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Tracking Error Performance - A case study on SBI Mutual Fund

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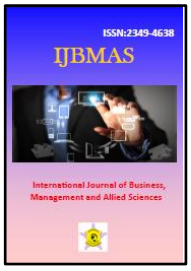


ABSTRACT
Active portfolio managers are eager to predict future volatility in the returns of schemes. Returns of each scheme are tracks with the returns of respective bench mark, technically called as tracking error. Ex-ante tracking error plays a crucial role in predicting future performance of the schemes. Ex-post tracking error indicates actual returns difference from the benchmark. The presented study tries to understand the efficiency of data packages (via, Bloomberg and BarraOne) used SBI Mutual Fund, one of the leading fund managers in India by considering ex-ante tracking error and the ex-post tracking error data.
Key word: Tracking Error (TE), Ex-ante & Ex-post TE, Bloomberg and Barra One.

1. Introduction:

Mutual fund is an investment basket in which professionalized management of funds is carried out by offering different schemes. Each schemes aim to meet the requirements of investors by creating target portfolios. Usually the managers are eager to track the schemes return with the underlying benchmark. There comes the concept of tracking errors. Tracking Error (TE) is nothing but the standard deviation of the difference between the return's of the portfolio and its underlying benchmark. Generally, Active risk manger designs the port-folio's to outperform the underlying bench mark. Whereas, the manager expects the portfolio return to mirror its benchmark return, then the portfolio is a passively managed one.

Tracking error calculated from actual active return observed for a portfolio is called as backward-looking tracking error or ex-post tracking error or actual tracking error. Ex-post tracking error does not reflect the effect of current decisions made by the managers for future returns and risk. Backward looking tracking error has little predictive value and can mislead investors in their risk perspective. In that case, portfolio managers require a forward looking tracking error. Using multifactor risk models and market index as the benchmark, forward looking tracking error can be estimated and also the portfolios exposure to the various risk factors can be computed and compared to the benchmark's exposure to the same factors. Using the differential factor exposures and the risks of the factors, a forward looking tracking error can be computed. Forward looking tracking error is

also referred to as ex-ante or predicted tracking error. Higher the forward looking tracking error, greater active management strategy pursued i.e. wide difference in the risk profiles of the portfolio and its benchmark.

The present study has been done with the selected schemes of SBI Mutual Fund (SBI MF), one of the leading fund managers in India. The investment and risk management department of the SBI MF uses two data package via Bloomberg and BarraOne for tracking error calculation. Through this analytical study, we wish to examine the efficiency of packages in predicting Tracking Error.

2. *Literature Review*

Tracking Error related literatures are developing only in the academic field its self. **William Fount Johnson, (2008)** found that the existence of tracking errors between foreign ETFs and its underlying home index are because of the differences across time and across countries. Foreign index positive returns relative to the US index and whether the foreign exchange trades simultaneously with the US markets were significant explanatory variables in the correlation coefficients between ETFs and their underlying home index. Another study was undertaken by **Patrick Kuok-Kun Chu** (2009) in Hong Kong stock market suggested that the determinants of tracking errors are comparatively higher than those documented in U.S. and Australia. Riadh Belhaj et al, (2013) examines the relation between the ex ante tracking error and ex post tracking error and determines the ex ante that must be set in order for the ex post to remain within a given tolerance margin.

Kevin and Tim (2014) analyze the tracking performance of commodity leveraged ETFs and discuss the associated trading strategies. It is known that leveraged ETF returns typically deviate from their tracking target over longer holding horizons due to the so-called volatility drag. This motivates them to construct a benchmark process that accounts for the volatility drag, and use it to examine the tracking performance of commodity leveraged ETFs. From empirical data, they find that many commodities leveraged ETFs underperform significantly against the benchmark, and they quantify such a discrepancy via the novel idea of realized effective fee. Finally, they consider a number of trading strategies and examine their performance by back-testing with historical price data. However, "Tracking Error Performance an Analytical Study" is completely different from the above works.

