UNDERSTANDING DECUMULATION MATTERS!

PERSPECTIVES

February 2022

The purpose of this paper is to outline the fundamental change when moving from the accumulation to the decumulation phase of a defined benefit plan´s life cycle and the implications for investment strategy.

OVERVIEW

Accumulation phase: in the early stages of the savings lifecycle the income needs to pay liabilities is far in the future, meaning that assets can remain invested for the long-term without need to sell. This provides freedom to the investor to focus on the compounding of risk-adjusted returns to meet a goal of maximizing the expected amount of the total asset pool at retirement. Short-term volatility of returns and drawdown risk can be absorbed through time and will have no bearing on the future result. Only the total compound rate of return will matter to the total capital accumulation.

Decumulation phase: as a plan begins to mature, there is a need to pay income to the beneficiaries over the expected lifetime of the annuitants and the capital pool is therefore expected to be depleted over the planning horizon. This situation means the dollar outcome is also sensitive to the cash flow weighted return rather than only the compound returns available on assets markets. In other words, when and how the investment returns occur matters and will have a material bearing on outcome. Optimizing the investment strategy therefore requires a liability orientated framework different to that used in the traditional mean-variance approach.

Many defined benefit plans are now in the decumulation phase of the life-cycle and have become "cash flow negative". This has important implications for investment strategy and liability risk management

Key difference between accumulation & decumulation phases

The key change when moving from the accumulation to the decumulation phase relates to being a net buyer or a net seller of assets.

The key difference is becoming a net seller of assets in the decumulation phase

- During the accumulation phase the plan is a **net buyer of assets** as inflows from investment income and plan contributions are much larger than outflows for benefits and expenses. This means that assets are always "invested" and will compound over time in line with long-term market returns. This situation is also referred to as being "cash flow positive".

- By contrast, during the decumulation phase as the plan is a **net seller of assets** as outflows are typically larger than inflows in each period. This situation is referred to as being "cash flow negative". This means that assets are consistently being sold and the long-term dollar outcome is therefore affected by the timing and volatility of the returns.

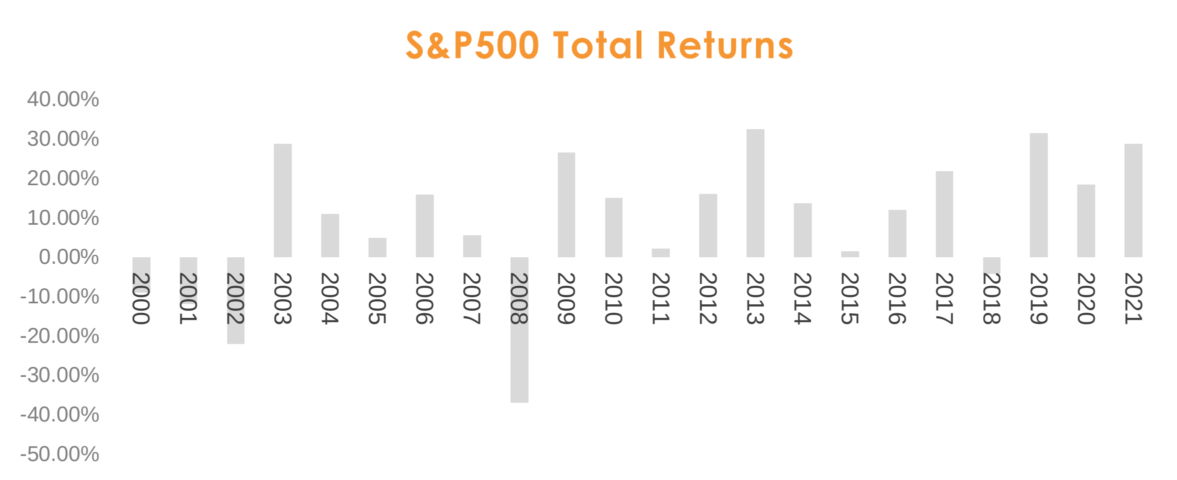
Sensitivity to the sequence of investment returns

