Platinum
ASSET MANAGEMENT

Solving the Retirement Riddle: Start Early, Embrace Equities and Stay the Course

August 2021

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Synopsis

This paper seeks to address the challenge facing individuals in achieving a comfortable retirement, by considering contemporary Australian data on employment income, longevity and superannuation rules, and testing the outcomes of a lifelong investment strategy against 150 years of real US market data, to provide a range of possible scenarios.

The conclusion is that investors must start investing early. The paper considers a working career spanning 40 years, starting at age 23 – highlighting the importance of embracing equities and staying the course. It recommends that an allocation of around 80% to equities, annually rebalanced over a lifetime, reduces the risk of failure to achieve a comfortable retirement to close to zero, based on the scenario testing applied.

Following the recommended approach removes both sequencing risk and longevity risk. The author acknowledges that this does not solve these problems for those later in life, who may not be 'on track' due to any number of reasons including, but not restricted to, starting late, under saving, lower allocation to equities, or previous poor investment outcomes.

The paper is structured in four parts:

- Firstly, the model assumptions are laid out.
- Secondly, the model and its output are demonstrated and discussed.
- Thirdly, with reference to equities, the challenges of staying the course are acknowledged, with comments on an appropriate approach.
- Finally, it is noted that the current Australian superannuation system is not too far away from the recommended position.

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1. Model assumptions

The model combines contemporary Australian data with a comprehensive dataset on US markets over the period 1871-2021.

There are three key inputs from an Australian perspective – income (earned in employment and required in retirement), longevity and the superannuation/tax rules. From a market perspective, data on equity markets, bond yields and inflation is drawn from the data set made publicly available by well-known economist and academic Robert Shiller of Yale University. In order to enable comparisons over time, real data is used.

Income

Data is sourced from the Australian Bureau of Statistics (ABS), 6333.0 Characteristics of Employment, Australia, August 2020 Table 2.1, Median Weekly Earnings for Employees by Demographic Characteristics.

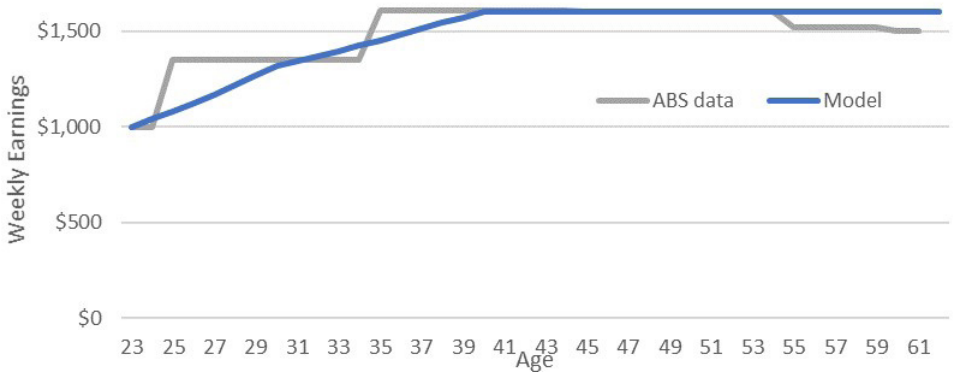
The following extract is key:

Age range (all sexes)	Full-time median weekly earnings as at August 2020 ($)
20–24	994.7
25–34	1,346.0
35–44	1,610.0
45–54	1,600.0
55–59	1,518.8
60–64	1,498.0

Source: ABS.

Without loss of generality, it is assumed that the employee earns $1,000 per week in real terms from 23 years of age, rising at 4% per annum to age 30, 2% per annum to age 40, and then zero growth thereafter.

The chart below shows the model progression against the age group data provided by the ABS.



Source: ABS, Platinum Investment Management Limited.

Data from the Association of Superannuation Funds of Australia (ASFA) can be used to make assumptions about income required in retirement.

The table below shows annual budgets for various households and living standards, based on data to March 2021.

