0.343 | 0.615 | 0.419 | 0.597 | 0.357 | 0.374 | 0.145 | 0.706 | 0.290 | 0.594 | 0.431 |
| **Skewness** | 0.146 | 0.148 | 0.133 | 0.177 | 0.182 | 0.024 | 0.244 | 0.163 | 0.196 | 0.192 | 0.178 |
| **Range** | 63.896 | 64.213 | 65.131 | 64.997 | 64.565 | 65.027 | 64.980 | 63.935 | 64.402 | 63.616 | 64.436 |
| **Minimum** | -23.503 | -23.260 | -23.617 | -23.216 | -22.609 | -26.051 | -23.774 | -24.015 | -23.386 | -22.707 | -23.357 |
| **Maximum** | 40.393 | 40.953 | 41.514 | 41.781 | 41.955 | 38.976 | 41.207 | 39.920 | 41.016 | 40.909 | 41.079 |
| **Count** | 31.000 | 31.000 | 31.000 | 31.000 | 31.000 | 31.000 | 31.000 | 31.000 | 31.000 | 31.000 | 31.000 |
| **Confidence Level (95%)** | 5.197 | 5.133 | 5.255 | 5.210 | 5.265 | 5.165 | 5.272 | 4.971 | 5.256 | 5.081 | 5.148 |

**TABLE 3: RISK RETURN ANALYSIS OF THE INDEX FUNDS**

| | Principal Index Fund | UTI Nifty Index Fund | Franklin India Index Fund | SBI Magnum Index Fund | ICICI Prudential Index Fund | HDFC Index Fund – Nifty Plan | Birla Sun Life Index Fund | LICMF Index Fund – Nifty Plan | Tata Index Fund-Nifty Plan | ING Large Cap Equity Fund | Canara Robeco Nifty Index Fund |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Schemes Return** | 3.8636 | 4.2323 | 4.2575 | 3.9757 | 4.5390 | 3.7561 | 4.0760 | 3.5748 | 4.3509 | 4.0443 | 4.0711 |
| **Risk free return** | 6.4647 | 6.4647 | 6.4647 | 6.4647 | 6.4647 | 6.4647 | 6.4647 | 6.4647 | 6.4647 | 6.4647 | 6.4647 |
| **Market return** | 4.2416 | 4.2416 | 4.2416 | 4.2416 | 4.2416 | 4.2416 | 4.2416 | 4.2416 | 4.2416 | 4.2416 | 4.2416 |
| **Excess return** | -2.6010 | -2.2324 | -2.2072 | -2.4890 | -1.9256 | -2.7085 | -2.3886 | -2.8899 | -2.1138 | -2.4204 | -2.3935 |
| **Schemes risk** | 14.1697 | 13.9948 | 14.3267 | 14.2043 | 14.3531 | 14.0812 | 14.3741 | 13.5531 | 14.3282 | 13.8518 | 14.0355 |
| **Beta of scheme** | 0.9456 | 0.9120 | 0.9561 | 0.9469 | 0.9567 | 0.9377 | 0.9506 | 0.8845 | 0.9497 | 0.9234 | 0.9235 |

Table 4 portrays the risk adjusted measures for the index fund schemes considered. Sharpe's Measure compensates the excess return for every unit of total risk taken. And it is evident from the results shown in Table 4 that the ICICI prudential gives the best performance on the basis of this measure and the Principal Index fund provides the least excess compensation over the total risk taken.

Jensens's measure tries to estimate the returns relatively on the basis of the risk taken by them i.e. risker portfolios should generate higher returns. On the basis of this estimate the UTI Nifty Index fund has outperformed the rest of the funds. But if we consider the total risk and beta in account as well then ICICI Prudential Fund should have given abnormal excess returns above the market returns. Treynor's measure estimates the compensation to the volatility of the portfolio. As per this measure ICICI Prudential has adjusted its well to the relative volatility of the Benchmark and the LIC MF Index fund has underperformed. Fama and French Decomposition measure provides a decomposition of the return into the various components stressing upon the performance of the fund manager for the diversification and selection of funds for generation of superior returns. As shown in the table the compensation for the systematic risk is the better for the LIC MF index fund and lowest for the Franklin India Index MF. Compensation for inadequate diversification should be in negative in order to underline the idea that the portfolio is well diversified. It is negative for all the funds and it shows that funds are adequately diversified. The third component of Fama French decomposition model is the 'net selectivity ' of the fund i.e. how much returns the fund manager has been able to generate because of superior selection of the stocks. As we know that the index funds are passive funds so the scope for the net selectivity reduces to a greater extent , so a passive fund should have comparatively low scores. as it is evident from the calculated values that only ICICI prudential and tata index fund has shown some selection of stock while principal index fund has shown the lowest net selectivity.

