Lifecycle Investment Strategies - Myths and Facts

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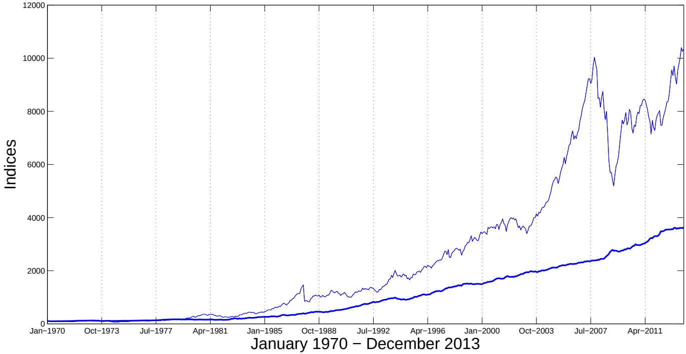
Overview

1. We investigate different investment strategies for superannuation investors including Target Risk Funds (TRFs) and Target Date Funds (TDFs)
2. The latter - also called 'lifecycle approaches' - reduce expected risk (and return) through reducing exposure to growth assets on an asset-weighted basis over the lifecycle
3. We focus specifically on the last 10 years prior to retirement
4. We examine the impact of various factors on the wealth outcome for superannuation investors

Outline of presentation

- MySuper investment strategies
- Applied modeling and simulation techniques
- Empirical results for benchmark models
- Impact of key factors on results
- Conclusions

Performance of equity and bond index



Cumulative performance of the Australian All Ordinaries Accumulation Index (AOI) and the proxy for the performance of Australian bonds for the sample period from January 1970 - December 2013 (base value 100).

MySuper investment strategies

The MySuper universe of products is part of the *Stronger Super* reforms announced by the Australian government. Products must comply with several features, including a minimum level of insurance cover.

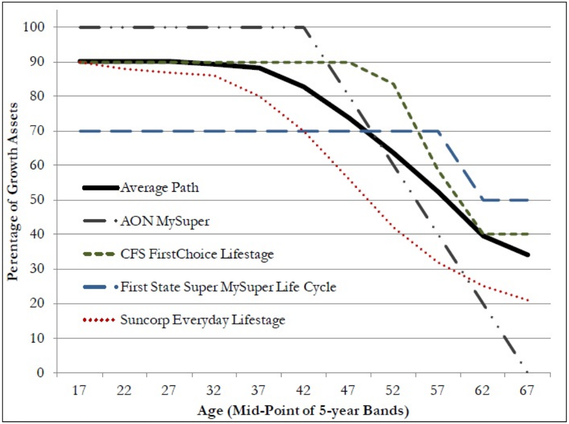
We study two types of standard investment strategies:

1. Target risk funds (TRFs) with constant weights for different asset classes (equities, bonds, cash)
2. Target date funds (TDFs) or so-called Lifecycle strategies that switch, e.g. from more aggressive to more conservative assets closer to retirement

Lifecycle strategies

- With origins back to the 1990s, lifecycle strategies gained popularity as a means for mitigating exposure to investment risk as investors approached retirement.
- Lifecycle funds look to lower the risk profile of the fund (by reducing exposure to growth assets) as the investor approaches retirement (or the 'decumulation' phase of their investment).
- Strategies are designed to minimize the impact of any adverse market movement, acknowledging that there is less likelihood to recover the value of the investment over a shorter investment time horizon.
- Lifecycle funds have been designed to improve the risk management framework for retirement investing.

MySuper Lifecycle Approaches



Data Source: Chant West Multi-Manager Quarterly Survey, September 2013; product disclosure statements

Average glide paths across 23 MySuper lifecycle funds, along with four selected examples to illustrate differing paths (Chant et al., 2014).

