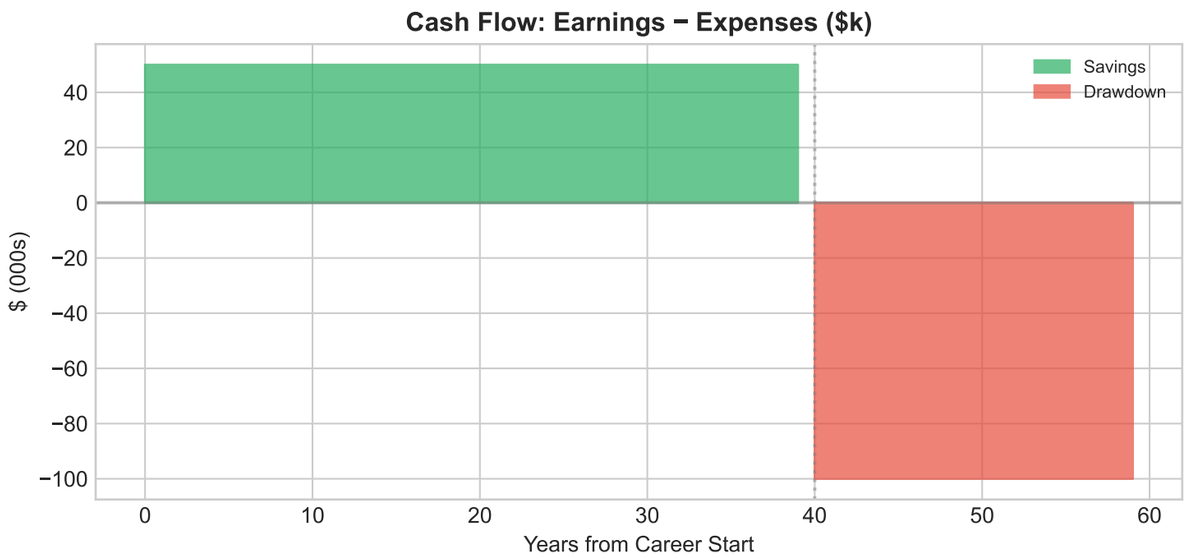
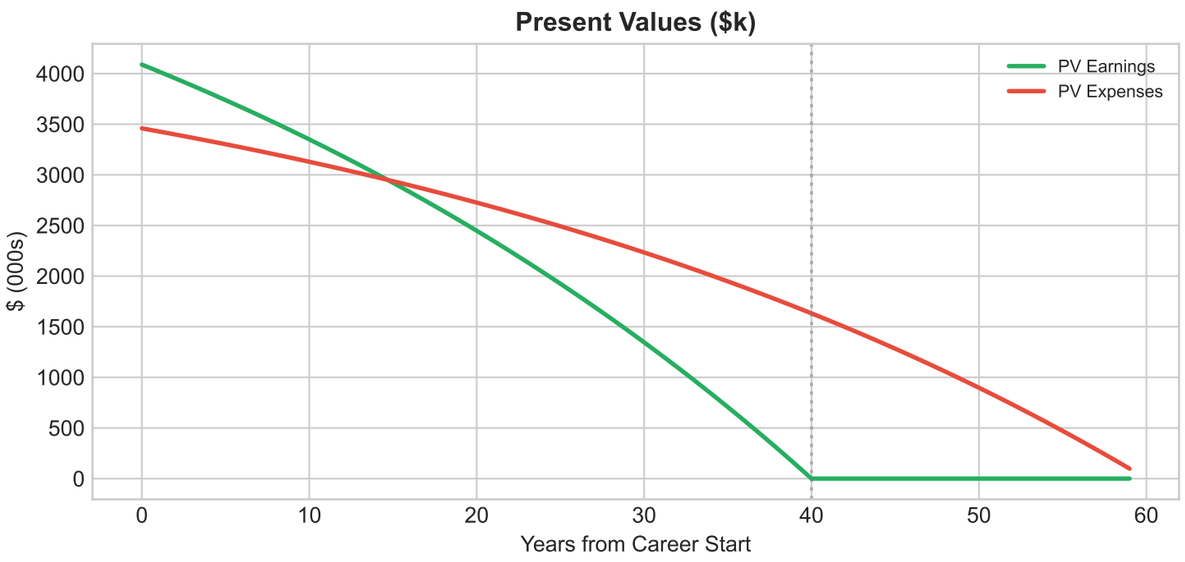
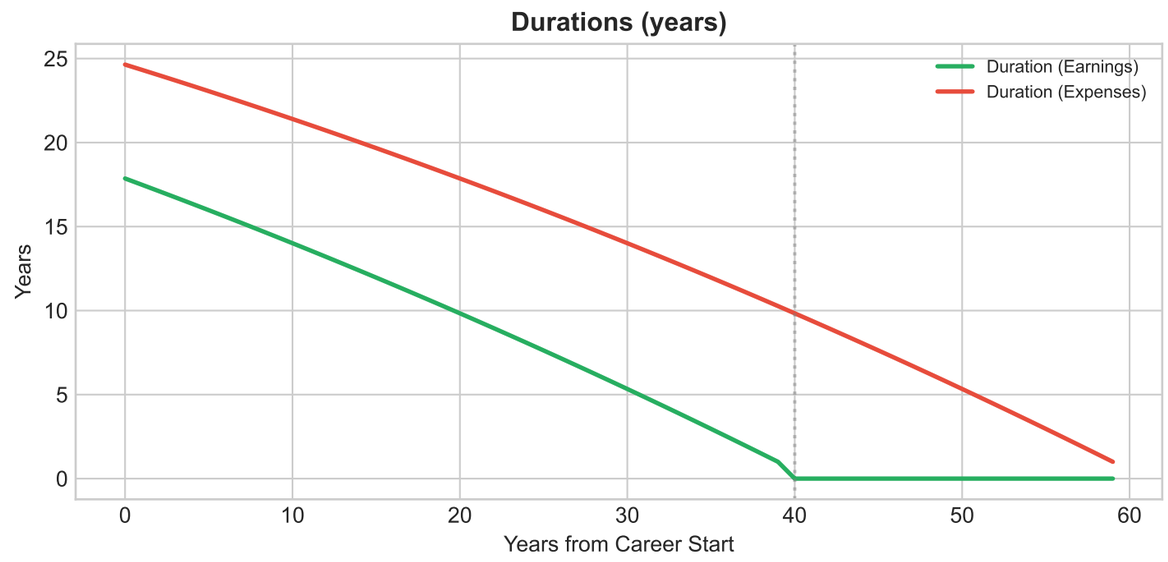
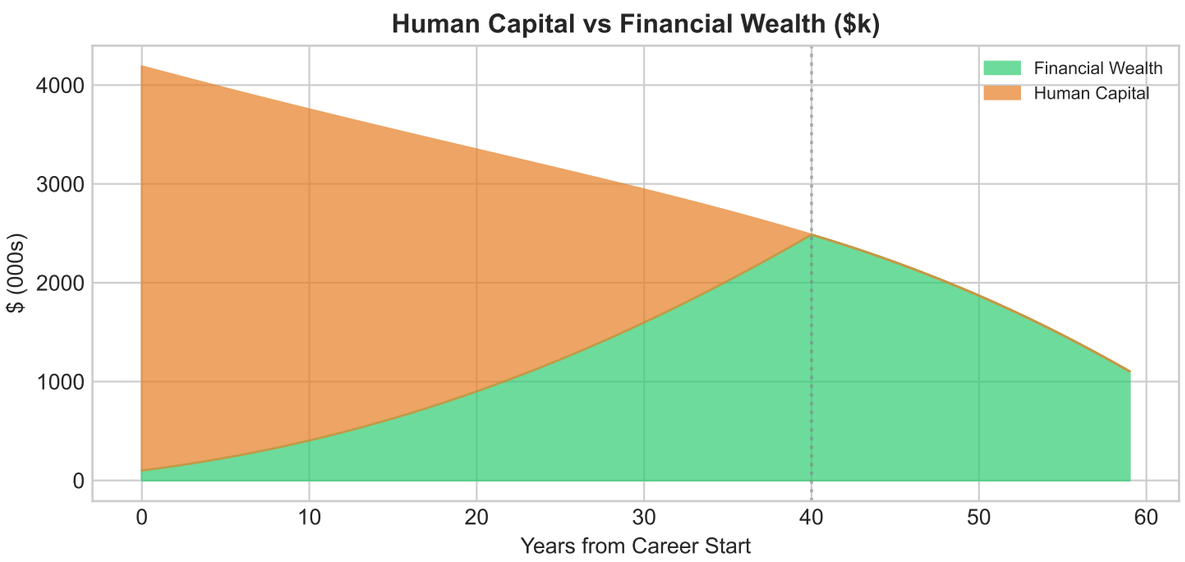
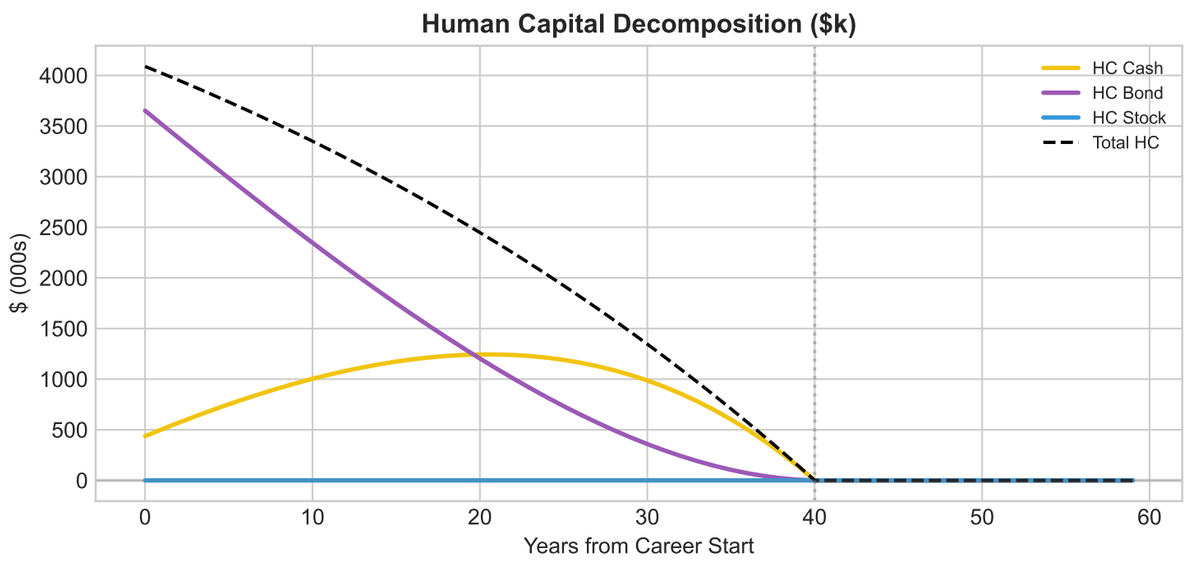
# PAGE 1: DETERMINISTIC MEDIAN PATH (Beta = 0.0)

