The ABCs of Retirement Income

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Morningstar Investment Management, LLC
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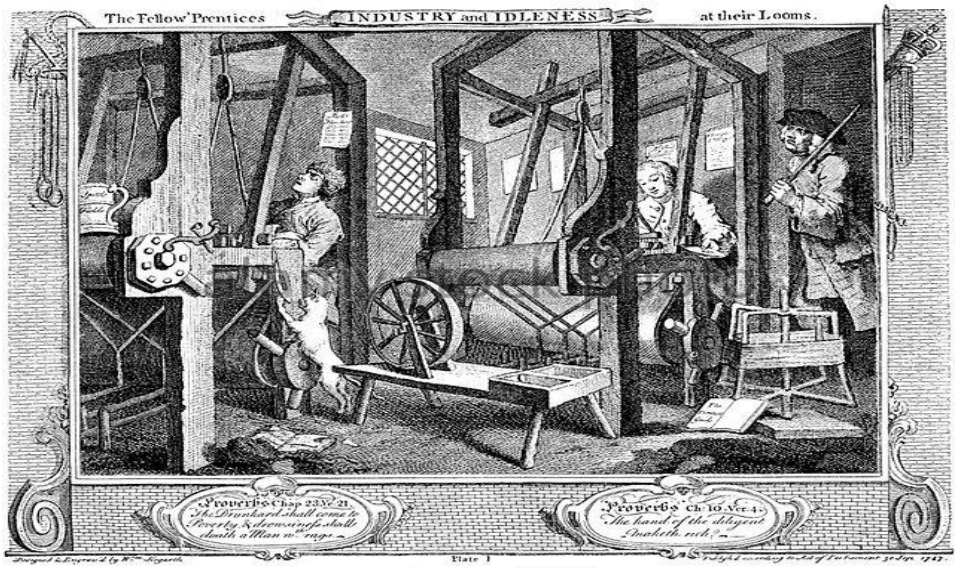
Agenda

- Backstory
- Retirement Risks
- Investor Model
- Asset Allocation
- Insurance
- Retirement Crisis?

Backstory

Backstory

- Concept originated in mid 1700's
- Life expectancy between 26-40.
- Worked until you physically unable or died.



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Backstory

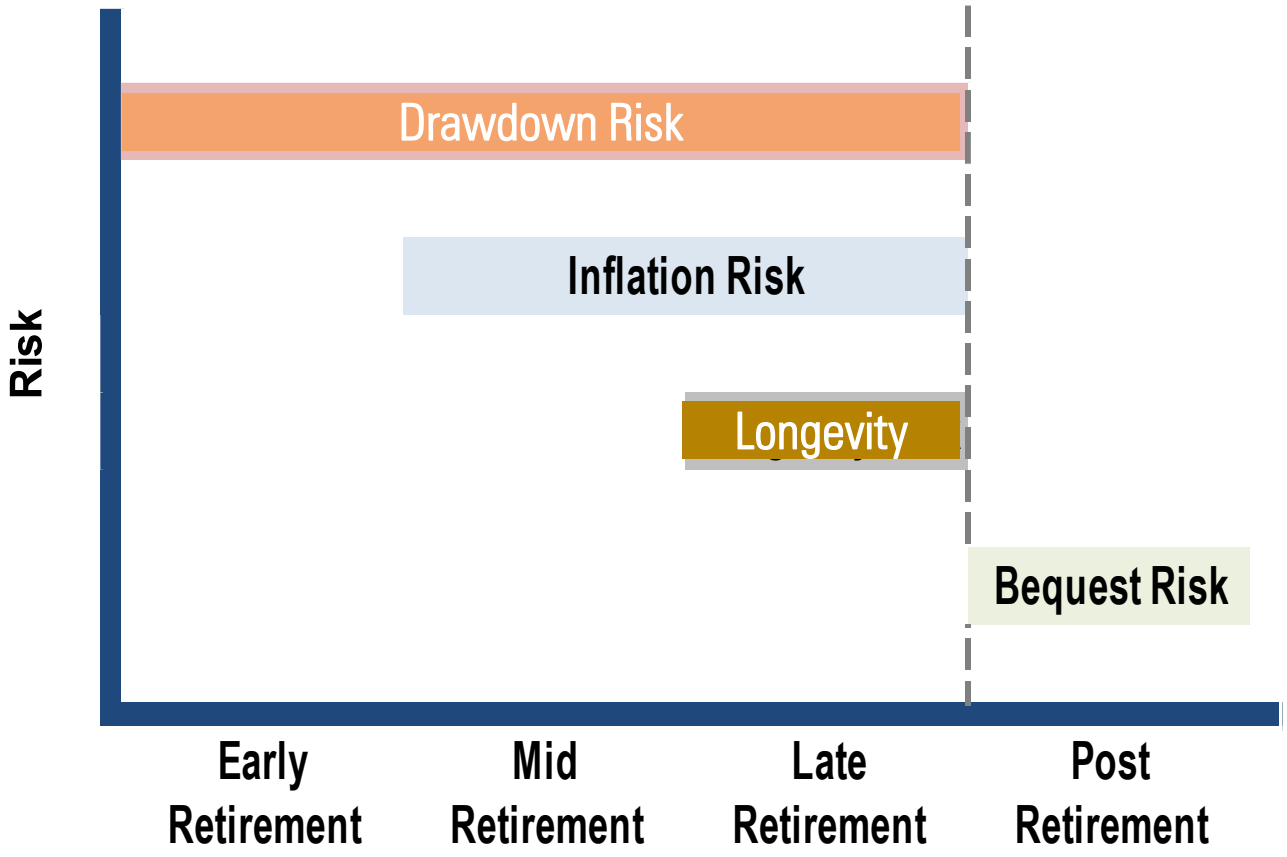
- Rise of modern state and increases in clerical and administrative occupations brought forth the public pension.
- Otto Von Bismarck, president of Prussia introduced a pension in 1881 for those 70 and above. Life expectancy was around 45.
- By 1920's many firms in US and Europe offered some form of private pension—typically beginning at age 65.
- 1935 Social Security Act guaranteed public pensions in US: Life expectancy for US male between 58 and 68.

Backstory

- Corporate pensions emerged in 1920s (Revenue Act(s) of 1921 and 1925)
- By 1940, 15% of private sector workers covered. By 1960 it was 41%
- 1960 – Life expectancy about 70 and general expectation that people would retire.
- Enter: Defined Contribution. Revenue Act of 1978 (section 401(k)). Shift risk from employer to individual.

Retirement Risks

Retiree Risks



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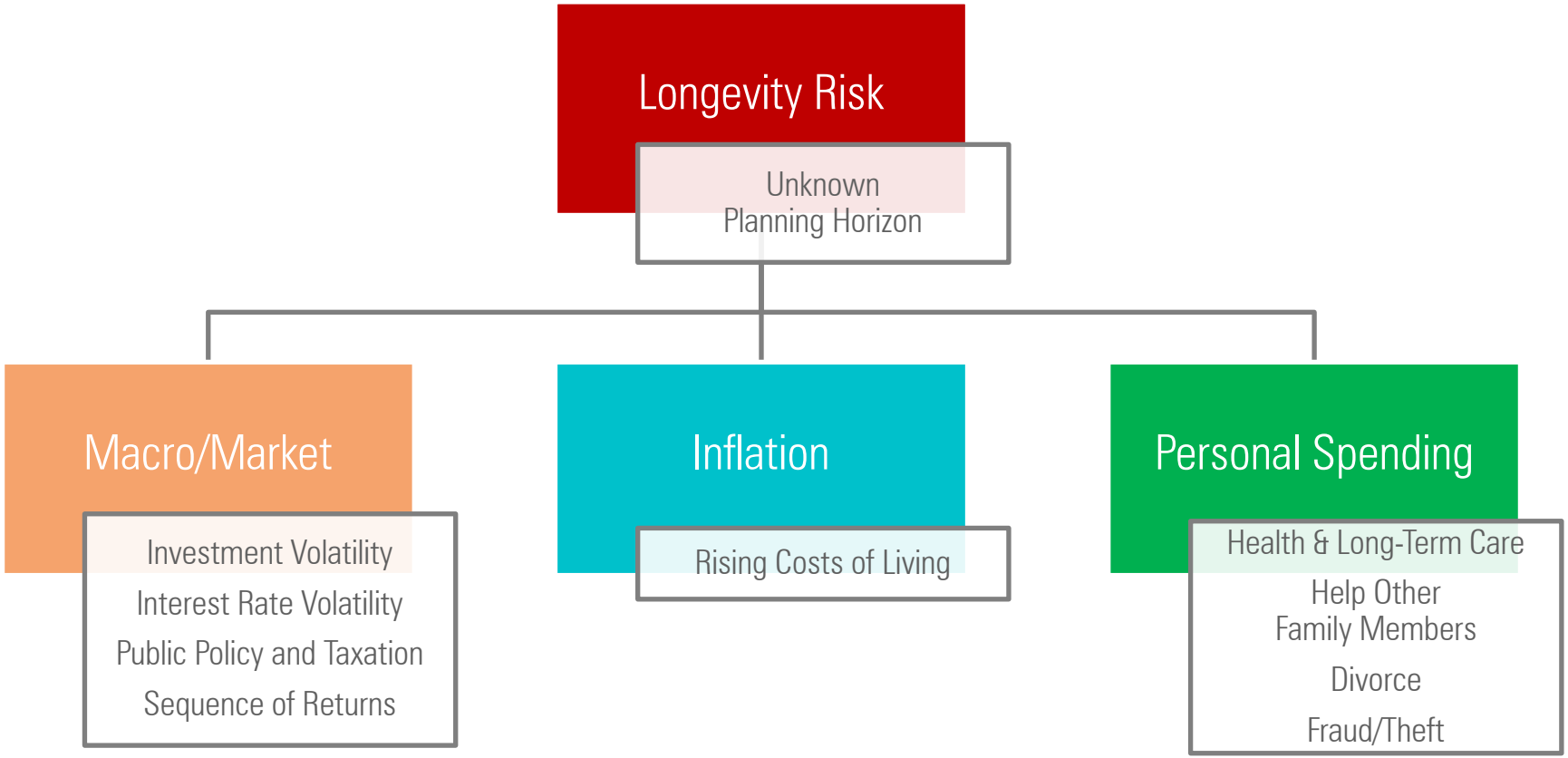
Retiree Risks



Four Levers


Timing
Contribution/Withdrawal Rate
Investment Selection
Goals

Time Value Problem: Cash Flow Matching

$$PV = \sum_{t=1}^{T} \frac{CF_t}{(1+r_t)^t}$$

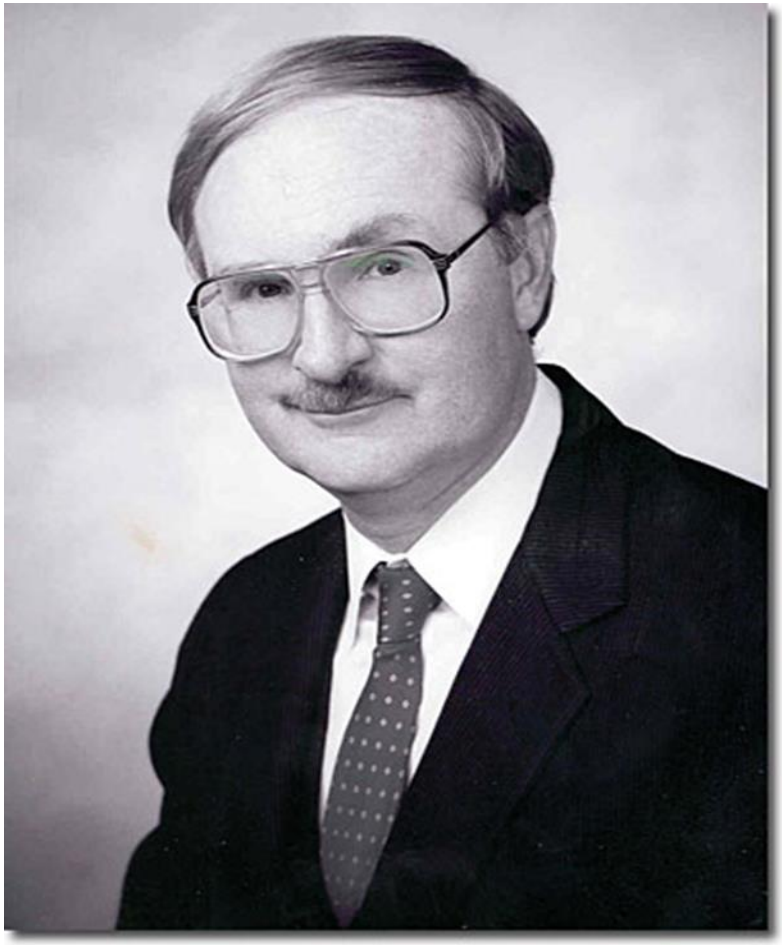
- CF = Net cash flow at time t
- r= rate of return at time t
- t= period

Planned Investment & Consumption

Asset & Product Allocation

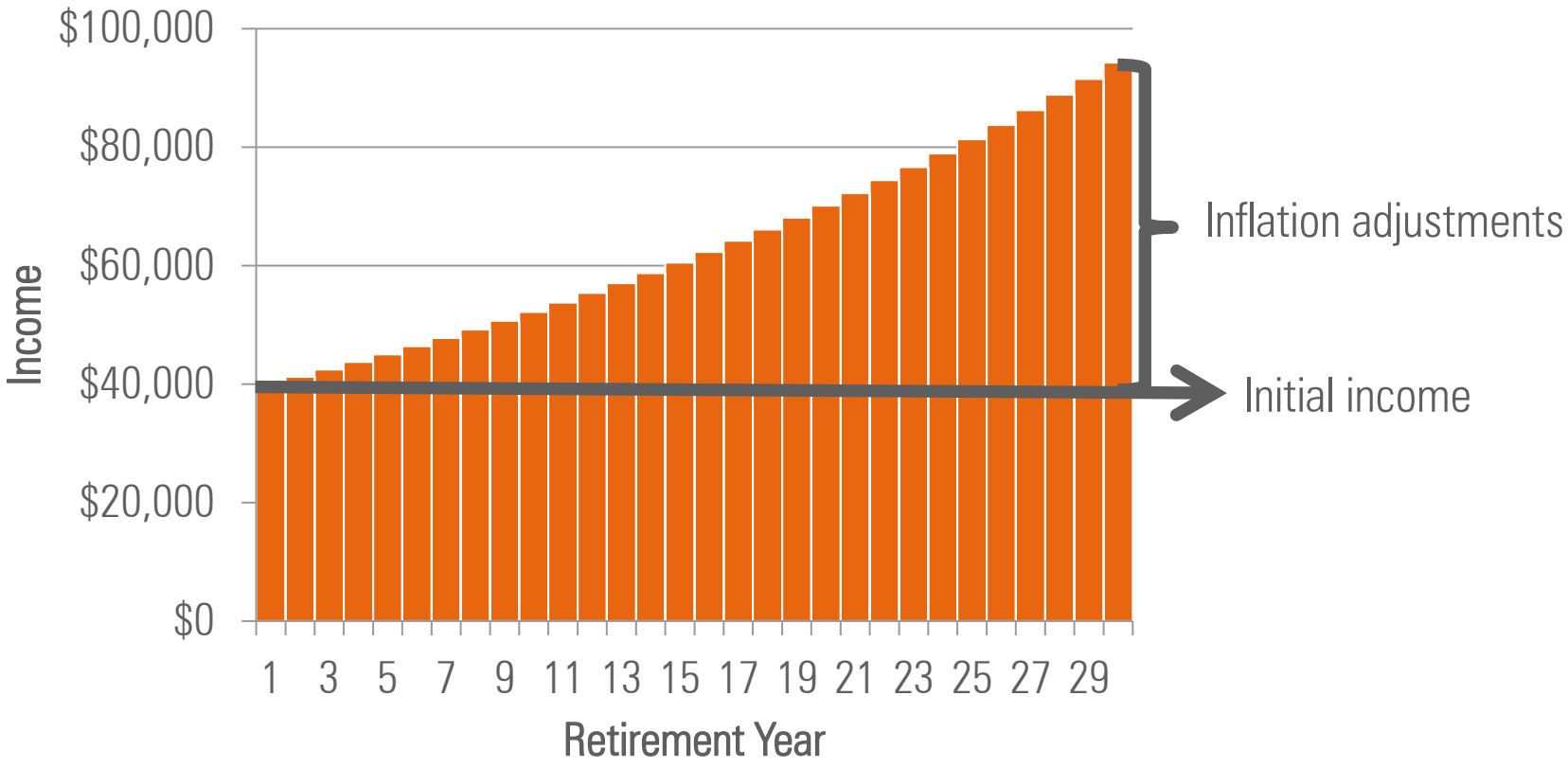
Timing & Horizon

Origin of the 4% Rule



William P Bengen, CFP

How Much Do I Have to Save for Retirement: The 4% Rule

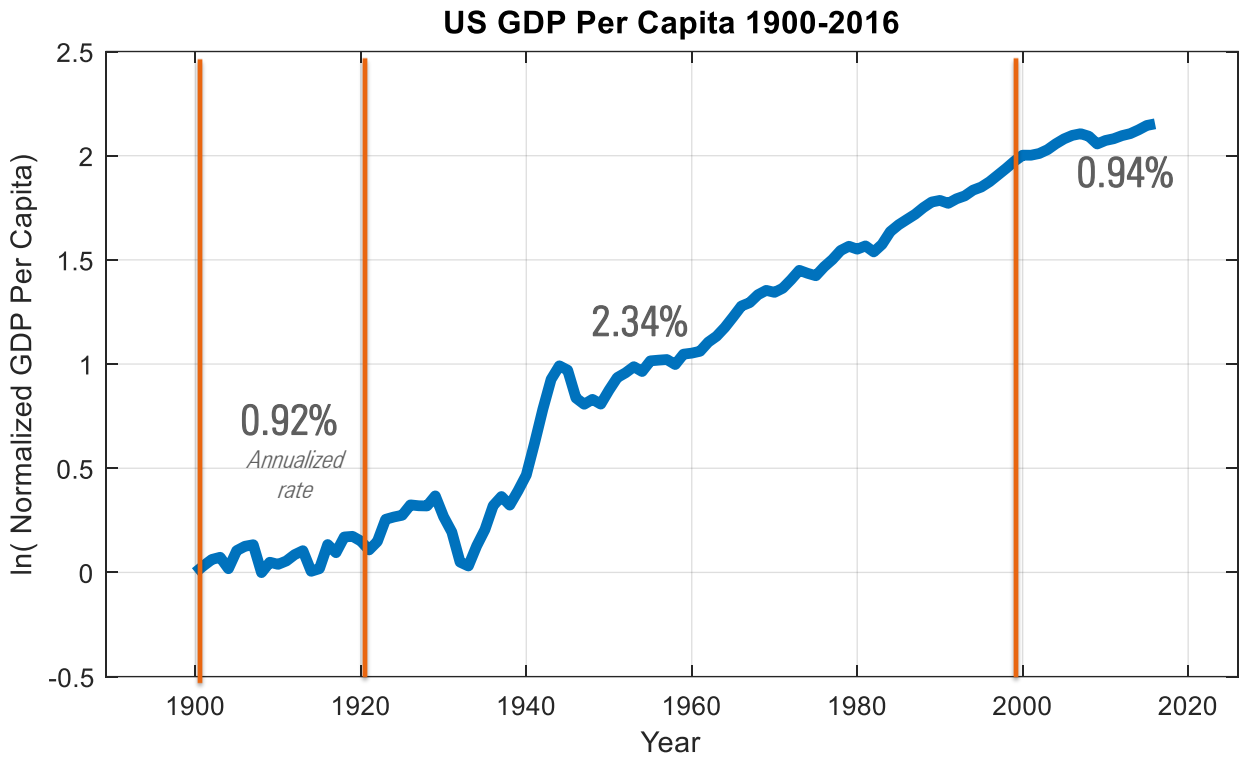


Source: Morningstar

Is the New Regime the old Regime?

The Arrow of Economic Time

Period of acceleration followed by slowing growth



Source: "Are We Really Worse Off?" by Hal Ratner, Morningstar Magazine

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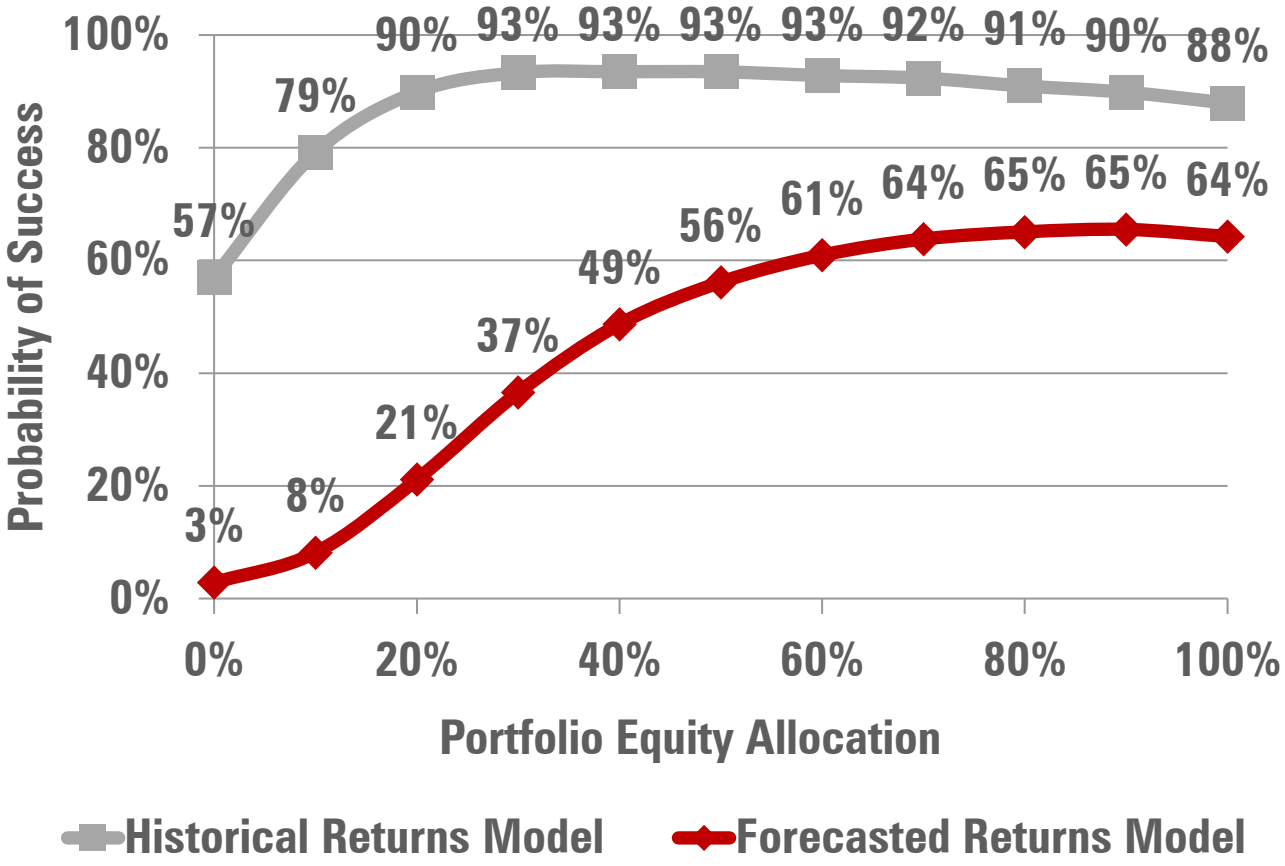
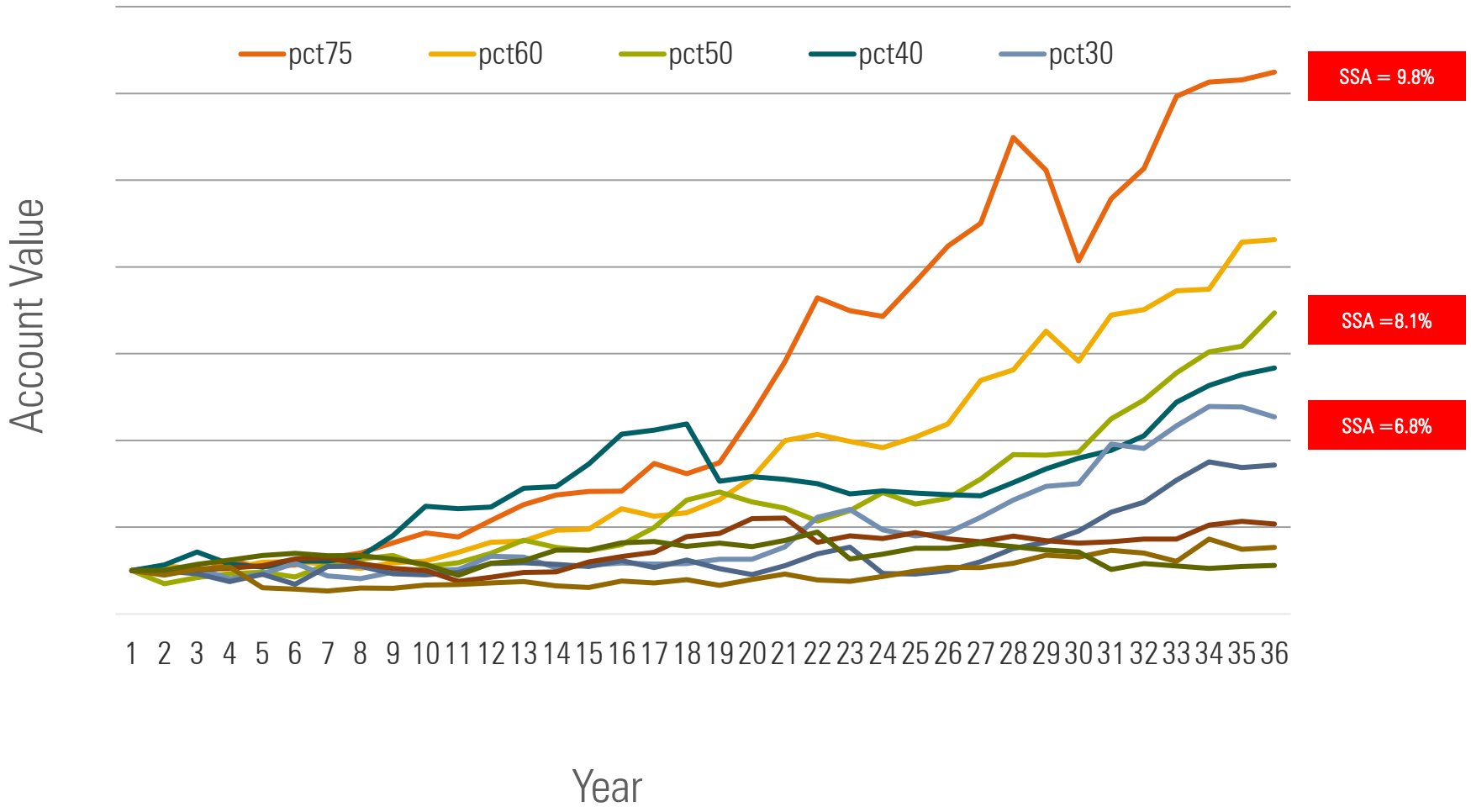
The Safety of The 4% Rule, Past versus Future



Source: "Low Bond Yields and Efficient Retirement Income Portfolios" by David Blanchett, Journal of Retirement

Modeling Returns: Simulated Market Paths



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Sustainable Spending Rate: The inflation-adjusted mortality-weighted percent of assets that can be continuously withdrawn until the moment of death at a given probability level.

