

SCALING RISK-TAKING WITH PLANNED SURPLUS AND TIME HORIZON

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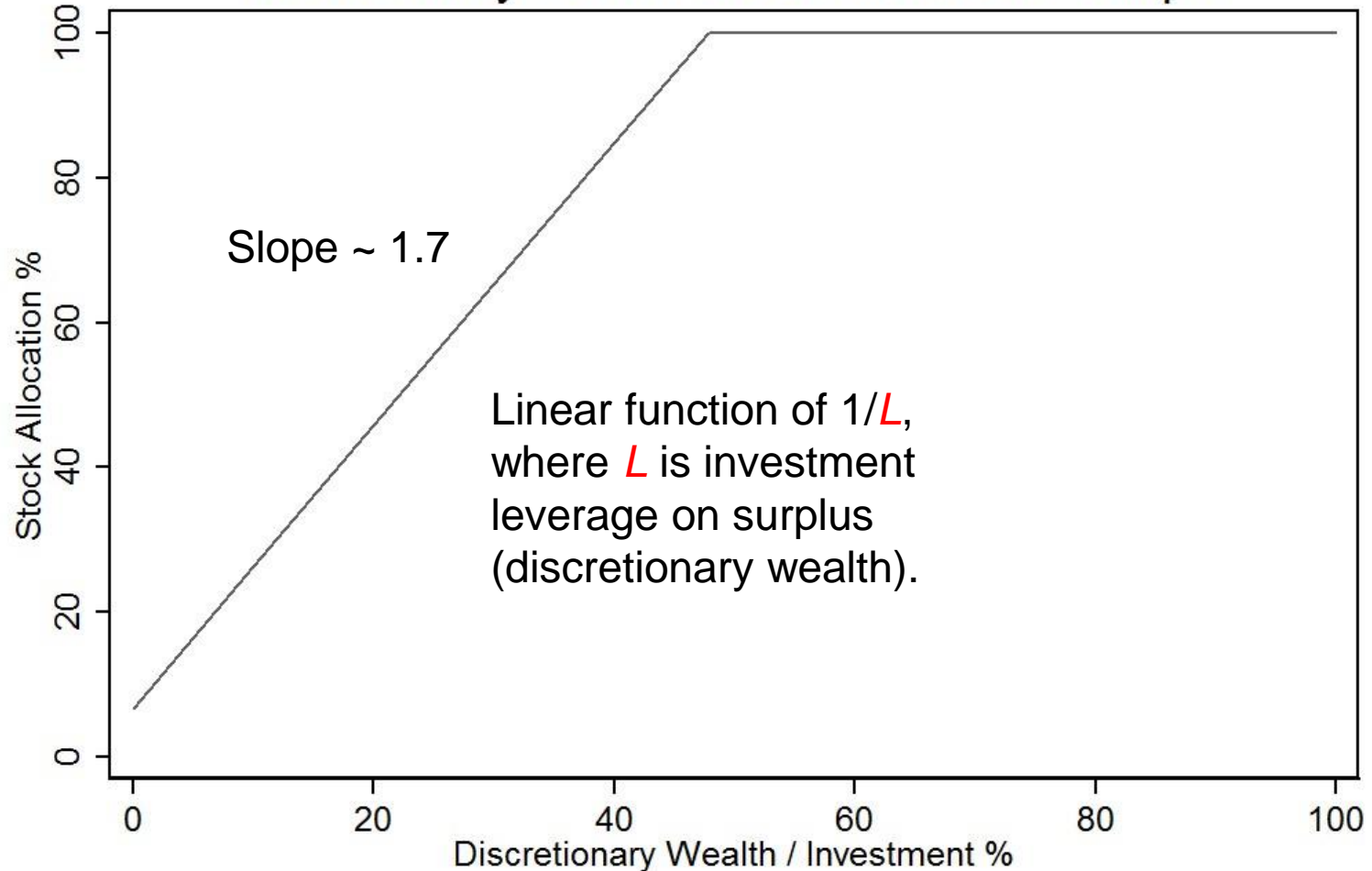


Allocating Your Own Portfolio

- How do you match financial goals and resources with good investment decisions?
 - Investment Characteristics
 - Expected returns
 - Investment risks
 - Personal Context
 - Projected **planned surplus** or deficit
 - **Time horizon** => Probability of Shortfall

If Risk-Bearing Capability Scales With Planned Surplus...

Discretionary Wealth Stock Allocation Example



Markowitz $W_s = (E_s - E_b) / (L(V_s + V_b)) + V_b / (V_s + V_b)$, where $1/L$ is Dis./Inv., $\rho=0$

To Maximize Median Future Surplus Given Positive Current Surplus:

