MPI'S INVESTMENT PORTFOLIO:
ASSET/LIABILITY ANALYSIS
AND PREVIOUS RECOMMENDATIONS

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

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 during 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[1] 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.

[1] 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[2] related to MPI's investment practices.

PUB Order 124-18

The PUB ordered[3] 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.[4] 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.

[2] Attachments include my evidence and testimony from two years ago.
[3] See PUB ORDER 124-18.
[4] 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[5] … 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)

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

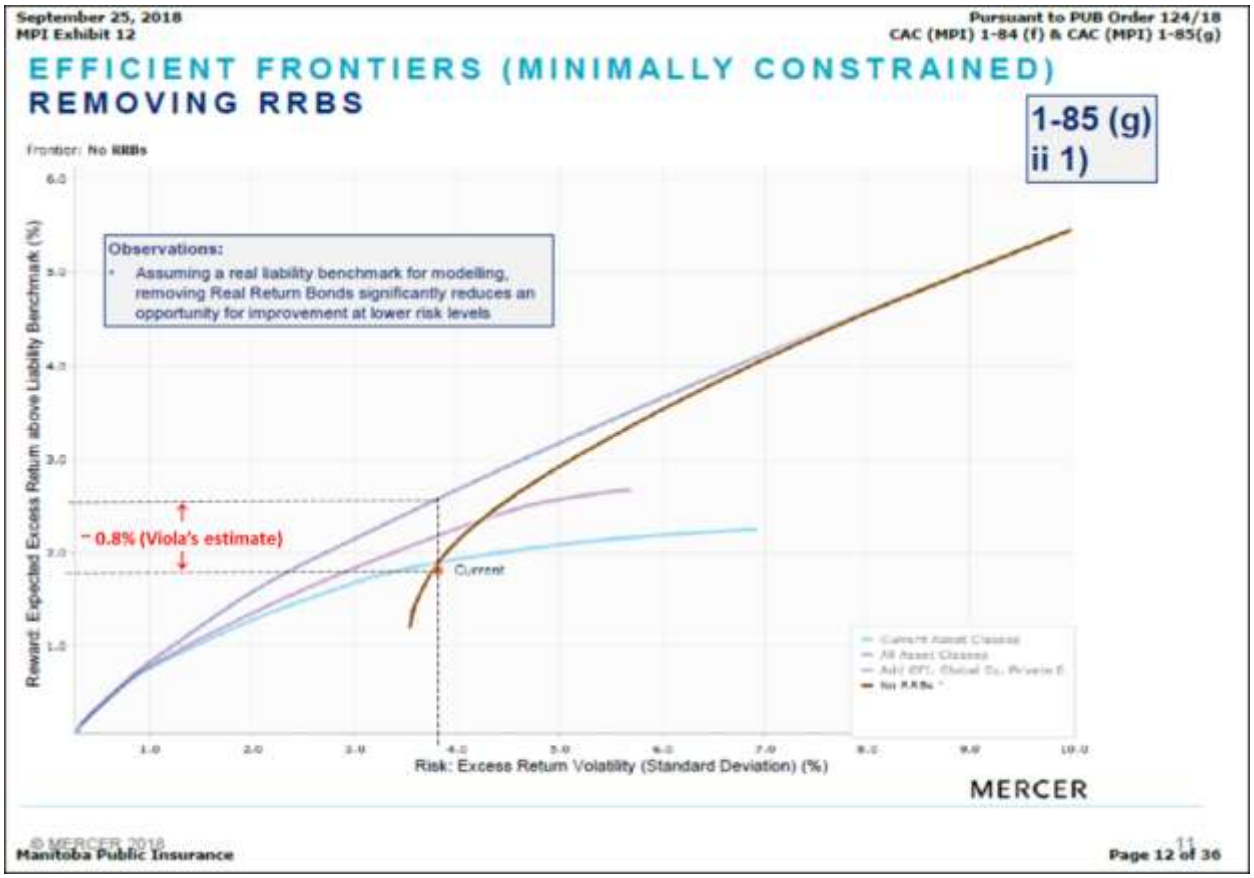
THE "REAL" STORY IN MPI EXHIBIT 12

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."*[6]

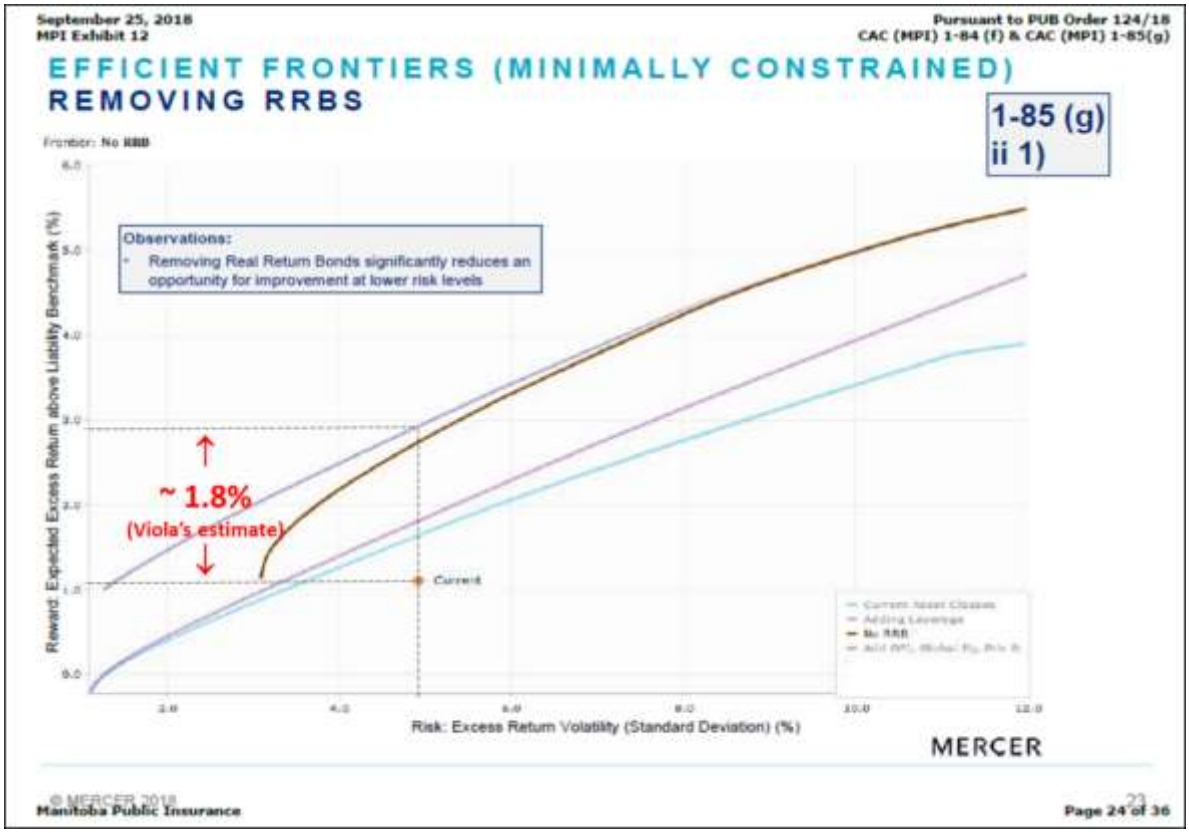
Mercer's finding is illustrated below for the **Basic** Portfolio, and on the next page for the **Pension** Portfolio.

Basic Portfolio



[6] 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)[7].

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).

[7] 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."* [8]

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."* [9] [10]

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 ~ 1.8% lower in the Pension Portfolio**.

[8] MPI Exhibit 12, page 12 (Basic) and 24 (Basic) of 36
[9] MPI Exhibit 12, page 11 of 36
[10] 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[11] 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?

[11] 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."*[12]

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.[13]

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

[13] 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%[14] 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.

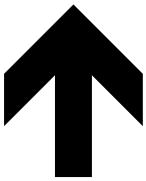
[14] Statistics Canada, https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=1810000413

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[15]	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[16]*** *… 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 …"*[17]

[15] Mercer's Median 10 Year Return

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

[17] 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[18]	Return +/- Impact	Excess Return/Risk[19]
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. Long-term bonds dominate fixed income, some RRBs a. Long duration liabilities b. Low expected returns on RRBs 4. Alternatives dominated by Infrastructure a. Infrastructure only marginally better than Real Estate b. Decision between the two depends on implementation	**41.5%**	**4.5%** ***+ 0.3%***	**0.57**
STEP 3. ADDING MORTGAGES AND PRIVATE DEBT 5. Adding Mortgages does not appear to benefit 6. Adding Private Debt provides an opportunity for return enhancement	**40.5%**	**4.6%** ***+ 0.1%***	**0.60**
STEP 4. ADDING DIVERSIFIED GROWTH FUND 7. Adding Diversified Growth Fund does not appear to benefit at this stage	**40.5%**	**4.6%** **–**	**0.60**
STEP 5. ADDING LEVERAGE (BOND OVERLAY) 8. Adding leverage (3X Real Return Bonds) provides an opportunity for improvement across risk spectrum	**45.0%**[20]	**4.9%** ***+ 0.3%***	**0.68**
STEP 6. REMOVING RRBS 9. 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%***[21]	**Not shown by Mercer**

[18] 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.

[19] 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.

[20] 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.

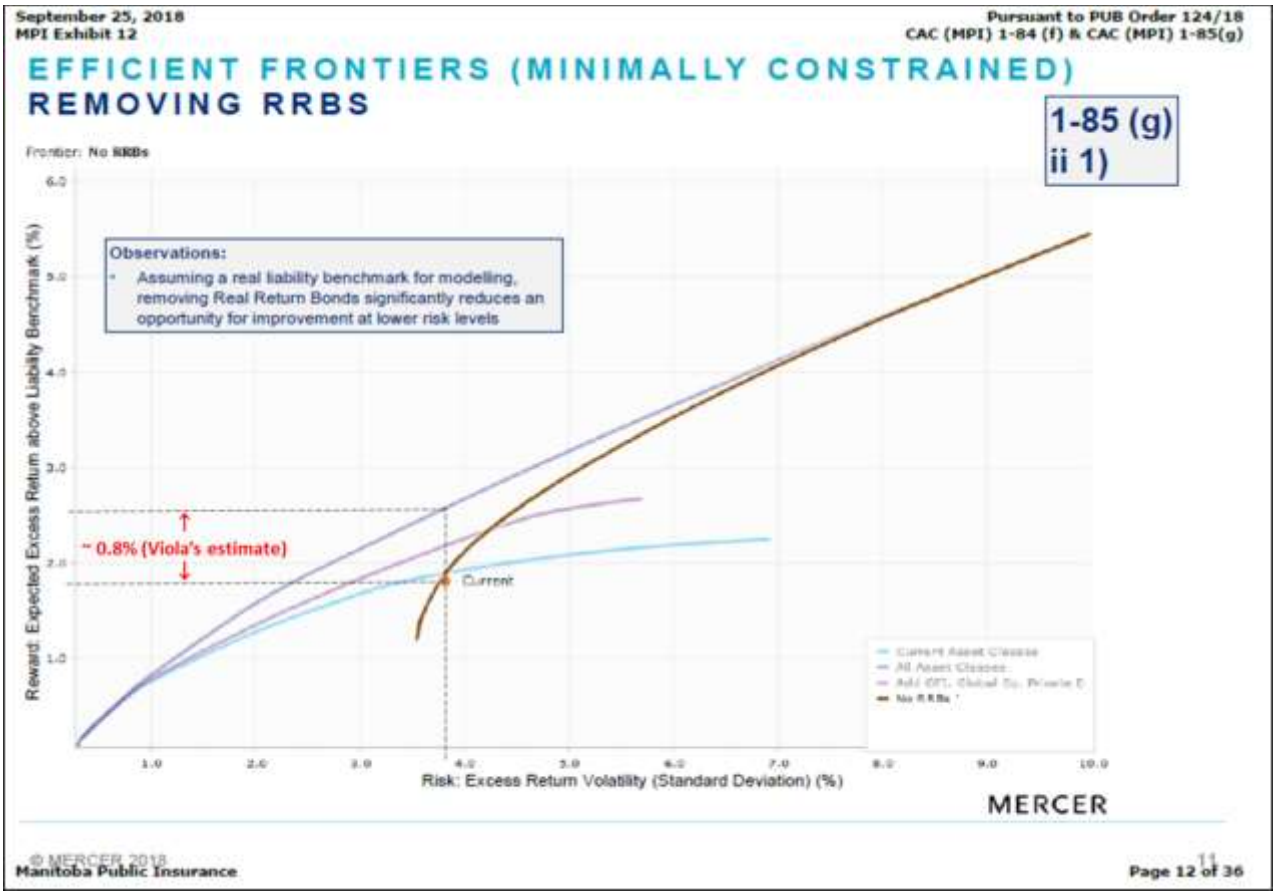
+45% "Gross" RRBs
- 30% Treasury Bills
+15% "3X RRBs"

[21] 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*



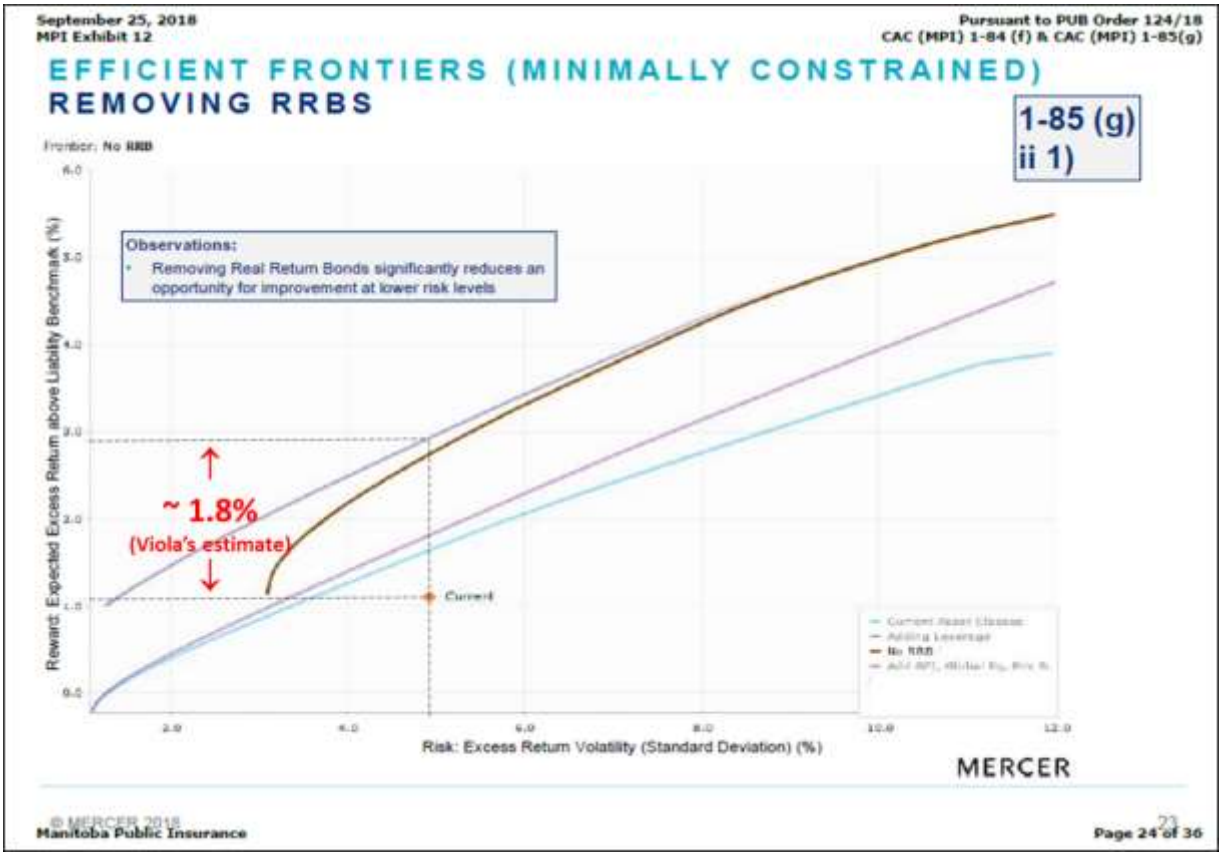
Mercer's Observations	Note
STEP 7. RESTRICTING PUBLIC EQUITIES (P 13 OF 36) 10. The unrestricted frontier (purple) contains higher allocations to Canadian equities at lower risk levels and higher allocations to Emerging Markets equities at higher risk levels 11. Restricting public equities based on the MPI recommended weights appears to slightly reduce the reward to risk trade-offs (the orange frontier is below the other lines) 12. The ACWI* weight restriction appears to further reduce the reward to risk trade-offs (green frontier is at the bottom) 13. 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[22]. 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 ~ 1.8% 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).

[22] 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**[23] to take less risk than the "Current" portfolio.

Portfolio		Asset Allocation	Return[24]	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[25]	3.9%	
R	"Minimally Constrained" Portfolio[26] (using **R**eal Liability Benchmark)	70.0% Fixed Income 21.5% Equities[27] 8.5% Other Real Assets	4.9%	

[23] 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).
[24] The 3.1% and 3.9% figures are my calculations, using Mercer's capital market assumptions.
[25] Real estate and infrastructure
[26] MPI Exhibit 12, page 11 of 36
[27] 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[28] 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)[29]

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).

[28] 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.)