	Modest		Comfortable		Average of Four Scenarios
	Single	Couple	Single	Couple	
Age 65	$28,254	$40,829	$44,412	$62,828	$44,081
Age 85	$26,827	$38,382	$42,470	$58,930	$41,652

Source: ASFA.[1]

1 https://www.superannuation.asn.au/resources/retirement-standard Accessed 11 August 2021

It is assumed in the table on the previous page that retirees own their own home at retirement. Data suggests that around 80% of Australians own their home at retirement using the 60–70 age group as a guide.[2]

For the purpose of the model, it is assumed the income required in retirement will be $41,704 per annum. This is close to the simple average of the scenarios above, and is held constant in the model given that 85-year-olds are reported to need around 94-96% of the income of 65-year-olds in the table on the previous page.

Longevity

The ABS Life Tables, 2017-2019 were released on 4 November 2020 and these allow us to look at the life expectancy for a 63-year-old Australian, which is the assumed retirement age in the model.

This is consistent with the average age of retirees in the last five years, based on ABS data 6238.0 Retirement and Retirement Intentions, Australia 2018-9 released on 8 May 2020.

For the average 63-year-old, table 1.9 of the Life Tables allows us to calculate future longevity in years.

Percentile	Male	Female
50th	22	25
80th	29	31
90th	32	34
95th	34	36
99th	38	40

Source: ABS, Platinum Investment Management Limited.

Superannuation and taxes

The Australian superannuation guarantee is 10% at the time of writing, but will be 12% from 1 July 2025 onwards,[3] which suggests this higher level is required for adequacy. Given the income level assumed and the concessional caps (currently $27,500 can be contributed into superannuation from pre-tax income[4]), it is assumed that any gap below 12% prior to 2025 would be added by the employee in the example.

Income can be taken from superannuation on reaching the member's preservation age[5] (currently 55-60 depending on the year of birth) and retire, or at 65. The example assumes 63. Note that while this may increase, this would lead to a commensurately higher balance on retirement, and hence all else being equal, would not invalidate the logic behind the exercise.

Contributions into superannuation are taxed at 15%,[6] as is investment income in the accumulation phase. While there are long-term capital gains discounts of one-third, the model remains simple by taxing all nominal investment returns at 15%. Retirement incomes can be complex, but for the assumed level of income, the interplay of retirement income strategies and marginal tax rates, make it reasonable to assume that investment earnings in retirement and income paid out in retirement are tax free, based on current legislation.[7]

2 Source: Australian Bureau of Statistics 2017. Census of Population and Housing: Reflecting Australia—Stories from the Census, 2016. ABS cat. no. 2071.0. Canberra: ABS. Sourced from Australian Institute of Health and Welfare (AIHW).

3 https://www.ato.gov.au/rates/key-superannuation-rates-and-thresholds/?anchor=Superguaranteepercentage#Superguaranteepercentage Updated: 30 July 2021

4 https://www.ato.gov.au/rates/key-superannuation-rates-and-thresholds/?anchor=Concessionalcontributionscap#Concessionalcontributionscap Updated: 30 July 2021

5 https://www.ato.gov.au/Individuals/Super/In-detail/Withdrawing-and-using-your-super/Withdrawing-your-super-and-paying-tax/?anchor=Whenyoucanaccessyoursuper#Preservationage Updated: 24 June 2021

6 https://moneysmart.gov.au/how-super-works/tax-and-super Accessed: 11 August 2021

7 https://moneysmart.gov.au/retirement-income/account-based-pensions Accessed: 11 August 2021. Note that while an account-based pension has prescribed levels of income, this complicates the modelling, and we are looking at sufficiency in the case study.

US investment returns

Robert Shiller's data set[8] has US market returns for equities and bonds dating back to 1871, along with a consumer price index (CPI). It is assumed that all investments are made into a simple two-asset portfolio, which can invest either in the broad US equity market via the S&P 500 index and its antecedents, or in the 10-year bond. Returns are all calculated in real terms, however, the CPI is used to generate a nominal return in order to apply appropriate levels of tax on investment earnings.

The mismatch between US and Australian markets is likely to be questioned. However, over the very long run (1900-2019), data from Credit Suisse[9] shows that real returns from Australian and US assets (shown in the table below) are broadly similar. The issue of franking credits is a moot point, in the context of the discussion, as the paper is looking at the risk of not meeting goals, and any benefits would reduce such risk.

Asset (USD)	Annual	Std. Dev.	10-year max p.a.	10-year min p.a.
Australian equities	6.8	17.5	16.0	-5.6
US equities	6.5	19.9	16.9	-4.1
Australian bonds	1.8	13.0	14.1	-8.4
US bonds	2.0	10.3	11.2	-5.5
AUD vs. USD	-0.2	11.5	7.6	-8.3

Source: Credit Suisse.