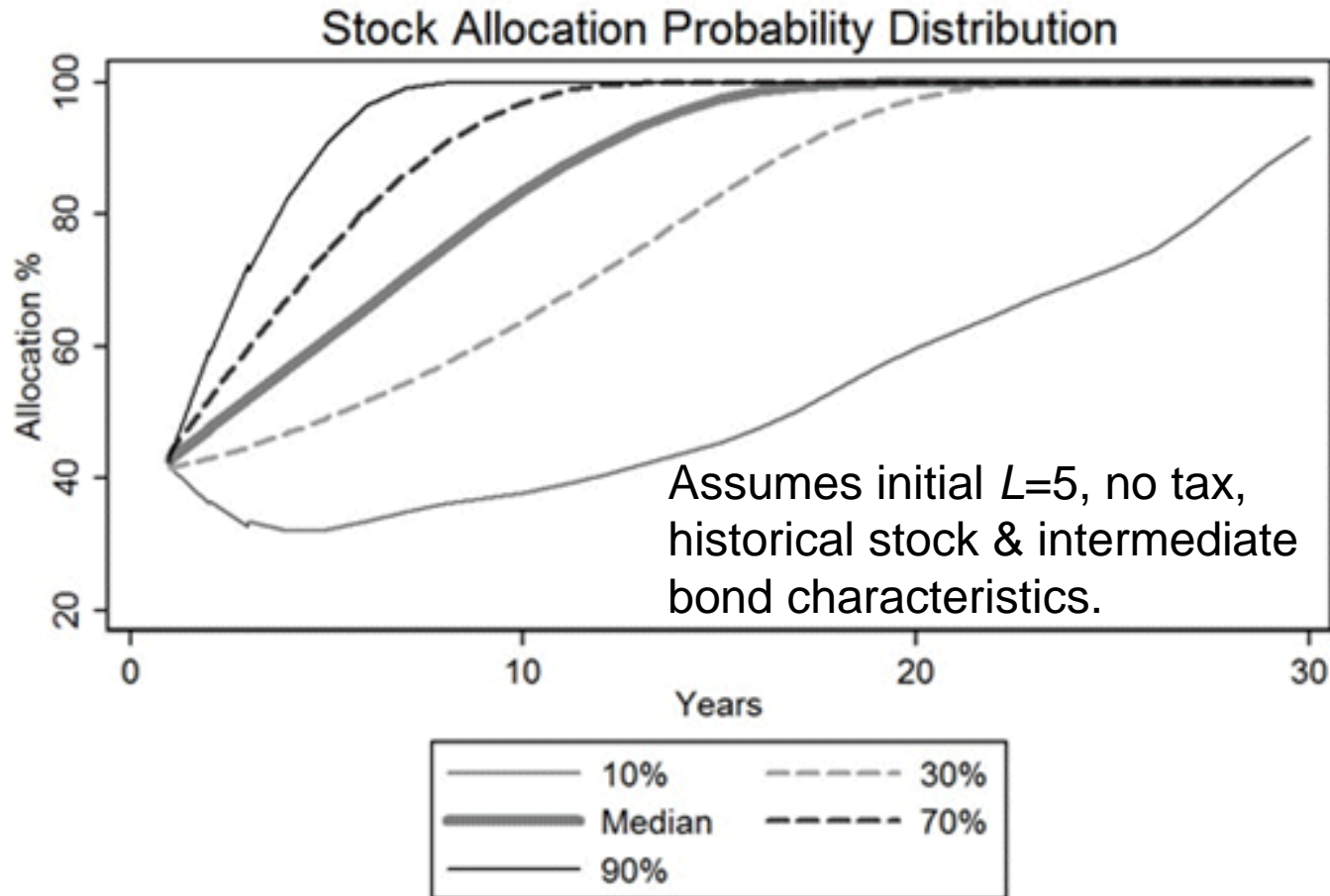
- Recursively maximizing **Expected $\ln(1+Lr)$**
 - Max median implied by Generalized Central Limit Theorem

- The first 2 terms in its Taylor series,

$$\ln(1+LE) - \frac{L^2V}{2(1+LE)^2}$$

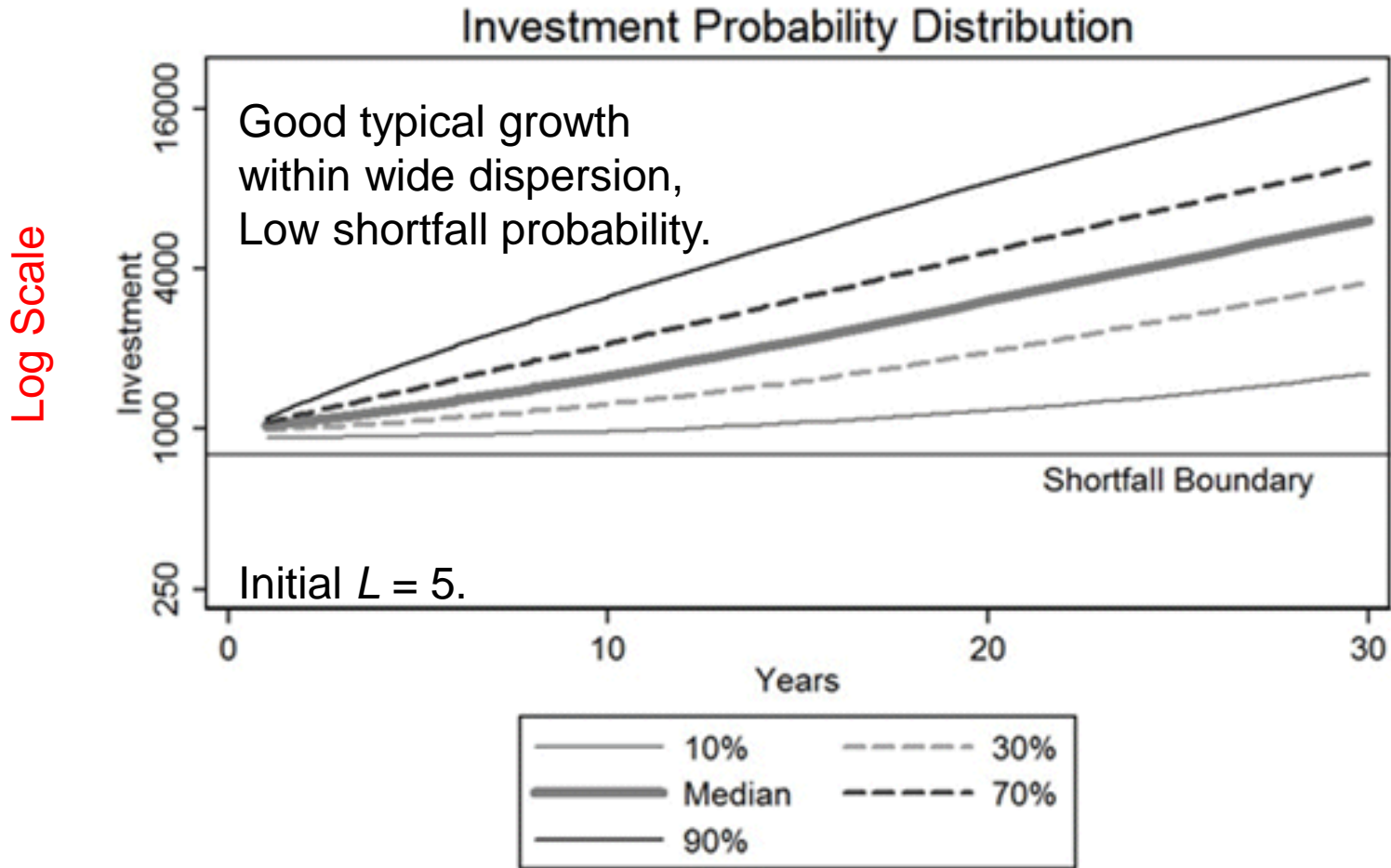
- ,if L is known, give a similar allocation result as maximizing $E - LV/2$. (Markowitz criterion)