Equity Allocation

ProbLevel	PctEq 10%	PctEq 50%	PctEq 97%
75	5.97%	7.54%	9.14%
50	5.49%	6.49%	7.24%
10	4.67%	4.73%	4.02%
5	4.48%	4.30%	3.22%
2.5	4.33%	3.82%	2.52%
1.5	4.26%	3.64%	2.20%

Sustainable Spending Rate: Closed-form Solution

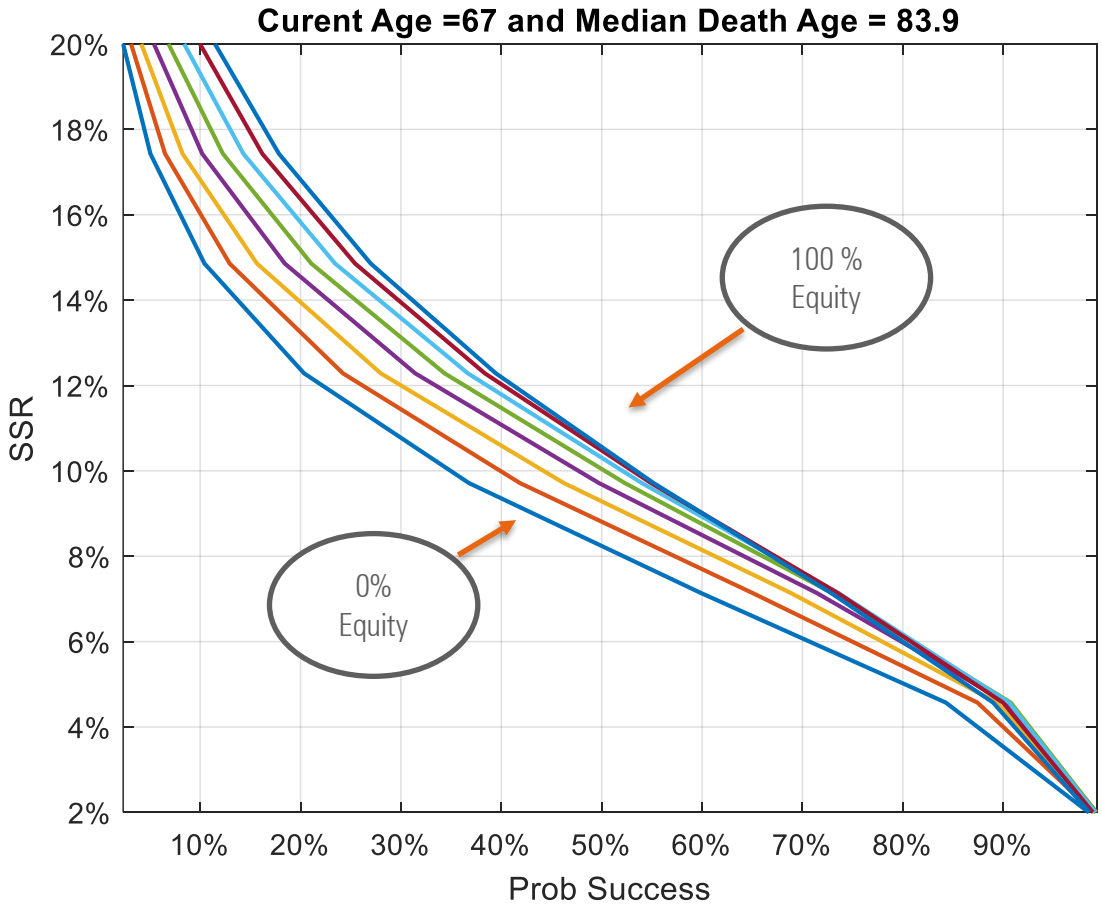
MILEVSKY Probability of Ruin

GAMMADIST(spend_goal/account_value,alpha,beta,lambda)

alpha = (2*mu + 4*lambda)/(risk ^ 2 + lambda)-1
beta = (risk ^ 2 + lambda)/2
lambda = ln(2)/median_life_span
mu = log expected return
risk = log standard deviation

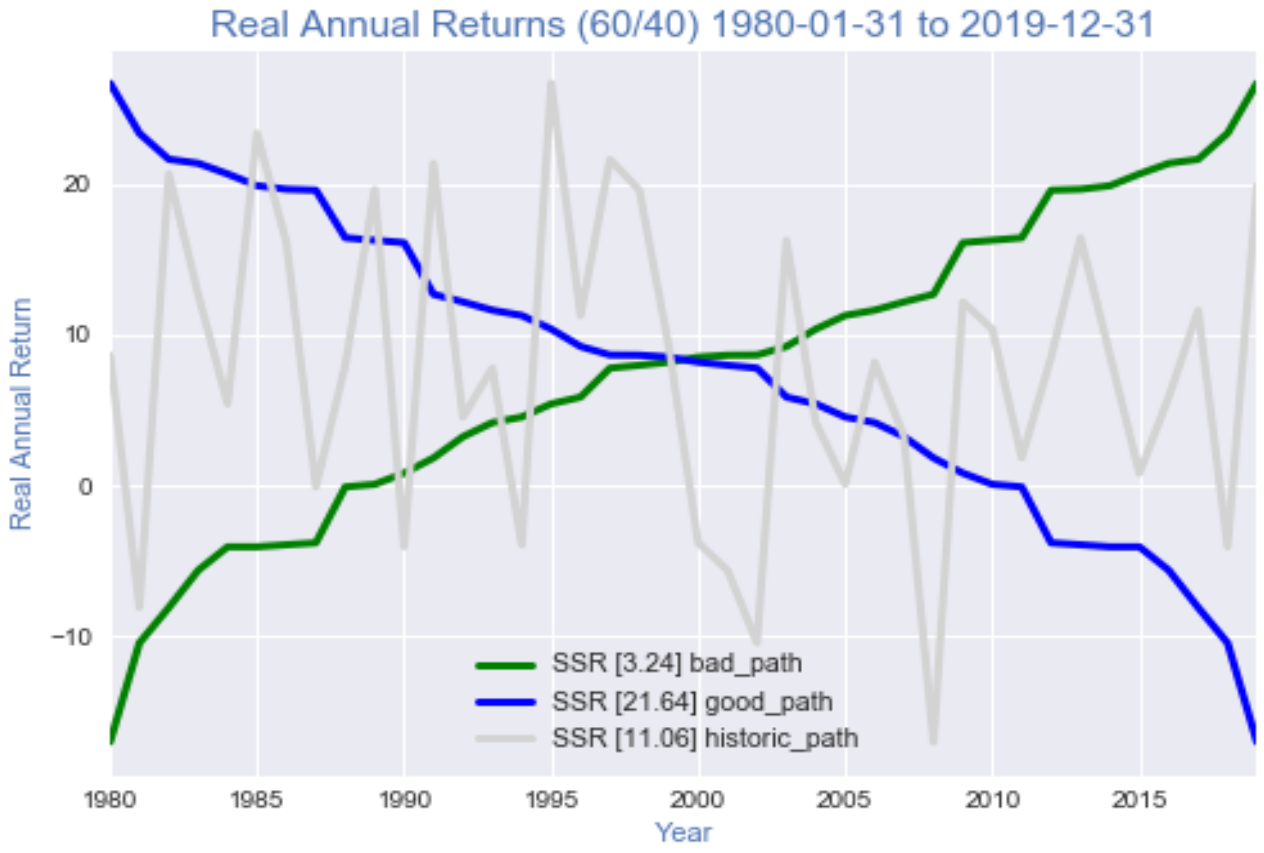
Reference: Milevsky, Moshe, "The Calculus of Retirement Income" (2006)

Sustainable Spending Rate: Closed-form Solution



Source: Morningstar

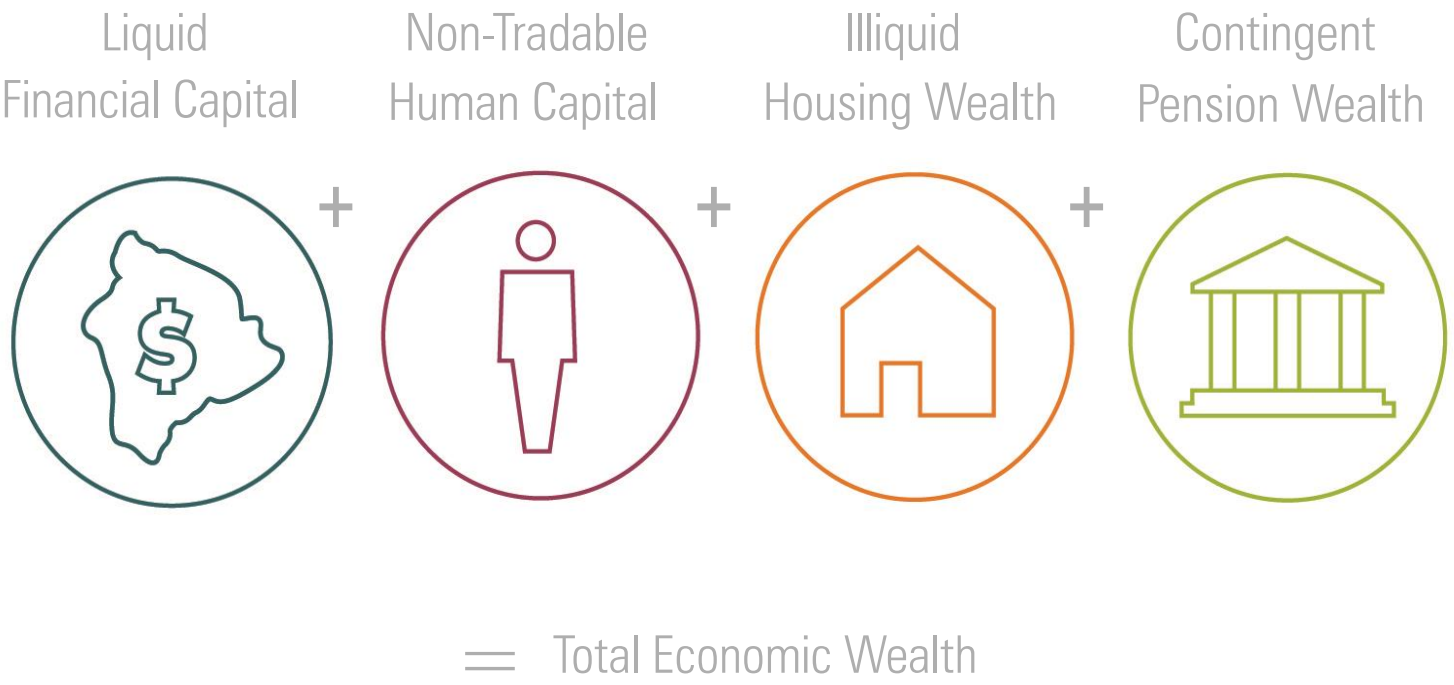
Sequence Risk: Sustainable Spending Rates (SSRs): 7.2% Real Horizon Return



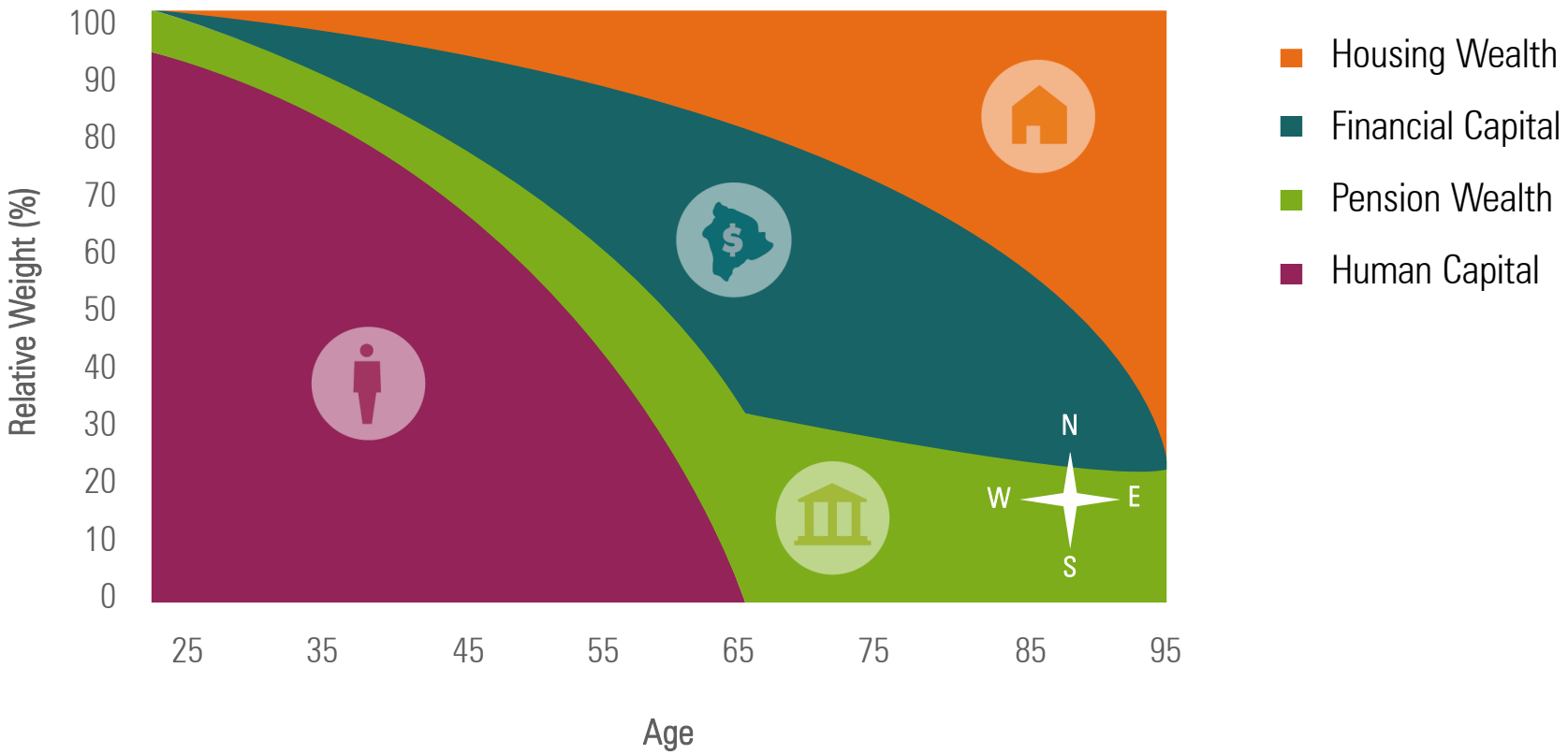
Source: Author

Investor Model

Total Wealth Allocation: No Portfolio is an Island

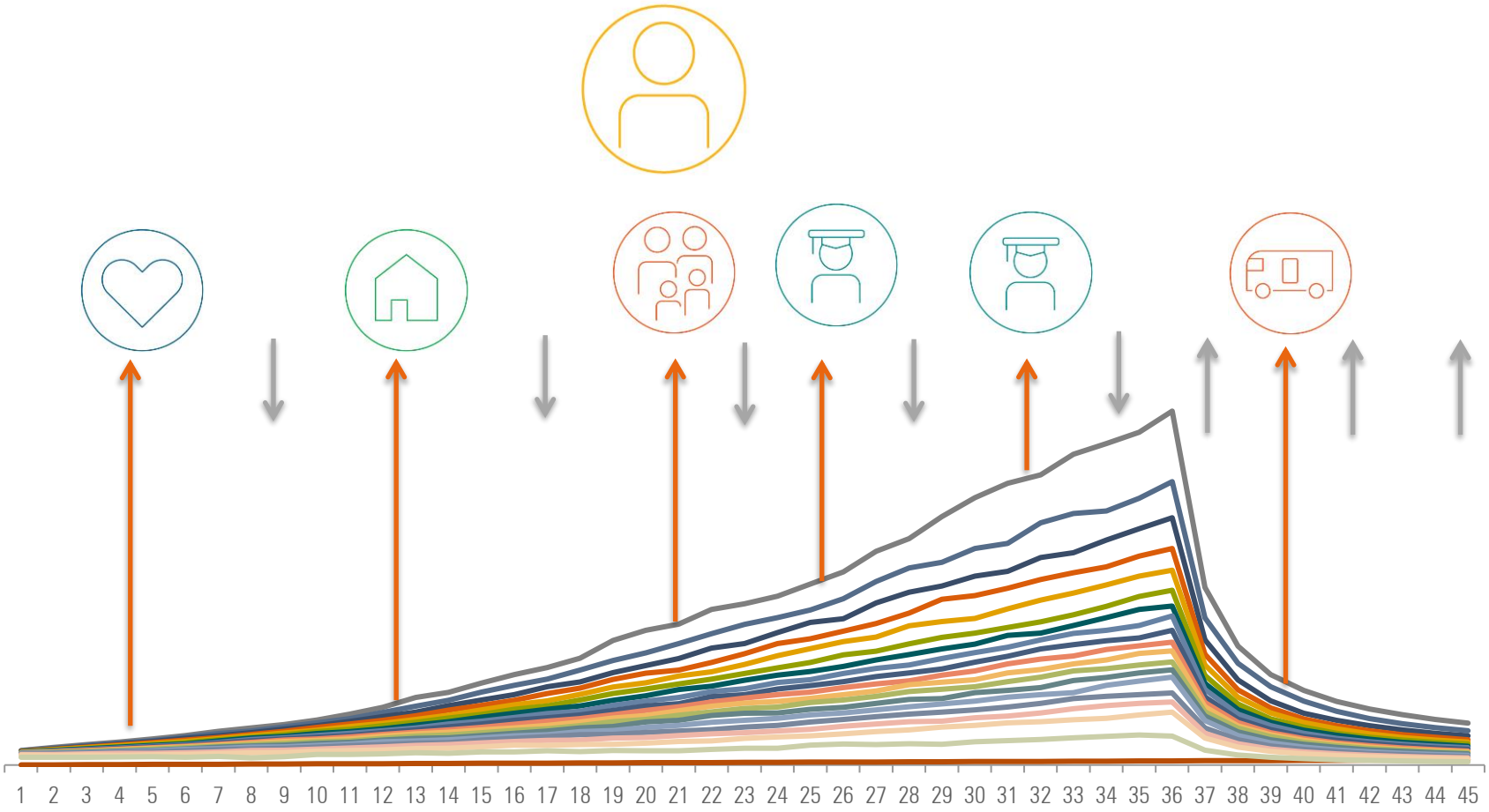


A Total Wealth Perspective Over the Lifecycle



For illustration only.

Lifecycle Investing Using Simulation: Using “robo” technology to power your service.