2. Model outcomes

Income and expenditure

The model takes a person on their 23rd birthday, with the career earnings profile described above and assumes a simple annual contribution of 12% of their pre-tax income into their superannuation, taxed at 15% on entry. It is assumed that for the last 10 years of their career, they increase their contributions to 20% of their salary, by making additional contributions from their pre-tax income. This is consistent with the idea that spending in the 55-64 age group is below that of the 45-54 age group.[10]

It is then assumed that in retirement, the desired income is half of the final salary calculated by the method above, paid annually in advance from their 63rd birthday.

Investment portfolio

The investment portfolio is assumed to be entirely invested in two assets – US equities, via the S&P 500 (or its predecessors) and the US 10-year bond. For the purpose of the model, the critical input variable X is the constant proportion allocated to equities, on an annual rebalancing.

Investment income is taxed at 15% throughout the employee's working life of 40 years, and is tax-free in retirement.

Sample periods

The sample dataset from Shiller allows full portfolio returns, for accumulation, to be generated over the period starting from January 1871 to June 1981 and running for 40 years, with a partial series for those periods starting from July 1981 to June 2020.

In decumulation, full periods of 40 years commence from January 1911 to June 1981, with partial periods starting from July 1981 to June 2020. This takes the person out to their 103rd birthday, which is beyond the 99th percentile of expectation for the average 63-year-old person in Australia today.

This leads to 846 full 80-year periods to be observed, a further 480 periods with full accumulation and partial decumulation, and a further 468 periods of partial accumulation – to show how these strategies would have fared in the experiences of the US market over the past 150 years.

8 http://www.econ.yale.edu/~shiller/data.htm Accessed: 28 July 2021

9 Credit Suisse Global Investment Returns Yearbook 2020

10 https://www.rba.gov.au/publications/bulletin/2020/mar/demographic-trends-household-finances-and-spending.html

The important part of the work is to note that the balances used to start the decumulation (retirement) period, are based on the experience in the accumulation (working) period. This is helpful in gaining a better understanding of the concept of sequencing risk.

Model features

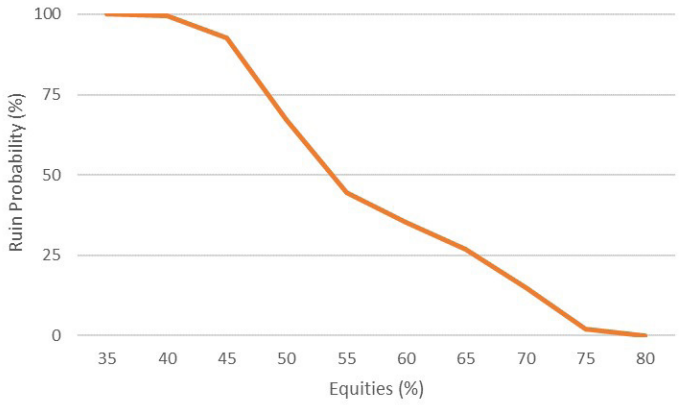
The model allows the accumulation and decumulation phases to be charted and allows the allocation to equities in the portfolio to be varied.

This allows the range of possible outcomes to be observed in terms of the multiple of final salary available at age 63 (retirement) and then the probability of ruin, based on withdrawing half of that salary per annum to age 103. The focus is on the median outcome and below, as this paper is considering the risk of shortfall, and not the upside of better-than-median outcomes.

Key statistic

The key statistic to look at, is the probability of running out of money by one's 98th birthday, which is the 95th percentile of life expectancy for the average retiring 63-year-old Australian person.

The chart below shows the ruin probability at age 98 based on varying X, the ratio of equities in the portfolio to bonds, based on the scenario modelling above.



Source: Model as described - developed by Platinum Investment Management Limited.

This shows that for a constant allocation to equities over the lifetime of the employee, ***80% is the level required to eliminate the risk of running out of money under the assumptions used***.

Accumulation phase

For the working period, the model can look at the returns achieved under the different scenarios and the multiple of final salary.

It is a neat coincidence in the 80% equity portfolio case that the median balance at retirement is $1 million. Perhaps a subtitle for this paper should be "Who Wants to be a Millionaire?"

