



The curvature of the tracking frontier: A new criterion for the partial index tracking problem

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ABSTRACT

Index tracking aims to select portfolios that imitate the behavior of a stock index. A tracking strategy is referred to as partial when the tracking portfolio is solely formed by a subset of stocks, so enabling a substantial cost reduction in comparison with full tracking. Three criteria are usually employed in the literature when building the tracking portfolio: tracking error variance, excess return and tracking portfolio variance.

This paper considers a new parameter for use with the above: frontier curvature. This criterion is not defined for a particular portfolio, but for all the portfolios that define the tracking frontier. The main implication is that a manager can satisfy different investment profiles with the same subset of stocks. The manager will therefore reduce transaction costs as all the portfolios on the frontier contain the same stocks.

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1. Introduction

The large number of academic papers published indicates that the analysis of the efficiency of investment funds remains a major area of research in the field of portfolio theory. The valuation of funds is still subject to analysis and comparison because of their crucial role in financial markets [1].

The questionable success of many actively managed investment funds in outperforming the benchmark explains that index tracking is currently among the most popular techniques used by investment fund managers [2].

All the papers which explore the possibilities of index tracking are characterized by the search for a single portfolio, characterized by a maximum of three possible parameters [3–5]: tracking error variance (TEV), excess returns and volatility of returns. The stocks in the tracking portfolio are identified during this process and the given weighting complies with the constraints imposed on those parameters.

This paper proposes the addition of a new parameter: the curvature of the frontier. This criterion is not defined for a given portfolio, but for the set of portfolios that define the tracking frontier. The main advantage is that a fund manager can satisfy different investment profiles using the same subset of stocks—with all the portfolios on the frontier containing the same stocks, thus reducing transaction costs.

Generally, the removal of one or more stocks from the tracking means a greater TEV without necessarily reducing the efficiency of the portfolio. In the example in Fig. 1, the TEV_{-i} frontier and the TEV_{-j} frontier partially improve the efficiency of the original TEV in the mean–variance sense. Specifically, both frontiers generate better risk–returns in portfolios nearer to the R_b index (the return of the index) than the TEV frontier in the full tracking. If the TEV_{-i} and TEV_{-j} frontiers are compared then different results will again be reached according to the considered return. However, it must always be remembered that Fig. 1 only reflects risk and return, and not TEV.

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