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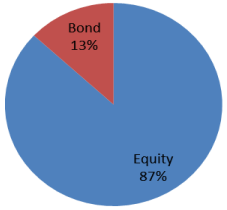
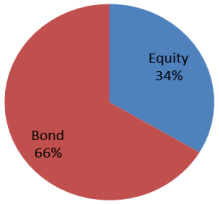
Lifecycle Investing using Optimization: Cascading—Investing Optimally *Through Time*

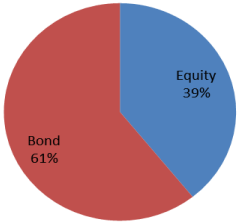
Additional Retirement



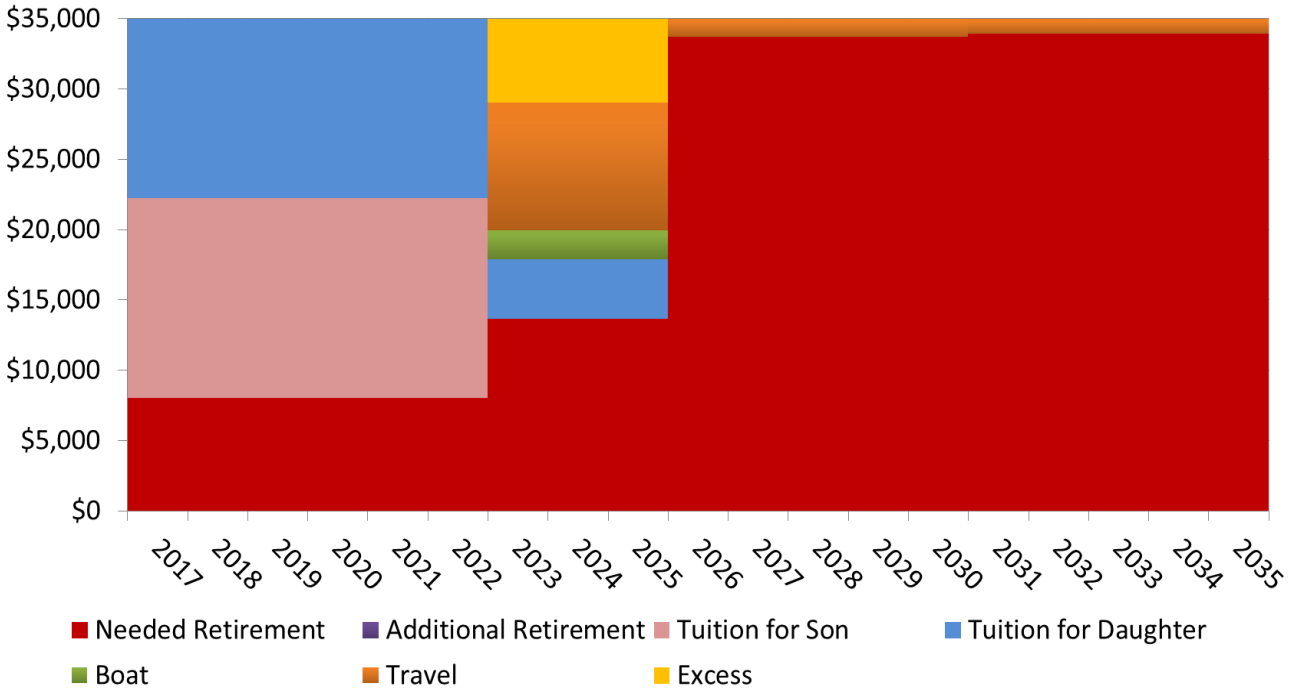
Tuition for Son



Tuition for Daughter



Your Recommended Saving Allocation in the Future



79%	78%	81%	81%
Expected Shortfall	Expected Shortfall	Expected Shortfall	Expected Shortfall
$157,872	**$691**	**$945**	**$1,506**

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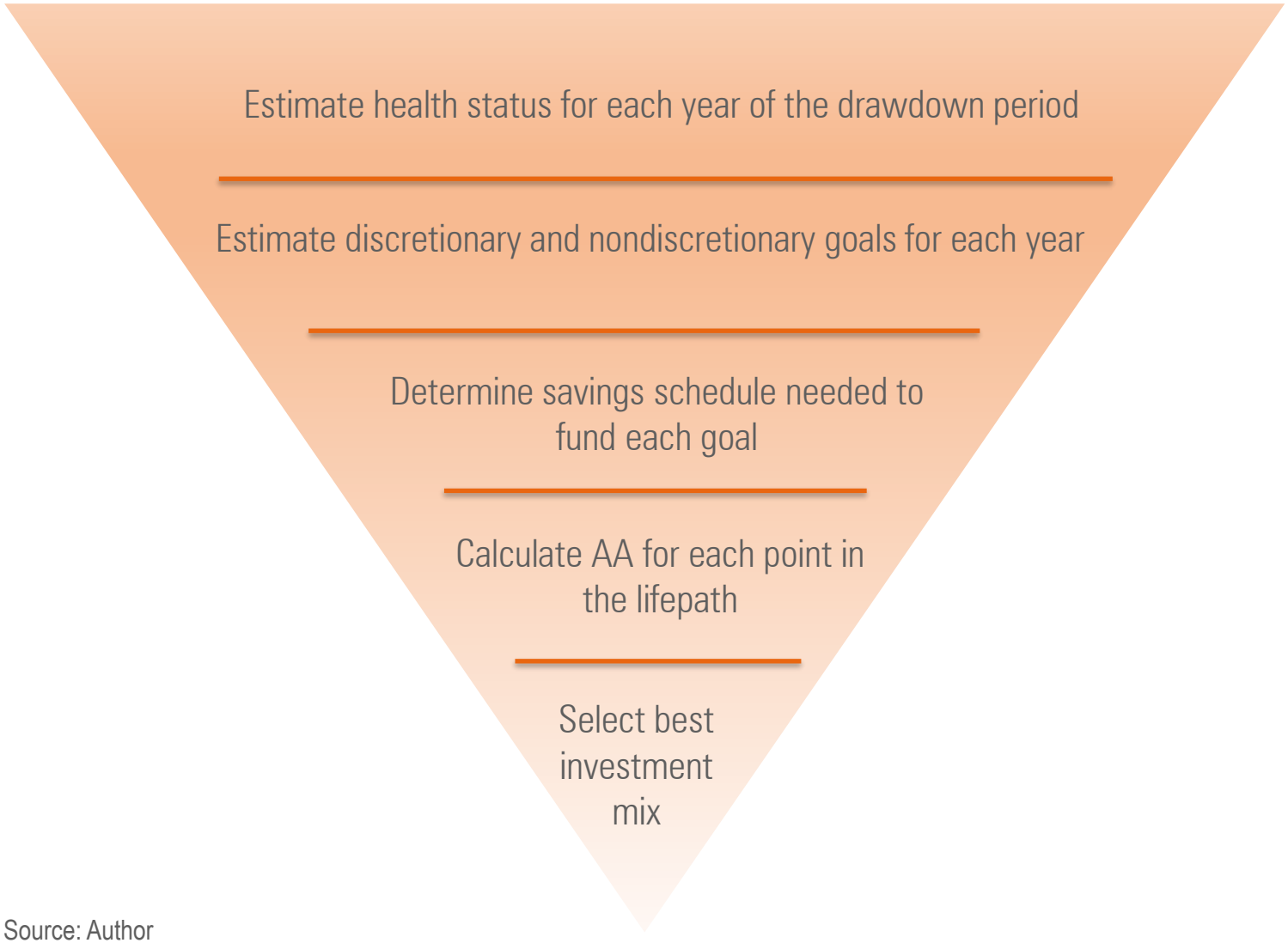
Lifecycle Investment Planning Hierarchy



Source: Author

The Three "Stages" of Retirement

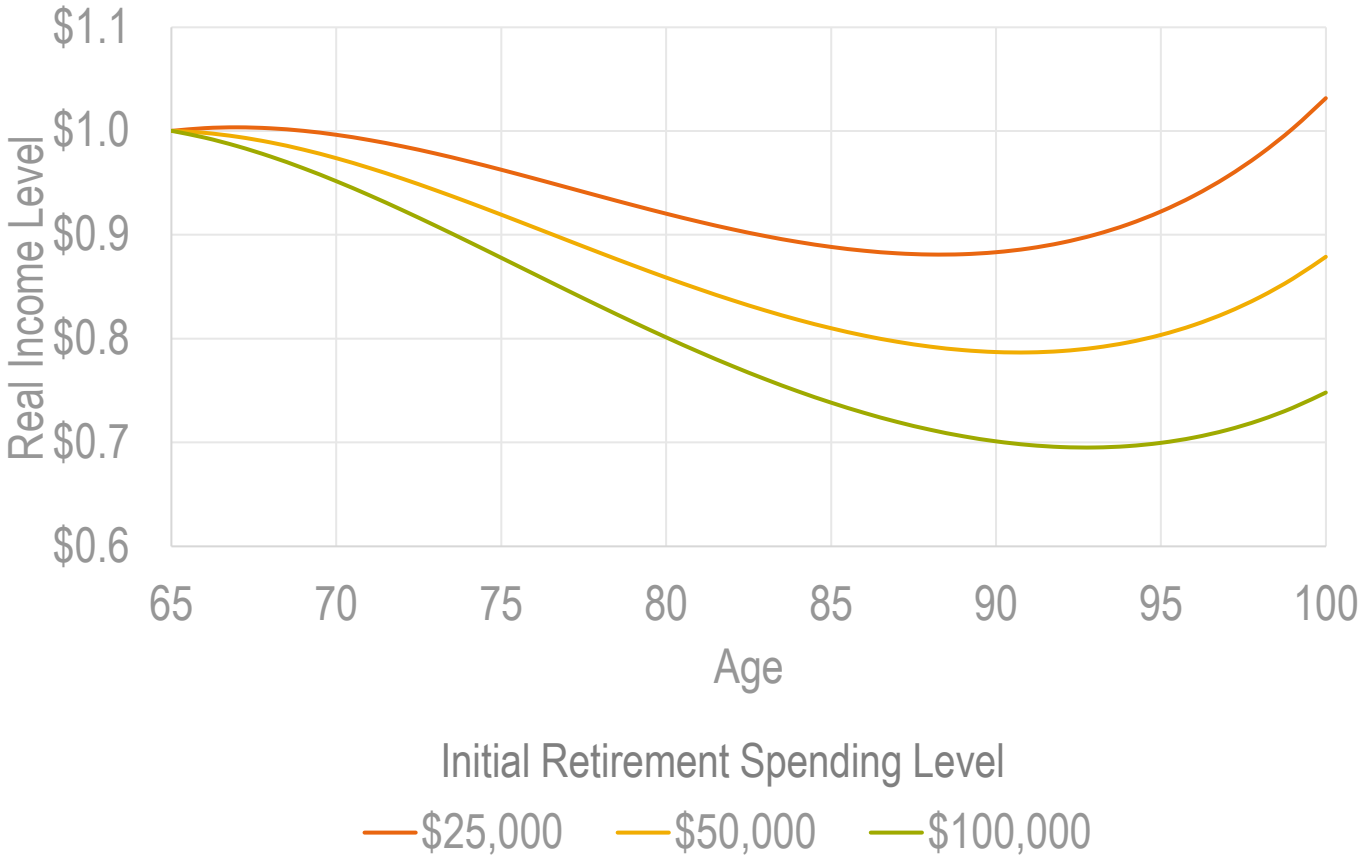
- **Go-Go:** Retirees maintain lifestyle, travel, the group that does not consider themselves "old".

- **Slow-Go:** Between the ages of 70 and 84, brought on by the body saying "Slow Down," 20%-30% budget decline.

- **No-Go:** 85+, significant changes in retirement lifestyle is generally brought on by health issues.

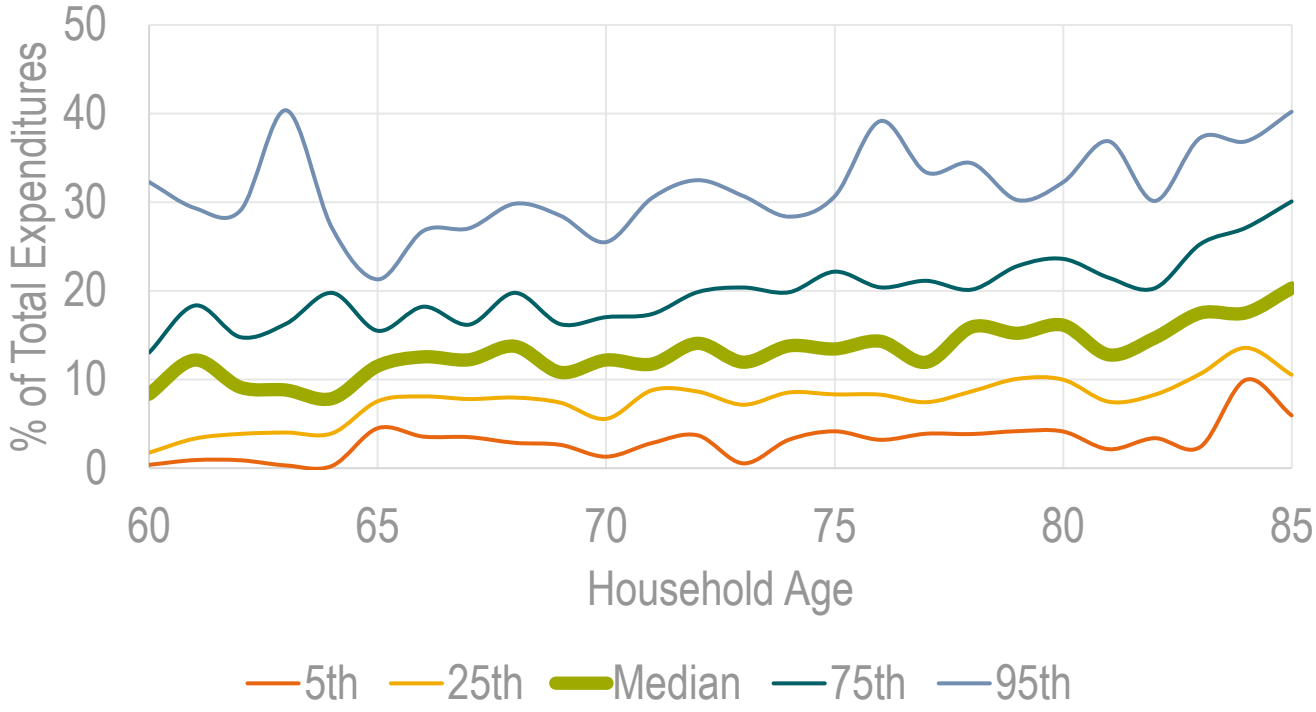
Source: "The Prosperous Retirement, Guide to the New Reality", Michael Stein

Inflation-Adjusted Spending for Age 65 Retiree



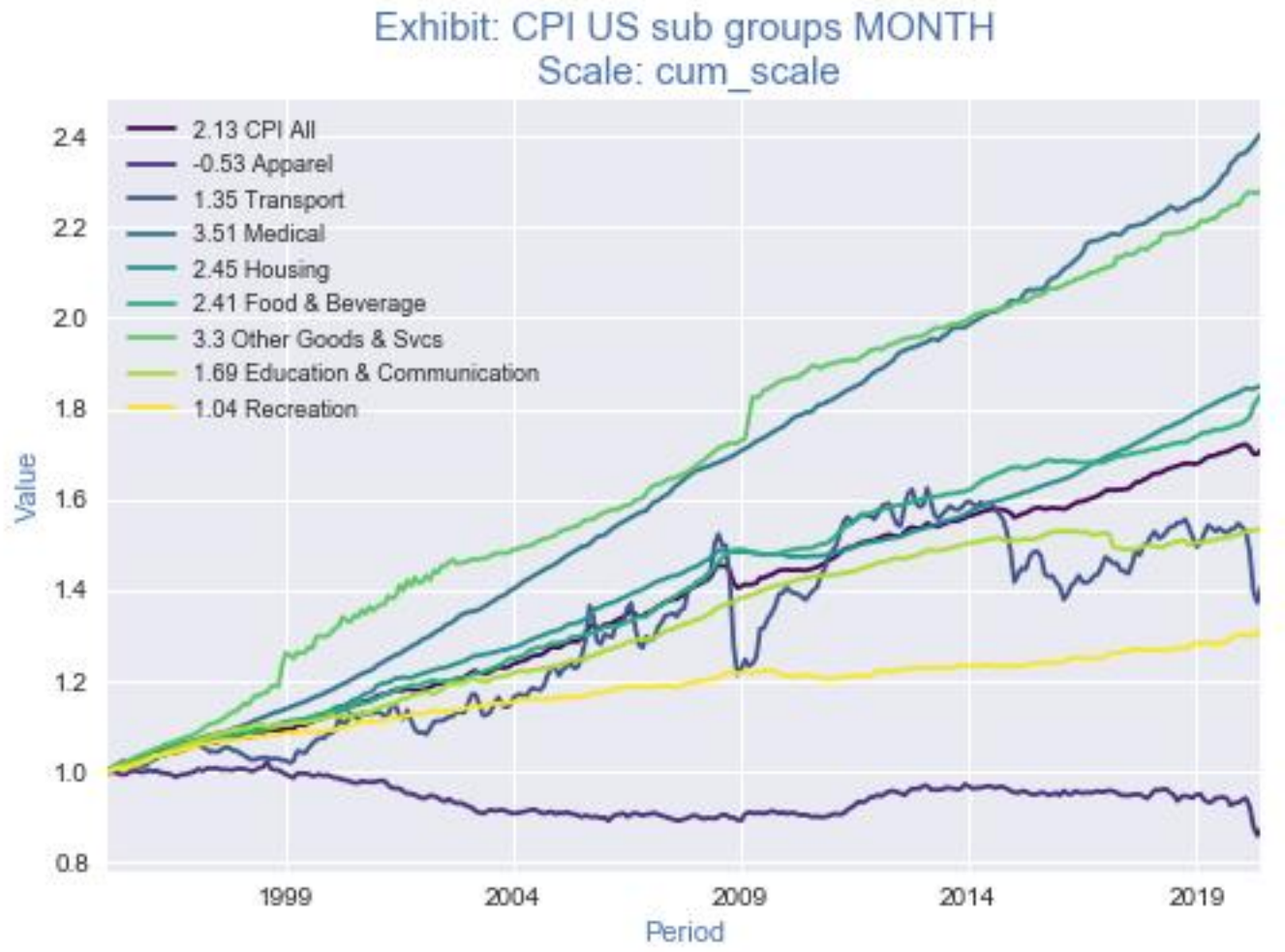
Source: "Estimating the True Cost of Retirement" by David Blanchett, Morningstar White Paper

Health Expenditures as a Percentage of Total Expenditures Increase with Age



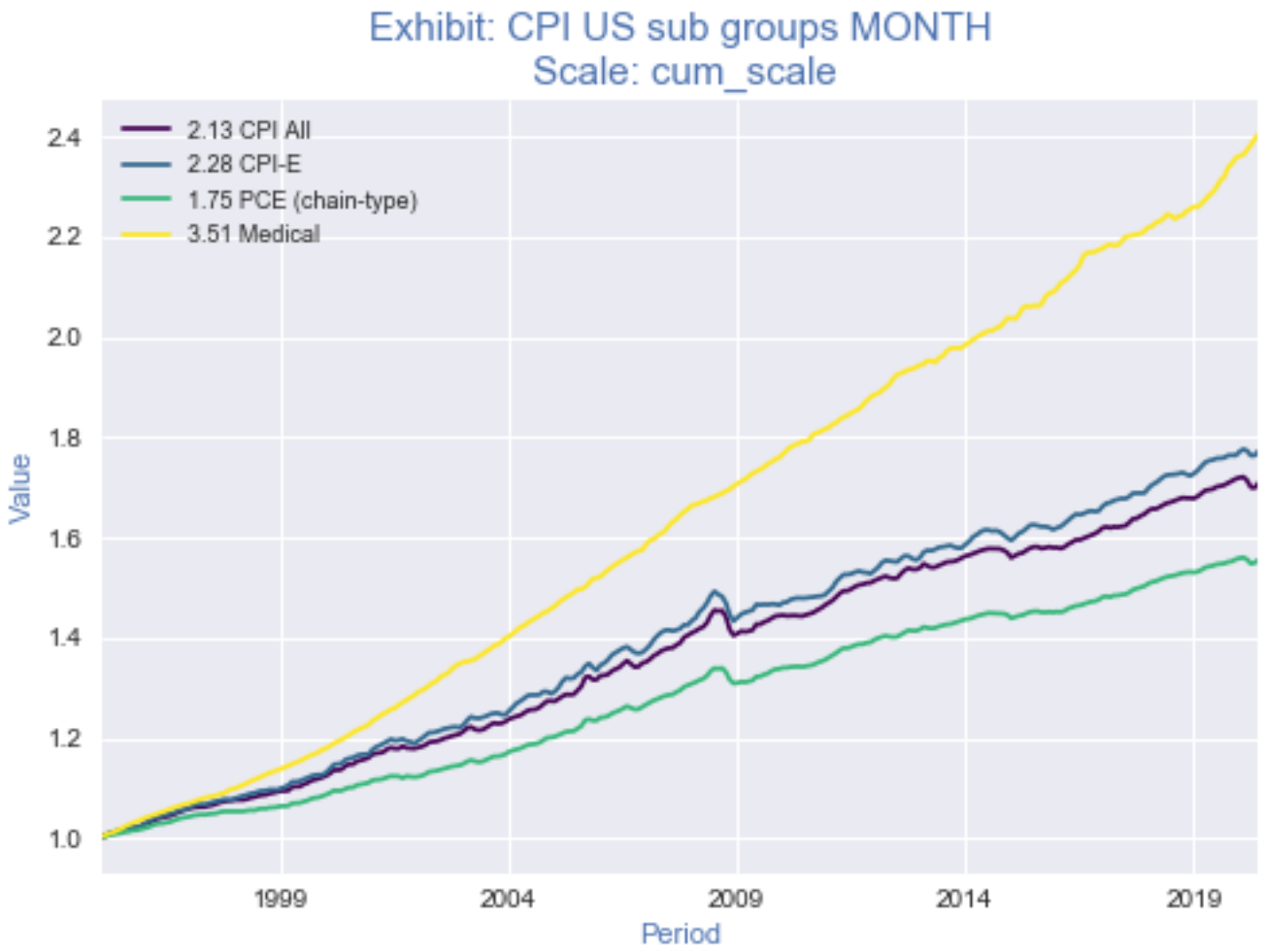
Source: "The Impact of Health Shocks on Retirement Spending" by David Blanchett, *Journal of Retirement*

Different Rates of Inflation



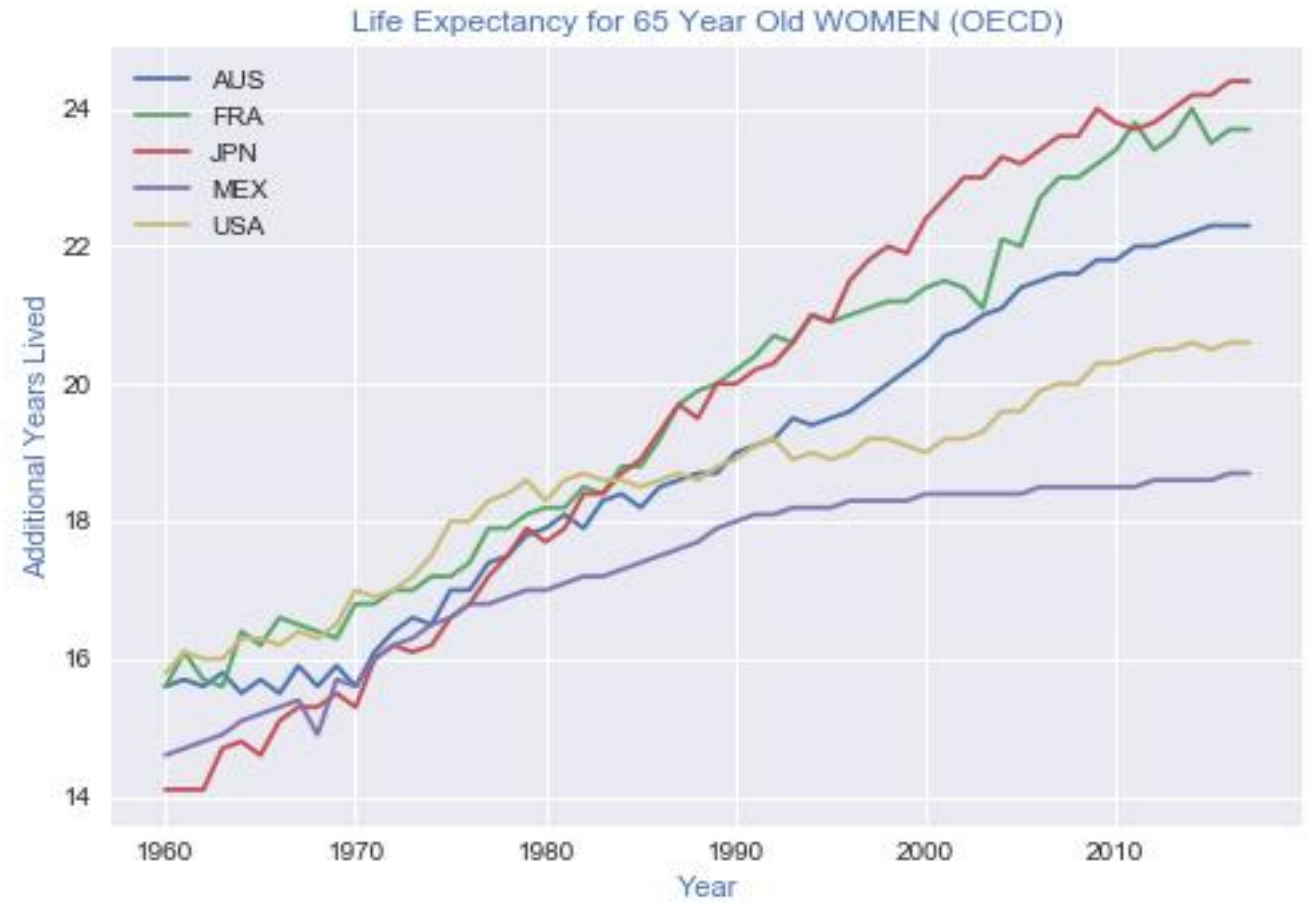
Source: Bureau of Labor Statistics.

Different Measures of Inflation



Source: Bureau of Labor Statistics.

