

Resampled optimisation

[Nematrian website page: [ResampledOptimisation](#), © Nematrian 2015]

Resampled optimisation is explained further in e.g. [Kemp \(2010\)](#), [Michaud \(1998\)](#), [Scherer \(2002\)](#) and [Scherer \(2007\)](#). In its mean-variance form (and using the relevant tool available through the Nematrian website for carrying out resampled optimisation) it involves:

- (a) Simulating many different return histories (with number of observations = *NoReturns*) as if they were coming from a (multi-variate) normal distribution (with mean, standard deviations and correlation coefficients equal to the *ForecastReturns*, *ForecastRisks* and *ForecastCorrelations* respectively).
- (b) For each such simulation set, calculating their mean returns, standard deviations etc. and, in conjunction with constraints (specified in the same manner as Nematrian's traditional mean-variance, i.e. [constrained quadratic](#), portfolio optimisation engine), identifying portfolios that efficiently trade-off risk and return given these simulated input assumptions
- (c) Calculating the average of the portfolio mixes identified in (b) and calling this the *resampled efficient* portfolio.

It is ostensibly an extreme version of a 'frequentist' rather than a 'Bayesian' approach to portfolio construction, i.e. it ostensibly relies exclusively on the contents of the input dataset rather than imposing any additional 'prior' (i.e. subjective, analyst derived) views about the risks and returns available on different asset categories.

However, in practice:

- i. In the *absence* of constraints (other than that weights add to unity) resampled optimisation (suitably formulated) gives the same result as more conventional mean-variance, i.e. [constrained quadratic](#), portfolio optimisation.
- ii. In the *presence* of additional constraints, resampled optimisation gives similar results as a more conventional optimisation approach in which a non-zero penalty is applied to portfolios close to a constraint, the penalty becoming greater and greater (and reaching infinity) at the point in which the constraint bites.

The net effect is to smooth out constraints. Depending on your point of view this may be considered desirable or of limited practical benefit.

[Kemp \(2010\)](#) describes one portfolio optimiser selection exercise in which the managers felt it appropriate to favour greater smoothness in response to small changes in the input assumptions, which resampled optimisation could achieve. Commonly in practice, traditional investment managers also operate under a no short-selling constraint. Resampled optimisation would tend to result in a greater number of modest positive positions being held than more traditional constrained mean-variance optimisation, which might also be considered desirable on an intrinsic diversification arguments.

Conversely, the way in which this smoothing and added diversification is achieved is arguably largely an accidental outcome of the methodology. If this sort of behaviour really was important for the optimiser to exhibit then it could perhaps be achieved more succinctly and in a more controlled

fashion by imposing a more explicit penalty function on portfolios close to the relevant constraints. Resampled optimisation is also quite time consuming, involving relatively large numbers of simulations, each one of which involves a separate portfolio optimisation exercise in its own right. Being a simulation (i.e. Monte Carlo) based methodology it also does not provide reproducible answers unless it is seeded with the same random numbers each time.

Tools that the Nematrian website provides allowing users to carry out resampled optimisation exercises are set out in [Resampled Optimisation Tools](#).

References

[Kemp, M.H.D. \(2010\)](#). *Extreme Events. Robust Portfolio Construction in the Presence of Fat Tails*. John Wiley & Sons

[Michaud, R. \(1998\)](#). *Efficient Asset Management: A Practical Guide to Stock Portfolio Optimization and Asset Allocation*. Oxford University Press.

[Scherer, B. \(2002\)](#). Portfolio Resampling: Review and Critique. *Financial Analysts Journal*, November/December 2002, 98-109

[Scherer, B. \(2007\)](#). *Portfolio Construction and Risk Budgeting*. 3rd ed. RiskBooks

Tools for carrying out resampled optimisation

[\[ResampledOptimisationTools\]](#)

The Nematrian website provides a tool to allow users to carry out resampled optimisation exercises, i.e. [MnResampledPortfolioOptimiser](#). This function provides an answer conceptually similar in format to the provided by the standard Nematrian [constrained quadratic portfolio optimiser](#), except that it can also include a range of percentile points for the distribution whose average defines the resampled optimum portfolio.