



Sequence-of>Returns Risk
and its amplified effect on retirees' returns



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1. What's the fuss?

Sequence-of-returns risk, or sequence risk, refers to the specific order how returns, good and bad, accrue during investors' life cycles, and it is especially relevant for living annuity investors, or investors that are making regular withdrawals from their investment portfolios.

Consider the following scenarios and the real returns (over and above the inflation rate) of a hypothetical medium-equity, multi-asset portfolio over the past ten years. First, an investor that contributed regularly to her investment plan over a period of ten years, and, second, one that withdrew regular amounts over the same period.

Open value of investment	Annual Portfolio Real return	Balance	Contributions end of each year	End value of investment
100,000	-15.8%	84,205	5,000	89,205
89,205	13.2%	101,017	5,000	106,017
106,017	12.3%	119,026	5,000	124,026
124,026	-1.5%	122,167	5,000	127,167
127,167	14.1%	145,099	5,000	150,099
150,099	7.9%	161,976	5,000	166,976
166,976	4.4%	174,374	5,000	179,374
179,374	-2.2%	175,482	5,000	180,482
180,482	-0.1%	180,238	5,000	185,238
185,238	11.1%	205,754	5,000	210,754

This investor made regular contributions (savings) at the end of each year. The average portfolio real return over the past ten years is **4.3%** per annum¹, and the investor's internal rate of return (considering opening value, contributions, and end value) over the 10-year period was **4.2%** real return per annum. Not much of a difference compared with the portfolio return over this period, but over other periods it may be different, higher or lower, than the average portfolio return.

Next, we use the same portfolio return numbers as before, but the investor is making regular withdrawals as opposed to regular contributions. For this investor the internal rate of return over the past ten years turned out to be **3.6%** real return per annum. Clearly, given the period involved, the differences are significant in money terms.

Opening value of investment	Regular withdrawals at the start of each year	Balance	Annual portfolio real return	End value of investment
100,000	- 5,000	95,000	-15.8%	79,995
79,995	- 5,000	74,995	13.2%	84,925
84,925	- 5,000	79,925	12.3%	89,732
89,732	- 5,000	84,732	-1.5%	83,463
83,463	- 5,000	78,463	14.1%	89,527
89,527	- 5,000	84,527	7.9%	91,215
91,215	- 5,000	86,215	4.4%	90,035
90,035	- 5,000	85,035	-2.2%	83,190
83,190	- 5,000	78,190	-0.1%	78,084
78,084	- 5,000	73,084	11.1%	81,179

¹ The average return is equal to the return a lump-sum investor would have realised over this period. Thus, sequence risk is not applicable for lump-sum investors.

Thus, what is often reported in the media, publications, and investment fact sheets are the portfolio returns without any specific transaction flows, but it is not equal to the investors' return where the specific timing of transactions, whether savings or withdrawals, are considered. As we will see going forward, this turns out to be a significant difference, and specifically, one is likely to over-estimate one's potential returns from a retirement plan where regular withdrawals are made over time.

For illustrative purposes, and to show "the other side of the coin", what if we reversed the order in which the ten annual returns accrued in a portfolio over the past ten years, i.e. starting with 11.1% real return in year 1 and ending with -15.8% real return in year 10. The average portfolio return remains at **4.3%** real return per annum, as the specific order of returns has no bearing on the outcome thereof. As before, this is equal to the return of a lump sum investor. When contributing regularly, however, the internal rate of return of investors would have been enhanced to **4.7%** real return per annum. For the investor withdrawing regularly, the internal rate of return would have been **4.2%** real return per annum, closely matching the lump-sum return.

Real portfolio returns per annum over the past ten years	Lump-sum	Regular contribution	Regular withdrawals
As-is order of returns	4.3%	4.2%	3.6%
Reversed order of returns	4.3%	4.7%	4.2%

Typically, when making regular contributions, one would prefer most positive returns grouped towards the end of the investment term, but when withdrawing, you would prefer most positive returns stacked at the beginning of the period, or alternatively, avoiding bad returns in the initial stages.

Yet, we don't have such a clear choice of "ordering" our sequence of returns in any plan. Moreover, do the good and bad sequences of returns not cancel each other out over time? Thus, in the fullness of time, perhaps one would have experienced both good and bad sequence periods, and overall one would have experienced basically similar returns as a lump-sum investor?

2. How to answer the question

One way to find out is to run multiple simulations covering full investment cycles, say, a 35-year savings or contribution phase and a 30-year drawdown or retirement phase.

First, let us consider the historical real returns from three different investment portfolios: ²

Portfolio	Growth assets (Stocks & REITS)	Long-term interest-bearing (bonds)	Short-term interest bearing (cash)	Annualised real return	Volatility
“Steadfast”	50%	30%	20%	5.6%	13.1%
“Assertive”	60%	25%	15%	6.4%	14.8%
“Bold”	70%	20%	10%	7.1%	16.7%

We used historical yields and volatilities as the expected portfolio real returns in our simulation model. The investment period in total spanned over 65 years – 35 years as the accumulation phase prior to retirement and 30 years as the retirement phase. During the accumulation phase regular constant contributions were made at the end of each year. At the retirement phase regular constant withdrawals were made at the beginning of each year.

² Returns are 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 financial markets data. The period covered is from 1900 – 2017, in total 118 years of data.

For example, consider an investor that invests in a savings plan on regular basis. Regular contributions are set at R5,000 per annum. The contributions will escalate each year with the inflation rate, meaning on a real basis, the contributions remain fixed at R5,000 per annum. The investor invests in the “steadfast” portfolio, of which the expected portfolio real return is 5.6% per annum and 13.1% volatility expected over time.

