MPI'S INVESTMENT PORTFOLIO:
ASSET/LIABILITY ANALYSIS
AND PREVIOUS RECOMMENDATIONS
(TWO REVISIONS [1] [2])

MANITOBA PUBLIC INSURANCE 2019/20 GRA

MANITOBA BRANCH OF THE CONSUMERS' ASSOCIATION OF CANADA
(CAC MANITOBA)

SUBMITTED BY THE PUBLIC INTEREST LAW CENTRE

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Contents

[1] **First Revision:** "Mercer's Observations" in Step 1 of Table 3 were duplicated, in error, in Step 2 of the table. This has been corrected to show Mercer's observations related to Step 2. (The related figures for Step 2 were correctly reported, only the description was incorrect.)

[2] **Second Revision:** By removing RRBs from an "optimized" portfolio at **current** risk levels, returns are expected to be **~ 0.2%** lower in the Pension Portfolio, **not ~ 1.8%** as reported. (1.8% represents the difference in return between the optimized portfolio (**including RRBs**) and **current** portfolio (rather than optimized portfolio **excluding RRBs**).) The graph illustrating this effect, which appeared twice, has also been updated.

INTRODUCTION

TERMS OF REFERENCE AND DUTIES

I was retained by the Manitoba Branch of the Consumers' Association of Canada ("CAC Manitoba" or the "CAC") to advise and assist on issues related to MPI's portfolio. As stated in my terms of retainer, it is my duty to provide evidence that:

- is fair, objective and non-partisan;
- is related only to matters that are within my area of expertise; and
- provides such additional assistance as the Public Utilities Board ("PUB") may reasonably require to determine an issue.

My duties include: preparation and attendance, via telephone, of the Asset Liability Management Study Technical Conference in March 2018; conducting a detailed review of the 2019-20 General Rate Application ("GRA"); preparing first round information requests ("IRs"); reviewing responses to first round IRs and preparing second round IRs; reviewing second round IR responses; preparing written evidence; and preparing for and attending the hearing.

I understand that my duty in providing assistance and giving evidence is to help the PUB, and this duty overrides any obligation to the CAC.

RATE APPLICATION MATERIALS REVIEWED

My review of the GRA focused on the investment portfolio, in particular:

- MPI's Investment Policies;
- the Asset/Liability Study conducted by Mercer (the "Mercer Study" or "Study"), and MPI's recommended changes to the portfolio that were based on the Study; and
- MPI Exhibit 12 (attached), filed by MPI on September 25, 2018 under PUB Order 124-18.

OTHER CONSIDERATIONS

I reviewed and considered the **information responses** prepared by MPI and/or Mercer to questions relating to the portfolio, as well as two documents that are included as attachments:

- a paper called ***MPI's Investment Portfolio: Risk, Return and Good Practice***, which I authored and filed as evidence two years ago; and
- a presentation called ***Testimony***, which I made in oral testimony during the GRA Process two years ago.

AUTHOR BACKGROUND

RELEVANT EXPERIENCE

With 25 years of experience in the institutional fund management sector, I have 12 years of combined executive, senior management, and other professional investment experience at two of Canada's largest institutional investors:

- CPP Investment Board (2000 to 2005; $367 billion today); and
- Ontario Teachers' Pension Plan (1993 to 2000; $176 billion today).

I also have more than a decade of consulting experience as an advisor to some of North America's largest institutional investors on various aspects of investment/risk management, risk measurement, and governance. Clients have included, for example, Canadian pension funds with assets under management that are about the same as those managed by MPI.

My specific expertise includes:

- investment research, economics, and risk management;
- portfolio management; and
- quantitative asset/liability modelling.

My curriculum vitae is in **Appendix 1**, and my relevant experience is described in **Appendix 2**.

P&C EXPERIENCE

As noted in the evidence that I presented two years ago, I did not have any prior work experience with property and casualty ("P&C") insurers prior to being engaged by the CAC in 2016.

ORGANIZATION OF THIS DOCUMENT

This paper consists of two parts. **Part I** contains the support for my **current recommendations** based on my review of **this year's GRA**, while **Part II** looks at any recommendations from my review of the **GRA two years ago** that have not been addressed fully by MPI.

These recommendations are grouped into the four (4) categories below.

Framework
Portfolio
Metrics
Oversight

Before looking at the recommendations, I provide some **background** information related to them. This includes re-stating two **investment beliefs** that are described more fully in Attachment A (GRA evidence from two years ago) and providing an **overview** related to **interest rate risk**, covering such topics as term risk ("duration"), and risks related to inflation, credit, and liquidity.

Attachments provide more detailed information, including the paper that I authored and filed as evidence two years ago, and the related presentation which I made in oral testimony. **MPI Exhibit 12**, which was filed by PUB Order 124-18, is also attached. This exhibit supports many of my recommendations, and the reader should consider reading MPI Exhibit 12 first. The exhibit was filed by MPI on September 25, 2018, and was not included in the GRA.

Appendices include the preambles, written by me, and other information related to two questions[3] that prompted Mercer's analysis in MPI Exhibit 12. An appendix on "leverage" provides some context for this concept, and its inclusion in the appendix (rather than the main document) is to not detract from the paper's main points.

[3] The two questions are CAC (MPI) 84 (f) and CAC (MPI) 85 (g).

BACKGROUND TO RECOMMENDATIONS

2017/18 GRA

18 recommendations

Two years ago, I provided evidence and testimony which included 18 recommendations[4] related to MPI's investment practices.

PUB Order 124-18

The PUB ordered[5] MPI to consider these 18 recommendations, including an order to conduct a new Asset/Liability Study.

2018/19 GRA

Delay in A/L Study

Mercer was engaged to complete the Study, and Mercer's findings were included in this year's GRA (but not available for inclusion in last year's GRA).

2019/20 GRA

3 concerns:

1. *inflation risk;*
2. *real interest rate risk; and*
3. *constraints*

In the first round of this year's IRs, MPI refused to answer two questions posed by the CAC related to some analysis in the Mercer Study.[6] Both questions were motivated by my concern about the long-term risks of inflation and changing **real** interest rates, as well as the cost of imposing certain constraints (i.e., min/max limits for certain asset classes).

PUB Order 124-18 compelled MPI to answer these questions, and the answers appear in MPI Exhibit 12. The questions requested more detailed analysis about the impact on return/risk of adding RRBs to the portfolios if a **"Real"** Liability Benchmark were used in the analysis, rather than the **Nominal** Liability Benchmark that MPI relied upon to support its recent asset allocation recommendations.

The information request included a "stepped" or incremental analysis to illustrate the impacts on efficient frontiers of adding or removing different asset classes to both the Basic and Pension Portfolios using the **"Real"** Liability Benchmark, similar to the analysis that was done using the **Nominal** Liability Benchmark and described in the GRA.

Today's evidence

That brings us to today.

[4] Attachments include my evidence and testimony from two years ago.
[5] See PUB ORDER 124-18.
[6] See CAC (MPI) 84 (f) and 85 (g).

EXECUTIVE SUMMARY OF RECOMMENDATIONS

Framework	**1. Real Liability Benchmark** Re-examine the reliance on a **Nominal** Liability Benchmark, rather than a **Real** Liability Benchmark, given the understatement of the long-term risk of inflation and changing real interest rates that are inherent in the Basic and Pension Liabilities. **2. Leverage Constraint** Re-examine the constraint prohibiting the use of "leverage", given the lower risk-adjusted returns that would result.
Portfolio	**3. Duration Policy "Basis" Risk** Re-examine the effectiveness of the **duration policy**, which uses (nominal) bonds as the basis for matching the inflation and real interest rate sensitivity of Basic and Pension Liabilities, since inflation **volatility** is not zero. **4. Lengthening Nominal Duration** Re-examine the decision to **lengthen** the **nominal** duration in the Basic Portfolio, given: MPI's "defensive" (lower risk) strategy; Mercer's return assumptions for bonds and RRBs; and concerns about the effectiveness of the duration policy noted above ("basis" risk). **5. Real Return Bonds** Re-examine the decision to exclude **RRBs** from both the Basic and Pension portfolios, given the better hedging characteristics of RRBs (compared to bonds), recognizing the long-term inflation and real interest rate risks inherent in the liabilities. **6. Other Real Assets** Re-examine MPI's recommended reduction in **other real assets** (real estate and infrastructure), given the low inflation protection that exists in the current portfolio and lower diversification that would result. **7. Fixed Income Risk Concentration** Re-examine the decision to concentrate risk in fixed income, rather than better diversify the sources of risk across the whole portfolio, and avoid "crowding out" risk-reducing RRBs.
Metrics	See Duration Policy "Basis" Risk
Oversight	**8. Quantitative Models** Continue to be vigilant about placing too much reliance on quantitative considerations, particularly if risk tolerances are low, given the high sensitivity of optimal asset allocations to capital market assumptions and the large number of inputs involved.

PART I. SUPPORT FOR RECOMMENDATIONS

INVESTMENT BELIEFS

My recommendations take into consideration the **five (5) investment beliefs** that are described in the evidence that I provided two years ago (Attachment A). Two of these beliefs are particularly relevant this year, and are described below.

By definition, investment beliefs have varying degrees of empirical support and theoretical justification. They are important because there is little that can be proven conclusively in the field of investments, which means we need beliefs to answer difficult questions about risk, for example, to better inform our investment strategies.

The first belief relates to the **Minimum Risk Portfolio** (called the "Liability Benchmark Portfolio" in this year's GRA and Mercer Study), and the second belief relates to **constraints**. The significance of these beliefs is summarized below.

Belief:	**MINIMUM RISK PORTFOLIO**	**CONSTRAINTS**
	*Determining the **Minimum Risk Portfolio** is the first step towards responsible long-term management of the portfolio.*	***Constraints** never increase expected risk-adjusted returns.*
Significance: (stated two years ago)	… MPI's minimum risk portfolio (MRP) should include … some … real return bonds (RRBs), given the nature of MPI's liabilities (long term, with some inflation exposure). … Belief #2 simply supports the **definition** of the primary risk, but says nothing about whether to buy any assets that make up the MRP (e.g., RRBs). The belief says nothing about how much risk should be taken in relation to it. Appropriate and prudent answers to these … questions requires additional beliefs ...	… there appear to be two very binding constraints that may cause MPI to have lower risk-adjusted returns. These … constraints relate to: 1. HOW RISK IS DEFINED …; and 2. HOW ASSET CLASSES ARE CONSTRAINED Minimum/maximum asset allocations in optimizations conducted as part of the most recent Asset-Liability Study[7] … are overly restrictive ...
(this year)	• **Real Liability Benchmark** (Recommendation #1) • **Duration Policy "Basis" Risk** (#3) • **Lengthening Nominal Duration** (#4) • **Real Return Bonds** (#5)	• **Leverage Constraint** (Recommendation #2)

[7] This reference was to the AON Study (not MERCER Study).