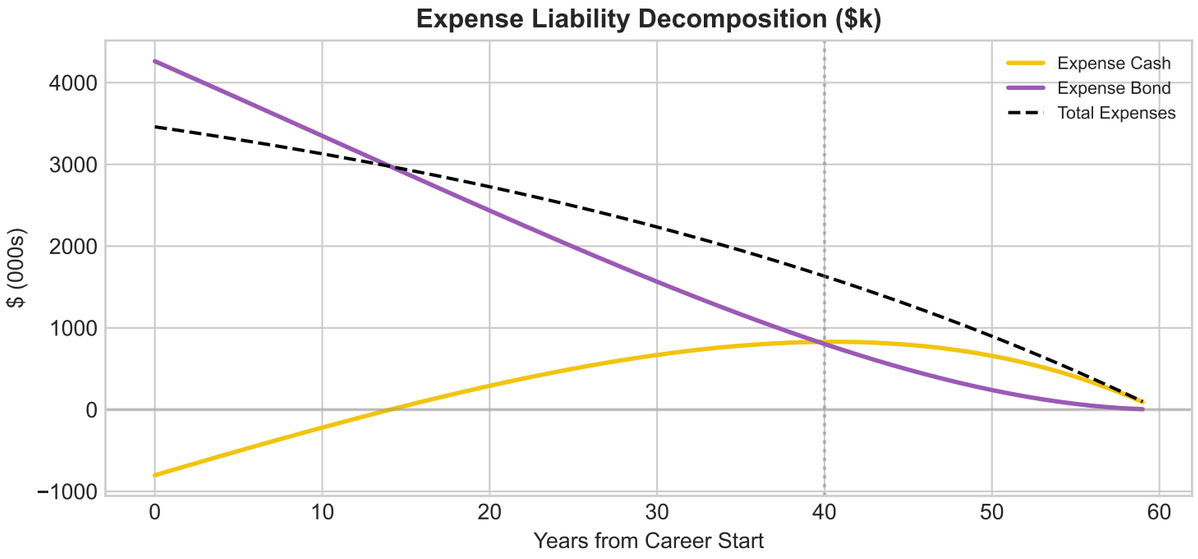



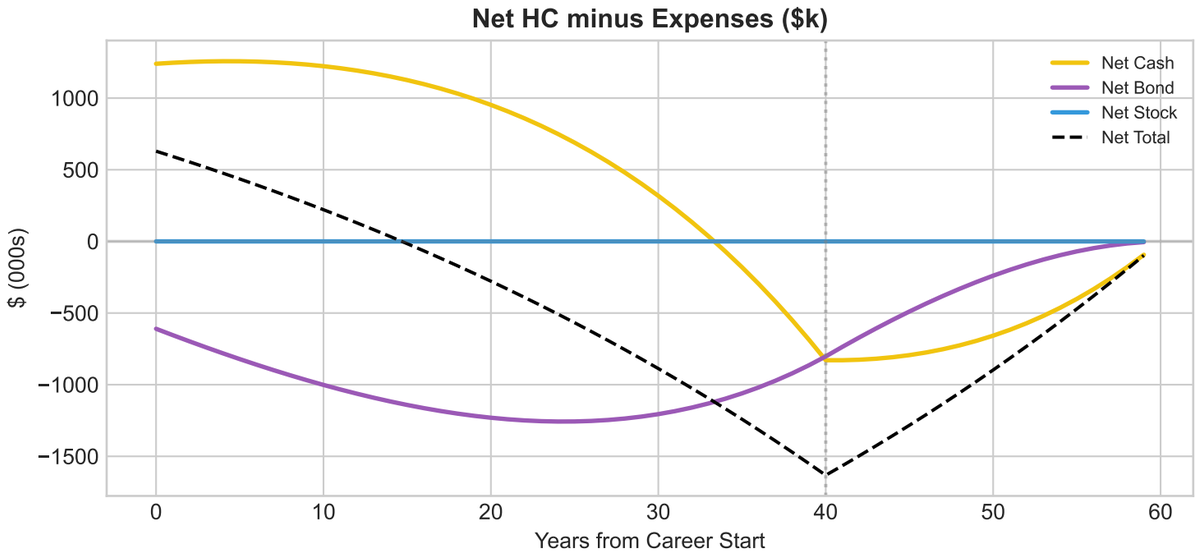



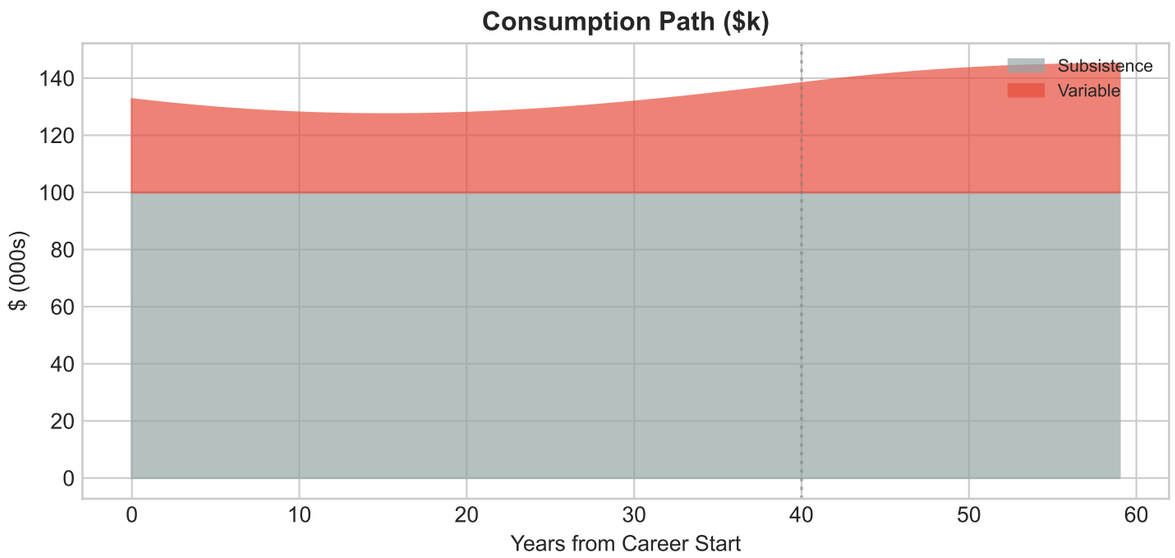



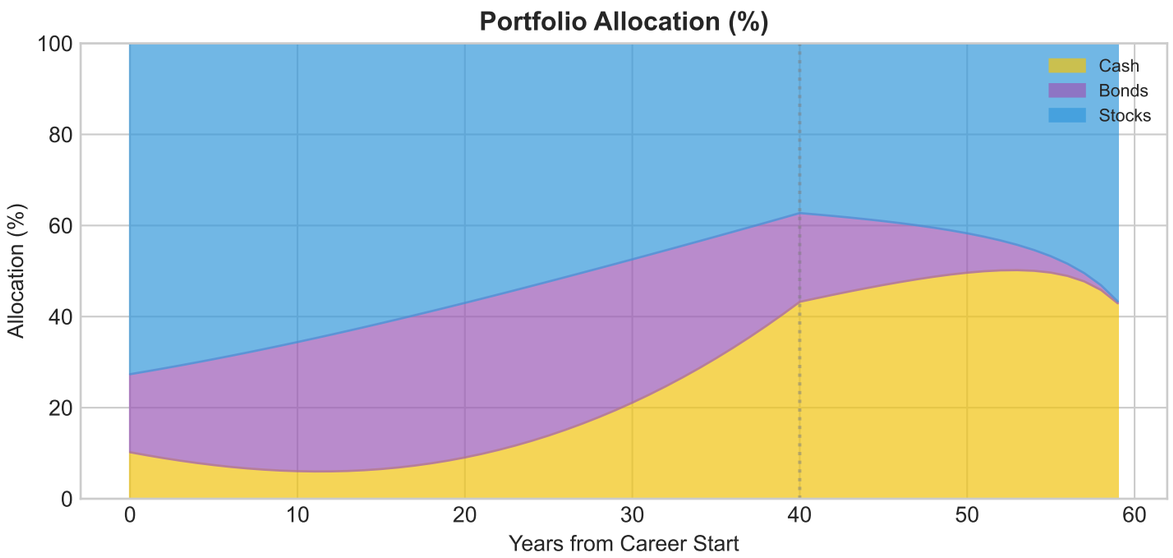



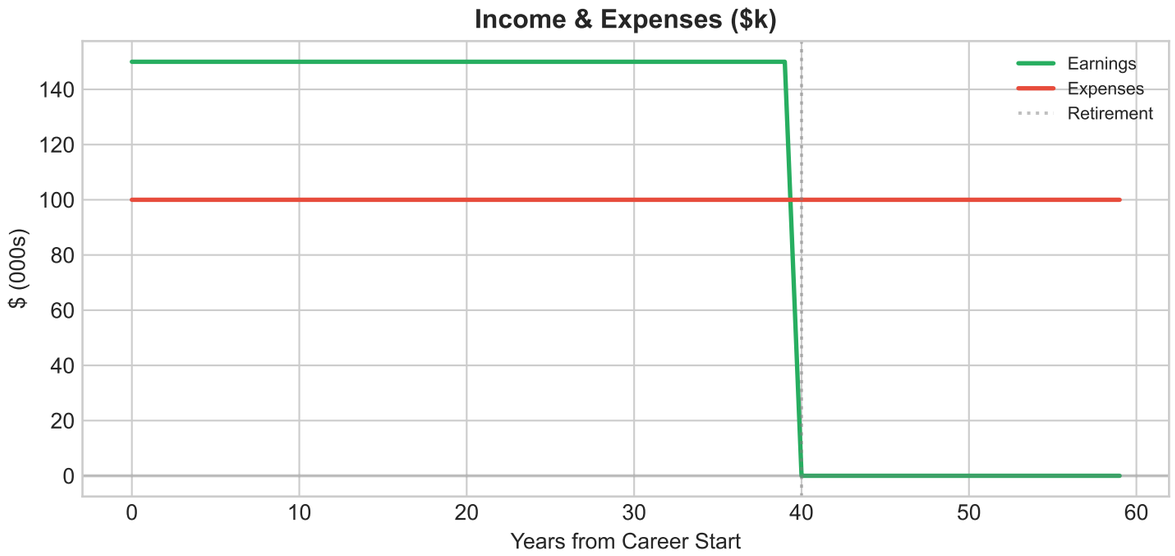



