

Living annuities and (much) less-than-expected
portfolio returns:

Do I really have enough capital?



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1. Assumptions are at the core of any plan

Any financial plan is subject to core assumptions – one such make-and-break assumption in retirement planning is the expected portfolio return one will experience in a retirement portfolio in the long run. That is key because it will determine whether the retiree will have enough capital to retire comfortably, as well as the appropriate drawdown rate required at retirement, and the long-term sustainability of the retirement plan in the post-retirement period.

Very often financial planners plug in an expected portfolio return of about 5% above the inflation rate over the long term, which is not wrong *per se* as it is based on the historical precedent of market returns through multiple decades, even though it is biased towards more recent history. That is to say, if the retiree's investment portfolio will mimic more or less the market portfolio on which the assumption is premised, typically a medium-to-high equity, multi-asset class investment portfolio.

Are there any reasons to doubt the validity of these numbers, going forward? While it is easy to succumb to current political and economic concerns of the day, often backed and highlighted by popular columnists (I would not use the term "experts") why this time around it should be very different than the past, the long history of financial markets have shown that it survived deep crises before, both political and economic in the past and yielded the desired returns to brave and patient investors that weathered those storms.

Thus, I for one, do not deviate from the numbers too much, I might use a bit more conservative return assumptions in my planning exercises, but I do not radically change my assumptions because I might feel at a particular point in time less optimistic, or conversely, very optimistic about the future, akin to participants' behaviour on the stock market. That, to me, is a very bad starting point in the planning process.

Yet, what's wrong playing devil's advocate with the expected return numbers? What if the market will yield substantially lower numbers than what we've witnessed in recent memories. Let's call it a stress-test exercise. How sound is my plan under (much) lower-than-expected returns, going forward. What alternative plans and options should I keep in mind when things really do go south?

2. Historical Perspective

Consider the outcome of a multi-asset class investment portfolio consisting of 55% allocated to equities, 25% bonds and 20% cash, re-balanced annually, from 1900 to 2017.¹ Since we are dealing with returns over very long periods of time, it is appropriate to evaluate only the real rate of return numbers; nominal rates of return less the official inflation rate over time, thus giving a return after inflationary effects have been stripped out of the return equation.²

The results are shown from the first rolling 30-year period that ended in 1930 until the last period that ended in 2017, in figure 1. During this long-term period of historical returns, we have had periods of real returns averaging as high as nearly 9% per annum ending in the mid 2000's, but on the other extreme real returns of only 2% per annum ending in mid 1970s.

¹ Based on a study by Firer and Staunton, published in 2002, titled: "102 Years of South African Financial Market History" and subsequently updated with the latest market data.

² The real rate of return is given by the formula: $(1+\text{nominal rate}) / (1+\text{inflation rate}) - 1$