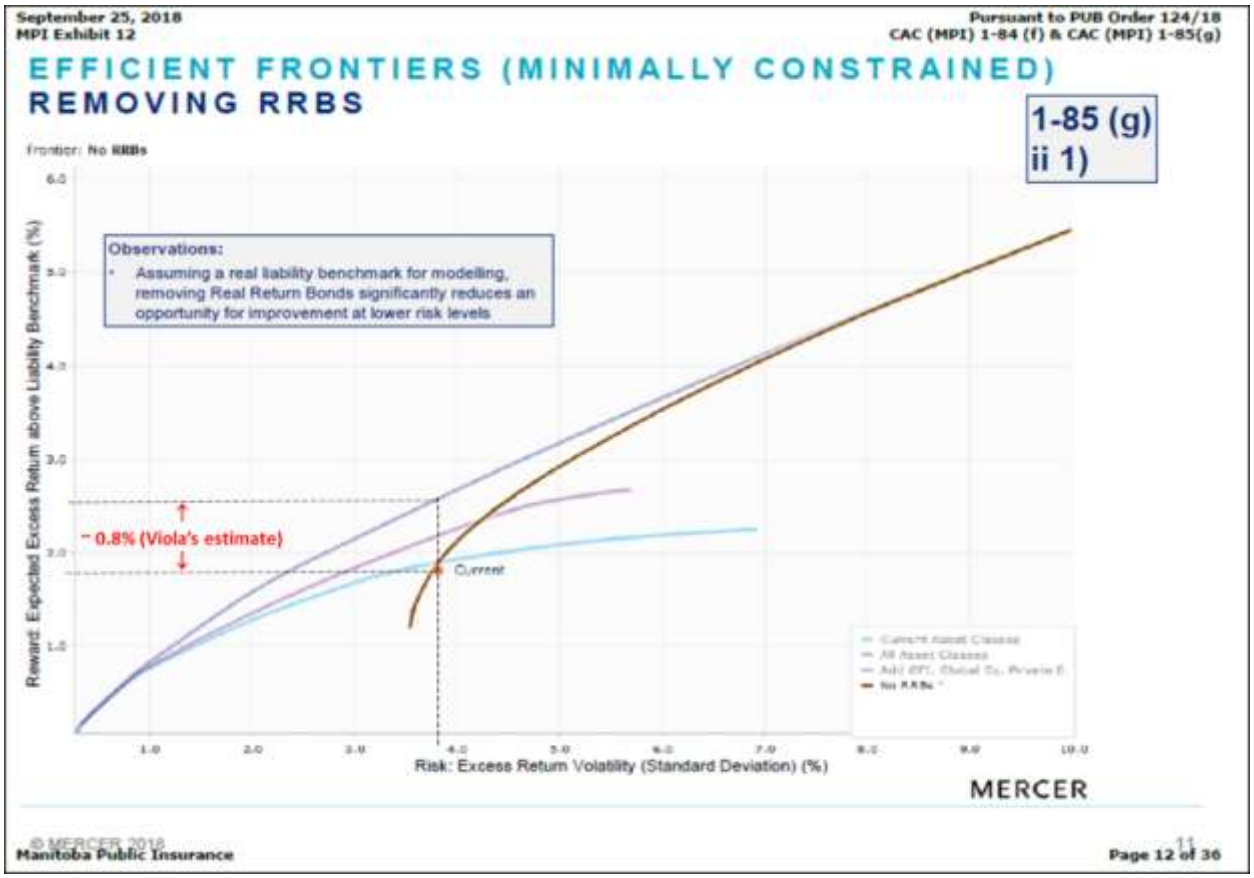
THE "REAL" STORY IN MPI EXHIBIT 12

At this stage, the reader should consider reading MPI Exhibit 12 (Attachment C), which shows the "real" analysis that is fundamental to my recommendations. In it, Mercer concludes (for example) that:

> *"Assuming a real liability benchmark for modelling, removing Real Return Bonds significantly reduces an opportunity for improvement at lower risk levels."*[8]

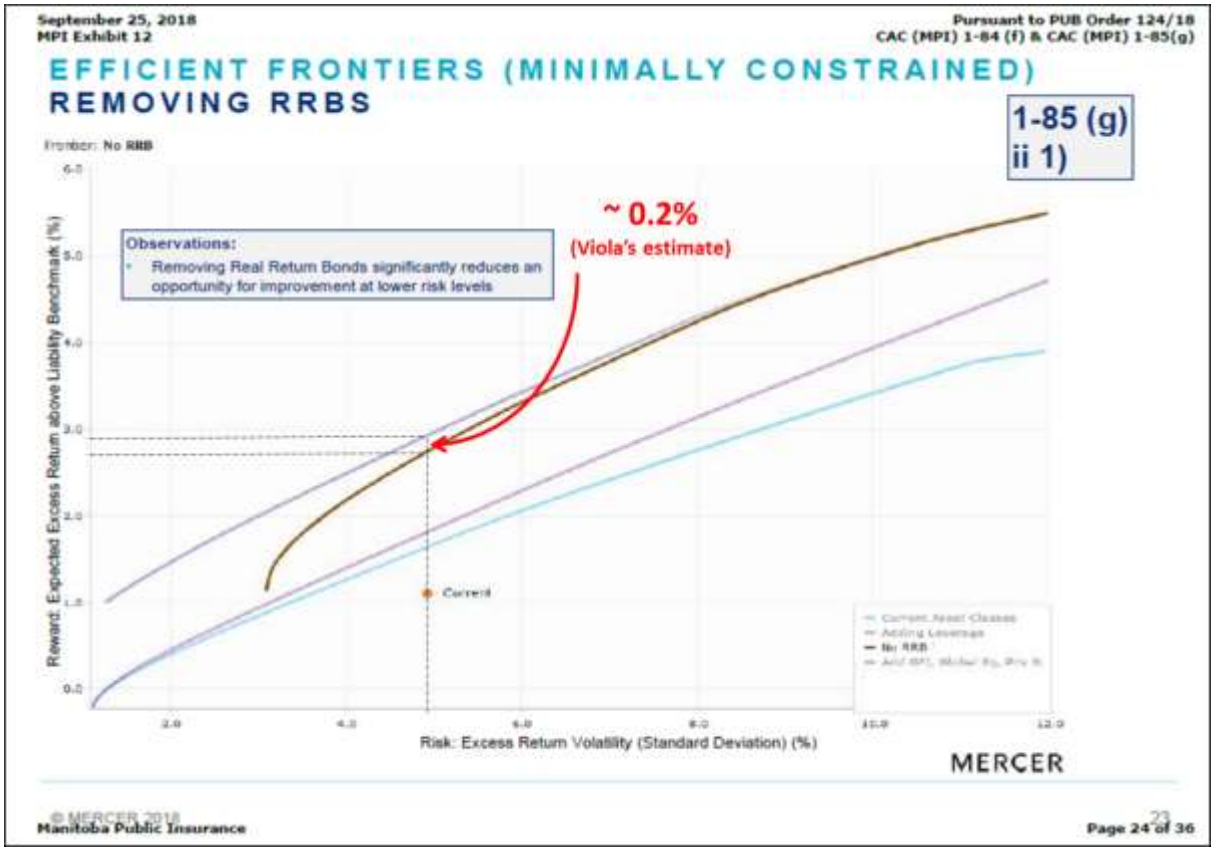
Mercer's finding is illustrated below for the **Basic** Portfolio, and on the next page for the **Pension** Portfolio.

Basic Portfolio



[8] MPI Exhibit 12, page 12 of 36

Pension Portfolio



REAL AND NOMINAL LIABILITY BENCHMARKS

The Mercer Study presented two possible liability benchmark portfolios for both Basic and Pensions. These four (4) liability benchmark portfolios are summarized below, and are clearly very different.

Table 1. Liability Benchmark Portfolios (Basic and Pension)

	Basic			Pension		
	Nominal	**Real**	Diff	Nominal	**Real**	Diff
Treasury Bills		**26**	26	-17	**-11**	6
Short-Term Provincial Bonds	28	**8**	-20			-
Mid-Term Provincial Bonds	18		-18			-
Long-Term Provincial Bonds	54		-54		**30**	30
Long-Term Corporate Bonds			-	117		-117
Real Return Bonds		**66**	66		**81**	81
	100	**100**	-	100	**100**	-

In the case of Basic, for example, the **Nominal** Liability Benchmark includes a 54% allocation to long-term provincial bonds while the **Real** Liability Benchmark has 66% in RRBs. The differences in the case of pensions is even larger. This is significant because it is my understanding that MPI informed its asset allocation recommendations using the **Nominal** Liability Benchmark, which has a 0% allocation to RRBs.

GENERAL OVERVIEW

THREE (3) OLD SYMPTOMS

In my review of the MPI portfolio two years ago, I identified a few problems and three (3) main "symptoms" that arose from those problems. Those symptoms, and their consequences, were:

1. a **Canadian Equity** portfolio that was concentrated;
    - larger-than average home bias; and
    - concentrated sectors/stocks;
2. no **International Equities** (i.e., outside North America); and
3. no **Real Return Bonds ("RRBs") in the portfolio**;
    - poor liability protection against unexpected inflation and real rate risk; and
    - less effective duration management.

While MPI's recent recommended changes in the portfolio have addressed the first two symptoms (equities), the third symptom (no RRBs) remains.

THREE (3) NEW SYMPTOMS

I would suggest that three (3) new symptoms have emerged, and they are:

4. no **RRBs in the Liability Benchmark Portfolio** that was used to inform MPI's asset allocations;
    - this understates the risk of unexpected inflation and **real** interest rate risk;
    - this also makes duration management less effective;
5. reduced allocations to other "real" assets (**real estate and infrastructure**);
    - this reduces any inflation protection that currently exists in the portfolio;
    - this also reduces diversification; and
6. more concentrated risk within the **bond** portfolio as a result (inflation, credit, and liquidity risk)[9].

In the next section, I review the third and fourth symptoms more closely, focused on the long-term risks of inflation and changing **real** interest rates that impact both sides of the balance sheet (assets and liabilities).

[9] This is a minor consideration, and is included only because of an ongoing concern regarding the impact of accounting (e.g., future IFRS changes) on portfolio decisions.

THE "REAL" STORY (MPI EXHIBIT 12)

As noted in my evidence two years ago, RRBs could play a significant role in hedging the long-term risks of inflation and changes in **real** interest rates that are inherent in MPI's liabilities. To see this, it is important to **examine MPI Exhibit 12 (Attachment C), which contains the "real" story**. By this I mean that the exhibit describes the efficient frontiers in a way that better reflects the "real" interest rate and inflationary risks inherent in MPI's liabilities. MPI's recommended changes in the portfolio that are described in the GRA relied on a Liability Benchmark Portfolio that is defined in **nominal**, rather than **real**, terms and I believe there is a material risk and cost in doing so. MPI Exhibit 12 explains why.

The main theme of the "real" story is that Mercer's model "loves" RRBs across the risk spectrum. According to Mercer:

> *"Assuming a real liability benchmark for modelling, removing Real Return Bonds significantly reduces an opportunity for improvement at lower risk levels."* [10]

The model loves RRBs so much that it would borrow to buy more RRBs (i.e., "leverage"), if permitted to do so. This is illustrated where Mercer shows the return/risk tradeoffs of having a 15% allocation to an asset class called "3X Real Return Bonds", as noted below. This is equivalent to having a 45% "gross" exposure to RRBs, given the 3:1 leverage ratio.

> *"Adding leverage (3X Real Return Bonds) provides an opportunity for improvement across risk spectrum."* [11] [12]

By excluding RRBs, return/risk tradeoffs are significantly reduced, particularly at the lower levels of risk that MPI finds acceptable in the **Basic** Portfolio.

The model's "love" for RRBs is even stronger in the **Pension** Portfolio.

Mercer's analysis shows that **by removing RRBs from an "optimized" portfolio at current risk levels, returns are expected to be ~ 0.8% lower in the Basic Portfolio and ~ 0.2% lower in the Pension Portfolio**.

[10] MPI Exhibit 12, page 12 (Basic) and 24 (Basic) of 36
[11] MPI Exhibit 12, page 11 of 36
[12] Mercer modelled "leverage" by defining an asset called "3X Real Return Bonds". This asset consists of "300% Real Return Bonds less 200% Treasury Bills and a 0.7% leverage cost". Mercer also defined an asset called "3X Long Provincial Bonds".

