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Research Symposium 2013
3 December ▶ Melbourne

The two faces of investment performance and risk*

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*This research was supported by Kaplan Higher Education.

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Abstract

Investment concepts are generally taught, learnt and spoken about amongst professionals in time-weighted terms. According to this view of the world, returns are the sole determinant of performance and risk, and a given return has an identical impact no matter its timing.

While appropriate in certain circumstances, time-weighted returns (TWRs), and the performance and risk measures derived from them, provide an incomplete picture when evaluating certain practical financial problems, like retirement investing. For example, we know that other variables – including current member balance, contribution rate, age, targeted retirement date and objective – are important factors in determining investment outcomes. This paper discusses the distinction between TWRs and more comprehensive measures (including money-weighted returns), and employs a range of performance and risk measures from each category in comparing a number of extant investment strategies.

We find that time-weighted measures overlook important aspects of retirement investing, whereas wealth-denominated, target-relative measures more accurately encapsulate the dynamics of retirement investing. Thus we see the two faces of investment risk. The paper concludes by discussing how these two classes of measures might be incorporated into investment governance at superannuation funds.

Outline

- Institutional setting
- Literature review
- Data and methodology
- Empirical evidence
- Findings
- Implications for investment governance
- Questions
- References

Institutional setting (1)

- Decline of defined benefit (DB) plans
- Rise of defined contribution (DC) investing (Towers Watson, 2013)
  - Globally - 45% of total AUM
  - US - 58%
  - Australia - 81%
- Why is this trend important to this research?
  - Highlights a fundamental shift in risk from institutions to individuals
  - Contemporaneous complicating factors - increase in life expectancy, comparatively low fertility rate, a largely fixed retirement date
- Implications?
  - Investment risk is no longer a subject just for a small group of actuaries
  - More people – most of whom are lay – need to understand investment risk to some degree, AND MAKE BETTER DECISIONS as a result
  - The stakes are higher – i.e. there are significant risks in getting DC investing wrong
    - Personal
    - Public finance
    - Political

Institutional setting (2)

- GFC has stress-tested the model and highlighted the deficiencies of the current system
- Cooper Review → Stronger Super reforms
- Key elements (to this research):
  - A MySuper option to "have a single, diversified investment strategy" (Commonwealth of Australia, 2011)
  - MySuper trustees "clearly articulate the targeted rate of return (over a rolling ten year period) and level of risk that the trustee has determined is appropriate for its MySuper members" (Commonwealth of Australia, 2011)
- In defining risk, the Government noted that:

