Commonwealth of Pennsylvania State Employees' Retirement System

Investment Fees Reduction Plan Project

December 2017

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Tab 1: Executive Summary

Acknowledgement to the PA SERS Staff for their Collaboration

The RVK – SERS Consulting Team presents this report with the acknowledgement of the timely cooperation of the SERS senior investment staff. Their provision of historical data on the SERS's funds mandates was critical to our ability to both reconstruct the historical record of asset management fees paid and build the asset management fee projection model used in this analysis.

Readers of this study should note the following:

- Unlike most strategic studies, this analysis has a short-term, three-year projection period per both the SERS Board request and the practical challenge of forecasting shifting allocations under multiple scenarios over longer periods.
- That the assumptions and footnotes in the study frame the interpretation and conclusions drawn from the seven potential asset management cost reduction scenarios.
- That over the three-year forecast period, market action (differential performance of asset classes and the pace at which GP's call capital) could make a material difference in our forecast.
- That this study focuses on asset management fees across the entire portfolio but excludes profit sharing/carried interest on limited partnership investments.
- That our study did not assume a continuation of the negotiated decline in asset management fees in all asset classes (though to varying degrees), despite evidence from SERS' experience and RVK's industry-wide experience that this gradual decline remains the trend. Instead, we assumes the fee levels in place in 2017 and generally available to SERS remain unchanged over the next three years.

Our Task and Our Approach

Our Task

At the September 13, 2017 meeting, the SERS Board requested an analysis that examined possible scenarios that could reduce asset management fees by up to 30%. Following the ratification of the amendment and restated agreement between the Board and RVK on October 24, 2017 to approve the project, RVK immediately coordinated with Staff to collect all data pertinent to the analysis.

Our Approach

We built a customized investment management fee generation model for the SERS Total Fund. The model contains both historical and projected fees for each mandate in every asset class except for private assets (private equity, private debt, and real estate), which – due to the wide variety of fees associated with each of the SERS fund's numerous LP interests – use composite management fees. However, the model does incorporate the respective pacing schedules for the private assets.

We looked back at actual asset management fees paid in years 2014, 2015, and 2016 to evaluate and determine how asset management fees actually paid by SERS had changed over that period. We then estimated 2017 asset management fees with our understanding of current investment mandates in place alongside our knowledge of known structure changes that have taken place thus far in 2017.

We then projected likely asset management fees through a three-year forecast period – 2018, 2019 and 2020 – using seven scenarios intended to achieve various levels of total fee reduction leading up to a 30% reduction. Each scenario forecasting an asset management fee reduction includes detailed assumptions and explanations regarding the reallocation of assets necessary to effect a fee reduction while maximizing risk-adjusted returns.

In estimating the investment consequences of these fee reduction scenarios, we used the RVK 2017 Capital Market Assumptions – identical to those used in the analysis of the options presented in the study leading to the Board's 2018 – 2019 Investment Plan under review. Please note: these assumptions are revised annually with the next revisions scheduled for February 2018.

Defining the Cost Reduction Scenarios

The seven scenarios we examined are:

<u>The Base Case</u>
Likely Path of Asset Management Fees under the 2018-2019 SERS Investment Plan

<u>Scenario A1</u>
10% Reduction from the Base Case via Complete Passive Exposure for All Global Public Equity and REIT Mandates

<u>Scenario A2</u>
10% Reduction from Base Case via Reductions in PE, RE and Multi-Strat Allocations

<u>Scenario B1</u>
20% Reduction from the Base Case via an Immediate Halt to all PE and RE Commitments, Reduced Commitments to Private Credit within Multi-Strat by $100 Million Annually, and Complete Passive Exposure for All Global Public Equity and REITs

<u>Scenario B2</u>
20% Reduction from the Base Case via an Immediate Halt to all PE and RE Commitments, and Complete Passive Exposure for all Global Public Equity, REITs and Public Fixed Income

<u>Scenario C1</u>
30% Reduction from the Base Case via an Immediate Halt to all PE, RE, and Private Credit Commitments, Complete Passive Exposure for all Global Public Equity, REITs and Public Fixed Income, and an estimated $700 million Reduction in the Multi-Strat Allocation to Credit-Focused Strategies in 2020

<u>Scenario C2</u>
30% Reduction from the Base Case via an Immediate Halt to all Private Equity, Real Estate, and Private Credit Commitments, Complete Passive Exposure for all Global Public Equity, REITs and Public Fixed Income, and a pro-rata Secondary Sale of Private Equity and Real Estate LP Interests at an Assumed $0.90 per Dollar (resulting in an estimated $335 million in sales of PE and $183 million in RE)

Reminder: As noted earlier, these scenarios are just examples of paths available to SERS to achieve reductions in asset management fees, and they do not represent RVK recommendations. Instead, we selected these scenarios from possibly dozens of other scenarios to illustrate general themes in cost reduction options.

General Observations

While the exercise with which we are charged is defined by reductions in asset management fees, we acknowledge that the Board, Staff, and RVK's focus remains firmly fixed on *maximizing net of fee expected returns and associated risk* – regardless of the fees required to achieve the highest level possible of returns with the lowest level of associated risk.

While we selected seven scenarios to analyze in depth, there are certainly many others that would result in varying degrees of fee savings with either benign or even beneficial effects on the SERS total fund's long-term expected return and risk. The need to produce this study in just a few weeks required us to limit the scenarios studied to prominent examples able to achieve the targeted level of fee reductions.

With the exception of Scenario A1, the cost reductions scenarios, if pursued, would require the SERS Board to abandon its current and proposed Investment Plan to varying degrees. And even A1 requires a shift in the current strategy away from a deliberate mix of significant passive exposures and selected active ones.

The asset management fee reduction scenarios generally tend to reduce the SERS total fund's expected long-term arithmetic and compound returns by varying degrees and often raise volatility risk. However, in most cases, the scenarios tend to increase fund liquidity, largely due to a reallocation of assets from illiquid investments to public equity and fixed income.

Some – but clearly not all – of the potential consequences of altering the Board's current investment strategy can be observed in the three-year forecast period. But other implications will take a longer period to manifest and some – such as the severing of relationships with General Partners – cannot be easily quantified.

Achieving significant asset management fees reductions in a period as short as three years requires in almost all scenarios greater restructuring of the SERS asset allocation and investment exposures with greater associated consequences for both the fund's expected risk and return than if those changes were made over a considerably longer period of time.

While these scenario's target specific levels of reductions in asset management fees to be achieved in 2020, it is absolutely critical to note that our estimates of the consequences to the total SERS' fund's return and risk in those scenarios which assume an immediate halt to private equity, real estate and private credit assume, post 2020, a return to normalized pacing for Private Equity, Real Estate and Private Credit sufficient to maintain the allocations estimated for 2020. This means that asset management fees will gradually rise after the low point targeted in 2020 if the proposed long-term target remains in place. Conversely, this means that a permanent long-term reduction in asset management fees would require continued reductions to these asset classes post 2020 with increased consequences to the fund's expected returns and overall diversification.

Know Where You Are and Where You Have Come From to Decide Where You Want to Go

The first step toward asset management fee reductions is determining where those fees are generated within the total fund.