"LEVERAGE"

Mercer illustrates how returns would be 0.3% higher[13] in the **Basic** Portfolio at current risk levels if MPI were to remove the restriction related to leverage. "Leverage" involves financing the acquisition of an asset (e.g., RRB or bond) by directly or indirectly borrowing (e.g., "shorting" T Bills).

MPI's policy to prohibit leverage is not a *major* concern of mine. Many funds impose such a constraint because of a **perceived** risk related to leverage. While some risks are real, others are not and/or are manageable. Like many constraints that are self-imposed by investors, a constraint that prohibits the use of some types of leverage has a material cost, and MPI Exhibit 12 measures how big this cost is (~ 0.3% lower return, in the case of the **Basic** Portfolio).

Appendix 5 describes how "leverage" can be viewed differently, and when viewed that other way it can be seen as a "positive" (not negative) tool. For example, while leverage has the effect of increasing the duration of the "net" RRB portfolio to ~ 45 (from 15, given the 3:1 ratio), an optimist might describe the effect as "de-leveraging" the liabilities from ~ 10.3 to ~ 8.0 in the case of the Basic line of business. (This calculation is in the appendix.)

Simply put, "leverage" is not a four-letter word, and MPI should consider the return/risk implications of imposing a constraint related to its use, given the cost of doing so.

BOTTOM LINE: THREE (3) QUESTIONS

I believe that MPI should give more weight to the "real" analysis in MPI Exhibit 12, instead of relying on a "Liability Benchmark Portfolio" that is defined in **nominal** terms. Unless inflation has zero **volatility**, it is important to distinguish between nominal interest rate risk, and the real and inflation components that make it up. Changes in these two components can have different impacts on the returns for (nominal) bonds and RRBs, given the long time horizon that we should be concerned about.

From my perspective, the key issue boils down to questions about risk **oversight**, risk **measurement**, and risk **management**, which are listed below.

1. Have the real and inflation risks been **identified** clearly
   by those who are responsible for their management and oversight?
2. Have these risks been **measured** as accurately as possible?
3. Are these risks being **managed** effectively?

[13] Returns would increase from 4.6% to 4.9% at current risk levels (3.8% surplus volatility).

INTEREST RATE RISK OVERVIEW

As noted in a 2016 paper produced and approved by the Insurance Regulation Committee of the International Actuarial Association ("IAA"):

> *"It is important to understand the multiple dimensions of the interest rate risk exposure."*[14]

TERM RISK ("DURATION")

The first dimension of interest rate risk relates to time horizon, and a common risk metric for measuring the risk of changing interest rates is "duration". Simply put, duration measures the sensitivity of a bond or liabilities, as the case may be, to changes in interest rates. Other things equal, bonds or liabilities with longer terms to maturity are more sensitive to changing interest rates. They have longer/higher durations.

For example, a bond that has a duration of 10 will rise (fall) by ~ 10% if interest rates ("yields") decrease (increase) by 1%. This inverse relationship between changing yields (Δ yield) and the resulting percentage (%) change in the value of an asset (A), such as a bond, or liability (L) is approximately equal to the product of the change in yield and duration.

$$\% \Delta \text{ in A or L} \sim - \Delta \text{ Yield} \times \text{Duration} \quad \text{(1): Duration Equation}$$

This yield/price relationship is not "linear", so this Duration Equation is accurate only for small changes in interest rates. For larger changes, "convexity" needs to be taken into account. Convexity measures the rate of change in duration, and takes into account the "curvature" or convexity effect that is bigger for larger changes in interest rates.[15]

[14] Page 13-1, Asset Liability Management Techniques and Practices for Insurance Companies (IAA Risk Book, Chapter 13)

[15] Interest rates don't simply shift up or down vertically. They may involve "twists" in the yield curve. A more accurate interest rate formula would add a second term to the Duration Equation above, shown in **red** below.

$$\% \Delta \text{ in A or L} \sim (- \Delta \text{ Yield} \times \text{Duration}) + \mathbf{\tfrac{1}{2}(\Delta \text{ Yield})^2 \times \text{Convexity}}$$

INFLATION RISK

Until now, we have not distinguished between "nominal" and "real" interest rates, but it is important to do so. The Fisher Equation, below, shows the relationship between a **nominal** interest rate or yield (n) and its two components, which are the **real** interest rate (r) and **inflation** (π).

$$n \sim r + \pi \quad \text{(2): Fisher Equation}$$

Simply put, the Fisher Equation says that the expected nominal rate (n) depends on inflation expectations (π) and the expected real rate (r). In other words, inflation protection is needed to maintain real purchasing power.

While the Fisher Equation describes expectations (i.e., average/mean) about the **level** of inflation (π), the volatility equation below shows how inflation **volatility** (σ_π) and its **correlation** ($\rho_{r,\pi}$) with real interest rates are factored into the risk discussion.

$$\sigma_n = \sqrt{(\sigma_r^2 + \sigma_\pi^2 + 2\rho_{r,\pi}\sigma_r\sigma_\pi)} \quad \text{(3): Interest Rate Volatility Equation}$$

The Volatility Equation says that the volatility of **nominal** interest rates depends on three factors:

- volatility of **real** interest rates (σ_r);
- volatility of inflation (σ_π); and
- correlation between **real** interest rates and inflation ($\rho_{r,\pi}$).

Only when inflation **volatility** is zero ($\sigma_\pi = 0$) can we safely ignore the distinction between nominal and real interest rates when hedging risk. That is when real interest rate risk and nominal interest rate risk are the same ($\sigma_n = \sigma_r$).

The correlation assumptions used by Mercer in the Study show how inflation volatility (σ_π) and "less than perfect correlations" (ρ) can impact the return distributions of RRBs and bonds. The table on the next page shows the correlation assumptions that were used in the Mercer Study.

Mercer's correlation matrix, below, shows how closely the returns on various asset classes are related. Along the shaded diagonal, for example, the correlation is +1.00 ("perfectly positive") because an asset class is perfectly correlated with itself.

The triangle above the shaded diagonal is a mirror image of the triangle below the diagonal because the "order" of the correlations between two asset classes doesn't matter. In other words, the 0.57 correlation between RRBs in **column 5** and federal bonds (row 4) is the same when you look at its mirror image in **column 4** and row 5.

Table 2. Correlations

	Correlations				
Asset Class	1	2	3	4	5
1 Treasury Bills	1.00	0.38	0.18	0.01	(0.19)
2 Federal short-term bonds	0.38	1.00	0.91	0.76	0.25
3 Federal mid-term bonds	0.18	0.91	1.00	0.94	0.46
4 Federal long-term bonds	0.01	0.76	0.94	1.00	0.57
5 Real return bonds	(0.19)	0.25	0.46	0.57	1.00
6 Provincial short-term bonds	0.31	0.96	0.91	0.77	0.39
7 Provincial mid-term bonds	0.02	0.79	0.92	0.92	0.65
8 Provincial long-term bonds	(0.14)	0.52	0.75	0.89	0.70
9 Corporate short-term bonds	(0.03)	0.47	0.46	0.40	0.53
10 Corporate mid-term bonds	(0.34)	0.07	0.23	0.32	0.62
11 Corporate long-term bonds	(0.38)	(0.05)	0.19	0.38	0.62
12 Global bonds	0.16	0.86	0.83	0.72	0.13
13 High yield bonds	(0.47)	(0.23)	(0.14)	(0.02)	0.35
14 Emerging debt	0.10	0.27	0.26	0.24	0.22

Note that the matrix shows a lower correlation between RRBs (column 5) and other bonds, compared to say federal long-term bonds (column 4). In other words, **inflation volatility matters**.

The use of "nominal" bonds to hedge "real" liabilities may be fine over very short time horizons if both the level and volatility of inflation are reasonably predictable over these short periods. However, a duration policy that does not differentiate between the real and inflation components over a longer time horizon is less effective. In other words, it is important to match the "basis" for hedging interest rate risk because the "basis risk" may be material.

A key question, then, is how stable or predictable is inflation over the long term? According to the MPI external actuary:

> *"Nobody can forecast interest rates (especially long term bonds) accurately and consistently."*
> Source: Mr. Cheng, on page 1,469 of the GRA

An Analogy: The Really "Risky" Component of the Dividend Discount Model

My concern about MPI's duration policy can be better appreciated, perhaps, by seeing how the Dividend Discount Model ("DDM"), shown below, compares to the Fisher Equation (2) described earlier.

MPI's approach **appears to** focus more on the **shorter-horizon** and on the inflation component (less risky), rather than the capital gain/duration effects from **longer-term** changes related to **both inflation and changing "real" interest rates** ("really" risky). This is like focusing on the dividend yield component of stock returns (low and stable), rather than the capital gain component (larger and more volatile). This is summarized below.

nominal yield	~	real yield	+	inflation	(2): Fisher Equation

return on stocks	=	capital gain (loss)	+	dividend yield	(4): Dividend Discount Model ("DDM")
		↑		↑	
		"Really" Risky		**Less** Risky	

INCREASED INFLATION TODAY

Finally, it is important to note that the 3%[16] inflation rate reported in July 2018 represented the highest year over year change in years, and is above the Bank of Canada's 2% target.

CREDIT RISK

Bonds with greater credit risk require higher yields.

Credit risk is the risk of suffering a loss from a "credit event" (e.g., failure by an issuer to meet a coupon payment or principal repayment on a bond that we own). Bonds issued by the Federal Government, for example, have less credit risk than those issued by the Provinces, and corporate bonds generally have even greater credit risk.

LIQUIDITY

Investors also need to be compensated for holding less liquid bonds, such as private debt.

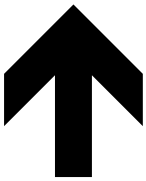
[16] Statistics Canada, https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=1810000413

SUMMARY: RISK PREMIA "BUILDING BLOCKS"

The table below summarizes the various risk premia or building blocks for fixed income assets.

- **T Bills** have the lowest return, given their **low duration** (< 1 year) and **low inflation risk**;
- **RRBs**, which hedge longer-term inflation risk by inflation-protecting the principal, have higher returns than T Bills, given their higher duration and an upward-sloping yield curve (most typical);
- **Bonds** don't provide inflation protection, and have higher yields than RRBs to compensate for inflation risk that erodes their purchasing power;
- **Provincial and corporate bonds** have even higher yields, given their higher credit risk; and
- **Private debt** has a higher yield, given its lower liquidity.

Time Horizon	Risk
Longer	Illiquidity
	Credit
	Inflation
	Term/Duration
Short	



Asset Class	Return[17]	Risk Premium "Building Blocks"
Private Debt	↑	+1.8%
Corporate Bonds	3.8%	
Provincial Bonds	↑	+0.6%
Federal Bonds	2.0%	
Federal RRBs	↑	
T Bills	1.4%	

As noted in a 2016 paper produced and approved by the Insurance Regulation Committee of the International Actuarial Association ("IAA"):

> *"One of the greatest challenges facing … insurance companies has been the … low interest rate environment. … Many … insurers started chasing yield, decreasing … credit quality … and increasing the allocation to riskier asset classes. The … pressure for higher yield has resulted in more risk …*
>
> *… There have been three main ways … to increase … yield ...*
>
> 1. ***Add credit spread[18]*** *… by decreasing the credit quality … and taking on more credit risk …, and often aiming to capture the illiquidity premium ...*
> 2. ***Increase expected return*** *… by increasing the allocation to riskier assets ...*
> 3. ***Increase yield to maturity*** *… by selling shorter assets that have a lower yield … and buying longer assets that have a higher yield …"[19]*

[17] Mercer's Median 10 Year Return

[18] Companies may use risk-adjusted yields but may for example seek to exploit the illiquidity premium.