MySuper investment strategies

In the following we examine the following three strategies:

1. *Balanced*: A portfolio with investments of 70% in growth assets (equities) and 30% in defensive assets (bonds)
2. *Conservative*: A portfolio with investments of 30% in growth assets (equities) and 70% in defensive assets (bonds)
3. *Lifecycle (TDF)* A portfolio that linearly switches from 59% stocks to 37% stocks and at the same time increases the share of defensive assets from 41% to 63%

Factors involved in determining terminal wealth

- The investment strategy
- Market conditions
- The applied modeling/simulation technique
- Periods of crisis
- Salary and contribution levels
- Initial balance of portfolio

The retirement wealth ratio

1. The basic motivation behind instituting retirement savings plans is to generate adequate income for the participating employees after retirement.
2. We employ a ratio which compares the terminal wealth of the participant's retirement account to their final income at the time of retirement.
3. This ratio is defined as the wealth at retirement divided by the final yearly income and is known as the retirement wealth ratio (RWR), see, e.g. Basu and Drew (2009).
4. As a complement to the RWR, we also consider a comfortable living standard amount of $430,000 at the age of retirement as recommended by the Association of Superannuation Funds of Australia (ASFA).

Nonparametric Approaches

The first class of applied models are so-called block bootstrap methods. They have the advantage that they capture the dependence between the different asset classes but also the autocorrelation structure of an individual asset class.

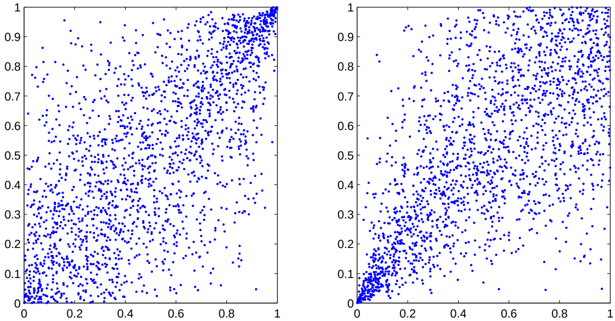
1. Benchmark model: we use a block size of $n = 6$ months, i.e. twenty blocks of six months are randomly resampled with replacement to generate returns for a 10-year investment horizon
2. We allow for alternative block sizes of $n = 3$, $n = 12$ and $n = 24$
3. We also allow for exponentially declining weights $\frac{\lambda^{n-i}(1-\lambda)}{1-\lambda^n}$, where a higher weight is assigned to more recent return observations

Parametric Approaches

1. To model the dynamic and heteroscedastic behavior of the individual asset classes, in the first stage, we fit ARMA-GARCH models to each series and obtain the standardized residuals for each series.
2. In a second stage, in order to account for the dependence structure of the data, we fit a range of copula models, including static as well as dynamic models time-varying dependence parameters (Patton, 2006):

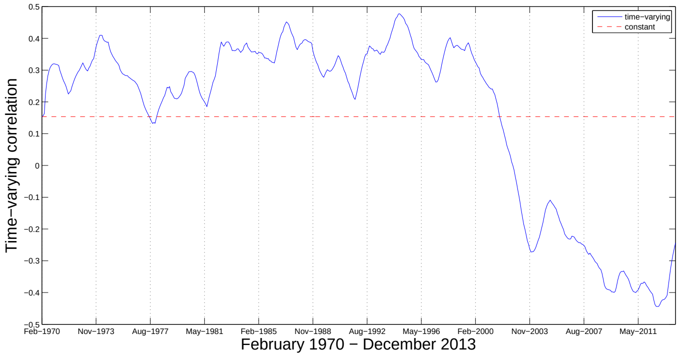
$$\rho_t = \Lambda_1 \left\{ \omega + \beta \rho_{t-1} + \alpha \frac{1}{12} \sum_{j=1}^{12} F^{-1}(u_{t-j}) F^{-1}(v_{t-j}) \right\},$$

Examples of copulas



Simulated $U(0,1)$ with $\tau = 0.7$ for the Gumbel (left panel) and Clayton copula (right panel)

Time-varying dependence structure



Estimates for dynamic Gaussian copula model with time-varying correlation parameter.

Simulation procedure

To assess the wealth outcomes of the applied strategies, for the parametric models we carry out the following simulation study:

- We consider the logarithmic returns of stocks and bonds and fit the ARMA-GARCH models.
- We use the inverse empirical distribution on the standardised residuals
- We fit the corresponding copula models and generate 10,000 samples of size 120. In the case of the time-varying parameter models, we generate one element of the sample at a time and update the dependence parameterrecursively.
- We filter the samples through the ARMA-GARCH models to generate random samples of logarithmic returns to use them for the conducted empirical analysis purposes.

