

Understanding Tracking Error



Quantitative Research
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Indexation: Defining and Dissecting “Tracking Error”

Introduction

The new millennium may not have ushered in many Y2K viruses but in the world of Fund Managers and Asset Consultants, the use of tracking error analysis has become far more pervasive over the past year and a half. This research report addresses the definition, application and sources of tracking error (TE) as well as provides a practical breakdown of factors contributing to TE costs.

Definition

Standard Deviation measures the spread of values around a mean value. Tracking error is defined as the standard deviation of the difference in returns between a tracker fund and the relevant benchmark index, measured over a certain period of time. What one must understand is that this is a statistical measure which carries probabilistic information. By this we mean that TE describes the distribution characteristics of the return differences, as apposed to an absolute measurement of return differences.

Standard Deviation is not an absolute measure

It is because of this “probabilistic” nature of the TE measurement that it can be used to predict future expected return differences. This measurement utilises one standard deviation which implies that 67% of the time, the fund’s return difference, relative to it’s benchmark, will fall within the TE. (Please note that no differentiation is made between whether this difference will be from out performance or under performance)

TE utilises one Standard Deviation

The above definition is the most widely used, however on occasion, TE has been alternatively defined as the cumulative difference in returns between the fund and it’s benchmark. This is an incorrect measurement as it is based purely on historical returns and cannot be used to predict future TE. This measurement will also appear to be far greater as the compounding effect will accentuate the difference, especially over long periods.

Using cumulative difference in returns is an incorrect measure

Standard Deviation Interpretation Problem

The accuracy of the standard deviation calculation increases as the number of return difference data points increases. Most calculations will incorporate 36 monthly, rolling data points, all of which are equally weighted. Therefore, an unusually large, once-off return difference will skew the standard deviation. For example, a tracker fund holding a small percentage of cash during a market correction may cause a once-off, return difference ‘spike’. This would detrimentally impact the TE and would remain in the rolling calculation for 36 months. Global research is currently being done to determine the appropriate weighting to be given to this type of event.

Large, once-off return differences will skew the S.D.

Application

TE is used to describe the “tightness” of historical tracker portfolio performances around the actual benchmark index returns. This gives an indication of the ‘volatility’ of the tracker fund’s returns relative to the benchmark.

TE derived from a multi-factor model is more accurate

As previously discussed, TE is ‘probabilistic’ in nature and is therefore a relatively sound predictor of a fund’s future return differences. However, a TE derived from a multi-factor model (e.g. Barra) has even better predictive capabilities. A multi-factor model is essentially a simulation tool that predicts portfolio behaviour based on how stocks have moved historically, relative to one another (co-variance). Barra’s ‘black-box’ consists of a very sophisticated co-variance matrix that has been proven over time to be an accurate predictor of a fund’s future TE

Sources of Tracking Error

The sources or components of TE are decomposed and classified into two main categories:

- **Non-controllable TE**
 - The fund manager has no control over this component of the TE. These slippage costs are relatively certain and are well defined
- **Partially controllable TE**
 - To some extent the fund manager does have control over this component. However the eventual costs are uncertain and are generally not well defined

TE Source	Non controlled TE	Partially Controlled TE
Fees Management fees Custodian fees	Fees charged	None
Cash Movements Deposits, withdrawals and cash dividends will require shares to be bought and sold to re-balance a fund’s exposure	Transaction Costs: •Brokerage •MST	Impact costs from: •Market timing •Agency vs portfolio trade decision •VWAP vs Closing price decision •Broker monitoring •etc
Benchmark Index Changes Constituent exclusions or inclusions Corporate actions can also lead to changes in the relative weighting of index constituents	Transaction Costs	Impact costs from: •Market timing •Tranche policy (eg. 1/3 before inclusion, 1/3 on the day and 1/3 after inclusion)

TE Source	Non controlled TE	Partially Controlled TE
Performance Calculations Return calculations generally assume a simplistic approach to dividends and other cash movements (timing). For example, 'Money Weighted Return' vs 'Time Weighted Return'	Prescribed Calculation method	Preferred Calculation Method
Rebalancing Fund After optimisation Non-replicating tracker funds imply periodic re-balancing actions, according to a specific optimising algorithm	None	Transaction costs from: •Basket trade (lower TE, higher trading costs) •Fewer individual trades (higher TE, lower trading costs)

Basis For Tracking Error Guarantees

TE will ensure diligent attention from Fund Managers

A TE guarantee serves the purpose of insuring a minimum deviation of investment returns from a specified benchmark index, thus ensuring diligent attention from the Fund Manager. The TE guarantee could be addressed as follows:

- Exclude the “non-controllable TE” component (slippage costs) from the TE guarantee, **OR**
- Make a pre-determined provision for the “non-controllable TE” by increasing the total TE guarantee

Numeric decomposition of TE

Replicated vs Optimised Portfolios

The following breakdown is an estimation that has been derived from the practical management of tracker funds. To ensure that the estimates are realistic, a scenario analysis approach has been used. Please note that one must always distinguish between Replicated Portfolios (fund is identical to benchmark) and Optimised Portfolios (fund consists of less counters than benchmark).

Optimised Tracker Portfolio

	Good TE	Normal TE	Bad TE
Non-controlled TE	0.14%	0.31%	0.44%
Partially controlled TE	0.78%	1.11%	1.70%
TOTAL	0.93%	1.42%	2.14%

Replicated Tracker Portfolio

	Good TE	Normal TE	Bad TE
Non-controlled TE	0.15%	0.28%	0.42%
Partially controlled TE	0.04%	0.14%	0.42%
TOTAL	0.18%	0.42%	0.84%

Factors that impact TE

Different factors will have a high, normal or low impact upon TE

This section is an attempt to give the reader a far more practical understanding of when different factors (measured as a % of total fund) will have a low, normal or high impact upon a fund's TE. For example, if the total 'cash inflows' (1st factor in table below), were approximately 10% of the total portfolio, over a one year period, then the impact upon TE would be low. This would be as a result of low re-balancing costs. However, as cash inflows increase, so does the impact upon TE.

As with the previous section, these percentages have been based upon actual portfolios, however, it must be stated that they are merely estimates.

Factors	Low TE Impact	Normal TE Impact	High TE Impact
Cash Inflows	10%	25%	30%
Cash Outflows	10%	15%	30%
Index Inclusions	6%	10%	16%
Index Exclusions	5%	8%	13%
Corporate Actions	5%	10%	15%
Optomisation Turnover	5%	15%	20%
Dividend Yield	2%	2.75%	4%
Brokerage Costs	0.12%	0.15%	0.17%
Market Timing Costs	0.20%	0.30%	0.50%
Performance Calculations *	0.05%	0.07%	0.09%

* Performance calculation differences incurred due to dividend yield mismatches

Conclusion

TE is only an effective 'policing' tool, if it is properly understood

The future reliance placed upon TE by Fund Managers and Asset Consultants is predicted to increase. Over the next 5 to 10 years, the asset management industry will probably undergo a number of structural changes. These changes include:

- Allocation of specialised mandates, with clearly defined benchmarks
- Core/Satellite approach, where active and passive mandates will co-exist
- Revised Regulation 28-draft:
“Trustees will be required to adopt an investment strategy specific to the fund. Trustees must seek professional advice.”

Source: Institute of Retirement Funds (Jan 2001)

All of the above changes will require more “policing” of Fund Managers by Trustees, Asset Consultants and Multi-Managers. TE is an effective “policing” measure, however, an understanding of this ‘tool’ is imperative, if it is to be truly effective.

References

- Barra International
- Deutsche Securities
- OMAM Quant Team