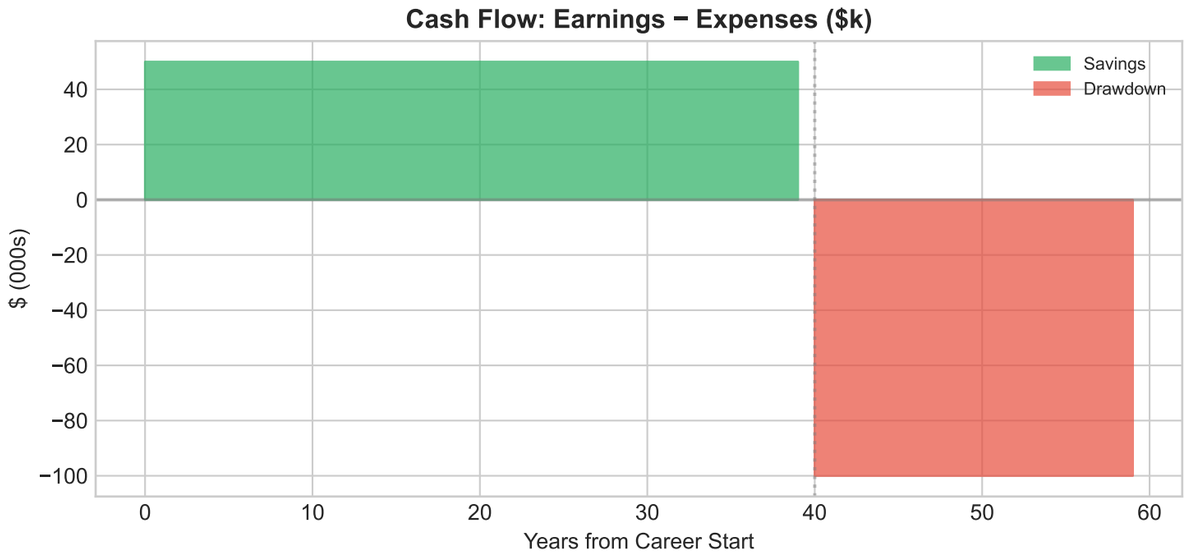



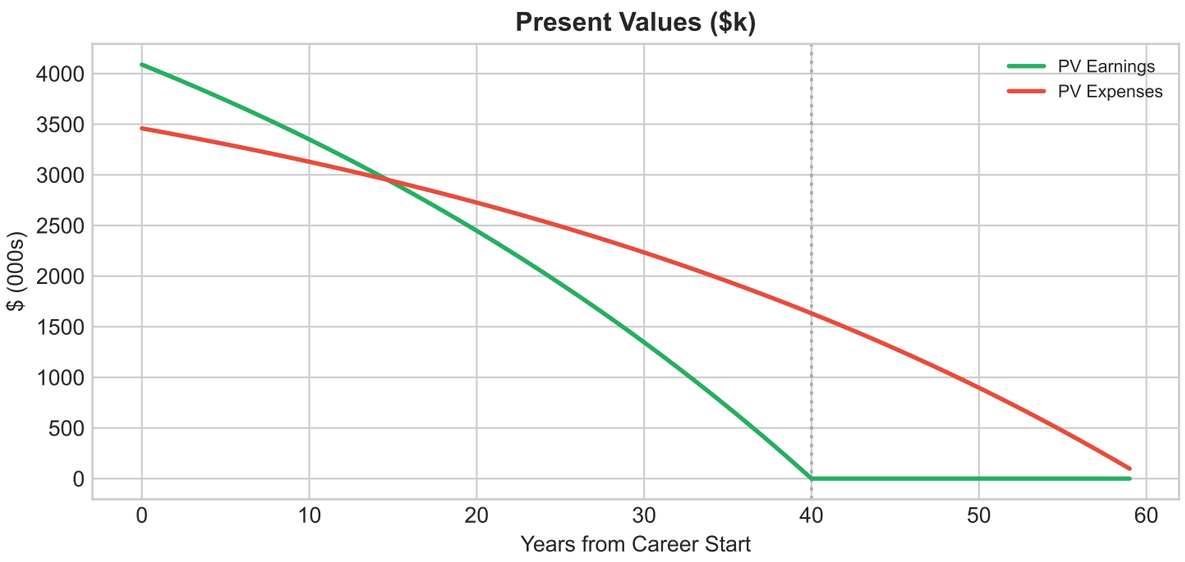



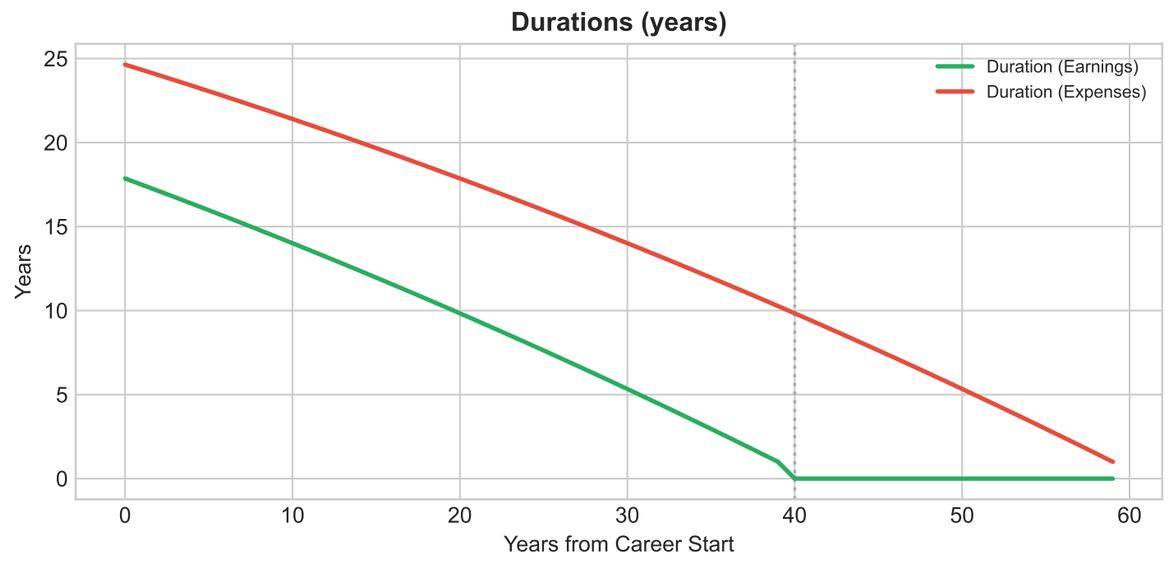



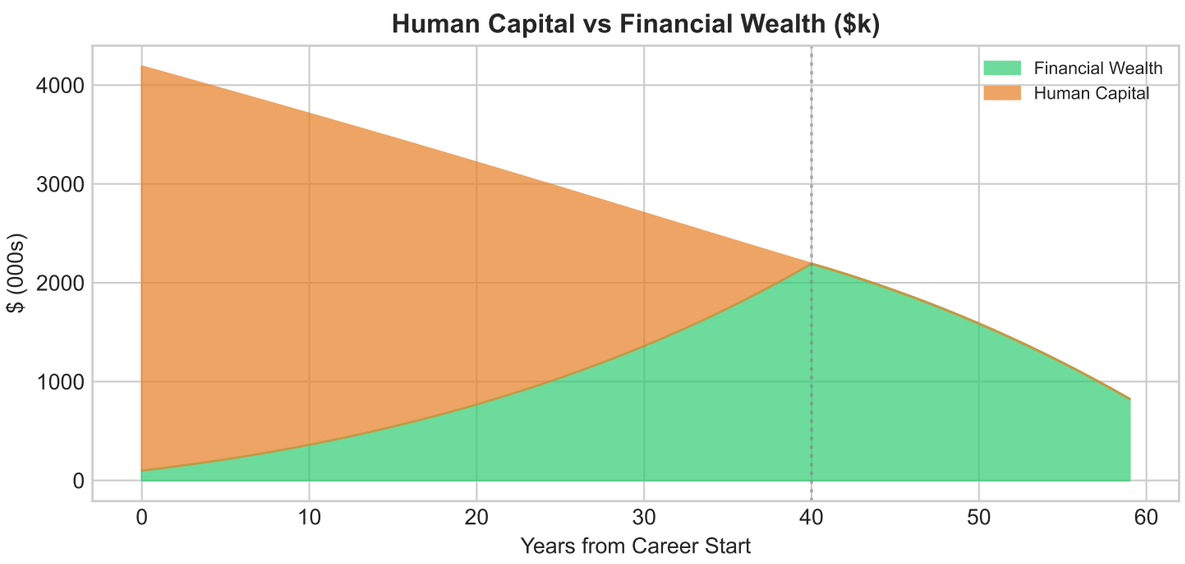
# PAGE 2: DETERMINISTIC MEDIAN PATH (Beta = 0.5)