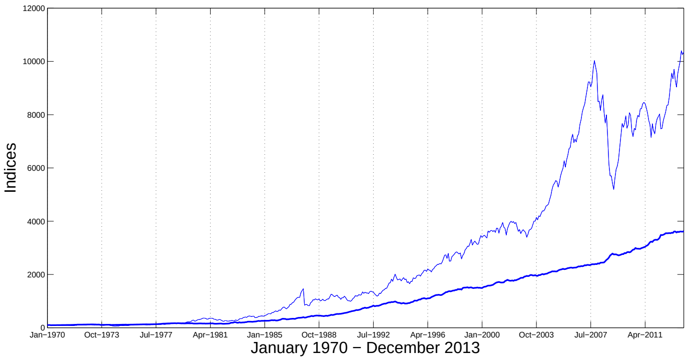
The data

- We use monthly logarithmic returns from January, 1970 to December, 2013 for Australian All Ordinaries Accumulation Index (AOI) and spliced time series of Australian bond indices.
- We consider asset classes instead of individual assets.
- We consider a portfolio consisting of investments in an Australian equity and bond index.

Series	Mean	Median	St. Dev.	Min.	Max.	Skew.	Kurtosis
Stocks	0.009	0.013	0.054	-0.547	0.173	-2.217	24.078
Bonds	0.007	0.007	0.019	-0.109	0.136	-0.171	12.585

Table 1: Descriptive Statistics for Logarithmic Returns of Australian Stocks and Bonds from January 1970 to December 2013

Performance of equity and bond index



Cumulative performance of the Australian All Ordinaries Accumulation Index (AOI) and the proxy for the performance of Australian bonds for the sample period from January 1970 - December 2013 (base value 100).

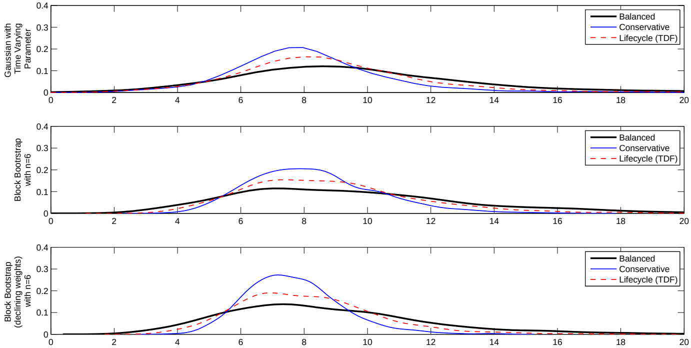
Initial values for analysis

In order to make this analysis we consider a representative superannuation investor 10 years before retirement. The investor has:

1. $500 monthly contributions (this implies a yearly income of $63,158)
2. The contributions increase 4% annually
3. The superannuation contribution is 9.5%
4. The initial balance 10 years before retirement is $250,000

Considering these values, the terminal yearly income is $93,489. This means that, for a RWR of 5, the required terminal wealth is $467,445.

Distribution for RWR outcomes



Distribution of simulated RWRs for the three strategies according to parametric and nonparametric benchmark models

Descriptive statistics for RWR outcomes

MODEL	Strategy	Mean RWR	Quantile for RWR						
			1%	5%	10%	50%	90%	95%	99%
Gaussian Copula with time-varying parameter	Balanced	**9.8401**	1.9979	4.1824	5.2853	9.1022	14.6848	17.5797	26.7048
	Conservative	**8.2407**	2.9342	4.7010	5.5175	7.9255	11.0678	12.5587	17.3262
	Lifecycle (TDF)	**8.9770**	2.7758	4.5925	5.4962	8.4878	12.6497	14.3637	21.8208
Block bootstrap with equal weights (block size $n = 6$)	Balanced	**9.6308**	3.3949	4.4004	5.3297	8.9881	14.9016	17.0258	22.6976
	Conservative	**8.3041**	4.7262	5.4712	5.9489	8.0821	10.9521	11.8340	13.9327
	Lifecycle (TDF)	**8.8513**	4.1927	5.1049	5.7699	8.5105	12.4031	13.8196	17.5419
Block bootstrap with declining weights (block size $n = 6$)	Balanced	**8.7346**	3.1767	4.3386	5.0390	8.1825	12.9661	15.1797	19.0349
	Conservative	**7.6719**	4.8623	5.4882	5.9126	7.5253	9.5770	10.3053	11.9993
	Lifecycle (TDF)	**8.1124**	3.9673	5.0773	5.5869	7.8803	10.8954	11.9847	14.8022