Resulting Allocations As Leverage L Varies

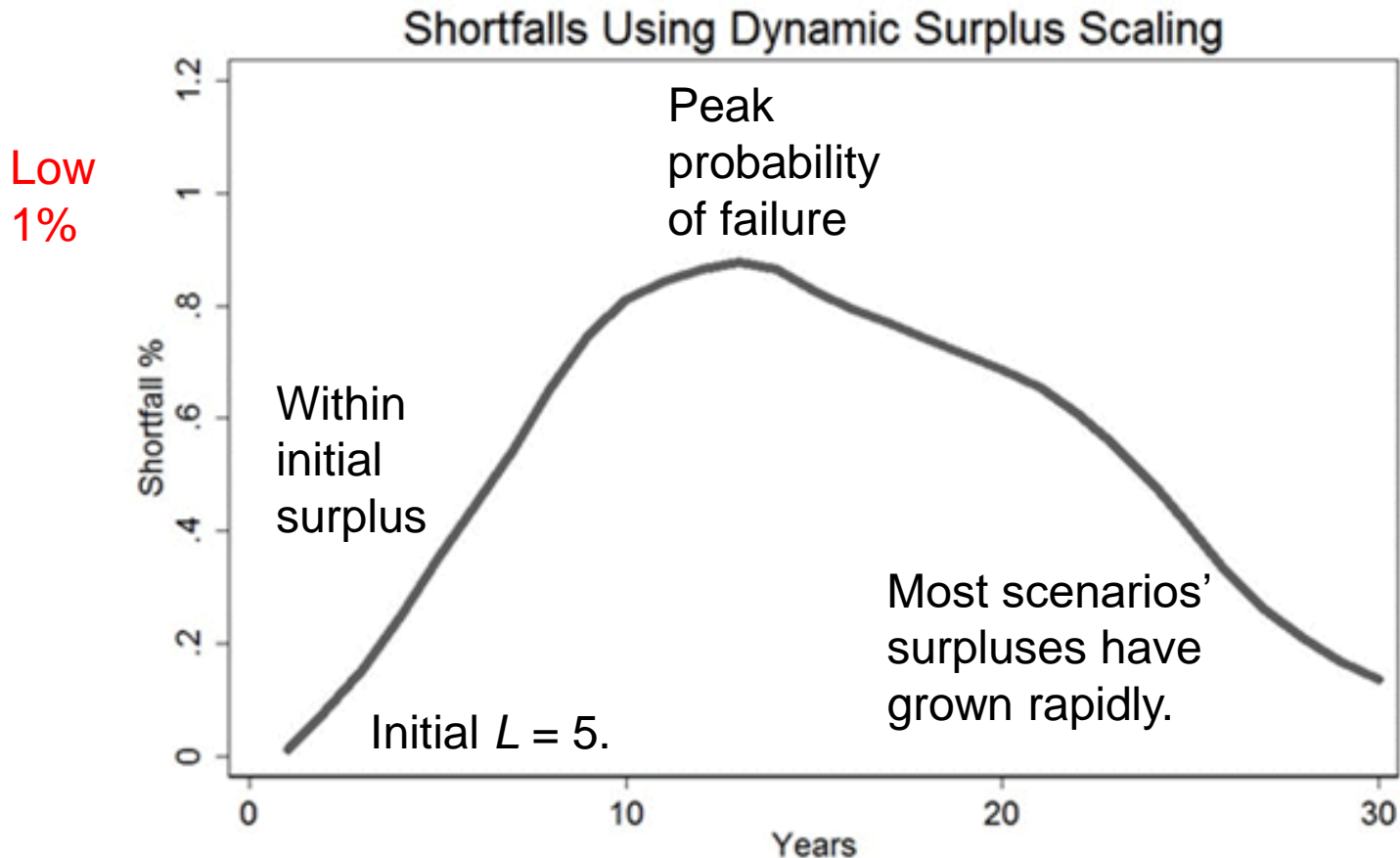


Notes: Shortfall point held constant. Exhibit plots smoothed quantiles from 1000 log-normal randomly-generated sequences.