Life Expectancy Keeps Increasing



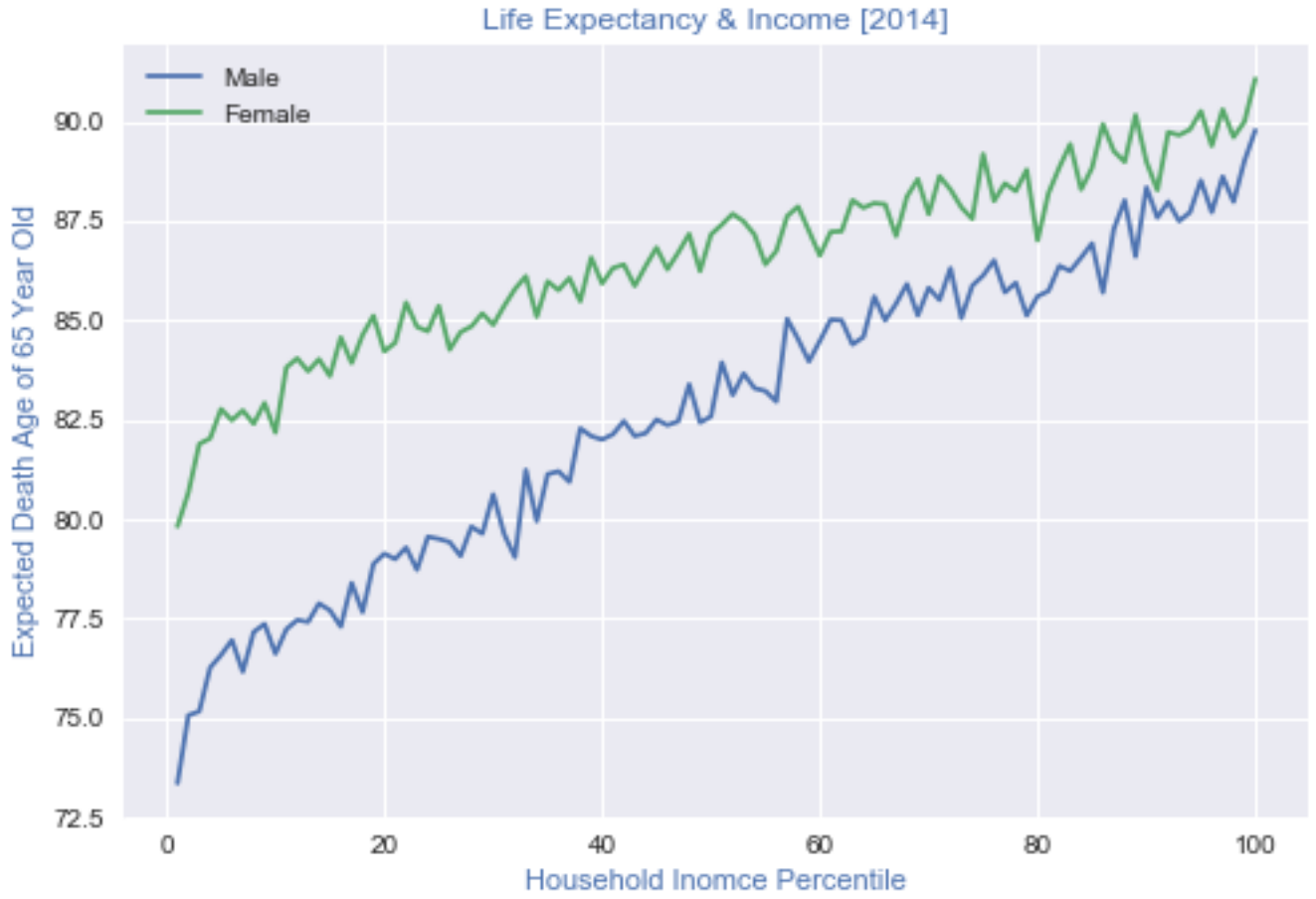
Source: OECD.

Probability of 65 Year Old Living to Age 95

	Male	Female	Both	≥1
Average American	7%	13%	1%	19%
Healthy American	20%	29%	6%	43%
Healthy American in 15 Years	25%	33%	8%	50%

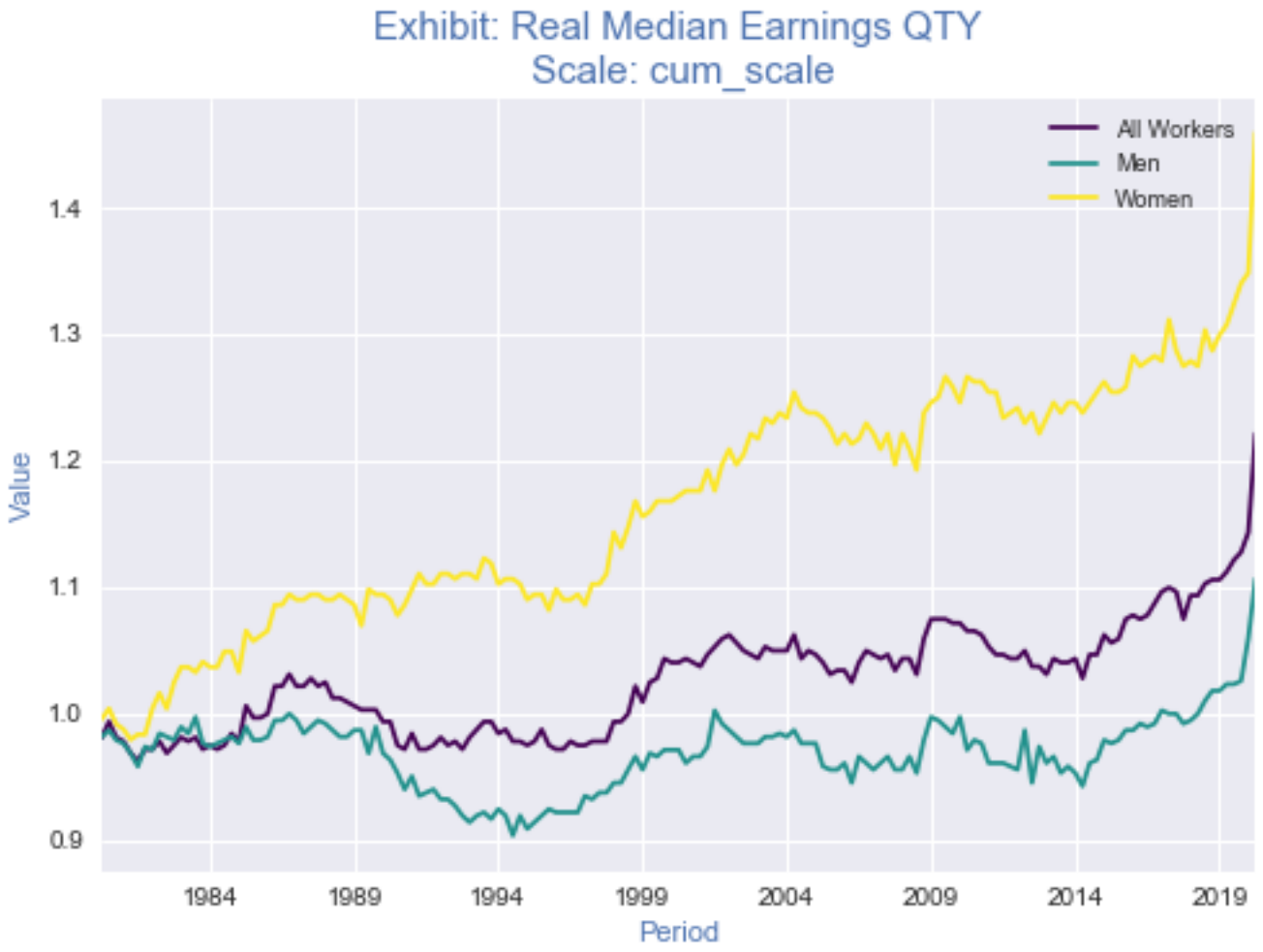
Source: Social Administration 2010 Periodic Life Table, Society of Actuaries 2012 Annuity Mortality Table

Life Expectancy is Correlated with Income



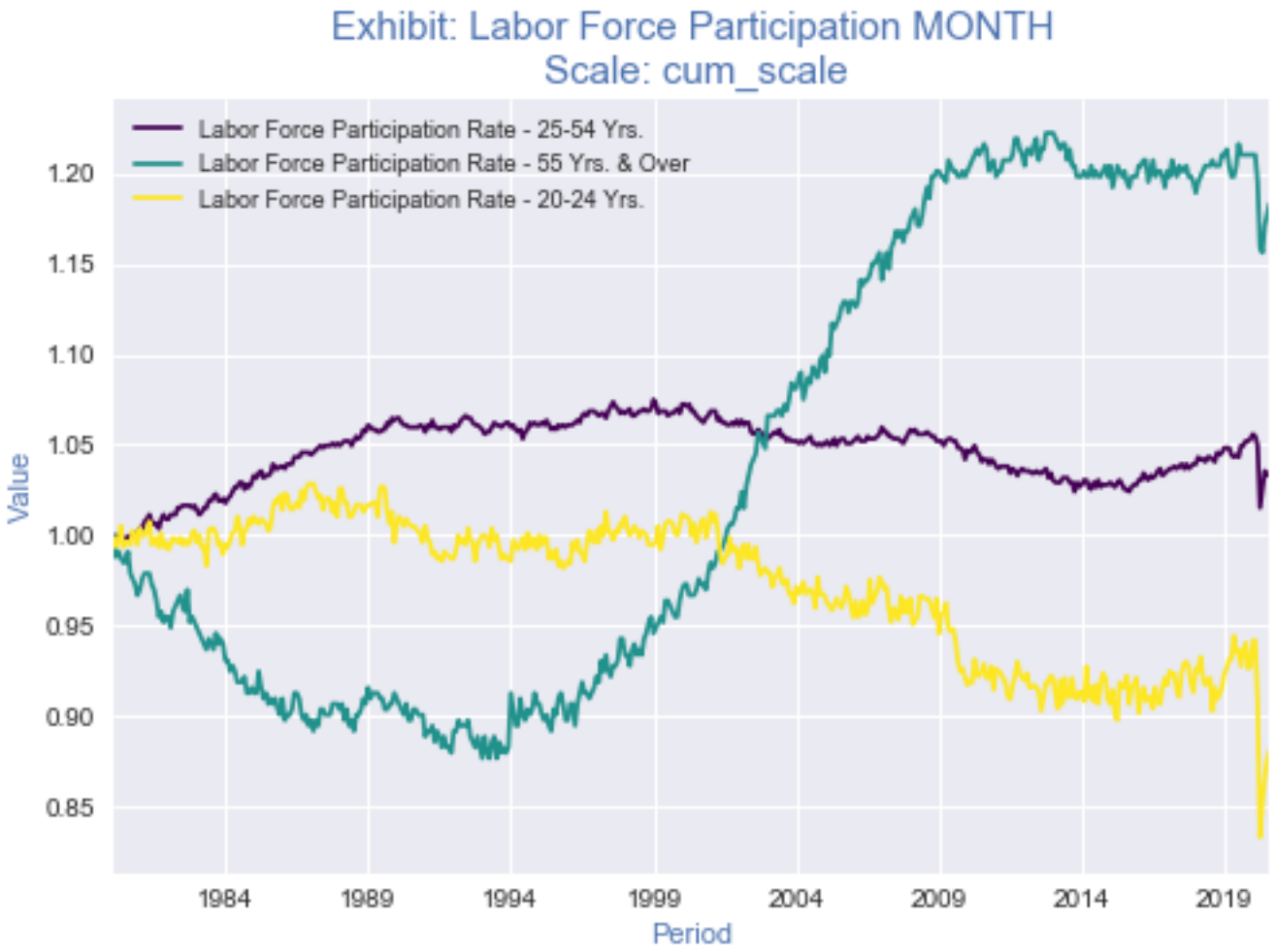
Source: Health Inequality Project

Growth of Female Wages



Source: Bureau of Labor Statistics

People in Workforce Longer



Source: Bureau of Labor Statistics

Asset Allocation

Investments: Income Investor Cares about Sources of Total Return

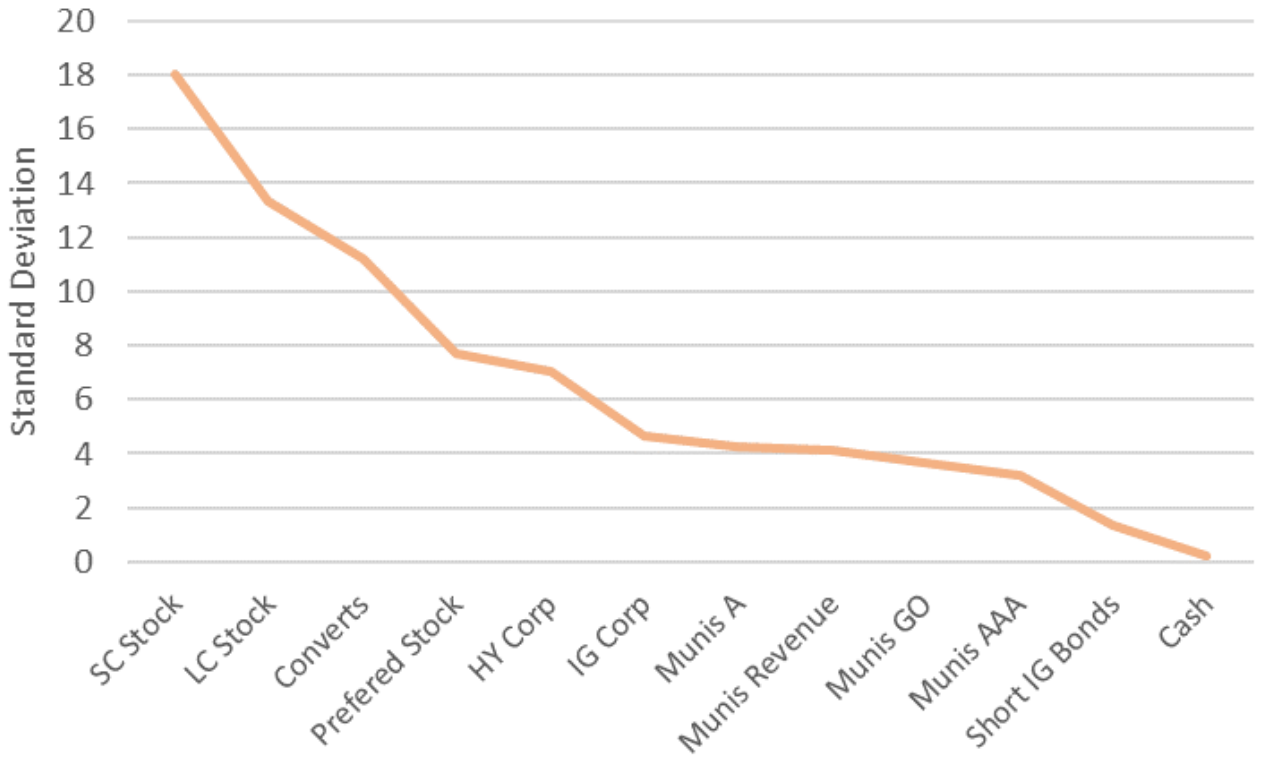
Capital Structure: Sources of Return

Position on capital structure determines "surety" of payment

- Strategic Asset Allocation is ultimately a cash flow matching exercise in which the cash flow structure of the portfolio is aligned with the investor's liabilities.

Risk Estimation
Cash Flow Risk and Valuation

- Risks for Various Asset Classes (10-year period through August 2020)



Source: Morningstar Direct. For illustrative purposes only.

The Market: 20-Year Horizons

Source: Morningstar

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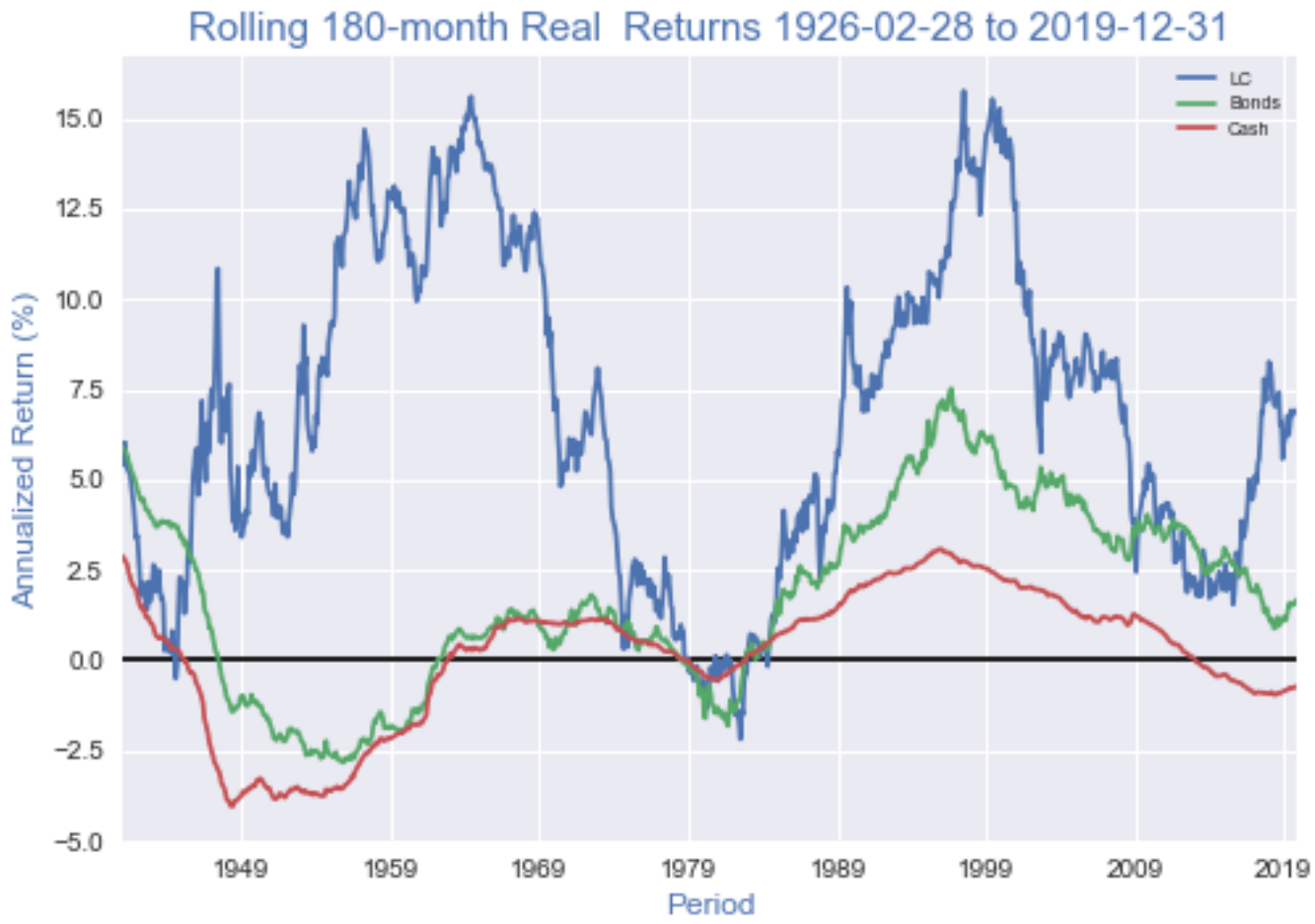
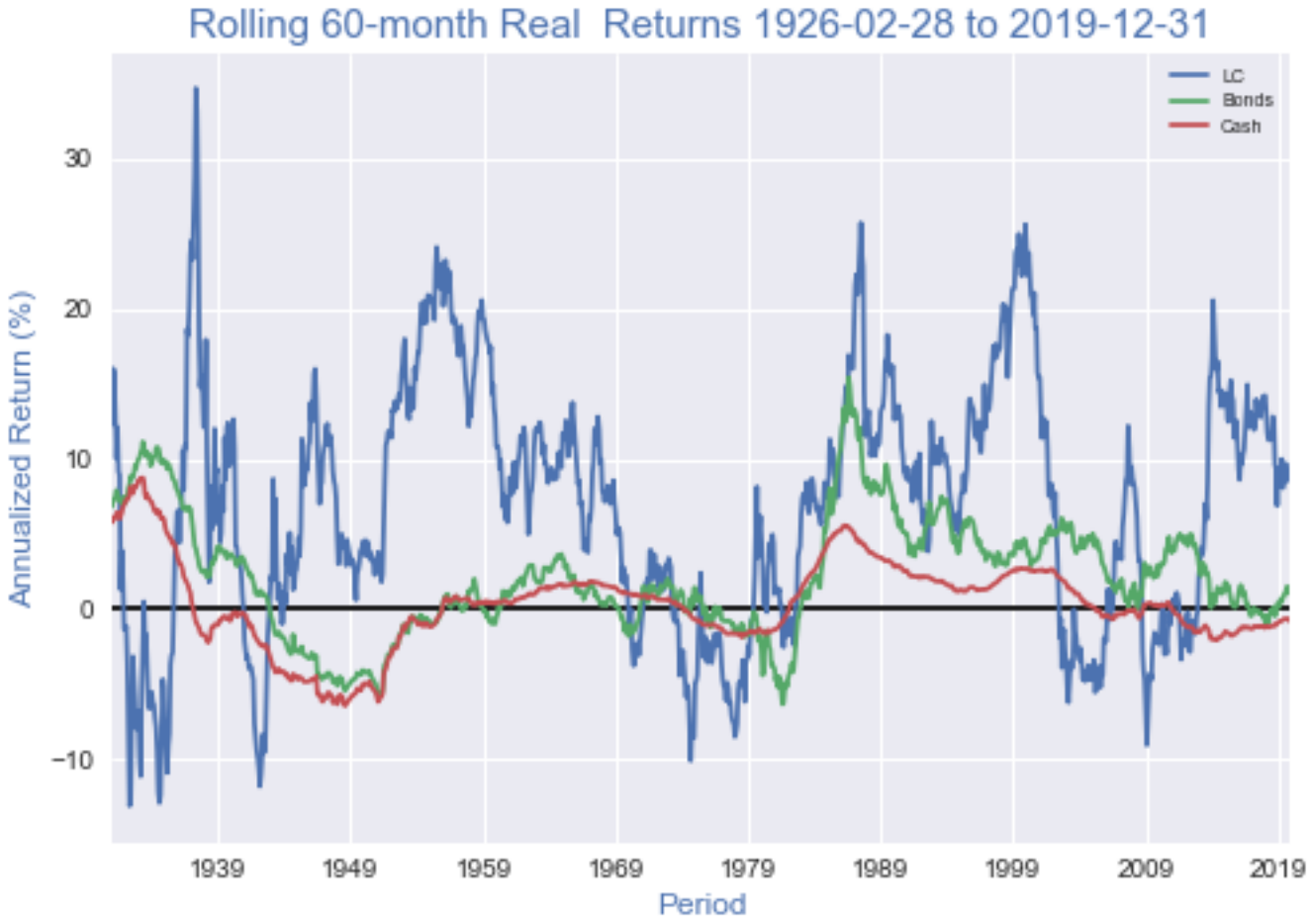
The Market: 15-Year Horizons



The Market: 5-Year Horizons



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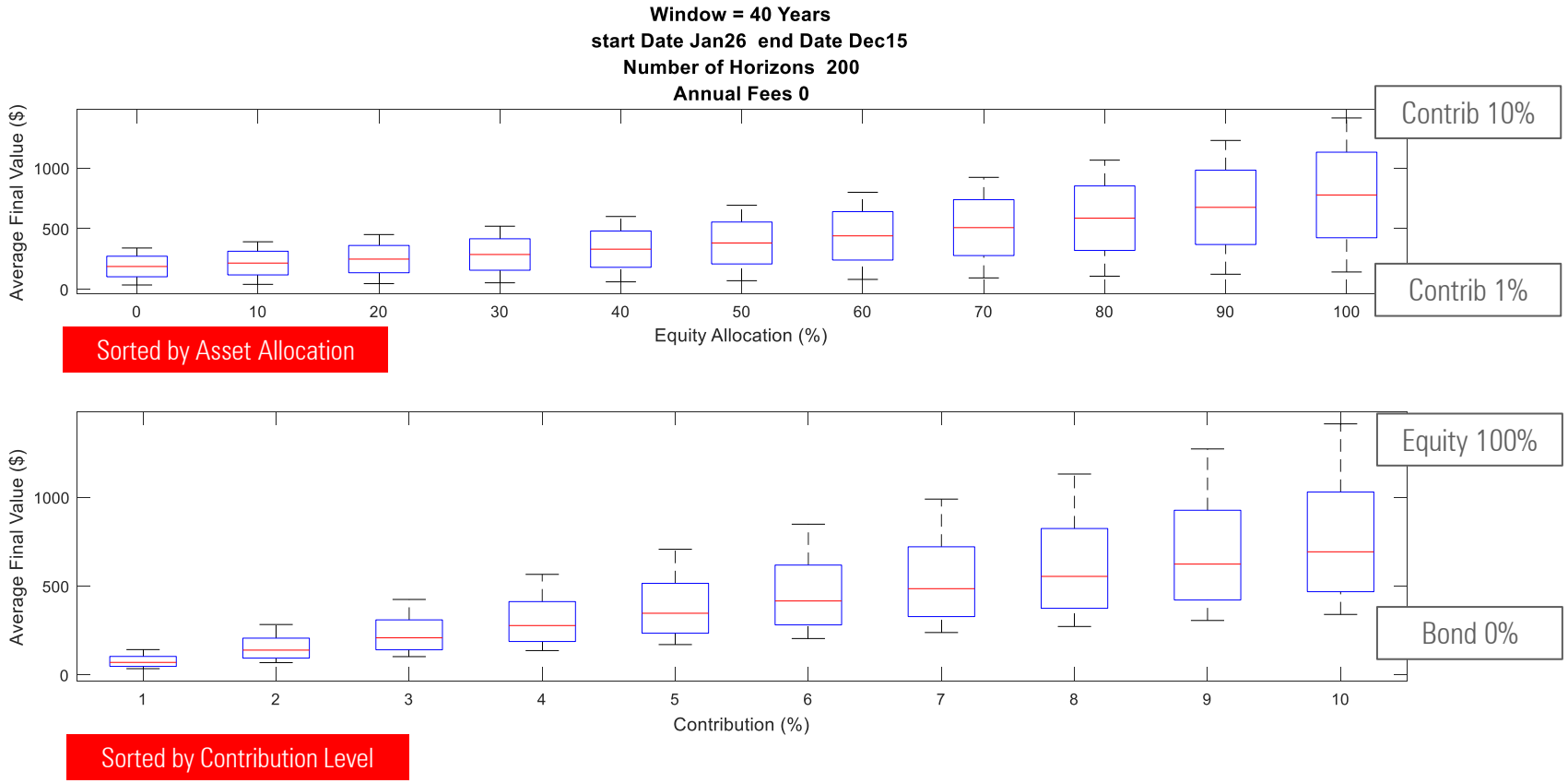
Contributions are King: Relative Impact of asset allocation and contribution level of dispersion of terminal account values. Contributions have greater impact on terminal wealth than does asset allocation.