To better understand the timing and volatility sensitivities in the decumulation phase, we examine the situation of a theoretical mature plan over the 20-year timeframe from 2000 to 2020:

The experience of an equity investor this century was very different for a plan accumulating vs decumulating assets

- We choose this period as the S&P500 index produced an outstanding total return of 305% despite experiencing significant periods positive and negative annal returns (15 positive years and 5 negative years), as outlined in the graph below:

- As a result of this return sequence, an investor who was able to follow a "**buy and hold**" strategy will have been able to increase the asset pool by **4x** from **2000** to the end of 2019 (and close to 5x by the end of 2021!).



This remarkable period of returns however produced very different experience for a DB plan in the decumulation phase. This is because the timing or "**sequence of returns**" mattered materially to the funded status outcome and was severely affected by negative returns in the early 2000-2002 period as well as the significant volatility and drawdown during the 2008-09 financial crises.

Modeling the effect of the sequence of returns for a plan in the decumulation phase

To illustrate the significance of the sequencing of returns we undertake analysis to look at the funding outcome under two investment return scenarios:

1. **Scenario 1:** assumes the annual equity returns follow the actual experience of the equity market index from 2000 to 2020; while
2. **Scenario 2:** assumes the equity return profile occurs in reverse chronological keeping everything else the same i.e., we assume that the 1st year of equity returns is equivalent to the annual return in 2019, the 2nd year is in line with 2018 etc., all the way back to the year 2000.

Under both scenarios, the defined benefit plan investor is assumed to start out with a liability of $1000M and a deficit of $200M but faces a very different plan funding cost profile.

Altering only the sequence of returns can lead to dramatically different financial outcomes

Table 1: Effect of Sequencing of Returns

Item		Scenario 1: Equity returns occur in chronological order	Scenario 2: Equity returns occur in reverse chronological order
Beginning asset pool		$800	$800
Beginning liability NPV		$1,000	$1,000
Beginning funded status	$	($200)	($200)
	%	80%	($200)
Initial cash outflow		$76	$76
Asset allocation: equity-bond mix		50%:50%	50%:50%
Projected funded status at end $		$12	$679
FV of required contributions over the period		($508)	($48)
Economic result: (negative)/positive cost		**($496)**	**$631**

The financial results[1,2] under the two scenarios is dramatically different as outlined in Table **1**. As you can observe:

- Under *Scenario 1*, some $508M of modeled contributions was required to maintain a healthy funded status over the 20-year period[3]; while
- Under *Scenario 2*, only $48M of modeled contributions is required (attributable to the assumed deficit at the beginning) and produces a very large surplus at the end of the period.
- In absolute terms the modeled result differs by a staggering $1,127m[4, 5], comparing an ending deficit of ($496) under *Scenario 1* vs a surplus position of $631 under *Scenario 2.*

What is important in explaining the result is that:

- The returns are negative in the early period under *Scenario 1*, i.e., 2000-2002, and largely positive in the later years following the 2008-09 crises, except for 2018 only; while
- The opposite is true for *Scenario 2* i.e., returns are positive in the early year, with a large drawdown in the middle of the period and further negative returns at the end.

What matters is not the total compound rate of returns but the timing profile or sequence of returns.

We can therefore conclude that, what matters in decumulation is not only the total compound rate of returns, which is the same under both scenarios, but also the timing profile or "sequence of returns"[6].

So, the question now becomes to understand why this is the case?

Understanding decumulation

The reason this is the case is due to the interaction of the investment returns with the liability outflows. As benefits must continue to be paid out in all decumulation scenarios, experiencing positive or negative returns in the early years has a magnified effect on the total dollar returns that can be achieved over a longer period.

The returns in the early years have a magnified effect.