Resulting Investment Accumulation



Resulting Probability of Shortfall vs. Interruption Time



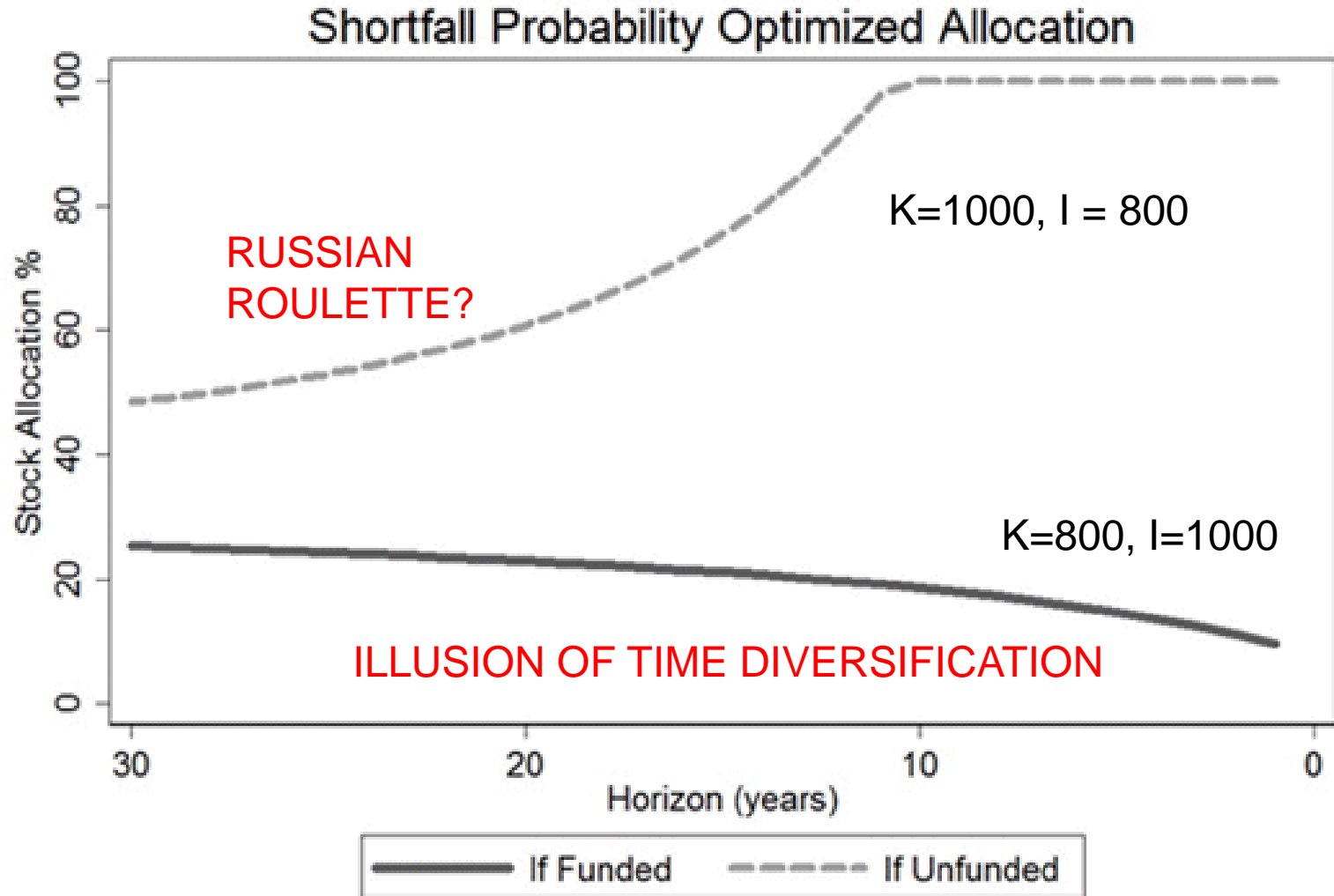
Risk-taking Properly Scaled With Surplus

- Delivers:
 - Good long-term growth, low probability of failure.
 - Objective differences in appropriate risk aversion **across** investors.
- Requires:
 - An initial realistic planned surplus, and allocation flexibility.
- Appropriate caution:
 - Speculative bubbles depart from investment return model.
 - Need to modify **dynamic** reaction for best investor results and market stability.