[29] 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

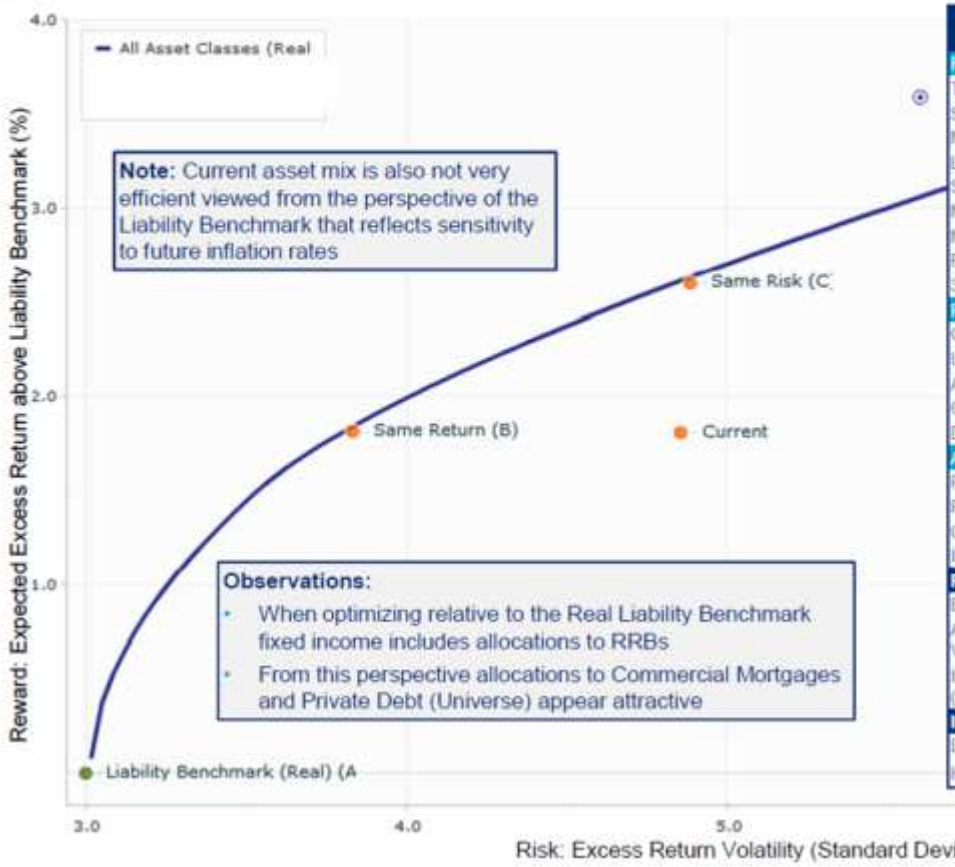
Table	Content	Materiality of Liability Benchmark Choice
A	**Table A shows return/risk metrics** for a portfolio that has the same expected return as the current portfolio (~ 4.2%), but is more efficient than the current portfolio (i.e. less risk); **The asset allocations** are also shown	The main difference 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

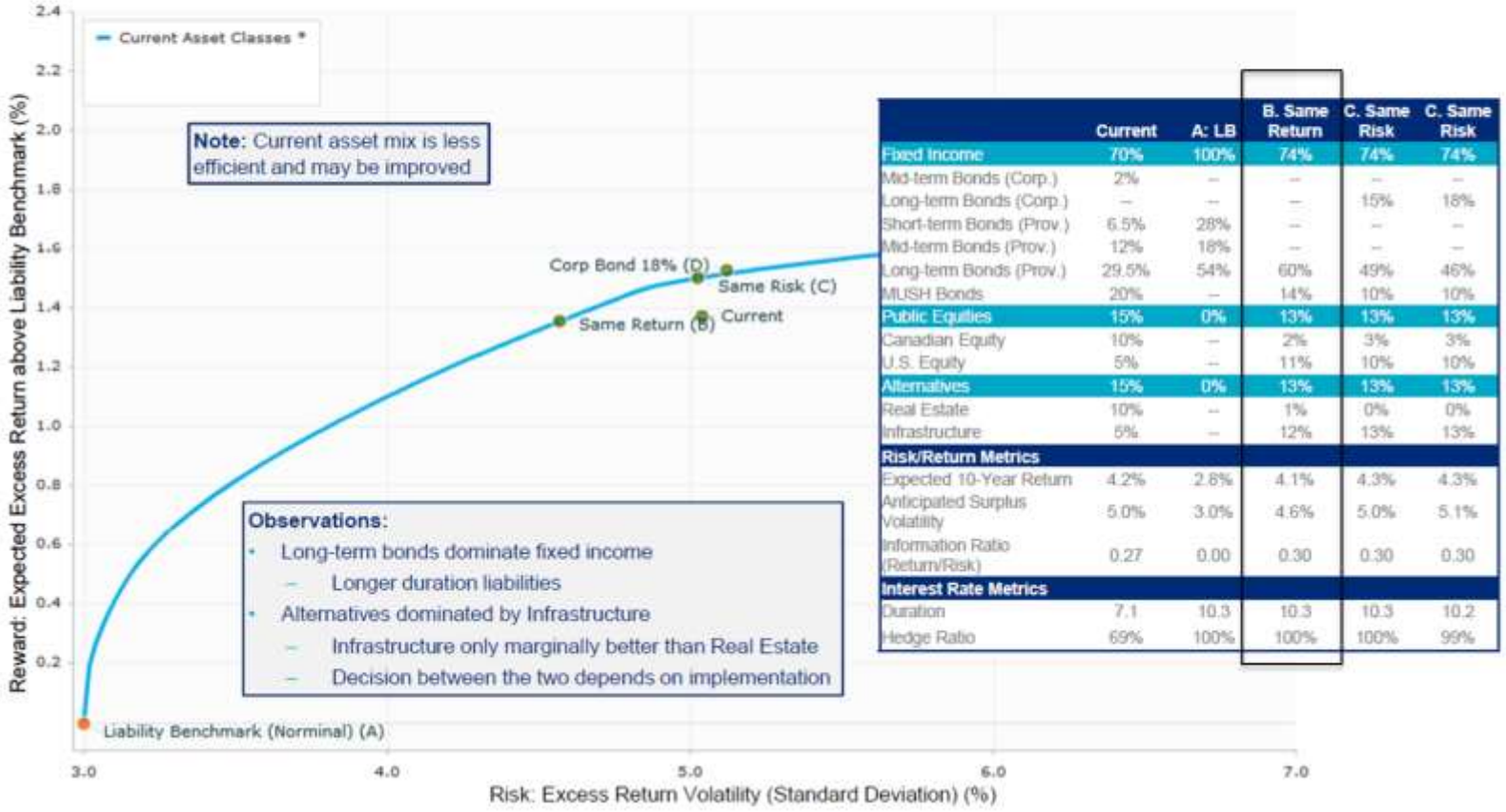


	Current	A. Real LB	B:Same Return	C. Same Risk
Fixed Income	70%	100%	59%	43%
Treasury Bills	--	26%	--	--
Short-term Bonds (Prov.)	6.5%	8%	27%	--
Mid-term Bonds (Prov.)	12%	--	--	--
Long-term Bonds (Prov.)	29.5%	--	--	--
Short-term Bonds (Corp.)	--	--	3%	15%
Mid-term Bonds (Corp.)	2%	--	--	--
MUSH Bonds	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:

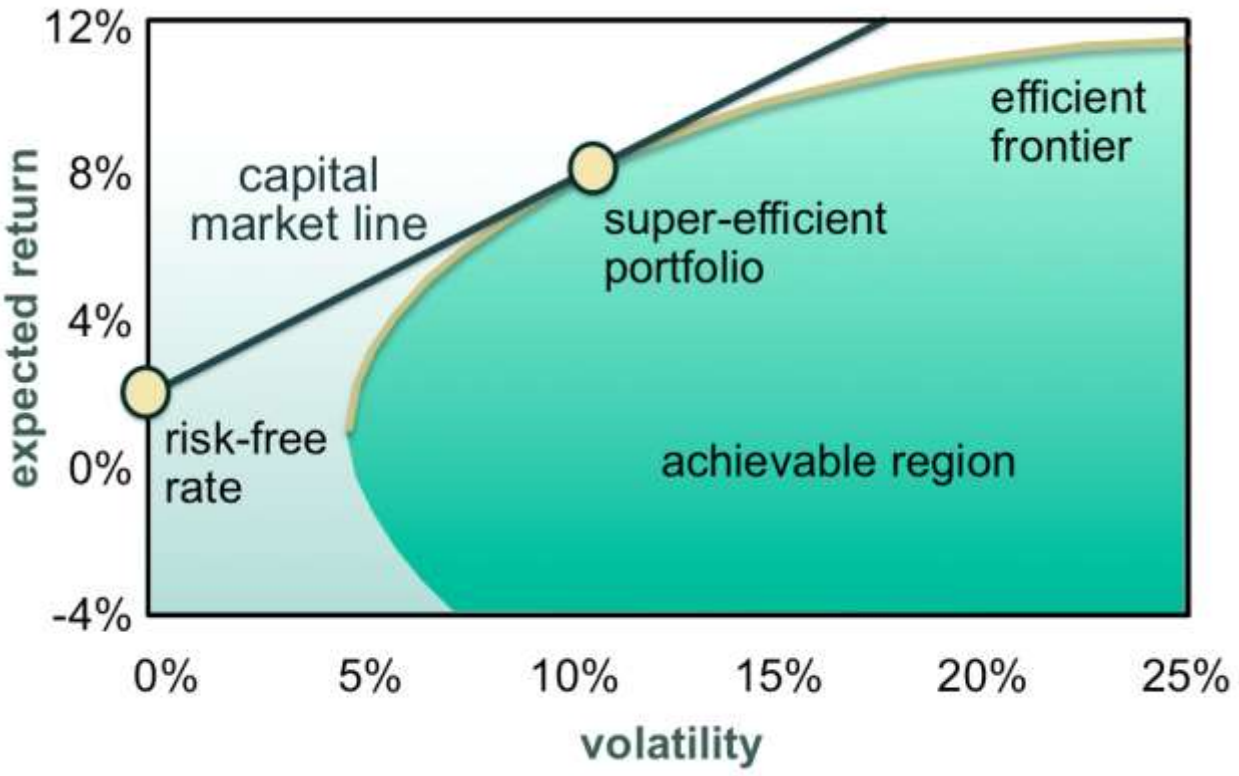
> By synthetically increasing exposure to bonds, investors can track liabilities in a capital efficient manner as market interest rates change.
>
> Since funding costs are currently lower than the yield-to-maturity on the underlying bonds, a long bond overlay strategy comes with a positive expected return. 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[30] 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".

[30] 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"[31], 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"[32].*

[31] Another portfolio, involving Provincial Bonds, was also considered.
[32] 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[33] (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.[34])

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)".

[33] 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).

[34] 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%).[35]

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*

[35] 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

Manitoba Public Insurance
2017/18 GRA

MPI's Investment Portfolio
Risk, Return and Good Practice

Prepared for Consumers' Association of Canada, (Manitoba) Inc.
Submitted by the Public Interest Law Centre

Valter Viola

September 26, 2016

CONTENTS

INTRODUCTION

Terms of Reference

I was retained by the Consumers' Association of Canada Manitoba ("CAC") to advise and assist on issues related to the MPI investment portfolio (the "Portfolio"), including a good practice consideration of issues related to risk versus return and prudent, reasonable and appropriate management of the 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.

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

Rate Application Materials Reviewed

My review of the Rate Application focused on information related to the portfolio, including:

- Asset-Liability Studies;
- MPI's Investment Policies; and
- MPI's Financial Statements and Accounting Principles.

Other Considerations

I also reviewed and considered the following other information:

- MPI's most recent annual report;
- Information responses prepared by MPI and/or Aon to CAC questions relating to its investment portfolio;
- annual reports/websites of selected other funds;
- selected information from Rate Applications related to prior years;
- Report on Canadian Economic Statistics to 2013[1]; and
- Asset Mix Survey of Canadian defined benefit ("DB") pension plans prepared by Pension Association of Canada ("PIAC").

To a lesser extent, I reviewed information about MPI's capital adequacy (reserves). I also read the IRFRF Technical Conference Materials and participated in the session by phone.

[1] The latest report was not used. Instead, data from 2013 was used since this data would have been the data available when the 2014 asset-liability study was completed by Aon.

Organization of this Document

This document consists of these three sections:

I. OVERVIEW AND OVERSIGHT/GOVERNANCE;
II. MEASUREMENT; and
III. MANAGEMENT.

This document takes into account three (3) inconvenient truths, and their consequences, which are illustrated below.

TRUTH	**We don't know very much**	**Beneficiaries/ owners ≠ managers**	**Correlations are not perfect**
	Low signal/noise (return/risk) ratio	*Institutions manage $ for clients/beneficiaries*	*Risks don't add (1 + 1 ≠ 2)*
Truth and Consequence	We need to make investment decisions but **we don't know very much**	The interests of stakeholders[1] may not be aligned because **beneficiaries/owners are not the same as managers**	The effect of an investment on total portfolio risk depends on the characteristics of other assets in the portfolio because **correlations are not perfect**
HELPFUL TOOLS	**BELIEFS[2]**	**CAPITAL/REGULATORY FRAMEWORK[3]**	**RISK FRAMEWORK[3]**

1. Stakeholders include MPI, rate-payers and Manitoba Finance.
2. Beliefs support long-term portfolio design (e.g., asset mix).
3. Capital/Risk/Regulatory Frameworks provide a focus (clarity in mission) and process to overcome common barriers to excellence.

BELIEFS: In Section I (OVERVIEW AND OVERSIGHT/GOVERNANCE) my beliefs related to risk management are summarized, along with a list of common challenges ("barriers to excellence") among organizations generally, and asset management firms in particular. I believe that two of the top three challenges facing asset management firms relate to their **focus and process**, and the beliefs help to address these challenges.

The third challenge relates to resources, which in MPI's case, includes a portfolio that is closer to $2 billion than $200 billion. Simply put, practices that are appropriate and prudent for a $200 billion fund may not be available to a $2 billion fund, though the beliefs and principles that are deemed to be appropriate and prudent for both funds may be the same.

FRAMEWORKS FOR RISK/CAPITAL MANAGEMENT: The second and third truths (including their consequences), inform **Measurement** (Section II) and **Management** (Section III) – i.e., long-term asset mix decision-making.

Terminology

Appendices include a glossary of terms to facilitate discussions, including the terms listed below. Not all of these terms may appear in this document, but all terms were defined in either CAC (MPI) 1-67 or CAC (MPI) 2-34.

• Accounting reports • Actuarial reports • Asset risk • Assumptions • Available for sale (AFS) • Duration • Financial assets and liabilities at Fair value through profit or loss (FVTPL) • Held to maturity (HTM)	• Inherent risk • Investment risk • Liability from Basic Claims • Liability from pension plan • Liquidity risk • Market interest rate • Market reports • Market risk • Other comprehensive income (OCI)	• Reinvestment rate risk • Risk • Risk (as defined in Asset-Liability Study) • Risk-free rate • Risk profile • Surplus risk • Unrealized gains and losses • Valuation methodology • Value

Appendices include other information that is referenced in one or more sections.

AUTHOR BACKGROUND

Relevant Experience

With over 20 years of experience in the institutional fund management sector, I have 12 years of combined executive, senior management and other experience at two of Canada's largest institutional investors:

- ~ $290 billion CPP Investment Board (2000 to 2005); and
- ~ $170 billion Ontario Teachers' Pension Plan (1993 to 2000).

I have a decade of consulting experience (Holland Park Risk Management, since 2005) advising some of North America's largest institutional investors (boards, investment committees, executives and other staff) on various aspects of investment risk management, measurement and governance. Clients have also included 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 A.

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).

EXECUTIVE SUMMARY

This paper has been informed by:

- principles that are generally accepted and relevant in the circumstances;
- investment beliefs that, by definition have varying degrees of empirical support and theoretical justification, but which I hold and consider to be reasonable and relevant in the circumstances; and
- facts from a variety of sources, including:
    - MPI (e.g., the Rate Application, audited financial statements and responses to CAC questions); and
    - Aon (e.g., Asset-Liability Study and responses to CAC questions related to it).

Recommendations

Clarity of Accounting Choices	MPI should clarify what flexibility it has regarding the accounting for assets and liabilities, while remaining GAAP-compliant, and the factors it takes into account in electing to use one method/assumption over others.
Adoption of More Comparable Accounting Principles	In measuring its investment portfolio and liabilities, MPI should consider adopting accounting principles, where GAAP allows MPI to make such elections, that reduce the discrepancy between net income and comprehensive income (as these terms are currently defined by MPI), to improve comparability across all assets as well as liabilities. Comparability would be improved, for example, by accounting for more assets in a way that is consistent with the treatment of financial assets and liabilities at fair value through profit or loss ("FVTPL").
AFS and HTM Accounting	Unrealized gains and losses for AFS assets (~ 20% of assets), for example, are reported as "other comprehensive income (OCI)" and are excluded from net income until realized, making the net income recognition for unrealized gains on equities (~ 18% of assets) inconsistent with FVTPL assets. The treatment of HTM Bonds (25%), recorded at amortized cost, should also be re-considered. Market valuations are generally more comparable, relevant, transparent, understandable and subject to less potential bias than valuations in reports that are based on MPI's current accounting practices.
Pension Liability Accounting	Reconsideration should also include the remeasurement of employee benefits (~ 15% of liabilities and equities) which is considered OCI. The remeasurement of employee benefits is large (given the long duration of pension liabilities), but OCI arising from changing interest rates that impact the value of pension liabilities is not recognized through transfers to net income under current practices.
Return/Risk Definitions for Asset Mix Decision	MPI should re-define return/risk used to inform its long-term asset mix decisions to be based on valuations that reflect market values, rather than accounting ones (which may be materially different). At a minimum, net income should be replaced by comprehensive income in the numerator (return) and retained earnings should be expanded to include accumulated other comprehensive income (AOCI) in the denominator (risk). In the long term, market returns and market risks will determine average long-term premium rates, regardless of how assets and liabilities are accounted for under GAAP.

De-Linking Discount Rates	For purposes of long-term asset allocation decision-making, MPI should consider "breaking the link" (recursive) between liability valuations and the yield on some of its assets. Economic theory suggests this approach is more appropriate.
Min/Max Asset Class Constraints	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.
Evolved Risk Framework	An evolved risk framework should be considered to improve portfolio/risk measurement, management and/or governance.

Explicit Risk Management Goals	Among other things, the risk framework could include explicit goals related to market risk management (as well as goals related to other types of risk if those require enhancement). One goal might be to avoid "undue risk", which is risk that is taken:
	• unknowingly, not having been identified (unaware); or
	• knowingly, but which:
	  ○ cannot be managed prudently, given current capacities (ineffective);
	  ○ exceeds risk tolerances (prohibited);
	  ○ is higher than it needs to be (inefficient); or
	  ○ is not understood (uninformed).
	
	Another goal might be to get paid better/well for those risks that are desired, with incentive systems that encourage desired behaviours that achieve desired outcomes and controls that monitor compliance with limits that discourage/prevent undesired behaviours and prevent undesired outcomes.

Minimum Risk Portfolio	A minimum risk portfolio (for market risk) should be clearly defined. It should be aligned with the interests of relevant stakeholders, with clarity regarding the short-term and long-term factors that impact rate sustainability and other important outcomes.
Canadian Equities' 10% Minimum Allocation	The appropriateness and prudence of having a 10% minimum weight to Canadian Equities ("to retain a meaningful exposure to home markets") should be reconsidered, given the different interests of different stakeholders (e.g., employees through the pension plan), the concentrated nature of Canada's equity market, and other such relevant considerations.
No International Equities	The appropriateness and prudence of having no exposure to International Equities should be reconsidered, given the large size of non-US foreign markets, the return opportunities that are potentially available from those missed opportunities and the effects of increased international diversification on long-term market risks.
No Over-Reliance on Quantitative Modeling	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.
Exclusion of Real Return Bonds	The role that RRBs can play in effectively managing relevant risks should be discussed, with consensus achieved regarding the effectiveness of RRBs from a risk management perspective (i.e., independent of the cost of any "insurance" as measured by RRB yields and their expected returns).
Effectiveness of Duration Policy	The effectiveness of the duration policy should be reviewed, given the inherent risks of changing real interest rates and unexpected inflation arising from MPI's liabilities, and exposure to changes in nominal interest rates in the MPI portfolio (i.e., nominal bonds

	without inflation protection). More specifically, MPI should re-assess the effectiveness of its duration-matching strategy since inflation (actual and/or expected) may differ from current expectations.
Integration of Real Estate/Infrastructure Liabilities in Duration Management	MPI should consider the liabilities arising from all sources (i.e., including real estate and infrastructure) in its interest rate risk management practices (duration), to be consistent with its management of risks arising from insurance, pension and other liabilities. The financial leverage assumptions used in Asset-Liability Studies that support long-term asset mix decisions should be made consistent with the leverage actually used in the portfolio, removing the ~ 4% difference related to real estate debt.
Removal of 105% Rule in Investment Policies	MPI should remove from its Investment Policies the ability to request external managers to realize gains (losses) ("105% Rule"), which MPI says "is no longer relevant". This would remove an ability by MPI to cause a manager to realize gains (losses) for the sole purpose of having an impact on net income, without yielding any economic value, reducing risk or otherwise conferring another benefit on MPI.
Pension Fund	The interests of all relevant stakeholders should inform decisions regarding both the accounting for and management of the assets and liabilities related to the pension plan and other employee benefits. A desirable outcome is to have greater clarity around the appropriateness and prudence of maintaining different types of assets and liabilities commingled in one fund.

I. OVERVIEW AND OVERSIGHT/GOVERNANCE

Principles that Informed Evidence and Questions

Principle #1: The Valuation Basis Should Reflect the Specific Need

The basis for valuing assets and liabilities, and recognizing revenues, expenses, gains and losses, should reflect the specific need (i.e., decision). Some needs are common to all stakeholders (e.g., assessment of past performance) and can be met by the application of generally accepted accounting principles (GAAP), with perhaps minor adjustments, while other needs are better met using other bases for measurement that require much larger adjustments to GAAP.

I believe that long-term, asset mix decisions in particular requires the use of market valuations in calculations of returns and risks rather than ones that are based on accounting valuations.

