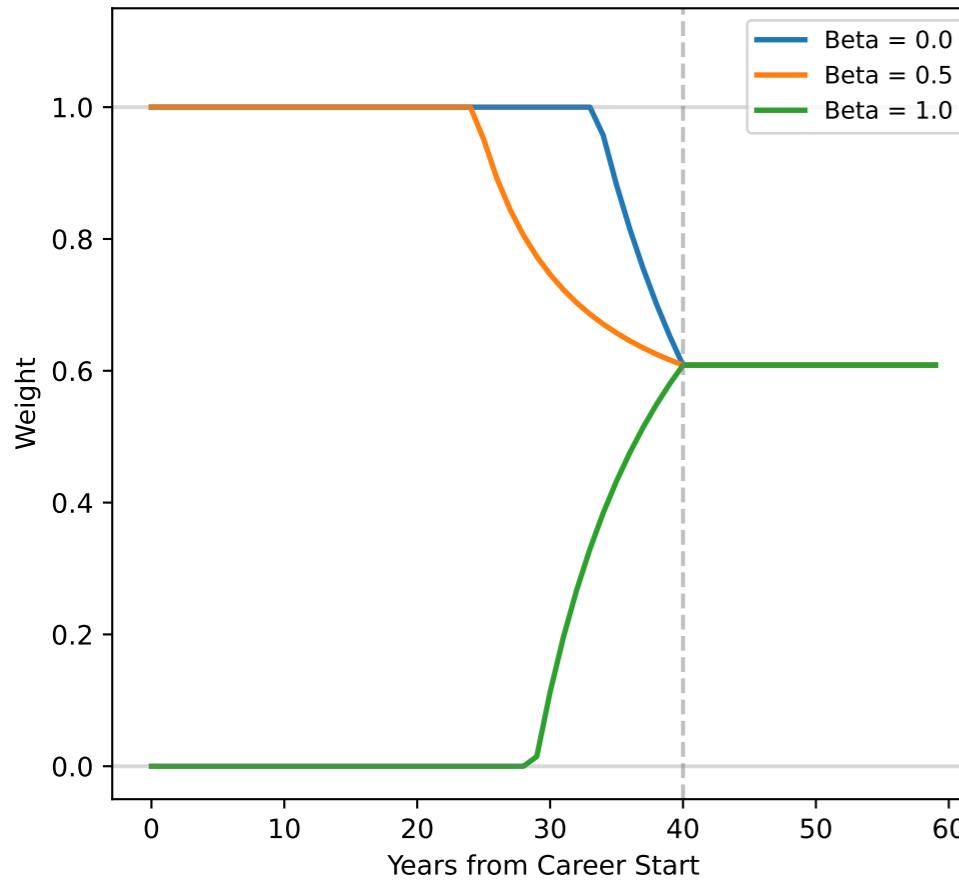
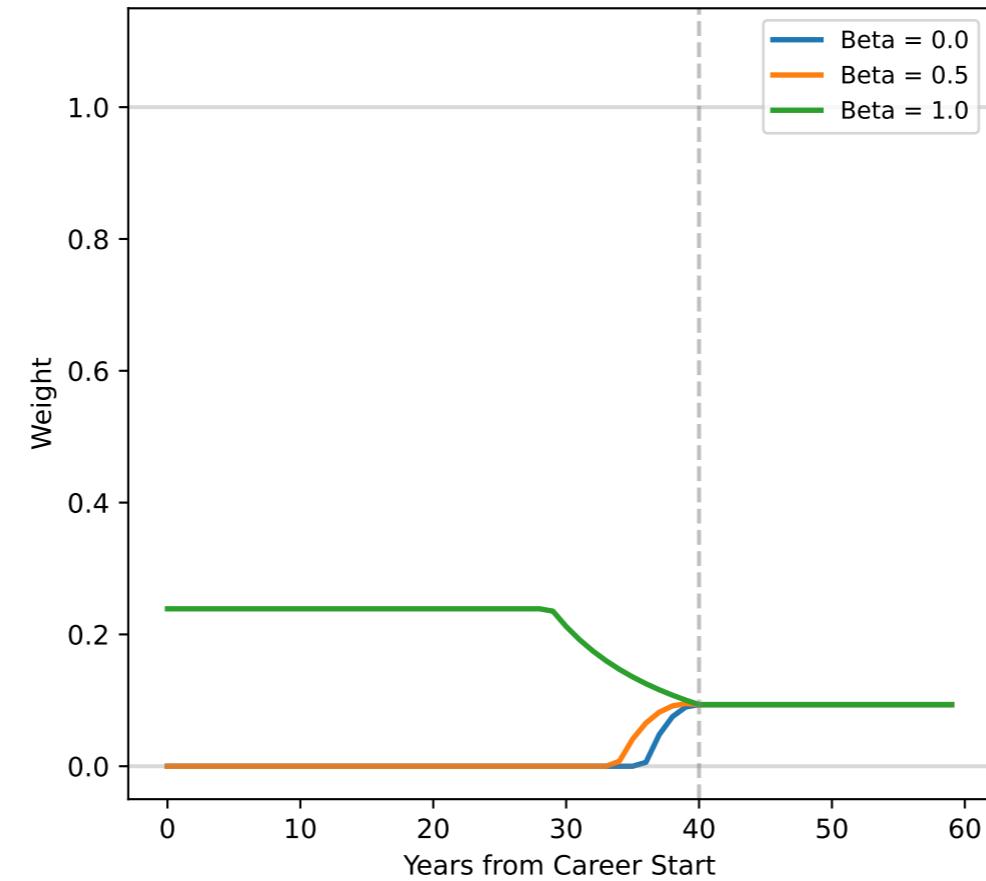