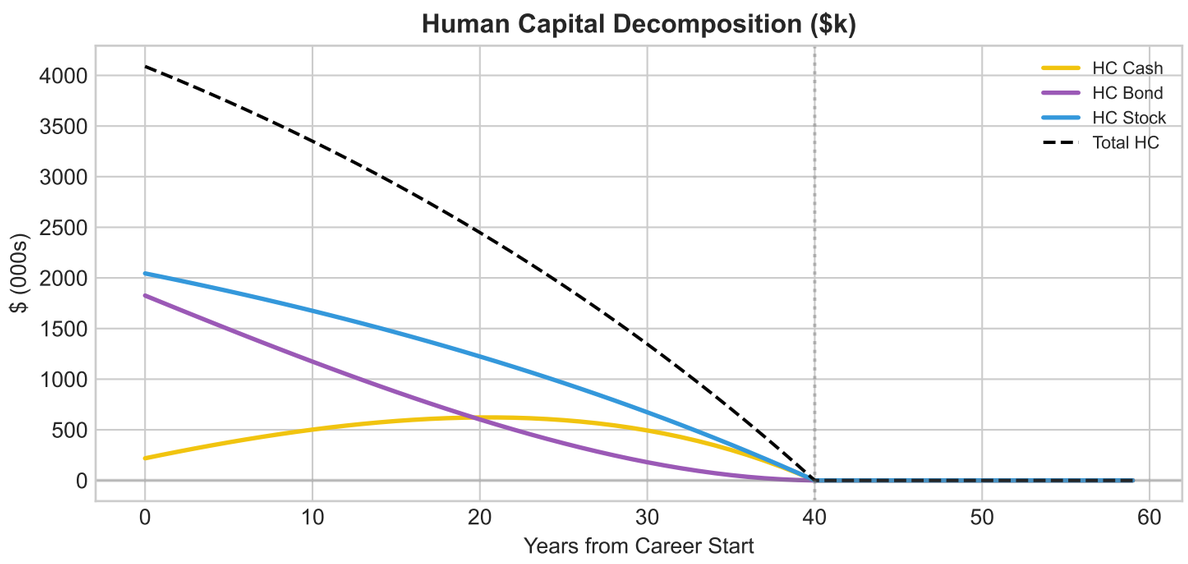


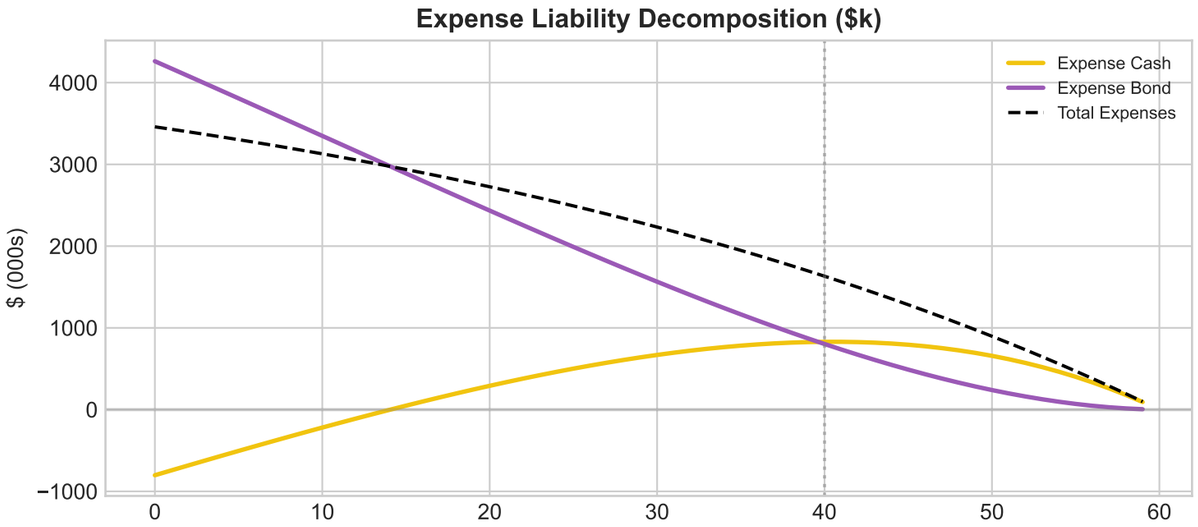



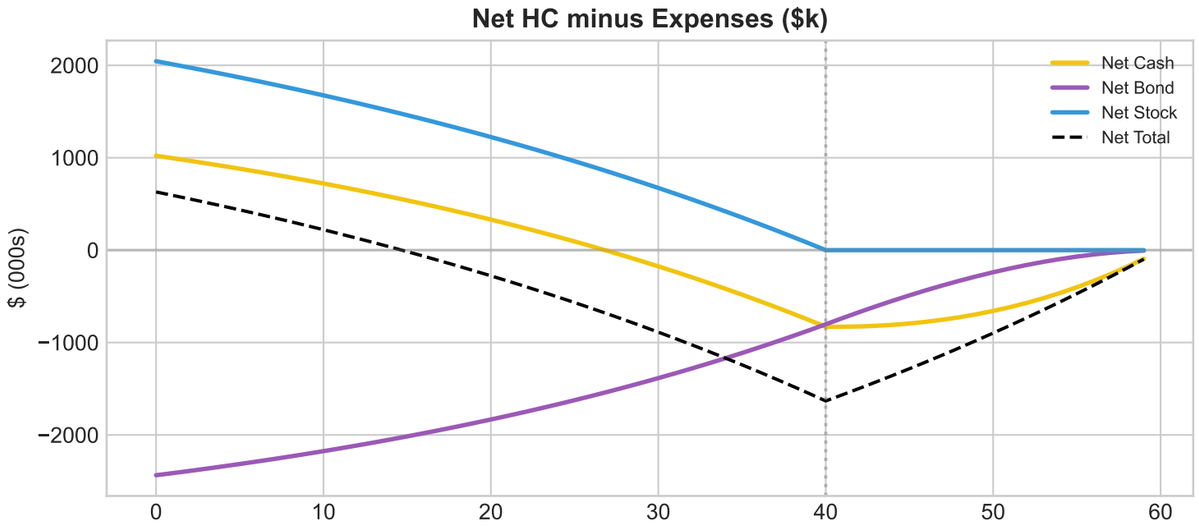



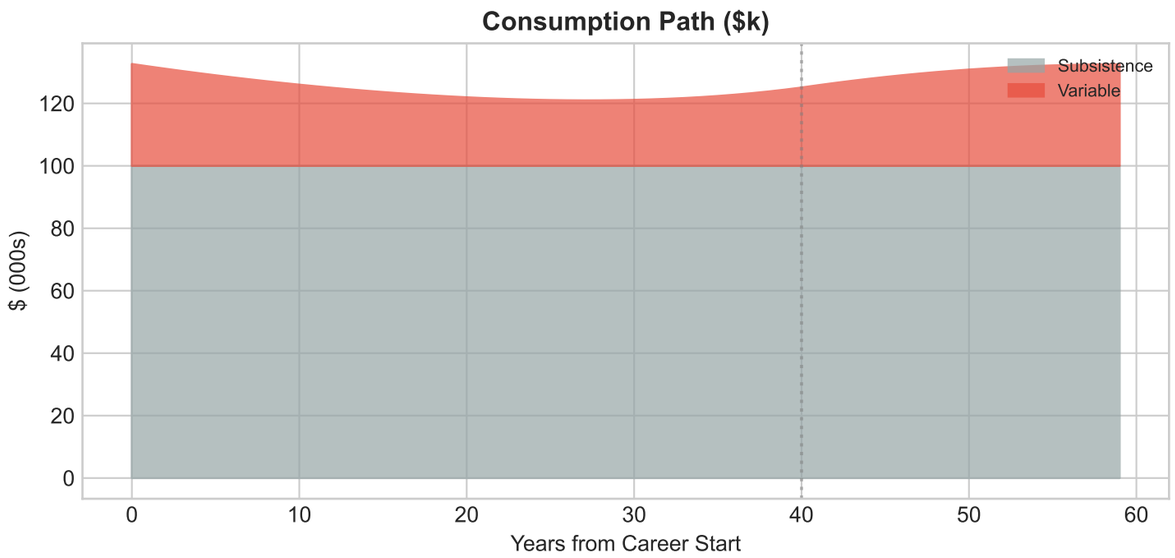



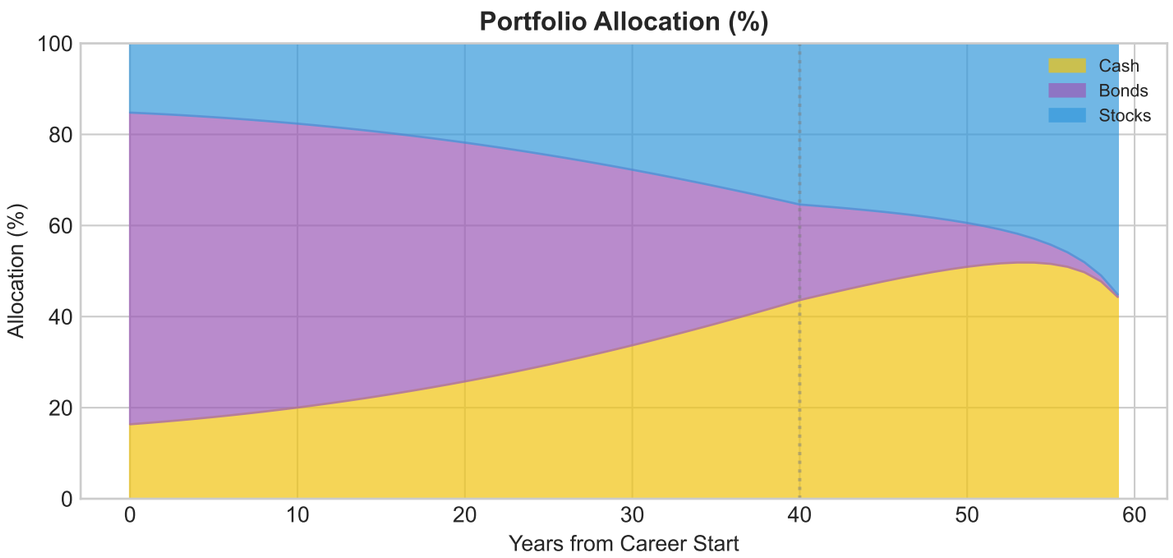



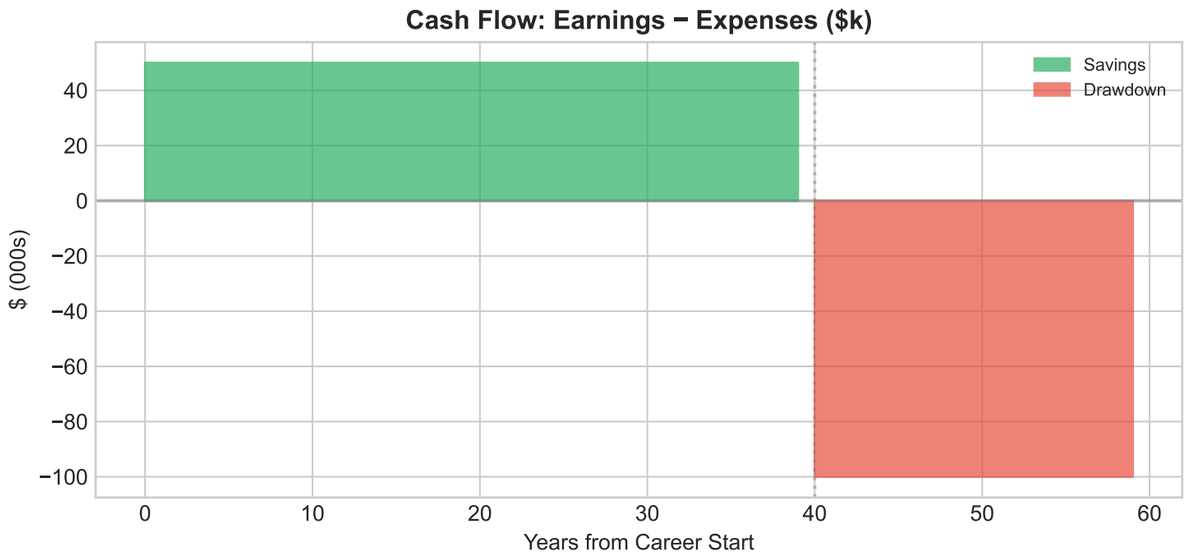