Principle #2: Common Barriers to Excellence Should Be Acknowledged and Addressed

Institutional investors face common challenges ("barriers to excellence"). For example, over 20 years ago senior executives responsible for managing defined benefit pension plans cited the following three largest barriers to excellence:

1. Poor **process** (almost 100%):
    a. Structure;
    b. **Communication**;
    c. Inertia;
2. Inadequate resources (~ ½); and
3. Lack of **focus** or clear mission (almost ½).

This evidence and questions I posed were informed by the first and third common challenge noted above. i.e., process (#1), including communication (i.e., accounting) and focus (#3), including how return/risk is defined.

Given the nature and scope of my terms of reference, I include no observations regarding resources (#2 challenge).

The next page shows the source for these common barriers, including the rest of the "Top 10" list of barriers, with "conservatism" being #4.

Table 2.2 Barriers to Excellence in Pension Fund Management: The Views of 50 Senior Pension Executives

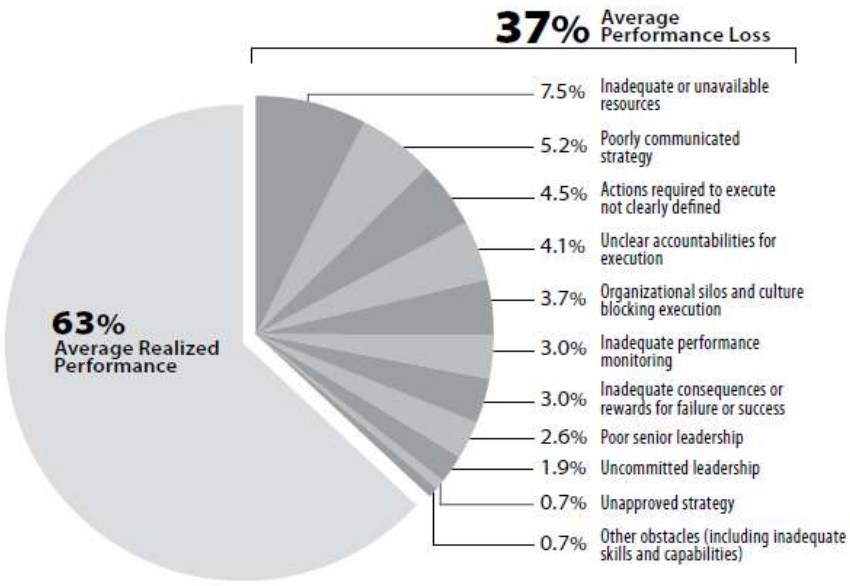
Rank	Barrier	Cited (%)
1	Poor process (including structure, communication, and inertia)	98
2	Inadequate resources	48
3	Lack of focus or of clear mission	43
4	Conservatism	35
4	Insufficient skills	35
6	Inadequate technology	13
7	Conflicting beliefs	8
7	Difficult markets	8
9	Lack of innovation	5
9	Suppliers	5

Source: Excellence Shortfall in Pension Fund Management: Anatomy of a Problem, by K. Ambachtsheer, C. Boice, D. Ezra, and J. McLaughlin, unpublished Research Paper, October 1995.

A Harvard Review article (2005) made similar observations (below) regarding organizational performance generally (i.e., not just pension funds or other types of institutional investors), describing "where the performance goes" and how average realized performance falls short (only 63%, per graph below).

Where the Performance Goes

This chart shows the average performance loss implied by the importance ratings that managers in our survey gave to specific breakdowns in the planning and execution process.



Beliefs that Informed Evidence and Questions

The first "inconvenient truth" is that **we need to make investment decisions but we do not know very much in the field of investments due to the low signal/noise (return/risk) ratio**. As a result, we need to rely on beliefs and I believe that it is important to be transparent about those beliefs. (MPI has included some of its beliefs in its Investment Policies, and I list five of mine below.)

The five beliefs listed below were developed by a former colleague of mine at CPPIB, whom I consider to be a global thought leader in investment management[4].

Belief #1: SUSTAINABILITY: The major stakeholder risk is that the current provisions will not be sustainable in the future (recognizing that investment returns are one of many factors which will contribute, positively or negatively, towards sustainability).

This belief is important because "lack of focus or clear mission" was cited by almost ½ of surveyed pension executives as being a large barrier to excellence (3rd largest challenge).

I believe that investment programs need to focus on the risk of long-term sustainability, and to develop the key metrics (starting with risk) that clearly define the primary risk (i.e., primary risk metric, and time horizon).

Belief #2 (MINIMUM RISK PORTFOLIO): Determining the Minimum Risk Portfolio is the first step towards responsible long-term management of the portfolio.

This belief is important because "poor process" was cited by almost 100% of surveyed pension executives as being the largest (#1) barrier to excellence. I believe that investment programs need to have better processes for communicating the primary risk and the structures to support the management of that primary risk (i.e., metrics that define return/risk tradeoffs, with a long-term perspective).

I believe that MPI's minimum risk portfolio (MRP) should include at least some long-duration real return bonds (RRBs), given the nature of MPI's liabilities (long term, with some inflation exposure). Note, however, that 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 follow-on questions requires additional beliefs, starting with the next two beliefs below (taken together).

[4] Donald Raymond led the development of these beliefs as Vice President, Public Markets at CPP Investment Board. These beliefs were approved by the CPPIB Board of Directors, and reviewed by three other external advisors who were considered to be thought leaders as well.

Belief #3 (ADDITIONAL RISK): Taking additional risk beyond the Minimum Risk Portfolio should be done only if the expected additional returns justify doing so.

AND

Belief #4 (TOTAL PORTFOLIO): The additional risk to the Total Portfolio is the relevant risk to consider if risk beyond the Minimum Risk Portfolio is taken.

Together, Beliefs #3 and #4 imply that the attractiveness of any asset class should be assessed, not in isolation, but in the context of the other assets that are in the portfolio or contemplated to be in the portfolio, and the MRP that is defined in Belief #1 and #2.

The rationale for taking a total portfolio approach stems from the "inconvenient truth", mentioned earlier, and re-stated below.

> The effect of an investment on total portfolio risk depends on the characteristics of other assets in the portfolio because correlations are not perfect.

In questions related to RRBs, MPI said:

> *"Real return bonds were excluded … because they were deemed to be expensive. Aon Hewitt's … assumptions showed **real return bonds to have significant volatility and down side risk*** with modest returns relative to nominal bonds …. Also, page 17 of the Phase 1 report Aon concluded that "RRBs are not a good inflation hedge"."* [5]
>
> *** Emphasized by me, not MPI, to highlight a fundamental difference in beliefs.**

When asked if MPI agreed with AON's conclusion that **RRBs are not a good inflation hedge**, MPI said:

> *"The Corporation accepts Aon's belief that there are other inflation hedging asset classes available (i.e.: real estate and infrastructure) with greater expected returns … At the time of the ALM study the real yields on RRBs were below 40 bps for 20 year terms and below 10 bps for 10 years and shorter terms. Real yields for the same terms are currently negative."*

Asked why Aon believes RRBs are not a good inflation hedge for MPI, Aon's response was:

> *"RRBs are not a good inflation hedge for MPI for the following reasons:*
>
> 1. *The underlying inflation according to nominal and real return bonds do not match the inflation used to value liabilities (which is based on a survey of Canadian banks);*
> 2. *RRBs suffer from a limited offering;*
> 3. *Supply and demand for RRBs have a large impact on the market value; and*
> 4. *Therefore, the economics of the inflation protection from **RRBs do not match the financial impact to MPI on a year by year basis**."* [6]
>
> *** Emphasized by me, not Aon, and discussed on the next page.**

[5] Source: CAC (MPI) 1-77

[6] Source: CAC (MPI) 2-39

My observations related to Aon's four points are:

1. this is a problem with the method for valuing the liabilities (survey of Canadian banks), which is not a market-based method, not a problem with the hedging properties of RRBs against a market-valued set of liabilities;
2. while RRBs suffer from a limited offering (liquidity), larger funds have managed to accumulate significant exposures (e.g., the average PIAC fund has 3%);
3. while supply and demand for RRBs may have a large impact on market value, presumably this is a one-time market impact acquisition cost – a small price to pay if RRBs are considered a buy-and-hold asset class, with little turnover; and
4. Aon appears to concede that RRBs do offer inflation protection (despite their earlier comment to the contrary) but that **RRBs do not match the financial impact to MPI on a year by year basis**. This last point represents the symptom of a bigger problem, which relates to the next belief (constraints).

When asked if Aon could list one or two asset classes that offer better inflation hedges than RRBs for MPI, and offer any evidence to support that belief, Aon said it could not, adding:

> *"There is no asset class that we know that can hedge the short term inflation risk … Over the long term, **where RRB's are held to maturity, shorter term price sensitivity is less relevant and inflation experienced over the period would result in higher cash flows and an inflation hedge*.** It is a commonly accepted belief … that higher inflation would gradually be reflected in nominal bond yields, equity returns through higher profits, real estate through increased rents and infrastructure, especially where regulated, through increased tariffs ..."*
>
> *** Emphasized by me, not Aon, to note the tradeoff between shorter term price sensitivity (less relevant according to Aon, with which I agree) and inflation experienced over the period which would result in higher cash flows and an inflation hedge.**

Belief #5 (CONSTRAINTS): Constraints never increase expected risk-adjusted returns.

This belief is important because there appear to be two very binding constraints that may cause MPI to have lower risk-adjusted returns.

These very binding constraints relate to:

1. **HOW RISK IS DEFINED** (i.e., with focus on the short term)
   "The short-term volatility of the premium rate requirement is a primary concern"[7]; and

2. **HOW ASSET CLASSES ARE CONSTRAINED**
   Minimum/maximum asset allocations in optimizations conducted as part of the most recent Asset-Liability Study, for example, are overly restrictive.

   The constrained optimization problem results in a "pre-determined" allocation to ≥ 80% of the portfolio, leaving little room to optimize return/risk tradeoffs (i.e., allocating ≤ 20% of the remaining assets). This is discussed further in another section.

[7] Source: CAC (MPI) 1-73

II. MEASUREMENT

The Measurement Section consists of two parts:

- Background; and
- Q&A with MPI about Accounting and Portfolio/Risk Management Dependencies.

Background

Different Users of Financial Information Have Different Needs

There are a variety of stakeholders who have an interest in MPI, including:

- MPI;
- consumers, who are premium/rate-payers; and
- Manitoba Finance.

Each stakeholder has common information needs regarding MPI's financial affairs, as well as unique ones that reflect their unique interest or relationship with MPI as well as their unique roles/responsibilities.

To meet the information needs of such a varied group of stakeholders, it is not reasonable to expect one set of reports to satisfy all needs of all stakeholders. That is why different kinds of reports are provided by different types of professionals, including:

- accountants;
- actuaries; and
- portfolio/risk managers.

These three information providers, and the bases for their reporting, are summarized below to facilitate discussions and avoid potential confusion. While accountants, actuaries and portfolio/risk managers use similar terms (e.g., "assets" and "liabilities"), the bases for assigning values to assets and/or liabilities often varies and these differences can be material.

This is important because the appropriateness and prudence of relying on a particular set of metrics (e.g., those prepared in accordance with GAAP) depends on the circumstances (i.e., the intended use of the information). In MPI's case, for example, MPI defines return/risk using accounting metrics ("net income/retained earnings"), rather than metrics based on market values. As a portfolio/risk manager on the one hand and former professional accountant on the other hand, I appreciate the usefulness of different measurement bases for different purposes and the potential for confusion among stakeholders that may arise.

Before reviewing the methods/assumptions used by each provider of information, and the circumstances under which one method or source is more appropriate and prudent than others, it is important to understand the characteristics of information that make it more useful in decision-making.

Useful Information Has Key Characteristics

The quality of information varies depending on many factors, and an assessment of information quality starts with clarity and agreement on the specific need (decision support) and the relevance of the information in meeting that need. Some of the characteristics of information that make it more useful are listed below. To inform the development of GAAP, for example, the accounting profession suggests that information is more useful if it is more:

- relevant;
- neutral/unbiased;
- free from error;
- comparable over time and across assets and liabilities;
- verifiable; and
- timely.

Tradeoffs exist, so choices need to be made. For example, information that is most relevant (e.g., about an uncertain future) may be less reliable compared to the past (no uncertainty, since it happened).

Accountants, Actuaries and Portfolio/Risk Managers are Guided by Different Principles

Each type of professional is guided by principles and standards that are considered appropriate and prudent in their profession.

Accountants are guided by **generally accepted accounting principles ("GAAP").**

Actuaries are guided by **actuarial standards of practice ("ASOP")**.

Portfolio/risk managers are guided by **generally accepted risk principles ("GARP")**.

GAAP, ASOP and GARP are All Important, But They Answer Different Questions

GAAP, ASOP and GARP have similarities, but also many differences. As the table below illustrates, reports prepared by accountants, actuaries and portfolio/risk managers differ in at least three respects:

- time period (past, present and future);
- basis for valuation and conservatism (e.g., historic/amortized cost, market value, etc.); and
- single valuation, compared to a range.

Role	Principles/ Standards	Relative[8] Focus (Scale from 1 to 10)			Perspective	Questions ↓ Decisions	Key Outputs (Answers)
		Past	Present	Future			
Accountant	**GAAP**	5 ●●●●●	4 ●●●●	1 ●	Today and Past (last 2 years)	What happened? ↓ Performance Assessment	GAAP-compliant Financial Statements (balance sheet, income statement)
Actuary	**ASOP**	0	3 ●●●	7 ●●●●●●●	Today and Future (decades)	What is expected to happen? ↓ Funding (Premiums/ Rates)	ASOP - compliant Rate-Setting Processes, Analyses and Valuations
Portfolio/ Risk Manager	**GARP**	0	2 ●●	8 ●●●●●●●●	Today and Future (decades)	What could happen (good and bad)? ↓ Return/Risk Profile (Asset Mix)	Efficient Frontiers (Expected Returns/Risks[9])

[8] Numbers are indicative and designed to illustrate different time perspectives.

[9] The author believes strongly that return/risk metrics should be based on the market value (as distinct from accounting value) of assets and liabilities.

The following observations are intended to distinguish between the perspectives of accountants, actuaries and portfolio/risk managers to facilitate discussions. The observations are not meant to be a complete list of how the three professionals satisfy the requirements of their profession.

Accountants

Accountants prepare accounting balance sheets (statements of financial position) at a point in time (the present), and income/cash flow statements about the recent past (prior two years).

While some values related to "present valuations" involve expected future cash flows, most reporting relates to the present financial condition as well as the results of operating, investing and financing activities from the recent past.

The present valuation of future cash flows, for the purpose of assigning a value to assets and/or liabilities, is prescribed under GAAP with GAAP-compliant practices that vary between different types of organizations (public sector vs private sector), different jurisdictions (Canada vs United States) and different sectors (insurance companies, pension plans, etc.).

Actuaries

Actuaries prepare actuarial valuations at a point in time (the present), and project income/cash flows into the future (decades). Their actuarial reports help to inform decisions about the sufficiency of assets in relation to the liabilities at a point in time and possibly the sustainability (i.e., rate adequacy) of an insurance plan or pension plan, as the case may be, over the longer term.

Portfolio/Risk Managers

Portfolio/risk managers prepare valuations at a point in time (the present) and assessments of the market value at risk arising from potential future scenarios that vary in terms of their likelihood/probability as well as severity/attractiveness (adverse vs favourable related to assets, liabilities or both).

Unlike accountants, portfolio/risk managers measure opportunity costs, as well as actual or projected costs. For example, a portfolio manager may consider the return of a benchmark portfolio (e.g., S&P 500) and a risk manager may consider risks in relation to that same benchmark portfolio ("tracking error" or active risk) as well as in relation to a minimum risk portfolio that serves as a proxy for underlying liabilities ("surplus at risk" or funding risk).

Many Discount Rates, Each to Meet a Different Need

For accounting purposes, MPI uses a discount rate for valuing liabilities that depends on yields related to MPI's assets. For actuarial purposes, MPI uses a discount rate that reflects the principles and standard for that profession. For portfolio/risk management purposes, discount rates should reflect market opportunities, and these rates may differ significantly from both accounting and actuarial discount rates.

Terminology Can Be Confusing, Given Different Bases for Measurement

The next page starts with MPI's balance sheet, prepared in accordance with GAAP, to facilitate discussions and to contrast GAAP (accounting perspective) on the one hand with GARP (portfolio/risk management perspective) on the other hand.

A glossary of terms is included in Appendix B.

> For example, "comprehensive income" is the sum of "net income" and "other comprehensive income (OCI)".

These definitions are important because MPI uses accounting definitions for return/risk analyses that support long-term asset mix decisions, and these are not the same as market-based definitions (which the author believes are more relevant to support long-term asset mix decisions).

The next page illustrates the "adjustments" that a portfolio/risk manager might make to MPI's accounting values, to meet his/her asset allocation/risk management needs, using information from MPI's financial statements that MPI confirmed (in a later section) was correctly interpreted by me.

MPI's Balance Sheet (GAAP) Needs "Adjustments" for Portfolio/Risk Management

The table below shows accounting values as a percentage (%) of the total portfolio from MPI's recent financial statements, including three (3) types of assets – each with a different accounting basis.

Three colours highlight the extent to which the bases for accounting differ from market valuations (red = larger potential difference, yellow = more modest differences, green = immaterial differences, if any).
To appreciate differences between accounting and market valuations, the table below groups assets vertically based on MPI's accounting (FVTPL, AFS, HTM) and horizontally based on market volatility[10].
Assets are sorted on an accounting basis, with asset groups characterized as having smaller differences between market values and accounting values (green) at the top and larger differences (red) below. Assets are sorted on a market volatility basis with the least volatile assets on the left. Liabilities are grouped similarly, noting that the duration of employee benefits (including the pension) is higher than for unpaid claims (i.e., greater volatility).

Accounting Asset Group	Difference Between Market and Accounting Value	
FVTPL	Financial assets and liabilities at fair value through profit or loss	**Immaterial, if any**
AFS	Available for sale	**More modest**
HTM	Held to maturity + non-financial	**Largest potentially**

Accounting Asset (Liability)		A GAAP	B Reclassify	A + B Reclassified GAAP	*Lowest* Market Volatilities → *Highest* Cash	Bonds	Real Estate	Infra-structure	Equities
FVTPL	Infrastructure	3[3]	*	3				3	
	Real Estate – Pool	9	4*	13			13		
	Liabilities – Real Estate		(4)*	(4)		(4)			
	FVTPL Bonds[11]	42		42		42			
AFS	Cash[12]	2		2	2				
	Equities	18		18					18
HTM[13]	HTM Bonds	25	0	25		25			
	Real Estate – Property	1		1			1		
	Total Portfolio	100	0	100	2	63	14	3	18
Non-Portfolio Liabilities									
	Unpaid Claims	(70)		(70)		(70)			
	Employee Benefits	(15)		(15)					(15)
	Total Equity	15		15					

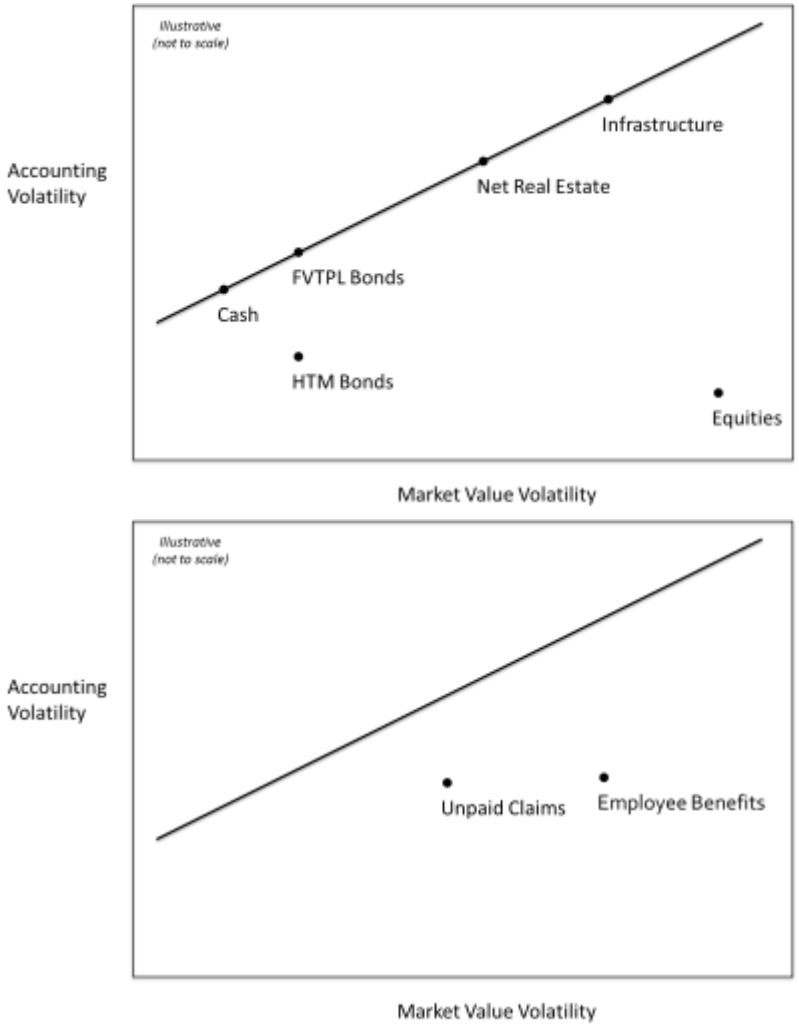
* Liabilities arising from real estate are reclassified for presentation purposes to "bonds" (by 4%) to be more consistent with assumptions used in Asset-Liability Studies. For simplicity, a similar adjustment could be made, but has not been, for liabilities arising from infrastructure given its smaller size and consistent treatment between asset-liability studies and implementation in practice.