Effect of Stock Beta on Portfolio Allocation

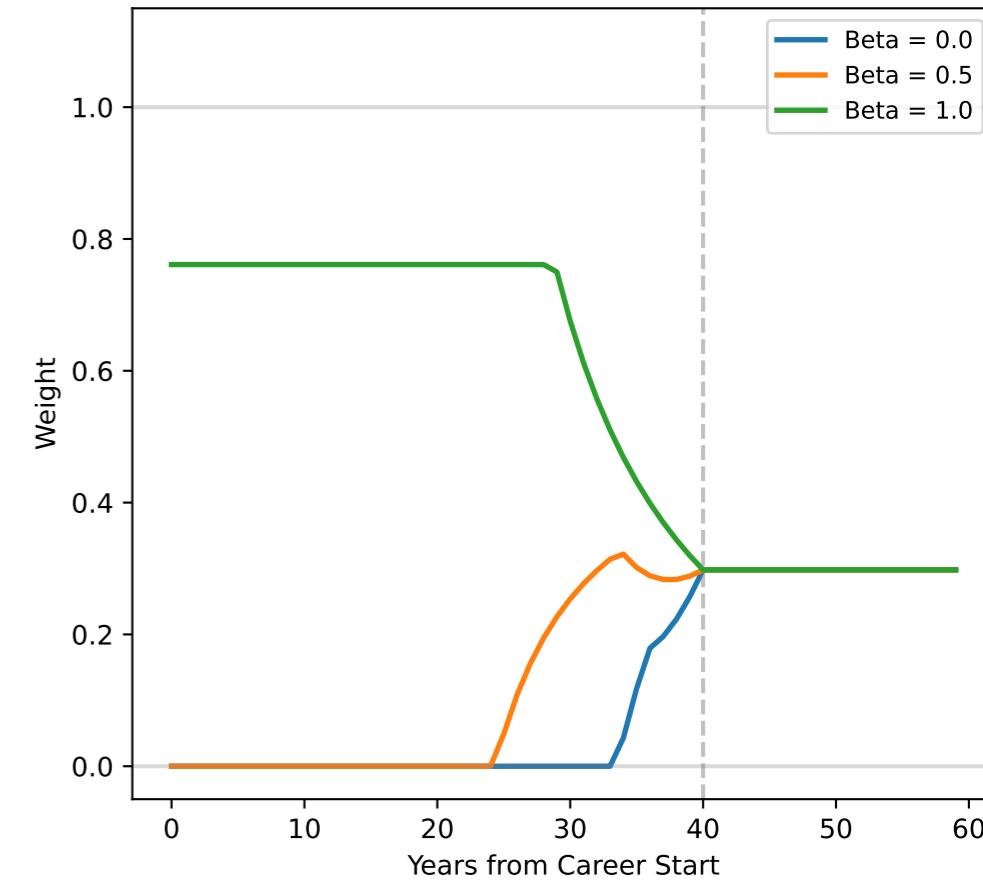
Stock Weight by Beta



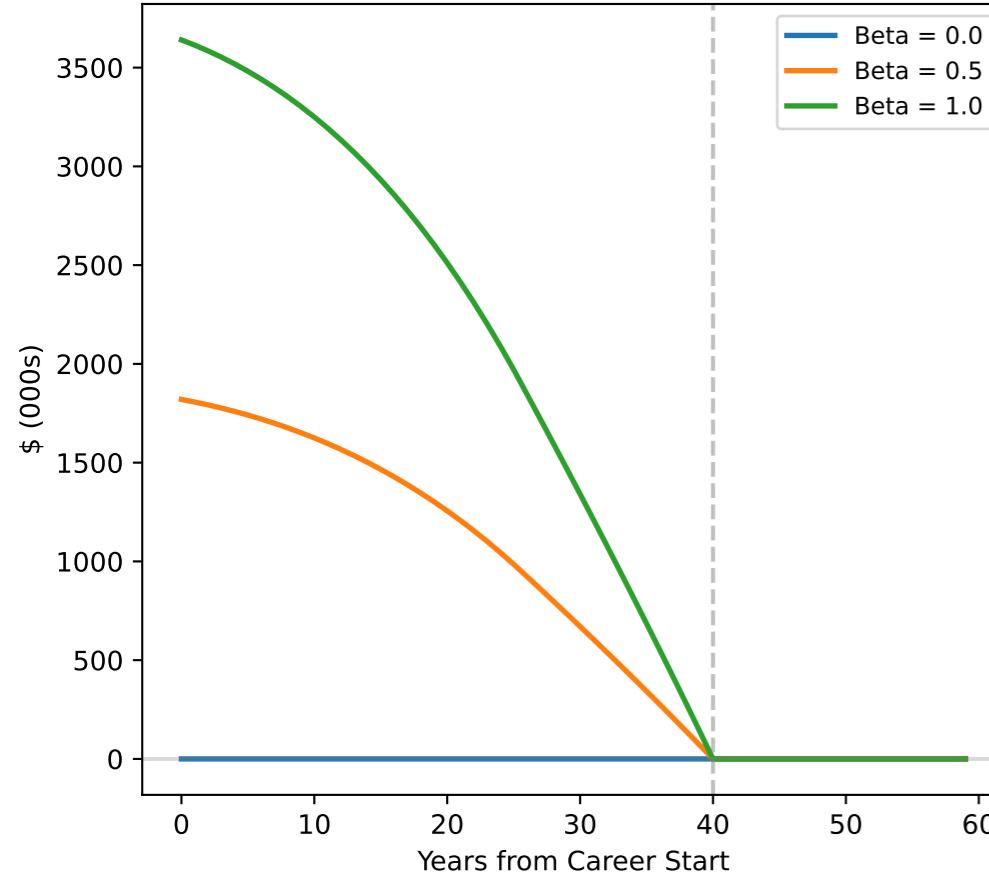
Bond Weight by Beta



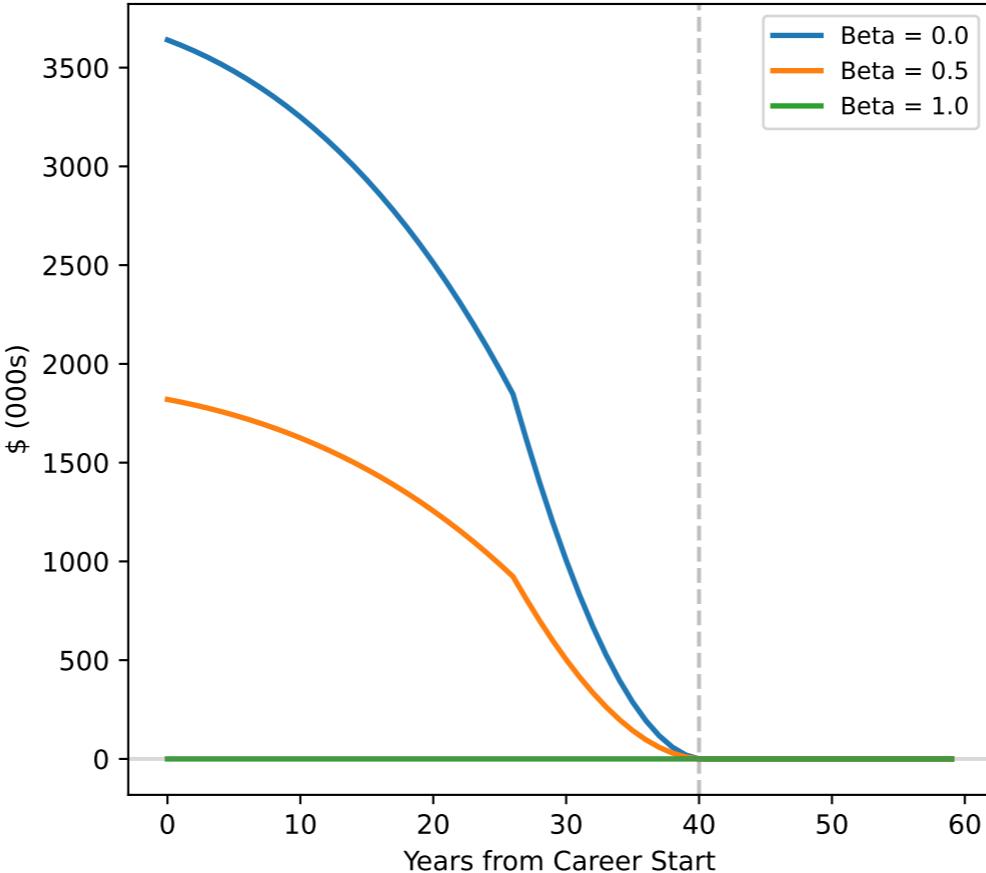
Cash Weight by Beta



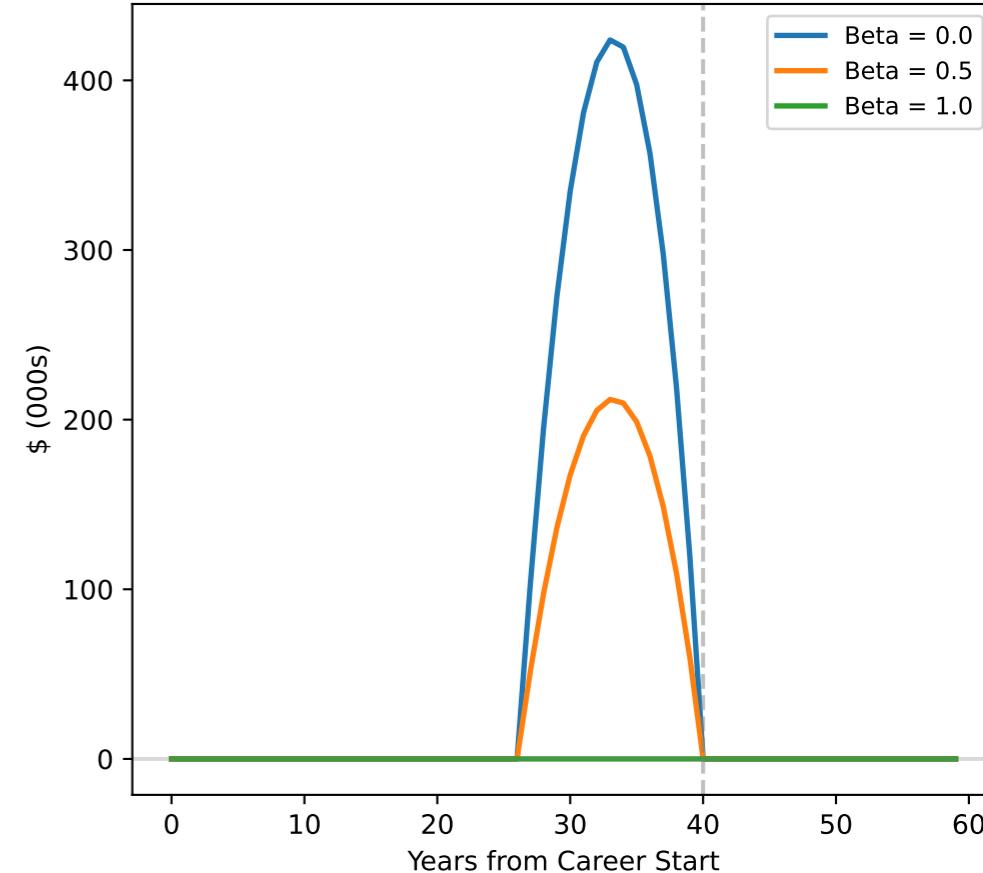
Stock Component of Human Capital



Bond Component of Human Capital

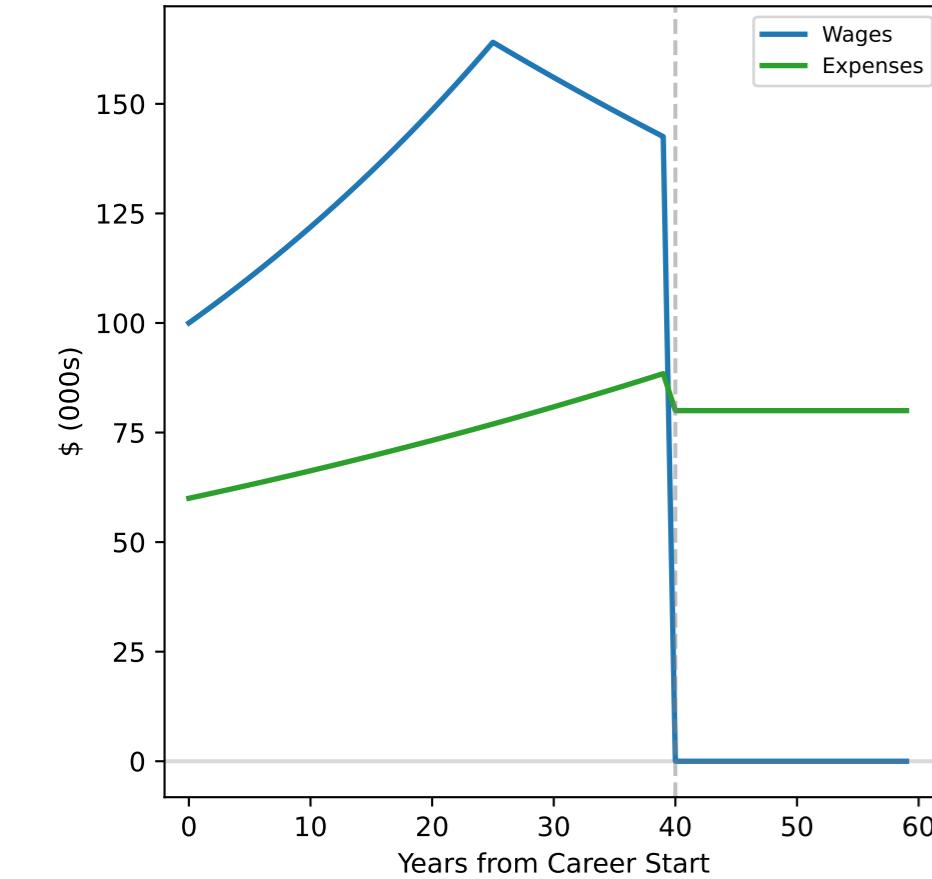


Cash Component of Human Capital

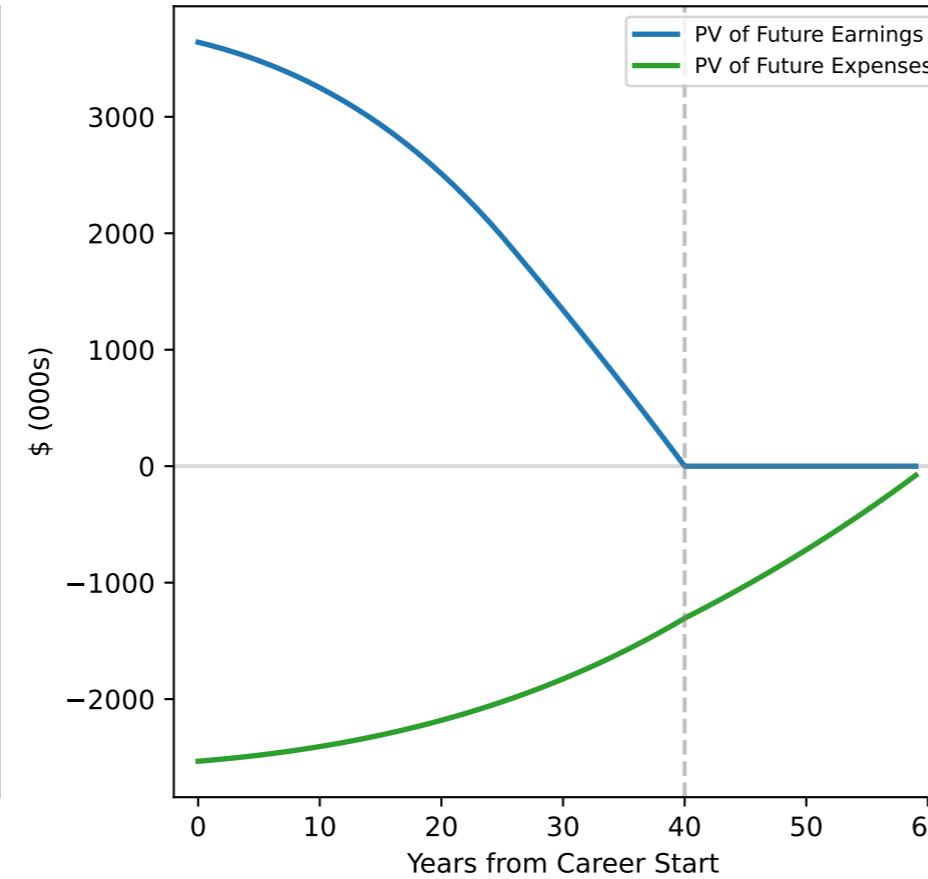


Lifecycle Investment Strategy - Beta = 0.0