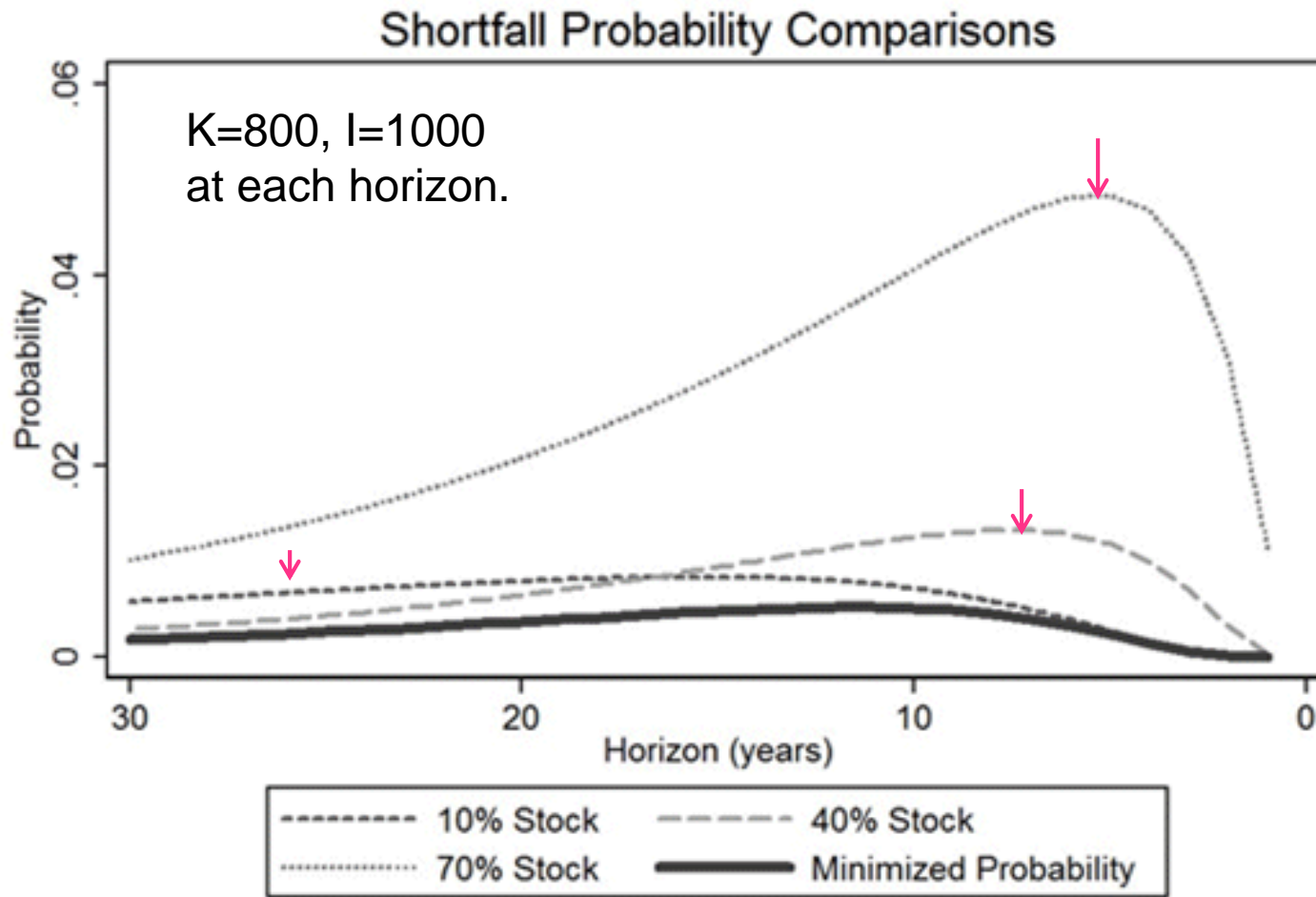
If Risk-taking Ability Scales With Low Probability of Shortfall

- Probability of Shortfall $P(F)$:
 $\text{std.norm.cdf} (\log (K/I) / sT^{1/2} - (m / s)T^{1/2})$
- Where:
 - K is shortfall ending investment, I is initial investment
 - s is log return period standard deviation
 - m is log return period mean
 - T is the number of time periods until shortfall evaluation.
- The right-hand term can create an illusion of *time diversification*.