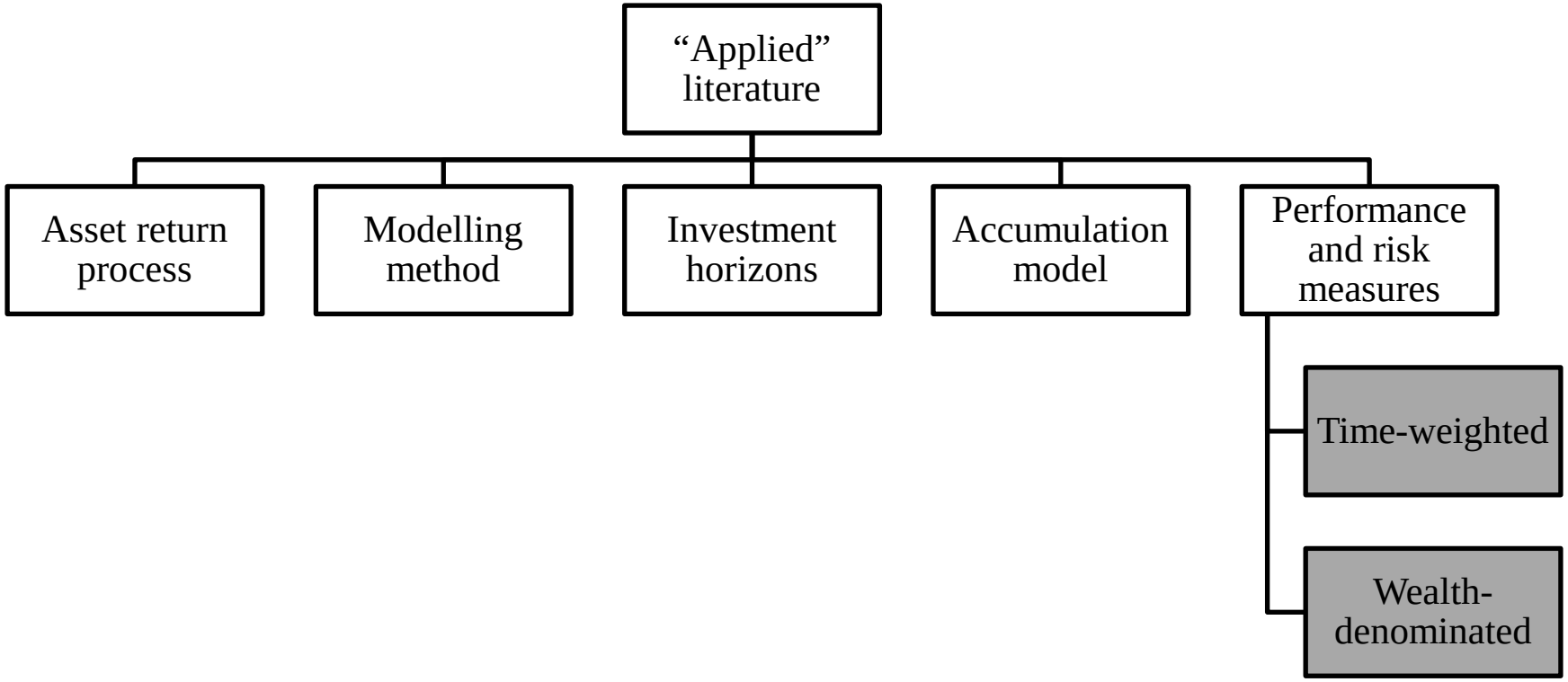
  "*APRA will consult with the industry to determine appropriate metrics for the standard reporting of the return and risk targets for MySuper products. Trustees will also be required to use the same approach for calculating and presenting this information in the new product dashboard*" (Commonwealth of Australia, 2011) (emphasis added)

→ In retirement investing, how should performance and risk be measured, incorporated into plan design, and communicated?

Literature review (1)

- To frame the debate on performance and risk measurement we use the time diversification literature as a point of departure
- Time diversification debate is important to this study for two reasons
  - At its core, it considers the essential relationship between risk and investment horizon
  - Offers an extensive literature that considers models of lifecycle investing, a variety of asset allocation approaches, as well as a range of performance/ risk measures
- Focus on the "applied" stream in the literature (Booth, 2004)
- Why?
  - Methodological sympathy - empirical, atheoretical, employs simulation techniques
  - Appropriateness for question - asset allocation comparisons, range of risk measures
  - Flexibility – allows us to consider three critical elements
    - realistic accumulation models involving contributions, salary growth, etc.
    - a comparison of a range of extant asset allocation strategies
    - a wide range of time-weighted and wealth-denominated (or money-weighted) risk measures

Literature review (2)



Literature review (3)

- **Applied literature typically varies on five (5) dimensions**
  1. **Asset return process – empirical, captured by the modelling method**
  2. **Modelling method – stationary bootstrap**
     - Block bootstrap simulation method beginning with Künsch (1989)
     - Block size is a geometrically-distributed random variable (Politis and Romano, 1994)
     - Random block is less sensitive to block size misspecification when compared to competing methods (e.g. Politis and Romano's (1992) circular bootstrap or the moving block bootstrap) (Politis and Romano, 1994)
  3. **Investment horizon – up to and including 40 years**
     - Time diversification literature (e.g. Reichenstein and Dorsett, 1995; Mukherji, 2002)
     - Broader pension finance literature (e.g. Basu and Drew, 2009; Basu, Byrne and Drew, 2011)
     - Institutional setting

Literature review (4)