Source: Morningstar. Portfolios calculated using 75/25 S&P 500/IA Small Cap Indexes and 75/25 IT and LT IA SBBI Govt Bond Indexes. Portfolios are rebalanced at end of each quarter and contributions are made at the beginning.

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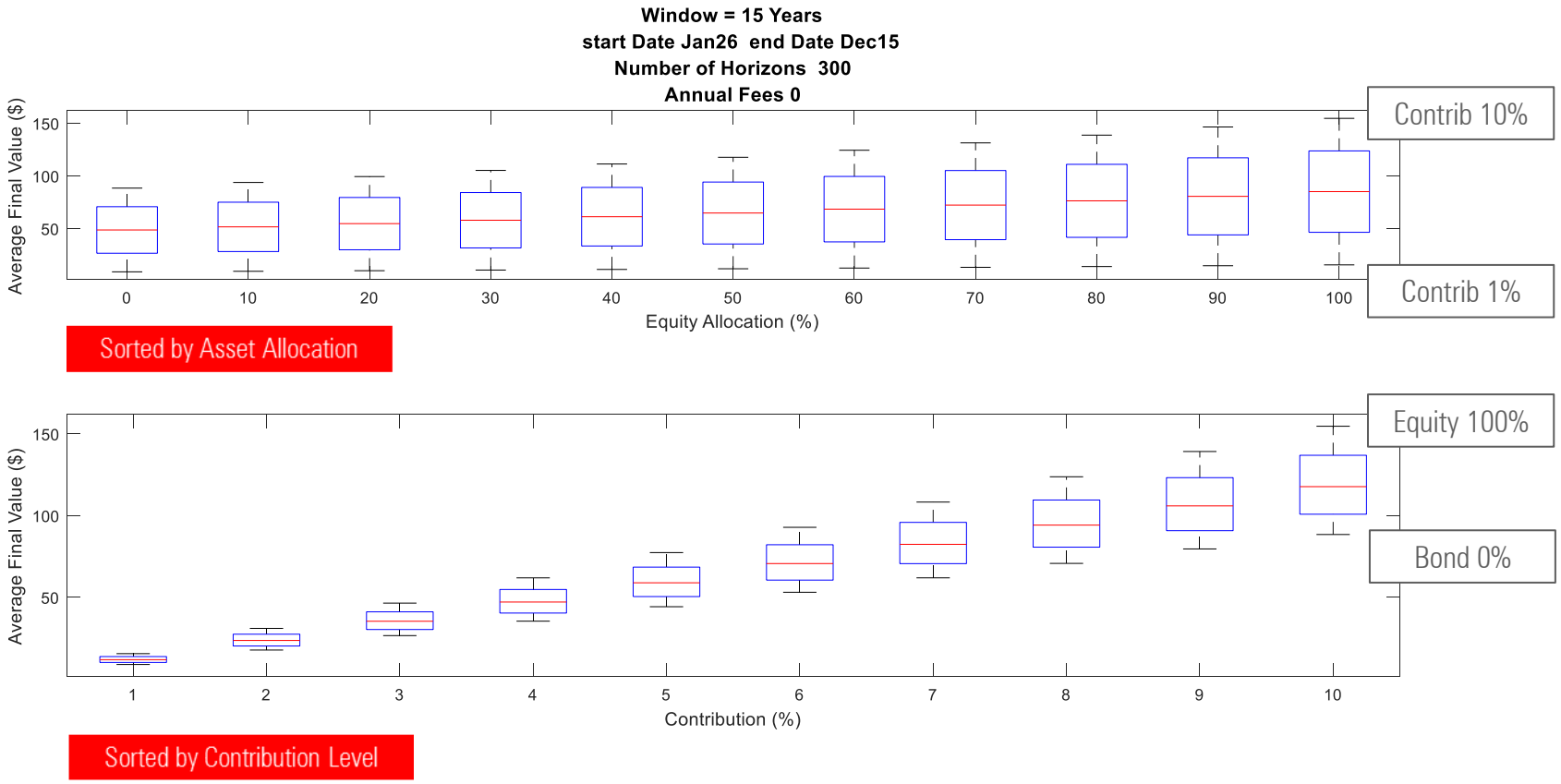
Contributions are King



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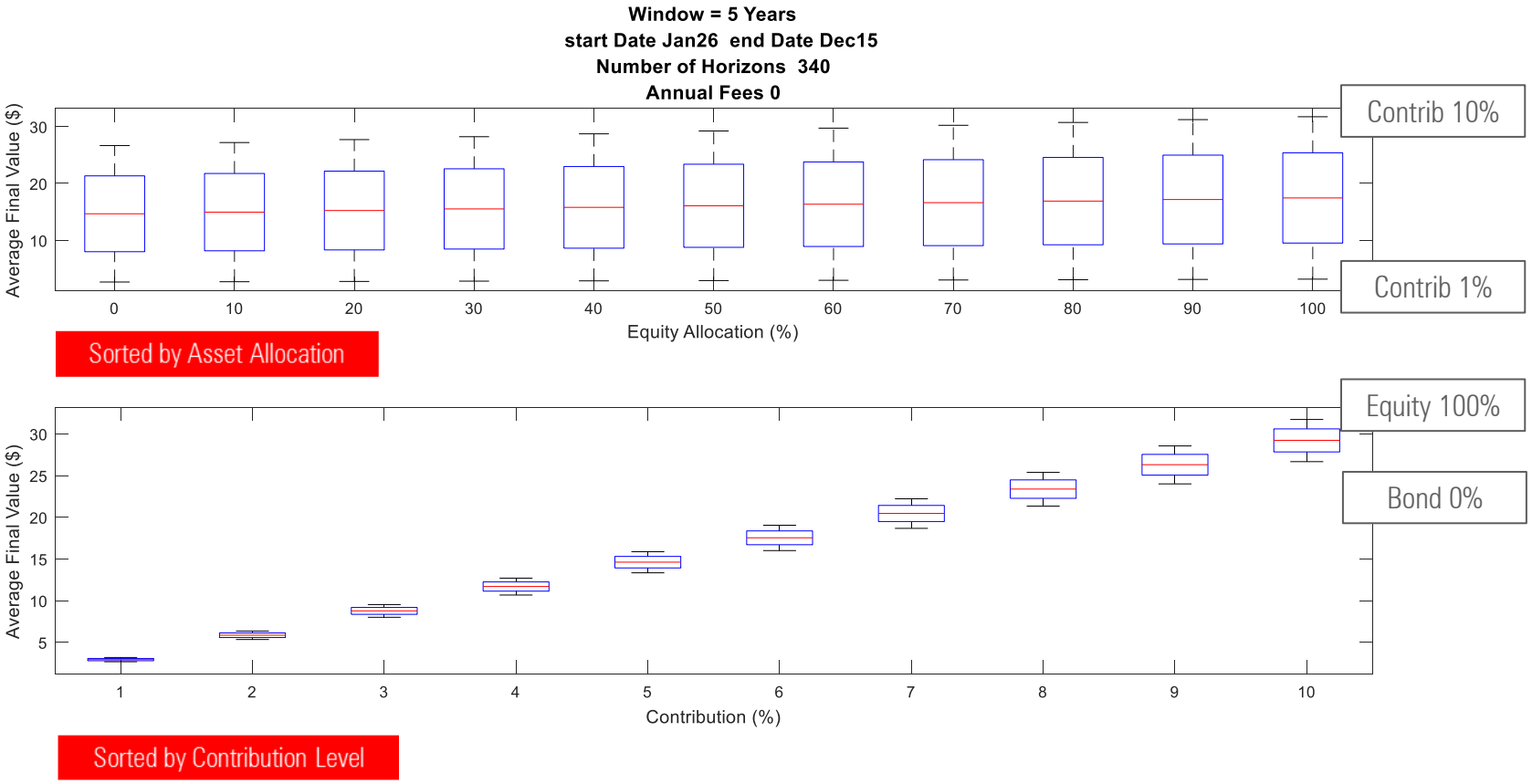

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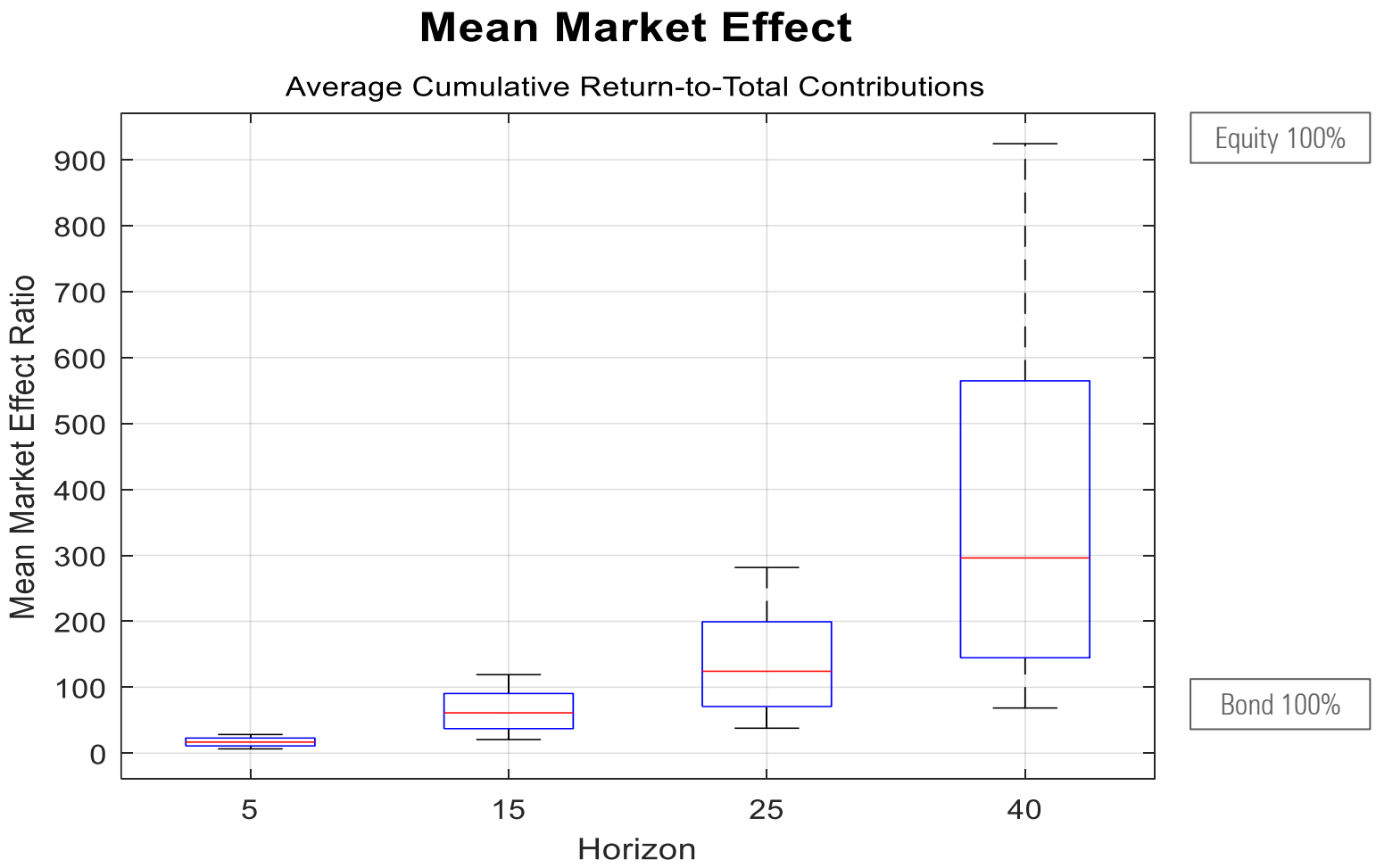

Source:: "Contributions Are King" Ratner (2017) Morningstar Magazine.. Portfolios calculated using 75/25 S&P 500/IA Small Cap Indexes and 75/25 IT and LT IA SBBI Govt Bond Indexes. Portfolios are rebalanced at end of each quarter and contributions are made at the beginning.

Initial Conditions: Valuation Matters

Sources: Robert J. Shiller, 10-Yeăr Yield, Hal Ratner, Implied Total Return

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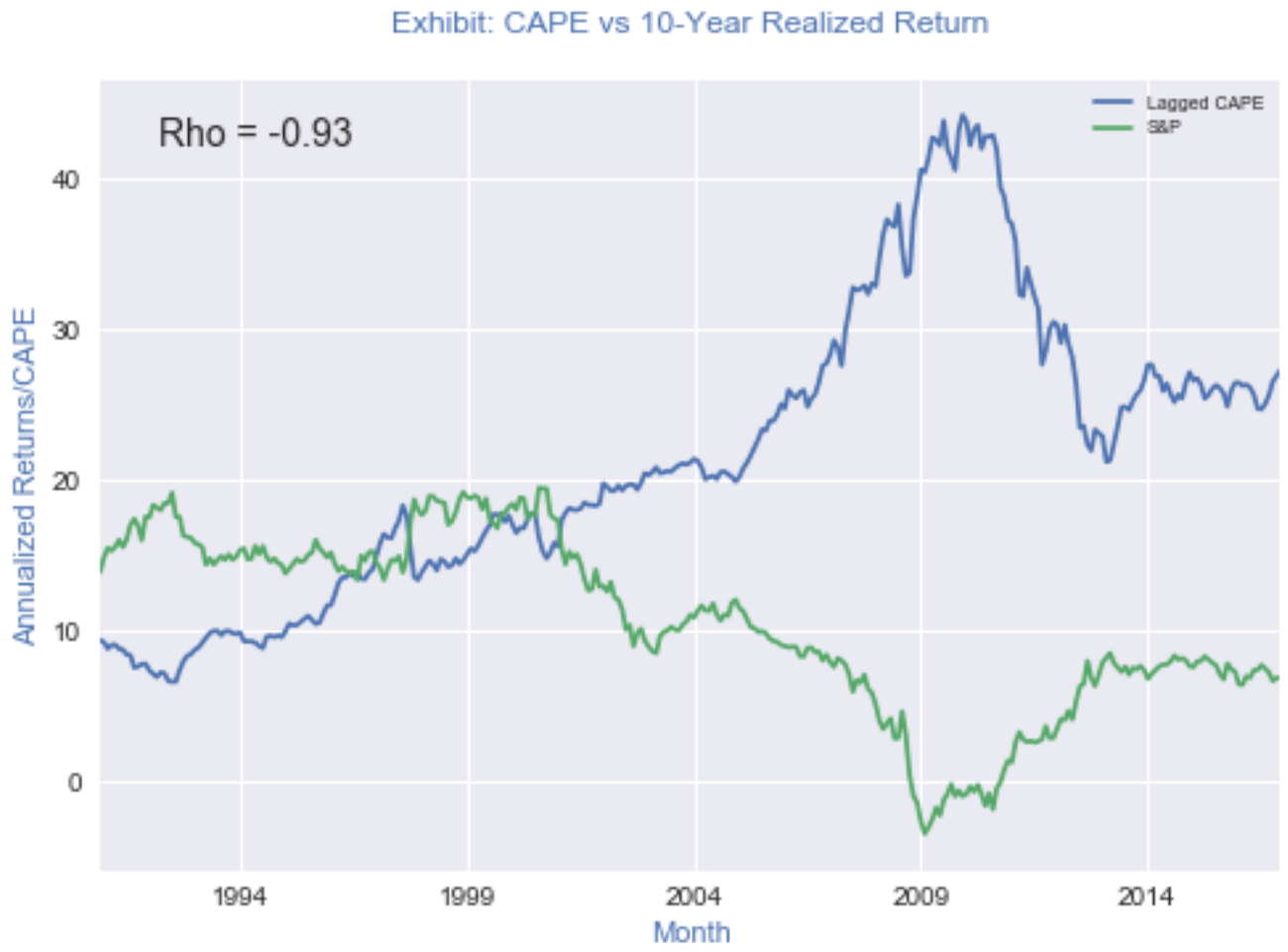
Initial Conditions: Valuation Matters



Sources: Robert J. Shiller

Risk Is Not Stationary: Economic Regime Matters

- Risk On/Risk Off (Sept 2007 - Aug 2017)

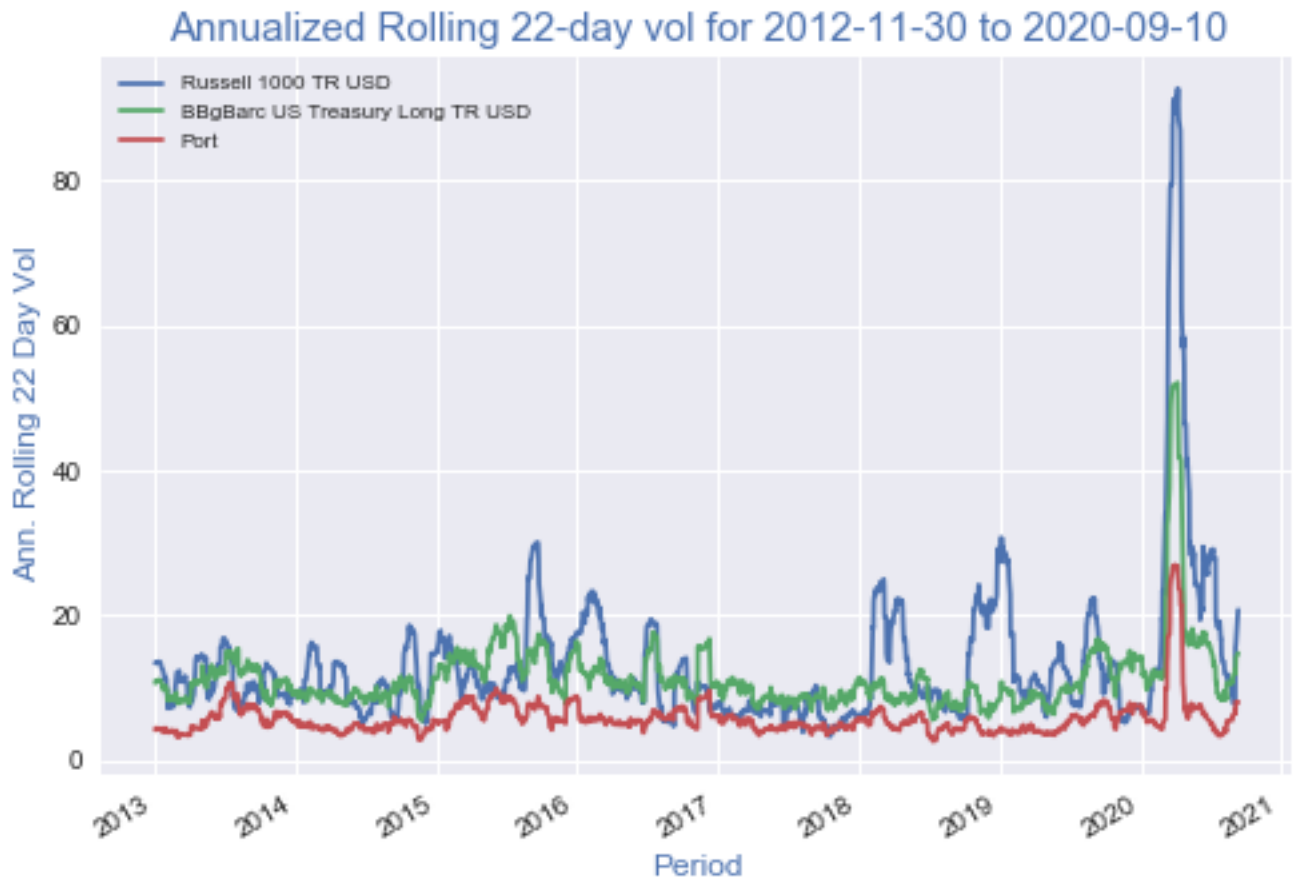
	LC	SC	EAFE	Bonds	Cash
LC	1.000	0.893	0.895	-0.318	-0.174
SC	0.893	1.000	0.757	-0.394	-0.167
EAFE	0.895	0.757	1.000	-0.245	-0.126
Bonds	-0.318	-0.394	-0.245	1.000	0.182
Cash	-0.174	-0.167	-0.126	0.182	1.000

- High Real Rates(Oct 1990- Sept 2000)

	LC	SC	EAFE	Bonds	Cash
LC	1.000	0.494	0.520	0.295	0.117
SC	0.494	1.000	0.334	-0.029	-0.024
EAFE	0.520	0.334	1.000	0.145	-0.008
Bonds	0.295	-0.029	0.145	1.000	0.242
Cash	0.117	-0.024	-0.008	0.242	1.000

Source: Morningstar Direct. Estimates are for the following indexes: the IA S&P 500, IA Small Cap, The Morgan Stanley Europe Asia Far East, and the IA Intermediate-Term, Govt, Long-term Govt, Long-Term Corporate and 30-Day T-Bill Indexes. Indexes shown are unmanaged and not available for direct investment.