[10] The order of market volatilities, from left to right, reflects the assumptions used in Aon's Asset-Liability Study.
[11] Includes Federal, Other Manitoba, Other Provinces and Corporates.
[12] Includes other assets (not material at ~ 0.1%).
[13] Accounting is assumed to be HTM. If this is not correct, the discrepancy is immaterial (only a 1% allocation).

The biggest differences between market values and accounting values are illustrated below, with assets shown in the top panel and liabilities in the bottom.

The X axis shows market volatility while the Y axis shows accounting value volatility.

If there were no differences between the bases for measuring assets/liabilities for accounting purposes on the one hand and portfolio/risk management purposes (market value based) on the other hand, assets and liabilities would plot along a straight 45 degree line (Y = X; i.e., no difference).



Assets/liabilities plotting below the line have market valuations that are more likely to deviate from their accounting valuations, on average. The larger the vertical gap from the line, the larger the difference is likely to be between accounting and market-based metrics. Portfolio/risk managers, including the author, may make adjustments to accounting values in their analyses to reflect these differences.

In MPI's case, notable differences from the above graphs arise for several items.

Equities (18% of Assets) and HTM Bonds (25%) Require the Biggest Adjustments

Equities (18%) are the most volatile assets, but the material component of equity volatility is recognized in net income only when gains/losses are realized through sales (i.e., unrealized gains/losses are included as OCI, not net income). HTM bonds (25%) are recorded at amortized cost for accounting purposes, which differs from market value.

Employee benefits (15%) and Unpaid Claims (70%) Require Adjustments Too

Employee benefits (15%) are the most volatile liabilities, given their long duration, but remeasurement of Employee Future Benefits Gains/Losses do not get recognized in net income (only OCI). Liabilities related to Unpaid Claims are valued for accounting purposes using a discount rate that is based on certain assets in MPI's portfolio, rather than a market rate that would be used by a portfolio/risk manager.

Q&A with MPI about Accounting and Portfolio/Risk Management Dependencies

This section reviews some of the questions that CAC posed and the responses from MPI and/or Aon. The questions were designed to better understand the dependencies, or lack thereof, between portfolio/risk management on the one hand (e.g., asset mix choice) and the basis for measurements (values of assets and liabilities, return/risk) on the other hand.

Reconciling Market Values, Accounting Values and the Nature of their Risks

The table below shows accounting values as a percentage (%) of the total portfolio using accounting values from a recent MPI balance sheet, consistent with those shown earlier.

	Portfolio[1]	FVTPL	AFS	HTM+Non-Financial
18	Equities		18	
10	Real Estate	9		1
3	Infrastructure	3		
42	FVTPL Bonds	42		
25	HTM Bonds			25
2	Cash		2	
100	**Total Portfolio**	**54**	**20**	**26**
		↓	↓	
	Unrealized Gains/Losses to:	Net Income	OCI	n/a
	Liabilities	**"Sticky" Yield[2]**	**"AA" Yield**	
70	Unpaid Claims	→ Net Income		
15	Employee Benefits	→	OCI	
85	**Total Liabilities**			
	Equity			
13	Retained Earnings			
2	Accumulated OCI			
15	**Total Equity**			
100	**Total Liabilities and Equity**			

[1] Other assets, net of other liabilities, are ~ 1% of the Total Portfolio (not shown).
[2] This represents the yield on the bond portfolio.

MPI confirmed that our understanding of the accounting, as depicted above, was correct by saying:

> *"your understanding is correct for the liabilities; however, please note that it is only the remeasurement of the employee future benefits that is put to Other Comprehensive Income (OCI), other items relating to employee future benefits is expensed to net income."*[14]

[14] Source: MPI's response to CAC (MPI) 1-71

I interpret this to mean that the (less uncertain/volatile) accrual related to employee future benefits is reflected in net income (and therefore included in the risk metric, as defined in the Asset-Liability Study), but that the (more uncertain/volatile) component arising from changing interest rates is not reflected in MPI's risk metric. (As noted in the notes to MPI's financial statements, the duration or interest rate sensitivity that results in "remeasurement" is high at 16 years – a topic discussed again in more detail in another section).

MPI did not comment on the "asset" side of the depiction above, so I assume that MPI is in general agreement with both the nature and size of the components of the assets, using the accounting-based valuations from MPI's financial statements.

Accounting as a Potential "Tool"

MPI was asked if one "general" tool that is either being used by MPI now, or could be used by MPI in the future, is the "choice" of metrics ("basis for measurement") for valuing assets, liabilities and income recognition. MPI said:

> "The "choice in metrics" for "valuing assets, liabilities and income recognition" is determined by … IFRS ... These items are not at … MPI … discretion."[15]

MPI Has Some Discretion re: Accounting, But It Is Not Clear What That Is

MPI was asked what flexibility it has in choosing accounting valuation methods for assets and liabilities and what their implications for net income and OCI are. MPI said:

> *"… MPI … is required to adhere to … IFRS ... Where there are choices within an IFRS standard, the Corporation evaluates the options and determines which is most appropriate for the Corporation."*[16]

MPI also said:

> *"certain interest rate movement can be elected to be in either Comprehensive Income or Net Income."*[17]

[15] Source: MPI's response to CAC (MPI) 2-34
[16] Source: MPI's response to CAC (MPI) 1-72
[17] Source: MPI's response to CAC (MPI) 2-34 f)

Asset Accounting is Not Comparable Across the Portfolio

The inconsistent valuation and treatment of unrealized gains and losses across asset classes is an undesirable characteristic of MPI's accounting metrics (lower transparency, less comparability), from the perspective of an external stakeholder (e.g., CAC). Some of this inconsistency may be due to the required application of GAAP in order to be GAAP-compliant while some of it may arise from MPI's election(s) to choose one method where GAAP provides such choice(s).

Asset Accounting: AFS Assets

Net income under GAAP is a metric that is influenced (positively or negatively) by both:

- the underlying transactions ("reality"); and
- how transactions are reported (i.e., accounting policies, which change over time, vary by industry/sector and region, and may provide some discretion or election to choose between two or more practices that are generally accepted and GAAP-compliant).

The adoption by MPI of AFS accounting for equities (~ 18% of assets), for example, implies that only realized gains will impact net income while unrealized gains will impact OCI. This means that net income depends on equity "turnover", which is controllable directly by the manager and indirectly by MPI. (Comprehensive income would not change as a result of turnover alone, except for the related transaction costs.) The potential for MPI to impact net income in this way, without adding real value as a result of the transaction, is a governance feature that can be improved upon.

The Investment Policy Statement says:

> *"The Corporation may … request external equity investment counsels to realize capital gains that have accumulated …. The ability to realize gains is subject to the ratio of the market value to book value of the total of both the Canadian and U.S. equity portfolios (in their native currencies) exceeding 105%. The market value to book value ratio must not fall below 105% as a result of the gains taking process."*[18]

When asked what circumstances would cause MPI to request managers to realize gains that had accrued and about the significance of the "105% rule", MPI replied:

> *"The Corporation has not requested equity managers to realize capital gains for several years and does not foresee any reasons to request the managers to realize capital gains in the future. The 105% rule was added to the Investment Policy Statement (IPS) during the 2005 IPS Review. The rule was established to provide a buffer from equity market volatility. This rule is no longer relevant to the management of the investment portfolio."*

[18] Source: CAC (MPI) 1-89

Asset Accounting: HTM Assets

Because HTM assets are carried at amortized cost in MPI's financial statements[19], some of the market risks for a significant portion of the portfolio (~ ¼ of MPI's assets) are not captured in the risk definition used by MPI in long-term asset-liability studies (i.e., the risk definition is an accounting one, which "under-reports" the true market volatility for HTM assets, among other assets and liabilities, as noted elsewhere in this document).

Liability Accounting: "Remeasurement" of Employee Benefits (Excluded from Risk Metric)

MPI said:

> "it is only the remeasurement of the employee future benefits that is put to … OCI … other items relating to employee future benefits is expensed to net income"[20].

When asked if remeasurement of the employee future benefits that is put to OCI is more volatile than the "other items relating to employee future benefits", MPI said:

> *"The response to this question requires a definition of 'volatility'. The split between remeasurement of employee future benefits and other items relating to employee future benefits is based on accounting standards. Both are actuarially determined and fluctuate year over year."*

MPI was asked if it agreed that "remeasurement of employee future benefits (as defined in Note 21 of MPI's financial statements") will never impact "net income" nor "retained earnings" as those terms are used in the definition of "return" and "risk" in the Asset-Liability Study. MPI's response is below.

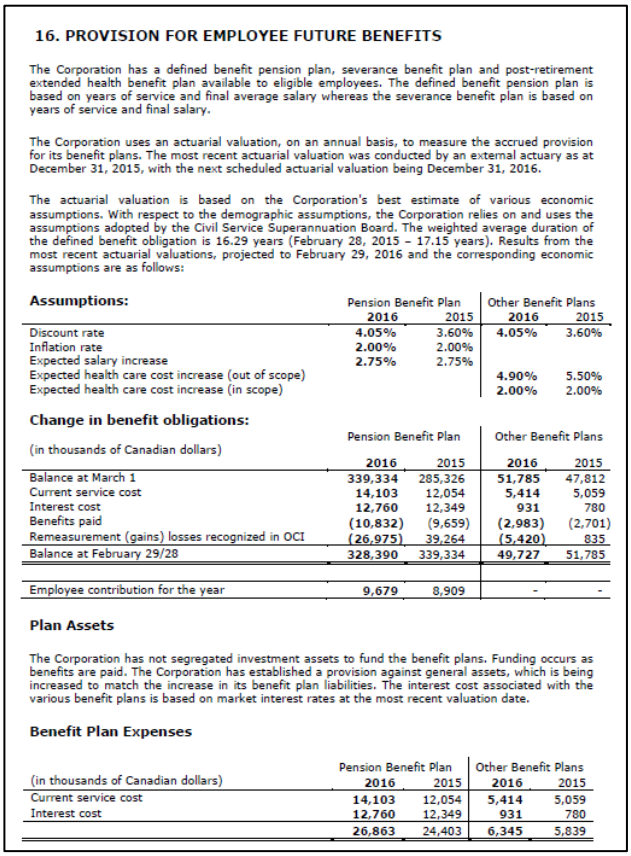
> *"The Corporation does not strictly agree …, as accounting standards related to the remeasurement of employee future benefits could change in the future. The Corporation … follows all relevant accounting guidelines (IAS 19) …, but has no control over prospective changes in those guidelines. Accordingly the Corporation cannot agree … that remeasurement of employee future benefits will never impact net income."*
>
> *In response to i) AON offers the following:*
>
> *We agree that the inherent economic or market risk arising from employee future benefits (reflected in the re-measurement of employee future benefits) is not reflected in the return/risk metrics in the Asset-Liability Study.*
>
> *There is a tenuous link between retained earnings and re-measurement of employee future benefits. Re-measurement … impacts … AOCI … AOCI is considered in the calculation of surplus distributions/special contributions. Surplus distributions/special contributions impact retained earnings. However, the impact is likely very small."*
>
> *Re-measurement of employee future benefits does not impact net income.*
>
> *The impact of changes in the present value of pension liabilities is modeled and flows into the AOCI."*

---

[19] Source: MPI's audited financial statements (Feb 2015)
[20] Source: MPI's response to CAC (MPI) 1-71

Based on these responses, I conclude that the inherent economic or market risk arising from employee future benefits (reflected in the re-measurement of employee future benefits), which I believe to be material, is not reflected in the return/risk metrics in the Asset-Liability Study and therefore not appropriately considered in asset mix decisions. As noted in MPI's financial statements "the weighted average duration of the defined benefit obligation is 16.29 years"[21]. This means that a 1% change in the discount rate used to value the liabilities would cause the value of the liability to change by approximately 16% in the opposite direction.

From MPI's financial statements (below, enlarged on the next two pages), the 0.45% increase in discount rate (to 4.05%) resulted in a remeasurement gain of ~ $27 million last year, consistent with MPI's sensitivity analysis (next page) which shows an expected $51 million gain[22] for a 1% increase (~ double the 0.45% actually reflected).



16. PROVISION FOR EMPLOYEE FUTURE BENEFITS

The Corporation has a defined benefit pension plan, severance benefit plan and post-retirement extended health benefit plan available to eligible employees. The defined benefit pension plan is based on years of service and final average salary whereas the severance benefit plan is based on years of service and final salary.

The Corporation uses an actuarial valuation, on an annual basis, to measure the accrued provision for its benefit plans. The most recent actuarial valuation was conducted by an external actuary as at December 31, 2015, with the next scheduled actuarial valuation being December 31, 2016.

The actuarial valuation is based on the Corporation's best estimate of various economic assumptions. With respect to the demographic assumptions, the Corporation relies on and uses the assumptions adopted by the Civil Service Superannuation Board. The weighted average duration of the defined benefit obligation is 16.29 years (February 28, 2015 – 17.15 years). Results from the most recent actuarial valuations, projected to February 29, 2016 and the corresponding economic assumptions are as follows:

Assumptions:

	Pension Benefit Plan		Other Benefit Plans	
	2016	2015	**2016**	2015
Discount rate	**4.05%**	3.60%	**4.05%**	3.60%
Inflation rate	**2.00%**	2.00%		
Expected salary increase	**2.75%**	2.75%		
Expected health care cost increase (out of scope)			**4.90%**	5.50%
Expected health care cost increase (in scope)			**2.00%**	2.00%

Change in benefit obligations:

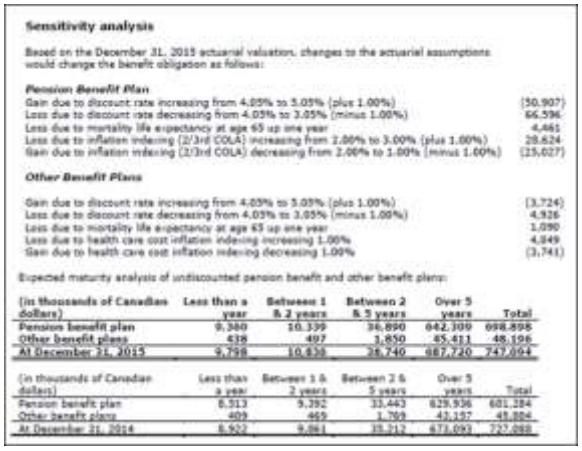
(in thousands of Canadian dollars)	Pension Benefit Plan		Other Benefit Plans	
	2016	2015	**2016**	2015
Balance at March 1	**339,334**	285,326	**51,785**	47,812
Current service cost	**14,103**	12,054	**5,414**	5,059
Interest cost	**12,760**	12,349	**931**	780
Benefits paid	**(10,832)**	(9,659)	**(2,983)**	(2,701)
Remeasurement (gains) losses recognized in OCI	**(26,975)**	39,264	**(5,420)**	835
Balance at February 29/28	**328,390**	339,334	**49,727**	51,785
Employee contribution for the year	**9,679**	8,909	-	-

Plan Assets

The Corporation has not segregated investment assets to fund the benefit plans. Funding occurs as benefits are paid. The Corporation has established a provision against general assets, which is being increased to match the increase in its benefit plan liabilities. The interest cost associated with the various benefit plans is based on market interest rates at the most recent valuation date.

Benefit Plan Expenses

(in thousands of Canadian dollars)	Pension Benefit Plan		Other Benefit Plans	
	2016	2015	**2016**	2015
Current service cost	**14,103**	12,054	**5,414**	5,059
Interest cost	**12,760**	12,349	**931**	780
	26,863	24,403	**6,345**	5,839



Sensitivity analysis

Based on the December 31, 2015 actuarial valuation, changes to the actuarial assumptions would change the benefit obligation as follows:

Pension Benefit Plan

Gain due to discount rate increasing from 4.05% to 5.05% (plus 1.00%)	(50,907)
Loss due to discount rate decreasing from 4.05% to 3.05% (minus 1.00%)	66,596
Loss due to mortality life expectancy at age 65 up one year	4,461
Loss due to inflation indexing (2/3rd COLA) increasing from 2.00% to 3.00% (plus 1.00%)	28,624
Gain due to inflation indexing (2/3rd COLA) decreasing from 2.00% to 1.00% (minus 1.00%)	(25,027)

Other Benefit Plans

Gain due to discount rate increasing from 4.05% to 5.05% (plus 1.00%)	(3,724)
Loss due to discount rate decreasing from 4.05% to 3.05% (minus 1.00%)	4,926
Loss due to mortality life expectancy at age 65 up one year	1,090
Loss due to health care cost inflation indexing increasing 1.00%	4,849
Gain due to health care cost inflation indexing decreasing 1.00%	(3,741)

Expected maturity analysis of undiscounted pension benefit and other benefit plans:

(in thousands of Canadian dollars)	Less than a year	Between 1 & 2 years	Between 2 & 5 years	Over 5 years	Total
Pension benefit plan	9,380	10,339	36,890	642,309	698,898
Other benefit plans	418	497	1,850	45,411	48,196
At December 31, 2015	9,798	10,836	38,740	687,720	747,094

(in thousands of Canadian dollars)	Less than a year	Between 1 & 2 years	Between 2 & 5 years	Over 5 years	Total
Pension benefit plan	8,513	9,392	33,443	629,936	681,284
Other benefit plans	409	469	1,769	43,157	45,804
At December 31, 2014	8,922	9,861	35,212	673,093	727,088

[21] Source: MPI's audited financial statements

[22] $51 million gain ~ 16 year duration x 1% change x $312 million average value of pension benefits in the year).

16. PROVISION FOR EMPLOYEE FUTURE BENEFITS

The Corporation has a defined benefit pension plan, severance benefit plan and post-retirement extended health benefit plan available to eligible employees. The defined benefit pension plan is based on years of service and final average salary whereas the severance benefit plan is based on years of service and final salary.

The Corporation uses an actuarial valuation, on an annual basis, to measure the accrued provision for its benefit plans. The most recent actuarial valuation was conducted by an external actuary as at December 31, 2015, with the next scheduled actuarial valuation being December 31, 2016.