3. *Methodology of Study:*

The study has been done with the Net Asset Value of funds and the historical prices of the indices (benchmark) for a period 2 years from Feb 2012 to Jan 2014. Thereafter, annualized value of *ex-post* tracking error for the year 2013 has been calculated manually using the formula,

$$SD_{TE} = \sqrt{\sum_n \frac{(r_{ix} - \bar{r}_{ix})^2}{n-1}} \times \sqrt{250}$$

Where, r_{ix} is the difference in the returns; n is the number of working days in the year considered. Using the same data set, *ex-post* tracking error (for the year 2013) and *ex-ante* tracking error (for the year 2012) are extracted from Bloomberg and BarraOne/Crisil. The result are plotted and analyzed for making comment about the efficiency of packages.

The following are the Schemes under consideration

Schemes under consideration	Benchmark
SBI Magnum Equity Fund	CNX NIFTY
SBI Contra Fund	BSE100
SBI Magnum Multiplier Plus Fund	BSE200

BarraOne and Bloomberg:

Both the tools use multi asset class risk models in calculating ex-ante tracking error. BarraOne uses its own Barra Integrated Model (BIM) and Bloomberg uses Asian Equity Model designed by Bloomberg to calculate Tracking Error (TE). However, in order to understand the disparity and similarity between BarraOne and Bloomberg, it is better to explain their respective models in their own terms.

BarraOne

The Barra Integrated Model is a multi-asset class model for forecasting the asset and portfolio level risk of global equities, bonds and currencies. BIM builds factor models of all the local equity and bond markets. These models attribute the explainable portion of an asset's return to the local factors at work in each market. These factors include styles and industries for equities and term structure movements and credit spreads for bonds. They may differ significantly from market to market.

Structured local models- Each local model decomposes an asset's local excess return into a part due to local factors and a part that is unique to the underlying asset, the specific return.

$$r = xf + u$$

Where r – A vector of excess return

x– A matrix of asset exposures to common factors

f – Factor return's vector

u – A vector of specific return

f and u are uncorrelated and u 's are uncorrelated across different assets.

And then form a factor covariance matrix F, using exponentially declining weights for the historical factor returns and also form a diagonal matrix of asset specific variances Δ.

To compute the risk of a portfolio of equities, we need a forecast covariance matrix of asset returns V. Using the factor covariance matrix and the matrix of asset specification variances, Δ.

$$V = \underbrace{XfX'}_{\substack{common\ factor \\ variance}} + \underbrace{\Delta}_{specific\ variance}$$

Thus, risk of a portfolio arises from its exposure to factors in the market as well as from the idiosyncratic behavior of individual securities it contains. BarraOne breaks risk into its major sources like local market risk, common factor risk, industry risk, style risk, term structure, spread, emerging market risk, factor interaction and selection risk. It is the annualized standard deviation of returns. Portfolio risk is the *ex-ante* volatility derived from BIM and is based on the asset weights. Active risk is the *ex-ante* volatility derived from BIM and is based on the active returns.

Portfolio risk = $\sqrt{w'(XFX' + \Delta)w}$ Similarly, *Active risk* = $\sqrt{w'(XFX' + \Delta)w}$

Where, w- Vector of asset effective active weights

X- Matrix of asset exposure

F- Factor covariance matrix

Δ- Specific covariance matrix

Benchmark weight is the weight of an asset in the assigned benchmark portfolio. Active weight is the difference between the weight of an asset in the portfolio and the weight of the same asset in its benchmark. If the portfolio weight exceeds benchmark weights then, the active weight would be positive and vice versa.

Bloomberg: Bloomberg uses its various factor models to calculate tracking error. The Asian model of Bloomberg are used for the following countries Hong Kong group, India group, Korea, Taiwan, Singapore, Malaysia, Indonesia, Thailand, China, Philippines and Vietnam/South East Asia. To calculate tracking error (ex-ante), Bloomberg takes the square root of the product of volatility, weight and correlation.

Modern portfolio theory shows that the security return can be decomposed into two parts-systematic return (industry, country, value, growth, curve etc risk factors) and idiosyncratic returns (since it accounts only to the individual asset, it can be diversified). In linear factor model, each asset's systematic return is modeled as the product of usually a small set of factor returns and the asset's exposure to those factors.

Consider N-securities, T-time period and – k factors.