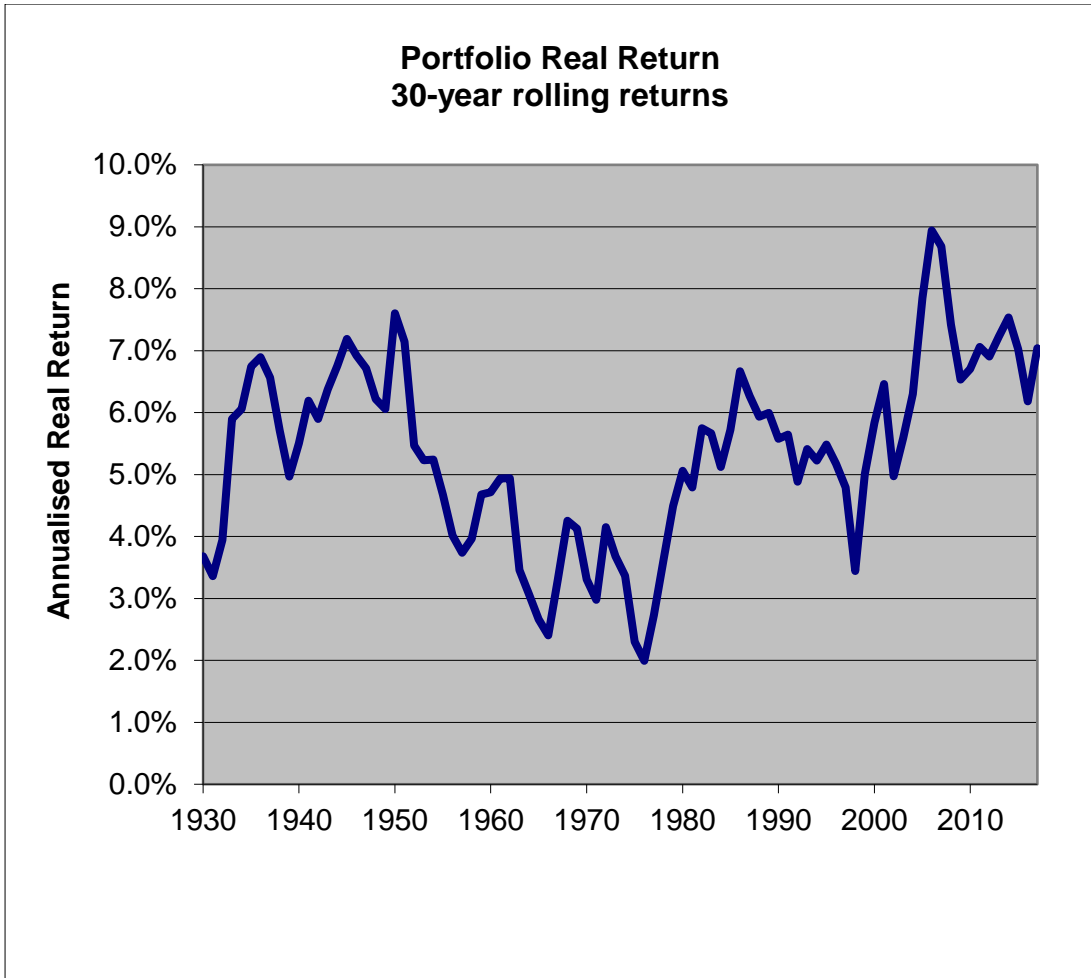


Figure 1: Long-term real returns from a medium-high equity, multi-asset class investment portfolio, based on market returns, 1900 – 2017.

3. Scope and Design

This study focuses on the impact that lower-than-expected portfolio returns would have on the sustainability of a retirement plan in the long run, specifically a living annuity portfolio. In this context I'm referring to lower portfolio returns over the long term, 20 – 30 years, and thus not only a periodic spate of lower returns in the short term, which is quite common, but a secular trend of lower market returns than what we've become accustomed to in recent times.

I'm considering the following alternative long-term annualised real (over and above inflation) return numbers: 3%, 1% and -2% versus the base case expectation of 5% real returns. How will these lower return assumptions affect the ability of the plan to meet its desired post-retirement income targets? What kind of drawdown rates will be required at different stages or intervals of the retirement phase? How will it impact the amount of retirement capital left at different stages? And, when, in the number of post-retirement years can one expect the plan to hit the maximum withdrawal rate of 17.5%, i.e. reaching the ceiling drawdown rate before retirement capital will be rapidly depleted thereafter.

I ran 1,000 simulations covering a post-retirement period of 30 years based on expected real return and inflation rates in each return scenario.³ Out of these multiple results I've drawn a probability distribution,⁴ and then calculated the following metrics at intervals of the 20th, 25th and 30th year of the retirement plan:

³ For example, 5% real return per annum with a standard deviation of 12%, and inflation rate of 5% per annum with a standard deviation of 1%. Similar projections were done for an expected real return of 3%, 1% and -2% per annum.

⁴ For example, 40th percentile refers to 40% of observations were worse/lower and 60% of observations were better/higher. The 75th percentile refers to 75% of observations were worse/lower and 25% of observations were better/higher. The median is the midpoint where 50% of observations are below and above.

- The real income as a percentage of the initial income the plan had yielded, thus excluding the effect of inflation over time, for example if a plan was at 100% real income in the 20th year, it meant that the plan could sustain the desired post-retirement income levels over the period.
- The real capital ratio available – capital available expressed in real terms (excluding inflation) at the specified intervals as a percentage of initial capital invested.
- The withdrawal rate required at the specified intervals, thus what percentage of capital were required to withdraw to meet income targets at those periods in time.
- The “breakdown” – at what year in the retirement plan was the maximum drawdown level of 17.5% reached, typically an indication that rapid capital depletion will follow thereafter, and the inability to fund future income needs. For example, if the maximum level was reached in year 15, it is highly unlikely that the plan would be deemed as sustainable for many years thereafter.

4. The Base Case

Let us assume the expected portfolio return over a thirty-year post-retirement period will be 5% real return (over and above the expected inflation rate). For our purposes, we assume a retiree requires initially an income of R250,000 per annum, that will escalate each year with the prevailing inflation rate. She has R5 million in retirement capital available to fund her future needs – it implies a capital-to-income ratio of 20 times. Therefore, initially she needs to withdraw 5% of her capital. What kind of outcome and probabilities for the retirement plan are possible, given these assumptions?

Simulated output: Real income

Percentile	20 th year	25 th year	30 th year
10	47.1%	20.5%	9.2%
25	100.0%	52.7%	23.4%
40	100.0%	100.0%	54.9%
50	100.0%	100.0%	100.0%
60	100.0%	100.0%	100.0%
75	100.0%	100.0%	100.0%
90	100.0%	103.1%	110.8%

At the median (50th percentile), the plan would be fully sustainable to meet future expected income demands over the three post-retirement intervals; 20th, 25th and 30th year in the post-retirement period, respectively.