The actuarial valuation is based on the Corporation's best estimate of various economic assumptions. With respect to the demographic assumptions, the Corporation relies on and uses the assumptions adopted by the Civil Service Superannuation Board. The weighted average duration of the defined benefit obligation is 16.29 years (February 28, 2015 – 17.15 years). Results from the most recent actuarial valuations, projected to February 29, 2016 and the corresponding economic assumptions are as follows:

Assumptions:

	Pension Benefit Plan		Other Benefit Plans	
	2016	2015	**2016**	2015
Discount rate	**4.05%**	3.60%	**4.05%**	3.60%
Inflation rate	**2.00%**	2.00%		
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Expected health care cost increase (out of scope)			**4.90%**	5.50%
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Change in benefit obligations:

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Benefit Plan Expenses

(in thousands of Canadian dollars)	Pension Benefit Plan		Other Benefit Plans	
	2016	2015	**2016**	2015
Current service cost	**14,103**	12,054	**5,414**	5,059
Interest cost	**12,760**	12,349	**931**	780
	26,863	24,403	**6,345**	5,839

Note 16 is continued below.

Sensitivity analysis

Based on the December 31, 2015 actuarial valuation, changes to the actuarial assumptions would change the benefit obligation as follows:

Pension Benefit Plan

Gain due to discount rate increasing from 4.05% to 5.05% (plus 1.00%)	(50,907)
Loss due to discount rate decreasing from 4.05% to 3.05% (minus 1.00%)	66,596
Loss due to mortality life expectancy at age 65 up one year	4,461
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Other Benefit Plans

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Loss due to discount rate decreasing from 4.05% to 3.05% (minus 1.00%)	4,926
Loss due to mortality life expectancy at age 65 up one year	1,090
Loss due to health care cost inflation indexing increasing 1.00%	4,849
Gain due to health care cost inflation indexing decreasing 1.00%	(3,741)

Expected maturity analysis of undiscounted pension benefit and other benefit plans:

(in thousands of Canadian dollars)	**Less than a year**	**Between 1 & 2 years**	**Between 2 & 5 years**	**Over 5 years**	**Total**
Pension benefit plan	**9,360**	**10,339**	**36,890**	**642,309**	**698,898**
Other benefit plans	**438**	**497**	**1,850**	**45,411**	**48,196**
At December 31, 2015	**9,798**	**10,836**	**38,740**	**687,720**	**747,094**

(in thousands of Canadian dollars)	Less than a year	Between 1 & 2 years	Between 2 & 5 years	Over 5 years	Total
Pension benefit plan	8,513	9,392	33,443	629,936	681,284
Other benefit plans	409	469	1,769	43,157	45,804
At December 31, 2014	8,922	9,861	35,212	673,093	727,088

Greater Volatility in Comprehensive Income than Net Income

MPI was asked if "comprehensive income" (i.e., including OCI) is more volatile than "net income" (i.e., excluding OCI). MPI said:

> "the answer depends on the definition of volatility and nature of volatility being assumed. If there is more potential for fluctuation due to valuation changes in equities and employee future benefits, then agreed."

A portfolio/risk manager's definition of volatility would be based on the market valuations of assets and liabilities (as distinct from accounting valuations), implying that comprehensive income is more volatile than net income as a result of investments in equities and employee benefits (mainly the pension plan's liabilities).

This greater volatility in comprehensive income, compared to net income, arises because comprehensive income includes OCI, but net income does not, for:

- unrealized gains and losses from changes in the market value of equities (AFS assets, which includes equities), noting that equities have higher market volatility compared to other assets; and
- unrealized gains and losses from changing interest rates that impact the value of pension liabilities, noting that the long duration (16 years, per MPI's financial statements) of pension liabilities makes these liabilities very sensitive to changes in interest rates.

MPI was asked if "comprehensive income" is closer to a market-based definition of "income" than is "net income", as these terms are currently defined. MPI's response is below.

> *"This question is theoretical in nature and the response requires a definition of 'market based'. Comprehensive Income and Net Income are determined based on adherence to Accounting Standards and available elections under the accounting standards. Certain interest rate movement can be elected to be in either Comprehensive Income or Net Income. Other actuarial valuations based on interest rates are required to be in comprehensive income based on accounting standards."*

I do not agree with MPI regarding the theoretical nature of the question. I believe that comprehensive income, as currently defined, is more volatile than net income, as illustrated in MPI's most recent audited financial statements below[23].

[23] Source: MPI's audited financial statements (Feb 2016)

Statement of Comprehensive Income (Loss)

For the years ended February 29/28 (in thousands of Canadian dollars)	Notes	2016	2015
Net income (loss) from operations	*24*	**(31,314)**	57,578
Other Comprehensive Income (Loss)	*16&21*		
Items that will not be reclassified to income			
Remeasurement of Employee Future Benefits		**32,395**	(40,099)
Items that will be reclassified to income			
Unrealized gains (losses) on Available for Sale assets		**(66,316)**	34,689
Reclassification of net realized (gains) losses related to Available for Sale assets		**33,771**	(28,064)
Net unrealized gains (losses) on Available for Sale assets		**(32,545)**	6,625
Other Comprehensive Loss for the year		**(150)**	(33,474)
Total Comprehensive Income (Loss)		**(31,464)**	24,104

OCI is the difference between Net Income and Comprehensive Income, which consists of:

- "items that **will not be** reclassified to income"
  – i.e., Remeasurement of Employee Future Benefits Gain (Loss); and
- "items that **will be** reclassified to income"
  – i.e., Unrealized gains (losses) on Available for Sale assets (inclusion + reversal or reclassification to AFS when realized as a result of a sale/turnover).

When asked if MPI agreed that "total equity" (i.e., including AOCI) has more volatility than "retained earnings" (i.e., excluding AOCI), MPI said "the answer depends on the definition of volatility and nature of volatility being assumed. If there is more potential for fluctuation due to valuation changes in equities and employee future benefits, then agreed."[24]

MPI's Return/Risk Metric is a Less "Comprehensive" Accounting Metric

"Return" and "risk" are measured in Aon's Asset-Liability Study on an "accounting" basis:

- "net income", on the return (Y) axis; and
- "average annual volatility of retained earnings", on the risk (X) axis.

MPI confirmed that:

> *"'return' and 'risk' metrics in the Asset-Liability Study reflect the accounting definitions for 'net income' and 'retained earnings' (i.e., they exclude … OCI … and … AOCI) in 'return' and 'risk' respectively)".*[25]

[24] Source: MPI's response to CAC (MPI) 2-34
[25] Source: CAC (MPI) 1-73

MPI Elects to Use Net Income/Retained Earnings in Return/Risk Definition

MPI said that it is not required, but elects to use "net income" and/or "retained earnings" (excluding AOCI), rather than "comprehensive income" (including OCI) or "total equity" (including AOCI), respectively, in "how return and/or risk are defined in Asset-Liability Studies".[26]

The decision to use net income/retained earnings in Asset-Liability Studies has the effect of under-reporting the volatility in Asset-Liability Studies compared to the underlying volatility that is actually inherent in those assets and liabilities on a market value basis.

Short-Term vs Long-Term Tradeoffs

MPI was asked if there is a trade-off between short-term rate stability on the one hand and long-term accuracy of market risk assessments that arises from using the same basis for measurement for both of these two purposes. MPI responded:

> "As stated on the PUB (MPI) 1-20 (a) Attachment B Phase II - Part A ALM Study page 5, MPI's Basic compulsory program is required to break even rather than to target profits. The objective of the ALM study was that "the short-term volatility of the premium rate requirement is a primary concern". Therefore, the benefits of long-term accuracy of market return and risk through comprehensive net income are not as important compared to reducing the short-term volatility of the premium rate requirement."[27]

MPI said that "short term volatility of the premium rate" is a primary concern, which was echoed by Aon in the Asset-Liability Study, by saying Aon perceived that "MPI has a low risk tolerance resulting from the mandate to break even instead of targeting profit, the extensive process to change targeted levels of reserve and the lack of control of MPI over premium rates."

MPI said that "for these organizations in year performance is less critical as they do not set annual rates as does MPI. As a result, these organizations are able to take more investment risk and have a much higher allocation to equities than MPI (an average of 50.8% vs. 18.5% in 2015). The average allocation to fixed income by these organizations is 31.7%, while MPI had 66.4% in fixed income."[28]

Comprehensive Income is Better than Net Income (for Risk Management), But Not Best

When asked if MPI believes that comprehensive income is a better or worse metric than net income, as these terms are currently defined, MPI said:

> "MPI would not define one measure as better than another. The two measures show different views of the corporation's activities which does not necessitate superiority of one over the other. One may be more suited to an analysis than the other, depending on what is being analyzed." [29]

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[26] Source: MPI's response to CAC (MPI) 2-34(c)(ii)
[27] Source: MPI's response to CAC (MPI) 2-36(b)(ii)
[28] Source: Volume II – Investment Income, page 25
[29] Source: MPI's response to CAC (MPI) 2-34(n)

I believe that the better metric depends on the principles/beliefs used to inform decision-making and the purpose for which the metrics are used. For the following reasons, I believe comprehensive income is better than net income, but still not the best, for the purpose of long-term asset allocation decision-making.

- **Comprehensive income is more relevant** than net income, reflecting OCI components that bring it closer to a market value basis;
- **Comprehensive income is more "comprehensive"** or complete than net income, because it includes unrealized gains and losses on AFS assets (20% of assets, including equities which are more volatile than other assets) and employee future benefits gains/losses (which have a high sensitivity to interest rates), while net income does not;
- **Comprehensive income is more neutral** because it is not impacted (as net income is) by portfolio turnover; and
- **Comprehensive income is more consistent/comparable and understandable**, by including more (but not all) assets and liabilities on the same valuation basis – market value, as distinct from an accounting basis that currently includes some but not all of unrealized gains/losses in income.

Any increased reliance on comprehensive income would likely involve higher costs (e.g., market valuations), but these costs are likely to be small compared to the benefits which would flow from its use (risk management generally, but long-term asset allocation specifically).

Market Values are More Relevant than Accounting Values for Portfolio Decision-Making

GAAP is designed to meet the common information needs of a variety of users who have different needs. GAAP measures of assets and liabilities may be appropriate for some purposes but are less relevant for others despite being "generally accepted" for accounting purposes.

Also, accounting (and actuarial) principles may differ from one jurisdiction to another, and they may change over time. These differences and changes, however, are unrelated to the underlying factors that create the inherent market risks related to the assets and liabilities. Simply put, measuring something differently does not change its characteristics.

Portfolio/risk managers generally agree that market values (rather than accounting values) are more relevant for informing investment/risk management decisions. This explains why portfolio/risk managers make various "adjustments" to net income or asset/liability valuations in making decisions about long-term portfolio designs (e.g., asset mix).

Market Risks Do Not Depend on How Assets and Liabilities are Measured by Accountants

MPI was asked if the market risk (e.g., volatility or other appropriate market risk metric) of MPI's liabilities depends on the principles, valuation methodologies, assumptions and/or values developed by actuaries.

MPI responded by referring to its earlier response (CAC (MPI) 1-72 (f)), where MPI was asked if the inherent market risks arising from the liabilities (viewed in isolation, not in relation to assets) can only be changed by changing the nature of the cash flows that underlie the liabilities (e.g., by changing their degree of indexation to inflation or other such basis), and not through the adoption of different "valuation" methodologies (including "smoothing").

In 1-72 f), MPI said:

> "*The Corporation agrees that inherent market risks arising from liabilities can be changed by changing the nature of cash flows underlying the liabilities. However, such change can also occur by the adoption of a different 'valuation' methodology. E.g. If the 'valuation' methodology required the use of a risk-free interest rate to discount the liabilities, then the inherent market risk would be reduced. However, the tradeoff is that MPI would have to hold a higher amount of liabilities. As stated in the responses above, the Corporation's current 'valuation' methodology is in adherence to IFRS and is in accordance with current accepted actuarial practice*".

MPI's responses to CAC (MPI) 1-72 e) appears to contradict its response to 1-72 f) regarding the dependency of market risks and their basis for measurement. In 1-72 e), MPI agreed that the "*'actual' market risks arising from MPI's liabilities do not depend on how those liabilities are valued (by either accountants or actuaries)"*.

The underlying or inherent risks related to assets and liabilities do not depend on how they are accounted for, in the same way that using a Celsius thermometer (rather than Fahrenheit) leaves the temperature unchanged despite having different readings on the two scales.

MPI's long-term portfolio decisions (e.g., asset mix) are influenced by return/risk accounting-based metrics, and these accounting metrics may differ materially from those that are "market-based".

Three "Theoretical" Questions About the Interdependence of Accounting and Portfolio Design

MPI was asked if it agreed with the following three statements, the first two relating to potential changes in accounting for asset and liabilities, and the third to the impact such accounting changes might have (e.g., lead to more, less or about the same allocation to equities, as compared to bonds).

1st Question: Changes in Asset Accounting

- Assuming that GAAP were to change and require MPI to use market interest rates/prices for valuing assets (i.e., 100% of unrealized gains and losses would impact net income):
  - net income for accounting purposes would become more volatile;
  - rates (i.e., premiums) would become more volatile (explain why; e.g., through the effects on both net income and the fact that the rate-setting formula is based on net income); and
  - the inherent (market) risk, as defined above, of the assets that would be subject to the revised accounting treatment would remain unchanged. If not, why not?

2nd Question: Changes in Liability Accounting

MPI was asked if it agreed with the following statements, assuming that GAAP were to change and require MPI to use market interest rates/prices for valuing liabilities:

- net income for accounting purposes would become more volatile;
- rates (i.e., premiums) would become more volatile. If so, please explain why;
- the inherent (market) risk, as defined above, of the liabilities that would be subject to the revised accounting treatment would remain unchanged; and
- if not, please explain why not?

3rd Question: Changes in Asset Mix

MPI was asked if the changes to GAAP related to either the assets, liabilities or both described above had been in place when the latest Asset-Liability Study was completed, what impact would the change(s) likely have had (e.g., likely lead to more, less or about the same allocation to equities, as compared to bonds)? Please explain briefly.

MPI's Response to Questions 1, 2 and 3

MPI's response to all these questions is below.

> *"This question is theoretical in nature and the request is to comment on potential currently undrafted accounting changes that may or may not occur. However, please note that MPI currently uses market interest rates and prices for valuing assets and liabilities where required under current accounting standards."*

My question may be theoretical, but I believe it is an important one to ask.

Also, MPI does have some discretion regarding its accounting choices (as discussed elsewhere).

An article, funded by the Rotman International Centre for Pension Management (ICPM), that illustrates how and why accounting matters (for better or worse) is included as a reference in the footnote below[30].

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[30] See *Pension Fund Asset Allocation and Liability Discount Rates: Camouflage and Reckless Risk Taking by U.S.*

III. MANAGEMENT

The Cost of Constraints

As noted in the beliefs section, "constraints never increase expected risk-adjusted returns".

Nevertheless, there may be good reasons for imposing constraints, including some of the following perhaps:

- Legislation or regulation (e.g., maximum foreign property);
- Market risk management (e.g., avoid concentration by setting a maximum);
- Liquidity risk management (e.g., set a maximum for illiquid assets as a group and/or at the asset class level for real estate, infrastructure and private equity);
- Return expectations (e.g., maximum for low-yielding assets);
- Insufficient internal/external asset management capabilities; and
- Concerns about the accuracy of modelling methodologies and/or assumptions, and the (widely-known) sensitivity of optimization results to assumptions re: returns, risks, correlations, etc.

Reliance on Quantitative Models

On this last point above, it important to note that:

- optimal solutions from quantitative portfolio optimizations are very sensitive to the capital market assumptions used; and
- there are at least 44 such assumptions in the Asset-Liability Study, involving MPI's 8-asset class portfolio, as calculated below.

44 Important Assumptions (estimates, but "unknowns")

8 average return assumptions (1 for each asset class)
8 volatility assumptions
28 correlations (= 8 x 7 ÷ 2)
44 "unknowns"

It goes without saying, perhaps, that an over-reliance on the quantitative results of optimizations is inappropriate and imprudent, given the large number of "unknowns" and other considerations.

Public Plans? at http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2070054.

Minimum/Maximum Constraints in Optimizations

The min/max constraints for asset classes in the Asset-Liability Study, listed below, are very binding. By establishing them, the constrained optimization problem results in a "pre-determined" allocation to ≥ 80% of the portfolio, leaving little room to optimize return/risk tradeoffs (i.e., allocating ≤ 20% of the remaining assets).

80% of the portfolio is constrained[31] as follows.

≥ 10% Canadian Equities
≥ 10% Real Estate
≥ 5% Infrastructure
≥ 55% Liability Matching
≥ 80% of the portfolio is "pre-determined" by minimum constraints

10% Minimum Weight to Canadian Equities to Retain a Meaningful Exposure to Home Markets

MPI said that the minimum weight of 10% for Canadian equities was set "to retain a meaningful exposure to our home equity markets".[32]

It is not clear why it is important for MPI to maintain a "meaningful" exposure to Canadian equities unless it relates to a regulatory requirement or return/risk consideration.

Pension plans and other institutional investors have generally acknowledged a "home bias" when it comes to investing (i.e., overweighting domestic equity markets relative to the domestic market's global capitalization %), and they have been diversifying their portfolios internationally to remove the bias and improve risk-adjusted returns.

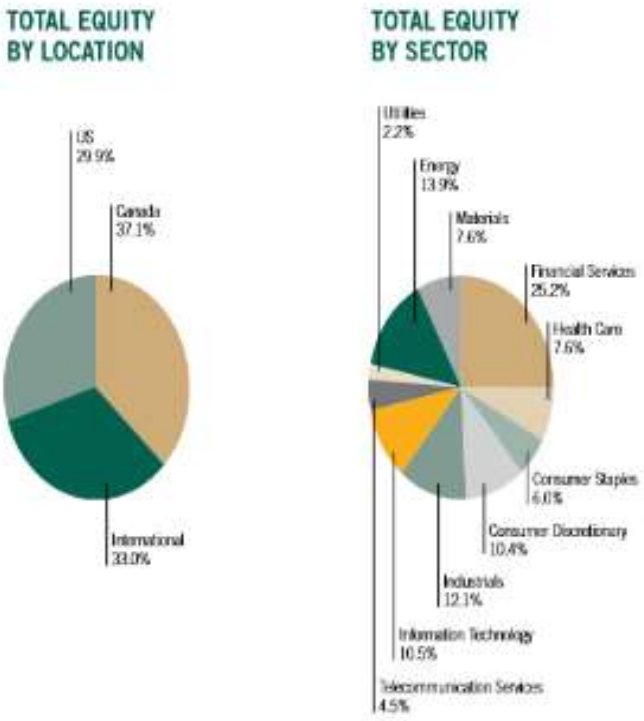
This international diversification has been more important for Canadian investors, given the concentrated nature of our market. Three (of 10) sectors in Canada, for example, typically represent a very large proportion of the TSX market cap:

- Financials > ⅓;
- Energy ~ 20%; and
- Materials ~10%.

Canadian equities are underrepresented in health care and information technology (< 3%), and Canada represents a very small (~ 3%) portion of the world's market capitalization of publicly-traded stocks.

[31] Source: MPI's response to CAC (MPI) 1-77

[32] Source: MPI's response to CAC (MPI) 2-39



Manitoba's TRAF (Teachers' Retirement Allowances Fund), for example, has a higher allocation of equities in International Equities (33%) than US Equities (30%) and a combined foreign exposure (63%) that is two times higher than in Canada (37%) (far left).[33]

TRAF's allocation by sector (near left) shows a more diversified portfolio on a sector basis as a result of having more foreign exposure.

When asked if MPI was comfortable with its concentration in Canadian Equities (⅔ of total equities), given Canada's small size (~ 3% of the world's market cap) and concentrated exposure to three (of 10 GICS) sectors (Financials, Energy and Materials), MPI said it was "comfortable with the current exposure to Canadian equities. The current portfolio was selected from the efficient frontier developed during the Asset Liability Management (ALM) study completed in January 2015".[34]

[33] Source: TRAF's annual report

[34] Source: MPI's response to CAC (MPI) 1-83

Equity Risk Concentration[35]

Most institutional investors have a significant allocation to International Equities (i.e., excluding Canada and US), but MPI has 0%.

