How good are default investment policies in defined contribution (DC) pension plans?

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Outline

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What is long-term investing?

It consists of investing with a typical holding period of more than five years (directly or through intermediaries), and is typically undertaken in private parternships.

Typical examples include

1. Infrastructure projects (highways, bridges, wind farms, water-related projects)
2. Fast-growing private firms
3. Cutting-edge technologies

PATIENT CAPITAL

THE CHALLENGES & PROMISES OF LONG-TERM INVESTING

Victoria Ivashina & Josh Lerner

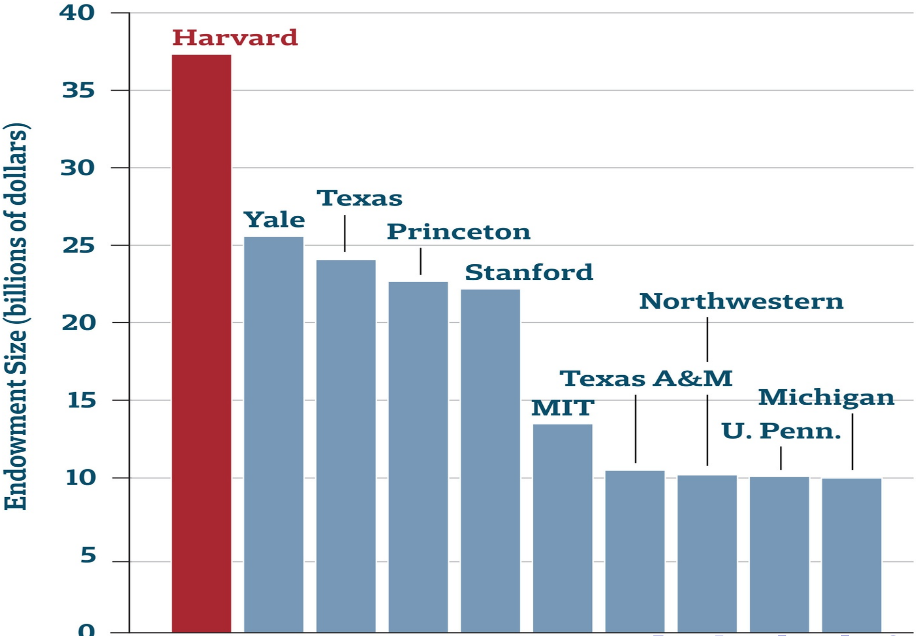
Typical players and characteristics

- Endowments, pension funds, insurance companies, sovereign wealth funds and family offices.
- Less liquid assets.
- Can tolerate more volatility.
- Market timing is essentially irrelevant.

Why long-term investing?

- The iPod release was an initial disaster: shares fell by 25%.
- The joke was that it stood for "I prefer other devices" (Wired '01).
- The board supported Steve Jobs and Apple ended up selling 390 million units
- In a context of low interest rates, long-term investing may be the only alternative to obtain attractive returns

10 Largest University Endowments



Endowments

- In universities, endowment returns account for around 30% of the yearly budget
- No more than 5% changes in the portfolio over consecutive years
- Capital gains in Yale: 5% in bonds, 12% in U.S. equities, 14% private equity and 16% in real assets such as farmlands and timber.
- Despite success stories, a study[1]. with 29,672 institutions has shown that the median annual returns are 4.46 percentage points below a 60-40 mix of U.S. equity and Treasury bond indexes.

[1] Investment Returns and Distribution Policies of Non-Profit Endowment Funds, by Sandeep Dahiya Georgetown University - Department of Finance David Yermack

More examples of long-term investing

- According to OECD, worldwide there are USD 35 trillion in pension funds (2015) and USD 15 trillion in life insurerS (2015)
- Sovereign wealth funds had around USD 1 trillion in 2001 and they jumped to USD 7.4 trillions in 2016
- Norway's GPGF (Government Pension Global Fund) has 1 trillion, market cap of local companies is 200 billion.
- Kiribati: guano stopped being sold in 1979, but they accumulated USD 700 million (10 times the country's GDP, 30% of nation's revenue).
- Family offices have more freedom than pensions funds: no constraints on which types of instruments they can hold, and for how long, less public pressure.