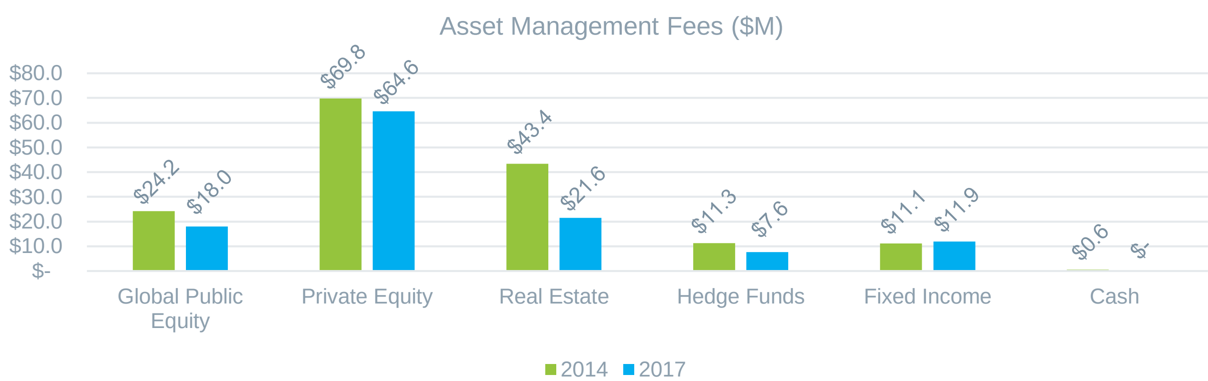
Examining the asset management fees generated by mandates within the SERS total fund over the past four years – 2014, 2015, 2016 and estimated for 2017 – yields four important observations.

1. Known SERS asset management fees paid declined significantly between 2014 and 2016, from $160.32 million (or 58 bps) to $139.87 million (or 52 bps). The basis points metric is the key measure here as it adjusts for increases in Total Fund size. Furthermore, another meaningful decrease in asset management fees paid is estimated for 2017, at $124 million (or 43 bps), due to an increasing move towards passive exposure within public composites.

2. Private equity and real estate asset management fees account for the largest percentage of asset management fees paid by far – more than 71% of fees paid in 2014 and estimated at 70% of fees paid in 2017.

3. By 2017, the estimated fees associated with the 71% of SERS fund allocated to public equity and public fixed income accounted for only 24% of the asset management fees paid.

4. Hedge funds fall into an intermediate category in terms of their effect on total asset management fees paid (and multi-strategy investments slated to be added to the fund generally fall in this category as well).



Tab 2: Asset Management Fee Reduction Scenario Analyses

The Base Case

The Likely Path of Asset Management Fees under the 2018-2019 SERS Investment Plan

The Base Case outlines a steady transition over the next three years from the current portfolio to the fund structure under consideration by the SERS Board in the 2018 – 2019 Investment Plan, subject to the pacing studies for the private capital investments. The most notable features of that Plan are (1) the build out of the Multi-Strategy composite, and (2) an increase in the Real Estate allocation. The Plan maintains the heavy utilization of passive exposure in large cap domestic equity and steady pacing of new commitments to Private Equity.

The expected investment consequences – expected risk, return and liquidity – are thus identical to those reviewed by the Board in the 2018 – 2019 Investment Plan. These expectations form the benchmark against which the other scenarios explored in this analysis can be viewed. These can be seen in the following template.

Similarly, the Base Case sets out our best estimate of the most likely path of asset management fees under the proposed long-term plan. With the substantial asset management fee reductions achieved from 2014 to 2017, we currently estimate 2017 at $124 million or 43 bps (down from $160 million or 58 bps in 2014, which is approximately a 23% decline). Under the Base Case, we expect asset management fees to increase moderately over the next three years to about 49 bps in 2020, still well below total asset management fees paid in 2014, but about 15% higher than those estimated in 2017. The chief drivers of that increase are the shift of assets out of global equity and fixed income into Multi-Strategy investments and to a lesser extent the expansion of the Real Estate exposure.

Base Case –

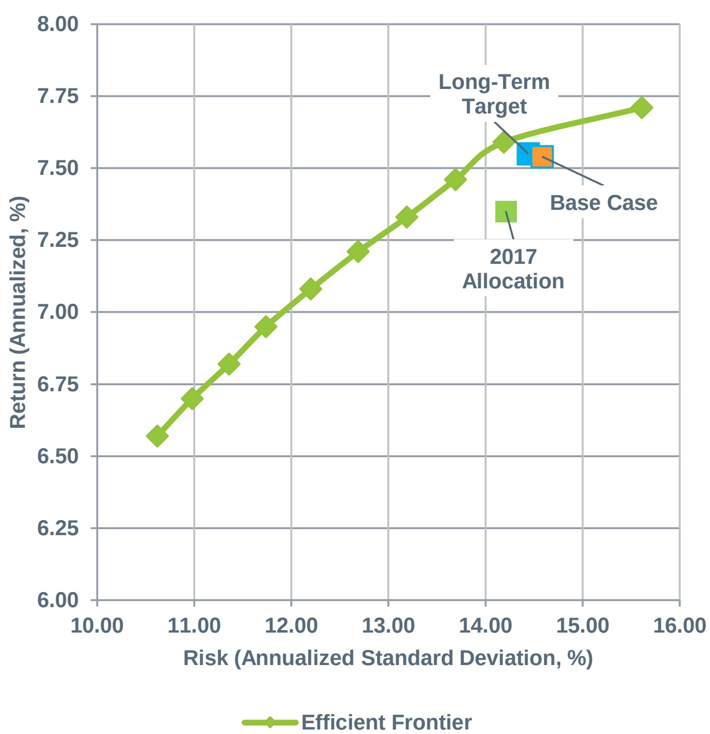
All Initiatives in 2018-2019 Investment Plan Met as Outlined

Estimated Asset Management Fees by Calendar Year (2018-2020)

	2018 $M	2018 %	2019 $M	2019 %	2020 $M	2020 %
Global Public Equity	$ 16.67	0.11%	$ 16.65	0.11%	$ 15.99	0.11%
Private Equity	$ 67.55	1.57%	$ 70.53	1.57%	$ 73.53	1.57%
Real Estate	$ 22.53	0.92%	$ 23.50	0.90%	$ 24.48	0.89%
Multi-Strategy	$ 13.66	0.58%	$ 19.13	0.82%	$ 23.12	0.86%
Fixed Income	$ 6.41	0.16%	$ 5.89	0.16%	$ 5.54	0.16%
Cash	$ -	0.00%	$ -	0.00%	$ -	0.00%
Total Fund	**$ 126.83**	**0.44%**	**$ 135.70**	**0.47%**	**$ 142.65**	**0.49%**

Total estimated investment management fees of $142.65m (49bps) represents the base-case scenario if all initiatives within the 2018-2019 strategic plan are met as outlined.

Resulting 2020 Asset Allocation and Monte Carlo Analysis Results



	2017 Allocation	Long-Term Target	Base Case
Global Public Equity	55%	48%	51%
Private Equity	15%	16%	16%
Real Estate	8%	12%	10%
Multi-Strategy	5%	10%	9%
Fixed Income	16%	11%	12%
Cash	3%	3%	3%
	100%	100%	100%
Expected Return (Arithmetic)	**7.35**	**7.55**	**7.54**
Expected Risk (Std. Dev.)	**14.21**	**14.44**	**14.58**
Expected Return (Compound)	**6.42**	**6.59**	**6.57**
Return/Risk Ratio	0.52	0.52	0.52
RVK Expected Beta	0.74	0.74	0.76
RVK Liquidity Metric	69	62	64
1-Year Downside Event (1st Percentile)	-32.12%	-34.91%	-34.48%
10-Year % Chance of Achieving 7.25%	46%	48%	48%

Observations

The Base Case scenario outlines significant progress made toward the long-term strategic asset allocation set forth within the 2018-2019 Investment Plan, most notably increases in Real Estate and the build-out of Multi-Strategy. It, in itself, represents an estimated increase in investment management fees by year 2020 of approximately 14%-15% compared with fees paid in calendar year 2017 (estimated to be $123.72m, or 43bps of the Total Fund market value). It is worth noting that significant progress has already been made with reducing investment management fees from years 2014-2017 (down from $160.32m, or 58bps of the Total Fund market value in year 2014).

