



Universidad Champagnat

Statiscal learning and portfolio optimizacion

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1 Introduction

2 Basic Concepts

2.1 Mixed Tempered Stable Paretian

The Mixed Tempered Stable Paretian was introduced by Rroji and Mercuri [3] in 2014. Is is a generalization of the Normal Variance Mean Mixtures. A ramdon variable variable V is Mixed Tempered Stable distributed if:

$$V = \mu_0 + \mu U + \sqrt{U}E \quad (1)$$

where:

- $\mu_0, \mu \in \mathbb{R}$
- V is a random variable defined in positive real number.???
- E is a classical Tempered Stable random variable.???

2.2 Risk Measure - ETL

Expected Tail Loss is defined as the average loss beyond VaR:

$$ETL_\varepsilon[V] = E[-V | -V > VaR_\varepsilon[V]] \quad (2)$$

ETL is also know as Expected Shortfall (ES) or Conditional Value-at-Risk (CVAR). Usually ε is equal to 0,01 or 0,05. ETL is a convex function weights and hence is usefull to optimize portfolios (see Rockafellar and Uryasev [4]).

2.3 Ratio - STARI

The Sharpe Ratio is the clasical portfolio performance measure, but it has a disadvantages. Martin, Svetlozar and Siboulet [2] described this disadvantages as follow:

- The standard deviation is a symmetric measure that not focus on downside risk.
- The standard deviation is not a coherent measure of risk (see Artzner [1]).‘
- The estimate of standard deviation is a highly unstable when the portfolio has a heavy-tailed distribution.

This authors propose the *Stable Tail Adjusted Return Indicator (STARI)* as an alternative performance measure that does not suffer these problems. The STARI is defined as:

$$STARI_{\epsilon} = \frac{E[\Delta X] - r_f}{ETL_{\epsilon}[V]} \quad (3)$$

Where:

- $E[\Delta X]$ is the expected return of portfolio.
- $ETL_{\epsilon}[V]$ is the Expected Tail Loss.
- r_f is the risk-free return

3 Portfolio Optimizacion

3.1 Portfolio without restriction???

3.2 Portfolio with restriction???

4 Conclusion

References

- [1] Artzner, P., Delbean, F., Eber, J. M. and Heath, D., *Coherent measures of risk*, Mathematical Finance 9, 203-228, 1999.
- [2] Martin R. Douglas, Svetlozar Rachev and Siboulet Frederic, *Phi-alpha Optimal Portfolios and Extreme Risk* , Wilmott magazine, November 2003.
- [3] Rroji, Edit and Mercuri, Lorenzo *Mixed Tempered Stable Distribution*, Article in Quantitative Finance, October 2014.
- [4] Rockafellar, R.T. and Uryasev, S., *Optimization of conditional value-at-risk*, Journal of Risk 3, 21-41,2000.
- [5] Hitaj, Asmerilda, Hubalek, Friedrich, Mercurim Lorenzo and Rroji, Edit *On Properties of the MixedTS Distribution and its Multivariate Extension*, Article in International Statistical Review, May 2018

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