$r = FB^{'} + \varepsilon$ ---------- (1)

Where, - T x N security return

F- *T* x *k* common factor returns

B– *N* x *k* factor exposures

ε - *T* x *N* idiosyncratic return.

There are three types of factor models that explain whether the exposure and/or the factor returns are pre-specified or estimated.

Statistical model: They are principal component based models i.e. conversion of possibly correlated variables into a set of values of linearly uncorrelated variables. It estimates both the exposure and factor return. It is easy to build these models but difficult to interpret the output since it is tricky to associate an economic meaning to a principal component.

Explicit factor: Here factor returns are pre-defined and factor returns are estimated. These models are also called exogenous factor models (predefined factors) or time-series models (since security exposures are determined on a security-by-security basis by running a time-series regression).

$r_i = B_i F + \varepsilon_i$ ---------- (2)

i =1, 2……N.

r_i -T x 1 Historical return

B_i- k x 1 Exposures

ε_i -T x 1 Idiosyncratic returns for security i.

Implicit factor: The models here specify each asset's exposures and allow the model to reveal the implicit returns to those factors.

$r_t = BF_t + \varepsilon_t$---------- (3)

r_t -N x 1 Cross section of excess stock return

F_t- k x 1 Factor returns

ε_t-N x 1 idiosyncratic cross section returns at t

Bloomberg utilizes an explicit model for equity, fixed income and balanced funds. While for commodity fund it uses simplified version of the explicit model. It uses explicit model because for other asset classes security exposures are available (company balance sheet, industry membership etc), therefore factor returns can be estimated by cross-sectionally regressing the security return on exposures. However, for funds risk exposures are not always available since a holding look-through is not possible; as a result one often cannot use an implicit model.

4. Discussion

For easy understanding the efficiency of data packages used by the SBI Mutual Fund, comparative study has been done by calculated annualized ex-post tracking error with the ex-post tracking error extracted from Bloomberg and BarraOne/Crisil .

4.1 Magnum Equity Fund (MEF): MEF is a diversified equity fund, which invest in equities of high growth companies and the balance in debt and money market instruments. MEF targets CNX NIFTY. Fig.4.1.a shows the comparison between manually calculated annualized *ex-post* TE (2013) and the *ex-post* TE extracted from Bloomberg and BarraOne/Crisil. It is very clear that calculated value is near-to Crisil even though the data collected is from Bloomberg. In fig 4.1.b, *ex-ante* tracking error of Bloomberg and BarraOne do differ. But, *ex-ante* TE of BarraOne/Crisil closes its *ex-post* TE by the end of given time compared to Bloomberg *ex-ante* TE closing its *ex-post* TE.

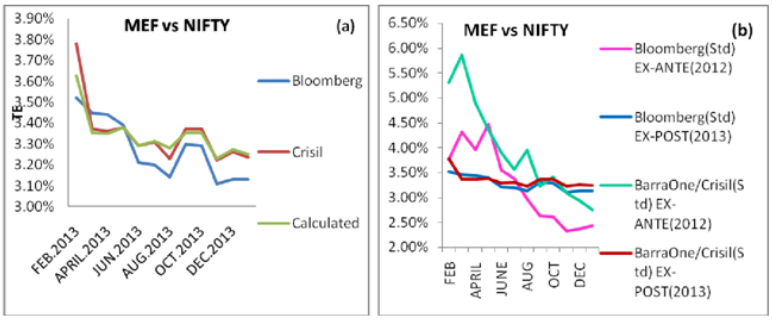


Fig. 4.1 shows Tracking Error comparison of MEF and NIFTY

4.2 SBI CONTRA

SBI Contra is a diversified fund which invests in stocks of growth oriented sectors i.e. investing in undervalued shares which may be presently out of favor but are likely to show constructive growth in the long run. Contra Fund track with **BSE100.** Fig **4.2.a** shows the comparison of manually calculated back-ward looking tracking error with the TE extracted from Bloomberg and Crisil. The predicted TE of CONTRA fund varies slightly from August to October between calculated and Bloomberg. But for the overall time period, it doesn't differ much between the three calculators. In the fig **4.2.b** depicts the gap between *ex-ante* tracking error of BarraOne and Bloomberg is noteworthy. And also, *ex-ante* TE of Bloomberg is close to the *ex-post* TE (Crisil& Bloomberg) up to August and then BarraOne *ex-ante* TE starts nearing the *ex-post* TE's gradually till the end of time period.