- **Applied literature typically varies on five (5) dimensions *cont.***
  4. **Accumulation model (i.e. how wealth accumulates) – "realistic"**
     - Literature generally assumes "initial endowment" model (beginning with Samuelson (1969))
     - Few exceptions (e.g. Jagannathan and Kocherlakota, 1996; Mukherji, 2008; Panyagometh, 2011)
     - Pension finance literature (e.g. "portfolio size effect" of Basu and Drew, 2009)
     - Institutional setting
  5. **Risk measures**
     - Time-weighted return (TWR) basis
     - Wealth–denominated (or money-weighted) return basis

Literature review (5)

Time-weighted	Wealth-denominated
Mean	Median RWR
Standard deviation	Probability of shortfall
Sharpe ratio	Expected shortfall
Negative reuturn 1 in x years	Sortino ratio

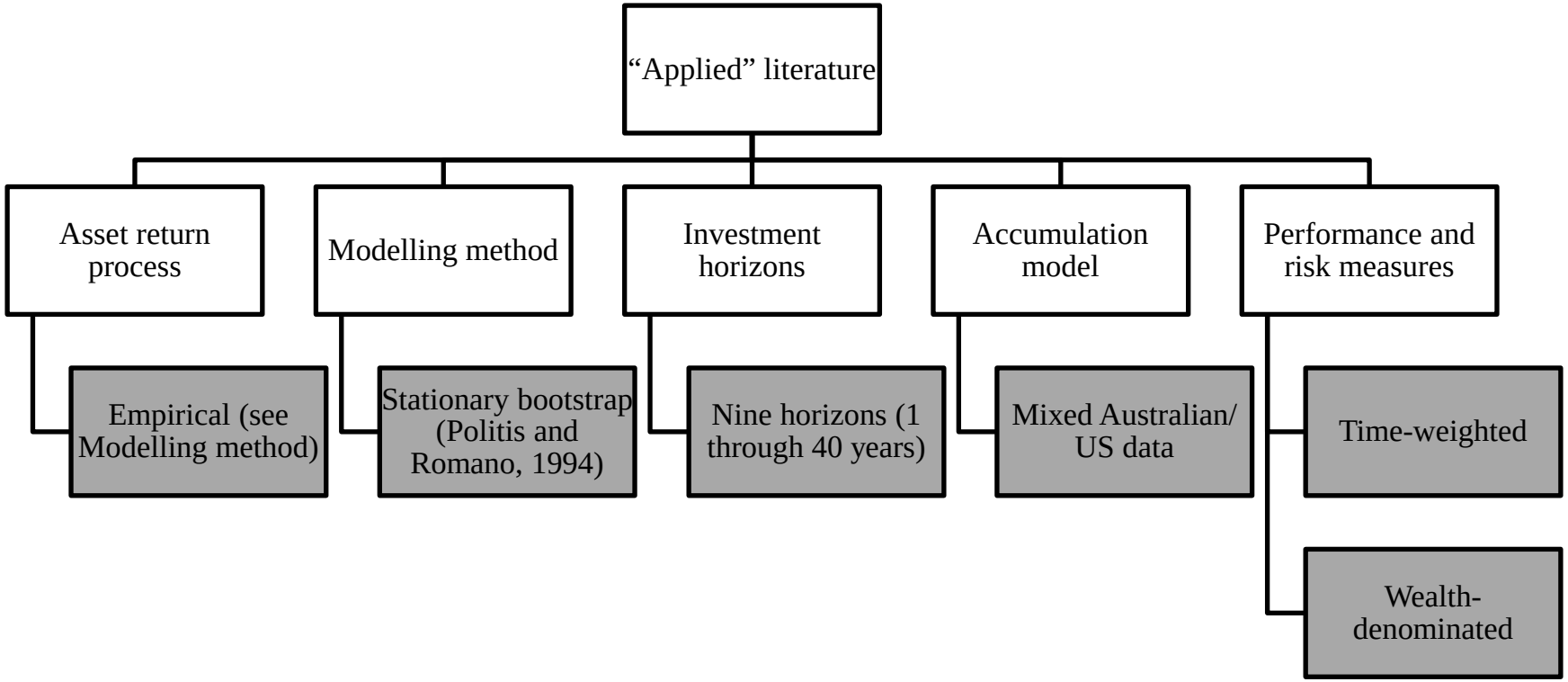
Literature review (6)