Table 2: Mean and quantiles of RWRs for the three strategies according to parametric and nonparametric benchmark models

RWR exceedance probabilities

RWR	5			6.65			8			10		
Strategy	Bal	Cons	**TDF**	Bal	Cons	**TDF**	Bal	Cons	**TDF**	Bal	Cons	**TDF**
Gaussian Copula with time-varying parameter	0.912	0.933	0.934	0.789	0.758	0.798	0.641	0.480	0.582	0.400	0.179	0.288
Block bootstrap with equal weights (block size $n = 6$)	0.919	0.979	0.956	0.767	0.792	0.791	0.605	0.519	0.575	0.398	0.196	0.284
Block bootstrap with declining weights (block size $n = 6$)	0.907	0.984	0.955	0.723	0.740	0.731	0.524	0.379	0.477	0.295	0.069	0.169

Table 3: Probability of exceedance of different TRWRs for the three strategies according to parametric and nonparametric benchmark models

Impact of investment strategy and applied model

- For the considered Australian historical return data, lifecycle and conservative investment strategies only offer a slightly better protection against adverse outcomes $(RWR < 5)$ for superannuation investors
- At the same time they significantly limit the upside potential $(RWR > 10)$ for investors
- Overall, the applied modeling techniques yield rater similar results for simulated RWR distributions
- However, block bootstrap with declining weights for observations in the more distant past suggests substantially lower outcomes for RWR
- Indication for lower expected outcomes for investors if the future behaves more similar to the recent past.

Impact of considered historical sample period

Next to simulating from the entire sample period from January 1970 - December 2013 we also consider shorter sample periods:

1. A sample period covering monthly returns over the last 10 years from January 2004 - December 2013
2. A sample period covering monthly returns over the last 20 years from January 1994 - December 2013

Period	Series	Mean	Median	St. Dev.	Min.	Max.	Skew.	Kurtosis
Complete data	Stocks	0.009	0.013	0.054	-0.547	0.173	-2.217	24.078
	Bonds	0.007	0.007	0.019	-0.109	0.136	-0.171	12.585
Last 20 years	Stocks	0.007	0.014	0.038	-0.150	0.077	-0.947	4.287
	Bonds	0.005	0.005	0.010	-0.026	0.041	0.223	3.998
Last 10 years	Stocks	0.008	0.019	0.041	-0.150	0.077	-1.178	4.727
	Bonds	0.005	0.005	0.008	-0.012	0.030	0.506	3.430

RWR outcomes for different historical periods

MODEL	Strategy	MEAN RWR	Quantile for RWR						
			1%	5%	10%	50%	90%	95%	99%
Entire sample period	Balanced	**9.6308**	3.3949	4.4004	5.3297	8.9881	14.9016	17.0258	22.6976
	Conservative	**8.3041**	4.7262	5.4712	5.9489	8.0821	10.9521	11.8340	13.9327
	Lifecycle (TDF)	**8.8513**	4.1927	5.1049	5.7699	8.5105	12.4031	13.8196	17.5419
Last 20 years	Balanced	**8.8218**	4.0733	5.1148	5.7531	8.5293	12.2254	13.4946	16.4794
	Conservative	**7.9909**	5.8251	6.3433	6.7069	7.9500	9.3542	9.8023	10.6837
	Lifecycle (TDF)	**8.3355**	4.9273	5.8802	6.3269	8.2342	10.4885	11.2144	12.6670
Last 10 years	Balance	**9.1802**	3.3787	4.4637	5.1934	8.6986	13.6542	15.2958	18.4410
	Conservative	**7.7905**	5.6372	6.2070	6.5224	7.7679	9.0968	9.4244	10.1604
	Lifecycle (TDF)	**8.3405**	4.4960	5.3383	5.9603	8.1858	10.9371	11.6182	13.4308

Table 4: Mean and quantiles of the simulated RWR distribution based on historical period covering (i) 43 years, (ii) the last 20 years, (iii) the last 10 years.

