## A new framework for portfolio management

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Stochastic portfolio theory provides a new mathematical framework for studying the behaviors of portfolios and the structure of equity markets. In contrast to the commonly adopted mean-variance framework which is essentially a dynamic optimization problem with significant estimation difficulty, stochastic portfolio theory focuses on empirically observable characteristics of equity markets such as the stability of capital distribution and the presence of sufficient volatility. Under mild conditions, explicit portfolios can be constructed which outperform a capitalization-weighted benchmark in the long run. Such portfolios are called *relative arbitrages* and we refer the reader to [1] and [2] for precise statements of these results.

In a recent paper [3], the authors develop a simple but novel *energy-entropy framework* which clarifies when and how rebalancing works and provides a consistent framework for attributing the performance of a hierarchical portfolio using information-theoretic concepts such as relative entropy and free energy. In [4] some central results in stochastic portfolio theory are given a geometric and intuitive interpretation.

Although there are several very good R packages for portfolio optimization and performance attribution, there is yet no R packages which implement these recent ideas in stochastic portfolio theory and related advances.

The author intends to fill the gap with a new *R* package to be called **RelValAnalysis** (relative value analysis). This package is designed to implement the aforementioned tools for analyzing the performance of portfolios relative to a capitalization-weighted benchmark. Among other things, the package will include classes and functions for measures of diversity of capital distribution, construction of functionally generated portfolios and the associated Fernholz decomposition, the energy-entropy decomposition and attribution, and simulation of common models in stochastic portfolio theory. The package should be of interest for students, researchers and practitioners. The talk will introduce the main functions of the package.

## References

- [1] Fernholz, E. R. (2002). Stochastic portfolio theory. Springer.
- [2] Karatzas, I. and R. Fernholz (2009). Stochastic portfolio theory: an overview. *Handbook of numerical analysis 15*, 89–167.
- [3] Pal, S. and T.-K. L. Wong (2013). Energy, entropy, and arbitrage. arXiv preprint arXiv:1308.5376.
- [4] Pal, S. and T.-K. L. Wong (2014). The geometry of relative arbitrage. arXiv preprint arXiv:1402.3720.