[19] Page 13-5 to 13-6, Asset Liability Management Techniques and Practices for Insurance Companies (IAA Risk Book, Chapter 13)

WALKING THROUGH THE "REAL" STORY IN MPI EXHIBIT 12

A **Real** Liability Benchmark is used to measure surplus volatility in MPI Exhibit 12.

FLIPPING THE STORY BOOK ON "BASIC"

The table on the next page shows the seven (7) incremental "steps" taken by Mercer in MPI Exhibit 12 to show the effects on return/risk for the **Basic Portfolio** by including (or excluding) different asset classes.

Starting from the Current Portfolio, the first step is to "re-optimize" the portfolio based on the current asset classes in the portfolio using updated capital market assumptions, and perhaps constraints.

These steps, using Mercer's terminology, are:

1. CURRENT ASSET CLASSES;
2. ADDING GROWTH FIXED INCOME, GLOBAL EQUITIES & PRIVATE EQUITY;
3. ADDING MORTGAGES AND PRIVATE DEBT;
4. ADDING DIVERSIFIED GROWTH FUND;
5. ADDING LEVERAGE (BOND OVERLAY);
6. REMOVING RRBS; and
7. RESTRICTING PUBLIC EQUITIES.

The table on the next page walks through Mercer's "observations", showing the incremental steps in the first column. (The reader can walk through these steps by flipping through the graphs in MPI Exhibit 12.)

The other columns show the returns and return/risk ratios calculated by Mercer, along with the role that RRBs played in achieving those returns (i.e., % allocation of RRBs in the portfolio). All figures reflect the same level of risk (3.8% surplus volatility), and are therefore comparable.

The question that prompted the creation of MPI Exhibit 12 is below.

> ***84 f) More Detailed Analysis for Real Scenarios:*** *Was the same "stepped" analysis that was performed using the* ***Nominal*** *Liability Benchmark (e.g. pages 1,749 to 1,753) also performed using the* ***Real*** *Liability Benchmark?*
>
> *84 f) i. If so, provide the analysis and commentary (at least for Basic and Pensions).*

Table 3. Return/Risk Impact from Different Asset Allocation "Steps"

Mercer's Observations (pages 7 - 13 of 36)	RRB Allocation[20]	Return +/- Impact	Excess Return/Risk[21]
STEP 1. CURRENT ASSET CLASSES ONLY 1. Long-term bonds dominate fixed income, some RRBs a. Long duration liabilities b. Low expected returns on RRBs 2. Alternatives dominated by Infrastructure a. Infrastructure only marginally better than Real Estate b. Decision between the two depends on implementation	**18.0%**	**4.2%**	**0.49**
STEP 2. ADDING GROWTH FIXED INCOME, GLOBAL EQUITIES & PRIVATE EQUITY 3. Adding Private Equity allows for further improvements(better risk/reward trade-offs) 4. Canadian Equity appears more attractive than Global Equities due to greater correlation with RRBs 5. Low corporate spreads do not support significant allocation to corporate bonds 6. Addition of Growth Fixed Income does not appear to benefit	**41.5%**	**4.5%** ***+ 0.3%***	**0.57**
STEP 3. ADDING MORTGAGES AND PRIVATE DEBT 7. Adding Mortgages does not appear to benefit 8. Adding Private Debt provides an opportunity for return enhancement	**40.5%**	**4.6%** ***+ 0.1%***	**0.60**
STEP 4. ADDING DIVERSIFIED GROWTH FUND 9. Adding Diversified Growth Fund does not appear to benefit at this stage	**40.5%**	**4.6%** **–**	**0.60**
STEP 5. ADDING LEVERAGE (BOND OVERLAY) 10. Adding leverage (3X Real Return Bonds) provides an opportunity for improvement across risk spectrum	**45.0%**[22]	**4.9%** ***+ 0.3%***	**0.68**
STEP 6. REMOVING RRBS 11. Assuming a real liability benchmark for modelling, removing Real Return Bonds significantly reduces an opportunity for improvement at lower risk levels	**0%**	**~ 4.1%** ***~ - 0.8%***[23]	**Not shown by Mercer**

[20] These optimized allocations are at the "current" level of risk. Optimized RRB allocations would be even higher at the lower levels of risk that MPI has chosen for the Basic Portfolio.

[21] Mercer defines an Excess Return/Risk, where the excess component represents the difference in return between the portfolio and the return of the Liability Benchmark.

[22] MPI Exhibit 12 shows a 15% allocation to "3X RRBs". This "net" exposure is equivalent to a gross exposure to RRBs of 45% (3 x 15%), as shown below.

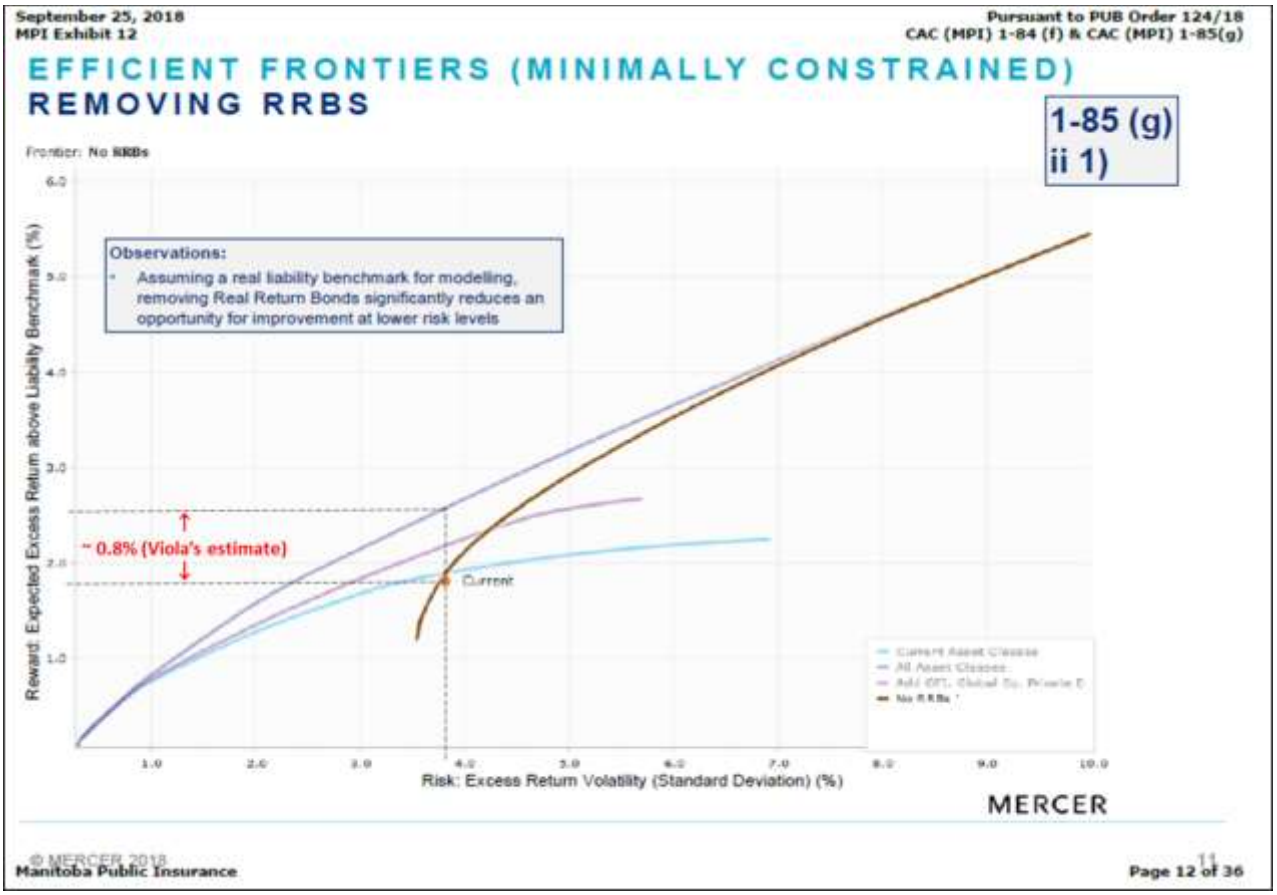
+45% "Gross" RRBs
- 30% Treasury Bills
+15% "3X RRBs"

[23] This is my estimate based on a visual inspection of the graph in MPI Exhibit 12 (page 12 of 36).

The effect of removing RRBs from the **Basic Portfolio** is illustrated by Mercer below.

Mercer did not report the impact on various statistics in this graph, so I estimated the impact from a visual inspection of the graph and concluded that **returns would be lower by ~ 0.8%**, measured at the "Current" risk level of 3.8%.

*Table 4. Removing RRBs in the **Basic** Portfolio*



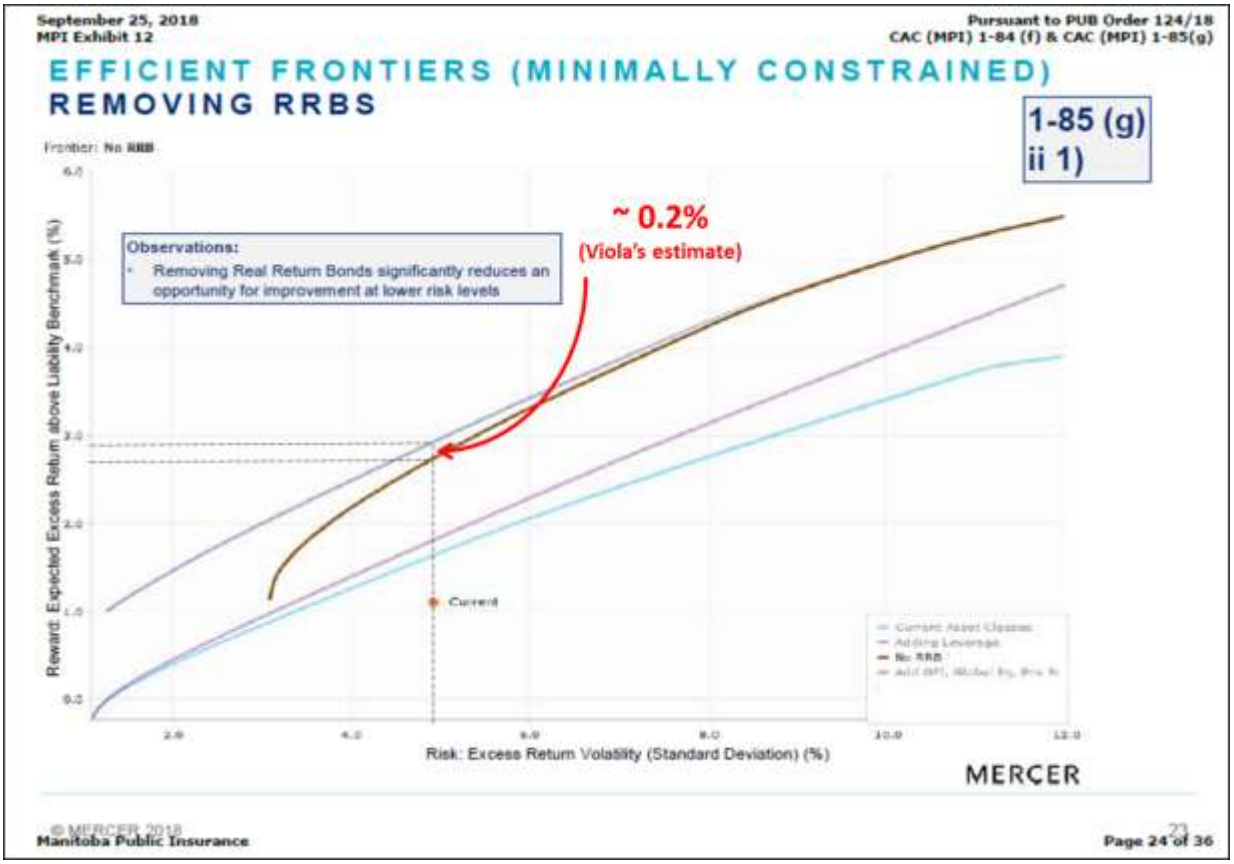
Mercer's Observations	Note
STEP 7. RESTRICTING PUBLIC EQUITIES (P 13 OF 36) 12. The unrestricted frontier (purple) contains higher allocations to Canadian equities at lower risk levels and higher allocations to Emerging Markets equities at higher risk levels 13. Restricting public equities based on the MPI recommended weights appears to slightly reduce the reward to risk trade-offs (the orange frontier is below the other lines) 14. The ACWI* weight restriction appears to further reduce the reward to risk trade-offs (green frontier is at the bottom) 15. Privates + ACWI* (0% fixed income) plots to the far right of the efficient frontier (iii) * All-Country World Index	**A table showing the quantitative impact at current risk levels was not reported by Mercer, and is hard to quantify from the graph alone**