Economic Environment: Risk on Risk Off



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Inflation Hedging Asset Classes

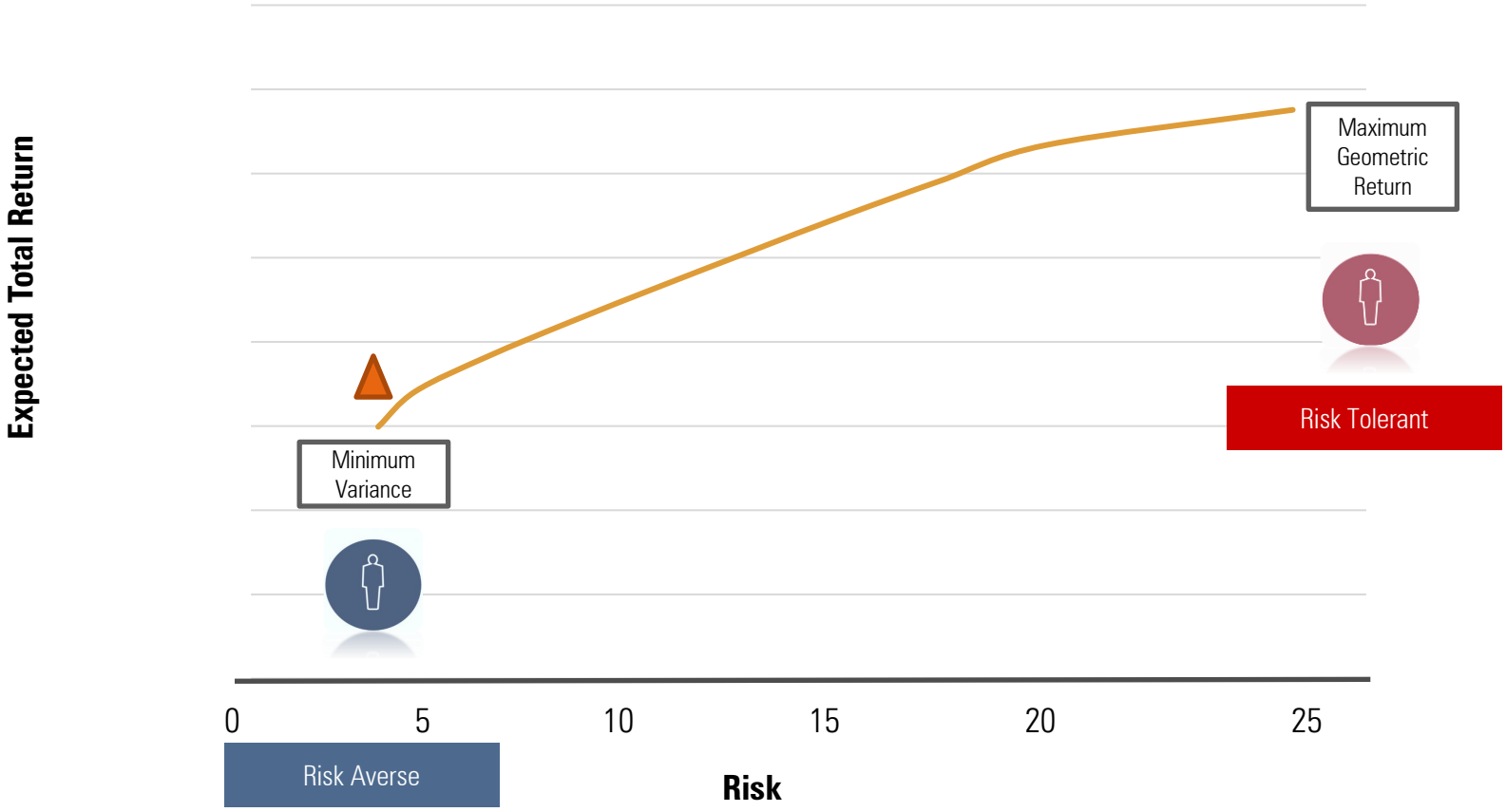
- Correlation of Asset Classes with Seasonally Adjusted CPI-U

	1 Months	3 Months	6 Months	12 Months	Stdev
BBgBarc Long Term US Treasury TR USD	-28%	-40%	-37%	-23%	11.14
EMIX Global Mining Global Gold TR USD	-4%	-4%	17%	17%	35.94
S&P GSCI Gold TR	5%	4%	21%	42%	16.91
FTSE Treasury Bill 3 Mon USD	12%	18%	26%	46%	0.43
Morningstar US REIT TR USD	6%	20%	34%	40%	20.32
BBgBarc US Treasury US TIPS TR USD	5%	9%	38%	37%	5.83
Russell 3000 TR USD	5%	27%	42%	26%	15.18
FTSE EPRA Nareit Developed TR USD	7%	23%	44%	45%	18.47
FTSE EPRA Nareit Developed Ex US TR USD	7%	23%	47%	42%	18.37
S&P/LSTA U.S. BB Ratings Loan TR USD	28%	32%	56%	37%	5.87
Morningstar US Real Asset TR USD	18%	38%	69%	78%	7.17
Bloomberg Commodity TR USD	33%	61%	82%	87%	15.99
US BLS CPI All Urban SA 1982-1984	100%	100%	100%	100%	1.04
nobs	229	76	38	19	-

Source: Morningstar Direct. Estimates are for the following indexes: the IA S&P 500, IA Small Cap, The Morgan Stanley Europe Asia Far East, and the IA Intermediate-Term, Govt, Long-term Govt, Long-Term Corporate and 30-Day T-Bill Indexes. Indexes shown are unmanaged and not available for direct investment.

Representing Risk: Efficient Frontier

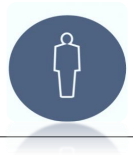
Mean-Variance Efficient Frontier for the Efficient Set of Portfolios



Source: Morningstar Associates, LLC. For illustrative purposes only.

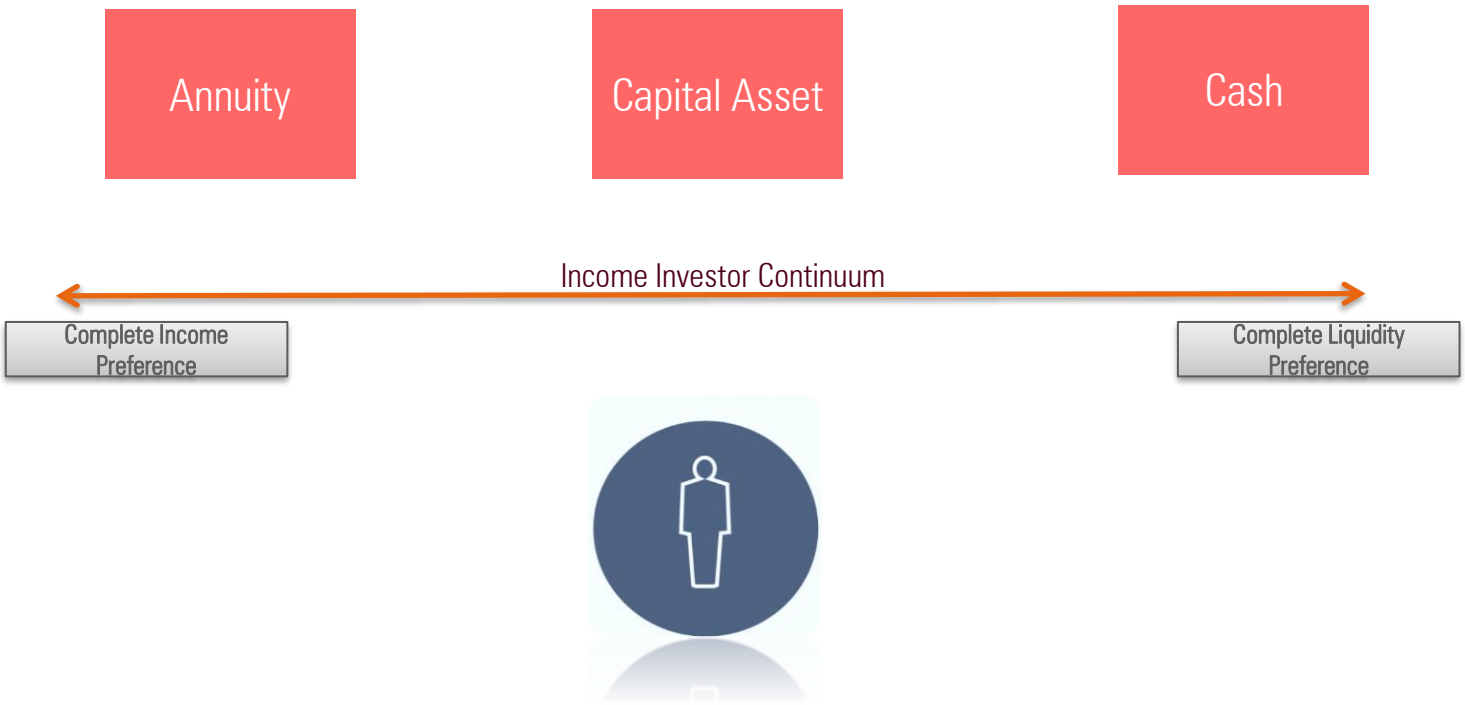
Investor Types and Asset Allocation: Defining the Investor

- Investors divide among the following groups:
  - *Total Return Investor*
    - Cares about the level of returns
  - *Benchmark-Relative or Liability-Driven Investor*
    - Cares about return and risk relative to a benchmark
      - Pension plans
      - Most Investment Funds
  - *Income Investor*
    - Cares about consistent level of nominal income
    - Highly tolerant of principle fluctuation



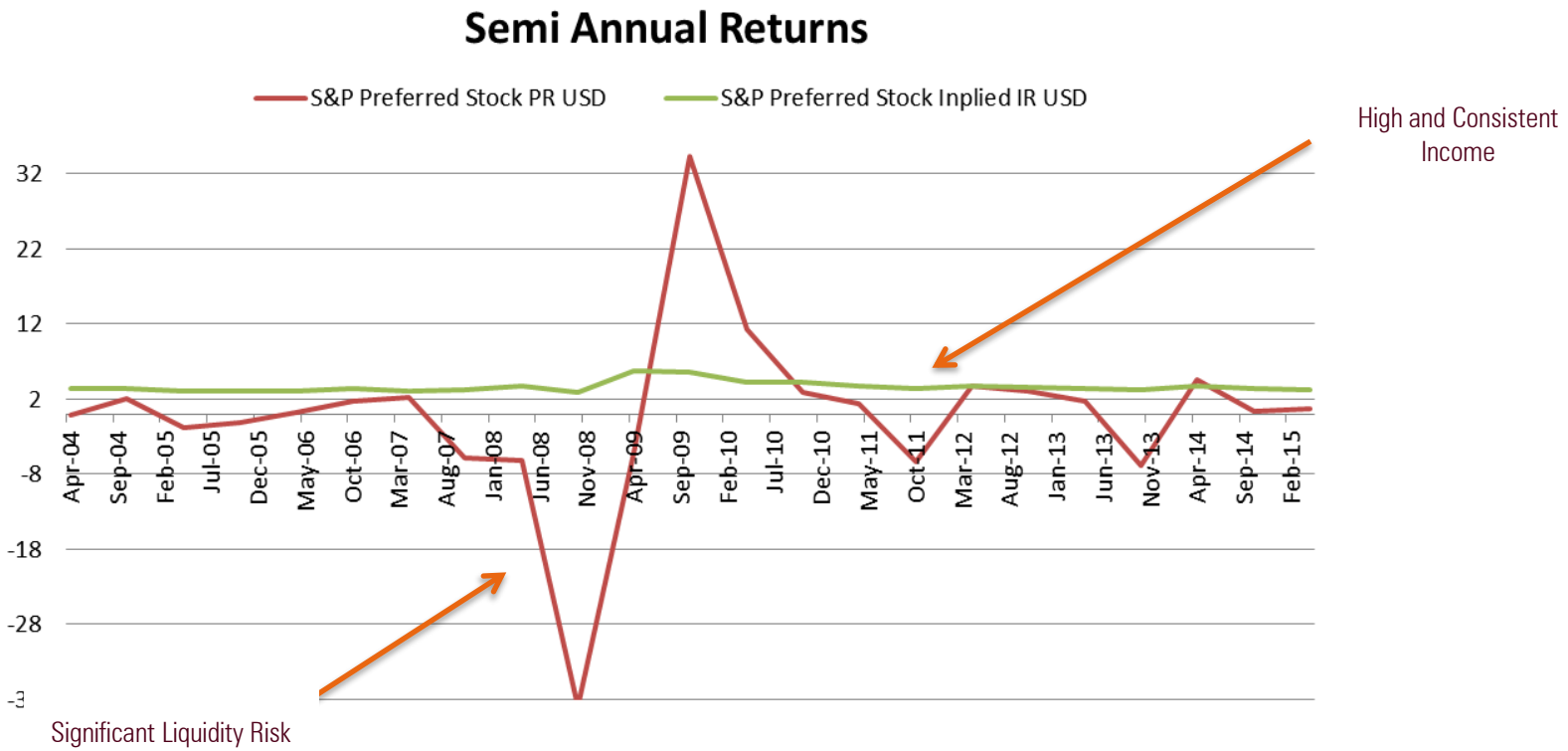
Representative Income Investor

- Income investor is willing to trade liquidity for income consistency.



Income vs. Total Return
Historical Record

Income is Comparatively Predictable



Source: "Building Efficient Income Portfolios" Blanchett & Ratner (2015) Journal of Portfolio Management

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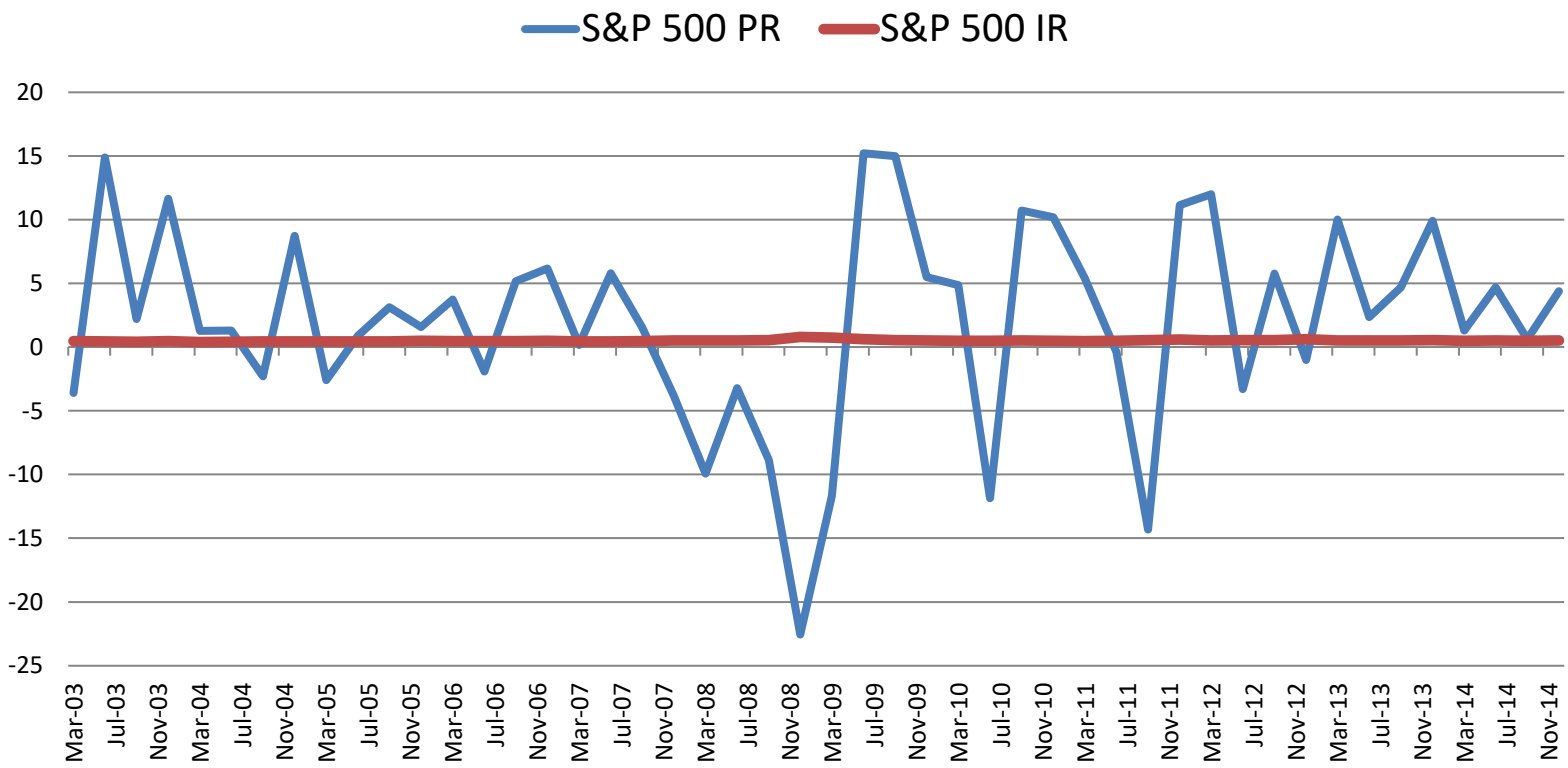
Income vs. Total Return
Historical Record

Income is Comparatively Predictable



Source: Authors calculations. For illustrative purposes only.

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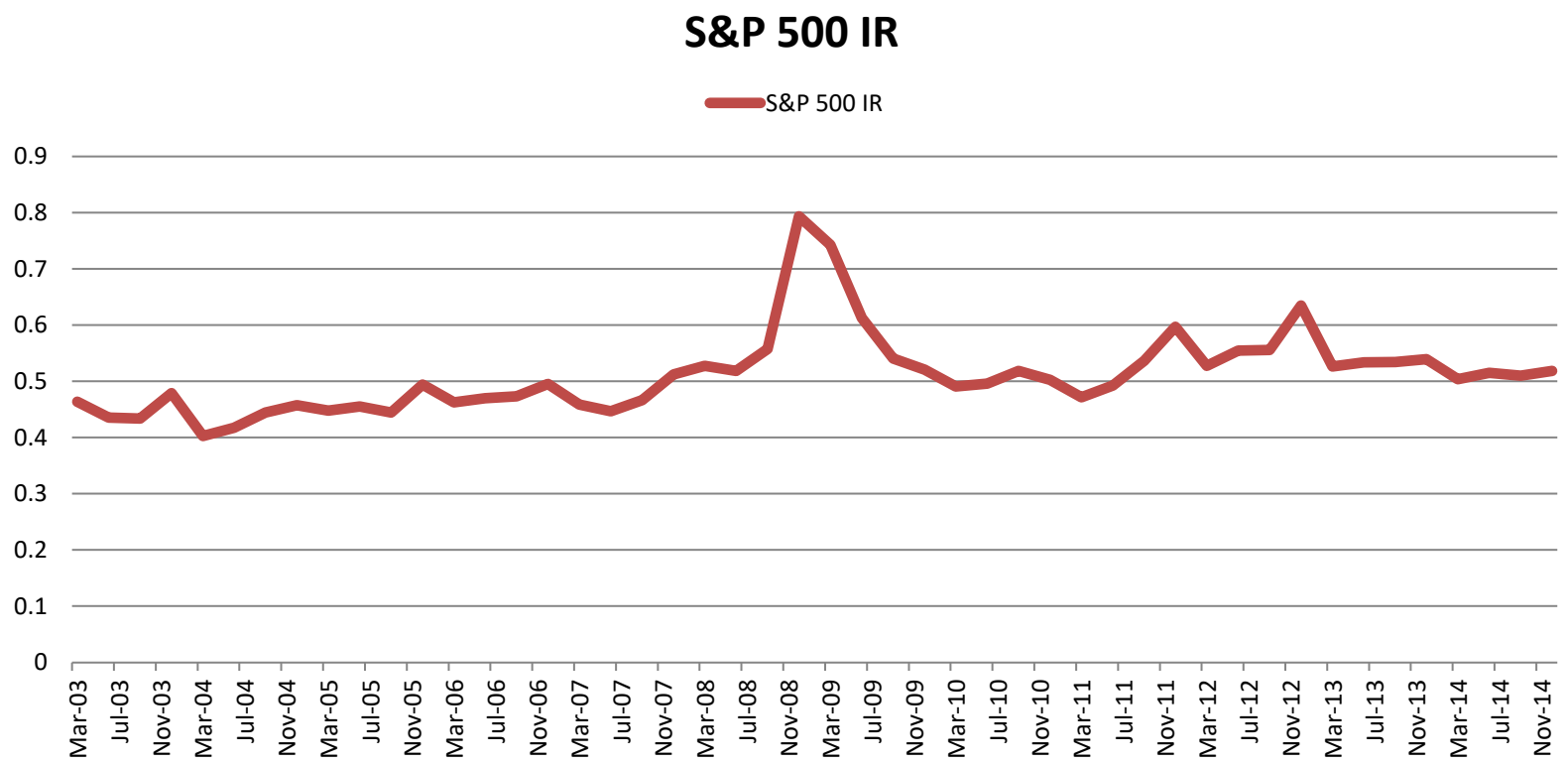
Income vs. Total Return
Historical Record

Income is Comparatively Predictable



Source: Authors calculations. For illustrative purposes only.

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Income vs. Total Return
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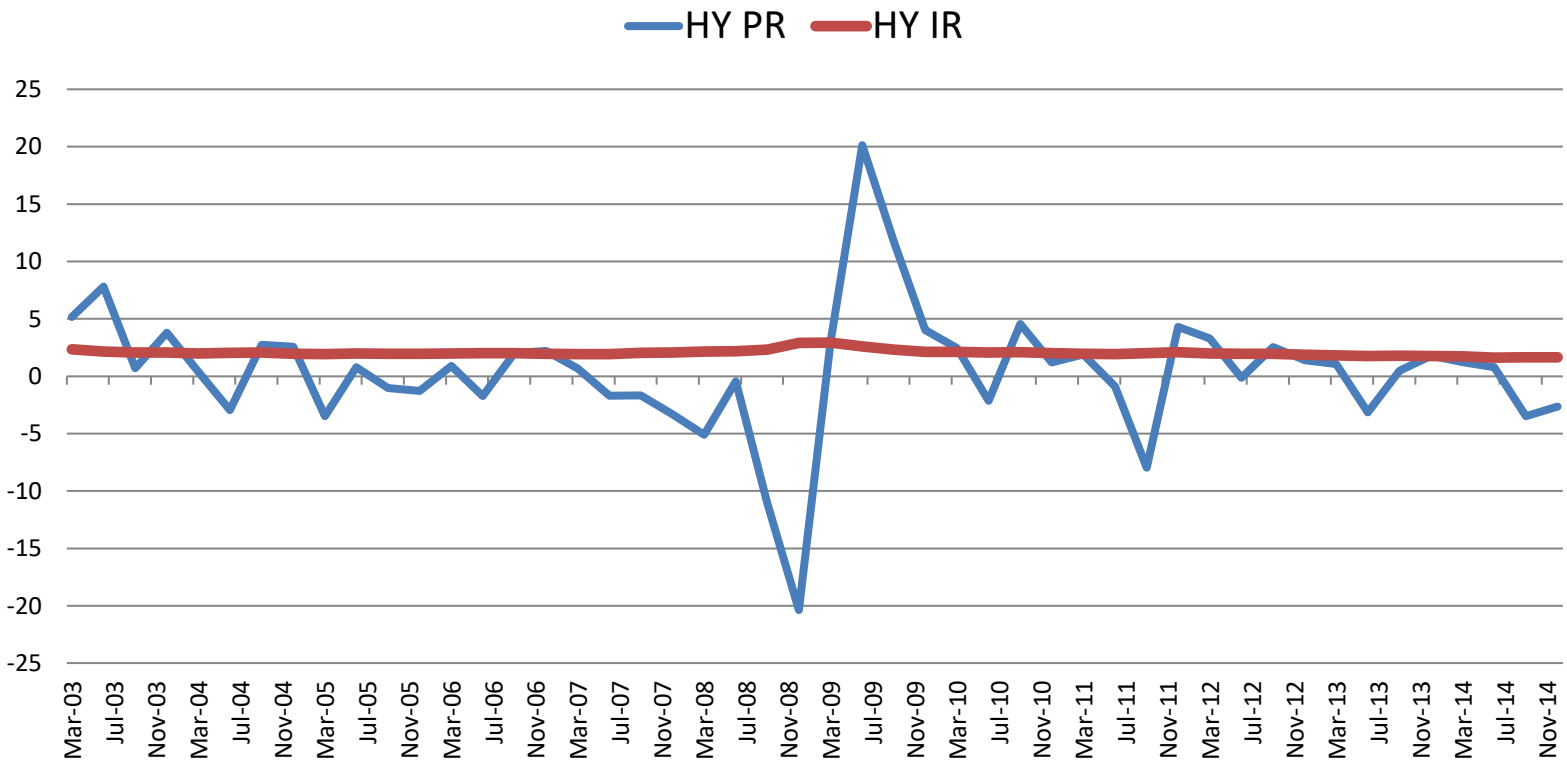

Source: Authors calculations. For illustrative purposes only.