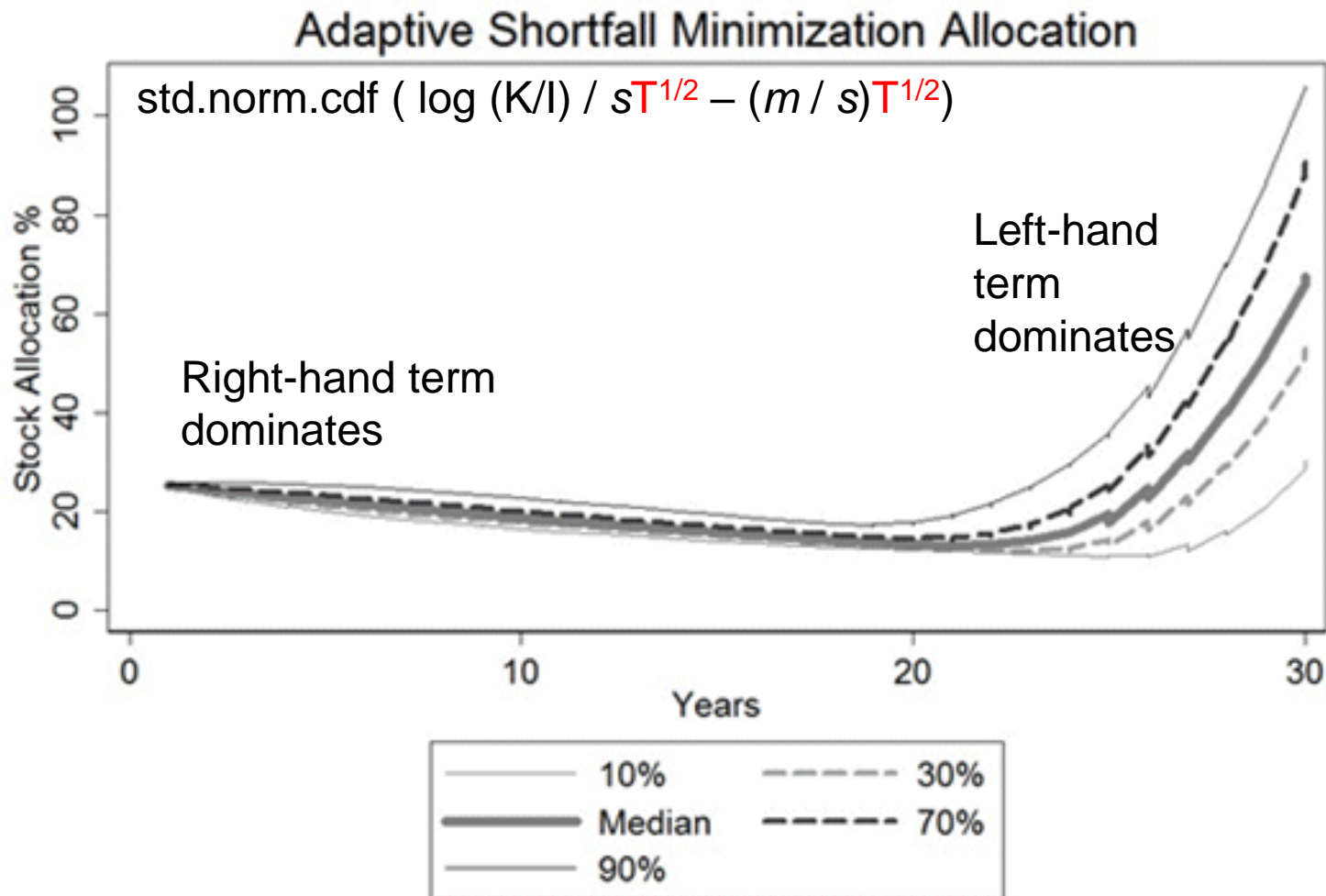
Initial Allocations By Time Horizon



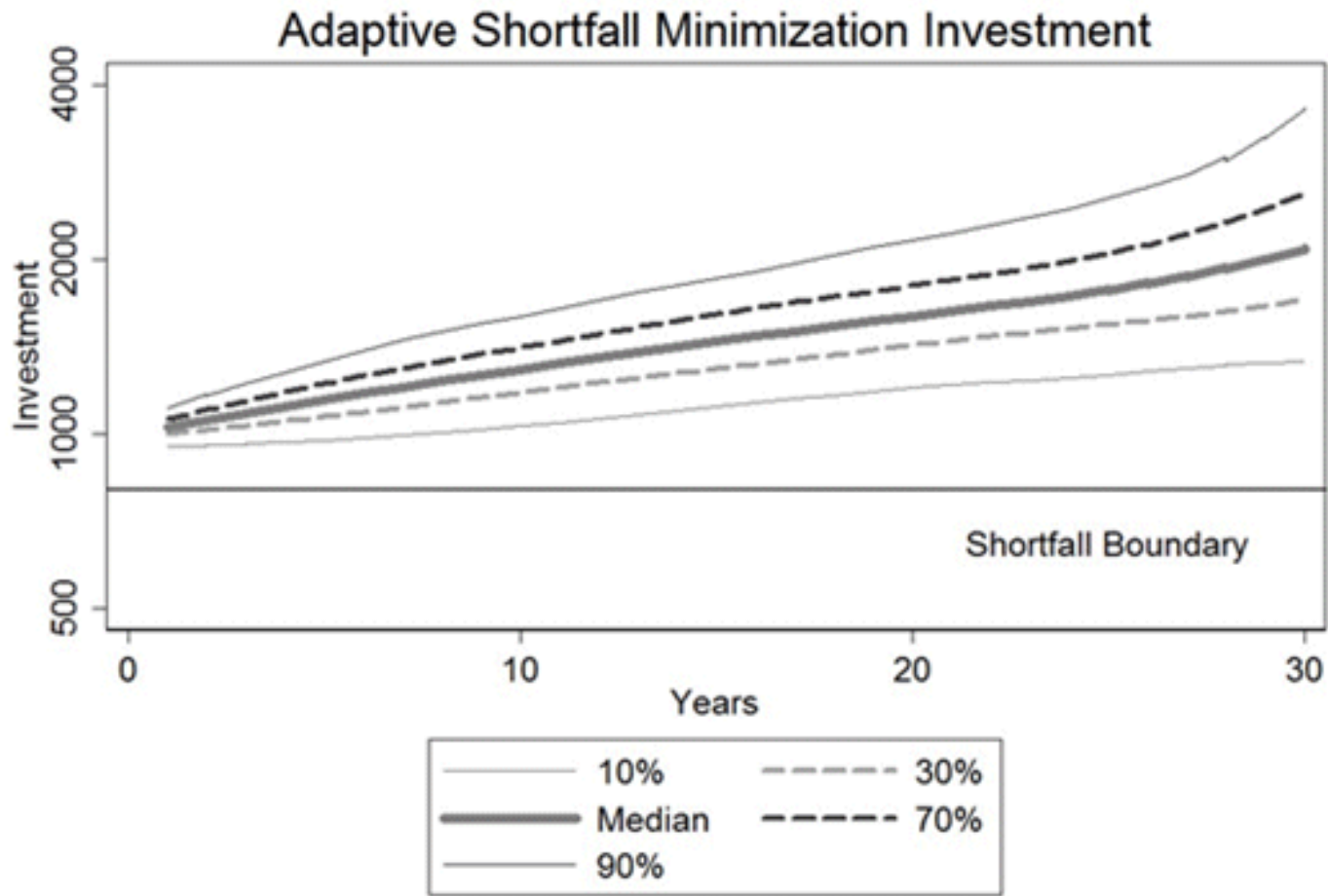
Shortfall Optimized vs. Fixed Proportion Allocations