What is stark, when looking at the differences in achievement at retirement, for different levels of X in equities, is there is what appears to be a subtle increase in the average internal rate of return (IRR) over one's working life from 4.4% at a 60% allocation, to 5.0% at an 80% allocation, but a dramatic change in the ruin probability from 35% to 0%.

The tables below show firstly, the progression of the multiples of final salary, and secondly, the implied post-tax IRRs as the equity allocation increases from 50% to 90% with the associated ruin probabilities.

Outcome	50% equities	60% equities	70% equities	80% equities	90% equities
50th percentile	9.6	10.5	11.3	12.0	12.5
20th percentile	7.4	8.0	8.5	9.0	9.6
10th percentile	5.8	6.3	6.8	7.4	8.1
5th percentile	5.3	5.7	6.2	6.7	7.1
1st percentile	4.5	4.9	5.1	5.3	5.5
Ruin probability	67%	35%	15%	0%	0%

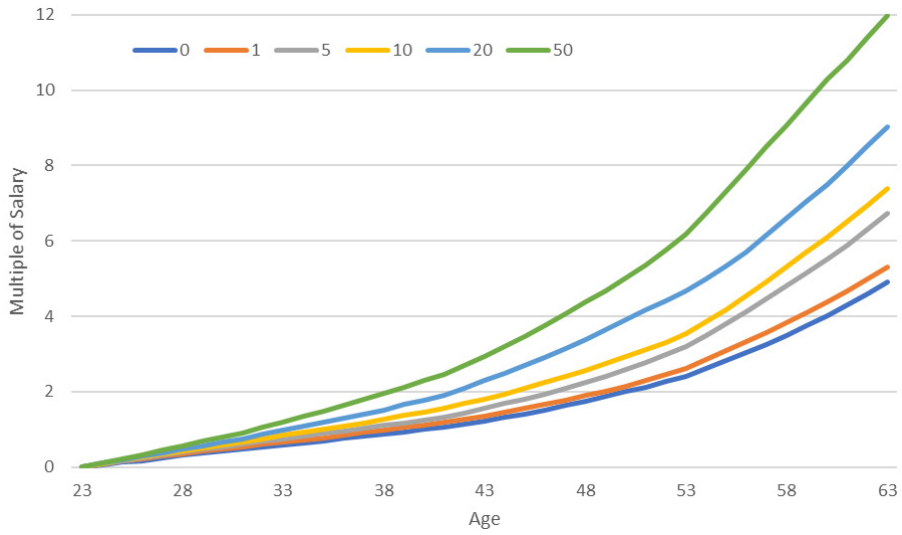
Source: Model as described - developed by Platinum Investment Management Limited.

Outcome	50% equities	60% equities	70% equities	80% equities	90% equities
50th percentile	4.0%	4.4%	4.7%	5.0%	5.2%
20th percentile	2.7%	3.1%	3.4%	3.7%	4.0%
10th percentile	1.5%	1.9%	2.3%	2.7%	3.2%
5th percentile	1.0%	1.4%	1.9%	2.2%	2.5%
1st percentile	0.0%	0.5%	0.8%	1.0%	1.2%
Ruin probability	67%	35%	15%	0%	0%

Source: Model as described - developed by Platinum Investment Management Limited.

The model allows a look at the progression of the balance year-on-year against the salary at the time, again looking at the percentiles to understand the range of outcomes.

Having ascertained that an allocation of 80% to equities is the minimum case where the probability of ruin is zero in the model, this portfolio choice is examined. The chart below shows the various percentiles (median (50) to minimum (0)) of outcomes as to how the portfolio progresses by age in multiples of salary at that point.



Source: Model as described - developed by Platinum Investment Management Limited.