Simulated output: Real capital

Percentile	20 th year	25 th year	30 th year
10	12%	5%	2%
25	27%	13%	6%
40	51%	31%	14%
50	67%	52%	30%
60	87%	72%	62%
75	126%	126%	126%
90	202%	224%	233%

At the median, the plan will consume capital on a real basis, especially deeper into the post-retirement phase. This is, however, not necessarily a major concern, as the primary objective would be to secure a sustainable income stream for the retiree, and if capital depletion only takes place towards the latter stages of the plan, it should be bearable.

Simulated output: Withdrawal rate

Percentile	20 th year	25 th year	30 th year
90	17.5%	17.5%	17.5%
75	16.6%	17.5%	17.5%
60	9.7%	14.6%	17.5%
50	7.5%	9.5%	15.5%
40	5.9%	7.0%	8.4%
25	4.2%	4.2%	4.2%
10	2.7%	2.5%	2.5%

At the median, the maximum withdrawal rate of 17.5% is not reached, even though the drawdown rate is nearing the ceiling rate towards the latter stages of the retirement plan.

Simulated output: Breakdown

Percentile	Breakdown in years
90	30
75	30
60	30
50	30
40	26
25	20
10	14

At the median, no “breakdown” point is reached within the full 30-year post-retirement phase, i.e. the retiree did not need to withdraw 17.5% of retirement capital value in any year.

In summary, it is clear under this portfolio return assumption, the plan is most likely fully sustainable for a long post-retirement period. Only a small percentage of observations showed a failed plan.

5. Comparing with worse return scenarios

Next, simulations were run with the same assumptions as before, but at different expected portfolio real returns, namely 3%, 1% and -2% per annum respectively. The results are summarised in the following sections, using the same criteria as before. For simplification purposes, only the median results are shown.

In addition, results are shown with different initial capital-to-income ratios. Whereas in the base case scenario a capital-to-income ratio of 20 times was assumed, capital ratios between 15 times to 60 times initial income needs were applied. It is done to show how much retirement capital would have been required if adverse market return conditions would prevail over the longer term.

5.1 Real income comparisons

Simulated output: Real income at the 20th year (median)

Capital ratio	Portfolio Real Return			
	5%	3%	1%	-2%
60	204%	138%	100%	100%
55	185%	128%	100%	100%
50	165%	115%	100%	100%
45	149%	104%	100%	100%
40	130%	100%	100%	100%
35	111%	100%	100%	100%
30	100%	100%	100%	61%
25	100%	100%	100%	35%
20	100%	100%	43%	17%
15	56%	29%	17%	8%

Simulated output: Real income at the 25th year (median)

Capital ratio	Portfolio Real Return			
	5%	3%	1%	-2%
60	222%	136%	100%	100%
55	196%	125%	100%	100%
50	176%	116%	100%	100%
45	163%	100%	100%	100%
40	139%	100%	100%	62%
35	114%	100%	100%	40%
30	100%	100%	100%	21%
25	100%	100%	49%	12%
20	100%	49%	17%	6%
15	28%	12%	7%	3%

Simulated output: Real income at the 30th year (median)

Capital ratio	Portfolio Real Return			
	5%	3%	1%	-2%
60	232%	136%	100%	100%
55	212%	121%	100%	74%
50	191%	108%	100%	60%
45	178%	100%	100%	37%
40	150%	100%	100%	22%
35	122%	100%	100%	14%
30	100%	100%	50%	7%
25	100%	100%	19%	4%
20	100%	22%	7%	2%
15	12%	5%	3%	1%

At an initial capital-to-income ratio of 15 times, the retirement plan would not be sustainable, under any of the return assumptions used, even if only required for a 20-year post-retirement period. At 20 times ratio the plan is sustainable for 30 years only under the 5% real return assumption. If the retiree had capital-to-income of 25 times, and 3% real return were realised, the plan would be sustainable for 30 years. Similarly, she would require capital of 35 times income needs if real returns of only 1% would apply. At the extreme assumption of negative real returns (historically unprecedented), one would have needed capital to the tune of 60 times initial income needs to make the plan sustainable for 30 years!⁵

5.2 Real Capital comparisons

Simulated output: Capital ratio at the 20th year (median)

Capital ratio	Portfolio Real Return			
	5%	3%	1%	-2%
60	145%	97%	66%	32%
55	140%	98%	64%	30%
50	142%	96%	63%	30%
45	142%	95%	59%	26%
40	139%	94%	57%	21%
35	134%	85%	48%	16%
30	122%	75%	38%	10%
25	104%	58%	24%	7%
20	71%	29%	11%	4%
15	20%	10%	6%	3%

⁵ With an initial income need of R250,000 per annum, the retiree should have had R15 million in retirement capital – unlikely to materialise from diligent savings only, but possible with the help of inheritance, business profits, net proceeds from the sale of business shares or even lotto winnings!

