

Index Fund Implementation in India

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1. Introduction

In the decade of the 1960s and 1970s, many studies indicated that actively managed funds which seek to obtain excess returns by actively forecasting returns on individual stocks, do not actually obtain statistically significant excess returns. This was consistent with the hypothesis of 'market efficiency', which suggested that obtaining excess returns should be difficult in a competitive market.

This research suggested a superior investment strategy: the index fund. This would be a portfolio which passively replicated the returns of the index. The most useful kind of market index is one where the weight attached to a stock is proportional to its market capitalisation. Index funds are easy to construct for this kind of index, since the index fund does not need to trade in response to price fluctuations. Trading is only required in response to issuance of shares, mergers, etc.

Index funds are central to the modern approach to fund management. Since the first index fund launched in 1972, investors all over the world have discovered that there are substantial benefits from utilising index funds as an alternative to actively managed funds. In many countries, assets with index funds amount to 30% to 40% of the total equity assets managed by professional fund managers.

In this article however, we do not address the question of whether index funds outperform actively managed funds in India; nor do we address the question of whether the agency conflicts between the investor and fund manager are better addressed by index funds. Our focus is on questions of implementation. Assuming that an investor is interested in utilising an index fund, the hurdle faced is that of tracking error, i.e. the annualised standard deviation of the error between index fund returns and index returns. It is argued that in developing countries, where the equity market is illiquid, the tracking error of index funds can be fairly large, thus diminishing the benefits from indexation. We make a systematic effort to measure and understand tracking error of index funds in India.

2. Issues in index fund management

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Index funds are arguably one of the most successful ideas that have flowed from academic economics into the real world. Indexing is based on the premise that if markets are fairly efficient, then it would prove difficult for active managers to obtain excess returns, after considering the higher fees and costs that they have to run up. Hence, instead of actively engaging in stock picking, index funds simply try to replicate the returns on a chosen market index and aim to deliver the returns and the risk of that index. Evaluating an index fund's performance boils down to observing how closely a fund tracks the underlying index.

In principle, managing an index portfolio requires investment in all constituent index securities in the exact proportion as the underlying benchmark. This is called a "full replication" approach. In practice, fund managers often face problems in replicating the benchmark index returns. The index represents a mathematical calculation derived from a portfolio of securities that are not subject to the same market frictions as those faced by index mutual funds.

Index funds incur transactions costs that are associated with portfolio implementation, re-balancing and capital flows. When the composition of the underlying index changes, either due to additions or deletions of constituents or due to corporate restructuring, the index assumes that the theoretical portfolio's new weights to each security can be achieved automatically. However, for the index fund, realigning the portfolio to mimic the underlying benchmarks involves physical trading in stock and the transactions costs incurred thereby.

Hence, factors driving tracking error include transactions costs, fund cash flows, uninvested/buffer cash, treatment of dividends by the index, corporate actions, and index composition changes. The liquidity of the underlying index securities also has implications for transaction costs (in terms of impact cost) and in turn the tracking error incurred by funds.

As a result of ongoing subscriptions and redemptions, open-ended index mutual funds engage in flow-induced trading. Upon subscriptions, they are required to rapidly invest the cash flow across index securities, and upon redemptions, to sell securities to generate cash. Index funds often maintain buffer-cash to meet redemptions. This gives $\beta < 1$ and innately yields tracking error.

The size and timing of cash flows also has an impact on tracking error. Liquidity of index stocks has implications for transactions costs, both implicit and explicit. Full-replication index funds could be required to have part of their assets in illiquid index securities. When

faced with large subscriptions or redemptions, the fund is forced to trade on the market under non-ideal liquidity conditions, resulting in high transactions costs and tracking error.

Typically there is a timing delay between when the index incorporates the dividend (at the ex-dividend date) and the actual receipt of the dividend by the index fund (after the ex-dividend date). Most indexes assume that accrued dividends are reinvested the day the stock goes ex-dividend. Actual receipt of dividends could take as long as several weeks.

When index securities are subject to corporate restructuring such as mergers, acquisitions or takeover by another company outside the index, there may be a timing delay between the date the company is removed from the index and the date the index fund receives the cash settlement. In addition, front running by risk arbitrageurs who acquire securities ahead of their inclusion in the index may also have an undesirable impact.