Table 2: Compounding of total returns during decumulation

	Scenario 1	Scenario 2	Scenario 3
Increase in asset index	50%	50%	50%
Return profile – sequence of returns	4.1% p.a.	Years 1-3: +10% p.a. Years 4-9: 1.7% p.a.	Years 1-3: (-10%) p.a. Years: 4-9: 10.9% p.a.
Volatility of annual returns	0%	4%	10.1%
Maximum drawdown in asset index	N/A	N/A	(27.1%)
Cumulative dollar value of earned investment returns	$40	$44	$23
Relative return performance % (vs scenario 1)	100%	112%	59%

We can see this sensitivity to early returns more clearly in the further analysis outlined in Table 2 below, as follows:

- Here we examine the investment outcome under 3 scenarios for a maturing defined benefit plan assuming the plan starts out with $100 of assets and $100 of liabilities in each scenario, with annual outflows of $5.
- We then model the results over a 10-year period, preserving the same compound increase in the market returns over the period but now with three different return patters.

As we can observe, the total cumulative market index returns are 50% in all three scenarios (compounding at an effective rate of 4.1% p.a.). However, the different timing of the returns under the scenarios produces a materially different financial result:

- *Scenario 2* did best as it benefited from the higher relative returns in the early years when compared to *Scenarios 1 and 3*
- *Scenario 2* also vastly outperformed *Scenario 3* resulting in significantly higher dollar returns of $44vs $23 respectively.
- *Scenario 3* performed poorly by comparison to both *Scenarios 1 and 2* and which is explained by the negative returns in the early years, leading to a total drawdown of 27.1% in the asset index and its higher rate of annual volatility (10.1% vs 0% and 4% respectively)

Table 3 below reproduces the same analysis but looking through the lens of funded status. Again, we observe that *Scenario 2* performs best while *Scenario 3* leads to an inferior outcome.

Table 3: Effect of sequence of returns on funded status

	Scenario 1	Scenario 2	Scenario 3
Assets at end of 10 years period	$90	$94	$73
Liabilities at end of 10 years period	$90	$94	$90
Funded status	100% $0 surplus	105% $4 surplus	82% ($17) deficit

What are the implications for investment strategy?

In basic terms we can conclude that it is not sufficient to make investment strategy decisions on expected return and volatility of the different available assets in the decumulation phase. Return optimization is a more complex problem with net cash outflows as it also requires consideration of the associated sequencing and volatility risk[7]. A failure to adapt the investment strategy can have a potentially material bearing on the long-term outcome

The investment objective in decumulation is not to maximize risk-adjusted returns

While others have made a similar observation to this, we believe that this conclusion on its own somewhat misses the bigger picture. This is because the investment objective in decumulation is not to maximize risk-adjusted returns, rather it is to minimize the risk of depleting the capital pool before the expected planning horizon. "Shortfall" & solvency risk is therefore the important optimization criteria. Solving this equation makes it necessary to adopt a liability orientated framework to balance the desire for higher returns with the need to manage the sufficiency of the capital pool through time[8]. This investment challenge is not addressed by traditional Modern Portfolio Theory (MPT)[9] and is a topic we will cover in a further paper.

The goal is to minimize the risk of depleting the capital pool before the expected planning horizon

Summary takeaways

Issue	Accumulation phase	Decumulation phase
Investment objective	The long-term outcome is optimized by maximizing risk-adjusted returns relative to the desired budget.	The long-term outcome is sensitive to the volatility and timing/ sequencing of returns. Liability risk management is necessary to mitigate the risk of depleting assets before the expected planning horizon.
Investment returns	Only the compound rate of return matters for an investor who is "cash flow positive" and who can follow a "buy and hold" strategy.	A plan in decumulation is in a cash flow negative situation, needing to sell assets to fund liabilities. The dollar outcome is sensitive to the cash flow weighted return.
Investment strategy	Optimizing investment strategy can follow a traditional MPT mean-variance approach.	Optimizing investment strategy requires a liability orientated framework incorporating risk management. Traditional MPT approaches are incomplete.