FLIPPING THE STORY BOOK ON "PENSIONS"

The analysis so far has focused on the **Basic** Portfolio. A similar analysis is available for the **Pension** Portfolio[24]. While levels of risk in the Pension Portfolio are higher (4.9% currently) than those in the Basic Portfolio (3.8%), similar conclusions can be reached.

The graph below, for example, shows that **returns are lower by ~ 0.2% when RRBs are excluded from the Pension Portfolio** at the "current" risk level.

*Table 5. Removing RRBs in the **Pension** Portfolio*



The higher risk in the Pension Portfolio arises for two reasons. First, the asset allocations are different (e.g., the MPI-recommended Pension Portfolio has equities but the Basic Portfolio does not). Second, the Pension Liabilities have a longer duration than the Basic Liabilities (~ 16 vs. ~ 10 respectively).

[24] MPI Exhibit 12, pages 18 – 25 of 36

THE "REAL" STORY, COMPARED TO THE "NOMINAL" STORY

The main difference in asset allocations, measured at current risk levels, appears to be the mix within fixed income.

The big difference, of course, is that the MPI Recommended portfolio has no RRBs, while Exhibit 12 shows that an optimal portfolio would have at least 48.5% in RRBs **at the same level of risk** – and likely more than ½ of the portfolio in RRBs, given MPI's decision to reduce risk below the current level.

MPI'S LOWER RISK TOLERANCE

While the earlier analysis shows the impact of adding or removing different asset classes **at the same level of risk**, the table below looks briefly at **MPI's recommended portfolio**, which **purports**[25] to take less risk than the "Current" portfolio.

Portfolio		Asset Allocation	Return[26]	Impact
M	**M**PI-Proposed Basic Portfolio	100% Fixed Income	3.1%	↓ 0.8% vs. **C**urrent ↓ 1.8% vs. **R**eal
C	**C**urrent Portfolio	70% Fixed Income 15% Equities 15% Other Real Assets[27]	3.9%	
R	"Minimally Constrained" Portfolio[28] (using **R**eal Liability Benchmark)	70.0% Fixed Income 21.5% Equities[29] 8.5% Other Real Assets	4.9%	

[25] In my oral testimony two years ago, I described the concept of a "risky bucket" and a "risk-free" or "minimum risk" bucket. Simply put, I believe MPI has a "leak", or two, in its Liability Benchmark Portfolio (minimum risk bucket).
[26] The 3.1% and 3.9% figures are my calculations, using Mercer's capital market assumptions.
[27] Real estate and infrastructure
[28] MPI Exhibit 12, page 11 of 36
[29] Includes 6.5% private equity

PART II. RECOMMENDATIONS FROM TWO YEARS AGO

The table below shows my 18 recommendations from the GRA Process two years ago, and whether I believe they have been addressed, deferred, or remain ongoing concerns.

		Addressed	Deferred	Ongoing Concern
Framework	**6. De-Linking Discount Rates**	**Mostly**		
	7. Min/Max Asset Class Constraints	☑		
	8. Evolved Risk Framework		☒	
	9. Explicit Risk Management Goals		☒	
	5. Return/Risk Definitions for Asset Mix Decision	☑		
	10. Minimum Risk Portfolio	**Partially**		
Portfolio	**14. Exclusion of Real Return Bonds**			☒
	15. Effectiveness of Duration Policy			☒
	16. Integration of Real Estate/Infrastructure Liabilities in Duration Management	☑		
	11. Canadian Equities' 10% Minimum Allocation	☑		
	12. No International Equities	☑		
Metrics	1. Clarity of Accounting Choices			n/a
	2. Adoption of More Comparable Accounting Principles			n/a
	3. AFS and HTM Accounting			n/a
	4. Pension Liability Accounting	☑		
Oversight	17. Removal of 105% Rule in Investment Policies	☑		
	13. No Over-Reliance on Quantitative Modeling			☒
	18. Pension Fund	☑		

DE-LINKING DISCOUNT RATES (#6)

While the Liability Benchmark Portfolios break the recursive[30] link between liability valuations and the yield on some assets for asset allocation decision-making, a link may still exist that creates an incentive to concentrate risk within fixed income. That is why this issue is "mostly" addressed. If the yield on the bonds **owned** is used to value liabilities, there may be an incentive to take more risk in fixed income (e.g., inflation and credit risk, less liquidity) to reduce the valuation of liabilities (higher discount rate). This may result in less diversification, and lower risk-adjusted returns.

EVOLVED RISK FRAMEWORK (#8) AND EXPLICIT RISK MANAGEMENT GOALS (#9)

I understand that the development of an Enterprise Risk Management ("ERM") Framework is a key corporate priority in fiscal 2018/19, and that an ERM Framework will be filed in the next GRA. I assume that these issues will be addressed once this corporate goal is met.

MINIMUM RISK PORTFOLIO (#10)[31]

While minimum risk portfolios were clearly defined for each segment (e.g., Basic and Pensions), the final definitions used by MPI were based on **nominal** definitions rather than **real** ones, as discussed in Part I. Accordingly, this issue is only partially addressed.

EXCLUSION OF REAL RETURN BONDS (#14), EFFECTIVENESS OF DURATION POLICY (#15)

My ongoing concerns related to RRBs and duration policy are covered in Part I of this paper.

NO OVER-RELIANCE ON QUANTITATIVE MODELING (#13)

My ongoing concern related to a possible over-reliance on quantitative modeling is covered in Part I of this paper. On a qualitative basis, a case can be made that a fund with long-term, inflation-sensitive liabilities should invest some of its assets in similarly long duration, inflation-sensitive assets (i.e. have > 0% in RRBs, and hold more, rather than less, real estate and infrastructure – other things equal).

[30] A recursive link is like a circular reference in Excel, where cell "G4" equals "A1", and A1 is recursively set to equal G4 again. This circular reference is not a "hit" as far as Excel is concerned, and Excel will warn you that a formula refers to a cell dependent on its own cell value – and this could sink the analysis in your YouSunkMyBattleship.xls file. (Another way of saying this is that it's the classic chicken/egg problem in the field of poultry management.)

[31] The Minimum Risk Portfolio is called "Liability Benchmark Portfolio" in the GRA and Mercer Study.

ACCOUNTING METRICS (#1 TO 4)

Given the other changes made by MPI, and reflected in the Mercer Study, I have less concern about accounting metrics. For example, by addressing Recommendation #5 (using market, not accounting return/risk metrics in the Mercer Study), and partially addressing #10, my concern about accounting is less important – but not unimportant. Accounting may still be driving some investment decisions, as described above (de -linking discount rates).

APPENDICES

APPENDIX 1. CURRICULUM VITAE – VALTER VIOLA

Consultant with 25 years of institutional portfolio management, investment research, and risk management experience (mostly defined benefit pension plans)

- *Consultant to institutional investors, advising boards, investment committees and client staff on investment strategies, investment risk management, and governance (primarily North America)*
- *Former executive and senior management roles in portfolio management, risk management, investment research, and economics at two of the world's largest institutional investors*

PROFESSIONAL EXPERIENCE

Since 2016 **Cortex Applied Research**, Toronto

Managing Director and Principal

- Advise pension funds, foundations and other institutional investors on governance matters, including fiduciary education and search services for investment consultants/outsourced chief investment officers (OCIOs)

2014 – 2016 **MaPLE** Toronto, Santiago

Partner in a private energy and infrastructure venture in Chile

2005 – 2014 **Holland Park** Toronto

President, Founder

- Advised institutional investors on investment risk governance, management and measurement practices, including:
  - developing investment/risk frameworks;
  - drafting investment/risk management policies/ procedures; and
  - developing risk budgets to support the management of surplus (assets and liabilities) and active management (performance vs. benchmarks)
- Provided risk monitoring and reporting services to pension funds, including:
  - managing third party risk analytics and related data;
  - recommending and implementing methodologies; and
  - reporting to boards and executives about investment risks

2000 – 2005 **CPP Investment Board** Toronto

Vice President, Research and Risk Management

- First executive responsible for total portfolio research, design and investment risk management of the largest single purpose pool of capital in Canada
- Led a growing team of professionals, focused on the total portfolio, including:
  - investment risk management (relative to liabilities and benchmarks);
  - policy asset mix and currency hedging;
  - active management; and
  - other investment policies
- Collaborated with the CEO/CIO, VP Private Markets, and VP Public Markets in the development and implementation of investment strategies
- Collaborated with other executives to develop and implement strategies and business plans, policies and procedures, including leading the development of an investment/risk management framework that took into account the unique circumstances of the CPP and CPPIB (e.g. large unfunded liability, non-marketable bonds, large cash inflows)

1993 – 2000 **Ontario Teachers' Pension Plan** Toronto

Director, Portfolio Manager, Analyst (Research and Economics)

- Member of the Investment Planning Committee, with shared responsibilities to advise the CIO on the tactical management of the total portfolio (shorter-term horizon, broad asset class allocations and currency hedging)
- Supported strategic/policy and tactical asset mix/currency hedging and other total fund decisions through independent research, including:
  - developing the fund's first asset/liability model, which supported the fund's asset mix transition shortly after the fund's inception;
  - conducting research to support new asset class introductions; and
  - recommending appropriate benchmarks
- Managed the tactical asset allocation portfolio, a portfolio that had one of the largest value added targets for the fund
- Managed the inflation-linked bond portfolio, including closing the largest single investment in the fund's history ($650 million private placement of inflation-linked bonds to finance the 407 Electronic Toll Road)

1992 – 1993 **Wilfrid Laurier University and York University** Waterloo, Toronto

Lecturer in Investments, Finance and Accounting

1990 – 1992 **Corporate Planning Associates** Toronto

Financial Advisor

1986 – 1988 **Price Waterhouse** Toronto

Auditor

PENSION ASSOCIATIONS/COMMITTEES

2006 – 2009 **Healthcare of Ontario Pension Plan (HOOPP)**

External Advisor to Investment Committee

- Advised the Investment Committee of a large, Canadian defined benefit plan on matters related to the management of the total portfolio

2003 – 2005 **Pension Investment Association of Canada (PIAC)**

Member of Investment Practices Committee

- Shared non-proprietary investment practices with peers as a member of an industry association
- Led the publication of a paper ("Risk Budgeting") to meet the needs of member organizations

EDUCATION

1995 ***Chartered Financial Analyst***

1990 ***Master of Business Administration***, Western University

1989 ***Chartered Accountant***

1986 ***Bachelor of Commerce***, University of Toronto

APPENDIX 2. RELEVANT PRIOR EXPERIENCE

The author's relevant prior experience, as described in the author's evidence during the GRA Process two years ago, is shown below.