If the index fund is perfectly aligned with the index, the volatility of the underlying index will not result in tracking error. Since the index fund owns exactly the same portfolio as the index, however volatile the index movements are, the fund will perfectly track them. If however, the index fund portfolio does not perfectly mirror the index, volatility of the underlying index will result in tracking error.

Index volatility is of much greater concern to funds that track the index by using optimisation techniques. They hold a portfolio that is different from the index portfolio in the hope of minimising transactions costs associated with trading illiquid stocks. The portfolio is chosen such that it has a high correlation with the index. Under situations of normal index volatility, such an optimised portfolio will track the index closely. However during periods of high index volatility caused by index securities not held by the optimised portfolio, the fund will fail to track the index, resulting in elevated tracking error.

An ideal index fund exactly replicates index returns. Indexing achieves the investor's goal of removing discretionary powers from the fund manager. Investors would expect the index fund return to under-perform the underlying index to the extent of the management fee. In reality, index funds underperform beyond fees charged. For reasons cited above, tracking error will be inherent in index fund performance. This can give 'cover' to discretion in fund management.

3. Motivation and goals of the study

Index funds have attracted considerable attention in India. Most major fund houses have already launched index funds while many others are on way to launching. Our work is of

direct usefulness to these fund houses. From the perspective of investors, our work helps in assessing the extent to which index funds deliver on their promise of exactly tracking the index. As of today, there is a lack of clarity on the extent to which index funds in India are able to accurately track the index. Our work helps produce some stylized empirical facts on this question.

Index funds may increasingly play a major role in public policy formulation. For example, the Dave Committee has recommended that equity investments by pension funds should exclusively be done using index funds. Similar arguments can, in principle, be made in the insurance sector also. While this recommendation is entirely defensible using conceptual arguments, we need to verify the extent to which accurate tracking is attainable under Indian conditions.

This study is concerned with measuring and understanding the tracking error of index funds in India. We seek to address the following questions:

Q1 What are the difficulties faced in measuring tracking error and how can they be overcome?

Q2 What is the overall experience with tracking error of the competing index fund products in India today? Which are the index funds with the best fidelity?

Q3 Can we decipher the source of tracking error? Is tracking error due to buffer cash maintained or due to active management at the fund?

Q4 What can we say about the determinants of tracking error?

4. Findings

Achieving low tracking error is not a simple task. Suppose a fund wants to maintain an annualised tracking error of 0.5. This means its daily tracking error can at most be 0.0316. A single day of high tracking error could use up the full year's budget for tracking error. Hence index funds need to be very careful in terms of consistently tracking the index. Small problems in measurement make it impossible to obtain low tracking error values like 0.5. Correct measurement of index fund performance calls for high quality data and great care in data handling. One problem faced is that of missing data days where index values were available, but fund NAV values were not. We offer an alternative heuristic for measuring tracking error which is unbiased in the face of such missing data.

We conduct a Monte Carlo simulation to measure the impact of missing data on tracking error calculations. Simulating a million points of data from an imaginary index with the daily

standard deviation of returns equal to 1.4, we focus on an index fund with a true daily tracking error σ , and a probability of missing data of λ .

We then measure tracking error of the simulated index fund by two methods of handling missing data – one, by using the standard practice of ignoring days with missing NAVs, and two, by using an alternative heuristic suggested by us. We calculate the exaggeration in tracking error obtained by ignoring days with missing NAVs and find that fairly modest rates of missing data (e.g. 0.4% or 1 point per year) suffice to bias annualised TE from 1% to 1.74%. Our finding reinforces the need for high quality data. The goal of an index fund is to minimise the tracking error. It is conventional to think of tracking error on an annualised basis. Suppose TE=0.5. Then the 95% confidence interval for index fund returns over one year will be $\pm 1\%$ compared with returns on the index. International evidence suggests that index funds incur a tracking error in the range of 4 basis points to about 120 basis points. We measure the overall tracking error for the four longest existing index funds in India for the entire life of the fund, IDBI Index INit' 99 Fund, UTI Nifty Index Fund, Templeton Franklin India Index Fund, Templeton Franklin India Tax Fund. To enable comparison across funds, we compute the tracking error for the last two years ending 31/3/2003, a period for which we have NAV data for all funds under study. To capture the time dynamics of changes in tracking error, we calculate the rolling tracking error using a 250-day moving window.