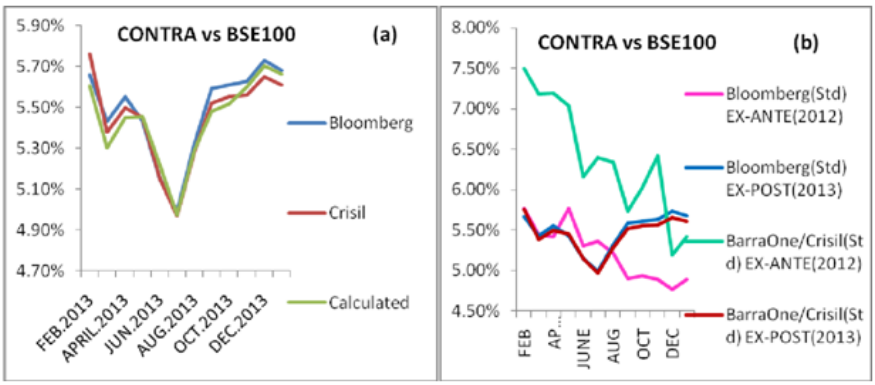
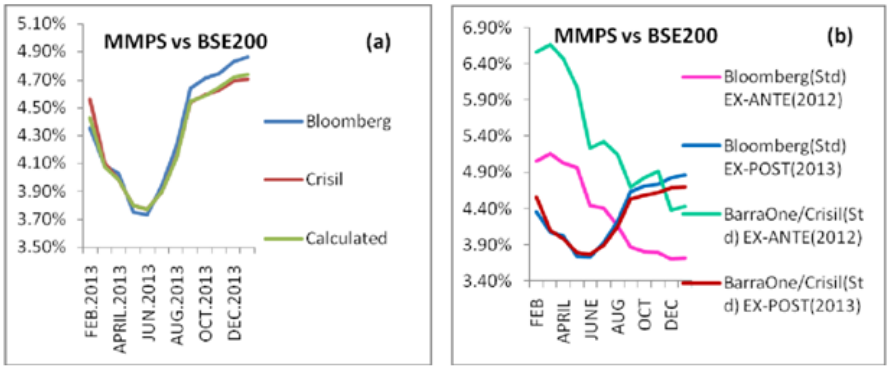


Fig 4.2 depicts the tracking error between Contra Fund and BSE100

4.3 Magnum Multiplier Plus Fund (MMPS):

This fund invests in equities along with debt and money market instruments. Its objective is to provide investors long term capital appreciation or dividends. MMPS benchmark is **BSE200**.



The Fig. 4.3 shows tracking error comparison between Magnum fund and BSE 200

In the fig 4.3.a clearly shows calculated ex-post tracking error overlaps Crisil's ex-post tracking error. But for overall period the tracking error doesn't differ more. Fig 4.3.b describes the ex-post and ex-ante tracking errors of different data packages. Bloomberg ex-ante TE nears its ex-post TE up to August and at once changes its course after August. Whereas BarraOne ex-ante TE gradually nears Crisil ex-post TE even though it starts off with a considerable gap.

4.4 Conclusion

Bloomberg and BarraOne use similar multi factor/asset class models but the output differs significantly due to the unexplainable reasons. We can make guess that each model considers different factors and weight. Most of the funds (MEF, CONTRA, MMPS); calculated ex-post tracking is close to Crisil ex-post tracking error, even though the collected data is from Bloomberg. In any case, ex-post tracking error has little predictive power and can deceive risk perspective of investors. Another point to be observed in funds is that ex-ante TE and ex-post TE of Bloomberg start off nearing each other and after a point (usually August) drift apart leaving a huge gap between them.

Whereas BarraOne ex-ante TE and Crisil ex-post TE start off with a gap and then near each other by the end of the period.

The reasons for the above observations cannot be explained further without any additional information from the two packages.

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