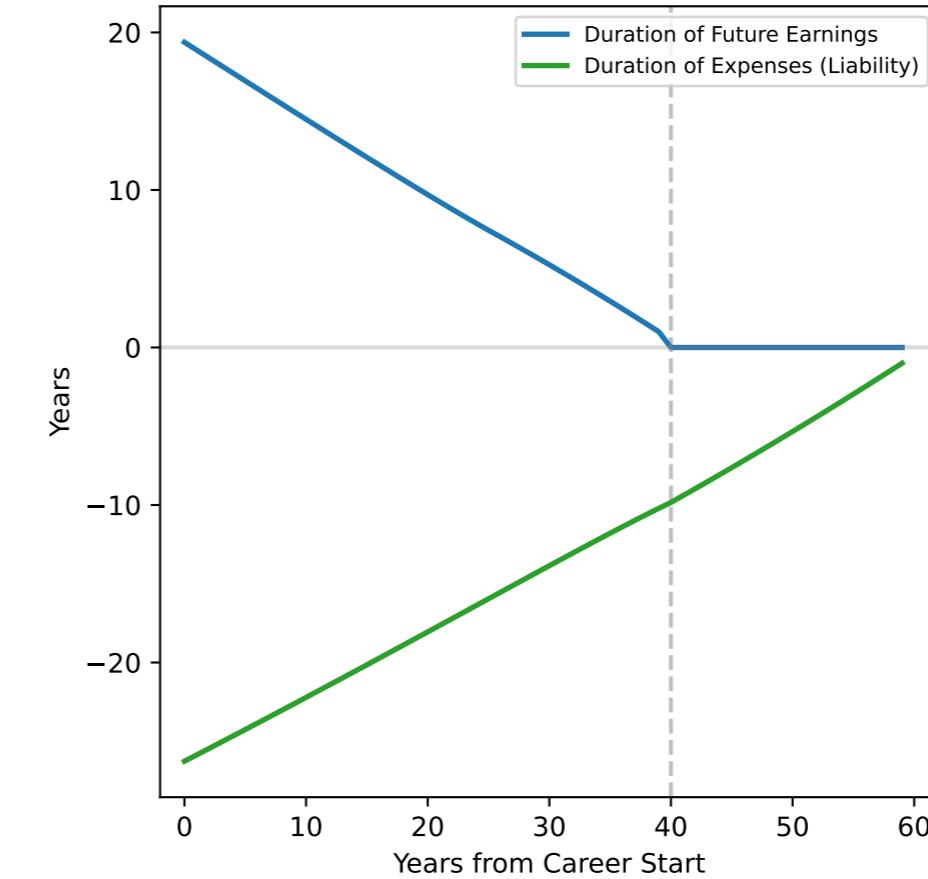
Profile of Earnings and Expenses



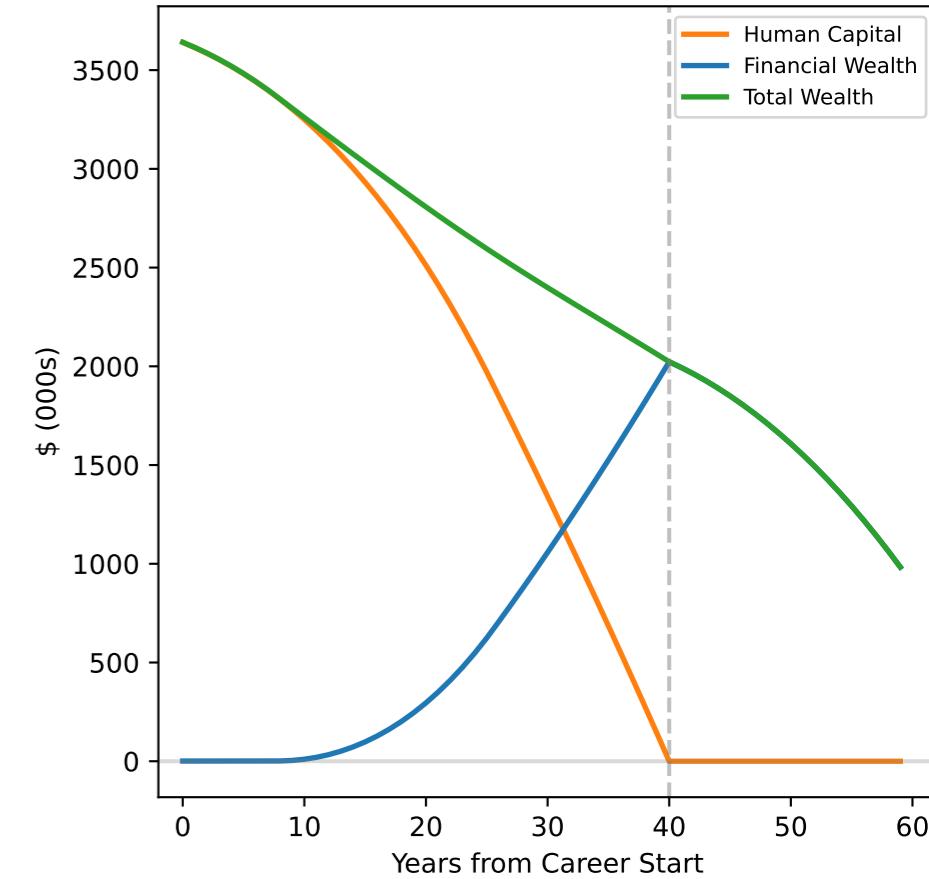
Forward Looking Present Values



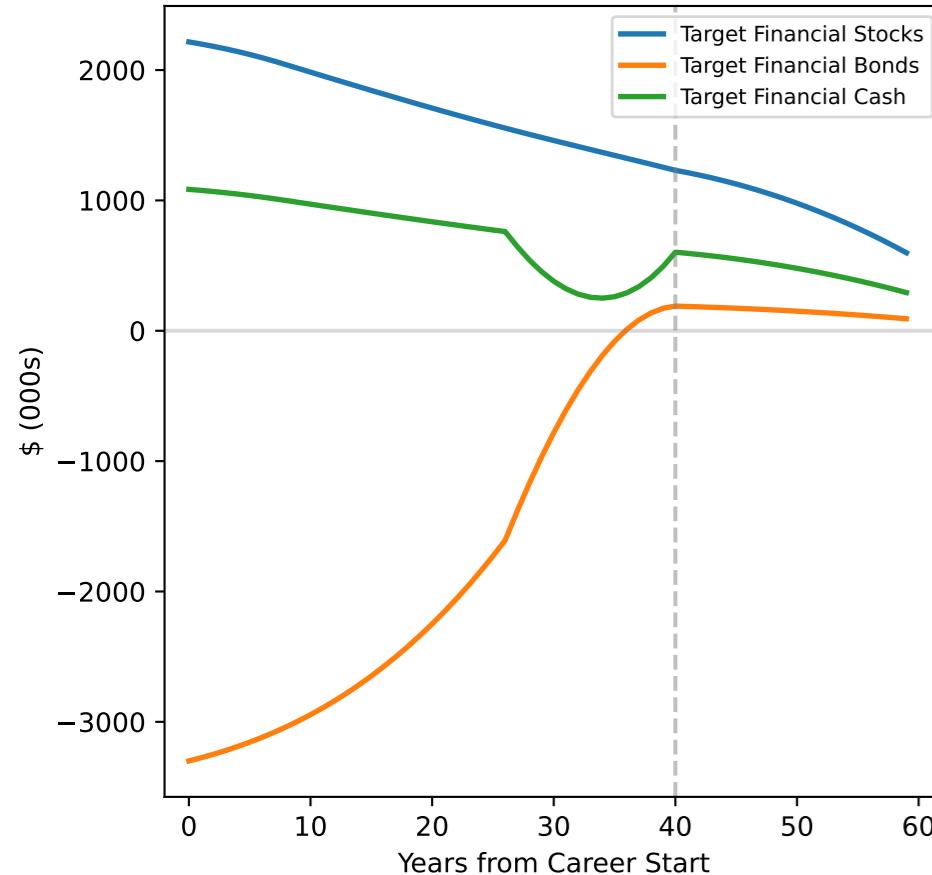
Durations of Assets



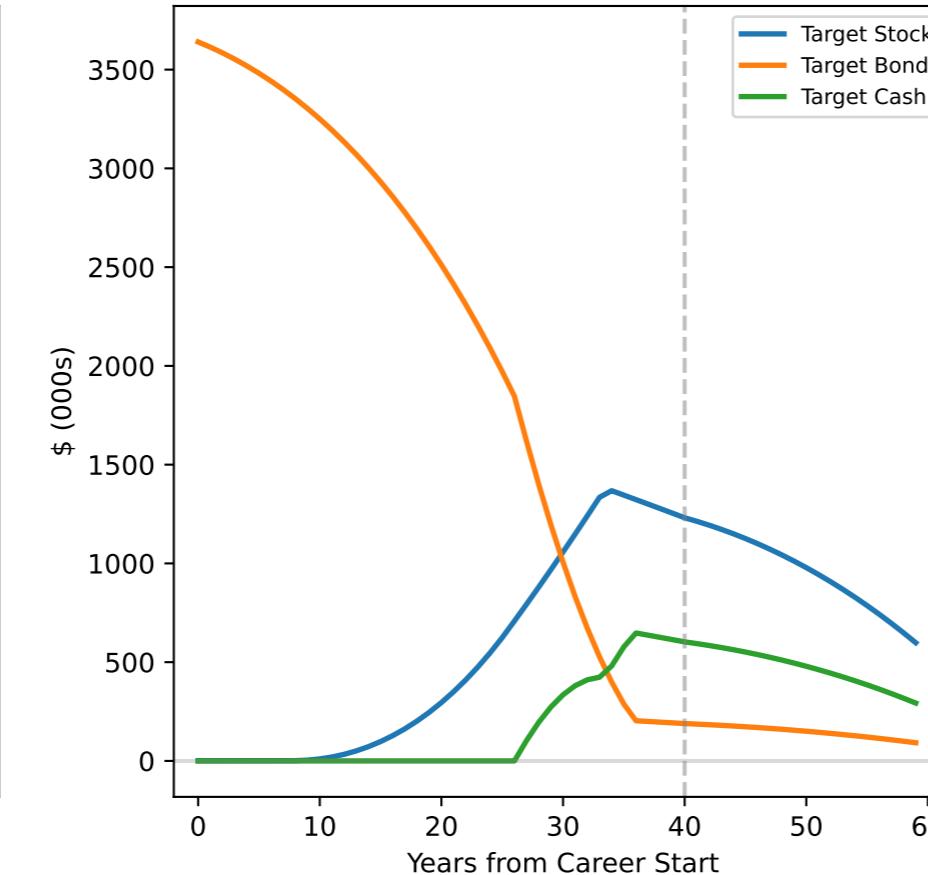
Human Capital vs Financial Wealth



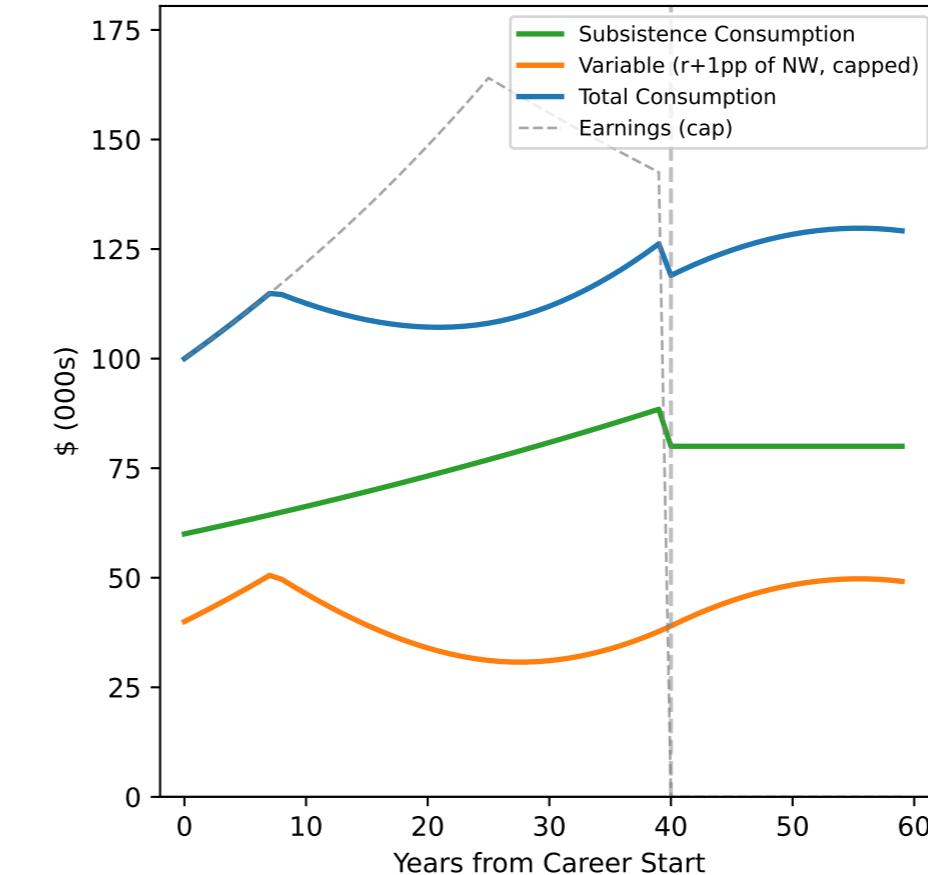
Target Financial Holdings



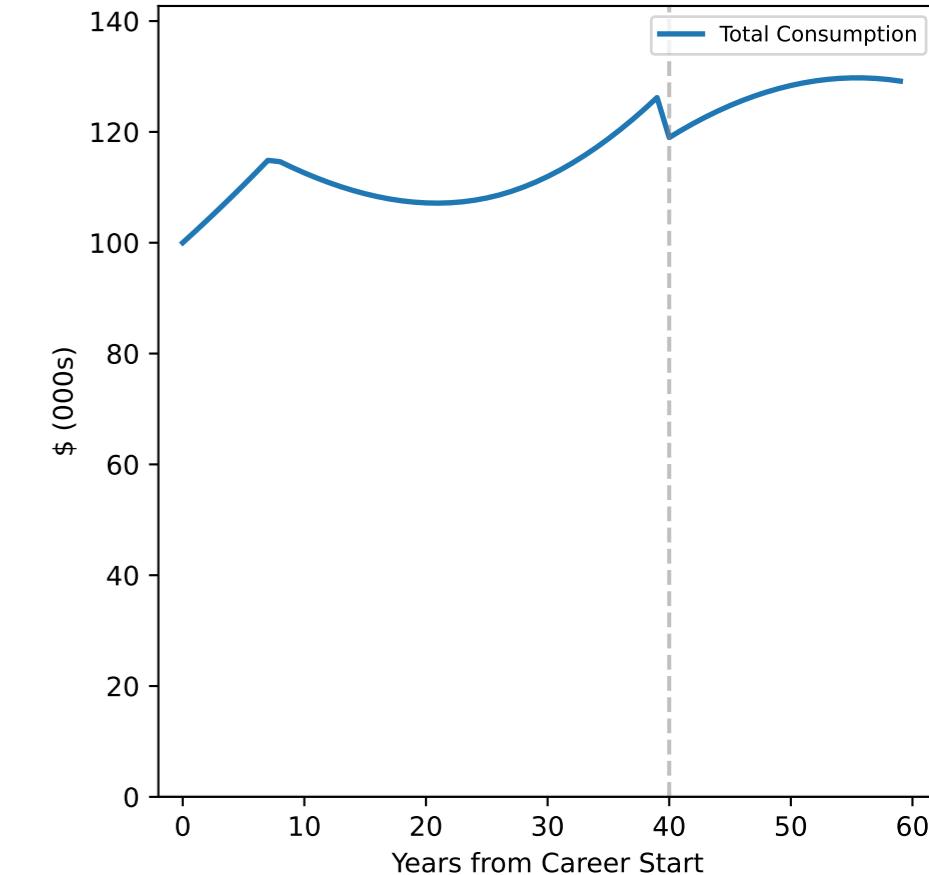
Target Total Wealth Holdings



Consumption Breakdown

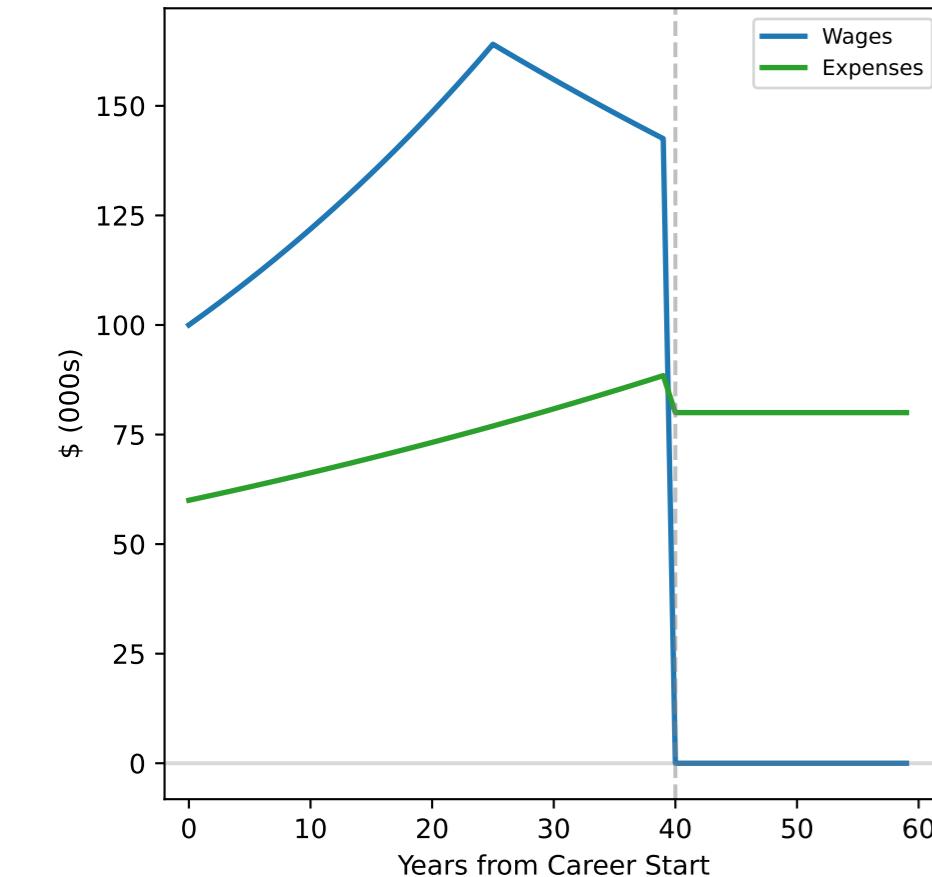