Dynamic Allocation Using Pure Shortfall Criterion as Horizon Shortens



High Resulting Safety, Slow Growth



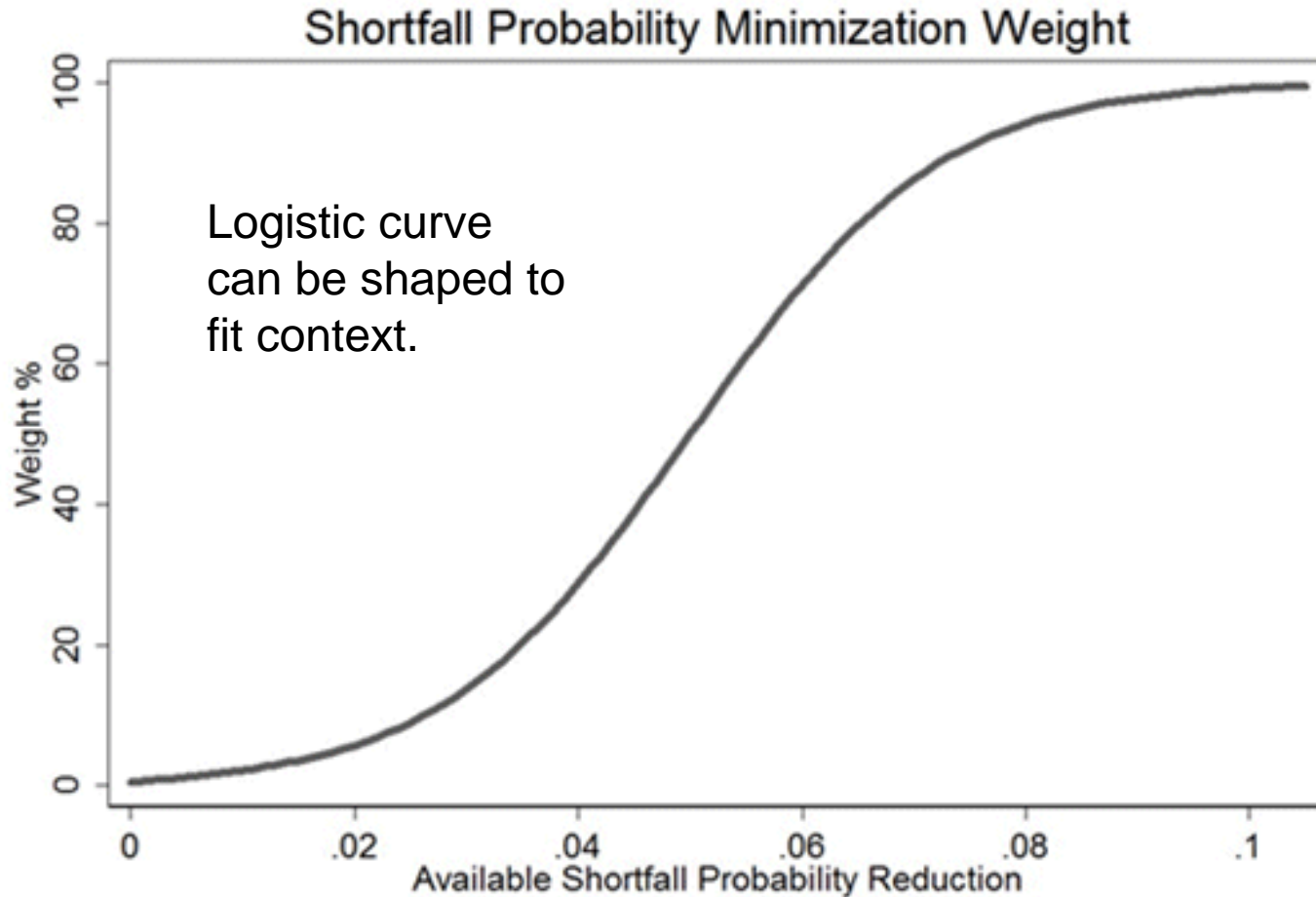
Risk-Taking Capacity Scaled With Low Shortfall Probability

- Quantifies qualitative intuition:
 - Low immediate risk portfolios can increase long-term risk of shortfall.
 - High risk portfolios are most dangerous when surpluses are low and time horizon is short.
 - Underfunded financial plans minimize shortfall probability by taking higher risks __ if the investor is indifferent to shortfall depth.
- Reveals different modes of behavior based on surplus and time horizon.
 - Including risk-peaking and time diversification illusion.