- **Asset allocation**
  - **Hickman et al. (2001)**
    - Considers comparative performance of four different asset allocation strategies comprised of six different assets
    - Mean and median terminal wealth, the standard deviation of terminal wealth, and the underperformance of each asset allocation strategy against a stock-only portfolio
    - Investment horizons up to and including 40 years
    - One of the few in the time diversification literature to incorporate contributions into the accumulation model.
  - **Reichenstein and Dorsett (1995)**
    - Employ "... historical returns to estimate probability distributions of excess returns, real returns, and ending wealth, based on random walk and mean-reversion models, for each of eight portfolios for holding periods of 1 year through 30 years (p. 6)"
    - Initial endowment model

Data and methodology (1)

- Two assets – Stocks and cash
- Data
  - US stock market (R_m) and 1-month US government Treasury bills (R_f) for the period July 1926 to December 2011 (n = 1,026) (French, 2012)
  - Nominal returns
- Investment horizons – 1, 5, 10, 15, 20, 25, 30, 35, 40 years
- Simulation – 10,000 trials per horizon using stationary bootstrap technique (Politis and Romano, 1994)
- Five strategies: 100% stocks, 100% cash, Balanced (60%/40%), TDF (linear decline from 80% to 56% stocks over last 20yrs), Dynamic strategy
- Target RWR of 9.9x for 40 year horizon (Desired target return = nominal 7% p.a.)

Data and methodology (2)



Empirical evidence (1)

- Validating simulation method
- Stylised facts of stocks are reproduced:
  - Negative skew
  - Leptokurtosis
- Maintains time series characteristics is a strength

Investment horizon	Mean	St.Dev.	Skewness	Kurtosis
40	10.93%	18.51%	-0.12	7.98
35	10.88%	18.51%	-0.13	7.76
30	10.94%	18.41%	-0.16	7.42
25	10.85%	18.39%	-0.19	7.10
20	10.93%	18.25%	-0.23	6.70
15	10.90%	18.06%	-0.28	6.14
10	10.84%	17.76%	-0.33	5.53
5	10.85%	17.05%	-0.33	4.53
1	9.91%	15.01%	-0.15	3.48

Moments of simulated stock returns (all horizons)

Empirical evidence (2)

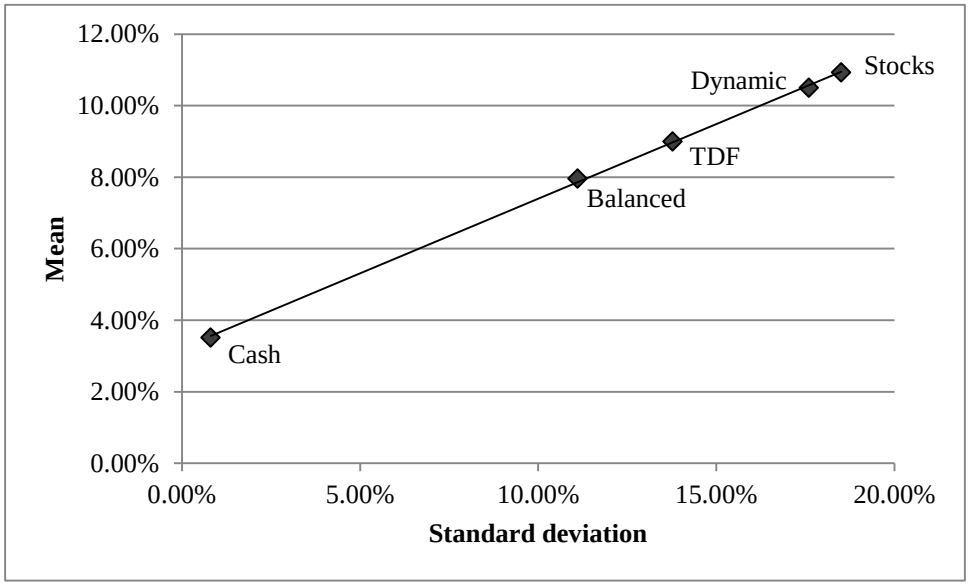
- **Results:**
  - Fit expectations
  - Return/ risk trade-off similar in each case
  - Dynamic, stocks look very similar
- **Downside risk similar**
- **Weaknesses:**
  - Ignores factors other than returns
  - Largely parametric