Total Consumption

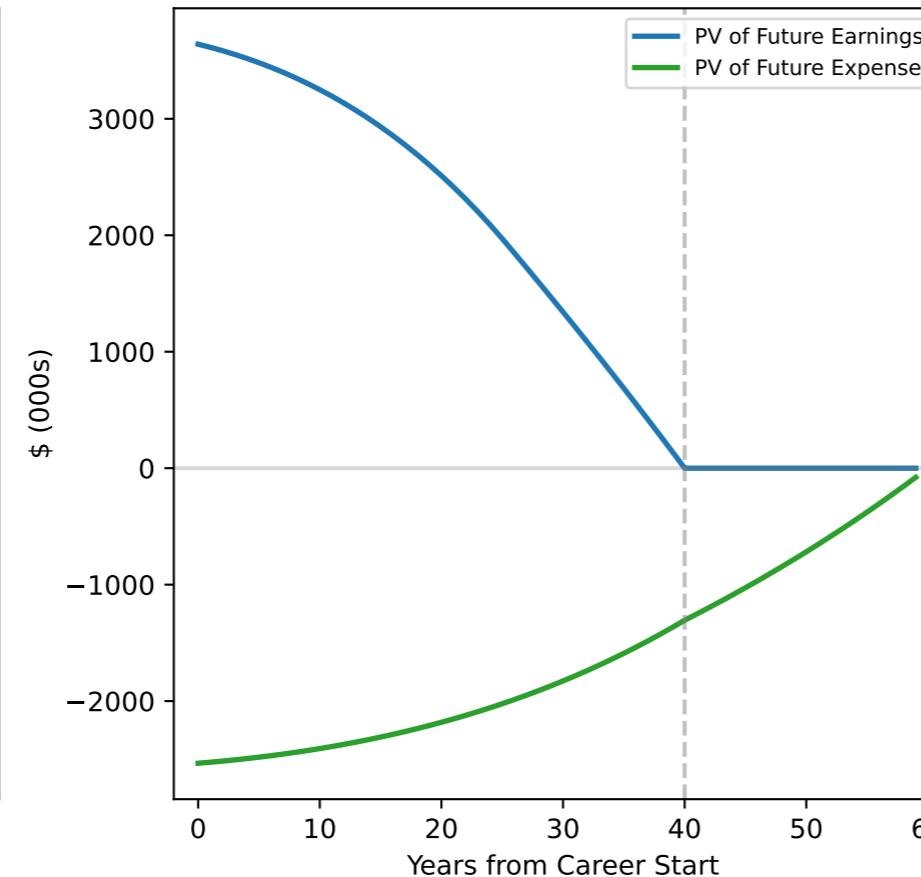


Lifecycle Investment Strategy - Beta = 0.5

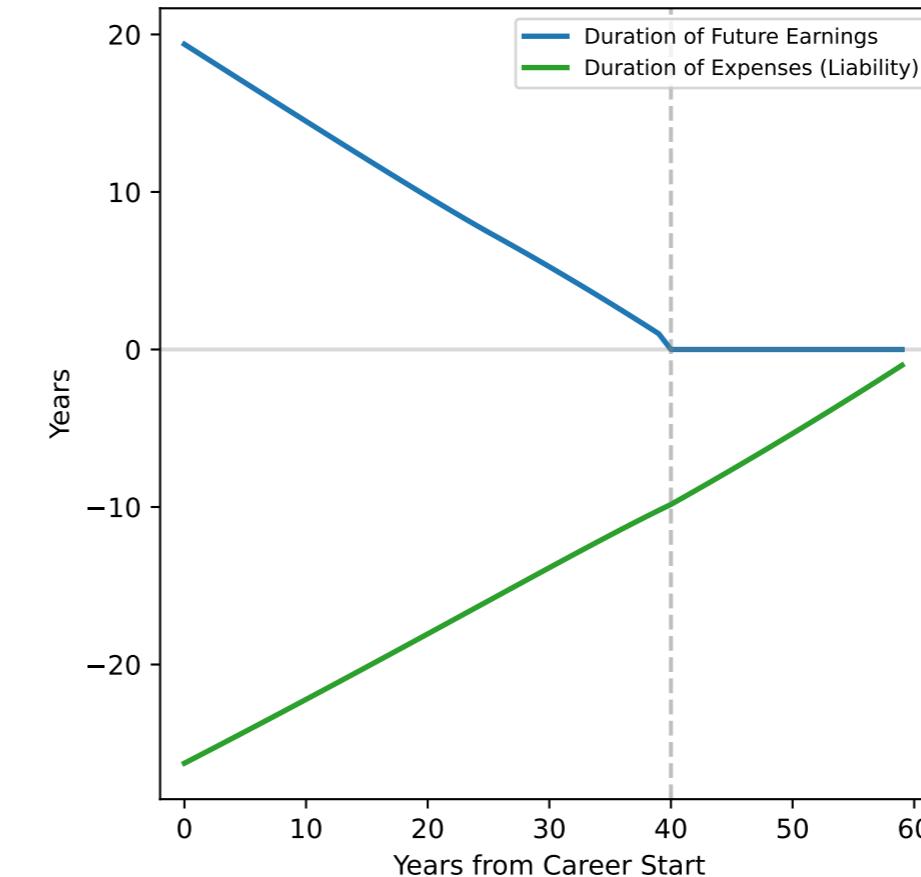
Profile of Earnings and Expenses



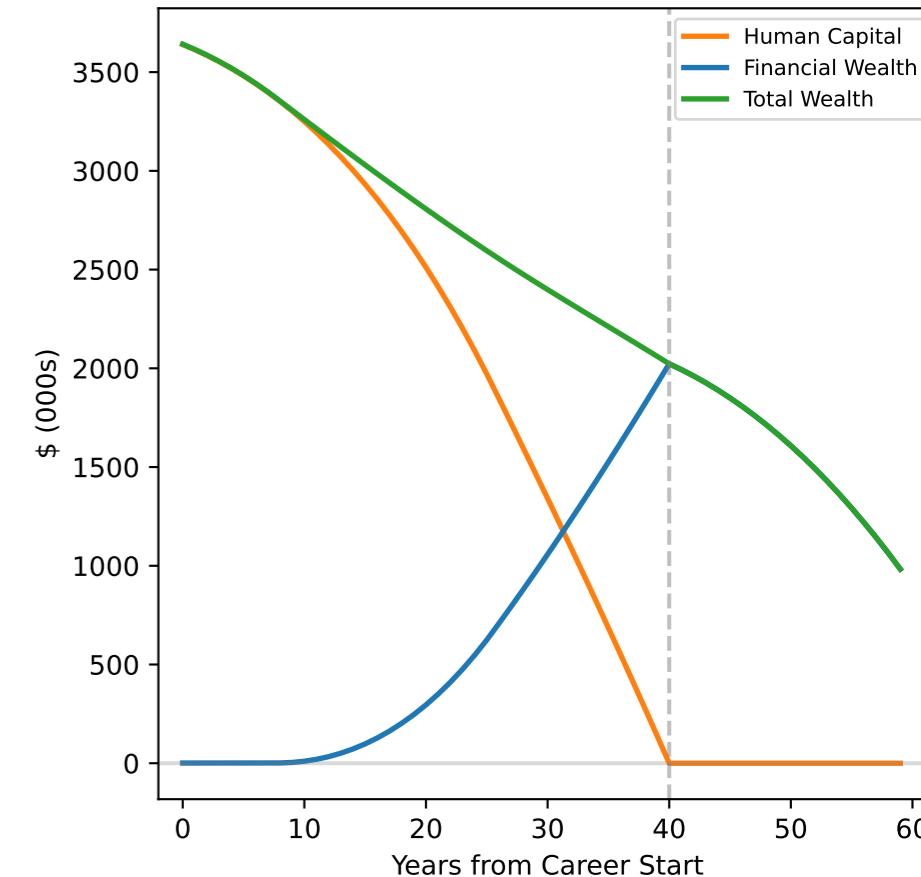
Forward Looking Present Values



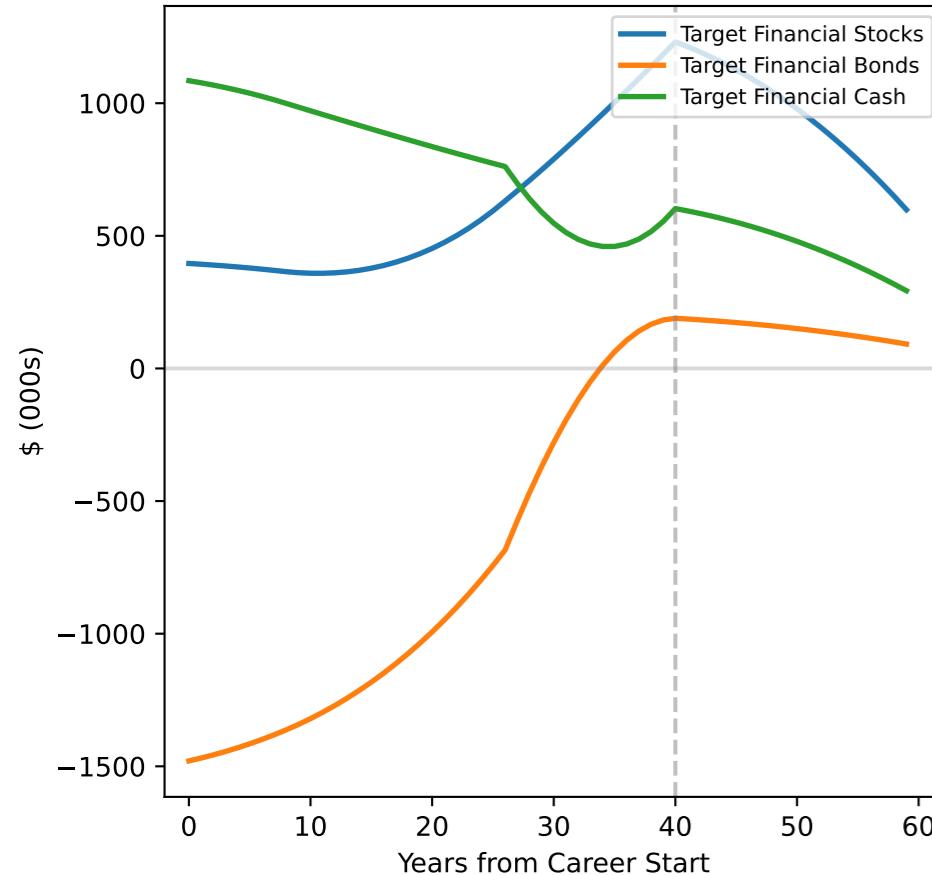
Durations of Assets



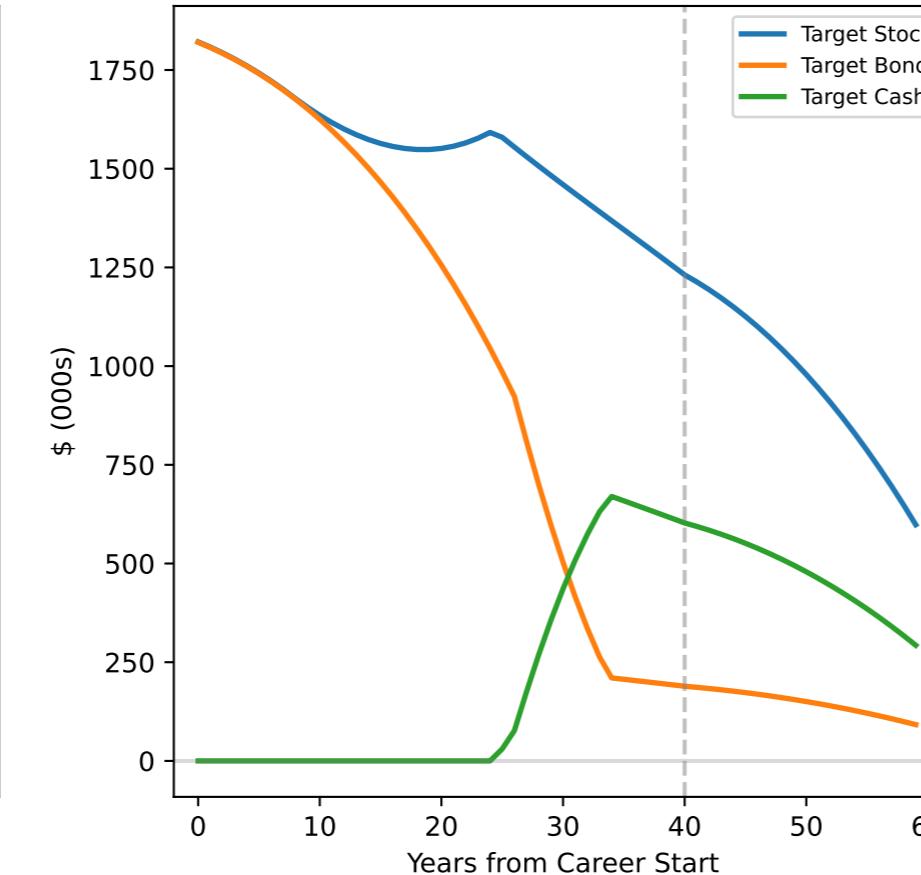
Human Capital vs Financial Wealth



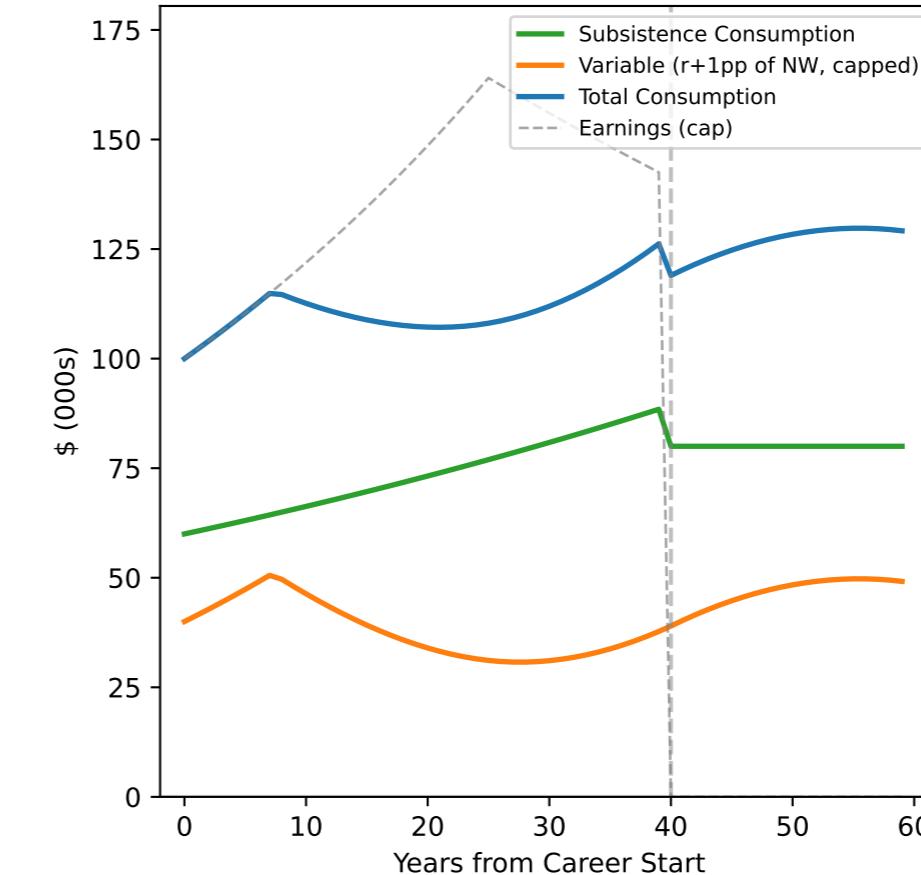
Target Financial Holdings



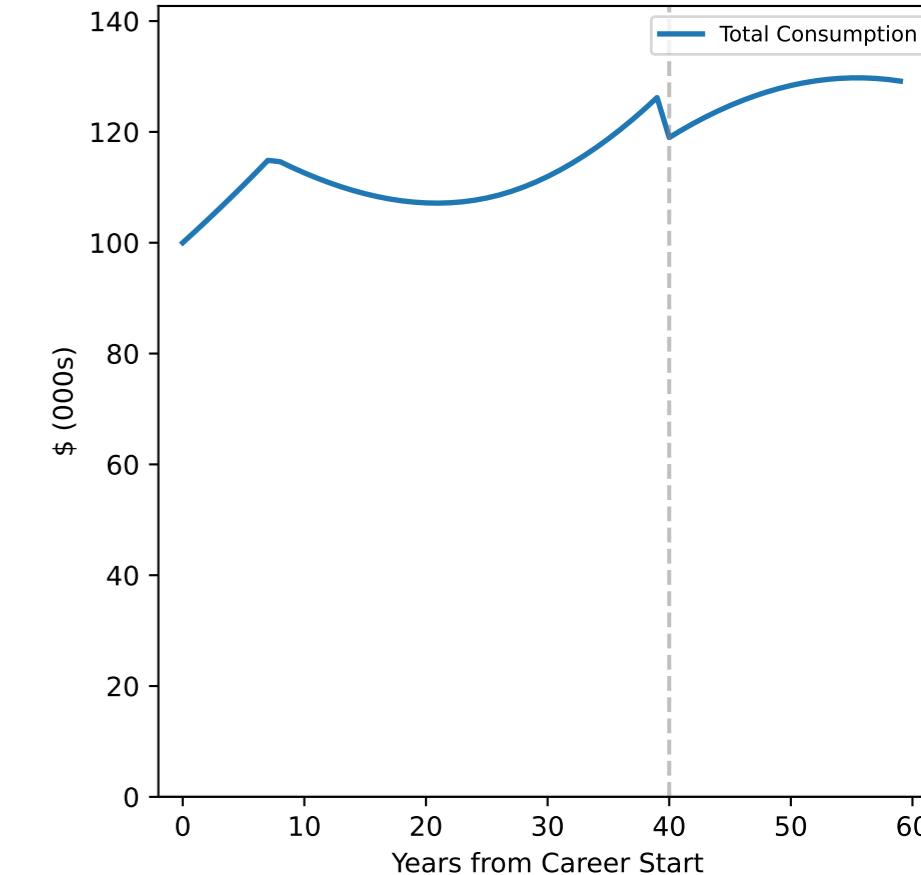
