

An Optimization Model For Scheduling Distributions From Tax-Deferred Retirement Accounts

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Why am I here?

- What I'm not
- What I am
- My objective today
 - To encourage you to think about building a holistic model for the optimal retirement withdrawal problem.

What we did...

MAX: NPV of income + NPV of balances at death

Subject to:

Annual income requirements met

The (federal) tax law

Ignored state taxes,
portfolio “balance” issues,
& numerous uncertainties.

(Ragsdale, Seila, Little, *Financial Services Review*, Vol 3, No 2, 1994.)

What we showed...

- Withdrawal heuristics applied to “simple” problems can be very sub-optimal.
 - Minimal heuristic: \$2.5 Million NPV
 - Proportional heuristic: \$3.1 Million NPV
 - Optimal solution: \$3.5 Million NPV
- Conjecture: Withdrawal heuristics applied to more complex problems can be very, **very** sub-optimal.

Why build a model?

- The problem is hard (that's why we are here)
 - The number of issues is overwhelming
 - Beneficiaries & RMDs
 - Life expectancies
 - Uncertainties in returns
 - etc, etc
 - Decisions have cascading effects
 - Impact of current year's withdrawal on future RMDs (and tax brackets)

Benefits of a model...

- A model
 - Considers all the issues simultaneously
 - Can answer “What-ifs?” accurately & quickly
 - Responds to changes “easily”
 - Can disseminate best practices
 - Doesn’t care what state you are in

What about uncertainty?

- Question: What happens if the data is inaccurate by 0.1%? (See: Ben-Tal & Nemirovski, 2000 “Robust solutions of Linear Programming problems contaminated with uncertain data,” *Mathematical Programming* , V. 88 (2000), 411-424.)
- Worst Case: ‘Optimal’ Solution Violates Constraints by 450% of RHS Value
- Conclusion: “In real-world applications of linear programming, one cannot ignore the possibility that a small uncertainty in the data can make the usual optimal solution completely meaningless from practical viewpoint.”

Markowitz Portfolio Optimization

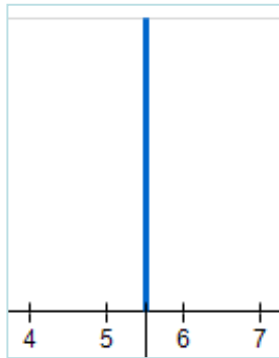
“...optimized portfolios are ‘error maximized’ and often have little, if any, investment value.”

Michaud, R. (1998). *Efficient Asset Management*. Harvard Business School Press.

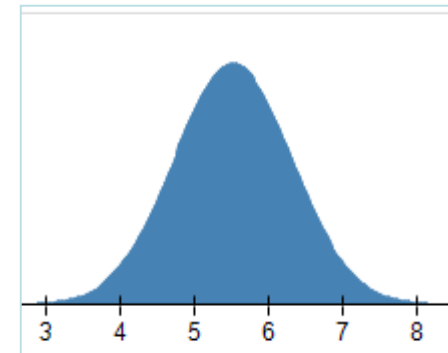
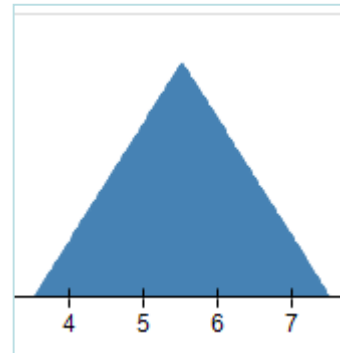
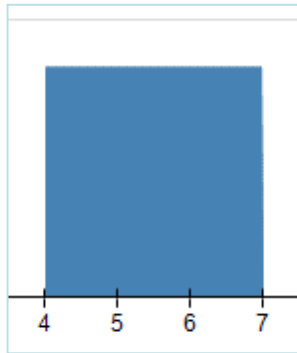
“M-V optimization’s sensitivity to uncertainty in risk return estimates typically results in an unstable asset management framework ... Tests demonstrate that M-V optimized portfolios are dominated by equal weighting and have essentially no practical investment value.”

Michaud & Michaud (2008). “Estimation Error and Portfolio Optimization: A Resampling Solution,” *Journal of Investment Management*. Vol 6, No 1, pp.8-28.

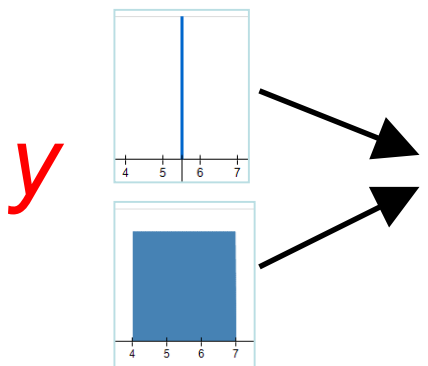
Certain and Uncertain Parameters



Certain
Parameter:
Single Value 5.5



Uncertain Parameters: Probability Distribution
Many Possible Values



$$g(x, y) \leq b$$

Optimizer presses $g()$ as far as possible towards b , taking advantage of y

Dealing with uncertainty...

Retirement Planning Issue		
	Deposits	Withdrawals
Old way (Ignore it)	Deterministic calculation	Heuristics LP / IP
“New” way (Model it)	Monte Carlo Simulation	<i>Robust Optimization Stochastic Programming</i>

Summary

- Building a model involves identifying
 - The objective(s)
 - The decisions (variables)
 - The constraints
 - **AND** the uncertainties
- It is now possible to optimize this type of problem

Questions?