Decumulation phase

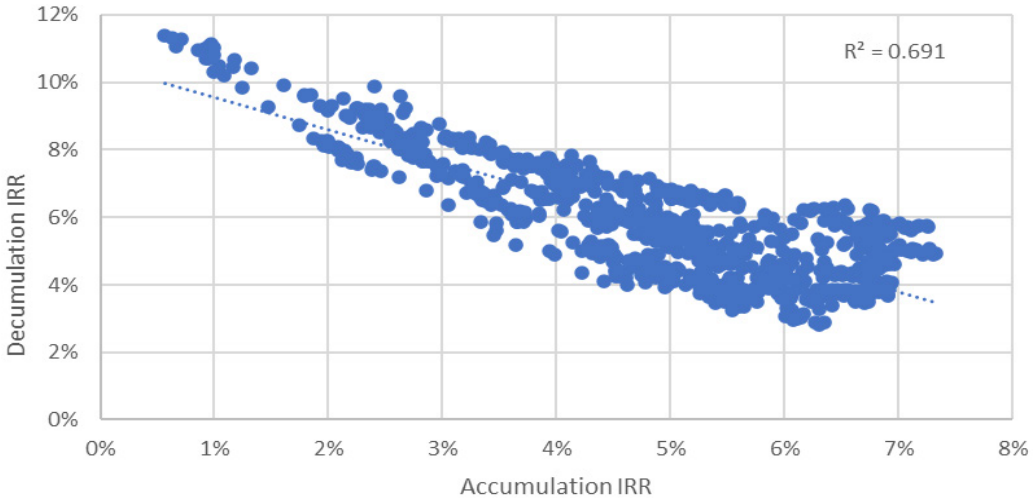
Once we reach retirement, the process of decumulation emerges.

The two challenges that are generally accepted are longevity risk and sequencing risk. Here, the former has been addressed by solving for the constant equity exposure that removes the risk of ruin at the 95th percentile of longevity.

Sequencing risk

For sequencing risk, there is a very important element that is often overlooked in popular discussions on this topic. Those at greatest risk of sequencing risk – that being, the risk of poor returns in the early years of retirement – are those who have likely been its biggest beneficiaries in the latter part of accumulation.

At the extreme, this can be seen by looking at the IRRs in retirement against the IRRs in accumulation and the very high negative correlation. Indeed, at the 80% equities level, 70% of the IRR in retirement is explained by the IRR in accumulation, albeit the relationship is negative. That means that a high IRR in accumulation generally predicts a lower IRR in retirement for the same portfolio choice, all else being equal. Note the lower accumulation IRRs are largely a function of applying tax in accumulation.



Source: Model as described - developed by Platinum Investment Management Limited.

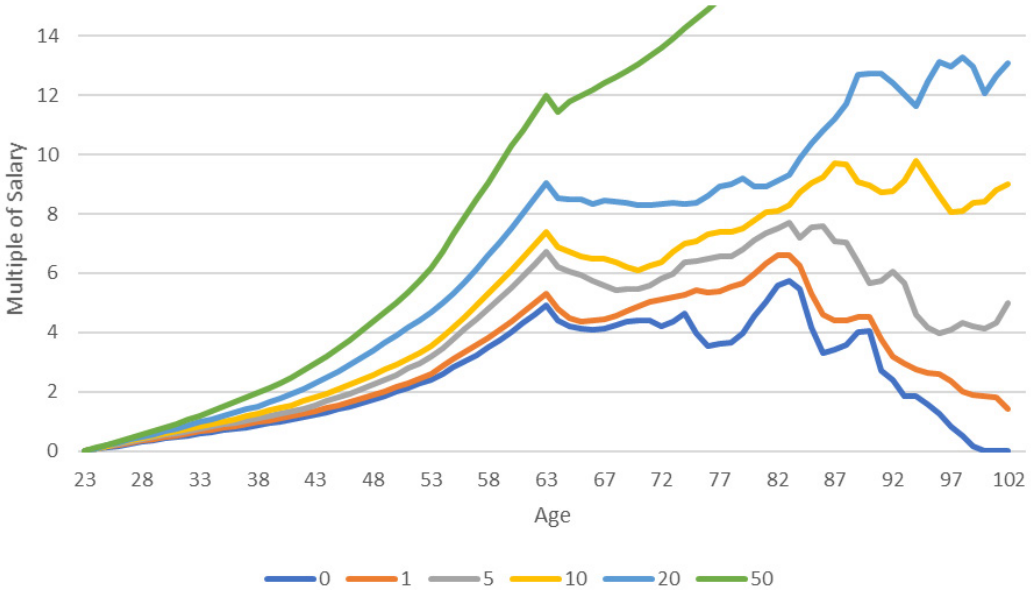
To look at sequencing risk, we can consider the correlation balance at 5-year intervals post retirement, with the achieved return in accumulation, in other words, the balance at retirement.

