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Optimizing Large Financial Portfolios

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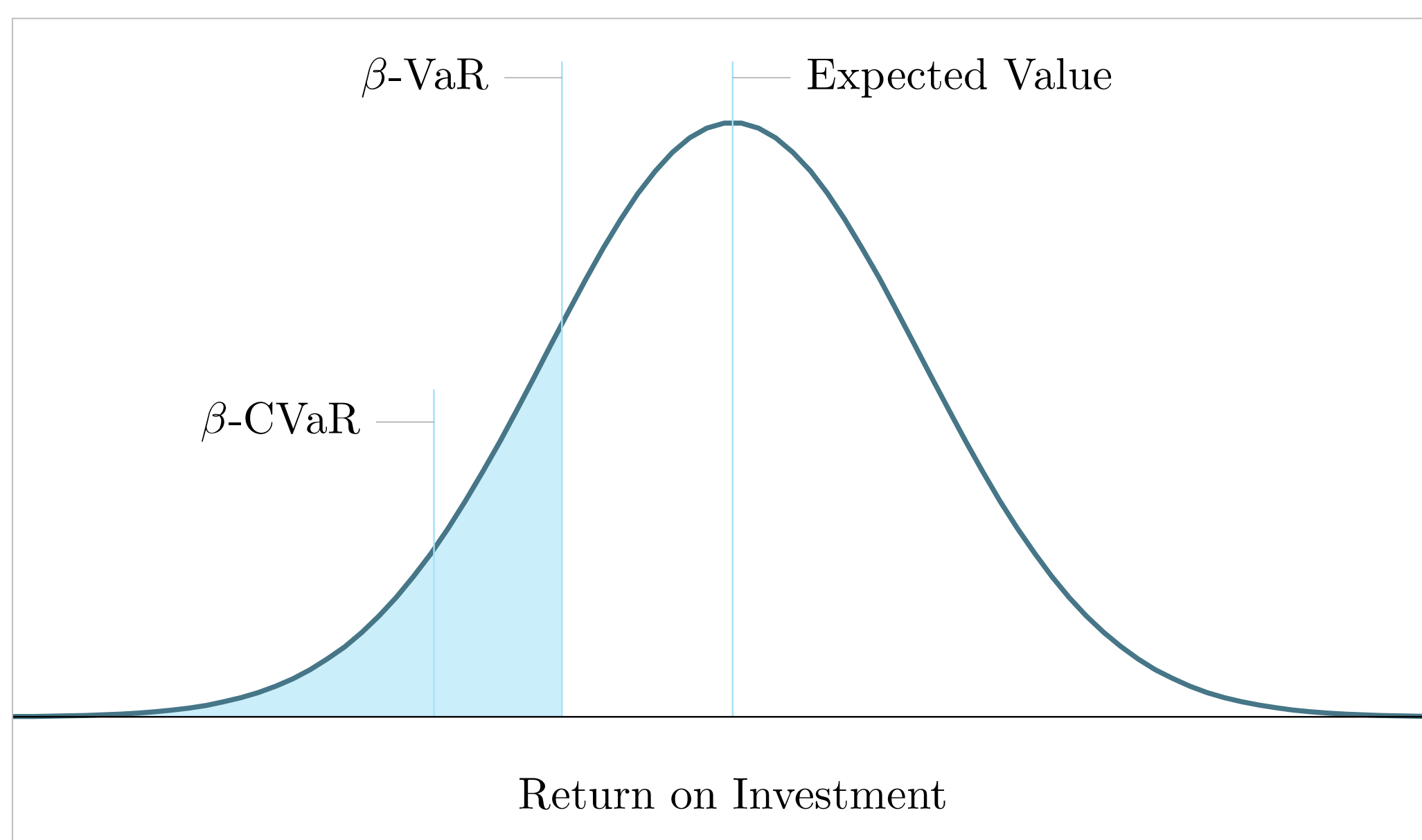
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Background

- The Office of the Chief of Naval Operations (OPNAV) N80E is responsible for providing fiscal analysis to support budget decisions and the defense of the Program Objective Memorandum.
- Many sources of uncertainty are present; e.g., in costs, scheduling, and performance of procured systems.
- This project is part of ongoing efforts to explicitly account for the risks associated with these uncertainties in fiscal analysis.