Strategy	Mean	St.Dev.	Sharpe	Negative return
Stocks	10.93%	18.51%	0.4009	1 in 3.6yrs
Balanced	7.96%	11.10%	0.4009	1 in 4.2yrs
TDF	9.00%	13.77%	0.3987	1 in 3.8yrs
Dynamic	10.50%	17.59%	0.3974	1 in 3.6yrs
Cash	3.51%	0.81%	0	Never

Time-weighted performance and risk measures (five strategies; 40 year horizon)

Empirical evidence (3)

- Consistent with finance theory:
  - Combination of two assets
  - Classical CML
- Differentiate based on risk tolerance only
- Open questions:
  - Is this the whole story?
  - Are dynamic, stocks so similar?
  - What do we get in retirement?



Return-risk trade-off

(five strategies; 40 year horizon)

Empirical evidence (4)

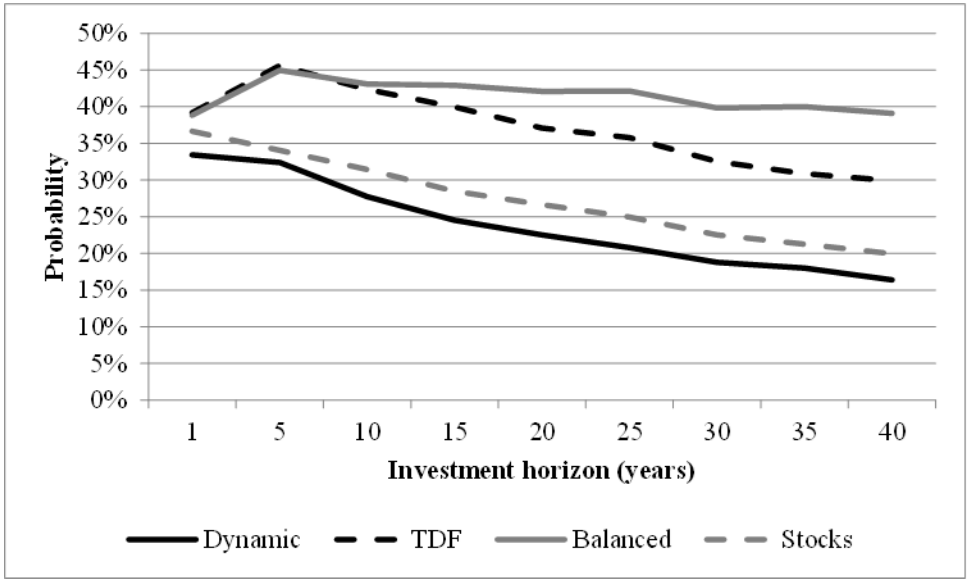
- Performance isn't as close as it looks in TW terms
- Picture is richer than the TWR measures suggest
- Return/ risk trade-off differs widely
- Targets matter

Strategy	Median RWR	P(Shortfall)	E(Shortfall)	Sortino
Stocks	20.41	20%	0.67	9.97
Balanced	11.35	39%	1.06	1.35
TDF	13.73	30%	0.82	3.35
Dynamic	17.94	16%	0.56	7.95
Cash	4.21	100%	5.48	-0.98

Wealth-denominated performance and risk measures (five strategies; 40 year horizon)