Saskatchewan Auto Fund, administered by Saskatchewan Government Insurance ("SGI"), for example, has almost ¼ of its public equities in International Equities as illustrated on the right.[36]

Public Equity Mix	MPI	SGI	Diff
Canadian Equity	67	47	20
US Equity	33	31	2
International Equity	-	23	- 23
	100	100	-

The average defined benefit pension plan, as surveyed by the Pension Investment Association of Canada (PIAC[37]), has an even higher allocation to International Equities (> ⅓ of equites), with non-Canadian Equities (US + International) representing almost ¾ of total public equities and Canadian Equities ~ ¼ as illustrated on the right.

Public Equity Mix	MPI	PIAC	Diff
Canadian Equity	67	24	42
US Equity	33	38	- 5
International Equity	-	37	- 37
	100	100	-

PIAC's 2015 asset mix report is on the next page.

[35] Source: CAC (MPI) 1-83

[36] These figures were included in CAC's questions and have not been updated since then.

[37] Source: PIAC website, at http://www.piacweb.org/publications/asset-mix-report.html

Asset Mix Report

Year :

2015

ASSET MIX OF DB PLANS OF SPONSOR ORGANIZATIONS REPRESENTED BY MEMBERS AS AT DEC 31, 2015	MILLIONS $	PERCENT OF TOTAL
CASH AND SHORT TERM	-8,172.19	-0.52%
CANADIAN NOMINAL BONDS	356,548.27	22.68%
REAL RETURN BONDS	49,546.23	3.15%
MORTGAGES	18,595.23	1.18%
FOREIGN FIXED INCOME	54,448.24	3.46%
CANADIAN EQUITIES	136,838.97	8.70%
U.S. EQUITIES	74,399.22	4.73%
EAFE EQUITIES	58,694.80	3.73%
EMERGING MARKETS EQUITIES	64,784.40	4.12%
GLOBAL EQUITIES	262,033.44	16.66%
REAL ESTATE	172,358.72	10.96%
VENTURE CAPITAL/PRIVATE EQUITY	151,721.50	9.65%
INFRASTRUCTURE	88,018.50	5.60%
OTHER ASSETS	58,685.20	3.73%
HEDGE FUNDS - used as part of portable alpha strategy	11,083.52	0.70%
HEDGE FUNDS - not used as part of portable alpha strategy	22,814.17	1.45%
TOTAL ASSETS AT MARKET	$1,572,398.22	100.0%
NOTE: TOTAL ASSETS DO NOT INCLUDE ASSETS OF NON-REPORTING FUNDS		
TOTAL ASSETS OF ALL DB FUNDS $1,572,303.60 MILLION		

Duration

MPI was asked if the duration-matching strategy would be as effective if future inflation (actual and/or expected) turns out to differ from current expectations. MPI replied:

> "MPI … agrees that the duration matching strategy is not as effective if future inflation turns out to differ from current expectations … MPI "has accepted short term inflation risk and has accounted for this risk through margins and reserve. The 'excess portfolio' was also designed to provide some long-term protection against inflation." The excess portfolio includes real estate and infrastructure."[38]

Borrowing (Interest Rate Risk) in Real Estate

The Real Estate Fund has leverage of ~ 30%, while Aon assumed an unlevered real estate investment (i.e., zero debt), which means the gross and net (of debt) metrics differ between what was modeled by Aon on the one hand in supporting the long-term asset mix decision and what was implemented in practice on the other hand – a difference of 4% below.

	Pooled Real Estate Fund		
% EV			% AUM
100%	Gross Enterprise Value (EV)	317,000	13%
30%	Debt	95,000	4%
70%	Net	222,000	9%

MPI agreed that this implies a 4% difference between the actual exposures implemented by MPI and the assumptions for "real estate" and "fixed income" in the Asset-Liability Study (i.e., gross real estate exposure is closer to 13% than 9%, and exposure to fixed income is 4% lower – i.e., by the amount of debt within the real estate portfolio). MPI added that it "reports the holding on a net basis in keeping with the Net Asset Value reported by the fund manager. Therefore, it is not necessary to split out the debt associated with the fund and report it separately".[39]

When asked if the 4% difference (~ $95 million) was material, and whether the difference should be reflected somehow for greater clarity (e.g., investment policy min/max constraints and targets) and reflected in duration and/or other calculations, MPI said:

> "The real estate pooled fund is reported net of debt as this represents the proceeds that would be realized … upon liquidation ... Real estate investments are reported at their estimated fair values as provided by the external manager in the audited financial statements for the fund.
>
> The use of leverage in the real estate pooled fund represents a liability to that fund and is integral to the manager's strategy and cannot be separated. Because of these facts, there is no need to consolidate the debt associated with the investment in GREF with the Corporation's fixed income portfolio and therefore no impact on duration.

[38] Source: MPI's response to CAC (MPI) 76
[39] Source: CAC (MPI) 76

> When the real estate pooled fund is measured on a net basis, the overall exposure to real estate (pooled real estate fund and CityPlace) as of February 2016 was 11.3%, which is within the min/max range defined for that asset class (7% - 13%). The rebalancing policy defines the monitoring of the target allocation on a fiscal quarterly basis, at a minimum, and rebalancing back to target within six months, if the weight of any asset class falls outside the allowable range. Because the real estate pooled fund is reported on a net basis there is no need for additional clarification of the investment policy min/max constraints and targets."

For greater clarification, here are a few observations.

- There is a 4% difference between what was modeled by Aon (and presumably the basis for the policy allocations implemented) and what was actually implemented in practice:
  - Real estate's gross exposure (excluding debt) is 4% higher than Aon's recommendation;
  - Net exposure to interest rates, at the total portfolio level, is 4% lower even though the effect of leverage is accounted for within the real estate asset class;
- MPI did not answer our question regarding the materiality of the 4% difference, where (though not stated) implicitly materiality refers to the effect that the 4% difference might have on portfolio decision-making or design as distinct from how items might be accounted for;
  - Given MPI's duration policy and interest rate risk management practices, which are very detailed, the risk management (as distinct from the accounting) treatment for liabilities arising from real estate activities is inconsistent with those for the liabilities arising from providing auto insurance (and pensions);
- I disagree with MPI's answer that "because the real estate pooled fund is reported on a net basis there is no need for additional clarification of the investment policy min/max constraints and targets". I would note that the policy min/max constraints and targets approved are therefore not consistent with the results and recommendations from the Asset-Liability Study
  - Greater clarity and consistency of treatment between the Asset-Liability Study and the policies would seem both more appropriate and prudent.

Commingling of Employee Benefit Plans

When asked if the creation of a separate trust for the pension plan would "trigger" a realization (recognition in net income) of "remeasurement of employee future benefits", MPI said:

> *"This question is theoretical in nature and therefore not relevant to the rates setting process. Further, without discussion on the nature of the trust and the type of transaction to create and fund the trust, an accurate answer can not be provided."*[40]

I believe strongly that the portfolio design of the whole portfolio (including the pension plan) should not be influenced by how the parts (insurance vs pension liabilities) are accounted for.

[40] Source: CAC (MPI) 2-34

APPENDIX A: VALTER VIOLA'S CURRICULUM VITAE

VALTER VIOLA

50 De Vere Gardens, Toronto, ON M5M 3E7 | vviola@hollandparkrisk.com 416 819 2307

PROFILE

Portfolio, research and risk management professional with over 20 years of experience in institutional investment management (mostly defined benefit pension plans)

- *Executive and senior management roles in investment research, economics and risk management at two of Canada's largest institutional investors*
- *Consultant to large North American institutional investors, advising Boards, Investment Committees and Management Teams on investment strategies and investment risk management*

PROFESSIONAL EXPERIENCE

2014 – 2016 **MaPLE** Toronto, Santiago

Partner

- Participating in private energy and infrastructure opportunities in South America, starting with power generation and related infrastructure in Chile

2005 – 2014 **Holland Park** Toronto

President, Founder

- Advised defined benefit pension plans, workers' compensation funds and other institutional investors on investment risk governance, management and measurement practices, including:
  - Board education;
  - developing investment/risk frameworks;
  - drafting investment/risk management policies and procedures that were prudent and appropriate in the circumstances and took into account relevant principles and leading practices; and
  - developing risk budgets to support the management of surplus (assets and liabilities) and active management programs (performance vs benchmarks)
- Provided investment risk monitoring and reporting services to pension funds, including:
  - managing third party risk analytics, clients' holdings and benchmark data, proxies for liabilities and market data;
  - recommending and implementing generally accepted and appropriate risk measurement methodologies; and
  - preparing and presenting reports to Boards and executive management teams to meet their needs for relevant, reliable and timely information about investment risks

VALTER VIOLA

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;
  - 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 decisions)
- 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 real return bond portfolio, including closing the largest single investment in the fund's history ($650 million private placement of inflation-linked bonds that financed the 407 Electronic Toll Road)

1992 – 1993 **Wilfrid Laurier University and York University**

Lecturer in Investments, Finance and Accounting

- Conducted lectures in the undergraduate programs at two universities

1990 – 1992 **Corporate Planning Associates**

Financial Advisor

- Advised high net worth individuals (portfolio management, tax planning, etc.)

1986 – 1988 **Price Waterhouse**

Auditor

- Completed audit and related work for corporate clients in various industries, as well as organizations in non-profit and other sectors

VALTER VIOLA

OTHER EXPERIENCES

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

VOLUNTEER

2013 – 2016 **Enbridge Ride to Conquer Cancer**

Fundraiser, Co-Captain

2004 – 2007 **North Toronto Soccer**

Coach

1988 – 1989 **New Visions Toronto**

Board Member

EDUCATION

1995 ***Chartered Financial Analyst***

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

1989 ***Chartered Accountant***

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

APPENDIX B: GLOSSARY OF TERMS

The table below includes the definitions of commonly used terms.

Concept	Definition
Accounting reports	Reports prepared by accountants to meet specific needs (which may differ from the needs of users of other types of reports). The basis of measurement in MPI's accounting reports is "historical cost … except for financial instruments and insurance contract liabilities and reinsurers' share of unpaid claims ... Insurance contract liabilities … are measured on a discounted basis in accordance with accepted actuarial practice (which in the absence of an active market provides a reasonable proxy for fair value) ..."
Actuarial reports	Reports prepared by actuaries to meet specific needs (which may differ from the needs of users of other types of reports).
Asset risk	Market risk related to assets measured in an absolute sense (i.e., not relative to a benchmark or liabilities).
Assumptions	The inputs used in a valuation.
Available for sale (AFS)	As defined in MPI's Financial Statements, AFS assets represent ~ 20% and include: • Equity Investments • Cash and Cash Equivalents • Other Investments (not material).
Duration	Market risk metric that measures the price sensitivity of a security or portfolio to changes in interest rates.
Financial assets and liabilities at fair value through profit or loss (FVTPL)	As defined in MPI's Financial Statements, FVTPL assets represent ~ 54% and include: • Other Bonds (Federal, Other Manitoba, Other Provinces, Corporates) • Infrastructure • Pooled Real Estate Fund.
Held to maturity (HTM)	As defined in MPI's Financial Statements, HTM assets represent ~ 25% and include: • Bonds – Manitoba • Municipal • Bonds – Manitoba, Schools.

Concept	Definition
Inherent risk	The “true” market risk of an asset or liability.
Investment risk	Risk of loss associated with investment activities, including: • market risk (including credit risk) • liquidity risk.
Liability from Basic Claims	Liability or provision at a point in time arising from providing basic auto insurance coverage.
Liability from pension plan	Liability or provision at a point in time arising from providing defined benefit pension coverage to employees.
Liquidity risk	Risk of not being able to generate sufficient cash or its equivalent to meet commitments as they come due in a way that is: • timely and • cost effective.
Market interest rate	A rate used to value an asset or liability based on an assessment of the inherent market risk of a security and/or its underlying cash flows
Market reports	Reports prepared to support market risk management, including portfolio design (e.g., asset mix). Reports are prepared using “best estimates” (i.e., no bias towards conservatism).
Market risk	Risk of loss in the market value of assets and/or liabilities due to changes in security prices, interest rates, currencies or other such factors in either absolute (e.g., assets only) or relative terms (e.g., vs benchmarks or liabilities, known as active risk/tracking error and surplus risk respectively).
Other comprehensive income (OCI)	As defined in MPI’s Financial Statements.
Reinvestment rate risk	Risk that reinvested income will be insufficient to meet a goal.
Risk	An outcome which has some (non-zero) probability of having an adverse impact on one or more stakeholders.
Risk (as defined in Asset-Liability Study)	An important consideration in portfolio design (i.e., asset mix).
Risk-free rate	A term used by MPI in response to a Round 1 question; not a term to be used in responses to questions below, unless “risk-free rate” is clearly defined by MPI and distinguished from other “rates”.

Concept	Definition
Risk profile	Risk level and/or risk allocation (composition).
Surplus risk	Market risk related to the difference between assets and liabilities.
Unrealized gains and losses	Gains and losses, representing differences between the cost (accounting or book value) of one or more assets and their fair value for accounting purposes.
Value	The quantitative assessment of an asset or liability based on the application of a valuation methodology and related assumptions (e.g., book value, accounting value, actuarial value, market value).
Valuation methodology	The method, excluding the assumptions used to implement the method, to value assets or liabilities for one or more purposes (e.g., discounted cash flow or present value methodology).

TESTIMONY

Manitoba Public Insurance
2017/18 GRA

Valter Viola
President, Holland Park
vviola@hollandparkrisk.com
416 819 2307

SYMPTOMS VS PROBLEMS

SYMPTOMS	SHAKY GOALIE	**No Real Return Bonds** • Poor liability protection against unexpected inflation, real rate risk • Less effective duration management
	PUCK HOG	**Canadian Equities** • Larger-than average home bias • Concentrated sectors/stocks
	SHORT-HANDED	**No International Equities** • Missed opportunities to add value, diversify portfolio
PROBLEMS	FOCUS	**Short-term Rate Stability** • At cost of lower long-term level
	PROCESS	**"Smoothed" Accounting** • Rather than "volatile" market value **Asset-Based Rebalancing** • Rather than risk **A-L Studies Every 4 Years** • Rather than annual/quarterly risk-informed discussions
	BARRIERS TO EXCELLENCE	

REMEDIES →

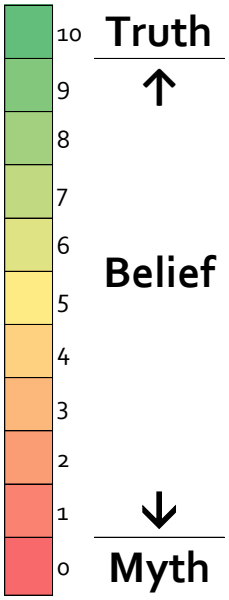
FRAMEWORK

RISK BUDGETING

TERMINOLOGY

Term	Definition
Valter	Best proxy for "Walter" (no "W" in Italian alphabet)
Risk	Potential future loss (absolute or relative)
Value at Risk	Market value that could be lost
VaR	See value at risk
Duration	Measure of interest rate risk • 16 year duration: 1% increase (decrease) in interest rate causes a ~ 16% decrease (increase) in asset/liability (accurate for small changes)
Inflation (i)	Annualized rate of change of prices
Nominal Interest Rate (n)	Approximately equal to sum of real rate (r) and inflation (i) n = r + i; e.g., 3% = 1% + 2%
Real Interest Rate (r)	Rate, net of inflation (r = n - i; e.g., 1% = 3% - 2%)
Nominal Bond	Bond (without inflation protection) • Market value changes with nominal rates
Real Return Bond	Bond with inflation protection • Market value changes with real rates • Principal "indexed to inflation" (e.g., $100 principal rises to $102 after 1 year if inflation = 2%); real coupon is applied to (rising) indexed base, assuming inflation > 0%
RRB	See real return bond

TRUTHS AND CONSEQUENCES



TRUTH	We don't know very much	Beneficiaries/ owners ≠ managers	Correlations are not perfect
	Low signal/noise (return/risk) ratio	*Institutions manage $ for clients/beneficiaries*	*Risks don't add (1 + 1 ≠ 2)*
Truth and Consequence	We need to make investment decisions but **we don't know very much**	The interests of stakeholders[1] may not be aligned because **beneficiaries/owners are not the same as managers**	The effect of an investment on total portfolio risk depends on the characteristics of other assets in the portfolio because **correlations are not perfect**
HELPFUL TOOLS	BELIEFS[2]	CAPITAL/REGULATORY FRAMEWORK[3]	RISK FRAMEWORK[3]

1. Stakeholders include MPI, rate-payers and Manitoba Finance.
2. Beliefs support long-term portfolio design (e.g., asset mix).
3. Capital/Risk/Regulatory Frameworks provide a focus (clarity in mission) and process to overcome common barriers to excellence.

BARRIERS TO EXCELLENCE

Lack of **focus** or clear mission

Poor **process**

- Structure
- Communication
- Inertia

Inadequate resources

INVESTMENT BELIEFS

SUSTAINABILITY:	1.	Major risk is provisions will not be **sustainable**
MRP:	2.	Determining **Minimum Risk Portfolio** is first step
ADDITIONAL RISK:	3.	Taking **additional risk** beyond MRP should be done only if expected additional returns justify doing so
TOTAL PORTFOLIO:	4.	**Additional risk to Total Portfolio** is relevant risk to consider if risk beyond MRP is taken
CONSTRAINTS:	5.	**Constraints** never increase expected risk-adjusted returns

MARKET EFFICIENCY

#6 MARKET EFFICIENCY

Markets are very efficient at pricing securities relative to one another, but are not perfectly efficient due to information and execution costs

- Implicit in recommendations re: Canada/US/International "risky" portfolio mix
- "Risky" sub-portfolios should reflect global market caps, other things equal
  - "Separation theorem", may go by other name(s)
  - Investors should (generally) hold same mix of risky assets, (Canada/US/International Equities), but different allocations between risky and risk-free assets to reflect different risk tolerances
- Common principle applied in portfolio management

FOCUS!
WHY FRAMEWORK MATTERS

FRAMEWORK

- Provides FOCUS (barrier to excellence)

- Context, cohesion, link between vision, mission, objectives and strategies

Example

- Want to earn actuarial (real) rate, which no asset guarantees
  - Closest: RRBs yielding < actuarial rate
  - Take risk to maximize returns

- Avoid undue risk, be paid for risks taken

- Measure/attribute risks to sources, improve understanding/management

FRAMEWORK

Elements:

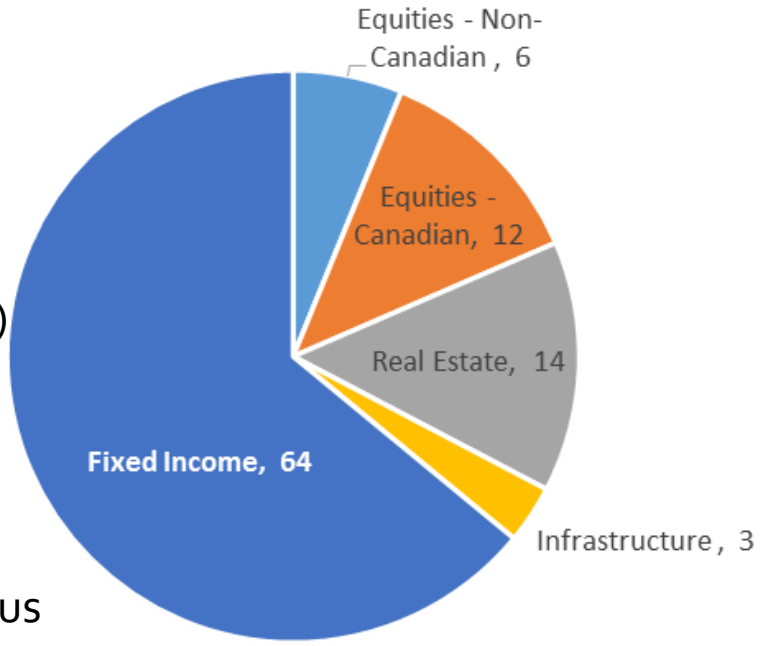
- Primary goal: risk-adjusted net value added (RANVA), not net income (market returns compensated for risks taken, costs incurred)
- MRP: benchmark for RANVA (e.g., Scotia Capital RRB Index at CPPIB*)
- Risk adjustment (cost of risk capital)
- Limits
- Budget linked to goal(s)

* Definitions and parameters may have changed (were in place 2000/01 to 2005)

PROCESS!
WHY RISK BUDGETING MATTERS

RISK BUDGETING

- Risk: a "good" to budget (like any resource)
  - Targets + limits
  - Discuss big issues (surplus return/risk)
  - Integrate > 1 risk (e.g., surplus, tracking error)
- Traditional "asset mix" process needs updating (> focus on why, not how) – i.e., asset mix (right ➔) says nothing about value <u>at risk</u>
  - Need "pie chart" of risk contributions/mix
- Risk measurement shocks people (size), but measurement does not create it (corollary true)
- Hope measurement de-emphasizes short-term focus
- Standardizes/simplifies metrics and comparison across asset classes
- Emphasizing faults like *"being in Stone Age, discovering iron, complaining about rust"*
- 20% to 60% solution – less to do with risk estimates than frequent reporting and disciplined return/risk discussions



TEACHERS' FOCUS: SURPLUS RISK METRIC: VALUE AT RISK (VAR)

RISKS AND RISK MANAGEMENT

We manage **surplus risk** using a Value at Risk (VaR) methodology. VaR has forced us to think of surplus risk as the aggregate of liability risk, asset-mix policy risk, and active management risk, taking into account correlation and diversification between the components.