OPNAV N80E is looking into ways to better incorporate uncertainty into its fiscal analyses.



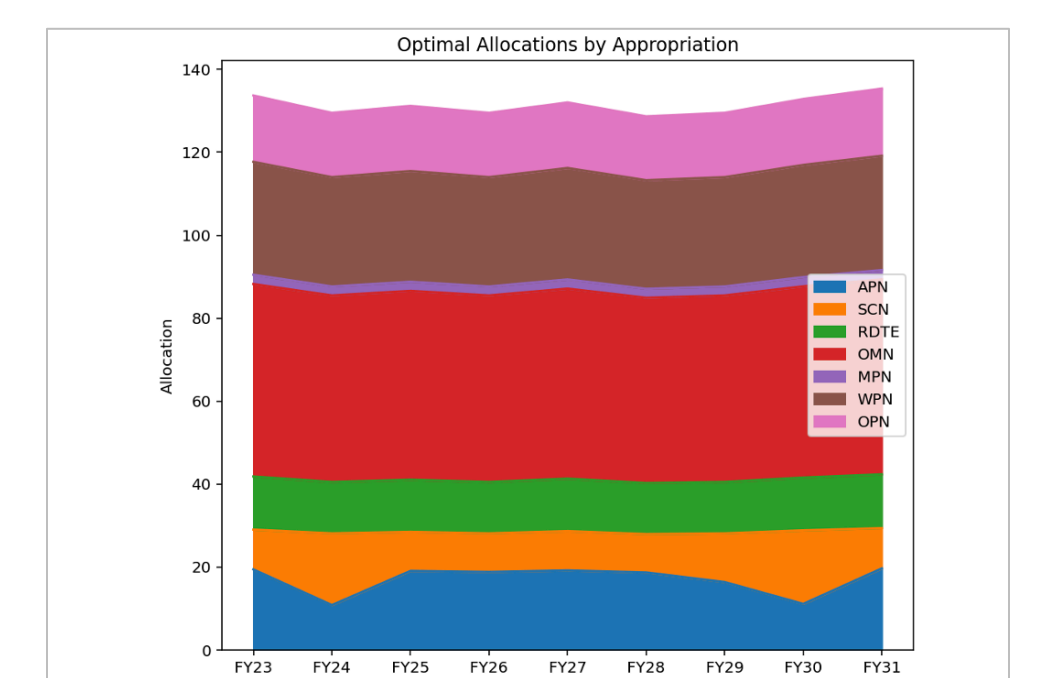
The CVaR objective penalizes portfolios with highly variable return on investment, depending on the parameter β .

Accounting for Risk

- Our focus is on decision problems that involve allocating investments to several different projects (i.e., portfolio optimization problems).
- If two portfolios have the same average return-on-investment, but the first has more variability in its return, then the second should be preferred.
- One way to account for variability, which has received much private-sector attention and has attractive computational properties, is to minimize the conditional value-at-risk (CVaR) of the portfolio.

Optimization Model

- We formulated and implemented a CVaR optimization model in the context of appropriation-level portfolio optimization.
- The model captures salient features of this context, including allowing the benefits of a given allocation in a particular fiscal year to be spread out over time, and constraints on the chance with which the total ownership cost will be within the total obligation authority in each fiscal year.
- We implemented the formulation in Pyomo, and created an accompanying dashboard for visualizing the recommended allocations and performing interactive model excursions.



The dashboard visualizes the recommended allocations.

Conclusions and Recommendations

- We provide a proof-of-concept for the use of CVaR optimization for appropriation-level portfolio optimization.
- Future research directions include studying how returns on investment should be quantified in the context of defense budgeting, and clarifying the kinds of behaviors that the portfolio optimization model incentivizes.



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