Simulated output: Capital ratio at the 25th year (median)

Capital ratio	Portfolio Real Return			
	5%	3%	1%	-2%
60	155%	93%	59%	20%
55	150%	95%	54%	17%
50	151%	96%	52%	16%
45	154%	91%	49%	12%
40	150%	89%	44%	8%
35	138%	77%	33%	5%
30	128%	64%	21%	3%
25	100%	41%	10%	2%
20	55%	12%	4%	1%
15	9%	4%	2%	1%

Simulated output: Capital ratio at the 30th year (median)

Capital ratio	Portfolio Real Return			
	5%	3%	1%	-2%
60	162%	93%	52%	9%
55	164%	93%	44%	6%
50	163%	91%	43%	6%
45	166%	86%	37%	4%
40	160%	82%	32%	3%
35	151%	68%	18%	2%
30	136%	51%	8%	1%
25	97%	23%	4%	1%
20	35%	6%	2%	0%
15	4%	2%	1%	0%

5.3 Withdrawal rate comparisons

Simulated output: Withdrawal rate at the 20th year (median)

Capital ratio	Portfolio Real Return			
	5%	3%	1%	-2%
60	2.5%	2.5%	2.5%	5.0%
55	2.5%	2.5%	2.9%	5.9%
50	2.5%	2.5%	3.2%	6.4%
45	2.5%	2.5%	3.9%	8.1%
40	2.5%	2.8%	4.4%	10.8%
35	2.5%	3.5%	5.8%	15.0%
30	2.9%	4.6%	8.3%	17.5%
25	4.0%	6.9%	15.2%	17.5%
20	7.0%	15.1%	17.5%	17.5%
15	17.5%	17.5%	17.5%	17.5%

Simulated output: Withdrawal rate at the 25th year (median)

Capital ratio	Portfolio Real Return			
	5%	3%	1%	-2%
60	2.5%	2.5%	2.8%	7.8%
55	2.5%	2.5%	3.4%	10.0%
50	2.5%	2.5%	3.9%	11.1%
45	2.5%	2.5%	4.6%	15.6%
40	2.5%	2.9%	5.6%	17.5%
35	2.5%	3.8%	8.3%	17.5%
30	2.7%	5.3%	14.5%	17.5%
25	4.2%	9.8%	17.5%	17.5%
20	8.9%	17.5%	17.5%	17.5%
15	17.5%	17.5%	17.5%	17.5%

Simulated output: Withdrawal rate at the 30th year (median)

Capital ratio	Portfolio Real Return			
	5%	3%	1%	-2%
60	2.5%	2.5%	3.3%	15.7%
55	2.5%	2.5%	4.1%	17.5%
50	2.5%	2.5%	4.7%	17.5%
45	2.5%	2.7%	5.8%	17.5%
40	2.5%	3.1%	7.5%	17.5%
35	2.5%	4.4%	14.6%	17.5%
30	2.6%	6.4%	17.5%	17.5%
25	4.3%	15.6%	17.5%	17.5%
20	13.2%	17.5%	17.5%	17.5%
15	17.5%	17.5%	17.5%	17.5%

5.4 Breakdown comparisons

Simulated output: Breakdown occurrence in number of years (median)

Capital ratio	Portfolio Real Return			
	5%	3%	1%	-2%
60	30	30	30	30
55	30	30	30	28
50	30	30	30	27
45	30	30	30	25
40	30	30	30	22
35	30	30	30	20
30	30	30	26	17
25	30	30	20	15
20	30	20	15	11
15	16	12	10	8

The above is self-explanatory. “Safe” capital-to-income ratios will increase as the portfolio returns trend lower, up from 20 times under a 5% real return assumption to 35 times and even 60 times as much lower return numbers are assumed than those that transpired historically.

6. Synopsis

It is prudent to use conservative to realistic return assumptions in retirement plan projections – my best guess would be between 3-5% real returns. It is difficult, nor practical to use “out-of-norm” return assumptions, like near-zero or negative real returns as a base-case portfolio return assumption. The output thereof will show perhaps unrealistic or too pessimistic projections.

Nonetheless, it is comforting to know that one would have enough retirement capital if future long-term market returns are way below historical trends, although one should realistically expect only a minority of retirees will be in such a fortunate position. In my opinion, when some retirees’ retirement plans are only marginally sustainable, even under “normal” (3-5%) real return scenarios, alternative retirement options should be investigated, namely postponing retirement (work longer, if health permits), earning additional sources of income, downscaling and restructuring lifestyle, and considering guaranteed life annuities to mitigate the risks of sub-par market return trends.



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