Scenario A1

10% Reduction from the Base Case via Complete Passive Exposure for All Global Public Equity and REIT Mandates

Scenario A1 envisions a complete movement of all global equity exposure and all REIT exposure to passive vehicles. These changes – and all else remaining equal – are likely to reduce asset management fees paid in 2020 by 10% versus the Base Case (45 bps vs 49 bps) with minimal (and we believe statistically inconclusive) increases in expected risk and reductions in expected return, along with a modest increase in total fund liquidity.

The potentially more consequential investment implications of this scenario is that it abandons all possibility of achieving any excess returns in the global equity sub-asset classes where probabilities of achieving it are meaningful – but, of course, not certain. Such asset classes include small cap U.S, international developed equity, emerging market equity, and the proposed emerging investment manager mandate. Similarly, by design, it will set the risk level of the SERS equity exposure at whatever the broader market determines it to be and negate any strategies within the global equity composite to lower its risk below market levels if the Board so chooses.

A1 - 10% Reduction from Base Case

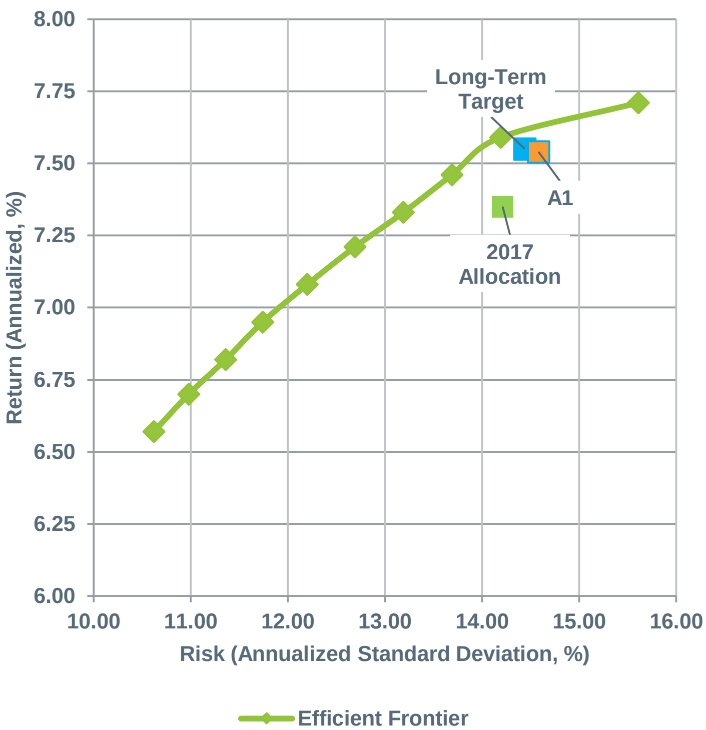
All Active Global Public Equity and REIT Mandates Moved to Passive Mandates

Estimated Asset Management Fees by Calendar Year (2018-2020)

	2018		2019		2020	
	$M	%	$M	%	$M	%
Global Public Equity	$ 2.63	0.02%	$ 2.63	0.02%	$ 2.62	0.02%
Private Equity	$ 67.55	1.57%	$ 70.53	1.57%	$ 73.53	1.57%
Real Estate	$ 21.83	0.90%	$ 22.79	0.88%	$ 23.77	0.86%
Multi-Strategy	$ 13.66	0.58%	$ 19.13	0.82%	$ 23.12	0.86%
Fixed Income	$ 6.41	0.16%	$ 5.89	0.16%	$ 5.54	0.16%
Cash	$ -	0.00%	$ -	0.00%	$ -	0.00%
Total Fund	**$ 112.07**	**0.39%**	**$ 120.98**	**0.42%**	**$ 128.57**	**0.45%**
					-10%	***-10%***

Total estimated investment management fees reduced by 10% relative the base case (savings of approximately $14m or 5bps in year 2020).

Resulting 2020 Asset Allocation and Monte Carlo Analysis Results



	2017 Allocation	Long-Term Target	A1
Global Public Equity	55%	48%	51%
Private Equity	15%	16%	16%
Real Estate	8%	12%	10%
Multi-Strategy	5%	10%	9%
Fixed Income	16%	11%	12%
Cash	3%	3%	3%
	100%	100%	100%
Expected Return (Arithmetic)	**7.35**	**7.55**	**7.54**
Expected Risk (Std. Dev.)	**14.21**	**14.44**	**14.58**
Expected Return (Compound)	**6.42**	**6.59**	**6.57**
Return/Risk Ratio	0.52	0.52	0.52
RVK Expected Beta	0.74	0.74	0.76
RVK Liquidity Metric	69	62	64
1-Year Downside Event (1st Percentile)	-32.12%	-34.91%	-34.48%
10-Year % Chance of Achieving 7.25%	46%	48%	48%

Observations

- By moving all remaining active mandates within the Global Public Equity and REIT composites to passive mandates, an estimated 10% reduction in investment management fees could be reasonably expected relative to the base case by calendar year 2020.
- No effect on excepted return, risk, liquidity or Monte-Carlo stress testing vs. the base case from a modeling perspective as RVK capital market assumptions assume no alpha where possible.
- However, Fund would lose the ability to rely on any alpha from these composites going forward.

Scenario A2

10% Reduction from Base Case via Reductions in Private Equity, Real Estate and Multi-Strategy Allocations

Scenario A2 explores an approach targeting the largest contributors to the SERS total fund fees – the investments in limited partnerships. To effect an overall reduction in asset management fees by 10% relative the Base Case we analyzed a scenario that gradually reduces the overall exposure to Private Equity, Real Estate and Multi-Strategy asset classes. This would require (1) reducing the pacing to Private Equity down from the proposed $650 million per year to $325 million per year, (2) reducing the pacing to Real Estate from the proposed $600 million per year to $300 million per year, (3) reducing the pacing to Private Credit within Multi-Strategy from the proposed $350 million per year to $100 million per year, and finally (4) no new commitments made to Opportunistic Equity and Fixed Income investments within the Multi-Strategy composite beyond currently committed investments.

The scenario demonstrates how halving the pacing to private equity and real estate and keeping, yet dramatically cutting, the allocation to private credit relative to the Base Case yields a fee savings closely approximating the fee savings in the less extreme case presented in Scenario A1 within a three-year period. We can reasonably forecast that the savings would increase over time as the allocation to private investments continues to decline.

A more noticeable difference between the Base Case (and scenario A1) and A2 is the forecasted return. The 7.41% expected arithmetic return for scenario A2 is 13 bps lower than the Base Case return of 7.54% (with corresponding -11 bps difference between the two scenarios) but yields a higher liquidity metric. This decrease in return is due to overall reductions in exposure to Private Equity, Real Estate and Multi-Strategy asset classes, and corresponding increases to overall lower expected returning asset class exposures such as Global Public Equity and Fixed Income.

A2 - 10% Reduction from Base Case

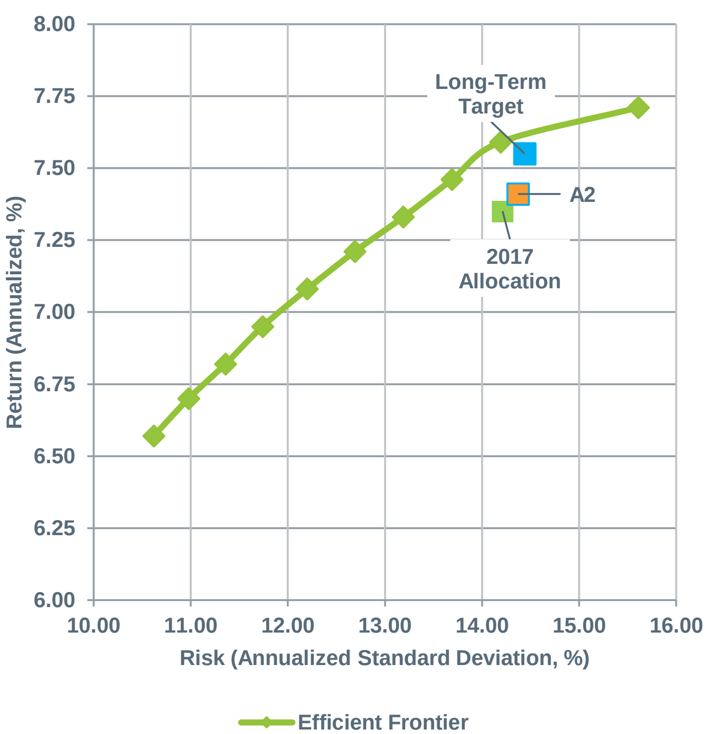
Pacing for PE down 50%, RE down 50%, Private Credit down 70% and No New Commitments to Opportunistic Equity and Fixed income