Over comparable time-periods, we observe tracking error in the range of 68 basis points to 1097 basis points. In the Indian experience, we find that the Templeton Franklin funds have consistently shown low tracking error since inception. IDBI Index I-Nit Fund appears to have learnt how to do index fund management and improved substantially in recent times. The UTI Nifty Index Fund exhibits unacceptably large tracking error through out.

We go on to seek some insights into the sources of tracking error. Open ended funds in India need to maintain buffer cash to meet redemptions. To the extent that a fund maintains buffer cash, it has $\beta \neq 1$. This inevitably induces tracking error. In addition, a fund could also incur tracking error due to active management. These constitute two competing hypotheses about the sources of tracking error.

We seek to obtain insights into this question using the single market model. We hypothesise that if the fund holds a fixed fraction of cash and does perfect indexation with the remainder, we would observe the following observable effects: (a) a highly stable beta which

is less than one, (b) alpha of roughly 0 and (c) an error variance of roughly 0. We engage in rolling estimation of beta, alpha and the variance of errors to look for these phenomena. We find that both the Templeton Franklin funds show a highly stable beta. The R^2 of the regression is almost one, suggesting that most of the tracking error incurred by these funds could be explained by the buffer cash held. The beta of UTI Nifty Index Fund has been highly unstable. We find that in the case of the UTI and IDBI products, where tracking error is clearly present, the buffer cash hypothesis does not serve to explain the bulk of tracking error.

We also explore the relationship between index volatility and index fund tracking error. When the index is more volatile, we expect index fund tracking error to be larger for two reasons: (a) Greater imprecision in achieving trades at the NSE closing price, (b) Liquidity is inferior when volatility is higher. In addition, if active management is present, then portfolio volatility is likely to be higher when index volatility is higher.

Since returns in many financial markets are not well modelled by an independent and identically distributed process, we model the time-varying volatility of Nifty returns by using an AR(1) – GARCH(1,1) model. Using regression, we try to explain tracking error in terms of Nifty volatility. We find that there is indeed a positive correlation between Nifty volatility and index fund tracking error. There is a remarkable homogeneity in the volatility – tracking error relationship, across different funds.

5. Conclusion

In this study, we look at the performance of index funds in India. Index management requires supreme care in data management – by fund managers in terms of providing daily NAVs, dividend and expenses related data, and by index providers in terms of providing a neat time-series of daily index values and impact cost data for various basket sizes. It should be possible for an external observer to simulate an ideal index fund, assume zero transactions costs, and replicate the index. Our study shows that incorrect handling of data can result in significantly exaggerated values of tracking error. We suggest an alternative heuristic to handle the missing data problem encountered by us.

Using a comparable period of performance, we find that the tracking error for index funds in India ranges between 0.68% and 10.97%. The Templeton Franklin funds seem to be the best of the lot, consistently maintaining low tracking errors. The IDBI Index I-Nit'99 Fund showed high tracking error during the first half of its life, but has reduced since. The UTI

Nifty Index Fund has fared very poorly on replicating index performance, exhibiting significantly high tracking error. Our rolling tracking error calculations to study the time-dynamics of tracking error suggest a *learning effect* over time.

We study buffer cash as a source of tracking error. Funds that hold buffer cash invariably run up tracking error. In the guise of holding buffer cash, funds could indulge in active management. We try to decipher this behaviour across funds by studying the single market model parameters for these funds. Except in the case of UTI Nifty Index Fund, we observe a highly stable beta, and alpha and variance of errors approximately equal to zero. We model the time-varying volatility of Nifty returns using the AR(1)- GARCH(1,1) model and try to explain tracking error in terms of index volatility. We conclude that Nifty volatility is positively correlated with index fund tracking error.

While some funds show unacceptably high tracking error, the consistency in performance of the better run funds suggests that it is possible to attain fairly low levels of tracking error under Indian conditions.