Target Total Wealth Holdings



Consumption Breakdown

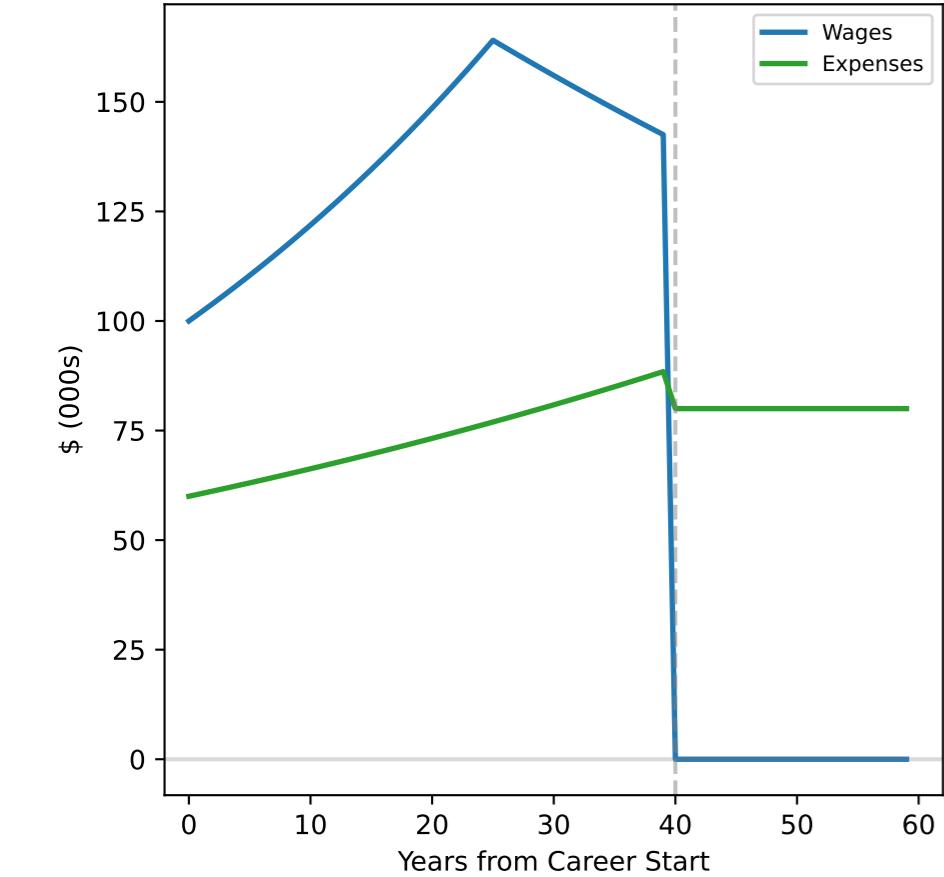


Total Consumption

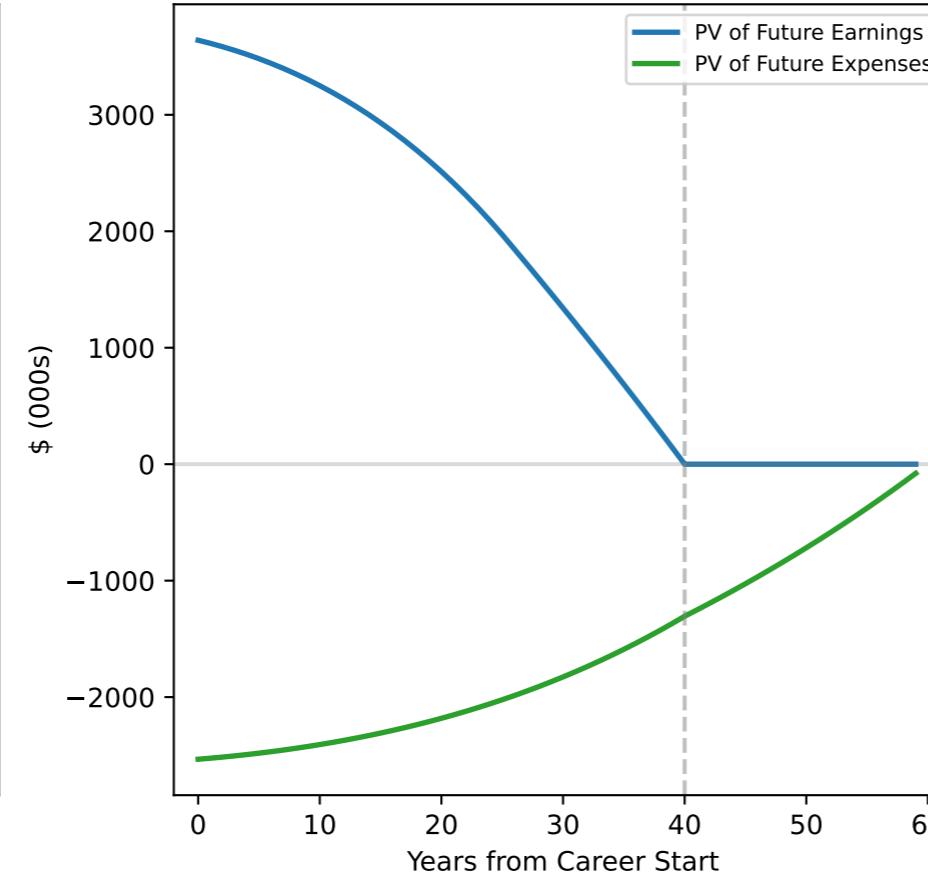


Lifecycle Investment Strategy - Beta = 1.0

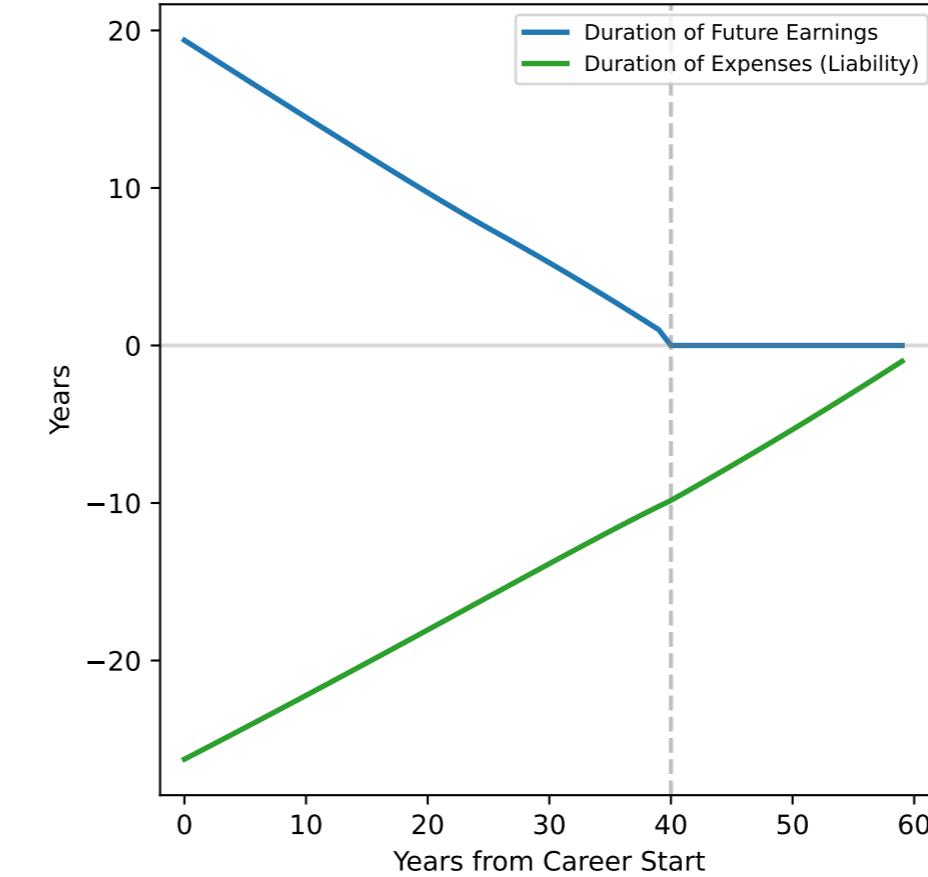
Profile of Earnings and Expenses



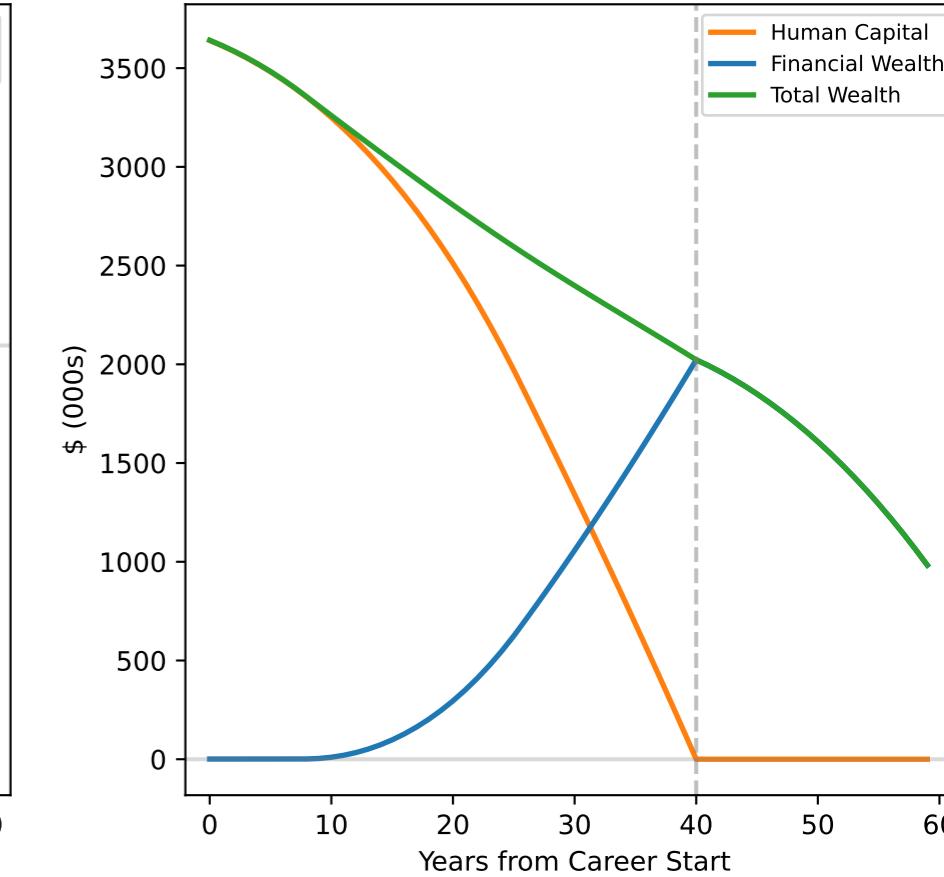
Forward Looking Present Values



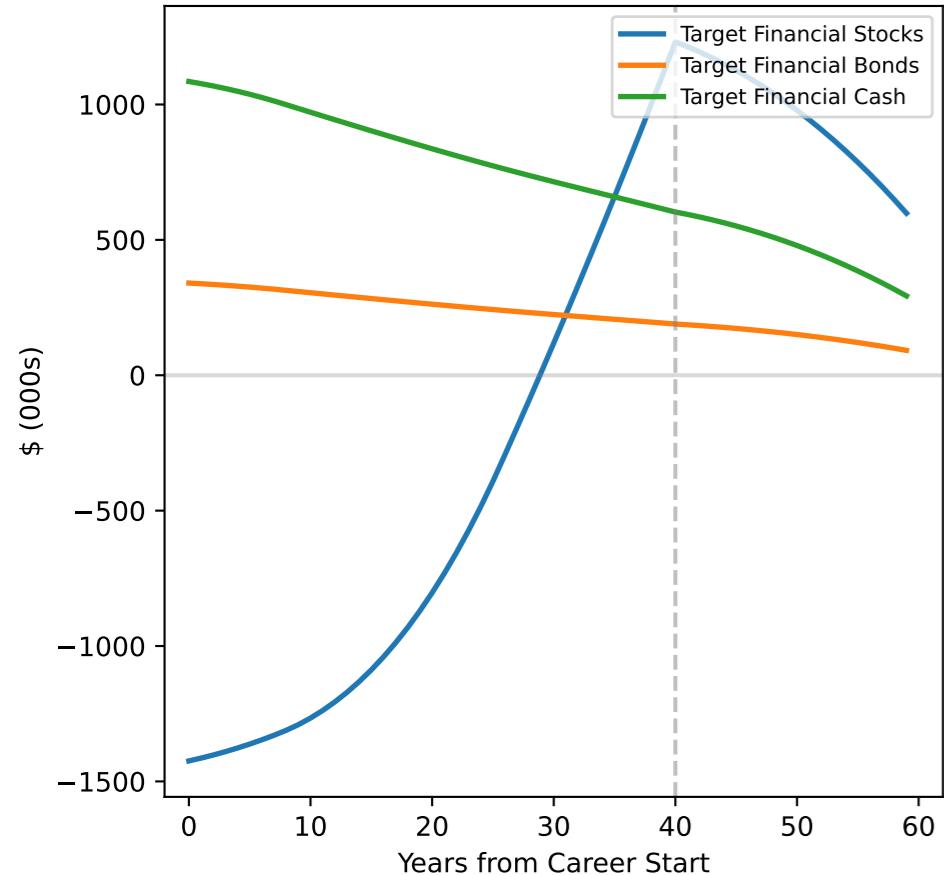
Durations of Assets



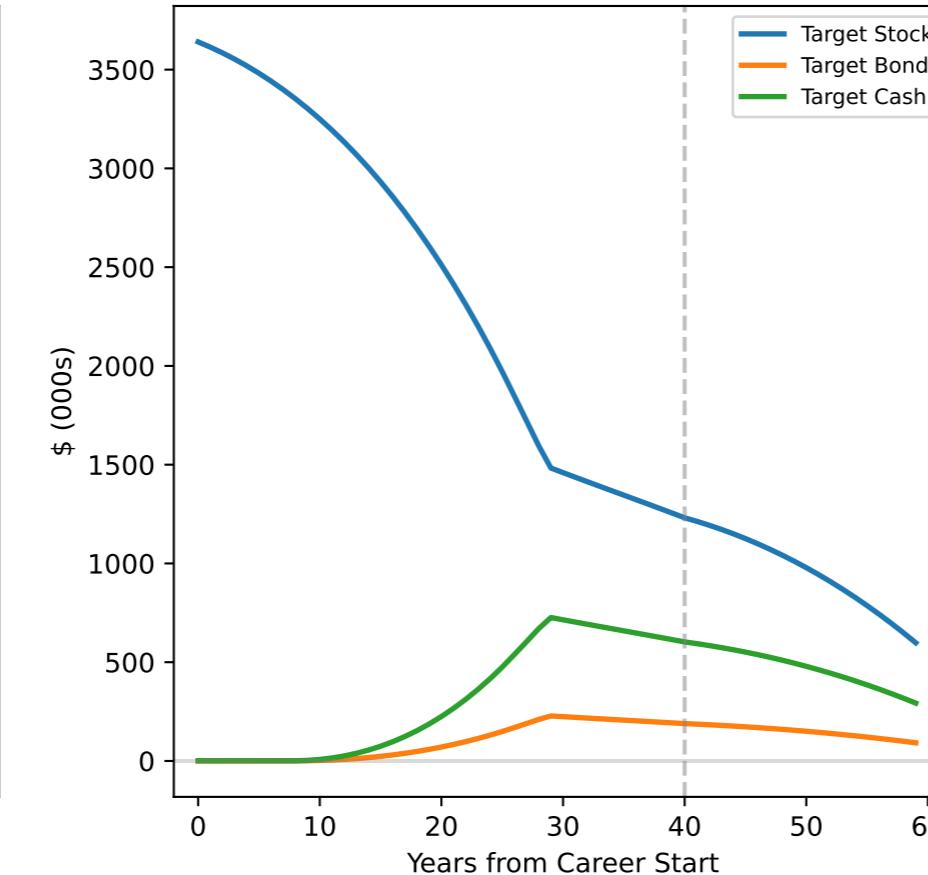
Human Capital vs Financial Wealth