Estimated Asset Management Fees by Calendar Year (2018-2020)

	2018		2019		2020	
	$M	%	$M	%	$M	%
Global Public Equity	$ 16.92	0.11%	$ 16.95	0.11%	$ 16.67	0.11%
Private Equity	$ 66.25	1.57%	$ 67.93	1.57%	$ 69.62	1.57%
Real Estate	$ 22.11	0.94%	$ 22.66	0.92%	$ 23.20	0.91%
Multi-Strategy	$ 10.27	0.55%	$ 13.72	0.75%	$ 14.54	0.75%
Fixed Income	$ 6.73	0.16%	$ 6.48	0.16%	$ 6.39	0.16%
Cash	$ -	0.00%	$ -	0.00%	$ -	0.00%
Total Fund	**$ 122.28**	**0.43%**	**$ 127.74**	**0.44%**	**$ 130.43**	**0.45%**
					-9%	***-10%***

Total estimated investment management fees reduced by 10% relative the base case (savings of approximately $12m or 5bps in year 2020).

Resulting 2020 Asset Allocation and Monte Carlo Analysis Results



	2017 Allocation	Long-Term Target	A2
Global Public Equity	55%	48%	53%
Private Equity	15%	16%	15%
Real Estate	8%	12%	9%
*Multi-Strategy**	5%	10%	7%
Fixed Income	16%	11%	14%
Cash	3%	3%	3%
	100%	100%	100%
Expected Return (Arithmetic)	**7.35**	**7.55**	**7.41**
Expected Risk (Std. Dev.)	**14.21**	**14.44**	**14.37**
Expected Return (Compound)	**6.42**	**6.59**	**6.46**
Return/Risk Ratio	0.52	0.52	0.52
RVK Expected Beta	0.74	0.74	0.75
RVK Liquidity Metric	69	62	66
1-Year Downside Event (1st Percentile)	-32.12%	-34.91%	-34.14%
10-Year % Chance of Achieving 7.25%	46%	48%	47%

Observations

- In order to gradually move PE, RE and Multi-Strategy allocations down by 2020 to levels which could reasonably be expected to produce meaningful fee reductions, PE and RE pacing would need to be cut in half ($650m/yr to $325m/yr in PE and $600m/yr to $300m/yr in RE), Private Credit pacing down to $100m/yr (from $350m/yr), and no new commitments could be made to Opp. Equity/FI within Multi-Strategy.
- This gradual shift in the Fund's asset allocation by year 2020 would bring PE and RE each down by 1% and Multi-Strategy down by 2% relative the base case, resulting in a reduction in expected compound return of 11bps.

*MS CMA differs due to change in structure.

RVK

Scenario B1

20% Reduction from the Base Case via an Immediate Halt to all PE and RE Commitments, Reduced Commitments to Private Credit within Multi-Strat by $100 Million Annually, and Complete Passive Exposure for All Global Public Equity and REITs

For this scenario, we choose to examine the asset management fee levels and investment consequences associated with the fund changes that form the basis for Scenario A1 combined with a set of additional changes needed to achieve a likely 20% reduction in fees by 2020. Those additional changes (versus the Board's proposed Strategic Plan) are (1) an immediate halt to all new commitments to both Private Equity and Real Estate (the two highest fee-generating asset classes), and (2) an immediate reduction of $100 million annually in the commitment of funding for the Private Credit portion of the Multi-Strategy allocation (current pacing is set at $350 million annually).

This combined set of changes is likely to reduce asset management fees materially versus the Base Case with expected fees in 2020 declining from 49 bps to approximately 40 bps points (or roughly a 20% reduction).

The potential investment consequences of this scenario also increase significantly. In addition to those associated with discussed in Scenario A1 above, the expected behavior of the total fund begins to degrade in most metrics. Expected arithmetic return falls by 9 bps, from 7.54% to 7.45%, while expected compound returns decline 10 bps, from 6.57% to 6.47%. The sensitivity of the fund to the equity markets rises slightly as well, but the fund does become more liquid due to the decline in assets placed in far less liquid LP structures.

Apart from these statistical changes in the expected behavior of the total fund under this scenario, there are other consequences to consider as well. Executing this scenario would create at least a three-year "hole" in the vintage year diversification of both the Private Equity and Real Estate exposures of the SERS total fund with unknown investment consequences over the succeeding 10-year period from 2021 through 2030. The three-year gap would be longer if the Board maintained Scenario B1 beyond 2020.

Conversely, if the Board re-established new Private Equity and Real Estate commitments post 2020, there would be approximately a three- to four-year period of lower returns due to an accentuated J-curve effect. Finally, a consequence that we cannot quantify at all is the extent to which an extended multi-year break in commitment would sever or at least diminish the relationships SERS currently has with top performing General Partners.

B1 - 20% Reduction from Base Case

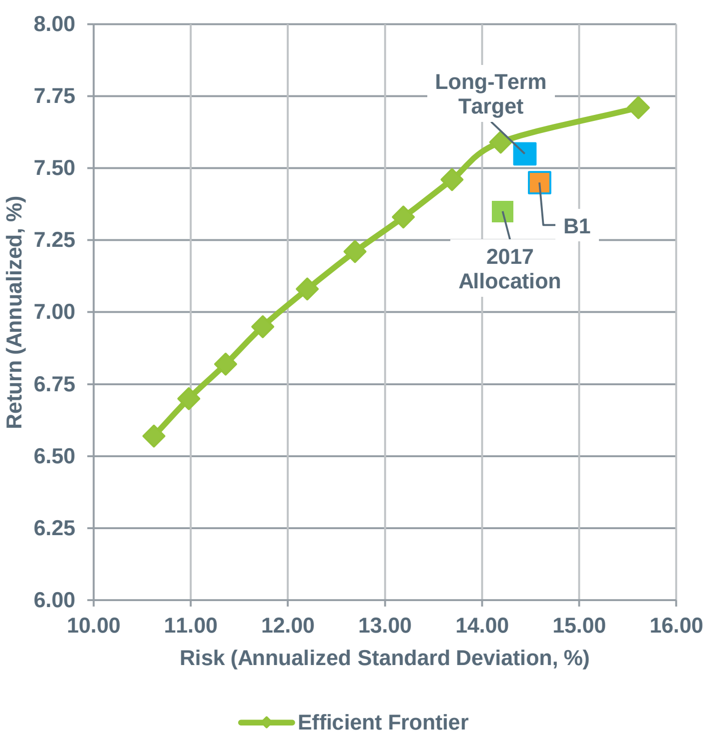
10% Scenario + Halting New Commitments to PE/RE + Reducing MS Pacing by $100m/year

Estimated Asset Management Fees by Calendar Year (2018-2020)

	2018 $M	2018 %	2019 $M	2019 %	2020 $M	2020 %
Global Public Equity	$ 2.66	0.02%	$ 2.68	0.02%	$ 2.69	0.02%
Private Equity	$ 65.00	1.57%	$ 65.41	1.57%	$ 65.83	1.57%
Real Estate	$ 20.98	0.92%	$ 21.10	0.92%	$ 21.22	0.92%
Multi-Strategy	$ 12.03	0.57%	$ 15.89	0.77%	$ 18.60	0.80%
Fixed Income	$ 6.41	0.16%	$ 6.43	0.16%	$ 6.19	0.17%
Cash	$ -	0.00%	$ -	0.00%	$ -	0.00%
Total Fund	**$ 107.09**	**0.37%**	**$ 111.51**	**0.39%**	**$ 114.53**	**0.40%**
					-20%	***-20%***

Total estimated investment management fees reduced by 20% relative the base case (savings of approximately $28m or 9.7bps in year 2020).