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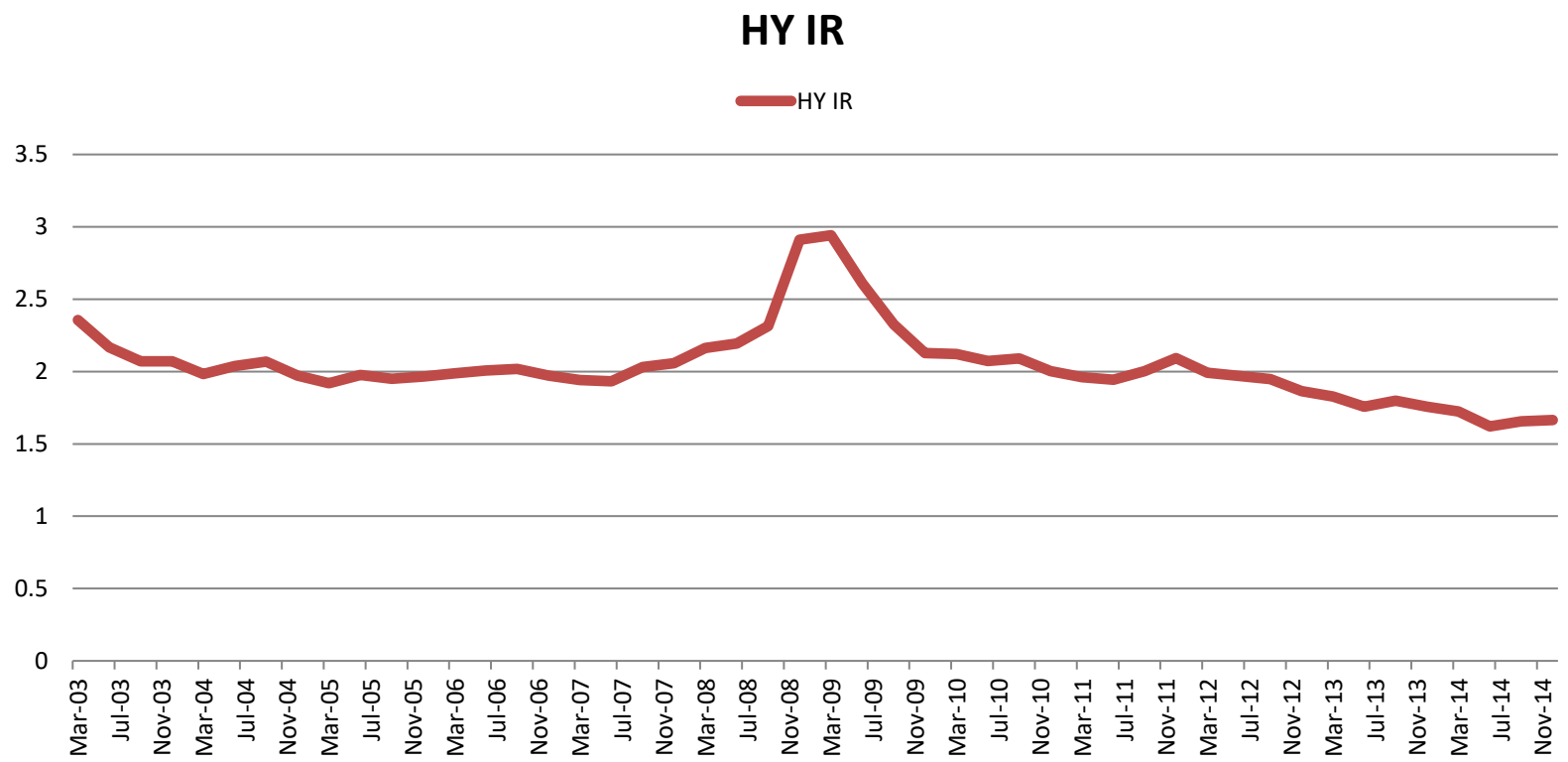
Income vs. Total Return
Historical Record

Income is Comparatively Predictable



Source: Authors calculations. For illustrative purposes only.

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Income vs. Total Return
Historical Record

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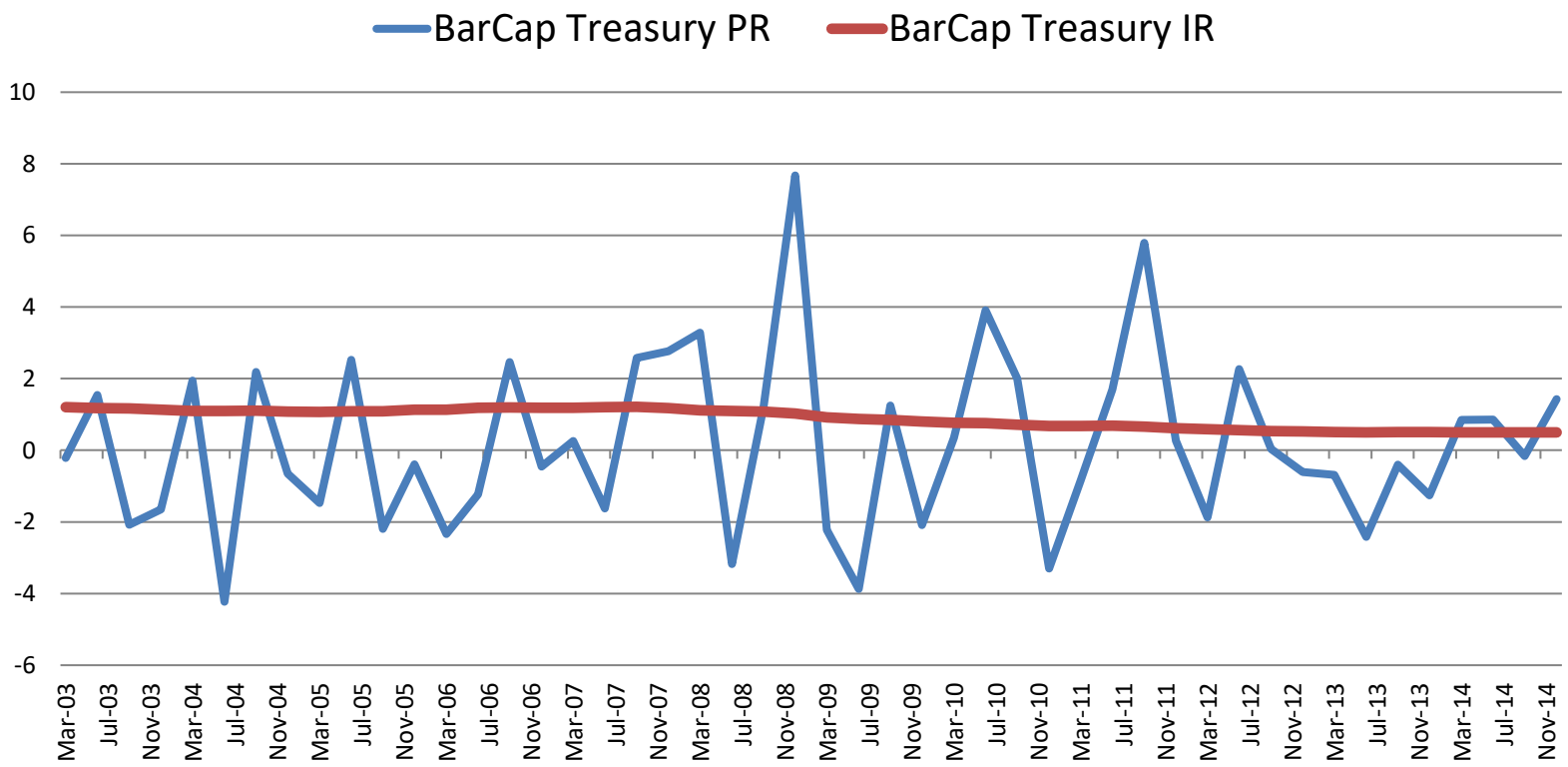

Source: Authors calculations. For illustrative purposes only.

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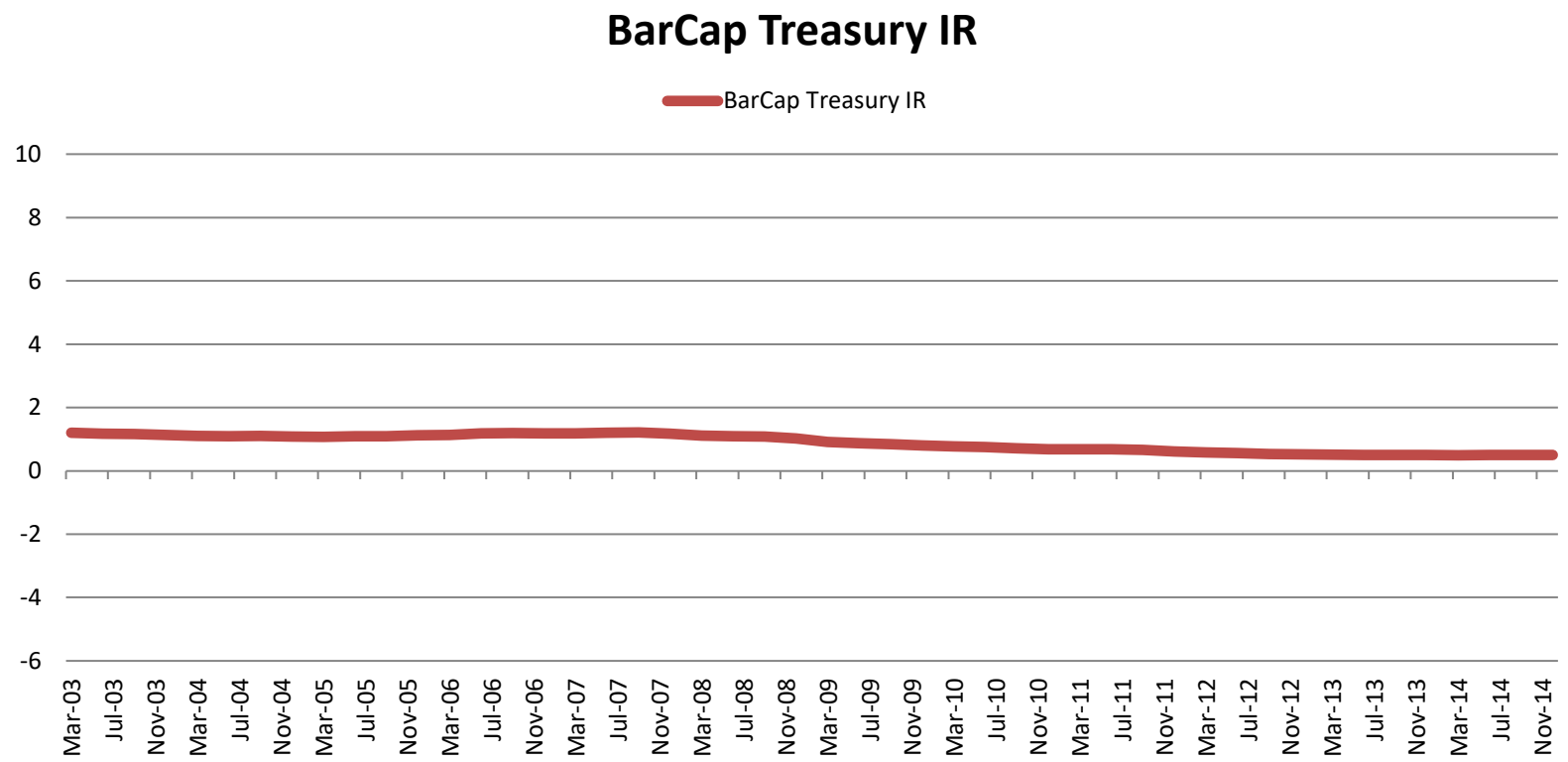
Income vs. Total Return
Historical Record

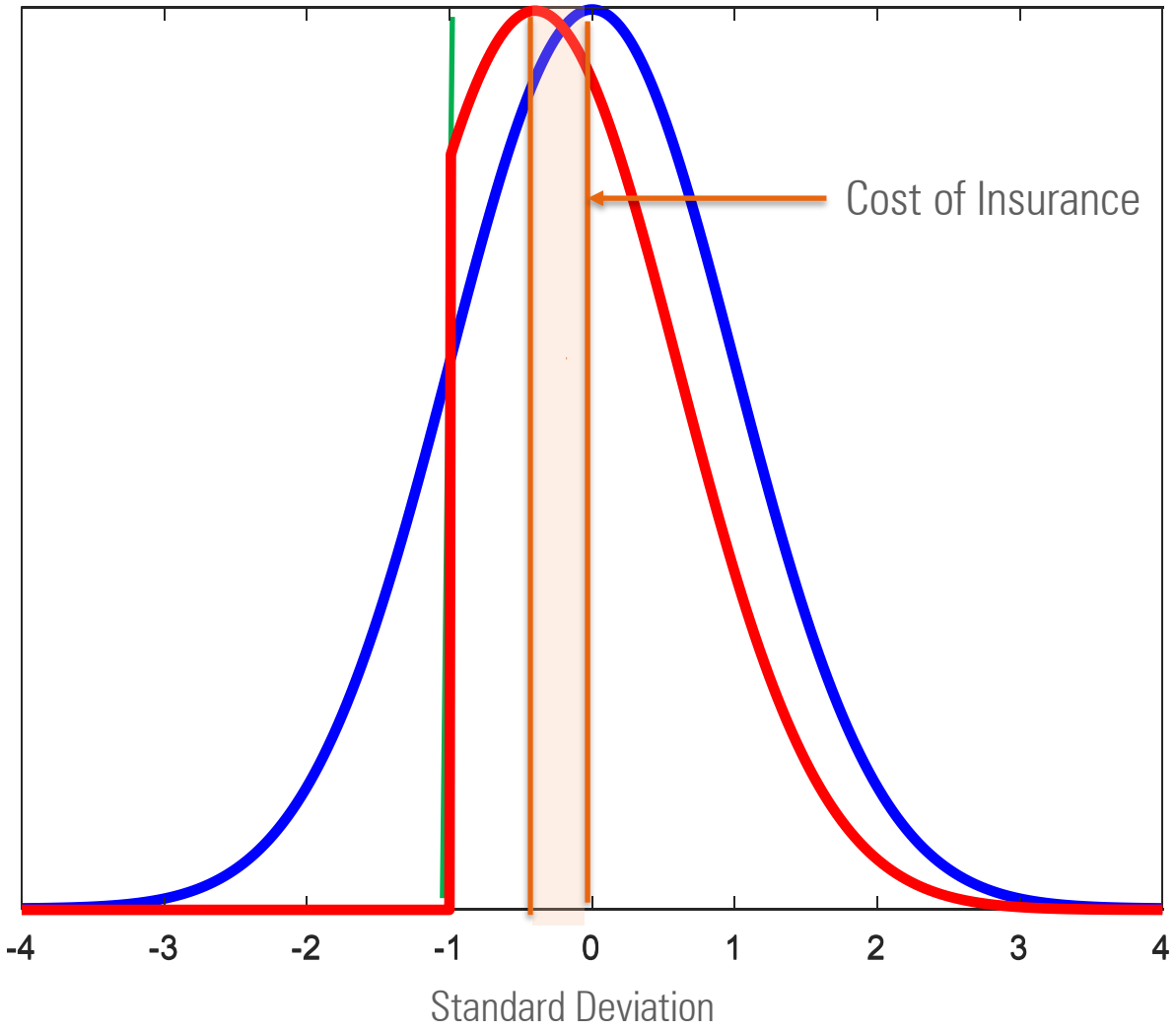
Income is Comparatively Predictable



Source: Authors calculations. For illustrative purposes only.

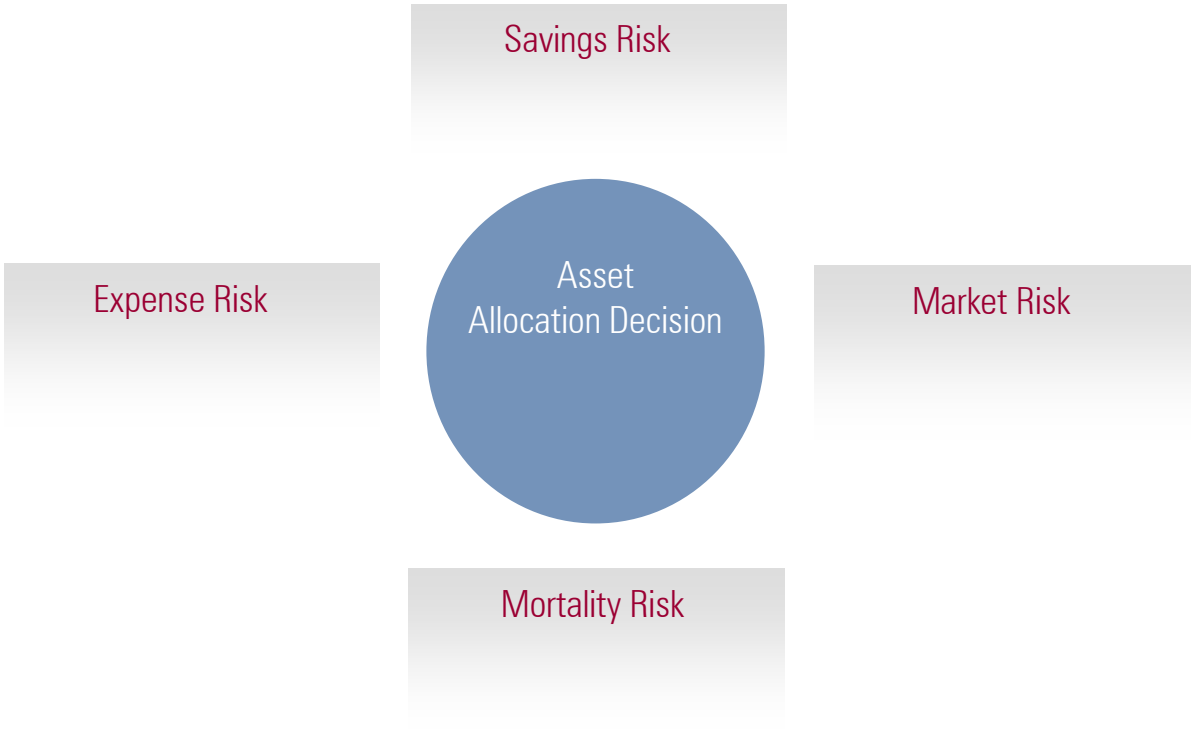
Insurance

Adding Insurance: Trimming the Tails

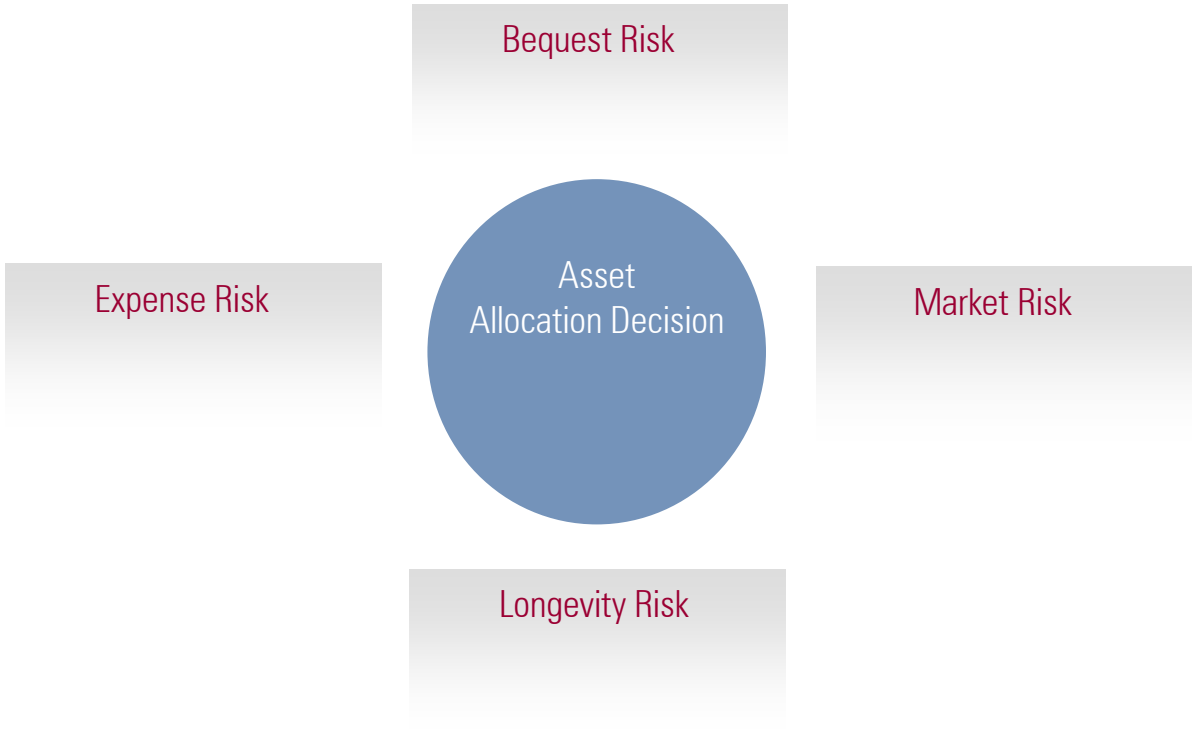


Source: Morningstar Investment Management,, LLC

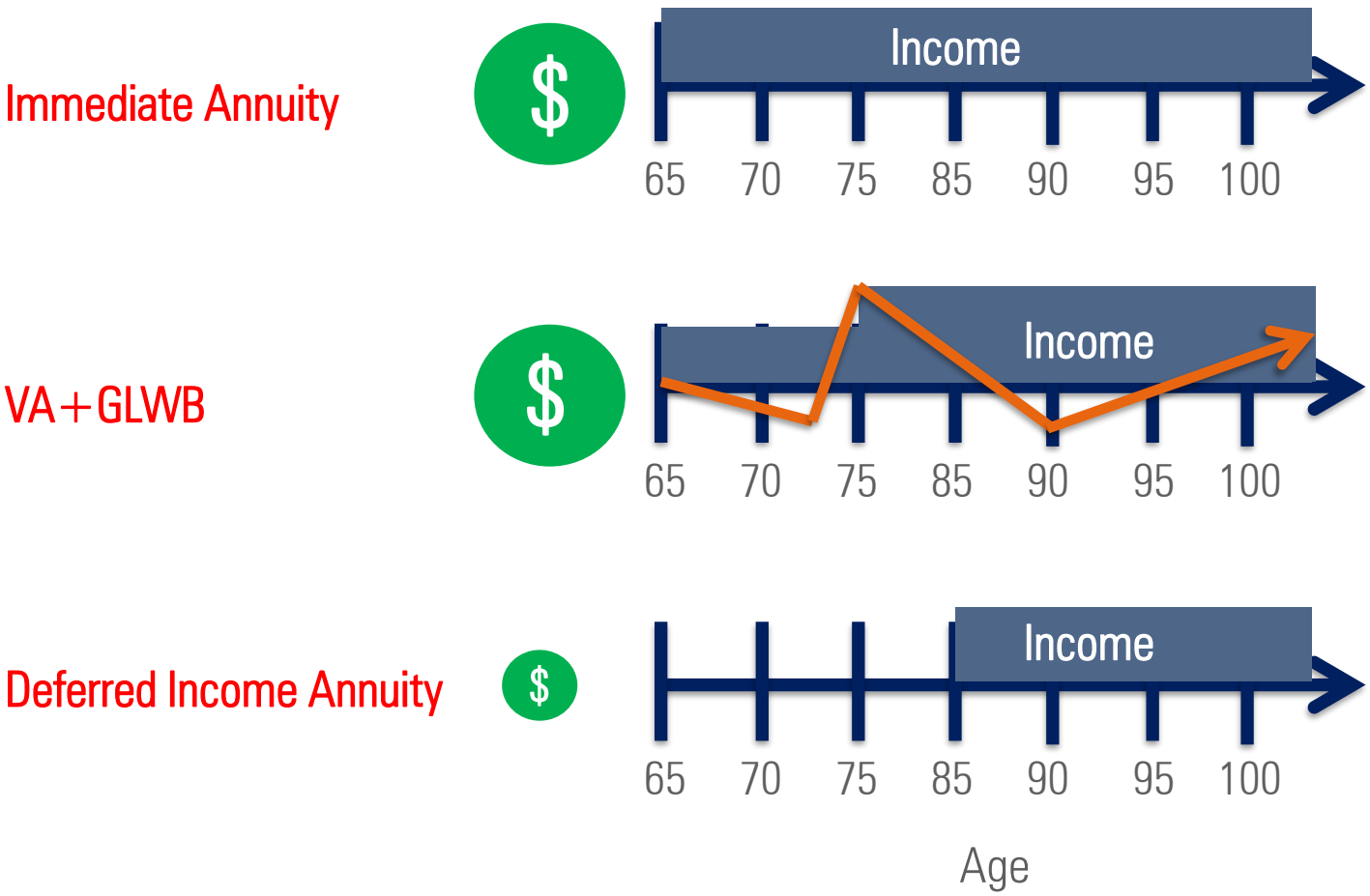
Managing Investment Outcomes: Accumulation Phase



Managing Investment Outcomes: Drawdown Phase



Insuring against Longevity Risk: Different Types of Annuities



For illustration only.