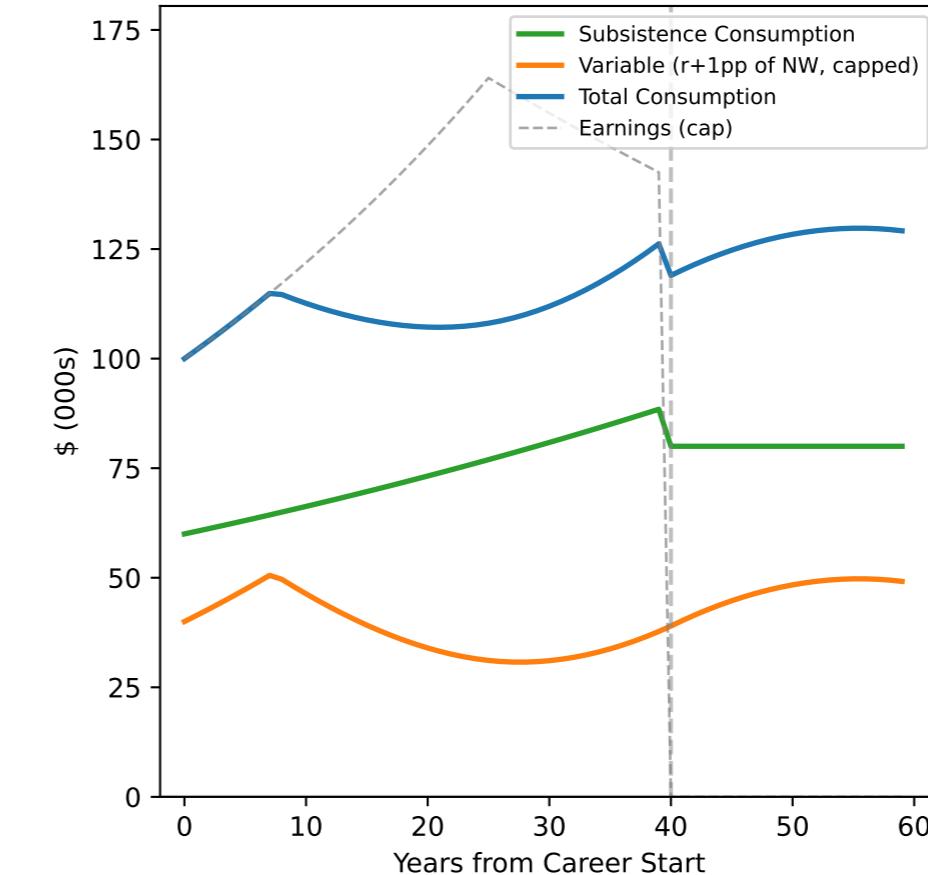
Target Financial Holdings



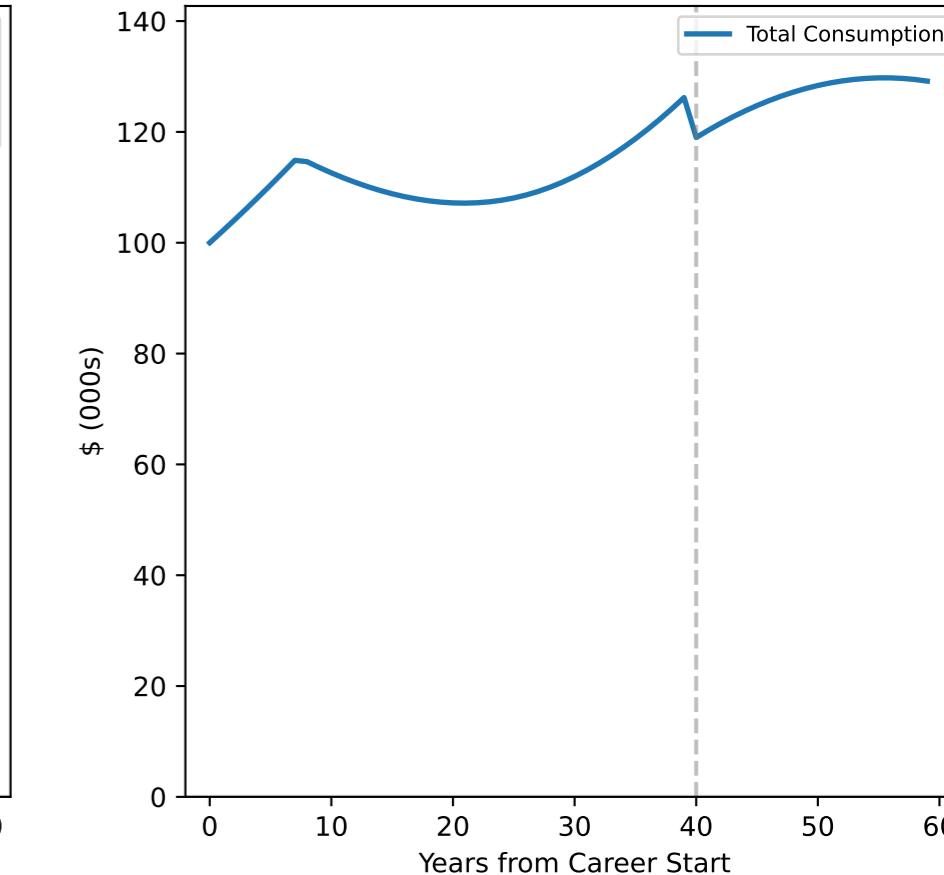
Target Total Wealth Holdings



Consumption Breakdown



Total Consumption



Lifecycle Investment Strategy Parameters

Age Parameters:

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

Income Parameters:

- Initial Earnings: \$100k
- Earnings Growth: 2.0%
- Peak Earnings Age: 50

Subsistence Expense Parameters:

- Base Expenses: \$60k
- Retirement Expenses: \$80k

Consumption Model:

- Total Consumption = Subsistence + Rate x Net Worth
- Net Worth = Human Capital + Financial Wealth - PV(Future Expenses)
- Consumption Rate = Median Return + 1pp

Human Capital Allocation:

- Stock Beta: 0.10
- Bond Duration Benchmark: 7.0 years

Mean-Variance Optimization (Full VCV):

- Risk-Free Rate ($r_{\bar{r}}$): 2.0%
- Stock Excess Return (μ_s): 4.0%
- Bond Excess Return (μ_b): 0.50%
- Stock Volatility (σ_s): 18%
- Rate Shock Volatility (σ_r): 1.2%
- Rate/Stock Correlation (ρ): -0.20
- Bond Duration (D): 7.0 years
- Risk Aversion (γ): 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: $R_s = r + \mu_s + \sigma_s * \epsilon_s$
- Bond: $R_b = r + \mu_b - D * \sigma_r * \epsilon_r$
- Bond Vol: $D * \sigma_r = 8.4\%$
- Cov(R_s, R_b): $-D * \sigma_s * \sigma_r * \rho = 0.302\%$

Target Total Wealth Allocation (from MV):

- Stocks: 60.9%
- Bonds: 9.3%
- Cash: 29.8%

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 γ , μ , σ , ρ , 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.