Outline

Fund's definitions in Chile

	Max %	Min%
A	80	40
B	60	25
C	40	15
D	20	5
E	5	0

Table: Limits on assets

	Max %	Min%
A	100	45
B	90	40
C	75	30
D	45	20
E	35	15

Table: Foreign instruments

Default strategy

		A	B	C	D	E
Men $\leq$ 35	Women $\leq$ 35		■			
Men 36-55	Women 36-50			■		
Men ≥ 56	Women ≥ 51				■	

Research question

Optimal policy

What is the best investment strategy in order to reach one's retirement goals?

In other words, what could be an alternative to the regulator's default strategy? Closed-loop is better, open-loop is simpler.

Closed-loop policies

- Discrete set of time periods $\{1, \ldots, T+1\}$
- ξ_t : Random returns at time t, simulated using NORTA (Cario and Nelson '97)

$$V_t(\overbrace{X_t}^{\text{wealth at time } t}) = \max_{a_t \in \mathcal{A}} \mathbb{E}_{\xi_t}[V_{t+1}(X_{t+1})],$$

$$X_{t+1} = \overbrace{(\xi_t^\top a_t)}^{\text{portfolio return at } t} X_t + \underbrace{c_t I_t}_{\text{additional contributions at time } t}.$$

Measuring risk at time T

Utility functions:

$$u_\gamma(x, G) = \frac{1}{1-\gamma}\left(\frac{x}{G}\right)^{1-\gamma},$$
$$u_\kappa(x, G) = \frac{\kappa_1}{\kappa_2 + e^{\kappa_3 \frac{x-G}{G}}}$$

Stochastic dominance:

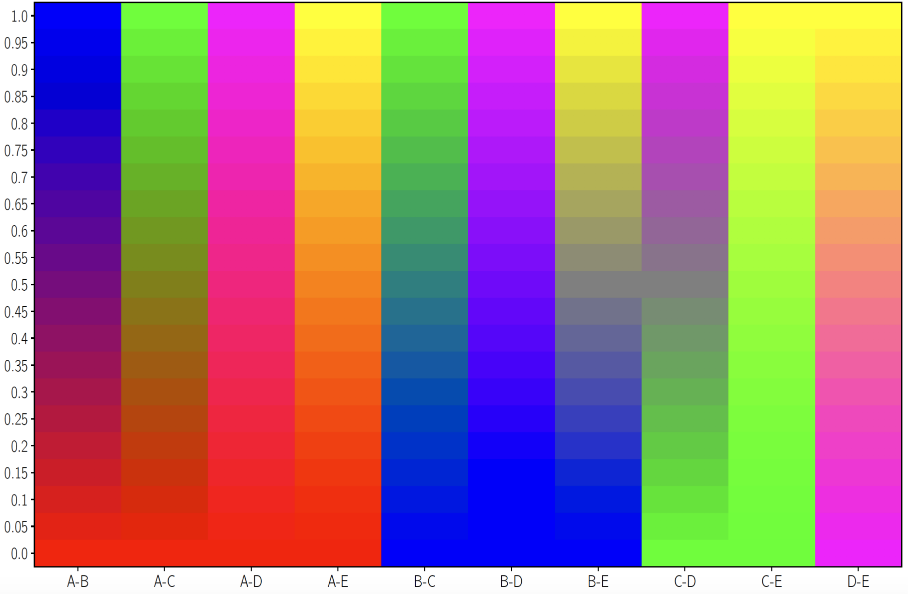
$$\sum_{i=1}^{n_Y} \left[\mathbb{E}\left[(y_i - Y_{T+1})_+\right] - \mathbb{E}\left[(y_i - x_{T+1})_+\right]\right] \qquad \text{(SSD sum)}$$

$$\min_{i=1,\dots,n_Y} \left[\mathbb{E}\left[(y_i - Y_{T+1})_+\right] - \mathbb{E}\left[(y_i - x_{T+1})_+\right]\right] \qquad \text{(SSD maxmin)}$$