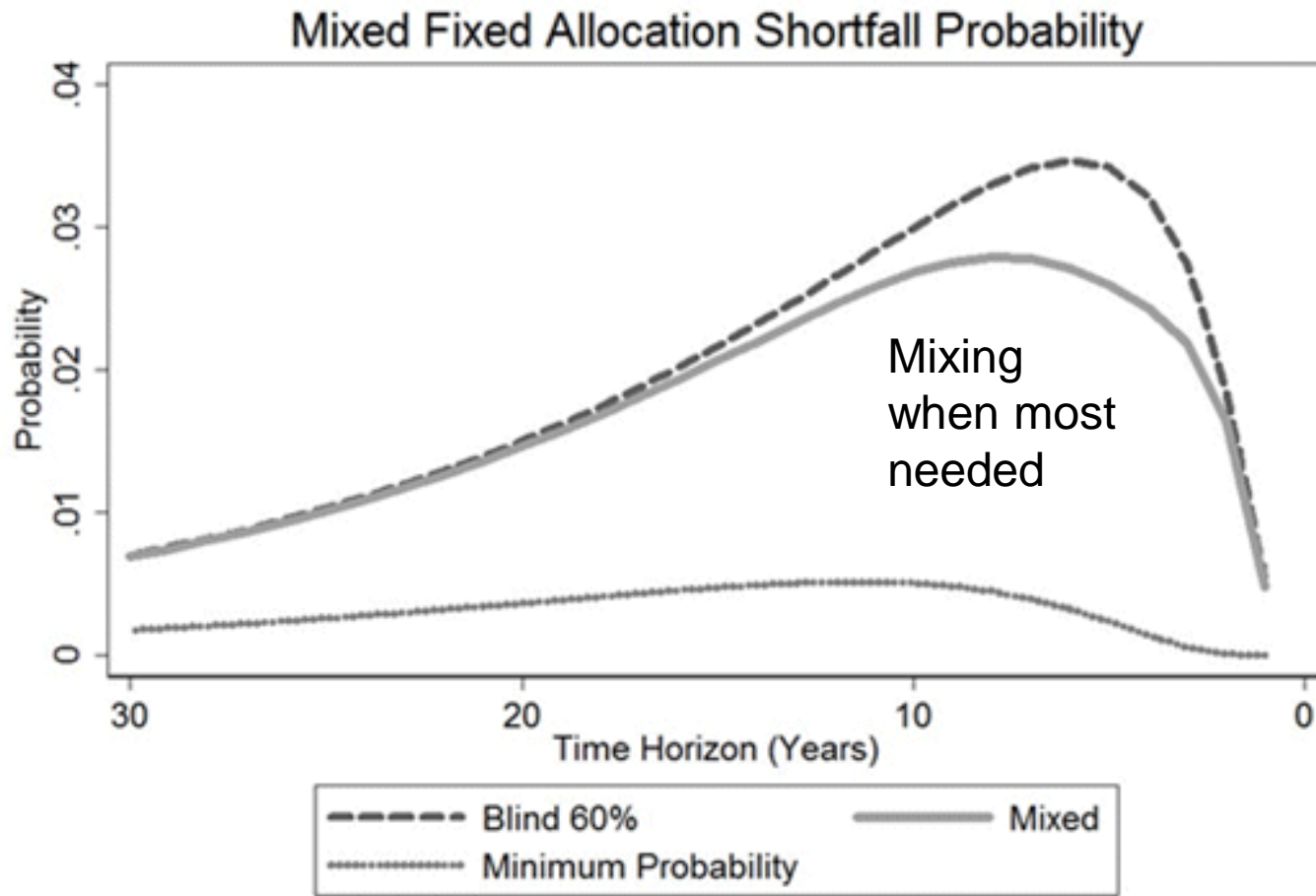
Combining Apples and Oranges

- In the previous example, proper risk-bearing scaling with surplus already reduced shortfall probability to low levels.
- But conventional fixed allocation rebalancing can be readily improved by modification with shortfall reduction.
- Can we intelligently mix optimizations without a universal objective function?

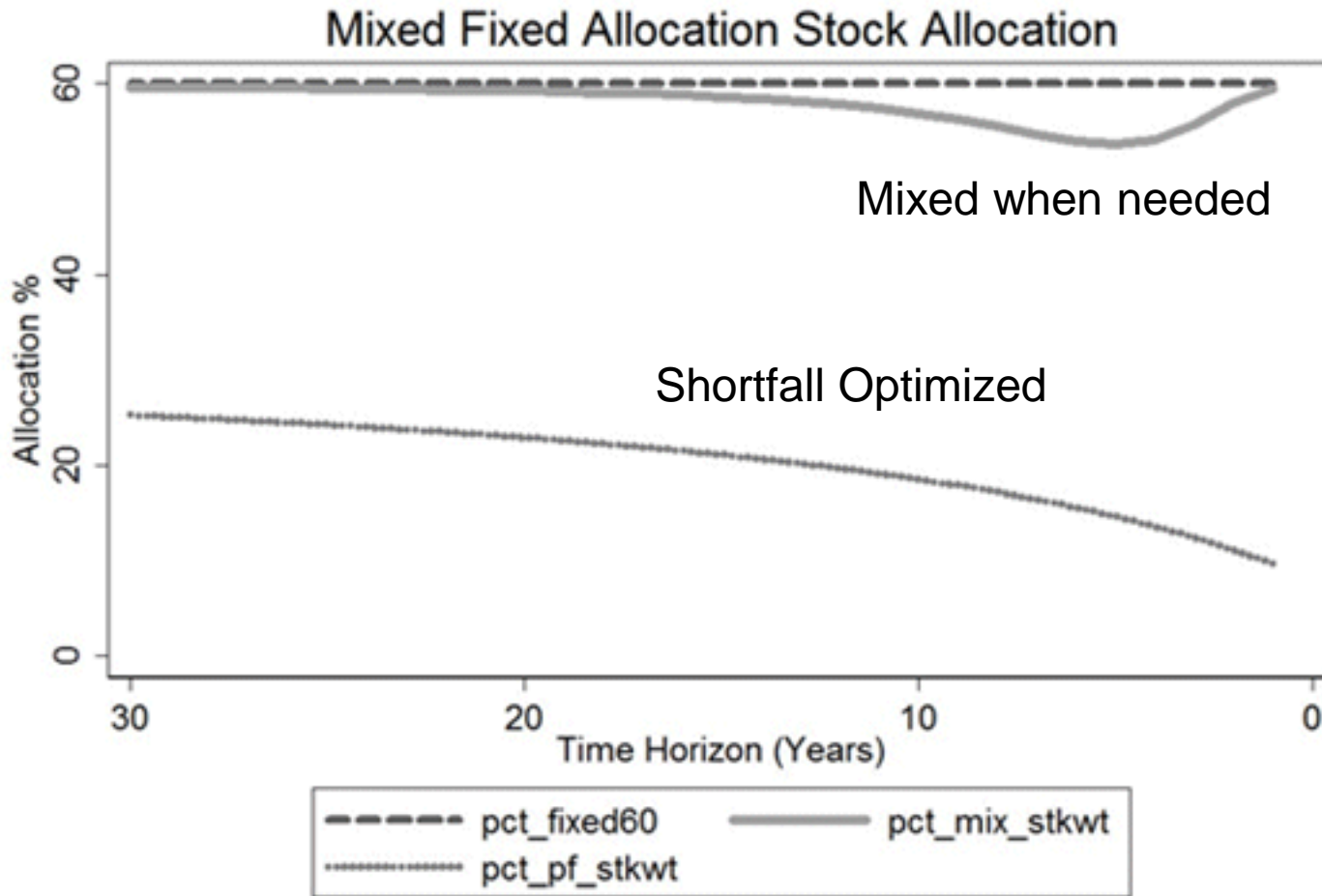
Combining Allocations: Surplus Based + Shortfall Minimized



Mixing Shortfall Optimization with A Fixed 60% Stock Allocation



Allocation Result



The View From 50,000 Feet

- Financial plans and investment strategy can be better if jointly derived.
- *Surplus* and *time horizon*, as expressed in growth rates and probability of shortfall, are key concepts to help us customize asset allocation.