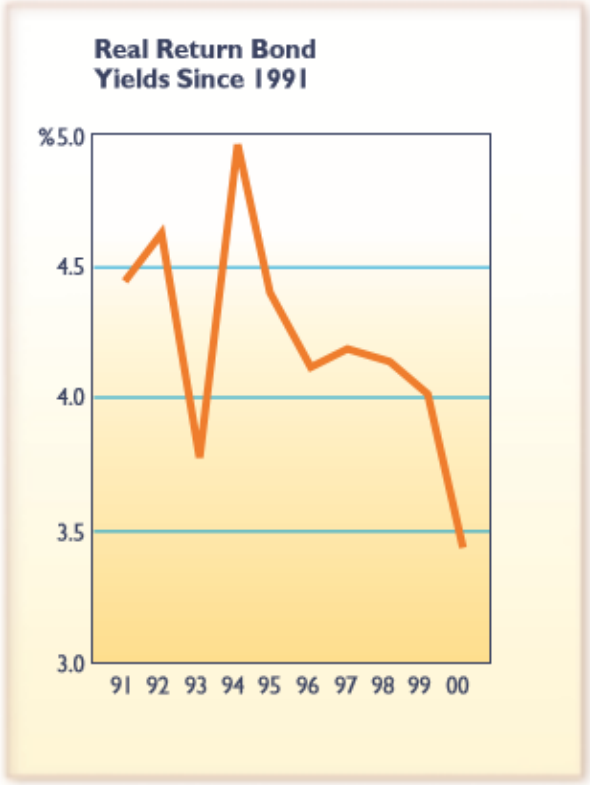
The main source of **liability risk** is a drop in real interest rates, which increases the present value of future pensions accumulated up to that point. It makes new pension liabilities more difficult to finance, and puts upward pressure on contribution rates. Higher real interest rates have the opposite effect.

Asset-mix policy risk would be the mirror image of liability risk, and surplus risk would be zero, if investments perfectly matched the plan's long-term objective that asset growth will average a real rate of about 4.5 percent plus inflation. Real return bonds come close, but fall a bit short on yield.

The absence of a perfectly matching asset forces us to consider assets that individually do not always behave like our pension promise, but collectively give us the best trade-off between longer term expected surplus return and acceptable short-term surplus risk. Consequently, our asset mix is heavily weighted to equities because they meet our long-term goals, while our inflation-sensitive investments give more modest real returns but dampen surplus risk.

Source: Teachers' 2000 Annual Report, page 22

MATCHING ASSETS AND LIABILITIES



Real return yields declined by 59 basis points in 2000, after remaining within a 10 basis point range for the three previous years.

Source: Teachers' 2000 Annual Report, page 19

MATCHING ASSETS AND LIABILITIES

To create a funding surplus we manage the relationship between investment assets and pension liabilities. Our goal is an asset mix that balances risks and rewards, avoids excessive volatility, and maintains stable contribution rates.

Because both assets and liabilities are sensitive to interest rate changes, one of our goals is to reduce the risk that liabilities will increase more than assets in response to lower real interest rates. Unfortunately, that is what happened in 2000. The sharp decline in real rates of return increased the value of total liabilities by $3 billion. During the year, we shifted assets from fixed-income and equity portfolios to real-rate products and real estate. Debt securities, along with inflation-sensitive assets, outperformed total equities to produce the healthy accounting surplus.

MRP AND RRBS

- Some liabilities resemble RRBs (zero-coupon real cash flows)
- RRBs could closely match risks in real liabilities
- "Insurance" cost varies with yield
- Nominal bonds only good fit if inflation stable

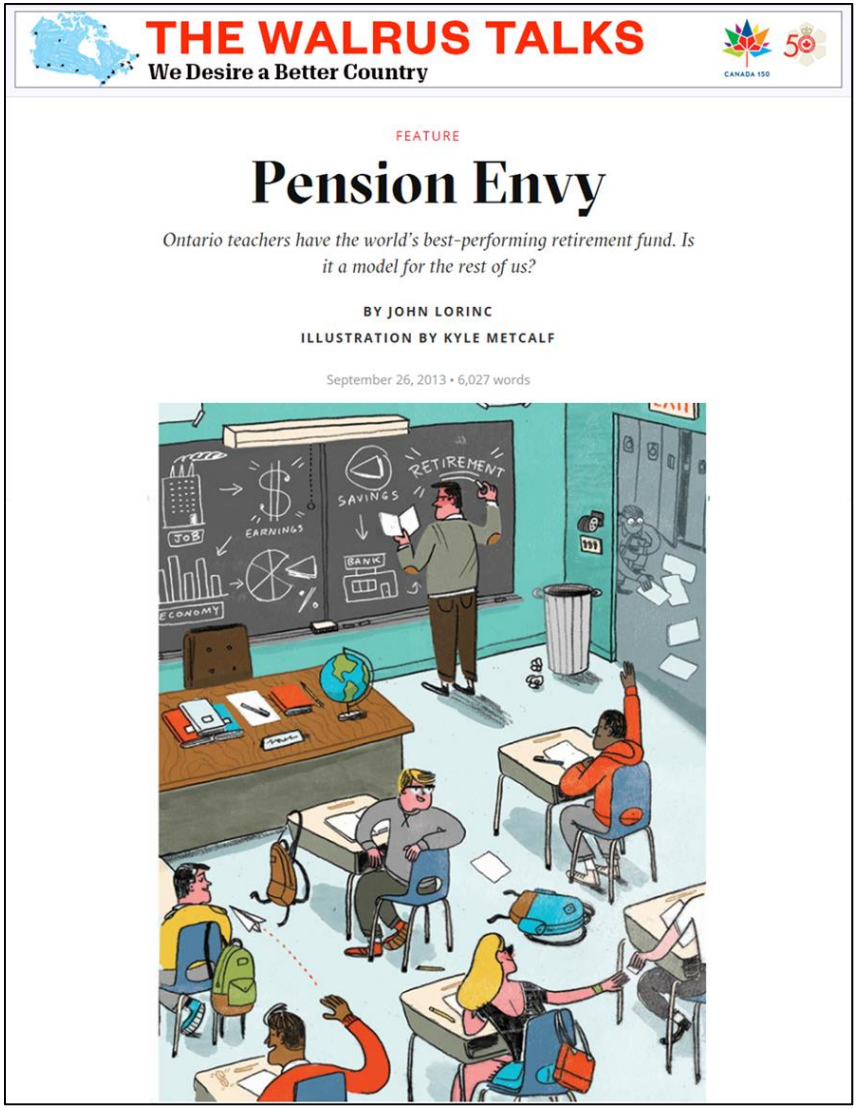
Tendency to ignore portfolio risk interdependence

- Assets risky in isolation, safer when combined with other assets/liabilities (long RRB duration risky on its own, not with long liabilities)
- Diversification makes management a team sport: appetite to take risk in one asset depends on risks in other assets and liabilities

RISK BUDGETING, NOT INFREQUENT ASSET MIX REBALANCING

- Teachers' asset mix policy reviewed annually (not every 4 years)
- Risk in static policy asset mix changes (constant asset mix ≠ constant risk)
- In 2000, Teachers' reduced exposure to stocks and fixed income and added inflation-sensitive assets (stocks, especially in Canada, overvalued)

TEACHERS' RANKED #1 IN WORLD "BEST-PERFORMING RETIREMENT FUND"



THE WALRUS TALKS
We Desire a Better Country

FEATURE

Pension Envy

Ontario teachers have the world's best-performing retirement fund. Is it a model for the rest of us?

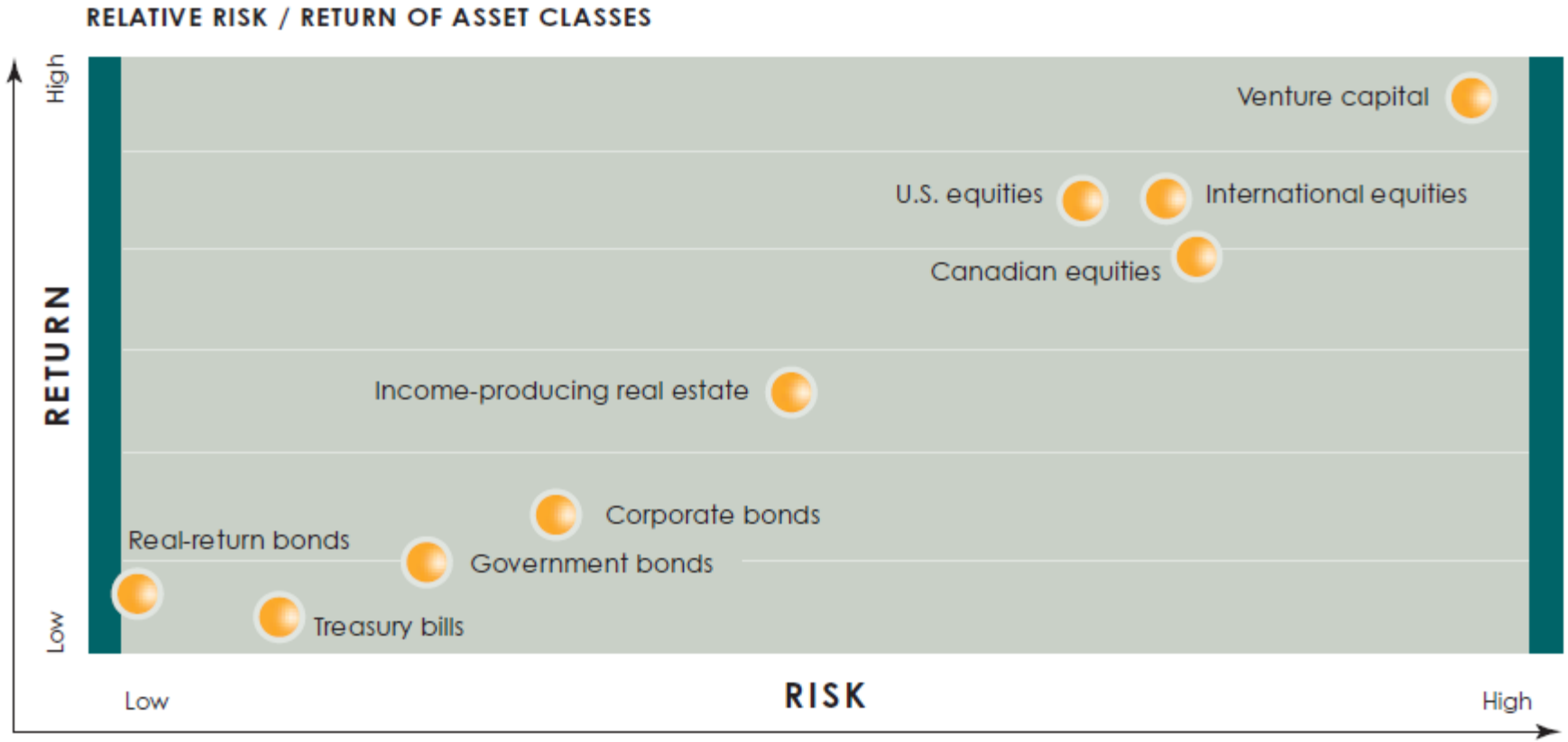
BY JOHN LORINC

ILLUSTRATION BY KYLE METCALF

September 26, 2013 • 6,027 words

Source:
Teachers' website
and The Walrus

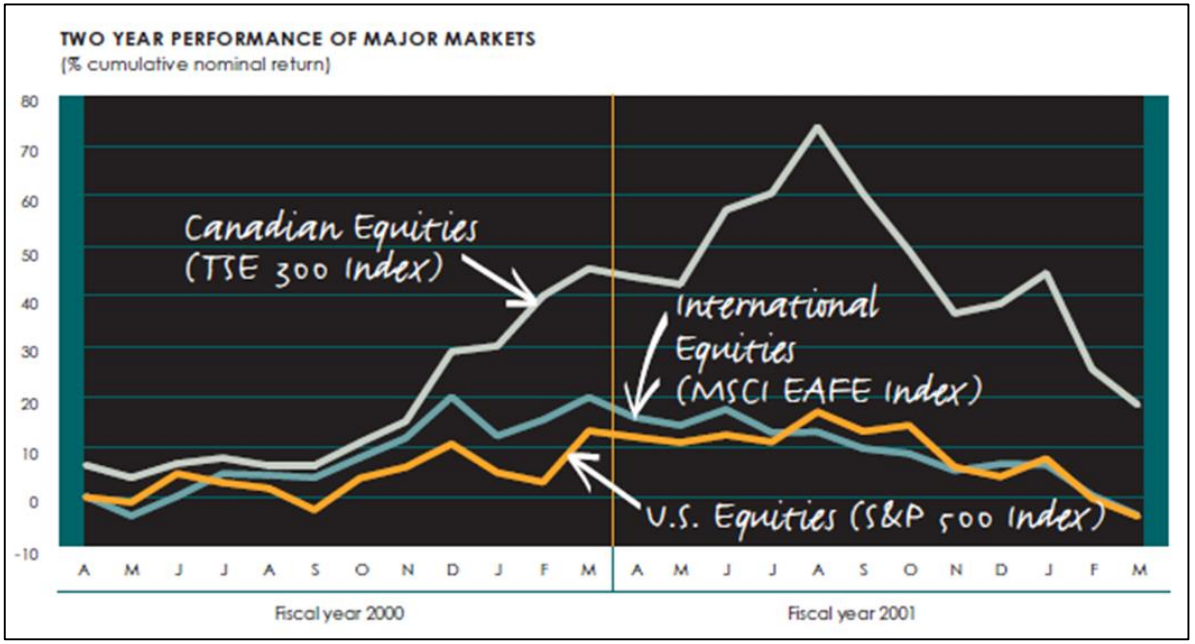
RETURN/RISK FRAMEWORK AT CPPIB (2001)

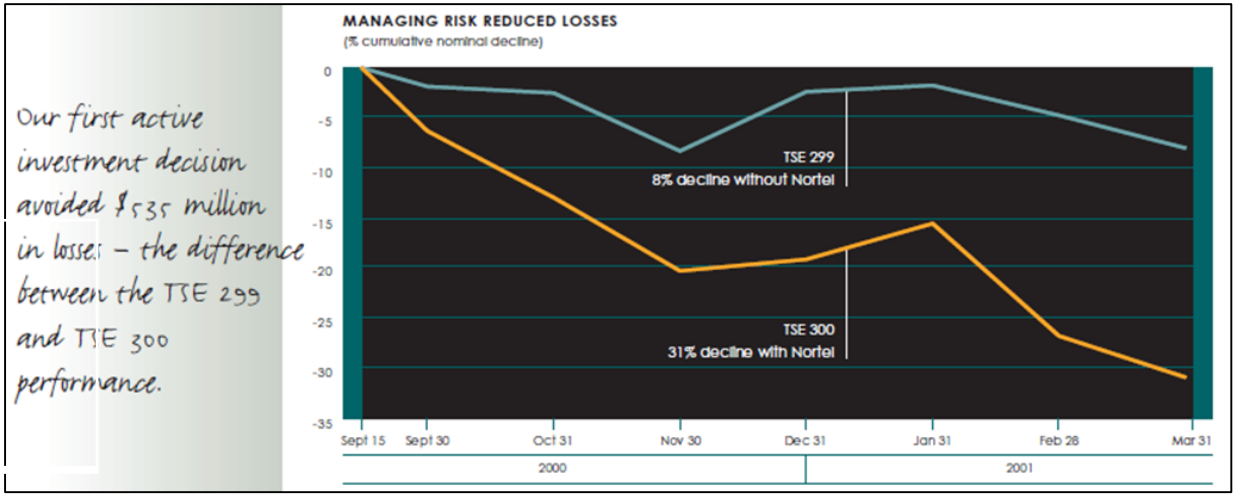


Source: CPPIB's Annual Report (March 2001), page 11

CANADIAN EQUITY CONCENTRATION

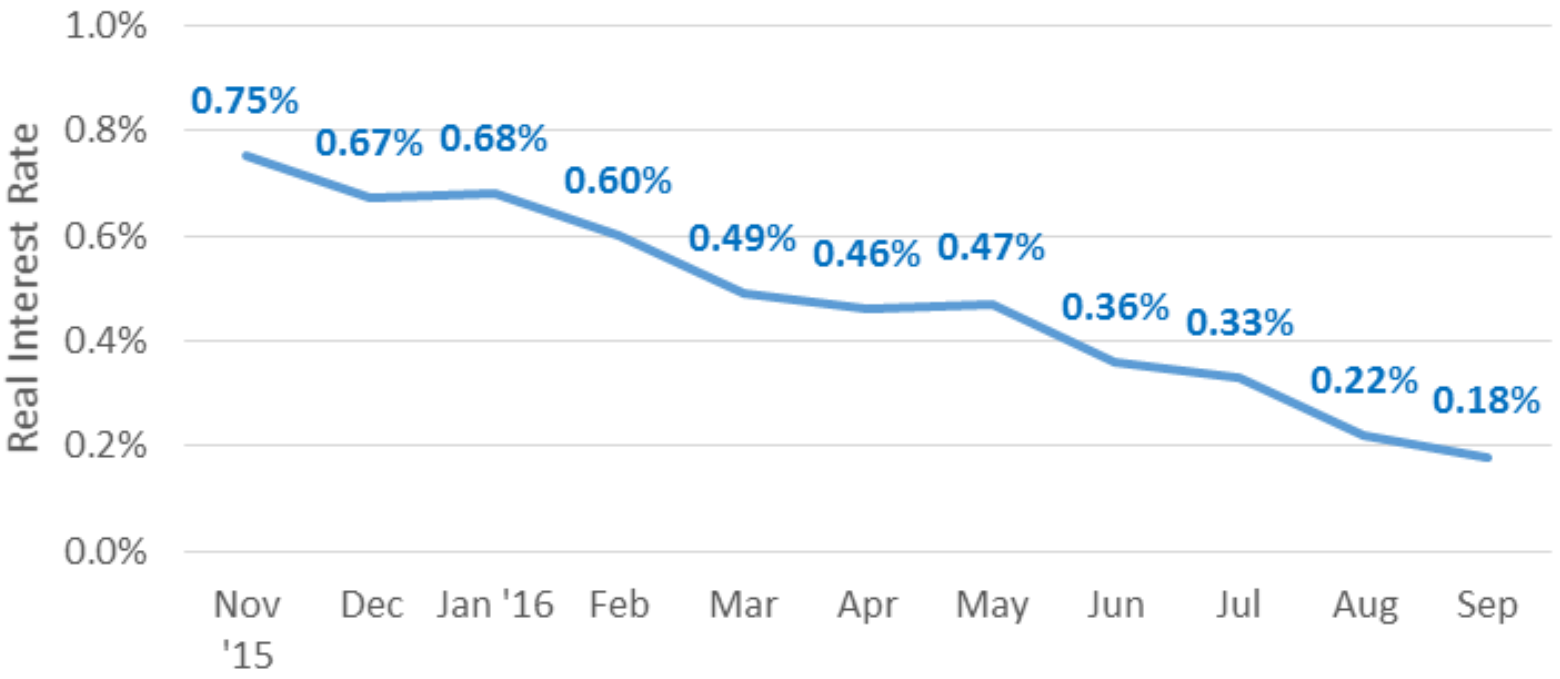
%	Fiscal year 2001
ACTUAL RESULTS	
Canadian equities	(7.7)
Foreign equities	(17.5)
Total portfolio	(9.4)
BENCHMARK RESULTS	
Canadian equities	(18.6)
Foreign equities	(18.2)
Total portfolio	(17.8)
Chief actuary's assumption	6.6
Long-term required return	7.9