Resulting 2020 Asset Allocation and Monte Carlo Analysis Results



	2017 Allocation	Long-Term Target	B1
Global Public Equity	55%	48%	54%
Private Equity	15%	16%	15%
Real Estate	8%	12%	8%
*Multi-Strategy**	5%	10%	8%
Fixed Income	16%	11%	13%
Cash	3%	3%	3%
	100%	100%	100%
Expected Return (Arithmetic)	**7.35**	**7.55**	**7.45**
Expected Risk (Std. Dev.)	**14.21**	**14.44**	**14.59**
Expected Return (Compound)	**6.42**	**6.59**	**6.47**
Return/Risk Ratio	0.52	0.52	0.51
RVK Expected Beta	0.74	0.74	0.76
RVK Liquidity Metric	69	62	67
1-Year Downside Event (1st Percentile)	-32.12%	-34.91%	-33.54%
10-Year % Chance of Achieving 7.25%	46%	48%	47%

Observations

- The halting of all new commitments to PE and RE in addition to reducing Private Credit pacing by $100m/year over this 3-year period prohibits any meaningful progress toward the long-term strategic asset allocation.
- It also leaves the Fund exposed to a lack of vintage year diversification within its private portfolios.
- The expected compound return of the Fund is reduced by 10bps vs. the base case in addition to reducing the probability of achieving and/or exceeding the 7.25% long-term assumed rate of return by 1%.
- Private Credit does, however still show meaningful progress toward its long-term target allocation, though not as quickly as in the base case.

*MS CMA differs due to change in structure.

Scenario B2

20% Reduction from the Base Case via an Immediate Halt to all PE and RE Commitments, and Complete Passive Exposure for all Global Public Equity, REITs and Public Fixed Income

Scenario B2 is constructed to show an alternative path to an anticipated 20% reduction in 2020 asset management fees versus the Base Case. In this scenario, we kept the anticipated annual pacing into the Multi-Strategy composite's private credit portfolio, but we extended the all- passive approach to the entire fixed income exposure in the SERS total fund. This combined set of changes in the Board's proposed Investment Plan results in an expected decline in asset management fees in 2020 from 49 bps in the Base Case to approximately 39 bps, or roughly 20%.

The potential investment consequences, as in Scenario B1, are worth noting. They include a 5 bps decline in expected long-term arithmetic returns and a 6 bps point decline in expected long-term compound returns for the fund versus the Base Case target. Expected risk (fund volatility) does not significantly change. Under Scenario B2, the SERS fund's sensitivity to the U.S. stock market increases slightly (2 bps).

Much like the conclusions drawn in scenario A1, implementing passive strategies in asset classes like small cap U.S. equity, non-U.S. equity, and fixed income eliminates the probability for earning net of fees excess returns (and reducing risk) in markets shown to have a high probability for successfully applying active strategies.

B2 - 20% Reduction from Base Case

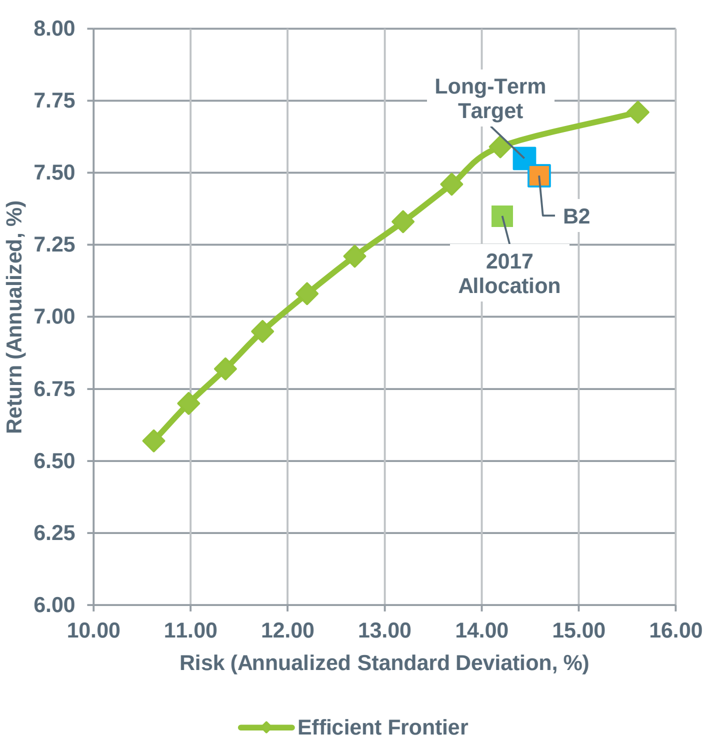
10% Scenario + All Active Fixed Income Moved to Passive + Halting New Commitments to PE/RE

Estimated Asset Management Fees by Calendar Year (2018-2020)

	2018 $M	2018 %	2019 $M	2019 %	2020 $M	2020 %
Global Public Equity	$ 2.65	0.02%	$ 2.66	0.02%	$ 2.68	0.02%
Private Equity	$ 65.00	1.57%	$ 65.41	1.57%	$ 65.83	1.57%
Real Estate	$ 20.98	0.92%	$ 21.10	0.92%	$ 21.22	0.92%
Multi-Strategy	$ 13.66	0.58%	$ 19.13	0.82%	$ 23.12	0.86%
Fixed Income	$ 0.98	0.03%	$ 0.98	0.03%	$ 0.90	0.03%
Cash	$ -	0.00%	$ -	0.00%	$ -	0.00%
Total Fund	**$ 103.27**	**0.36%**	**$ 109.29**	**0.38%**	**$ 113.74**	**0.39%**
					-20%	***-20%***

Total estimated investment management fees reduced by 20% relative the base case (savings of approximately $29m or 10bps in year 2020).

Resulting 2020 Asset Allocation and Monte Carlo Analysis Results



	2017 Allocation	Long-Term Target	B2
Global Public Equity	55%	48%	53%
Private Equity	15%	16%	15%
Real Estate	8%	12%	8%
Multi-Strategy	5%	10%	10%
Fixed Income	16%	11%	13%
Cash	3%	3%	3%
	100%	100%	100%
Expected Return (Arithmetic)	**7.35**	**7.55**	**7.49**
Expected Risk (Std. Dev.)	**14.21**	**14.44**	**14.59**
Expected Return (Compound)	**6.42**	**6.59**	**6.51**
Return/Risk Ratio	0.52	0.52	0.51
RVK Expected Beta	0.74	0.74	0.76
RVK Liquidity Metric	69	62	66
1-Year Downside Event (1st Percentile)	-32.12%	-34.91%	-34.18%
10-Year % Chance of Achieving 7.25%	46%	48%	47%

Observations

- B2 differs from B1 in that, 1) private credit's pacing remains at $350m/year as opposed to being decreased, but 2) all remaining active mandates within the Fixed Income composite are shifted to passive mandates.
- While the capital market assumption for Fixed Income does not change, there is loss of potential for alpha within the composite.
- We would express the risk of moving towards passive fixed income as greater than the risk of passive equity given the current construction of the Barclays U.S. Agg. Bond Index and likely forward-looking environment.
- Expected compound return is decreased by 6bps vs. the base case, resulting in a 1% decreased chance of achieving and/or exceeding the 7.25% long-term assumed rate of return.