The correlation co-efficient is negative and increases in magnitude out to 15 years post retirement peaking at -0.43. This suggests sequencing is less of a risk, and the evidence from the probability of ruin, is that it is unlikely to be catastrophic in any case. That is not to diminish its psychological impact.

Longevity risk

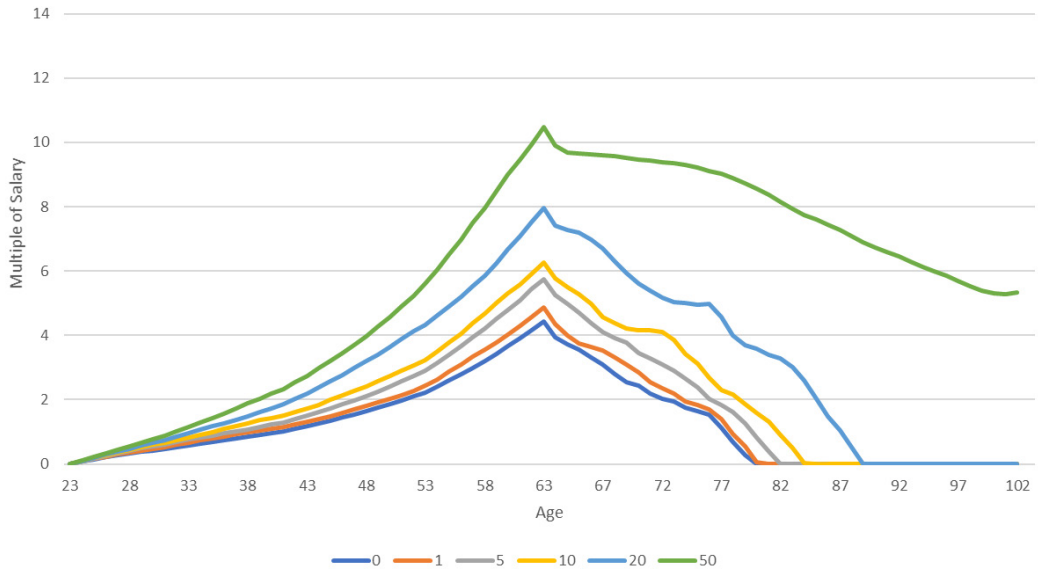
The decumulation phase can be modelled in the same way as the accumulation phase to show the progression of the investment balance as a multiple of current salary in working period, and final salary from retirement. The very small number of cases where ruin occurred between ages 100-102, for an 80% equity portfolio, hypothetically started in 1878 and 1879, retiring in 1918-1919 and running out of money in around 1957.

The chart below shows the percentiles of outcomes at various ages from the median (50)[11] down to the minimum (0).



Source: Model as described - developed by Platinum Investment Management Limited.

To provide context for the 80% equities selected, the same chart is replicated for portfolios with 60% exposure to equities showing the much-poorer outcomes from the low equity allocation. In this case, there is a meaningful probability of ruin, happening in some cases before the median life expectancy (85 for men, 87 for women).[12]



Source: Model as described - developed by Platinum Investment Management Limited.

11 In order to show the progression of 0-20 percentiles clearly, the Y-axis was scaled accordingly. The 50th percentile reaches 30x salary at age 100.

12 Source: ABS Life Tables, 2017-2019 of a 63-year-old Australian male and female respectively.

3. Staying the course

The key challenge for investors in equities is behavioural. This is borne out by the long-term outcomes described previously.

A significant challenge for the investor in equities comes from various biases that are well documented in behavioural finance literature including a previous paper by the author.[13]

