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Performance of risk-based portfolios under different market conditions: Evidence from India

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ABSTRACT

This study evaluates the performance of risk-based portfolios under different market conditions. We compare four strategies, namely, the equally weighted portfolio (EW), the global minimum variance portfolio (GMV), the most diversified portfolio (MDP) and the equal risk contribution portfolio (ERC). No single strategy consistently dominates the others, under different market conditions. As expected, the GMV has the least downside risk. Although there is no clear winner among the risk-based portfolios, there is evidence that they generally outperform the market capitalization based portfolio.

1. Introduction

Mean-Variance Optimization (MVO) is probably the most widely practiced approach for portfolio design. However, the ex ante implementation of MVO is fraught with problems. Jobson and Korkie

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(1989) found that the unconstrained MVO has no practical investment value, and may indeed be dominated by the equally weighted portfolio. More recently, DeMiguel et al. (2009) tested the performance of 14 different models, based on mean-variance efficiency. They found that none of them provide reliable improvements over an equally weighted portfolio. Best and Grauer (1991) found that the MVO was highly sensitive to small changes in inputs, and leads to very different portfolio compositions, even for small changes in the input parameters. Michaud (1989) observed that the MVO is likely to give more importance to the parameters with large estimation errors. It is overweight (underweight) on the assets with large positive (negative) errors in the expected return, and large negative (positive) errors in the expected variance and covariance. As a result, the mean-variance optimal portfolio is often highly inefficient in terms of ex post performance. This fact is reported by numerous studies (see, for example, Cochrane, 2005; Grinold, 1992; Haugen and Baker, 1991; Markowitz, 2005; Sharpe, 1991).

The primary problem in implementing the MVO is the difficulty in forecasting asset returns. Black (1993) demonstrated that a long history of returns is required to make a statistically accurate forecast for the expected returns. However, using such data is hard to justify, since the underlying price process does not remain stationary over long periods. The difficulty in implementing the MVO inspired a new approach, called the risk-based investing. The risk-based strategies do not require the forecasts of expected returns, and are solely based on the expected risk (Maillard et al., 2010). Covariance and variance, the most frequently used measures of risk, can be predicted with far greater precision than the expected returns, with historical data (Merton, 1980). Consequently, the risk-based strategies are claimed to be more robust to estimation errors (Chaves et al., 2011).

We examine the four major classes of risk-based portfolios, namely, the equally weighted portfolio (EW), the global minimum variance portfolio (GMV), the most diversified portfolio (MDP) and the equal risk contribution portfolio (ERC). The EW distributes the investment equally across all the assets in the investment universe. It does not require the forecasts of either the expected returns or the covariance matrix of asset returns. This strategy appears quite naive, but DeMiguel et al. (2009) showed that the MVO based portfolios are unable to outperform the EW consistently. The GMV attempts to minimize the expected portfolio variance. It holds a special position in our investigations, as it is a mean-variance efficient portfolio, yet it does not rely on the return expectations. The GMV strategy is widely used in the investment literature (see, for example, Arnold et al., 2004; Brière and Signori, 2013; Vortelinos, 2013) as well as by the practitioners in the asset management industry (Scherer, 2011). The ERC approach equalizes the risk contributions of all the portfolio constituents. The risk contribution of a portfolio constituent is the share of the total portfolio risk attributable to that constituent. Maillard et al. (2010) derived the properties of ERC, and demonstrated that it provides a tradeoff between EW and GMV, in terms of portfolio risk and asset concentration. Choueifaty and Coignard (2008) proposed the MDP, which identifies the asset weights that maximize the diversification gains for a portfolio.

The risk-based strategies lack an axiomatic foundation to justify their superiority over the traditional mean-variance efficient portfolios. All that the risk-based portfolios attempt to do is to improve upon the portfolio diversification in some manner. But, there is no universally accepted definition of diversification, and hence, no theory for the economic gains that may be solely attributable to a superior diversification (Meucci, 2009). For a strategy that is agnostic to return expectations, and does not have a clearly defined economic objective that it attempts to maximize, it is difficult to form an expectation about its performance, in terms of risk-adjusted returns (Lee, 2011). Nonetheless, the risk-based investing is popular owing to the low risk tolerance of investors, and the intuitive appeal of diversified asset exposures. There is considerable empirical evidence that the risk-based portfolios outperform the MVO based approaches (Behr et al., 2008; Choueifaty and Coignard, 2008; Clarke et al., 2006; DeMiguel et al., 2009; Martellini, 2008).

Maillard et al. (2010) demonstrate that each risk-based strategy is optimal under a distinct set of assumptions, in the mean-variance sense. Intuitively, different market conditions may favor different set of assumptions. This study examines the performance of various risk-based portfolios under different market conditions: the down-trending market, the mean-reverting market and the up-trending market. We employ a number of performance and downside risk measures to study the distributional characteristics of portfolio returns from these strategies. The study builds on the existing literature in a number of ways. First, it attempts to identify the strategy that is likely to