**TABLE 4: RISK ADJUSTED MEASURES AND RISK DECOMPOSITION OF THE SCHEMES CONSIDERED**

| | Principal Index Fund | UTI Nifty Index Fund | Franklin India Index Fund | SBI Magnum Index Fund | ICICI Prudential Index Fund | HDFC Index Fund – Nifty Plan | Birla Sun Life Index Fund | LICMF Index Fund – Nifty Plan | Tata Index Fund-Nifty Plan | ING Large Cap Equity Fund | Canara Robeco Nifty Index Fund |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Sharpe's measure** | -0.1836 | -0.1595 | -0.1541 | -0.1752 | -0.1342 | -0.1924 | -0.1662 | -0.2132 | -0.1475 | -0.1747 | -0.1705 |
| **Jensen's measure** | 4.0720 | 4.1465 | 4.0487 | 4.0691 | 4.0472 | 4.0896 | 4.0609 | 4.2077 | 4.0628 | 4.1212 | 4.1210 |
| **Treynor's measure** | -2.7507 | -2.4477 | -2.3086 | -2.6285 | -2.0127 | -2.8886 | -2.5128 | -3.2672 | -2.2257 | -2.6211 | -2.5917 |
| **Sharpe's differential return** | 3.9981 | 4.0249 | 3.9739 | 3.9927 | 3.9699 | 4.0116 | 3.9667 | 4.0928 | 3.9737 | 4.0469 | 4.0187 |
| **Fama French Decomposition Model Return** | 3.5062 | 4.2237 | 4.2727 | 3.7239 | 4.8236 | 3.3009 | 3.9186 | 2.9849 | 4.4547 | 3.8620 | 3.9137 |
| **Compensation for systematic risk** | -2.1021 | -2.0275 | -2.1254 | -2.1050 | -2.1269 | -2.0845 | -2.1132 | -1.9663 | -2.1113 | -2.0528 | -2.0530 |
| **Compensation for Inadequate diversification** | -0.0739 | -0.1216 | -0.0747 | -0.0763 | -0.0773 | -0.0779 | -0.0942 | -0.1150 | -0.0891 | -0.0744 | -0.1024 |
| **Net selectivity or net superior return** | -0.4250 | -0.0832 | -0.0071 | -0.3076 | 0.2785 | -0.5461 | -0.1812 | -0.8086 | 0.0866 | -0.2932 | -0.2381 |

**TABLE 5: ESTIMATES OF TRACKING ERROR**

| Tracking Error | Principal Index Fund | UTI Nifty Index Fund | Franklin India Index Fund | SBI Magnum Index Fund | ICICI Prudential Index Fund | HDFC Index Fund – Nifty Plan | Birla Sun Life Index Fund | LICMF Index Fund – Nifty Plan | Tata Index Fund-Nifty Plan | ING Large Cap Equity Fund | Canara Robeco Nifty Index Fund |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Estimate 1** | 0.3780 | 0.0093 | -0.0159 | 0.2659 | -0.2974 | 0.4855 | 0.1656 | 0.6668 | -0.1093 | 0.1973 | 0.1705 |
| **Estimate 2** | 0.8926 | 3.1755 | 0.8562 | 1.0924 | 1.0862 | 1.3017 | 2.0838 | 3.1371 | 1.8532 | 1.2079 | 2.5259 |
| **Estimate 3** | 0.8591 | 3.1720 | 0.8672 | 1.0840 | 1.1105 | 1.2657 | 2.1386 | 2.9862 | 1.8963 | 1.0512 | 2.5234 |

Table 5 provides the tracking error estimates. As per the simplest estimate of the tracking error i.e. Tracking error estimate 1 the ICICI prudential fund has the lowest error and HDFC index fund has the highest fund. According to the estimate 2 which considers the deviation of returns from its benchmark the icici prudential fund has outperformed the rest and the uti mf index fund has underperformed. Considering the estimate 3 for the tracking error which is based on the errors of regressing the portfolio returns on the benchmark returns the ing large cap is the best performing fund while the uti mf index fund is the least performing fund. the estimate 3 is provides a better assessment of the tracking error and it can to some extent assurance in the forecasting of the returns as well.

## 6. CONCLUSION

Considering all the estimates and measures it can be assessed that the ICICI prudential index fund has outperformed the rest of the fund in passively managing its portfolio and tracking the benchmark and the analysis also gives a hint that at times of low performance of benchmark index the fund manager tries to balance the returns by superior selection of scrips.

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