RVK

Scenario C1

30% Reduction from the Base Case via an Immediate Halt to all PE, RE, and Private Credit Commitments, Complete Passive Exposure for all Global Public Equity, REITs and Public Fixed Income, and an estimated $700 million Reduction in the Multi-Strat Allocation to Credit-Focused Strategies in 2020

In Scenario C1, asset management fees fall sharply to 35 bps in 2020, roughly 30% lower than the 49 bps in the Base Case, and nearly 19% lower than the recent low point reached in 2017 of 43 bps. As described above, this scenario immediately eliminates commitments to Private Equity and Real Estate, as well as halting any new commitments to Private Credit. Furthermore, in order to achieve the 30% reduction, elimination of a sizeable allocation to the Credit-Focused strategies within Multi-Strat must also be experienced—by selling approximately $700 million and reallocating to low-cost global public equity or global fixed income.

At the same time, the tradeoffs between asset management fee reductions and expected total fund risk, return and other characteristics become more apparent as the fee reductions required in this scenarios rises. In addition to eliminating all prospects of excess return in the fund's equity allocation and fixed income allocation, to achieve this Scenario's required 30% asset management fee reduction, the expected return of the resulting 2020 fund asset allocation falls 21 bps below that of the Board's projected Base Case target, driven in part by the meaningful reallocation of higher expected return Multi-Strategy assets into passive Fixed Income. Expected risk (fund volatility) declines moderately for the same reason.

As with all scenarios that assume a halt to new commitments to Private Equity and Real Estate, it also triggers a consequence that we cannot quantify and that is the extent to which an extended multi-year break in commitment would sever or at least diminish the relationships SERS currently has with top performing General Partners that can assure allocations from the most sought after investors in the years following the freeze on new commitments.

C1 - 30% Reduction from Base Case

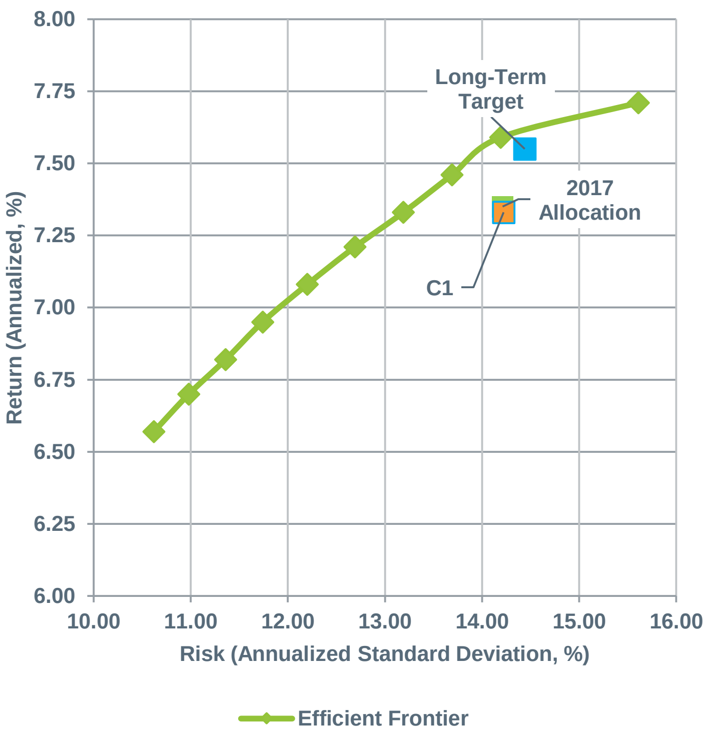
20% Scenario #2 + Halting New Commitments to Private Credit + Reducing Credit-Focused Strategies within Multi-Strategy by $700m

Estimated Asset Management Fees by Calendar Year (2018-2020)

	2018 $M	2018 %	2019 $M	2019 %	2020 $M	2020 %
Global Public Equity	$ 2.66	0.02%	$ 2.68	0.02%	$ 2.75	0.02%
Private Equity	$ 65.00	1.57%	$ 65.41	1.57%	$ 65.83	1.57%
Real Estate	$ 20.98	0.92%	$ 21.10	0.92%	$ 21.22	0.85%
Multi-Strategy	$ 12.77	0.68%	$ 14.12	0.77%	$ 9.63	0.85%
Fixed Income	$ 1.06	0.03%	$ 1.06	0.03%	$ 1.19	0.03%
Cash	$ -	0.00%	$ -	0.00%	$ -	0.00%
Total Fund	**$ 102.46**	**0.36%**	**$ 104.36**	**0.36%**	**$ 100.62**	**0.35%**
					-30%	***-30%***

Total estimated investment management fees reduced by 30% relative the base case (savings of approximately $42m or 15bps in year 2020).

Resulting 2020 Asset Allocation and Monte Carlo Analysis Results



	2017 Allocation	Long-Term Target	C1
Global Public Equity	55%	48%	55%
Private Equity	15%	16%	15%
Real Estate	8%	12%	8%
*Multi-Strategy**	5%	10%	4%
Fixed Income	16%	11%	16%
Cash	3%	3%	3%
	100%	100%	100%
Expected Return (Arithmetic)	**7.35**	**7.55**	**7.33**
Expected Risk (Std. Dev.)	**14.21**	**14.44**	**14.22**
Expected Return (Compound)	**6.42**	**6.59**	**6.40**
Return/Risk Ratio	0.52	0.52	0.52
RVK Expected Beta	0.74	0.74	0.75
RVK Liquidity Metric	69	62	69
1-Year Downside Event (1st Percentile)	-32.12%	-34.91%	-34.83%
10-Year % Chance of Achieving 7.25%	46%	48%	44%

Observations

- By also halting new commitments to Private Credit and materially reducing exposure to Credit-Focused Strategies within Multi-Strategy (BAAM Keystone), a 30% reduction in estimated investment management expenses can be achieved.
- Note that within this scenario, Multi-Strategy's overall allocation would be less than current exposure.
- Assumes that Funds currently earmarked for Multi-Strategy would be allocated to either passive Global Public Equity or passive Fixed Income.
- Relative to the base case, this results in a significant reduction in the expected compound return by 10bps, which translates into a 4% decreased probability of achieving and/or exceeding the 7.25% long-term assumed rate of return.

*MS CMA differs due to change in structure.

RVK

Scenario C2

30% Reduction from the Base Case via an Immediate Halt to all Private Equity, Real Estate, and Private Credit Commitments, Complete Passive Exposure for all Global Public Equity, REITs and Public Fixed Income, and a pro-rata Secondary Sale of Private Equity and Real Estate LP Interests at an Assumed $0.90 per Dollar (resulting in an estimated $335 million in sales of PE and $183 million in RE)

This scenario is essentially C1 and contains all the required restructuring of the portfolio's asset allocation with one key difference to effect a 30% reduction in asset management fees by 2020. Instead of only an immediate freeze on new commitments to Private Equity and Real Estate, we modeled the sale of a substantial segment of the current Private Equity and Real Estate allocations via a secondary offering assumed to yield $0.90 per dollar of current private equity asset value.

The consequences to the SERS total fund's expected long-term results would be roughly the same as Scenario C1 with roughly the same declines in expected arithmetic and compound returns. However, in addition, the fund would also suffer an immediate capital loss associated with the $0.09 per private equity dollar discount associated with the secondary sale envisioned in this scenario.