Important facts

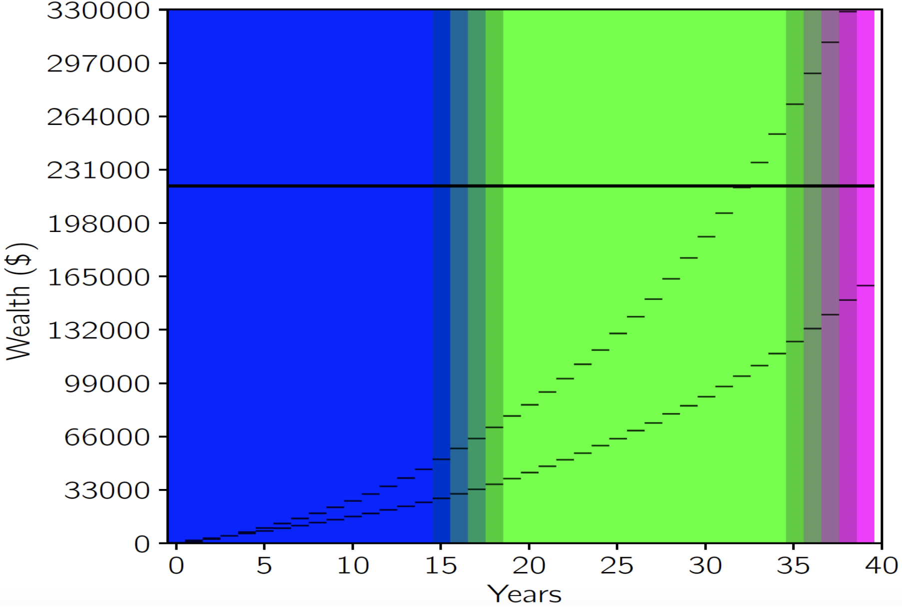
- For all periods but the last one we are risk neutral: we have the expected value in the objective.
- The wealth will oscillate, and we will offer protection against drawdowns, volatility, etc.
- Risk is only enforced in the *last period*.

Portfolios



1.0
0.95
0.9
0.85
0.8
0.75
0.7
0.65
0.6
0.55
0.5
0.45
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0.0
A-B
A-C
A-D
A-E
B-C
B-D
B-E
C-D
C-E
D-E