Bear markets

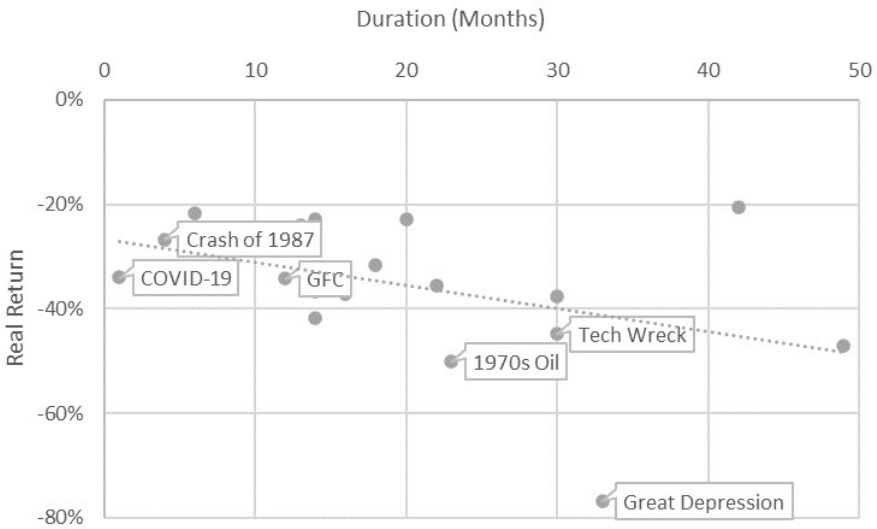
Over the 150-year study there were 19 bear markets, as defined by a (in this case real) return of greater than -20%. These are shown below in tabular form.

Start	End	Months	Return	Start	End	Months	Return
Jun 1876	Jun 1877	12	-34%	Apr 1946	Feb 1948	22	-35%
May 1892	Jul 1893	14	-23%	Dec 1961	Jun 1962	6	-22%
Aug 1902	Oct 1903	14	-26%	Dec 1968	Jun 1970	18	-32%
Sep 1906	Nov 1907	14	-37%	Jan 1973	Dec 1974	23	-50%
Jun 1911	Dec 1914	42	-20%	Nov 1980	Jul 1982	20	-23%
Nov 1916	Dec 1920	49	-47%	Aug 1987	Dec 1987	4	-27%
Sep 1929	June 1932	33	-77%	Aug 2000	Feb 2003	30	-45%
Feb 1934	Mar 1935	13	-24%	Oct 2007	Feb 2009	16	-37%
Feb 1937	Apr 1938	14	-42%	Feb 2020	Mar 2020	1	-19%[14]
Oct 1939	Apr 1942	30	-38%				

Source: Platinum Investment Management Limited, using Shiller data.

Of these, the average bear market lasts for 20 months, with an annualised fall of -24% for a total negative return of -37%.

It is revealing to view these bear markets by severity and duration in graphical form, including the more recent events, and the Great Depression for context.



Source: Platinum Investment Management Limited, using Shiller data.

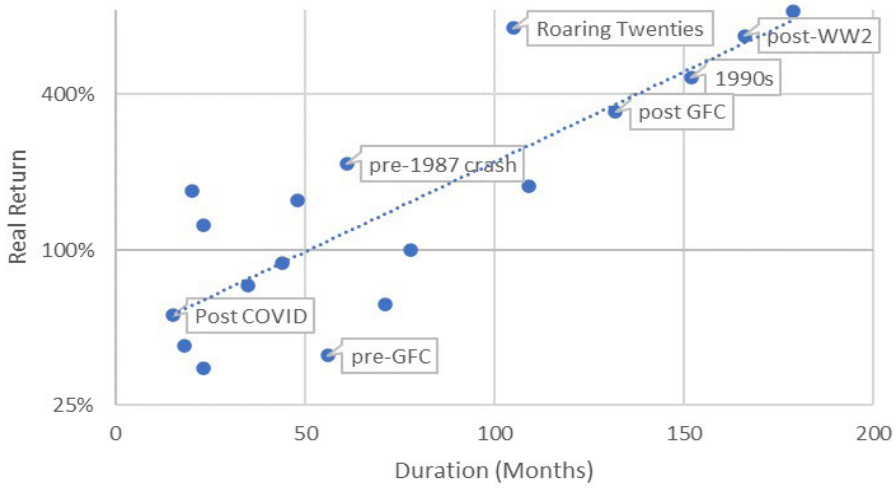
13 https://portfolioconstructionforum.edu.au/article/2313/loss-aversion-fomo-anxiety-and-mistiming

14 While the Shiller data set is monthly, the COVID-induced sell-off saw the S&P 500 fall 34% from 19 February to 23 March 2020. This -34% number is used in the graph. Source: FactSet Research Systems.

Bull markets

Between each pair of bear markets is a bull market. These last on average 72 months, with an annualised return of 17% and a total return of 156%.