Author: **Kevin McLaughlin**, Founder **Renuaa Risk Management Advisors LLC**
kevin.mclaughlin@renuaa.com | www.reunaa.com

Footnotes

1. For asset liability modeling purposes, we assume closed population with initial average age of 60. Annual benefit outflows of $76 p.a., declining over time in line with projected deaths. Deaths follow the RP-2014 mortality table without improvements. Minimum contributions are assumed to be required if funded status is below 100% at the end of any year and calculated to be sufficient to amortize the deficit over 15 years at a 4% discount rate. Equity market returns based on S&P500 total return index. Bond returns and the liability discount rate are assumed to be 4% p.a. in each period. For simplicity, all cash flows are assumed to occur at the end of the year.

2. FV of required contributions over the period are calculated using a 4% rate of compounding from the year in which they are paid until 2020 i.e., a contribution at the end of 2009 would be compounded at 4% p.a. for 10 years to the end of 2019.

3. We assume a 50%:50% mix between equity and fixed income for both scenarios with fixed income returns assumed to be a constant 4% in all years. Therefore, the aggregate index returns of the underlying asset mix is the same under both scenarios, with the difference only relating to the order of the equity market returns.

4. This is a before tax result.

5. Assuming a fixed asset allocation over the period, the optimal result for this plan to minimize its funding costs over the period would have been achieved by adopting a 100% bond allocation at the outset. We also tested a strategy of allocating 100% to equities. This resulted in an economic result of ($685), made up of modeled contributions of ($713) and an ending surplus of $28M. However, without contributions, assets would have been fully depleted in the first 10 years.

6. This can also be referred to as “path dependency”. This is also true regardless of the total compound rate of return-on-investment market indices.

7. Also, while it is beyond the scope of this paper, what is critical to consider is (i) the relative amount of the projected net outflows relative to the starting asset base, (ii) the strategy to liquidate assets to fund the outflows and (iii) the interaction with the asset rebalancing policy. The good new however is that there are a number of strategies that investors can deploy to better manage sequencing and volatility risk during decumulation. This is a topic we cover in a separate paper.

8. Solving this equation is similar to managing/optimizing the cost of liability defeasance.

9. Also referred to as the “Markowitz model”.

How can RENUAA uniquely help you?

Renuaa´s mission is to help Plan Sponsor´s and Fiduciaries to address the long-term affordability and sustainability of pensions and savings programs. To meet this aim, we believe it is important to achieve an alignment among all stakeholders with a clear specification of the risk management objective. Our strategic advice and services are firmly grounded in the disciplines of corporate finance and financial economics. Importantly, this gives us an ability to distinguish between actuarial funding costs and true economic costs of capital, allowing us to design more efficient liability risk management programs. We have developed a unique solvency solution and set of tools to allow Plan Sponsor´s and fiduciaries of mature pension plans to optimize their approach to managing shortfall risk in the decumulation phase. History has shown us that holistically addressing governance, financial strategy and risk management practices are too important to ignore, as getting it wrong can have a detrimental impact on the long-term cost and viability of the pension program.

FOR INSTITUTIONAL INVESTORS ONLY

Disclaimer

"This article is not intended as investment advice and has been writing without taking into consideration the specific needs, objectives, constraints, or other considerations of any individual investor. Information regarding investment solutions and services are interned for institutional investors only and provided solely to include information about our investment philosophy, our strategies and to be able to contact us for further information. Individual investors are not to act upon information without seeking the service of a professional accountant, attorney and/or financial advisor. Presentation of this information is not intended to create, and receipt does not constitute, a client relationship. Renuaa does not accept any liability for any loss or damage arising out of the use of all or part the information presented including any inadequacy, inaccuracy or omission contained herein. Any U.S. federal (or other) tax information contained in this website is not intended as advice nor to be used for the purpose of avoiding penalties under U.S. federal tax law. The information in this paper is not available to be copied or disclosed, in whole or in part, without the prior written consent of Renuaa.