CPP Investment Board

I was the first executive officer responsible for research and risk management of CPP Investment Board ("CPPIB"), the largest single purpose pool of capital in Canada with assets under management of ~ $290 billion today. As VP, Research and Risk Management I reported to the CEO/Chief Investment Officer over a five year period and was the chief risk officer responsible for all aspects of investment risk management. Research responsibilities covered a broad range of investment issues, including long-term asset allocation, currency hedging and investment policies. As one of four investment executive officers, I was involved in investment strategy specifically and the management of the organization generally.

Ontario Teachers' Pension Plan

I held a variety of roles over a seven year career at Ontario Teachers' Pension Plan ("Teachers'"), the largest single-profession pension plan in Canada with ~ $170 billion of assets under management today. Teachers' is considered a global leader in pension/risk management.

As the first analyst in the Research and Economics Department, I developed Teachers' first Asset-Liability Model to support long-term asset allocation strategies (e.g., allocation between equities, bonds and other asset classes). As a Director of Research, my responsibilities included conducting research to support the introduction of new asset classes, currency hedging policies, as well as broad asset allocation decisions on both a strategic (policy/long-term) and tactical (active/short-term) basis.

As a member of Teachers' Investment Planning Committee, I participated in shorter-horizon (tactical/active) decisions regarding asset allocation and currency hedging. As the first Portfolio Manager of Teachers' Tactical Asset Allocation ("TAA") portfolio, I was responsible for managing one of the most "active" programs at Teachers'[2]. I was also the Portfolio Manager of the real return bond ("RRB") portfolio[3].

Pension Investment Association of Canada (PIAC)

I was also a member of the Investment Practices Committee of the Pension Investment Association of Canada ("PIAC").

No P&C Experience

I have not worked with property and casualty ("P&C") insurers, but I have been an advisor to workers' compensation funds in Canada and asset managers who manage assets for workers' compensation funds in both Canada and the United States.

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[2] Performance of the TAA portfolio exceeded value added targets and resulted in the maximum bonus multiplier allowed under Teachers' performance incentive system.

[3] As RRB portfolio manager, I was part of a team that greatly increased the size of Teachers' RRB portfolio. In the year that I left Teachers' to join CPPIB (2000), Teachers' increased its exposure from $8.6 billion to $20.6 billion.

Teaching, Applied Research and Education

I received the Chartered Accountant (CA) designation and taught accounting as well as finance/investments at Wilfrid Laurier University and York University respectively before starting my career in applied research and portfolio/risk management in the Research and Economics Department at Teachers', where I qualified as a Chartered Financial Analyst ("CFA").

I am an MBA graduate from the Richard Ivey School of Business (Western University) and graduated from the University of Toronto with distinction (BComm).

APPENDIX 3. CAC (MPI) 1-84(F)

This appendix contains the preamble, prepared by me, and other information related to question CAC (MPI) 1-84 (f). (This question has been answered by MPI in MPI Exhibit 12.)

PREAMBLE TO IR (IF ANY):

Recommendation #13

> MPI should be vigilant about its potential over-reliance on quantitative considerations, given the high sensitivity of optimal asset allocations to seemingly small changes in capital market assumptions (returns, volatilities and correlations) and the large number of inputs.

Mercer's response:

> Mercer agrees that investors should not rely solely on quantitative modeling. The ALM process began with projections of the risk, return, and correlation of a variety of asset classes. **The ALM process concluded with a thorough discussion of practical considerations and observations regarding the current market environment.**

On page 1,654, Mercer said:

> While quantitative models can be instructive and useful, we very much agree that investors should never rely solely on quantitative modeling …

Capital Market Assumptions for the Liability Benchmark

Page 1,765 (INV Appendix 17, Attachment A) shows the assumptions related to the components of the liability benchmark, which CAC summarized below (Basic and Pension only).

Table 6. Components of Liability Benchmarks

	Components of Liability Benchmarks	Return	SD
1	Treasury Bills	1.50%	1.50%
2	Short-Term Provincial Bonds	2.40%	3.50%
3	Mid-Term Provincial Bonds	3.00%	6.50%
4	Long-Term Provincial Bonds	3.30%	8.50%
5	Long-Term Corporate Bonds	4.20%	8.50%
6	Real Return Bonds	3.00%	7.50%

Table 7. Correlations

	Correlations					
	1	2	3	4	5	6
Treasury Bills	1.00					
Short-Term Provincial Bonds	0.31	1.00				
Mid-Term Provincial Bonds	0.02	0.87	1.00			
Long-Term Provincial Bonds	(0.14)	0.61	0.89	1.00		
Long-Term Corporate Bonds	(0.38)	0.14	0.51	0.69	1.00	
Real Return Bonds	(0.19)	0.39	0.65	0.70	0.62	1.00

The significant difference between the nominal and real bases are shown below for both Basic and Pension liabilities.

Table 8. Difference in Liability Benchmark Portfolios (Basic and Pension)

	Basic			Pension		
	Nominal	**Real**	Diff	Nominal	**Real**	Diff
Treasury Bills		**26**	26	- 17	**- 11**	6
Short-Term Provincial Bonds	28	**8**	- 20			-
Mid-Term Provincial Bonds	18		- 18			-
Long-Term Provincial Bonds	54		- 54		**30**	30
Long-Term Corporate Bonds			-	117		- 117
Real Return Bonds		**66**	66		**81**	81
	100	**100**	-	100	**100**	-

The GRA included many efficient frontiers using the **Nominal** Liability Benchmark, showing for example, the effects of adding different asset classes one step at a time ("stepped approach") so the effects on return/risk could be seen. (Fewer such analyses were provided using the **Real** Liability Benchmark, and no "steps" were shown in the GRA on this basis.)

The table below shows how material the Liability Benchmark decision is on return/risk and asset allocation. (The supporting tables, A to C, are on the next two pages. They show the different implications reported by Mercer arising from the selection of a different Liability Benchmark – i.e., nominal vs. real).

Table 9. Materiality of Liability Benchmark Choice

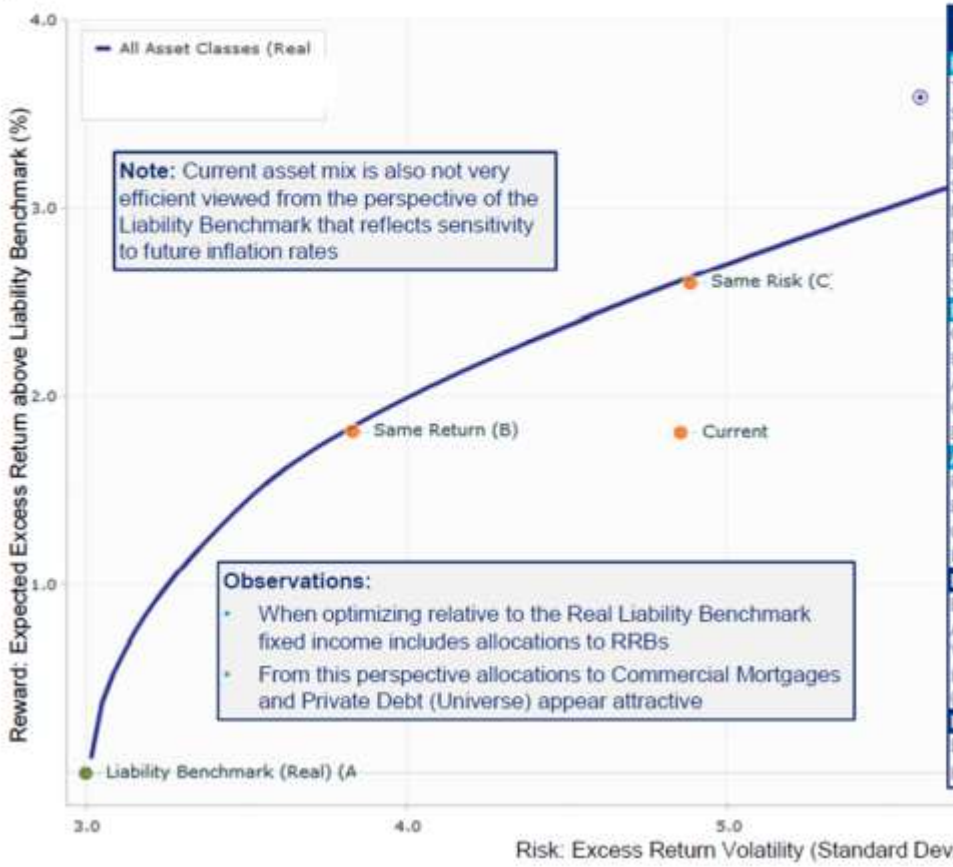
Table	Content	Materiality of Liability Benchmark Choice
A	**Table A shows return/risk metrics** for a portfolio that has the same expected return as the current portfolio (~ 4.2%), but is more efficient than the current portfolio (i.e. less risk); **The asset allocations** are also shown	The main difference between the optimizations relates to the inclusion of **RRBs in the portfolio under the <u>real</u> optimization**; The total fixed income allocation is the same (~ 75%) under both real and nominal optimizations
B	**Table B shows the current portfolio's return/risk metrics**	n/a
C	**Table C shows the improved efficiency** (less risk, same return) of the optimized portfolio, compared to the current portfolio (i.e. C = A minus B)	**Surplus volatility falls more when the <u>real</u> liability proxy is used (1.1% risk reduction, rather than 0.4%)**

Table 10. Return/Risk Metrics and Asset Allocations

B	**Current Portfolio**	Real	Nominal	
	Expected 10-Year Return:			
	Portfolio	4.2	4.2	
	Liability Benchmark Portfolio	2.4	2.8	
	Excess Return	1.8	1.4	
	Anticipated Surplus Volatility	4.9	5.0	
	Excess Return/Anticipated Surplus Volatility	0.37	0.28	
	Information Ratio (Return/Risk)	0.37	0.27	
	Difference	- 0.00	0.01	
C	**Improved Efficiency (Same Return)**	Real	Nominal	C = A - B
	Expected 10-Year Return:			
	Portfolio	- -	0.1	No change in return (except rounding)
	Liability Benchmark Portfolio	-	-	
	Excess Return	- -	0.1	
	Anticipated Surplus Volatility	- **1.1**	- **0.4**	More measured risk reduction with Real Liability
	Excess Return/Anticipated Surplus Volatility	0.11	0.00	
	Information Ratio (Return/Risk)	0.11	0.03	
	Difference	- 0.00	- 0.03	

The source for the above data is on the following two pages.