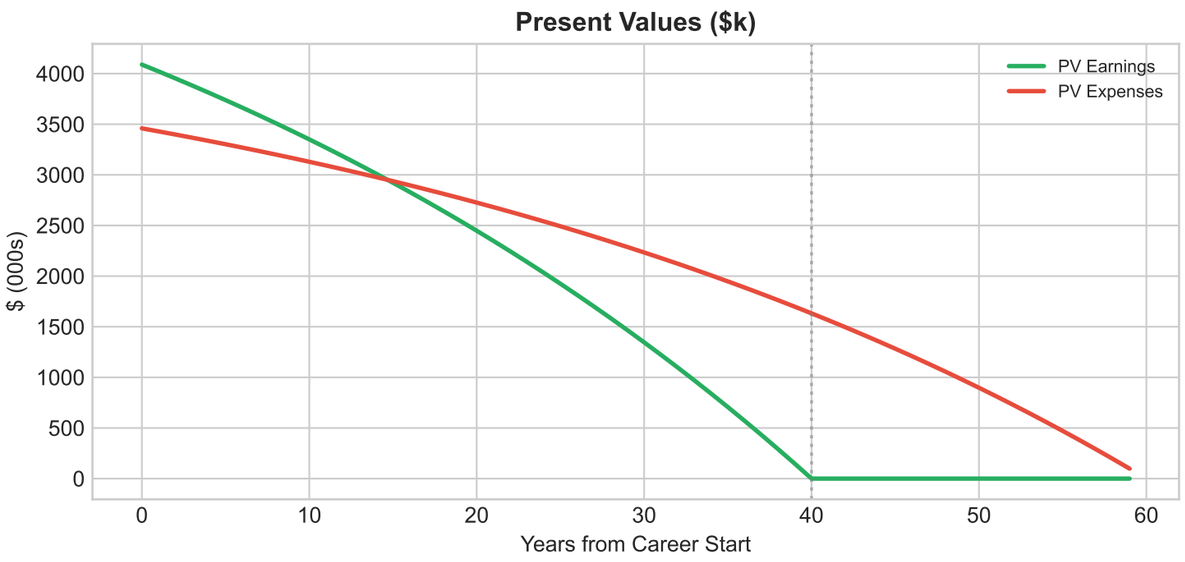



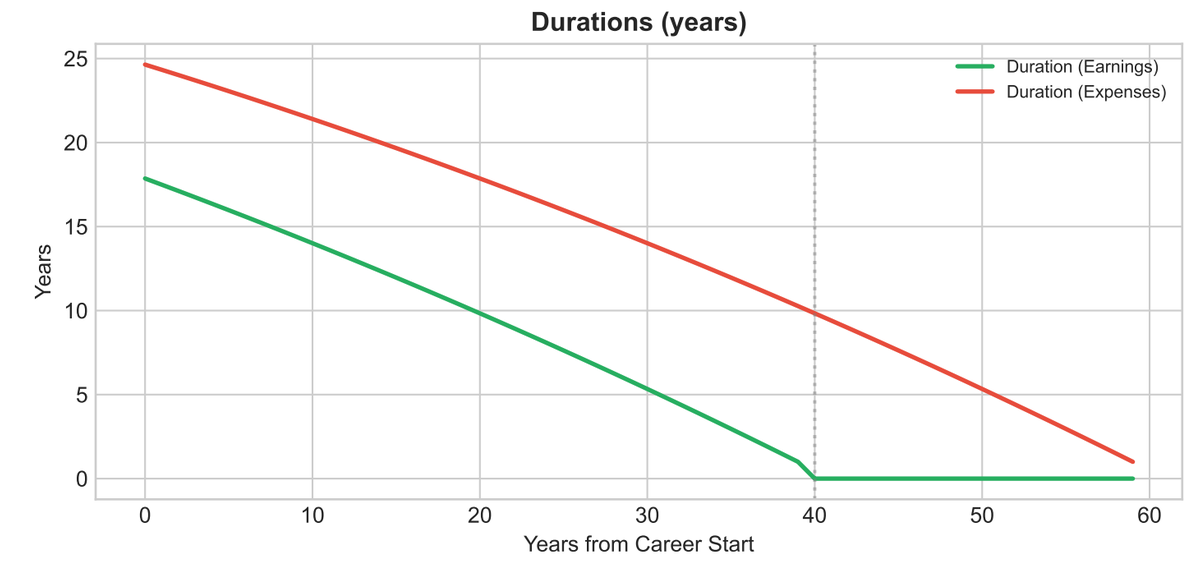



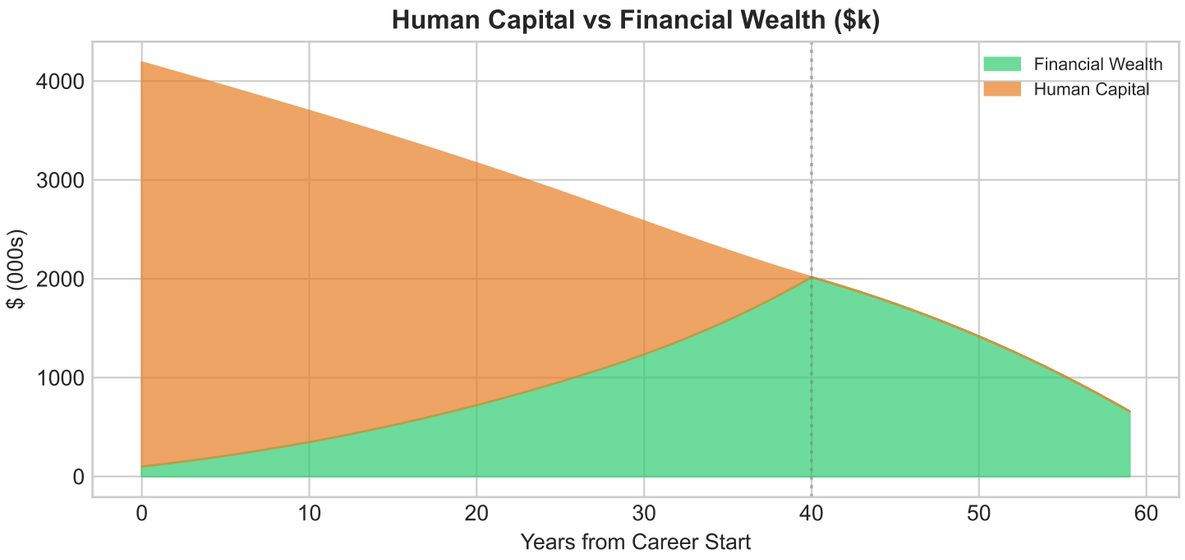



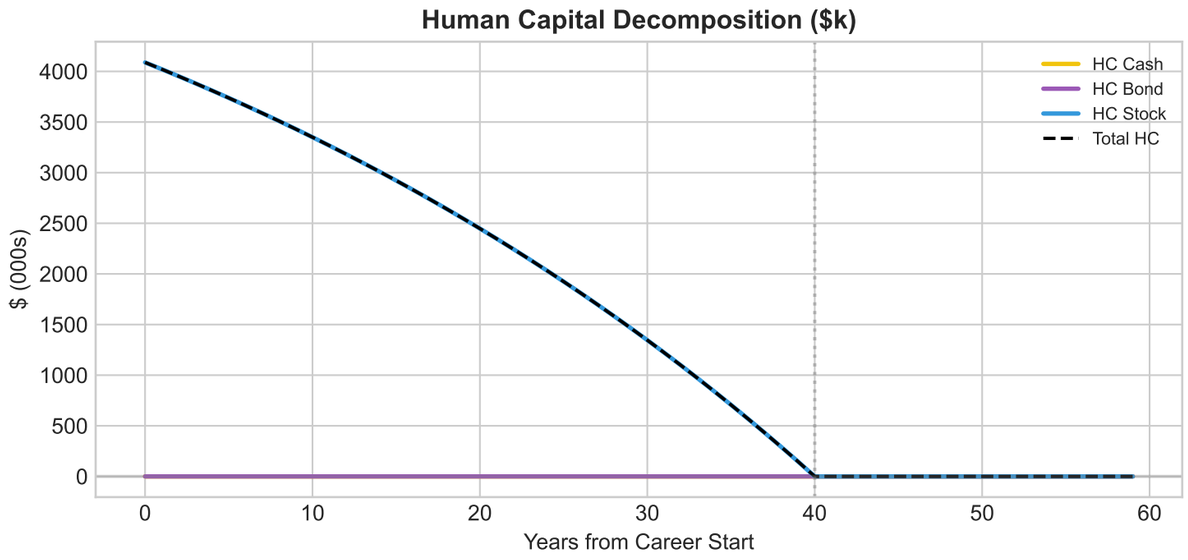
# PAGE 3: DETERMINISTIC MEDIAN PATH (Beta = 1.0)