Social Security: Percent of Base Benefit

Base Year Retirement

Birth Year	Retirement Age 62	63	64	65	66	67	70
1954	75	80	87	93	100	108	132
1955	74	79	86	92	99	107	131
1956	73	78	84	91	98	105	129
1957	72	77	83	90	96	104	128
1958	72	77	82	89	96	102	127
1959	71	76	81	88	94	101	125
1960	70	75	80	87	93	100	124

Sources: Social Security Administration

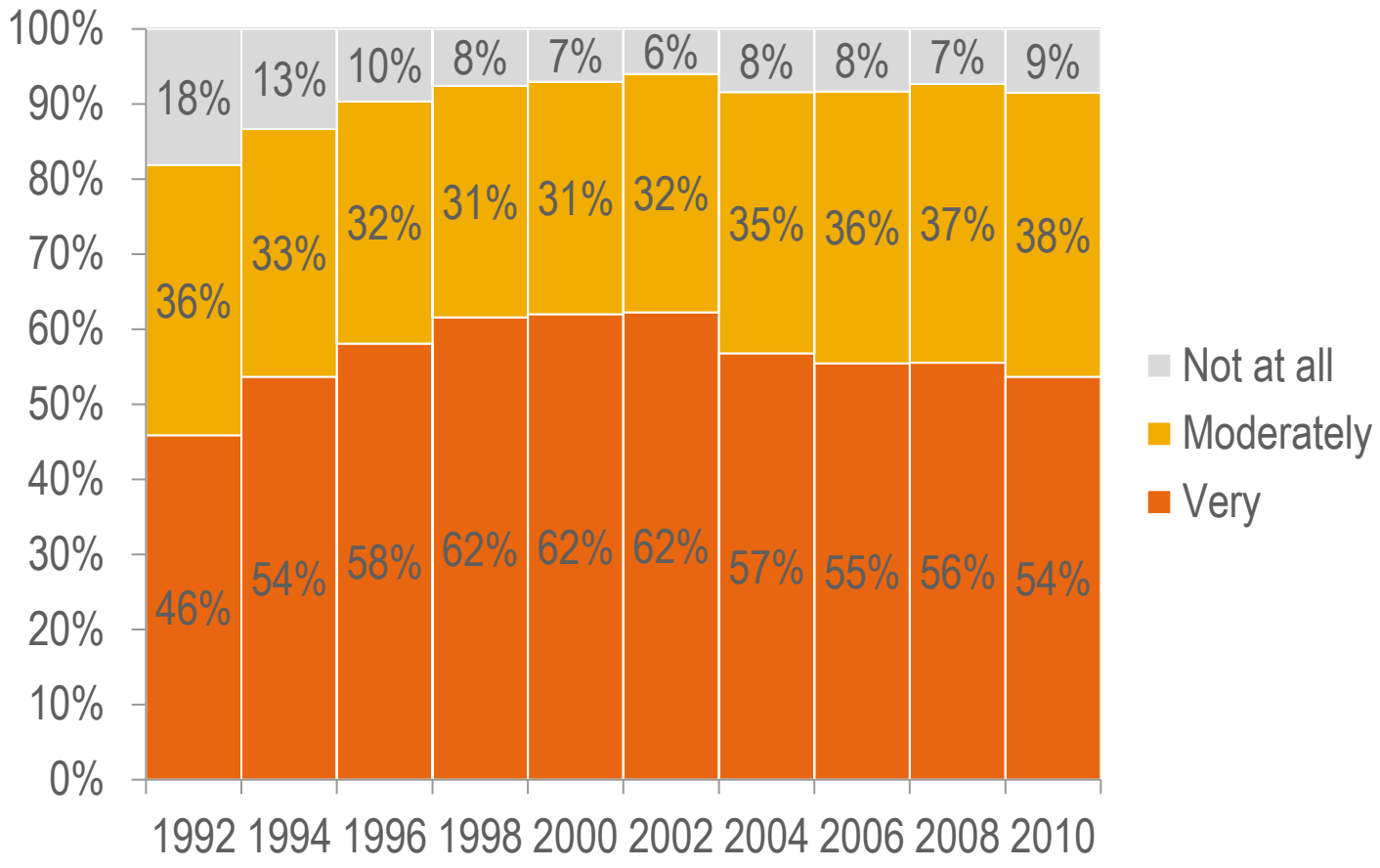
Retirement Crisis?

Do We Have Global Retirement Crisis?

- Expected $224 trillion-dollar gap by 2015 for US, UK, Japan, Netherlands, Canada & Australia
- If we add China and India: $400 trillion 5x current GDP.
  - Longer expected longevity
  - Lower savings rates.
- Largest gap is in the US. Current $28 trillion expected to rise to $137 trillion by 2050.

Retirement Satisfaction

Are Retirees Happy? (Yes)



Source: "Exploring Retiree Satisfaction" Morningstar Investment Management group White Paper.

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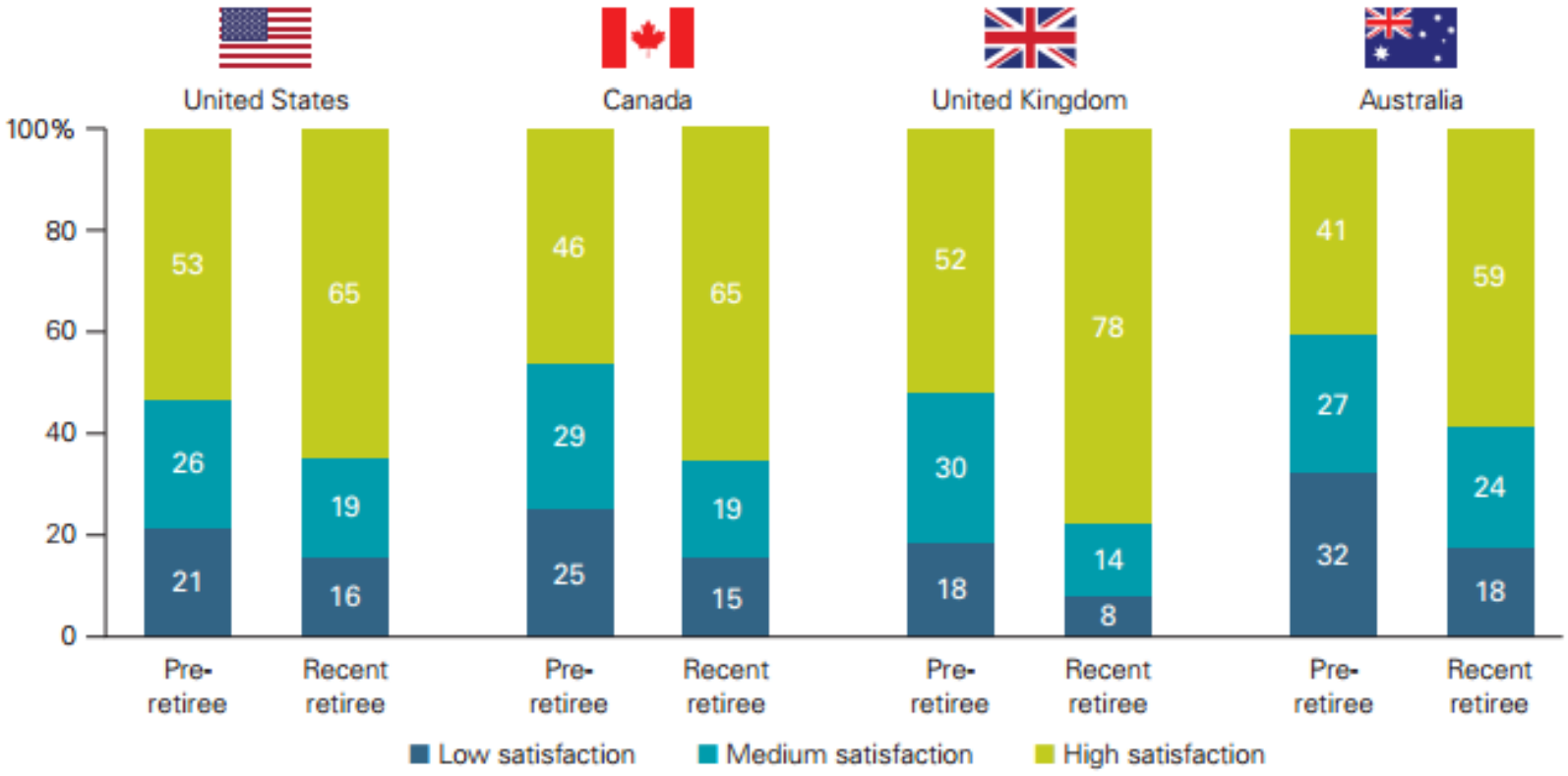
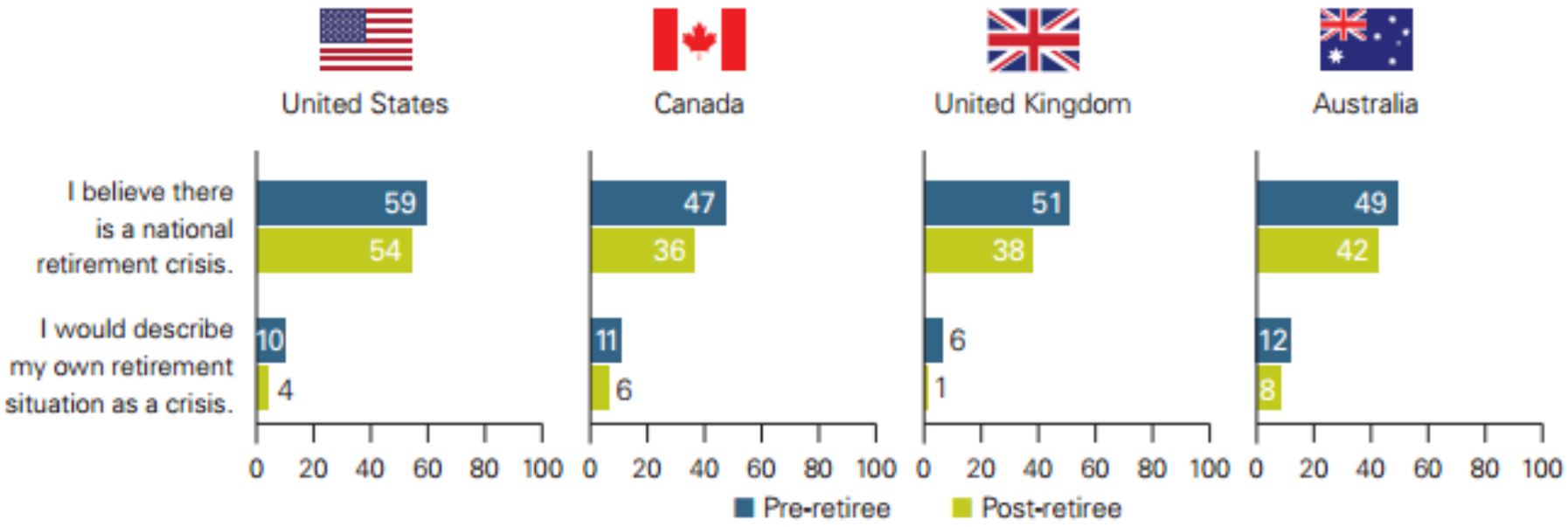
Satisfaction with Financial Situation



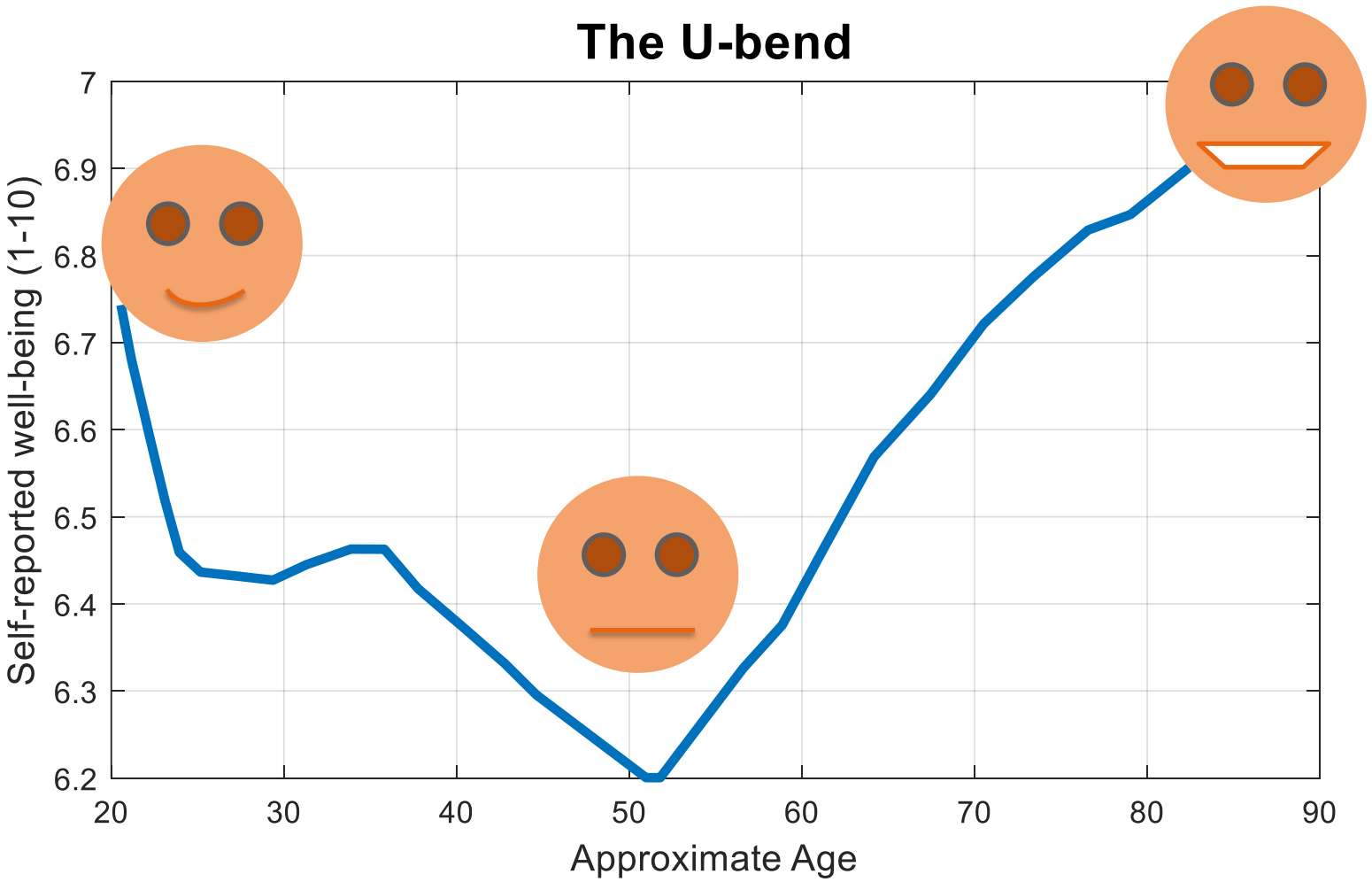
Source: Madamba & Utkus (2017)

Somebody Else's Crisis…



Source: Madamba & Utkus (2017)

Somebody Else's Crisis…



Secondary source: The Economist ((12/23/2016) Primary source: PNAS paper: "A Snapshot of the age distribution of psychological well-being in the United States" Arthur Stone.

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Epilogue: Transition from Terrestrial to Cyber Economy.

- Cyber-led quality of life improvements (tele-medicine, zoom, etc.)
- Medical improvements to longevity (median death age 100)
- Location flexibility
- Financial product innovation (greater focus on guaranteed income, behavioral solutions, auto enrollment, etc.)
- People working into "retirement", not really retiring, taking second careers.
- Likely greater government support for pensions

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Thank You: Q&A

Some Examples: Base Case (Male)

Investor Profile	Inputs
Age	30
Retirement Age	65
Gender	M
Current Wealth	£ 22,000
Current Income	£ 50,000
Real Pension	£ 25,000
Contribution Rate	7.00%

Terminal Salary	£	61,445
Desired Income At Retirement	£	45,000

Percentile	SSA	sortfall/ surplus
75	£91,312	£46,312
50	£71,288	£26,288
25	£57,429	£12,429
10	£48,401	£3,401
5	£44,669	-£331
2.5	£42,270	-£2,730

Beginning Equity	100%
Terminal Equity	60%

Some Examples: Base Case (Female)

Investor Profile	Inputs
Age	30
Retirement Age	65
Gender	F
Current Wealth	£ 22,000
Current Income	£ 50,000
Real Pension	£ 25,000
Contribution Rate	7.00%

Terminal Salary	£ 61,445
Desired Income At Retirement	£ 45,000

Percentile	SSA	sortfall/ surplus
75	£85,353	£40,353
50	£67,082	£22,082
25	£54,403	£9,403
10	£46,177	£1,177
5	£42,822	-£2,178
2.5	£40,616	-£4,384

Beginning Equity	100%
Terminal Equity	60%

Some Examples: Less-aggressive Allocation

Investor Profile	Inputs
Age	30
Retirement Age	65
Gender	M
Current Wealth	£ 22,000
Current Income	£ 50,000
Real Pension	£ 25,000
Contribution Rate	7.00%

Terminal Salary	£ 61,445
Desired Income At Retirement	£ 45,000

Percentile	SSA	sortfall/ surplus
75	£77,978	£32,978
50	£64,603	£19,603
25	£54,775	£9,775
10	£48,055	£3,055
5	£45,096	£96
2.5	£43,180	-£1,820

Beginning Equity	85%
Terminal Equity	35%

Some Examples: Retire Later

Investor Profile	Inputs
Age	30
Retirement Age	67
Gender	M
Current Wealth	£ 22,000
Current Income	£ 50,000
Real Pension	£ 25,000
Contribution Rate	7.00%

Terminal Salary	£	61,445
Desired Income At Retirement	£	45,000

Percentile	SSA	sortfall/ surplus
75	£89,065	£44,065
50	£72,485	£27,485
25	£60,249	£15,249
10	£52,009	£7,009
5	£48,470	£3,470
2.5	£46,135	£1,135

Beginning Equity	85%
Terminal Equity	35%

Some Examples: Pre-retirement Expenditure

Investor Profile	Inputs
Age	30
Retirement Age	67
Gender	M
Current Wealth	£ 22,000
Current Income	£ 50,000
Real Pension	£ 25,000
Contribution Rate	7.00%

Terminal Salary	£	61,445
Desired Income At Retirement	£	45,000

Extraordinary CF Pre retirement	-£	10,000
Year of CF		3

Percentile	SSA	sortfall/ surplus
75	£82,264	£37,264
50	£67,918	£22,918
25	£57,246	£12,246
10	£49,763	£4,763
5	£46,733	£1,733
2.5	£44,361	-£639

Beginning Equity	85%
Terminal Equity	35%

Some Examples: Post-retirement Cash Flow

Investor Profile	Inputs
Age	30
Retirement Age	67
Gender	M
Current Wealth	£ 22,000
Current Income	£ 50,000
Real Pension	£ 25,000
Contribution Rate	7.00%

Terminal Salary	£ 61,445
Desired Income At Retirement	£ 45,000

Extraordinary CF Pre retirement	-£ 10,000
Year of CF	3
Extradonory CF Post retirement	£ 250,000
Year of CF	5

Percentile	SSA	sortfall/ surplus
75	£98,925	£53,925
50	£84,521	£39,521
25	£73,596	£28,596
10	£66,064	£21,064
5	£62,714	£17,714
2.5	£60,058	£15,058

Beginning Equity	85%
Terminal Equity	35%

Some Examples: Post-retirement Expenditure--Later

Investor Profile	Inputs
Age	30
Retirement Age	67
Gender	M
Current Wealth	£ 22,000
Current Income	£ 50,000
Real Pension	£ 25,000
Contribution Rate	7.00%

Terminal Salary	£ 61,445
Desired Income At Retirement	£ 45,000

Extraordinary CF Pre retirement	-£ 10,000
Year of CF	3
Extradonory CF Post retirement	£ 250,000
Year of CF	20

Percentile	SSA	sortfall/ surplus
75	£86,235	£41,235
50	£71,867	£26,867
25	£61,241	£16,241
10	£53,804	£8,804
5	£50,723	£5,723
2.5	£48,529	£3,529

Beginning Equity	85%
Terminal Equity	35%

Some Examples: Base Case--Investment In Annuity

Investor Profile	Inputs
Age	30
Retirement Age	65
Gender	M
Current Wealth	£ 22,000
Current Income	£ 50,000
Real Pension	£ 25,000
Contribution Rate	7.00%

Terminal Salary	£ 61,445
Desired Income At Retirement	£ 45,000

Immediate Annuity at Retirement	50%
Expected Annuity Rate	7.0%
Inflation Rate	3.5%

Percentile	SSA	sortfall/ surplus
75	£86,782	£41,782
50	£69,313	£24,313
25	£56,562	£11,562
10	£48,488	£3,488
5	£44,951	-£49
2.5	£42,294	-£2,706

Beginning Equity	100%
Terminal Equity	60%

Some Examples: Base Case--Investment In Annuity--Female

Investor Profile	Inputs
Age	30
Retirement Age	65
Gender	F
Current Wealth	£ 22,000
Current Income	£ 50,000
Real Pension	£ 25,000
Contribution Rate	7.00%

Terminal Salary	£ 61,445
Desired Income At Retirement	£ 45,000

Immediate Annuity at Retirement	50%
Expected Annuity Rate	7.0%
Inflation Rate	3.5%

Percentile	SSA	sortfall/ surplus
75	£80,998	£35,998
50	£65,156	£20,156
25	£53,585	£8,585
10	£46,241	£1,241
5	£43,005	-£1,995
2.5	£40,623	-£4,377

Beginning Equity	100%
Terminal Equity	60%

This commentary may contain forward-looking statements, which reflect our current expectations or forecasts of future events. Forward-looking statements are inherently subject to, among other things, risks, uncertainties and assumptions which could cause actual events, results, performance or prospects to differ materiality from those expressed in, or implied by, these forward-looking statements. The forward-looking information contained in this commentary is as of the date of this report and subject to change. There should not be an expectation that such information will in all circumstances be updated, supplemented or revised whether as a result of new information, changing circumstances, future events or otherwise.

The results from the simulations described, while hypothetical in nature and not actual investment results or guarantees of future results, can provide an important look at strategies designed to help retirees reach their goals.

Monte Carlo is an analytical method used to simulate random returns of uncertain variables to obtain a range of possible outcomes. Such probabilistic simulation does not analyze specific security holdings, but instead analyzes the identified asset classes. The simulation generated is not a guarantee or projection of future results, but rather, a tool to identify a range of potential outcomes that could potentially be realized. The Monte Carlo simulation is hypothetical in nature and for illustrative purposes only. Results noted may vary with each use and over time. This should not be considered tax or financial planning advice. Please consult a tax and/or financial professional for advice specific to your individual circumstances.

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