EFFICIENT FRONTIERS (MINIMALLY CONSTRAINED)
REAL LIABILITY BENCHMARK

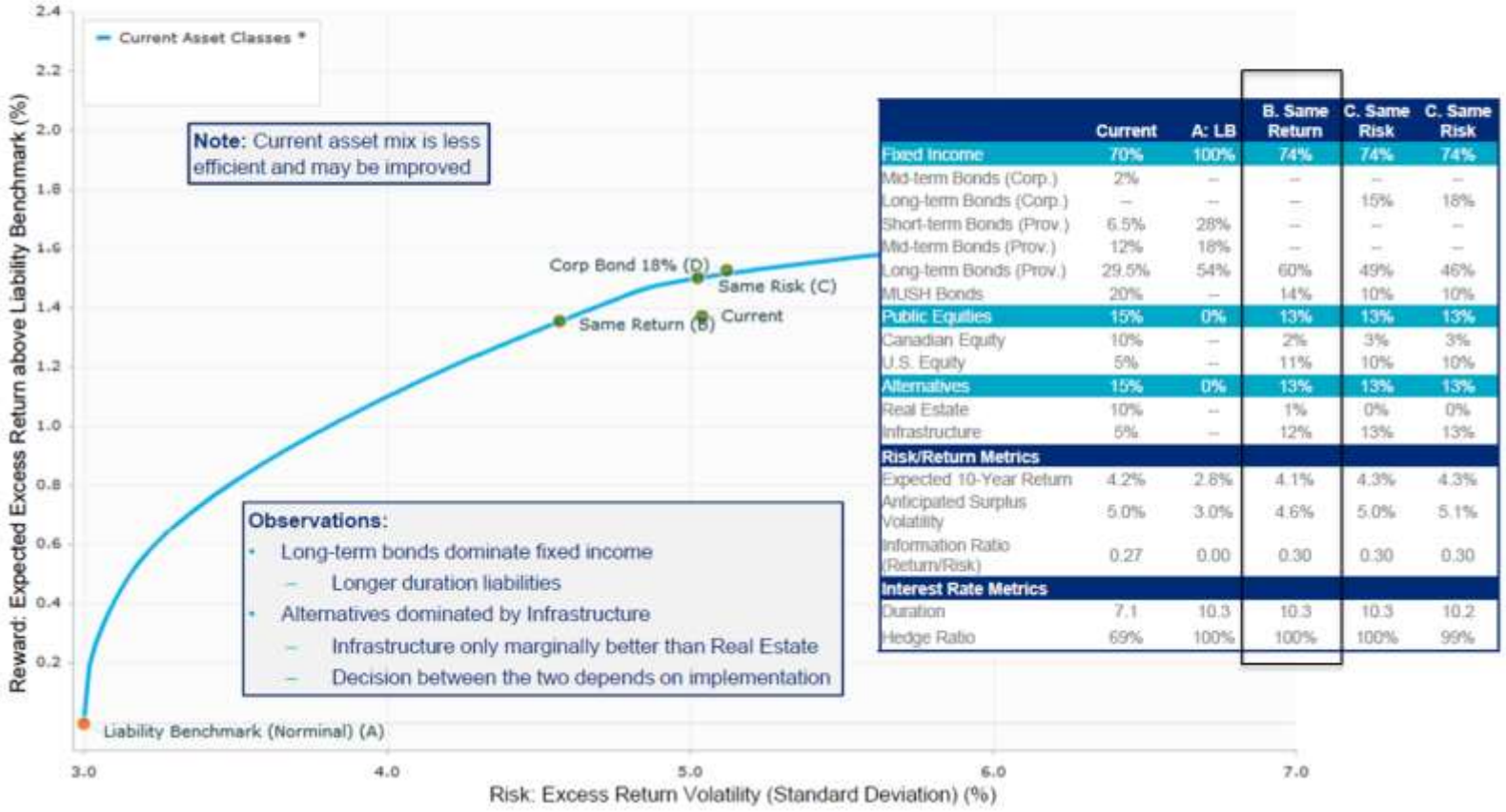


	Current	A. Real LB	B:Same Return	C. Same Risk
Fixed Income	70%	100%	59%	43%
Treasury Bills	--	26%	--	--
Short-term Bonds (Prov.)	6.5%	8%	27%	--
Mid-term Bonds (Prov.)	12%	--	--	--
Long-term Bonds (Prov.)	29.5%	--	--	--
Short-term Bonds (Corp.)	--	--	3%	15%
Mid-term Bonds (Corp.)	2%	--	--	--
MUSH Bonds	20%	--	10%	10%
Real Return Bonds	--	66%	--	--
3X Real Return Bonds	--	--	19%	18%
Public Equities	15%	0%	15%	26%
Canadian Equity	10%	--	4%	6%
U.S. Equity	5%	--	--	--
All-Country World Equity	--	--	4%	5%
Global Equity (low vol)	--	--	4%	7%
Diversified Growth Fund	--	--	3%	8%
Alternatives	15%	0%	26%	31%
Real Estate	10%	--	6%	8%
Private Debt - Universe	--	--	3%	13%
Commercial Mortgage	--	--	13%	3%
Infrastructure	5%	--	2%	7%
Risk/Return Metrics				
Expected 10-Year Return	4.2%	2.4%	4.2%	4.9%
Anticipated Surplus Volatility	4.9%	3.0%	3.8%	4.9%
Information Ratio (Return/Risk)	0.37	0.00	0.48	0.53
Interest Rate Metrics				
Duration	7.1	10.3	10.3	10.2
Hedge Ratio	69%	100%	100%	99%

Table 11. "Real" Liability Benchmark (page 1,755)

"Real" Liability Benchmark (page 1,755)

EFFICIENT FRONTIERS (MINIMALLY CONSTRAINED)
CURRENT ASSET CLASSES ONLY



	Current	A: LB	B. Same Return	C. Same Risk	C. Same Risk
Fixed Income	70%	100%	74%	74%	74%
Mid-term Bonds (Corp.)	2%	--	--	--	--
Long-term Bonds (Corp.)	--	--	--	15%	18%
Short-term Bonds (Prov.)	6.5%	28%	--	--	--
Mid-term Bonds (Prov.)	12%	18%	--	--	--
Long-term Bonds (Prov.)	29.5%	54%	60%	49%	46%
MUSH Bonds	20%	--	14%	10%	10%
Public Equities	15%	0%	13%	13%	13%
Canadian Equity	10%	--	2%	3%	3%
U.S. Equity	5%	--	11%	10%	10%
Alternatives	15%	0%	13%	13%	13%
Real Estate	10%	--	1%	0%	0%
Infrastructure	5%	--	12%	13%	13%
Risk/Return Metrics					
Expected 10-Year Return	4.2%	2.8%	4.1%	4.3%	4.3%
Anticipated Surplus Volatility	5.0%	3.0%	4.6%	5.0%	5.1%
Information Ratio (Return/Risk)	0.27	0.00	0.30	0.30	0.30
Interest Rate Metrics					
Duration	7.1	10.3	10.3	10.3	10.2
Hedge Ratio	69%	100%	100%	100%	99%

Table 12. "Nominal" Liability Benchmark

"Nominal" Liability Benchmark (page 1,749)

QUESTION 84 f): More Detailed Analysis for Real Scenarios

More Detailed Analysis for Real Scenarios: Was the same "stepped" analysis that was performed using the **Nominal** Liability Benchmark (e.g. pages 1,749 to 1,753) also performed using the **Real** Liability Benchmark?

i. If so, provide the analysis and commentary (at least for Basic and Pensions).

If not, could a similar analysis and commentary be provided, showing the effect of including RRBs ("minimally" constrained)? (at least for Basic and Pensions).

Rationale for Question:

While MPI and/or Mercer have responded to CAC's 18 Recommendations, CAC respectfully disagrees that certain responses have been "completed in full", as suggested by MPI. Accordingly, CAC has clarifying/additional questions.

Model optimizations are very sensitive to the assumptions (established in 2017 GRA), including assumptions related to the Liability Benchmark used to measure a key metric (surplus risk).

APPENDIX 4. CAC (MPI) 1-85 (G)

This appendix contains the preamble, prepared by me, and other information related to question CAC (MPI) 1-85 (g). (This question has been answered by MPI in MPI Exhibit 12.)

PREAMBLE TO IR (IF ANY):

Recommendation #7

> The minimum/maximum and other constraints imposed on the portfolio (e.g., when asset-liability studies are conducted) should be reviewed and relaxed, to avoid costly constraints (lower risk-adjusted returns). The rationale for imposing any such constraints should be made explicit.

Mercer's response (page 1,460):

> The ALM study had minimally constrained and practical implementation constraints.

Leverage Constraint

The Liability Benchmarks developed by Mercer included negative (short) exposures related to TBills in both the nominal and real representations of the Pension Liability (17% and 11% short respectively), as summarized by CAC on the right.

Table 13. Pension Liability Benchmark Portfolio (Real vs. Nominal)

	Pension Liability		
	Nominal	Real	Diff
Treasury Bills	- 17	- 11	6
Short-Term Provincial Bonds			-
Mid-Term Provincial Bonds			-
Long-Term Provincial Bonds		30	30
Long-Term Corporate Bonds	117		- 117
Real Return Bonds		81	81
	100	100	-

Benefits of Leverage

On page 1,753, Mercer said "adding leverage (Bond Overlay) provides an opportunity for improvement across risk spectrum".

On page 1,588, Mercer said this about overlay bonds:

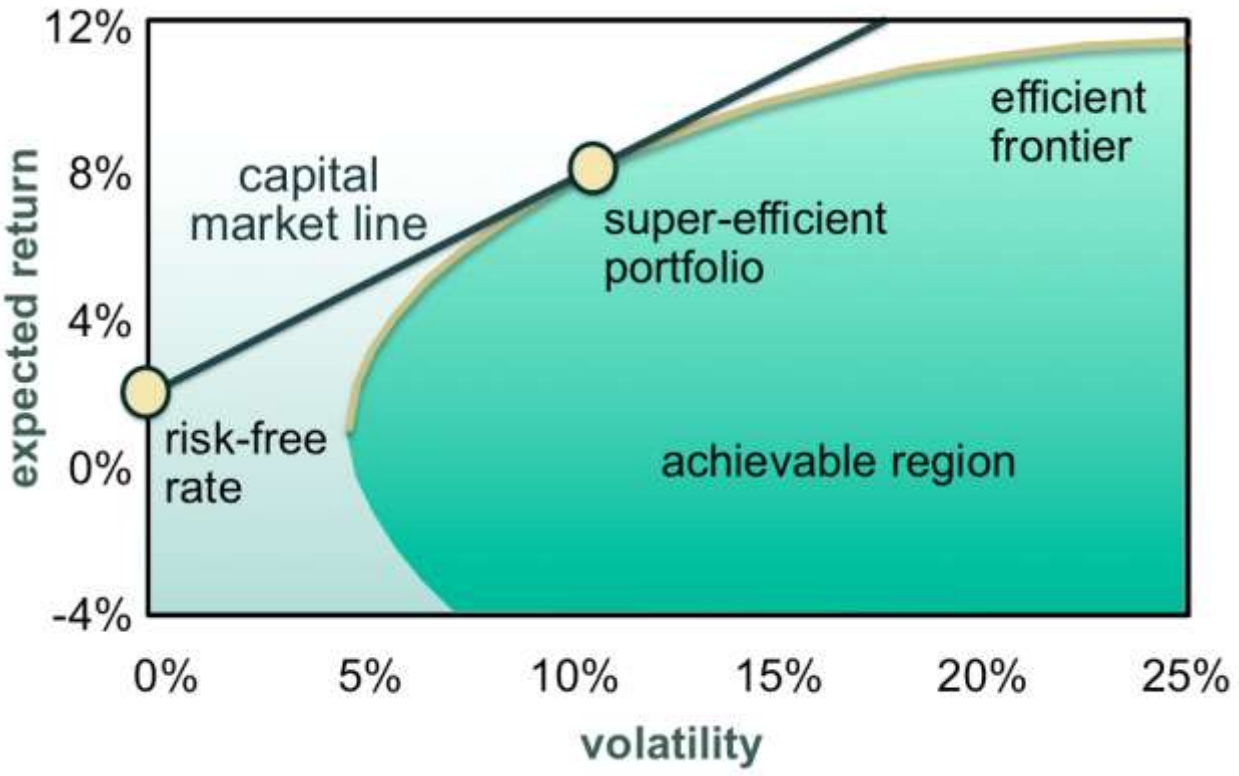
> By synthetically increasing exposure to bonds, investors can track liabilities in a capital efficient manner as market interest rates change.
>
> Since funding costs are currently lower than the yield-to-maturity on the underlying bonds, a long bond overlay strategy comes with a positive expected return. In addition, an RRB overlay strategy normally includes a return enhancer equal to the long term spread between federal and provincial bonds.