C2 - 30% Reduction from Base Case

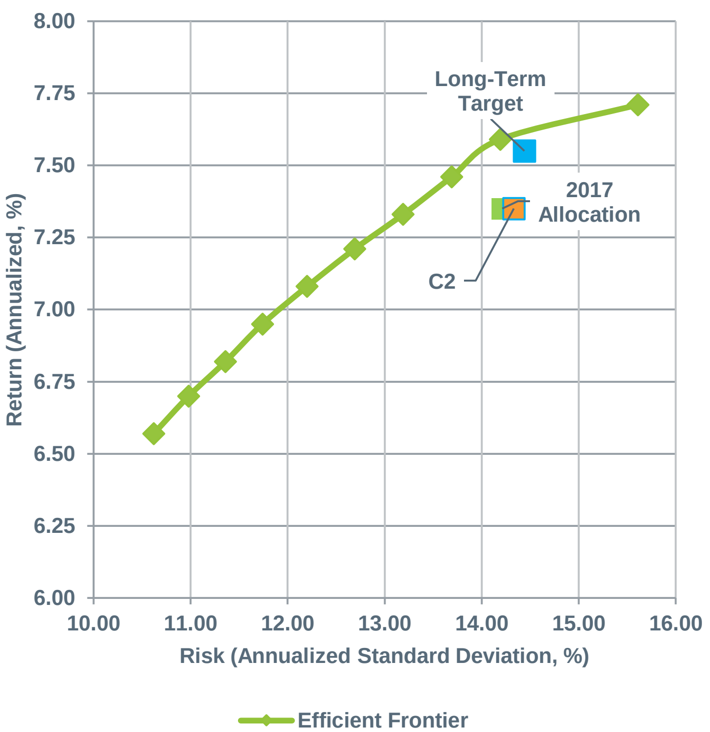
20% Scenario #2 + Halting New Commitments to Private Credit + Selling Pro-Rata across PE/RE & Assuming $0.90/$1 Recovery Rate

Estimated Asset Management Fees by Calendar Year (2018-2020)

	2018 $M	2018 %	2019 $M	2019 %	2020 $M	2020 %
Global Public Equity	$ 2.66	0.02%	$ 2.68	0.02%	$ 2.78	0.02%
Private Equity	$ 65.00	1.57%	$ 65.41	1.57%	$ 60.56	1.57%
Real Estate	$ 20.98	0.92%	$ 21.10	0.92%	$ 19.54	0.92%
Multi-Strategy	$ 11.16	0.52%	$ 16.52	0.78%	$ 16.60	0.78%
Fixed Income	$ 0.98	0.03%	$ 0.98	0.03%	$ 1.03	0.03%
Cash	$ -	0.00%	$ -	0.00%	$ -	0.00%
Total Fund	**$ 100.78**	**0.35%**	**$ 106.69**	**0.37%**	**$ 100.50**	**0.35%**
					-30%	***-30%***

Total estimated investment management fees reduced by 30% relative the base case (savings of approximately $42m or 15bps in year 2020).

Resulting 2020 Asset Allocation and Monte Carlo Analysis Results



	2017 Allocation	Long-Term Target	C2
Global Public Equity	55%	48%	55%
Private Equity	15%	16%	14%
Real Estate	8%	12%	8%
*Multi-Strategy**	5%	10%	8%
Fixed Income	16%	11%	14%
Cash	3%	3%	3%
	100%	100%	100%
Expected Return (Arithmetic)	**7.35**	**7.55**	**7.35**
Expected Risk (Std. Dev.)	**14.21**	**14.44**	**14.33**
Expected Return (Compound)	**6.42**	**6.59**	**6.41**
Return/Risk Ratio	0.52	0.52	0.51
RVK Expected Beta	0.74	0.74	0.76
RVK Liquidity Metric	69	62	68
1-Year Downside Event (1st Percentile)	-32.12%	-34.91%	-35.51%
10-Year % Chance of Achieving 7.25%	46%	48%	44%

Observations

- Represents the most extreme scenario in which a 30% reduction in investment management fees could be achieved—selling current PE and RE investments pro-rata on the secondary market, and assuming a recovery rate of $0.90/$1.00.
- Not necessarily visible from a modeling perspective, this would result in actual loss of capital.
- Relative to the base case, this results in a significant reduction in the expected compound return by 16bps, which translates into a 4% decreased probability of achieving and/or exceeding the 7.25% long-term assumed rate of return.
- Assumes that received capital from sales would be allocated to either passive Global Public Equity or passive Fixed Income.

*MS CMA differs due to change in structure.

Tab 3: Appendix
Key Study Assumptions

Appendix – Key Study Assumptions

1. 2014-2016 asset management fees were provided by SERS Investment Staff and represent best estimations of actual fees at the composite level during each calendar year, excluding any and all carried interest.

2. SERS Investment Staff and RVK confirmed all 2017 investment mandate fees for all public asset classes (Global Public Equity, REITs, Fixed Income and known Multi-Strategy exposures) in order to estimate the 2017 calendar year asset management fees based on known exposures during the four quarters, and also known and anticipated structure changes.

3. 2018-2020 calendar years under each scenario are estimated using the following broad assumptions:

    a. All strategic initiatives outlined within the 2018-2019 Investment Plan are followed under the Base Case, and only differ where noted.

    b. Future calendar year market values and all mean-variance optimization and monte-carlo analysis outputs reflect use of RVK's forward-looking 2017 capital market assumptions by each composite, and sub-composite where possible (shown in following Appendix pages).

    c. Future distributions from private investments were estimated to be the average of the known distributions over the 2014-2016 time periods (approximately $1.5 billion for Private Equity and $589 million for Real Estate)

    d. Future benefit payments estimated to be approximately $125 million per month, net of contributions from employees and employers. 2018-2019 Investment Plan notes an increase from a current level of $100 million to $140 million over the coming 10-years.

    e. All legacy Absolute Return and Direct Hedge Fund distributions are received by end of calendar year 2019.

    f. Where mandate moves from active to passive were estimated, existing mandates and their associated fee schedules were used where possible. REITs assume an estimated fee schedule of 8bps.

    g. Known sub-composite structure targets/exposures (Global Public Equity, Private Equity, Real Estate and Multi-Strategy) are assumed to be phased into over the 3-year projection period for the Base Case, and only differ where noted.

Appendix – RVK 2017 Capital Market Assumptions

Figure 1: 2017 Asset Class Return and Risk Assumptions

Asset Class	Return (Nominal Arithmetic)	Risk (Standard Deviation)
Cash and Inflation		
US Inflation	2.50%	3.00%
Cash Equivalents	2.25%	3.00%
Fixed Income		
Intermediate Duration Fixed Income	3.50%	6.00%
Non-US Dev’d Sovereign FI (UH)	2.25%	10.50%
TIPS	3.75%	6.25%
Low Duration Fixed Income	2.50%	3.50%
Long Duration Fixed Income	4.00%	11.50%
High Yield	6.00%	15.00%
Emerging Markets Debt (Hard)	5.75%	12.50%
Emerging Markets Debt (Local)	6.75%	12.50%
US Equity		
Large/Mid Cap US Equity	7.00%	17.75%
Small Cap US Equity	7.50%	21.25%
Broad US Equity	7.05%	17.80%
International Equity (Non-US)		
Dev'd Large/Mid Cap Int'l Equity	8.25%	19.00%
Dev'd Small Cap Int'l Equity	8.50%	23.00%
Emerging Markets Equity	10.75%	29.00%
Broad International Equity	8.85%	20.65%
Global Equity	7.90%	18.30%
Real Estate		
Core Real Estate	6.25%	12.50%
Global REITs	6.25%	19.00%
Master Limited Partnerships	8.50%	23.00%
Alternative Strategies		
Diversified Hedge Funds	6.25%	9.50%
GTAA	6.25%	10.00%
Private Equity	10.00%	25.50%
Commodities	5.75%	19.75%
Diversified Inflation Strategies	5.25%	11.50%