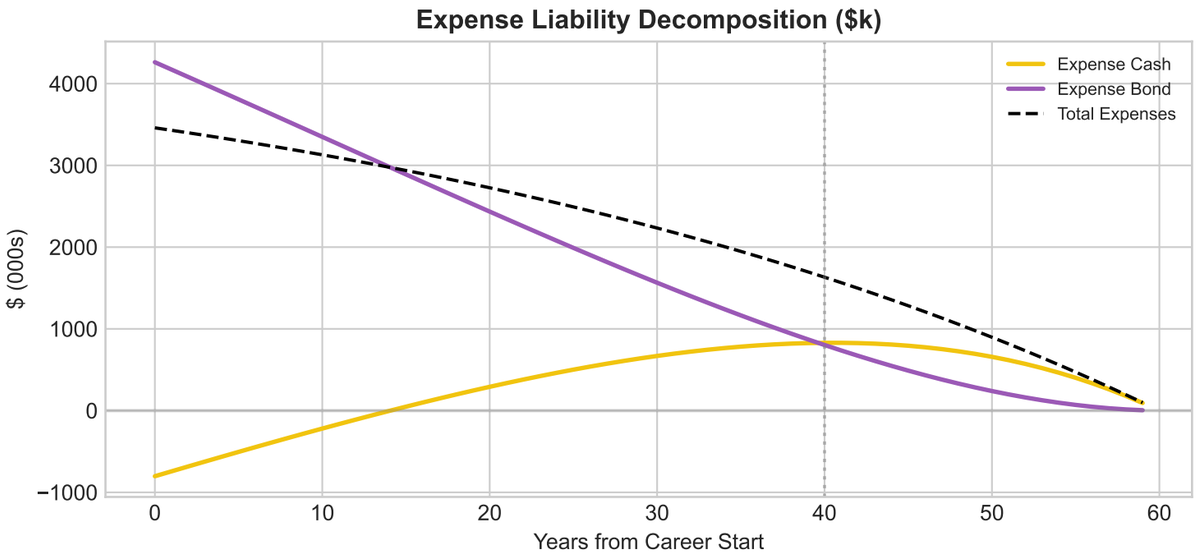



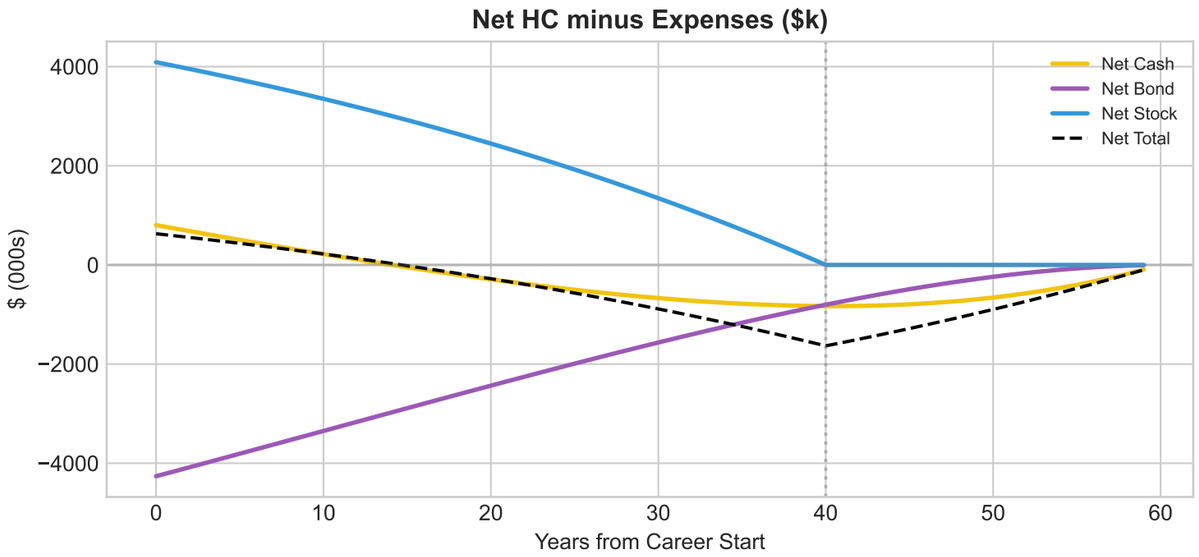



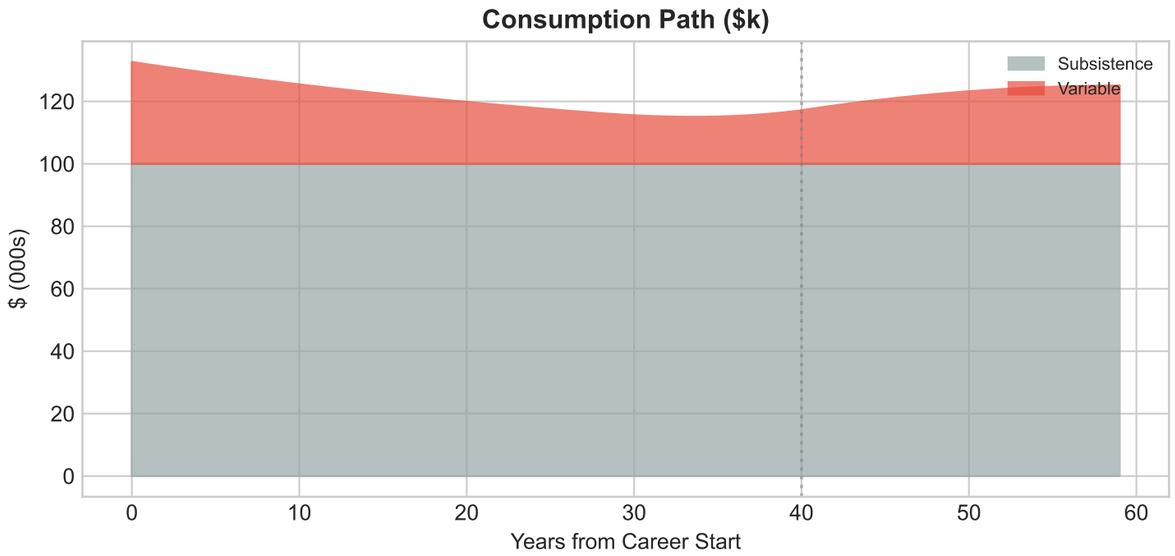



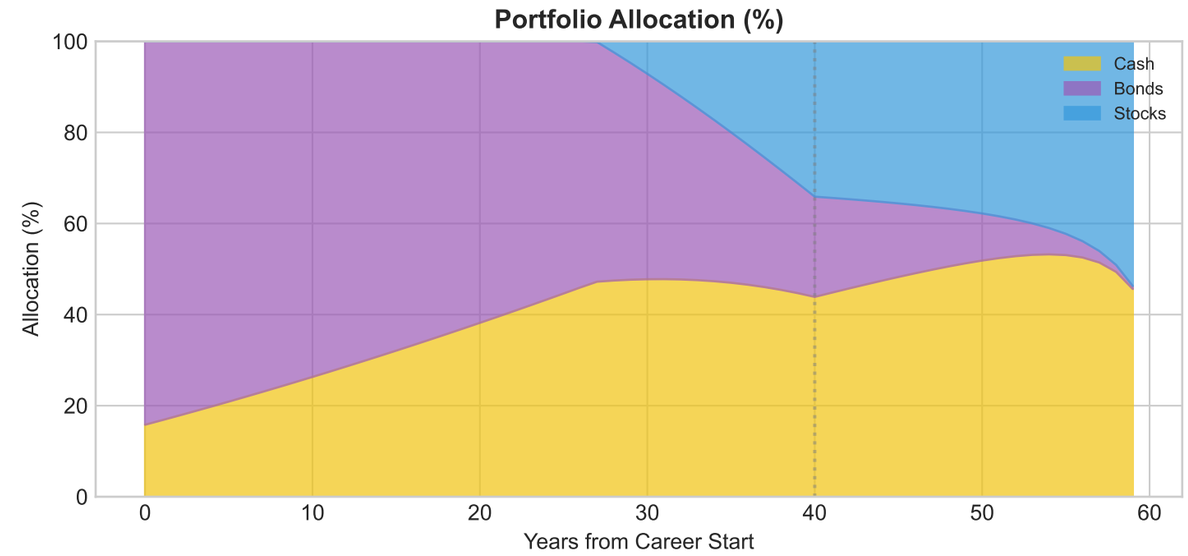



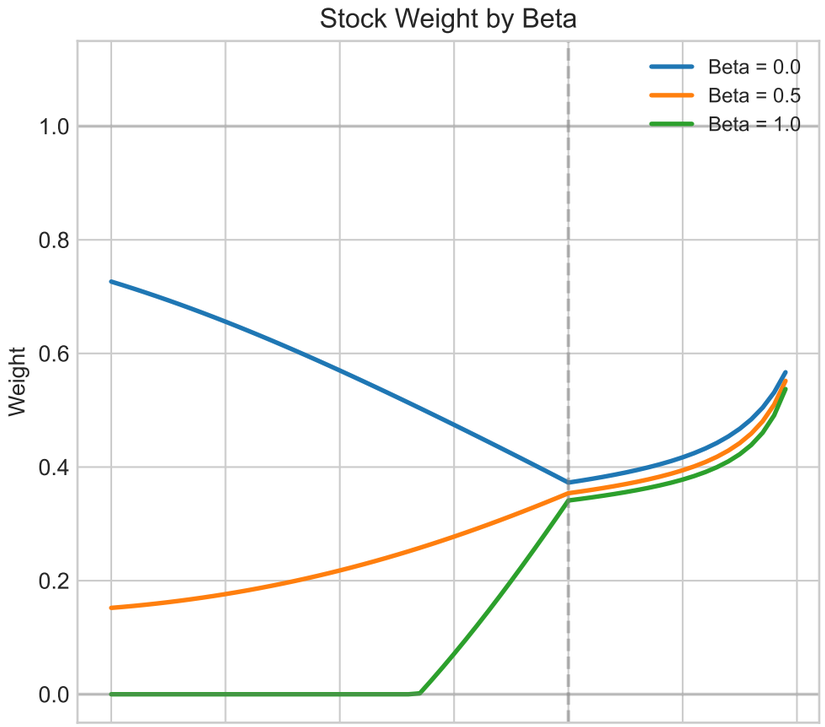



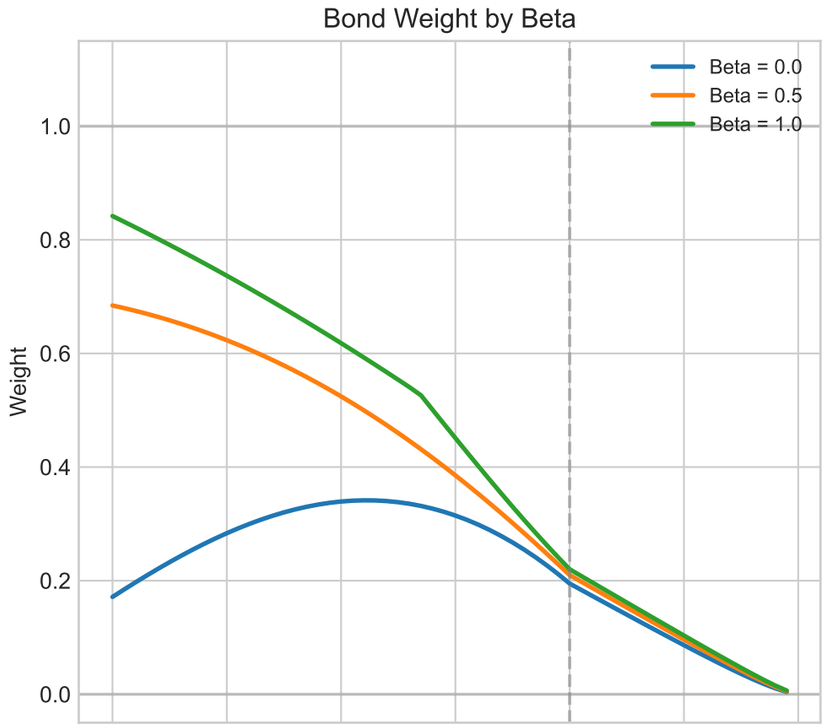



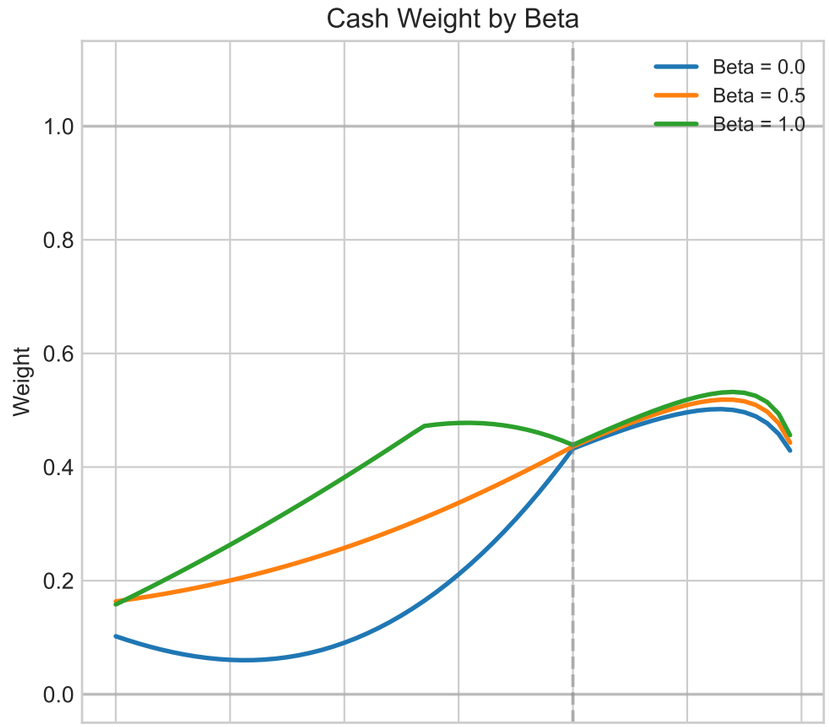



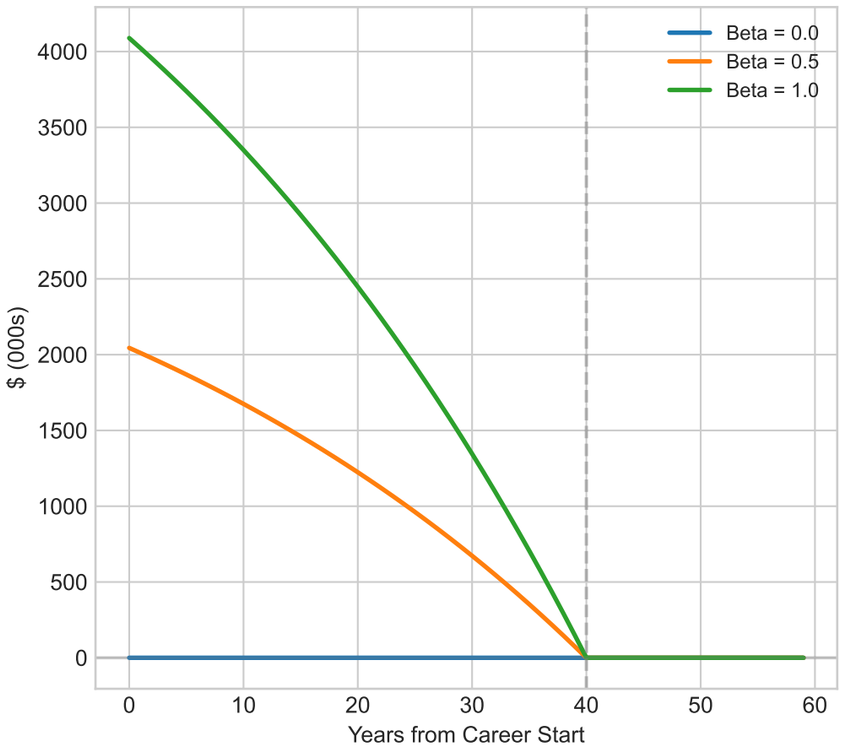



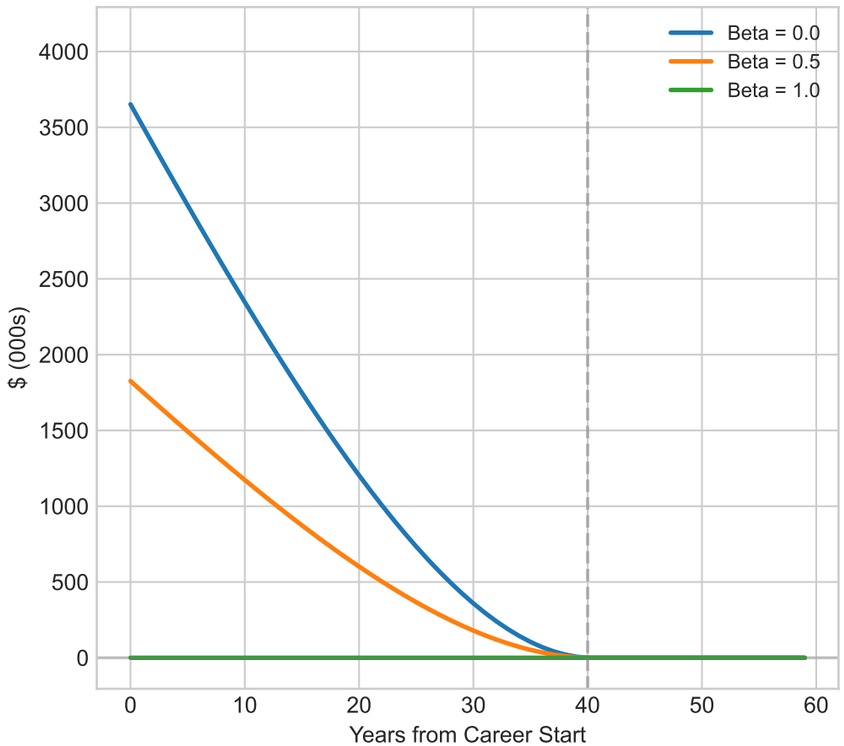
# Effect of Stock Beta on Portfolio Allocation & Human Capital