When all other assets are kept unchanged, adding a bond overlay strategy will typically increase the Plan's expected return.

Capital Market Line Theory

In an asset-only context (i.e. ignoring liabilities), the Capital Market Line illustrated below shows how the introduction of a risk-free asset (e.g. Government of Canada TBills in an asset-only context) expands the efficient frontier.

Figure 1. Capital Market Line



While many assumptions underlie the Capital Market Line in the broader CAPM[32] theory, two implications for "asset-only" investors are:

- All investors (regardless of risk tolerance) hold the "market portfolio"; and
- The proportion of an investor's portfolio held in the risk-free asset reflects their risk tolerance, with the balance invested in the market portfolio.

Exclusion of Leverage

On page 1,618, the rationale for excluding "Levered Bonds" was provided:

> Levered bonds allow investors to increase their exposure to longer duration securities via derivative contracts. Typically, investors pledge capital and pay a borrowing cost (typically short-term rates) and receive returns from a longer-term fixed income index (such as Long-Term Provincial Bonds or RRBs). …
>
> Levered bonds can provide capital efficient matching of desired duration or inflation exposures and are well suited for investors who are looking to match interest rate risk while maintaining healthy allocations to a growth portfolio.
>
> **Given MPI's preference to avoid equity exposure or additional types of risk within the Basic Portfolio, Levered Bonds are not included in the Policy recommendation. For the other Components, the desire is not to use leverage in the Portfolio.**

On page 1,719, Mercer's report said RRBs and leveraged bond funds (RRBs & Provincial bonds) were rejected from consideration because they were "either deemed too risky or the expected returns were too low".

[32] CAPM: Capital Asset Pricing Model

QUESTION 85 G): EFFICIENT FRONTIERS

Can Mercer show efficient frontiers, similar to the Capital Market Line shown above, except that risk is to be defined to take into account liabilities (surplus, not assets only), and the "risk-free" asset is the Minimum Risk Portfolio (Real Liability Benchmark, not Nominal Liability Benchmark, and not TBills)?

i. The analysis should show the effects of allowable leverage **for fixed income assets only** (e.g. bond overlays, including RRBs). Other constraints can be added in a "stepped approach", starting from the "minimally constrained" scenario, in the same way such "steps" were shown on pages 1,749 to 1,753 of the GRA to illustrate the effects of adding new asset classes.

ii. The steps should include, at a minimum, the imposition of various constraints that were actually imposed, directly or indirectly, or which would illustrate the return/risk tradeoffs arising from various "steps" taken (or decisions made) as listed below:
    1) Set 0% maximum in RRBs
    2) Restrict the weight to the "final MPI recommended" weight, rather than the global market cap, in three (3) individual steps for:
        1) Canadian Equity
        2) Emerging Markets Equity
        3) Other Equity

iii. The analysis should clearly show a portfolio ("Privates + ACWI") that consists of 0% fixed income, with a private/public split below:
        1) Real estate, infrastructure, and private equity using MPI's recommended weights
        2) Public equity in Canada, US, Emerging Markets, and other regions at their global market cap weights (e.g., All Country World Index Equities (ACWI))

iv. Mercer's "Observations" would facilitate the interpretation of results, as would Mercer's "Asset Mix Options" and "Expected Surplus Growth", similar to the observations and other reporting Mercer provided on pages 1,749 to 1,753 and 1,790 to 1,793 respectively of the GRA.

v. The scope of the above analysis could be limited to Basic and Pension.

RATIONALE FOR QUESTION:

While MPI and/or Mercer have responded to CAC's 18 Recommendations, CAC respectfully disagrees that certain responses have been "completed in full", as suggested by MPI. Accordingly, CAC has clarifying/additional questions.

Model optimizations are very sensitive to constraints (established in 2017 GRA).

APPENDIX 5. LEVERAGE

This note describes financial leverage because the Mercer Study demonstrates its use by including an asset called "3X Real Return Bonds"[33], which represents a leverage factor of 3:1.

HOW IS LEVERAGE DEFINED?

Mercer defined this asset as "300% Real Return Bonds less 200% Treasury Bills and a 0.7% leverage cost". This "Levered RRB" portfolio is no different than a real estate portfolio that has borrowed money to finance more real property acquisitions. Real estate is typically shown "net of debt" (rather than "gross of bricks and mortar").

HOW DOES THE "3X" LEVER IMPACT RETURN/RISK?

Financial leverage works much the same way as a crowbar works in a physical context. Simply put, crowbars allow us to get a desired/better result with fewer resources (e.g., lift a heavy object).

The characteristics of Mercer's Levered RRBs are shown below, with leverage shown as a "short" T Bill (-200%) exposure, and the resulting net "longer" RRB exposure of +300%. On a net basis, Mercer calls this "3X RRBs" (+100% = 300% - 200%).

Using Mercer's return assumptions, the table shows how leverage "lifts" returns higher (almost 2%, from 2.7% to 4.6%). This return lift comes at a small leverage cost (0.7%). In other words, crowbars aren't free.

Table 14. "Levered RRBs" Portfolio

Asset Allocations	Composition	Median 10 Year Return	Duration
Treasury Bills	-200%	1.4%	0.1
RRBs	300%	2.7%	15.0
3X RRBs	100%	5.3%	**44.8**
Less Leverage Cost		-0.7%	
Total		4.6%	

For both the Basic Portfolio and Pension Portfolio, Mercer says:

> *"Adding leverage (3X Real Return Bonds) provides an opportunity for improvement across risk spectrum"[34].*

[33] Another portfolio, involving Provincial Bonds, was also considered.
[34] MPI Exhibit 12, pages 11 and 23 of 36

WHY PUT A CONSTRAINT ON LEVERAGE?

One motivation for prohibiting the use of leverage is to limit the potential losses from price movements. For example, stocks can double in price (100% gain), but they can't fall below $0 (negative 100%). As a result, selling a stock "short" (one we don't own) comes with a risk because we need to buy it back to close out the position, and the cost of doing so may rise substantially if its price rises enough.

Another form of leverage is simply to borrow funds and use the proceeds to buy more assets. A similar risk arises – the cost of your financing (short) could rise and/or the value of your (larger) assets could fall.

MOVING LEVERAGE DOWN THE BALANCE SHEET

If Mercer's model could speak for itself, it might agree with my description about asset "leverage" below, because the model focuses on "surplus" (assets and liabilities).

> "One asset's 'leverage' is another liability's 'hedge'."
> Valter Viola

While asset "leverage" increases the net duration of RRBs to ~ 45[35] (and may seem "high"), this is too narrow a view because the return/risk profile of asset classes should never be viewed in "isolation". We should always take a total portfolio perspective by consider all assets together, and we should also take into account both sides of the balance sheet (i.e., liabilities).

On the next page, we show how the leverage contemplated by Mercer could be re-classified on the balance sheet from RRBs to Bonds (top panel). (This re-grouping of T Bills from real to nominal bonds is better because T Bills are a "nominal" product.[36])

The bottom panel shows a third way of looking at asset "leverage", by moving the "short" T Bill (borrowing equivalent) to the other side of the balance sheet – with other liabilities – where it naturally belongs. This treatment is consistent with my recommendation two years ago (Recommendation #16) related to real estate borrowing, and recognizes that a short T Bill exposure is equivalent to "borrowing short-term (say < 90 day term to maturity)".

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[35] This assumes a 15 duration for the RRB Index, and TBills at ~ 0.1. Using the "3X" factor, the leverage increases the net duration of RRBs from ~ 15 to ~ 45 (3X).

[36] T Bills don't provide inflation indexation per se, though given the short time to maturity, real purchasing power would typically be maintained on T Bills.

Table 15. Re-classifying "Leverage" from RRBs to Bonds

The table below shows how leverage could be re-classified to show a 45% exposure to RRBs (3 X 15%).[37]

Assets (A)	(1) Per Mercer	(2) Show Asset Leverage	(3) Re-classify TBill Leverage	(4) = (1) + (2) + (3) Assets (A)		
RRBs (Gross)	-	+30.0	-	RRBs (Gross)	45.0	← *45% RRBs*
T Bills	-	-30.0	+30.0			
RRBs (Net)	15.0	0.0	+30.0			
Bonds	53.0	-	-30.0	Bonds (Net)	23.0	← *23% Bonds*
Other Assets	32.0	-	-	Other Assets	32.0	
Total Assets	**100.0**	**0.0**	**0.0**	**Total Assets**	**100.0**	

The table below shows how **liabilities** are "**de-leveraged**" by including "3X RRBs". If T Bill and Basic Liability durations are ~ 0.1 and ~ 10.3 respectively, liability duration (including short T Bills) **falls** to 8.0 (from 10.3). In other words, asset leverage can reduce surplus risk. This way, "leverage" starts to sound less "risky".

Table 16. Re-classifying "Leverage" to the Liability Side of the Balance Sheet

	(4) From Above		(5) Show Liability De-Leverage	(6) = (4) + (5) Sub-Total	(7) = (6)/130% Express as % of 100	Duration	
	Assets (A)						
45% →	RRBs (Gross)	45.0	-	45.0	35.0		
23% →	Bonds (Net)	23.0	+30.0	53.0	41.0		
	Other Assets	32.0	-	32.0	24.0		
	Total Assets	**100.0**	**30.0**	**130.0**	**100.0**		
	Liabilities (L)						
	Basic Liabilities	100.0	-	100.0	77.0	~ 10.3	
	Short-term Borrowing	0.0	30.0	30.0	23.0	~ 0.1	
	Total Liabilities	**100.0**	**30.0**	**130.0**	**100.0**	**~ 8.0**	← *Lower Duration*

[37] MPI Exhibit 12, page 12 of 36

ATTACHMENTS

ATTACHMENT A. EVIDENCE FROM VALTER VIOLA (TWO YEARS AGO)

ATTACHMENT B. TESTIMONY FROM VALTER VIOLA (TWO YEARS AGO)

ATTACHMENT C. MPI EXHIBIT 12 (MERCER'S "REAL" EFFICIENT FRONTIER ANALYSIS)

REFERENCES

Gilbert, Charles (2016) *Asset Liability Management Techniques and Practices for Insurance Companies (IAA Risk Book, Chapter 13)*, paper produced and approved by the Insurance Regulation Committee of the IAA on 24 October 2016

Viola, Valter (2016) *MPI's Investment Portfolio: Risk, Return and Good Practices*, written evidence prepared for Consumers' Association of Canada, (Manitoba) Inc. and submitted by the Public Interest Law Centre on September 26, 2016

Viola, Valter (2016) *Testimony*, presentation slides of testimony prepared for Consumers' Association of Canada, (Manitoba) Inc. and presented by Valter Viola two years ago