Simulated output for “steadfast” portfolio during the accumulation phase

Period (year)	Open value	Simulated portfolio real returns	Value before contributions	Contributions	End value
1	-	0.2%	0	5,000	5,000
2	5,000	3.8%	5,189	5,000	10,189
3	10,189	2.9%	10,483	5,000	15,483
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33	733,430	22.3%	897,019	5,000	902,019
34	902,019	1.1%	911,568	5,000	916,568
35	916,568	15.9%	1,062,344	5,000	1,067,344

Overall, the portfolio real return averaged **7.7%** over the 35-year period, better than initially expected. Moreover, the regular investor achieved a real return of **9.0%** per annum. In this example, the sequence risk worked in favour of the investor – due to some strong positive returns towards the end of the investment cycle.

Next, the same investor moves on to the drawdown (retirement) cycle. She will withdraw 5% of the asset value in the first year. Thereafter, this withdrawal amount will remain the same on a real basis (after considering inflation effects) during the cycle. However, this amount may be limited by an upper boundary of 17.5% or a lower boundary of 2.5% of the asset value each year. She remains invested in the same portfolio for the drawdown cycle of 30 years.

Simulated output for “steadfast” portfolio during retirement phase

Period (years)	Open value	Withdrawal	Value after withdrawal	Simulated portfolio real returns	End value
1	1,067,344	53,367	1,013,977	1.5%	1,029,143
2	1,029,143	53,367	975,776	-3.7%	939,868
3	939,868	53,367	886,501	28.1%	1,136,032
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28	177,034	30,981	146,053	5.2%	153,672
29	153,672	26,893	126,779	8.3%	137,301
30	137,301	24,028	113,273	12.8%	127,733

Overall, the average portfolio real return over the 30 years was **4.7%** per annum (lower than expected), but the investor’s return, as measured by the internal rate of return, was only **3.1%** per annum. In this case, sequence risk worked against the investor (due to lower or negative returns during the initial stages of the drawdown cycle).

In the example above, the investor experienced both good and bad sequence risk effects. But what is most likely? Is it 50/50 between bad and positive effects, i.e. do sequence risks cancel each out over time? To test this, we ran the model 5,000 times to generate an output of simulated returns and thereby establishing a probability distribution of outcomes.

3. And the results are...

The tables below show the results of the simulations for the three different investment portfolios mentioned above. “Percentiles” refer to probability that a result will occur. For example, the “40%” percentile indicates that 60% of all results showed a better outcome and conversely, “60%” percentile that 40% of results were better, etc. “Avg Return” refers to the average portfolio real return during the accumulation and retirement phase, respectively. “Saving” refers to the 35-year accumulation phase and “Drawdown” to the 30-year retirement phase.

“Steadfast” portfolio: Results from 5,000 simulations

Percentile	Avg Return_acc	Saving	Avg return_dd	Drawdown
10%	2.8%	1.7%	2.6%	0.5%
25%	4.1%	3.2%	4.0%	2.6%
40%	5.0%	4.2%	5.1%	4.0%
50%	5.5%	4.9%	5.7%	4.7%
60%	6.1%	5.5%	6.3%	5.4%
75%	7.1%	6.6%	7.3%	6.4%
90%	8.4%	8.0%	8.7%	8.1%

“Assertive” portfolio: Results from 5,000 simulations

Percentile	Avg Return_acc	Saving	Avg return_dd	Drawdown
10%	3.2%	1.9%	2.9%	0.5%
25%	4.7%	3.7%	4.5%	2.9%
40%	5.7%	4.9%	5.6%	4.3%
50%	6.4%	5.6%	6.4%	5.1%
60%	7.0%	6.2%	7.0%	5.9%
75%	8.0%	7.3%	8.2%	7.1%
90%	9.5%	8.9%	9.9%	9.1%

“Bold” portfolio: Results from 5,000 simulations

Percentile	Avg Return_acc	Saving	Avg return_dd	Drawdown
10%	3.5%	1.8%	3.3%	0.3%
25%	5.2%	3.9%	5.1%	3.0%
40%	6.5%	5.2%	6.4%	4.6%
50%	7.1%	6.1%	7.2%	5.7%
60%	7.9%	6.8%	8.0%	6.6%
75%	9.1%	8.2%	9.3%	8.1%
90%	10.7%	9.9%	11.0%	10.0%

4. And the conclusion...

In all instances the investor's return most likely would be lower than the actual portfolio return, and the differences are more accentuated in the drawdown phase. Thus, sequence risks have a more detrimental effect while withdrawing regularly (retirement) from your investments than with regular contributions (savings). Moreover, the more volatile the composition of the investment portfolio, the more severe sequence risk will be – notice the divergence in the numbers in the “bold” portfolio relatively to the “steadfast” portfolio.

How do we interpret these findings? For example, you've decided to invest in the “assertive” portfolio. Historically, such a portfolio has yielded a real return of 6.4% per annum – that's the number you will expect. However, because sequence risk is alive and well, therefore, during the accumulation/savings phase you should really expect a return of 5.6% per annum. In the retirement phase your expectations should be reduced even further to 5.1% per annum. Effectively, sequence risk will act as a drag on your investment returns over time. Thus, it should be considered as a negative or bad investment risk. Importantly, when planning your retirement, it is best to lower your expected returns from investments.

Follow-up articles will discuss strategies to mitigate sequence risk, especially during the initial stages of the retirement phase.



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