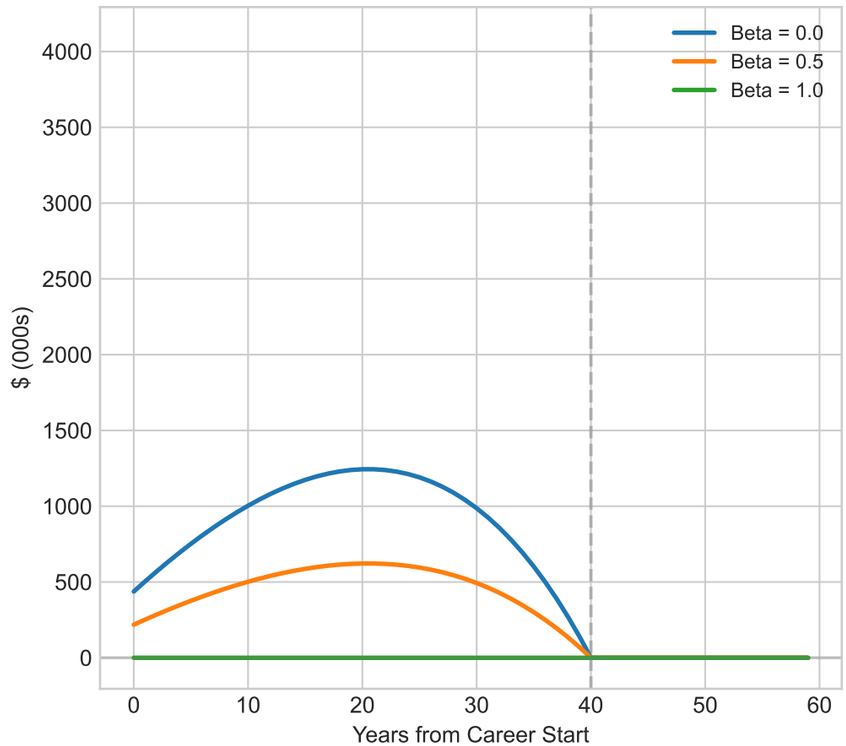


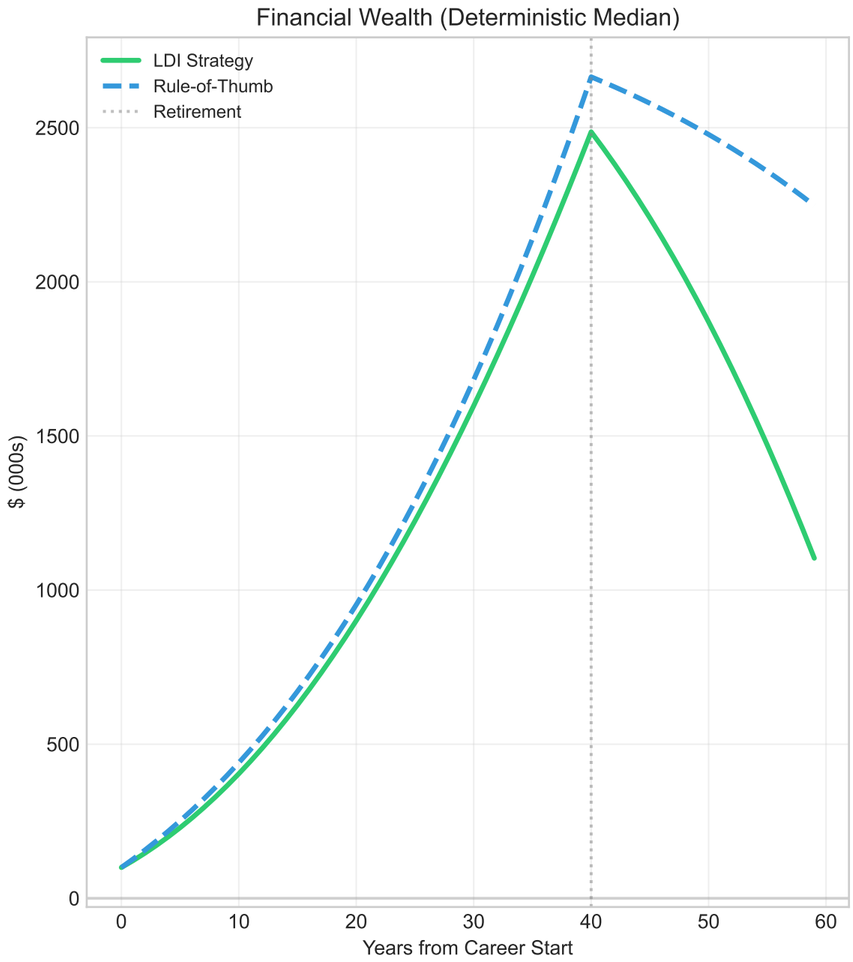



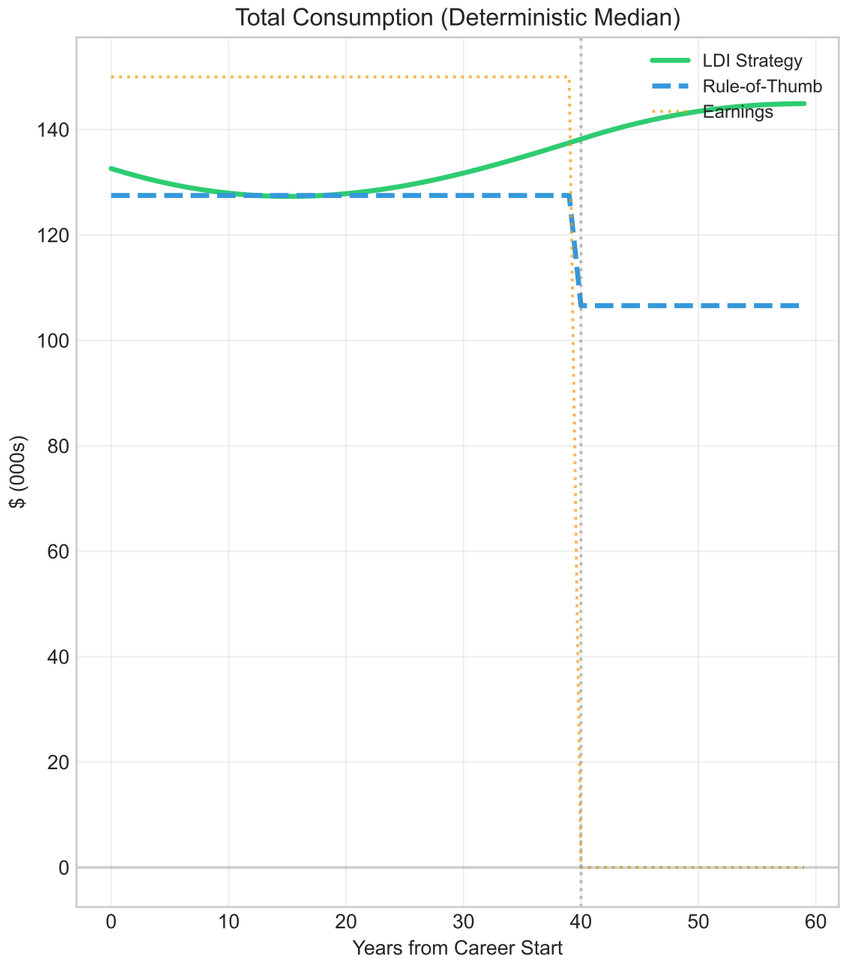



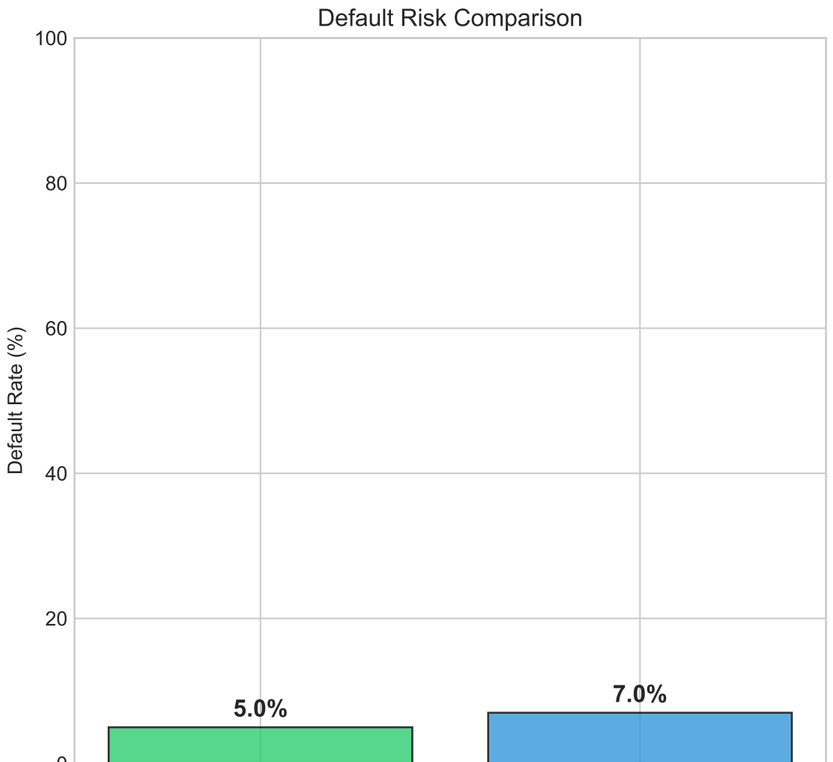
# PAGE 5: LDI vs Rule-of-Thumb (Deterministic Median Path)