The default policy



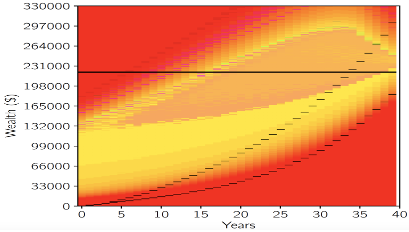


Figure: SSD-sum

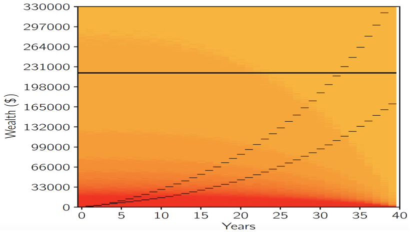


Figure: Power utility

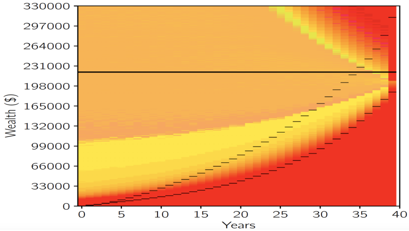


Figure: SSD-maxmin

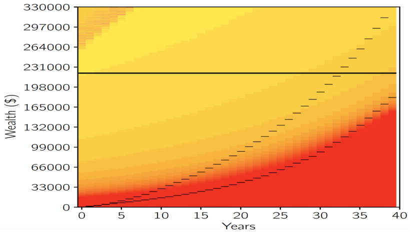


Figure: Sigmoidal utility

Results

Model	Avg. Wealth	SD−	SD+	Prob. of reaching x% of G					Exp. Shortfall
				70%	80%	90%	95%	100%	
Default	\$254,306	\$39,199	\$49,672	0.980	0.924	0.815	0.747	0.675	\$9,633
SSD-sum $\beta = G$	\$246,213	\$25,430	\$31,385	0.987	0.978	0.938	0.883	0.774	\$4,341
SSD-sum $\beta = 1.05G$	\$251,634	\$27,436	\$31,460	0.983	0.972	0.946	0.910	0.835	\$3,970
SSD-sum $\beta = 1.10G$	\$256,696	\$29,615	\$31,609	0.978	0.968	0.944	0.920	0.870	\$4,020
SSD-sum $\beta = \infty$	\$314,243	\$64,190	\$69,576	0.950	0.921	0.887	0.869	0.851	\$7,896
SSD-maxmin $\beta = G$	\$253,744	\$33,552	\$40,671	0.982	0.961	0.901	0.827	0.738	\$6,394
SSD-maxmin $\beta = 1.05G$	\$257,593	\$34,950	\$40,986	0.979	0.959	0.906	0.851	0.772	\$6,011
SSD-maxmin $\beta = 1.10G$	\$260,871	\$36,268	\$41,350	0.975	0.956	0.910	0.864	0.799	\$5,878
SSD-maxmin $\beta = \infty$	\$276,598	\$44,011	\$44,170	0.962	0.940	0.906	0.882	0.852	\$6,433
Power utility $\gamma = 6$	\$269,696	\$41,481	\$51,280	0.987	0.952	0.881	0.828	0.761	\$6,373
Power utility $\gamma = 7$	\$259,573	\$36,093	\$43,751	0.990	0.955	0.878	0.817	0.738	\$6,487
Power utility $\gamma = 8$	\$251,926	\$32,224	\$38,535	0.993	0.958	0.872	0.803	0.716	\$6,730
Power sigmoidal $\kappa = (0.99, 8, 6)$	\$280,108	\$42,326	\$40,270	0.968	0.952	0.931	0.910	0.880	\$5,166
Power sigmoidal $\kappa = (0.99, 9, 6)$	\$267,321	\$35,485	\$36,083	0.981	0.970	0.933	0.898	0.846	\$4,454
Power sigmoidal $\kappa = (0.99, 10, 6)$	\$257,137	\$31,064	\$33,161	0.989	0.973	0.919	0.868	0.801	\$4,731

Policy evaluation

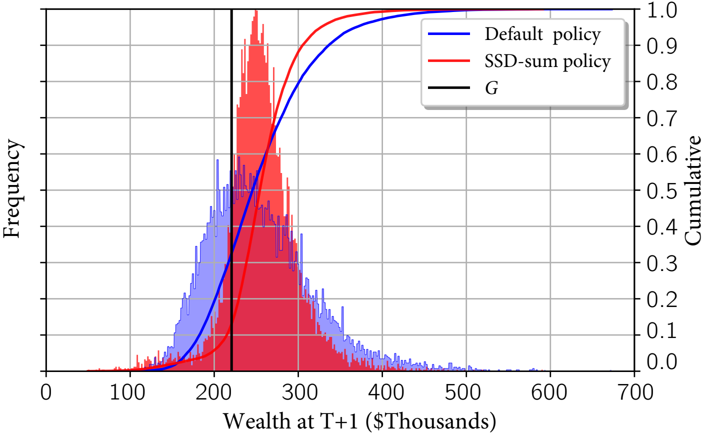


Figure: Terminal wealth distribution under default and SSD-sum policies.

Outline

Conclusions

- In the context of pension funds, the default strategy must include wealth as a state variable
- Risk should be included at the end of the horizon, not at intermediate periods
- Do we need 5 funds?
- Long-term investing is different from typical portfolio management problems
- New tools, new strategies and new ideas are required!
- Future work include studying endowments, sovereign wealth funds (infinite horizon problem?) and family offices ("Can you double my money in 30 years?")

Contact information

Thank you!

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