

The Properties of Risk-based Approaches to Asset Allocation Using Combined Metrics of Portfolio Volatility and Kurtosis: Theoretical and Empirical Analysis

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Abstract : Risk-based approaches to asset allocation are portfolio construction methods that do not rely on the input of expected returns for the asset classes in the investment universe and only use risk information. They include the Minimum Variance Strategy (MV strategy), the traditional (volatility-based) Risk Parity Strategy (SRP strategy), the Most Diversified Portfolio Strategy (MDP strategy) and, for many, the Equally Weighted Strategy (EW strategy). All the mentioned approaches were based on portfolio volatility as a reference risk measure but in 2023, the Kurtosis-based Risk Parity strategy (KRP strategy) and the Minimum Kurtosis strategy (MK strategy) were introduced. Understandably, they used the fourth root of the portfolio-fourth moment as a proxy for portfolio kurtosis to work with a homogeneous function of degree one. This paper contributes mainly theoretically and methodologically to the framework of risk-based asset allocation approaches with two steps forward. First, a new and more flexible objective function considering a linear combination (with positive coefficients that sum to one) of portfolio volatility and portfolio kurtosis is used to alternatively serve a risk minimization goal or a homogeneous risk distribution goal. Hence, the new basic idea consists in extending the achievement of typical risk-based approaches' goals to a combined risk measure. To give the rationale behind operating with such a risk measure, it is worth remembering that volatility and kurtosis are expressions of uncertainty, to be read as dispersion of returns around the mean and that both preserve adherence to a symmetric framework and consideration for the entire returns distribution as well, but also that they differ from each other in that the former captures the "normal" / "ordinary" dispersion of returns, while the latter is able to catch the huge dispersion. Therefore, the combined risk metric that uses two individual metrics focused on the same phenomena but differently sensitive to its intensity allows the asset manager to express, in the context of an objective function by varying the "relevance coefficient" associated with the individual metrics, alternatively, a wide set of plausible investment goals for the portfolio construction process while serving investors differently concerned with tail risk and traditional risk. Since this is the first study that also implements risk-based approaches using a combined risk measure, it becomes of fundamental importance to investigate the portfolio effects triggered by this innovation. The paper also offers a second contribution. Until the recent advent of the MK strategy and the KRP strategy, efforts to highlight interesting properties of risk-based approaches were inevitably directed towards the traditional MV strategy and SRP strategy. Previous literature established an increasing order in terms of portfolio volatility, starting from the MV strategy, through the SRP strategy, arriving at the EQ strategy and provided the mathematical proof for the "equalization effect" concerning marginal risks when the MV strategy is considered, and concerning risk contributions when the SRP strategy is considered. Regarding the validity of similar conclusions when referring to the MK strategy and KRP strategy, the development of a theoretical demonstration is still pending. This paper fills this gap.

Keywords : risk parity, portfolio kurtosis, risk diversification, asset allocation

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