Appendix – RVK 2017 Capital Market Assumptions

Figure 2: 2017 Correlation Matrix

	US Inflation	Cash Equivalents	Int. Duration Fixed Income	Non-US Dev'd Fixed Income I	TIPS	Low Duration Fixed Income	Long Duration Fixed Income	High Yield Fixed Income	Emerging Markets Debt Hard	Emerging Markets Debt Local	Large/Mid Cap US Equity	Small Cap US Equity	Broad US Equity	Dev'd Large/Mid Int'l Equity	Dev'd Small Int'l Equity	Emerging Markets Equity	Broad International Equity	Global Equity	Core Real Estate	Global REITs	MLPs	Diversified Hedge Funds	GTAA	Private Equity	Commodities	Diversified Inflation Strategies
US Inflation	1.00	0.37	-0.11	0.00	0.08	0.03	-0.18	0.06	0.03	0.09	0.01	-0.01	-0.01	0.05	0.11	0.07	0.07	0.06	0.15	0.04	0.18	0.14	0.10	0.32	0.25	0.17
Cash Equivalents	0.37	1.00	0.25	0.16	0.06	0.48	0.14	0.00	0.04	0.09	0.03	0.01	0.02	-0.03	-0.09	-0.05	-0.05	-0.03	0.01	-0.04	0.04	0.13	-0.01	-0.03	0.09	0.00
Int. Duration Fixed Income	-0.11	0.25	1.00	0.44	0.77	0.89	0.94	0.29	0.41	0.42	0.18	0.07	0.16	0.01	0.06	0.01	0.01	-0.01	-0.08	0.19	0.04	0.06	0.28	-0.28	0.03	0.27
Non-US Devd Fixed Income UH	0.00	0.16	0.44	1.00	0.53	0.44	0.40	0.12	0.22	0.62	0.05	-0.03	0.04	0.31	0.34	0.20	0.31	0.22	-0.10	0.34	0.13	0.00	0.43	-0.14	0.28	0.47
TIPS	0.08	0.06	0.77	0.53	1.00	0.60	0.71	0.29	0.43	0.49	0.01	-0.02	0.02	0.11	0.18	0.17	0.14	0.09	0.08	0.26	0.14	0.10	0.40	0.00	0.27	0.48
Low Duration Fixed Income	0.03	0.48	0.89	0.44	0.60	1.00	0.73	0.19	0.28	0.38	0.13	0.04	0.11	-0.05	-0.03	-0.03	-0.05	-0.07	-0.09	0.07	0.09	0.06	0.16	-0.29	0.08	0.19
Long Duration Fixed Income	-0.18	0.14	0.94	0.40	0.71	0.73	1.00	0.27	0.37	0.34	0.18	0.05	0.14	0.01	0.05	0.02	0.01	-0.01	-0.06	0.18	-0.01	0.03	0.25	-0.27	-0.01	0.23
High Yield Fixed Income	0.06	0.00	0.29	0.12	0.29	0.19	0.27	1.00	0.57	0.65	0.59	0.60	0.61	0.66	0.69	0.65	0.69	0.70	0.09	0.61	0.58	0.48	0.79	0.55	0.36	0.63
Emerging Markets Debt Hard	0.03	0.04	0.41	0.22	0.43	0.28	0.37	0.57	1.00	0.80	0.51	0.44	0.52	0.53	0.59	0.67	0.57	0.57	0.08	0.62	0.33	0.52	0.76	0.43	0.30	0.64
Emerging Markets Debt Local	0.09	0.09	0.42	0.62	0.49	0.38	0.34	0.65	0.80	1.00	0.59	0.51	0.59	0.73	0.69	0.80	0.77	0.72	0.12	0.74	0.43	0.50	0.83	0.50	0.52	0.78
Large/Mid Cap US Equity	0.01	0.03	0.18	0.05	0.01	0.13	0.18	0.59	0.51	0.59	1.00	0.83	0.99	0.83	0.76	0.72	0.82	0.93	0.24	0.69	0.42	0.56	0.82	0.75	0.30	0.59
Small Cap US Equity	-0.01	0.01	0.07	-0.03	-0.02	0.04	0.05	0.60	0.44	0.51	0.83	1.00	0.88	0.73	0.72	0.68	0.75	0.84	0.21	0.64	0.40	0.59	0.74	0.71	0.30	0.56
Broad US Equity	-0.01	0.02	0.16	0.04	0.02	0.11	0.14	0.61	0.52	0.59	0.99	0.88	1.00	0.83	0.77	0.73	0.83	0.94	0.25	0.70	0.43	0.59	0.83	0.76	0.31	0.61
Devd Large/Mid Int'l Equity	0.05	-0.03	0.01	0.31	0.11	-0.05	0.01	0.66	0.53	0.73	0.83	0.73	0.83	1.00	0.92	0.80	0.98	0.96	0.33	0.76	0.43	0.68	0.89	0.75	0.44	0.71
Devd Small Int'l Equity	0.11	-0.09	0.06	0.34	0.18	-0.03	0.05	0.69	0.59	0.69	0.76	0.72	0.77	0.92	1.00	0.83	0.93	0.89	0.34	0.77	0.45	0.73	0.87	0.69	0.51	0.75
Emerging Markets Equity	0.07	-0.05	0.01	0.20	0.17	-0.03	0.02	0.65	0.67	0.80	0.72	0.68	0.73	0.80	0.83	1.00	0.87	0.85	0.22	0.74	0.43	0.70	0.85	0.66	0.46	0.74
Broad International Equity	0.07	-0.05	0.01	0.31	0.14	-0.05	0.01	0.69	0.57	0.77	0.82	0.75	0.83	0.98	0.93	0.87	1.00	0.97	0.31	0.77	0.45	0.71	0.92	0.75	0.49	0.76
Global Equity	0.06	-0.03	-0.01	0.22	0.09	-0.07	-0.01	0.70	0.57	0.72	0.93	0.84	0.94	0.96	0.89	0.85	0.97	1.00	0.33	0.77	0.46	0.72	0.91	0.79	0.43	0.71
Core Real Estate	0.15	0.01	-0.08	-0.10	0.08	-0.09	-0.06	0.09	0.08	0.12	0.24	0.21	0.25	0.33	0.34	0.22	0.31	0.33	1.00	0.29	0.20	0.30	0.33	0.57	0.22	0.32
Global REITs	0.04	-0.04	0.19	0.34	0.26	0.07	0.18	0.61	0.62	0.74	0.69	0.64	0.70	0.76	0.77	0.74	0.77	0.77	0.29	1.00	0.39	0.50	0.79	0.61	0.35	0.84
MLPs	0.18	0.04	0.04	0.13	0.14	0.09	-0.01	0.58	0.33	0.43	0.42	0.40	0.43	0.43	0.45	0.43	0.45	0.46	0.20	0.39	1.00	0.40	0.52	0.49	0.40	0.47
Diversified Hedge Funds	0.14	0.13	0.06	0.00	0.10	0.06	0.03	0.48	0.52	0.50	0.56	0.59	0.59	0.68	0.73	0.70	0.71	0.72	0.30	0.50	0.40	1.00	0.70	0.79	0.38	0.54
GTAA	0.10	-0.01	0.28	0.43	0.40	0.16	0.25	0.79	0.76	0.83	0.82	0.74	0.83	0.89	0.87	0.85	0.92	0.91	0.33	0.79	0.52	0.70	1.00	0.74	0.63	0.88
Private Equity	0.32	-0.03	-0.28	-0.14	0.00	-0.29	-0.27	0.55	0.43	0.50	0.75	0.71	0.76	0.75	0.69	0.66	0.75	0.79	0.57	0.61	0.49	0.79	0.74	1.00	0.50	0.64
Commodities	0.25	0.09	0.03	0.28	0.27	0.08	-0.01	0.36	0.30	0.52	0.30	0.30	0.31	0.44	0.51	0.46	0.49	0.43	0.22	0.35	0.40	0.38	0.63	0.50	1.00	0.78
Diversified Inflation Strategies	0.17	0.00	0.27	0.47	0.48	0.19	0.23	0.63	0.64	0.78	0.59	0.56	0.61	0.71	0.75	0.74	0.76	0.71	0.32	0.84	0.47	0.54	0.88	0.64	0.78	1.00