The chart below shows these by duration and intensity, ignoring the first period to June 1876, as the start date was undefined. The return is shown on a log-scale and there is a neat pattern again, with some of the familiar events highlighted.



Source: Platinum Investment Management Limited, using Shiller data.

Stylised cycle

It is therefore possible to define a very stylised cycle, without loss of generality, as six 'up' years of 17% each followed by two 'down' years of -20%.

Previous work by the author in the section on mistiming in the previously referenced paper and others (e.g. Dalbar's QAIB[15]) note that investors are attracted and repelled by recent past performance. The author has previously used an average of 1- and 3-year relative and absolute performance numbers to forecast managed fund flows. At an index level, a simple sentiment indicator could be derived from the same principles by using the average of 1- and 3-year returns.

Applying this to the stylised cycle shows the challenge facing investors. In the stylised cycle, where years 1-6 see returns of 17%, followed by years 7-8 seeing 20% sell-offs, the sentiment indicator would suggest equities are 'attractive' at the end of years 3-6, with investors quick to sell after year 7. If one assumes an average entry price being the average of years end 3-6, and exit at end of year 7, the investor would receive NO return from an asset that rises by 6% per annum. This is consistent with real data from the Dalbar survey that forms the core of Nick Murray's value proposition in "*Behavioral Investment Counselling*".

Drawdowns

In the 80% model, the person is forced to deal with drawdowns – including in the accumulation phase. The table below shows the fall from peak balance pre-retirement, and maximum fall from at retirement balance in decumulation, at various percentiles. This is part of the emotional journey that must be travelled.

Percentile	Fall from peak to retirement	Fall from retirement to low
50th percentile	0%	29%
20th percentile	12%	57%
10th percentile	20%	62%
5th percentile	25%	65%
1st percentile	33%	88%

Source: Model as described - developed by Platinum Investment Management Limited.

15 https://www.dalbar.com/qaib/index

4. Australian superannuation system

Data from ASFA and the Australian Tax Office (ATO) shows the current asset allocation in the Australian superannuation system.

Utilising the idea of a simple two-asset model,[16] where all portfolio assets are either equities or debt. The challenge is how to allocate 'Other and Hedge Funds'. This leads to ranges being provided.

Applying this logic to funds larger than four members, which comprise 75% of the system's assets, shows the following aggregate asset allocation.

	Funds > four members - asset allocation (%)[17]
Cash and fixed interest	29
Total debt	29-32
Listed shares and unlisted equity	54
Property and infrastructure	14
Total equity	68-71
Hedge funds and other	3

Source: ASFA, Platinum Investment Management Limited.

It is a reasonable assertion to state that the system is approximately 70% exposed to equity-like investments when we look at the 75% of SMSF assets that can be defined by asset class and note the ratio of equity (i.e. shares and property) to debt (cash and fixed interest) is 68:32.

According to this data source, real returns earned by Australian superannuation funds over the last 40 years have been 6.2% (to 30 June 2019), which is above the amounts used in the model. Indeed, for a 70% allocation to equities, this would be at the 97th percentile (the median is 4.7% p.a. in the model). Even for a 100% allocation to equities this would be at the 70th percentile. One might argue that a long period of above-normal returns is an unforeseen systemic risk, that needs to be considered, but is beyond the scope of this paper.

Conclusion

This paper set out to use a dataset of real market outcomes over a very long history, and apply this to contemporary Australian circumstances and solve for a lifetime consistent exposure to equities to eliminate the risk of running out of money in retirement.

This suggests that starting early, having a higher allocation to equities (80%) than conventional wisdom, and staying the course, could be an optimal solution.

The author is cognisant that given one pre-condition is to start early, that it is not possible to simply rectify any shortfall for those who are significantly more mature than 23-years-old.

The author acknowledges that given the cyclical element of bull and bear markets in equities that a skilled long-biased/long-short equity manager could deliver a better outcome with the flexibility to vary that, but that is beyond the scope of this paper, as it would need to consider valuation and requires an assessment of manager skill.

16 As suggested by Andrew Clifford with methodology provided: https://portfolioconstructionforum.edu.au/article/2844/roi-is-everything-abstractions-are-distractions

17 https://www.superannuation.asn.au/resources/superannuation-statistics May 2021 report using March 2021 data