Impact of a market crash and sequencing risk

In the following we assume that a market crash or significant drop in equity prices occurs at some point over the last 10 years of contributions:

1. we assume that the crisis happens at the beginning (i.e. in year one) of the 10 year period,
2. we assume that the crisis happens in the middle (i.e. in year five or six) of the 10 year period, and
3. we assume that the crisis year happens at the end (i.e. in year 10) of the contribution period.

In our simulation procedure, we set the returns for the market crash period equal to actually observed returns during the 2007-2008 global financial crisis.

Impact of a market crash and sequencing risk

Regime	Strategy	MEAN RWR	Quantile for RWR 1%	5%	10%	50%	90%	95%	99%
No crisis	Balanced	**9.840**	1.998	4.182	5.285	9.102	14.685	17.580	26.705
	Conservative	**8.241**	2.934	4.701	5.518	7.925	11.068	12.559	17.326
	Lifecycle (TDF)	**8.977**	2.776	4.593	5.496	8.488	12.650	14.364	21.821
Crisis in the beginning	Balanced	**7.660**	1.662	3.003	3.686	6.847	11.904	14.679	25.904
	Conservative	**7.929**	3.185	4.434	5.086	7.534	10.827	12.396	19.072
	Lifecycle (TDF)	**7.421**	2.430	3.639	4.245	6.874	10.773	12.799	20.645
Crisis in the middle	Balanced	**7.994**	2.323	3.623	4.424	7.664	11.803	13.536	19.244
	Conservative	**7.743**	3.349	4.750	5.385	7.439	10.251	11.327	15.370
	Lifecycle (TDF)	**7.857**	2.841	4.342	5.109	7.555	10.694	12.091	17.183
Crisis in the end	Balanced	**7.970**	1.458	3.199	4.203	7.449	11.769	14.041	20.843
	Conservative	**7.836**	2.781	4.534	5.213	7.562	10.417	11.815	16.834
	Lifecycle (TDF)	**8.262**	2.744	4.280	5.014	7.814	11.470	13.541	20.783

Table 5: Mean and quantiles of RWRs for the three strategies for different timing of crisis ($t = 1$, $t = 5$ and $t = 10$)

Impact of a market crash and sequencing risk

- As expected RWR outcomes are significantly lower if a crisis occurs during the last 10 year period.
- Occurrence of crisis yields most significant impact on RWR outcomes if it happens at the beginning of the 10 year period.
- Difference between benchmark simulation and crisis scenarios is largest for balanced strategy and less pronounced for conservative and lifecycle strategies.
- Surprisingly, even under the occurrence of a crisis, conservative and lifecycle strategy do not necessarily perform better than balanced strategy.
- Higher performance of equity markets typically seems to compensate even for substantial losses during crisis period.

Conclusions

- Focusing in particular on the last 10 years before retirement, we apply different parametric and nonparametric techniques to examine wealth outcomes for superannuation investors at retirement.
- Balanced strategy provides far more upside potential for high wealth outcomes.
- Surprisingly, the use of more conservative and a lifecycle strategies only slightly improves results in the lower tail of simulated wealth outcomes.
- Overall, the use of growth assets seems to be preferable even as we approach the age of retirement (unless investors are very risk averse).

Conclusions

- Allocating higher weights to more recent observations or considering shorter historical sample periods yields significant lower results for wealths outcomes.
- Occurrence of crisis has most significant impact if it happens at the beginning of the 10 year period.
- Surprisingly, even under the occurrence of a crisis, conservative and lifecycle strategy do not necessarily perform better than balanced strategy.
- Especially investors with lower incomes should invest in growth assets to increase chances if achieving comfortable lifestyle standard according to ASFA.

Thank you!