Investor Solutions

Building a robust strategic asset allocations process

FOR PROFESSIONAL CLIENTS AND, IN SWITZERLAND, FOR QUALIFIED INVESTORS ONLY

The key to rapid delivery of a portfolio solution that can consistently fulfill numerous competing objectives while maintaining superiority are flexible tools and the ability to adapt. Here, *Keith R. Collier, CFA, Head of Asset Allocation Research*, **explains how the BNY Mellon Investor Solutions team went about creating a robust strategic asset allocations (SAA) design process that can stand the test of time.**

Several years ago, when the nucleus of the BNY Mellon Investment Solutions team functioned more as a think tank, strategic asset allocation (SAA) design was an important but infrequent exercise. The process was collaborative and "artisanal". Experience and an inherent knowledge of asset class behavior and interaction served as robust, but approximate, guiding principles.

Today, that approach has evolved. As the team's mission has moved into directly managing client assets, SAA design has become a far more frequent exercise, and greater emphasis has been placed on improving the technical precision of SAA recommendations.

Then and now

To meet this challenge, the team's initial approach was to produce a few dozen or a few hundred portfolio options, each with a normal distribution of allocation weights around intuitively-driven target allocations. The obvious problem was that the method didn't fully explore the space of feasible solutions that might be out there. Further, the possibility of bespoke portfolio constraints was non-existent.

To address the incomplete coverage of the normally distributed portfolio sets, we developed a methodology for generating random portfolios uniformly throughout a range of allocations. This capability, however, required large pools of portfolios (50,000+) to effectively cover the expanded range of possible solutions. If simple constraints were required, we simply screened out the unfeasible portfolios. The random portfolios were generated in code, but then imported into Excel to compute and evaluate portfolio statistics. Because of the large candidate pool, it took nearly eight hours to compute portfolio statistics in Excel with point forecast Capital Market Assumptions (CMAs).

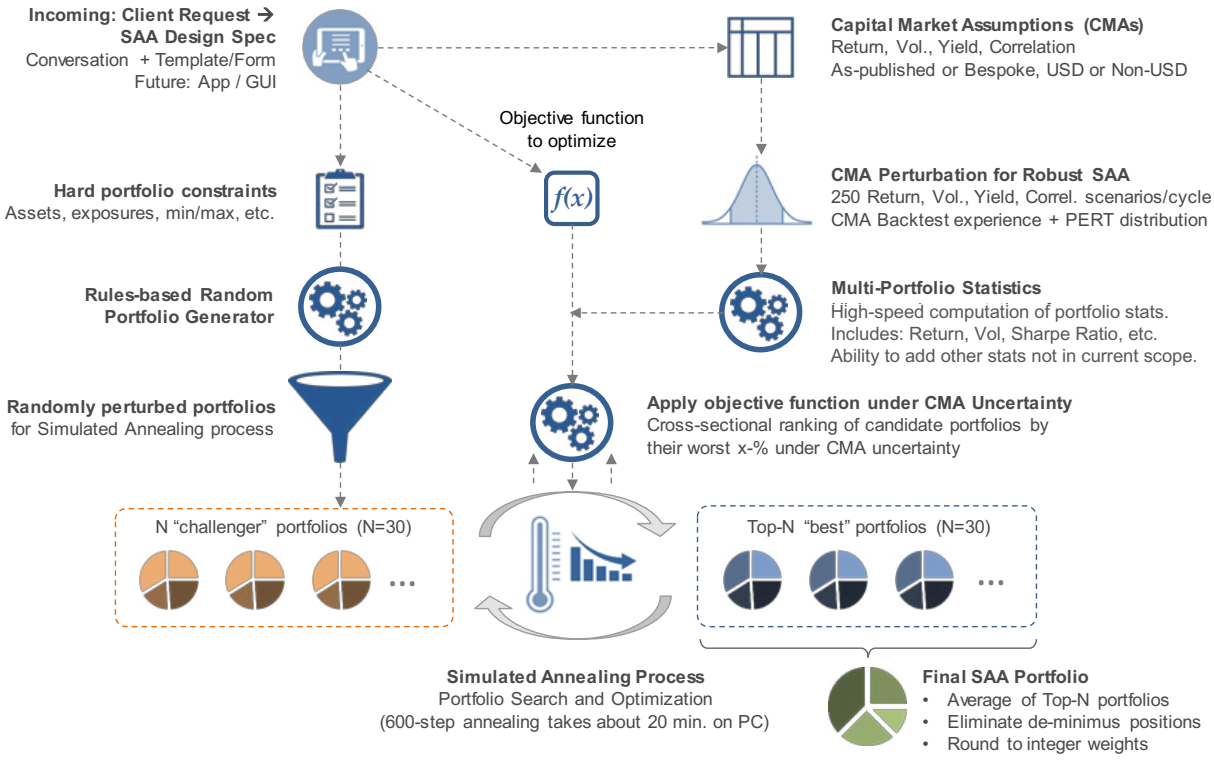
After a few months of straining against the overnight Excel computations, the entire process (portfolio generation and evaluation) was moved to code in R (widely used among statisticians and data miners for developing statistical software and data analysis). Doing this reduced eight hours to 30 minutes, and later to 30 seconds with matrix math (eliminating for loops). These were phenomenal speed gains but an old practice became the new bottleneck. The statistics ran quick, but our team was still in a room poring through candidate portfolios by hand and debating trade-offs. We needed to systematize balancing multiple objectives and trade-offs without bias or oversight. At the same time, there was a call for "robust" portfolios. In other words, how do we know that our SAA design would be both stable (if the CMAs changed, as they do a little each year), and still near optimal (if actual market experience differs markedly from CMA forecasts)? These two requirements: systematized solution selection and robust design, motivated a landmark change in our SAA design process.