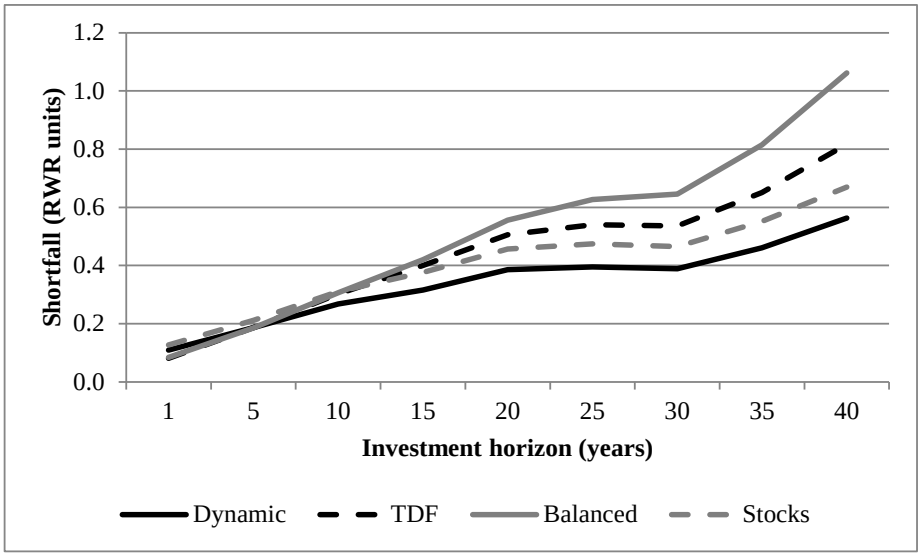
Empirical evidence (5)

- Through a wealth-denominated lens interesting findings emerge …
- Dynamic strategy has:
  - Lowest probability of shortfall
  - Lowest expected shortfall
  - Second best Sortino ratio

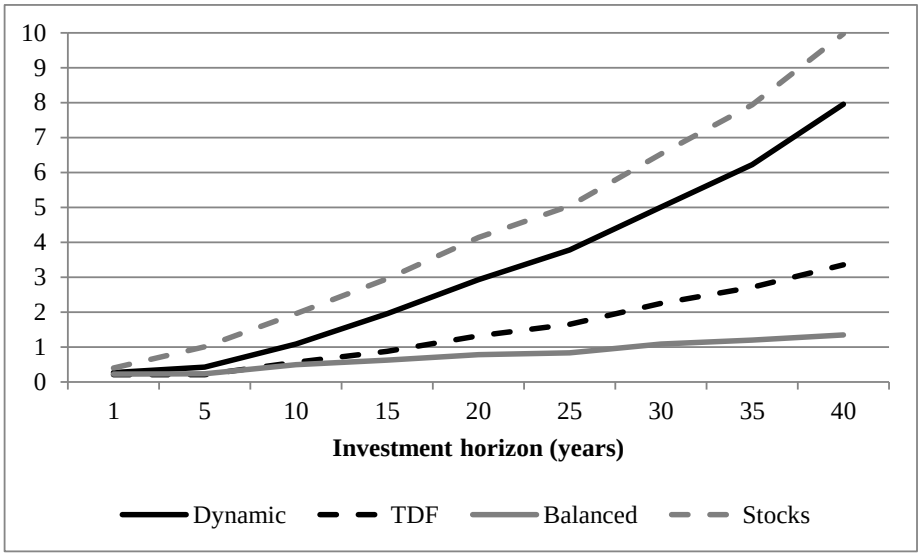


Probability of shortfall
(four strategies; all horizons)

Empirical evidence (6)



Expected shortfall
(four strategies; all horizons)



Sortino ratio
(four strategies; all horizons)

Findings

- **Time-weighted measures**
  - One dimensional, in abstract terms
  - Because risk-adjusted performance is virtually identical for each strategy, we can only differentiate between strategies based on risk tolerance
  - Using these measures, we have little idea about what I might be able to expect in retirement
- **Wealth-denominated measures**
  - Richer picture, in intuitive terms
  - Improves evaluation of retirement portfolios (compared to TW measures)
  - Target-relative performance and risk measures useful in focussing attention on the purpose of retirement savings: funding retirement
  - Target-aware investment strategies may increase the probability of achieving the retirement objective (without giving up much in terms of time-weighted performance)

Implications for investment governance

- What's the investor's objective?
  - Hint: What's the liability?
  - Hint: It's not CPI + x% over rolling ten year periods
- DEFINE, MEASURE and REPORT success in these terms
- Direct alignment between investor objectives and the investment arrangements – e.g. dynamic strategy
- Horses for courses – In investment governance, know when to use
  - Time-weighted (e.g. manager evaluation)
  - Wealth-denominates (e.g. measuring success, reporting to clients)
- Retirement risk measures … Why aren't they used more widely?

Questions?

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