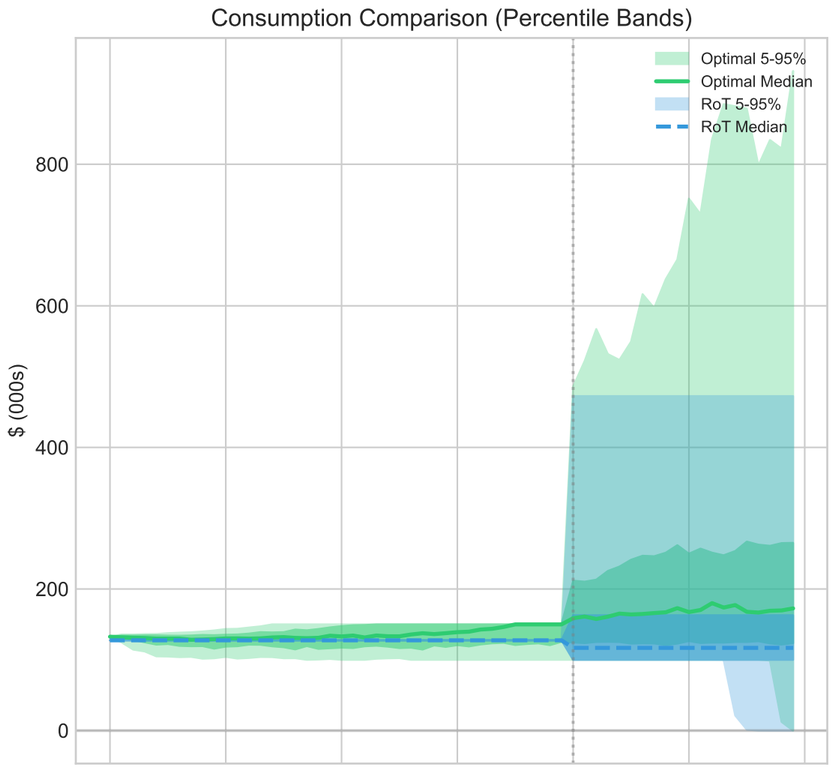


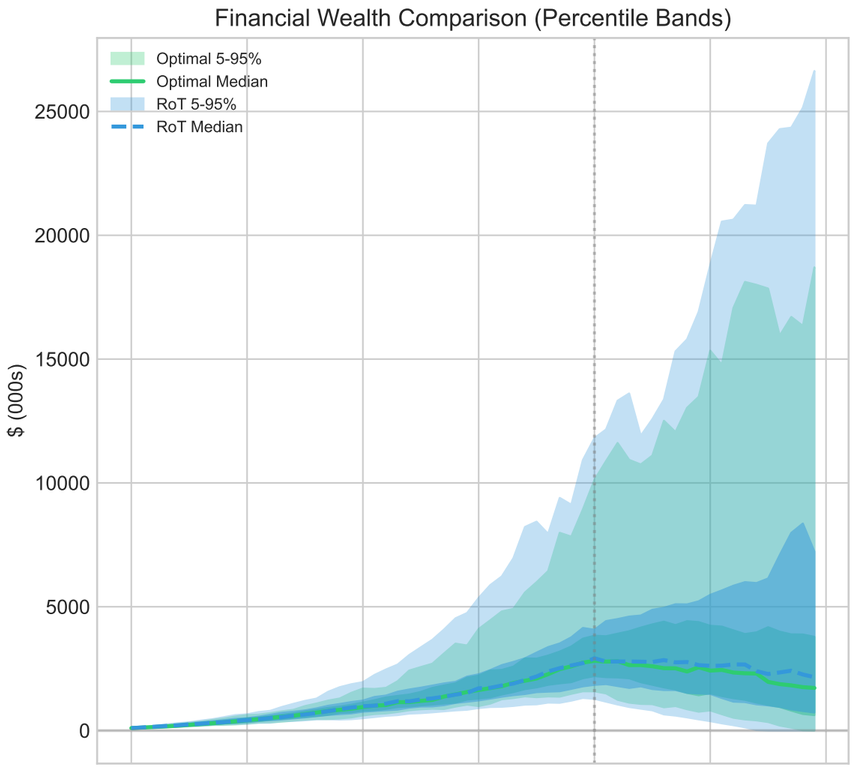



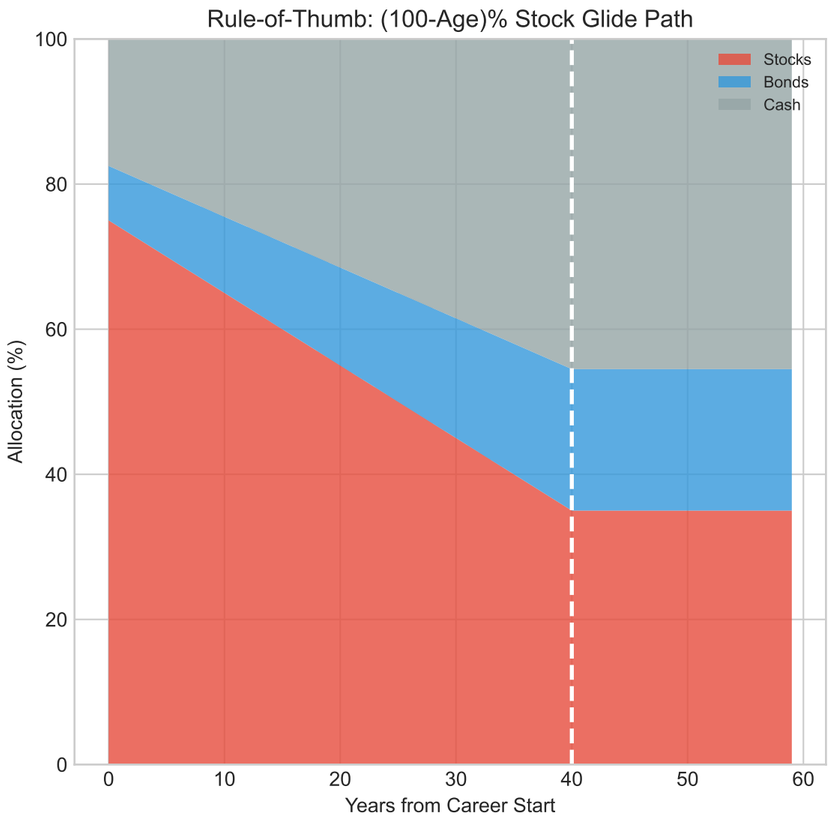

```
Median Path Comparison (Expected Returns)
==========================================

LDI Strategy:
  - Variable consumption based on net worth
  - MV-optimal allocation (constant targets)
  - Adapts consumption to wealth changes

Rule-of-Thumb Strategy:
  - Savings Rate: 15% of income
  - Stock Allocation: (100 - age)%
  - FI Target Duration: 6 years
  - FI Split: 30% bonds / 70% cash
    (bonds=20yr duration)
  - Retirement: 4% fixed withdrawal

PV Lifetime Consumption (@ r=2.0%):
  - LDI Strategy:     $4,704k
  - Rule-of-Thumb:    $4,363k
  - Difference:       $+341k
                      (+7.8%)
```

# PAGE 6: LDI vs Rule-of-Thumb (Monte Carlo Comparison)

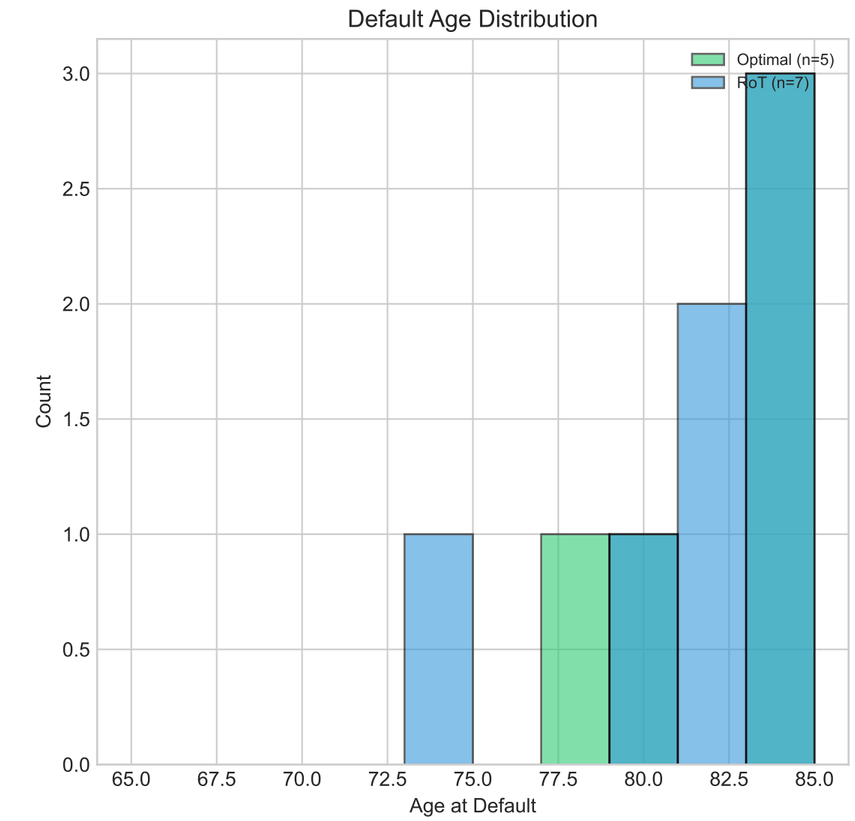



```
Strategy Comparison Summary
========================================
Number of Simulations: 100

                    Optimal    Rule-of-Thumb
                    -------    -------------
Default Rate:          5.0%          7.0%
Median Final Wealth: 1,722k          2,155k

Rule-of-Thumb Strategy:
  - Savings Rate: 15% of income
  - Stock Allocation: (100 - age)%
  - FI Duration: 6 years (30% bonds, 70% cash)
  - Retirement: 4% fixed withdrawal

LDI Strategy:
  - Variable consumption based on net worth
  - MV-optimal allocation
  - Adapts to market conditions
```



```
Lifecycle Investment Strategy Parameters
========================================

Age Parameters:
  - Career Start: 25
  - Retirement Age: 65
  - Planning Horizon: 85

Income Parameters:
  - Initial Earnings: $150k
  - Earnings Growth: 0.0%
  - Peak Earnings Age: 65

Subsistence Expense Parameters:
  - Base Expenses: $100k
  - Retirement Expenses: $100k

Initial Wealth:
  - Starting Financial Wealth: $100k

Consumption Model:
  - Total Consumption = Subsistence + Rate x Net Worth
  - Net Worth = Human Capital + Financial Wealth - PV(Future Expenses)
  - Consumption Rate = Median Return + 0.0pp

Human Capital Allocation:
  - Stock Beta: 0.00
  - Bond Duration: 20.0 years (used for HC decomposition and MV optimization)

Mean-Variance Optimization (Full VCV):
  - Risk-Free Rate (r_bar): 2.0%
  - Stock Excess Return (mu_s): 4.0%
  - Bond Sharpe Ratio: 0.00 → mu_b = 0.00%
  - Stock Volatility (sigma_s): 18%
  - Rate Shock Volatility (sigma_r): 0.6%
  - Rate/Stock Correlation (rho): 0.00
  - Risk Aversion (gamma): 2.0
  - Allocation Source: Mean-Variance Optimization (Full VCV)
  - w* = (1/gamma) * Sigma^(-1) * mu (Full VCV Merton solution)

VCV-Based Asset Return Models:
  - Stock: R_s = r + mu_s + sigma_s * eps_s
  - Bond:  R_b = r + mu_b - D * sigma_r * eps_r
  - Bond Vol: D * sigma_r = 12.0%
  - Cov(R_s,R_b): -D*sigma_s*sigma_r*rho = -0.000%

Target Total Wealth Allocation (from MV):
  - Stocks: 61.7%
  - Bonds: 0.0%
  - Cash: 38.3%

Key Insights:
-------------
1. Portfolio allocation is derived from full Merton
   solution: w* = (1/gamma) * Sigma^(-1) * mu

2. The VCV matrix accounts for bond return volatility
   from duration and rate shock correlation with stocks.

3. Changing gamma, mu, sigma, rho, or duration allows
   studying how portfolios respond to assumptions.

4. Human capital is treated as implicit asset holdings,
   and financial portfolio adjusts to reach total targets.
```