A two-pronged approach

Our solution was a two-pronged approach: Generate stats as a "cloud" around central tendency (point CMA forecast) and map a representation of each portfolio's performance characteristics (to optimize on) as a point in a multi-dimensional space. It's an elegant and theoretically sound approach. Of course, the new problem was that all of the portfolios now required 250x the number of calculations.

For a few months, we accepted the computational demand as the price of robustness. Then one night, while staring at the pool of thousands of portfolios in a cube, the solution became apparent. Robust portfolio stats under 250 CMA scenarios increased the computation burden by 250x, yet only a fraction of those are relevant or exhibit sufficient performance characteristics to be incorporated into an allocation recommendation. A faster and more efficient search process could generate smaller pools of candidate portfolios "on-demand" in regions where superior solutions were starting to emerge, adjusting dynamically to the findings. This led to the application of the Simulated Annealing technique, and represents our current state of the art in multi-objective SAA design. [1]

Overview flowchart of the SAA design process



[1] The core of our process is based on an efficient search technique from the world of machine learning, known as simulated annealing. As the name implies, the algorithm is inspired by the field of metallurgy and the strengthening process that occurs in metals as they are systematically cooled from the furnace. In a similar way, the simulated annealing process allows our portfolio design algorithm to systematically explore a wide range of possibilities and "harden" the ultimate result into a robust portfolio allocation.

Conclusion

Financial market performance contains a high degree of noise, making forecasting inherently error-prone. These errors become even more protracted as forecast horizons extend. Regardless of forecast horizon, the reality that forecast error exists – for any horizon – means that an optimal solution is potentially a quite risky one, as it requires certainty to identify and exploit the differences and interactions in utility between available investments. Thus, when designing a policy portfolio to weather the highs and lows of the next market cycle, we choose to create a "robust" portfolio, rather than an "optimal" one. In other words, we seek to create a portfolio which delivers the highest utility (vs. all other possibility) under the most adverse conditions for that portfolio. Said another way, the robust portfolio has less downside uncertainty than the non-robust portfolio.

In summary, our approach is built around three key concepts:

- Embracing and solving for forecast uncertainty
- Incorporating necessary ad hoc portfolio constraints
- Applying a purpose-built, multi-objective portfolio search methodology

The value to the client is in the rapid delivery of a portfolio solution that can consistently fulfill numerous competing objectives while maintaining superiority to a vast number of alternative portfolio allocations despite uncertainty in whatever the markets may bring.

The value of investments can fall. Investors may not get back the amount invested.

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