Source:
CPPIB's Annual Report (March 2001), pages 6, 15, 18

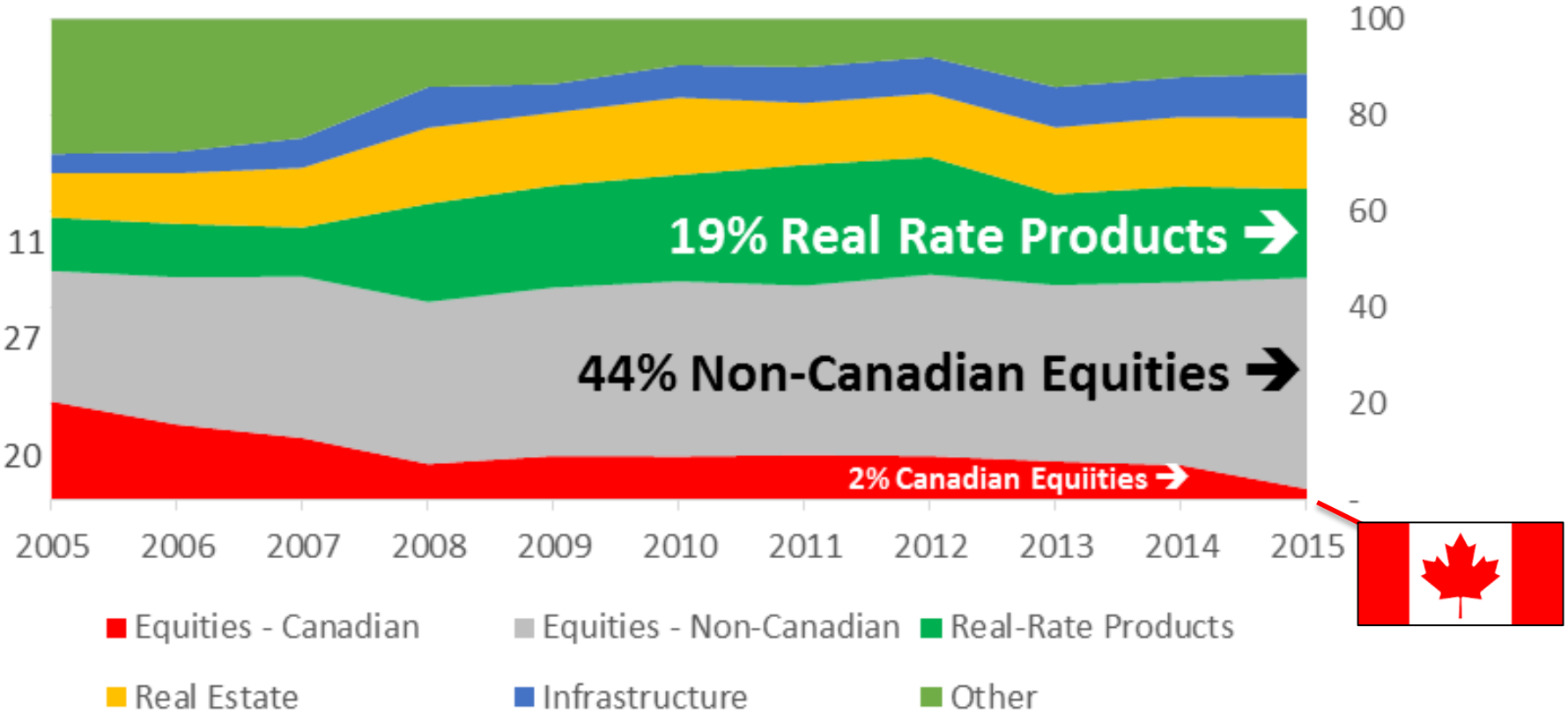
REAL YIELDS: ~ 0% NOW



Source: Graphed using data from Bank of Canada, Real Return Bond series V122553

TEACHERS' IN 2015

Teachers' RRBs = 19%, Non-Canadian Equities = 44%, Canadian Equities = 2%



Source: Graphed using data from Teachers' 2015 Annual Report, page 71

RECOMMENDATIONS

FRAMEWORK	6. De-Linking Discount Rates 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
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 2. Adoption of More Comparable Accounting Principles 3. AFS and HTM Accounting 4. Pension Liability Accounting
OVERSIGHT	17. Removal of 105% Rule in Investment Policies 13. No Over-Reliance on Quantitative Modeling 18. Pension Fund

6. DE-LINKING DISCOUNT RATES

For … asset allocation decision-making, … consider "breaking … link" (recursive) between liability valuations and … yield on … assets … theory suggests … approach is more appropriate	
Need to Model Market "Volatility"	• Market value of liabilities does not depend on portfolio composition (only cash flows from insurance, pensions, etc.) • "Linking" may mask market value at risk in liabilities • If A-L modeling doesn't reflect long-term returns/risks, optimizations won't yield best long-term return/risk tradeoffs

7. MIN/MAX ASSET CLASS CONSTRAINTS

constraints … should be reviewed and relaxed, to avoid … lower risk-adjusted returns … **rationale for … constraints should be … explicit**
• See 5th belief: "Constraints never increase expected risk-adjusted returns"

8. EVOLVED RISK FRAMEWORK
9. EXPLICIT RISK MANAGEMENT GOALS

8.
evolved risk framework should be considered to improve portfolio/risk measurement, management and/or governance

9.
framework could include … goals … avoid "undue risk", … risk … taken:

- unknowingly, … (unaware); or
- knowingly, …:
  - cannot be managed …, given … capacities (ineffective);
  - exceeds … tolerances (prohibited);
  - … higher than … needs to be (inefficient); or
  - … not understood (uninformed) …

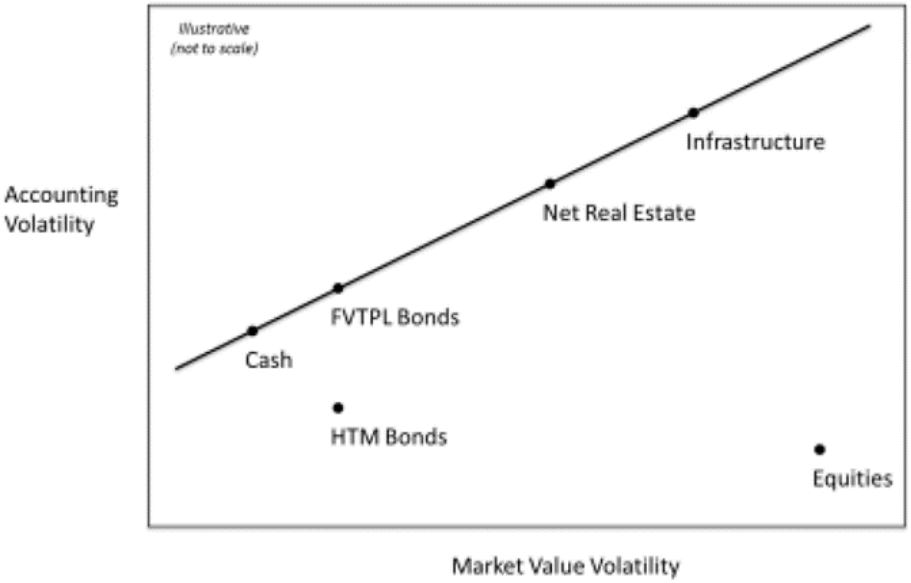
- See earlier discussion re: Framework

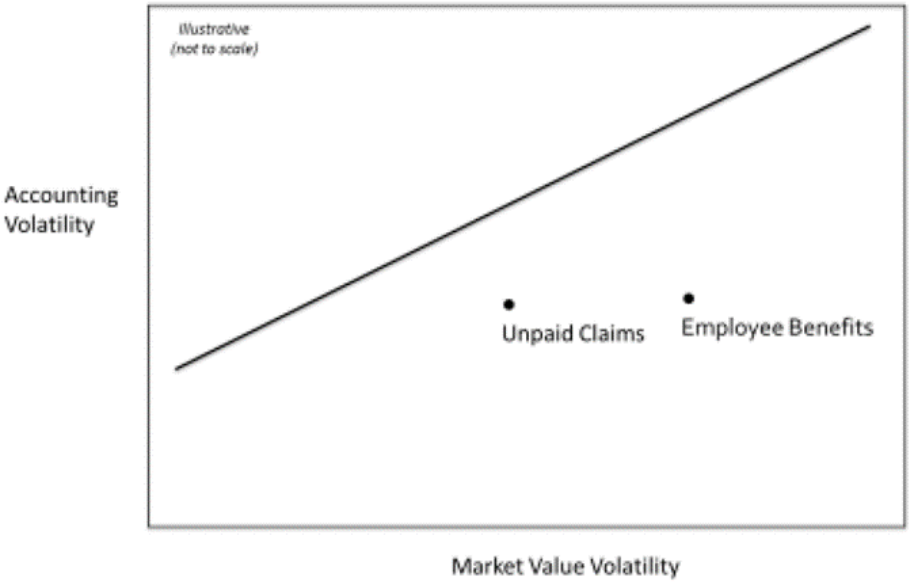
5. RETURN/RISK DEFINITIONS FOR ASSET MIX DECISION

re-define return/risk … to inform … asset mix … based on … market values, rather than accounting … At a minimum, net income … replaced by comprehensive income in … return … and retained earnings … expanded to include … AOCI … in … risk …
In … long term, market returns and market risks … determine average long-term premium rates, regardless of how assets and liabilities are accounted for …

Market Value
≠
Accounting Value
⬇
Market Risk
>
Accounting Risk
	• Accounting risk definition (volatility in retained earnings) understates market volatility (excludes largest market risks)
	  • Remeasurement of pension liabilities (~ 16 duration) never impacts net income/retained earnings (permanent AOCI)
	  • Equity unrealized gains/losses (temporary AOCI)
	• Makes RRBs look unattractive from risk perspective
	• Reality: RRBs hedge long-term real rate/inflation risk best
	• Adoption of comprehensive income/AOCI better (not best)
	• See next page

ACCOUNTING VS MARKET VOLATILITY





Illustrative
(not to scale)

10. MINIMUM RISK PORTFOLIO

minimum risk portfolio … should be … defined … aligned with … stakeholders …

- MRP should reflect risk in cash flows re: insurance, pension and other liabilities (e.g., real rates, inflation)
- MRP should include some RRBs
- MRP definition ("benchmark" for risk and surplus growth) says nothing about whether to buy RRBs

14. EXCLUSION OF REAL RETURN BONDS

role that RRBs can play in … managing … risks should be discussed, with consensus … regarding … effectiveness … from a risk … perspective … independent of … cost of … "insurance" … measured by RRB yields and … expected returns

- Consensus should be achieved on RRB's effectiveness in hedging liability risks (insurance vs pensions) compared to other assets (e.g., cash, "nominal" bonds, real estate, infrastructure) on a market value basis
- Consensus should be achieved on RRB's efficiency in a total portfolio context, and on a market value basis

MPI'S VIEW

In questions related to RRBs, MPI said:

> *"Real return bonds were excluded … because they were deemed to be expensive. Aon Hewitt's … assumptions showed **real return bonds to have significant volatility and down side risk*** with modest returns relative to nominal bonds …. Also, page 17 of the Phase 1 report Aon concluded that "RRBs are not a good inflation hedge"."*[5]

*** Emphasized by me, not MPI, to highlight a fundamental difference in beliefs.**

[5] Source: CAC (MPI) 1-77

MPI'S VIEW

When asked if MPI agreed with AON's conclusion that **RRBs are not a good inflation hedge**, MPI said:

> *"The Corporation accepts Aon's belief that there are other inflation hedging asset classes available (i.e.: real estate and infrastructure) with greater expected returns … At the time of the ALM study the real yields on RRBs were below 40 bps for 20 year terms and below 10 bps for 10 years and shorter terms. Real yields for the same terms are currently negative."*

AON'S VIEW

Asked why Aon believes RRBs are not a good inflation hedge for MPI, Aon's response was:

> *"RRBs are not a good inflation hedge for MPI for the following reasons:*
>
> 1. *The underlying inflation according to nominal and real return bonds do not match the inflation used to value liabilities (which is based on a survey of Canadian banks);*
> 2. *RRBs suffer from a limited offering;*
> 3. *Supply and demand for RRBs have a large impact on the market value; and*
> 4. *Therefore, the economics of the inflation protection from* ***RRBs do not match the financial impact to MPI on a year by year basis.****"*[6]
>
> *** Emphasized by me, not Aon, and discussed on the next page.**

[6] Source: CAC (MPI) 2-39

MY VIEW

My observations related to Aon's four points are:

1. this is a problem with the method for valuing the liabilities (survey of Canadian banks), which is not a market-based method, not a problem with the hedging properties of RRBs against a market-valued set of liabilities;
2. while RRBs suffer from a limited offering (liquidity), larger funds have managed to accumulate significant exposures (e.g., the average PIAC fund has 3%);
3. while supply and demand for RRBs may have a large impact on market value, presumably this is a one-time market impact acquisition cost – a small price to pay if RRBs are considered a buy-and-hold asset class, with little turnover; and
4. Aon appears to concede that RRBs do offer inflation protection (despite their earlier comment to the contrary) but that **RRBs do not match the financial impact to MPI on a year by year basis**. This last point represents the symptom of a bigger problem, which relates to the next belief (constraints).

AON AGREES

When asked if Aon could list one or two asset classes that offer better inflation hedges than RRBs for MPI, and offer any evidence to support that belief, Aon said it could not, adding:

> *"There is no asset class that we know that can hedge the short term inflation risk … Over the long term,* ***where RRB's are held to maturity, shorter term price sensitivity is less relevant and inflation experienced over the period would result in higher cash flows and an inflation hedge****. It is a commonly accepted belief … that higher inflation would gradually be reflected in nominal bond yields, equity returns through higher profits, real estate through increased rents and infrastructure, especially where regulated, through increased tariffs …"*

*** Emphasized by me, not Aon, to note the tradeoff between shorter term price sensitivity (less relevant according to Aon, with which I agree) and inflation experienced over the period which would result in higher cash flows and an inflation hedge.**

15. EFFECTIVENESS OF DURATION POLICY

duration policy should be reviewed, given … inherent risks of changing real … rates and … inflation …, and exposure to … nominal … rates in … portfolio (… bonds without inflation protection)

- MPI agrees that duration matching is not as effective if inflation turns out to differ from expectations
- "Accepted short term inflation risk and … accounted for risk through margins and reserve"
- "Excess portfolio was designed to provide some protection against inflation"

16. INTEGRATION OF REAL ESTATE/ INFRASTRUCTURE LIABILITIES IN DURATION MANAGEMENT

consider … liabilities … from all sources …, including real estate … in … duration … financial leverage … in Asset-Liability Studies … should be … consistent with … leverage actually used …, removing … ~ 4% difference related to … debt

- Materiality of4% difference depends on the marginal contribution to return/risk, measured on a market value basis, of real estate vs fixed income

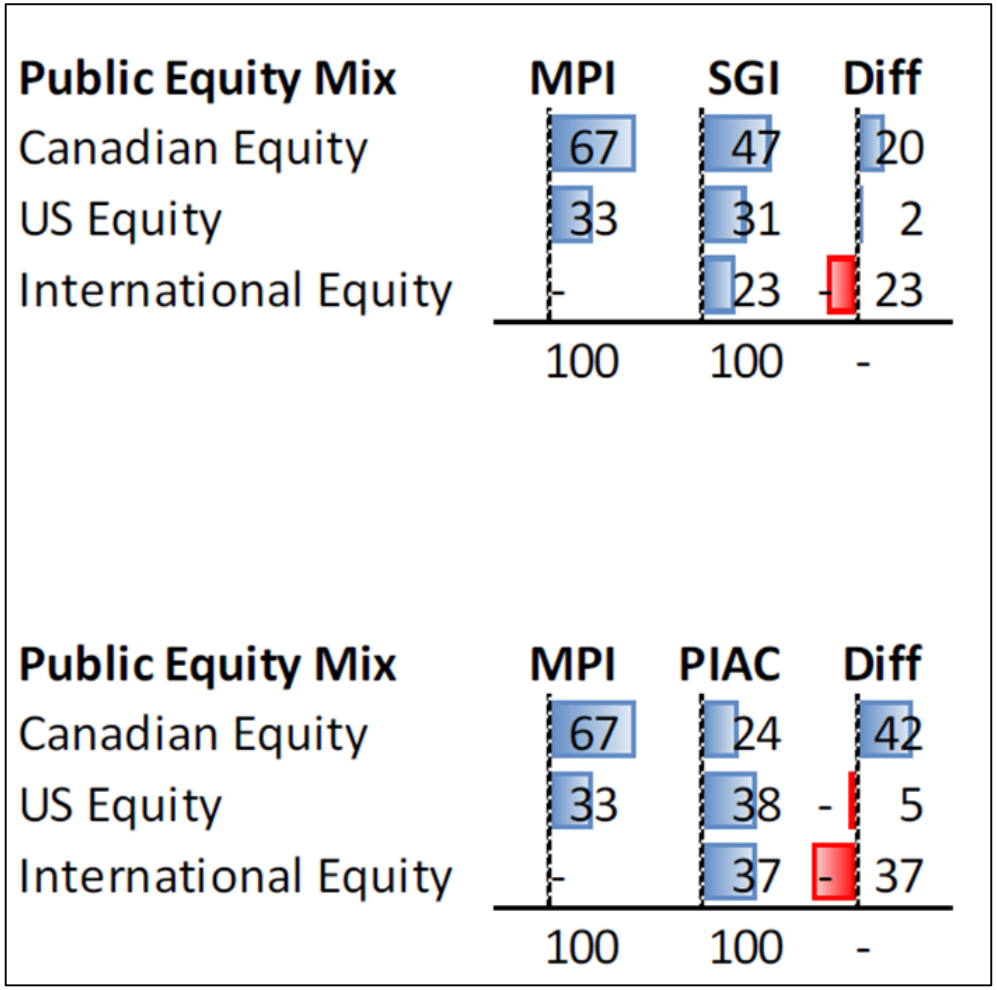
11. CANADIAN EQUITIES' 10% MINIMUM ALLOCATION

10% minimum … to Canadian Equities ("to retain … meaningful exposure to home …") should be reconsidered, given … different interests of … employees through … pension …, … concentrated … market …

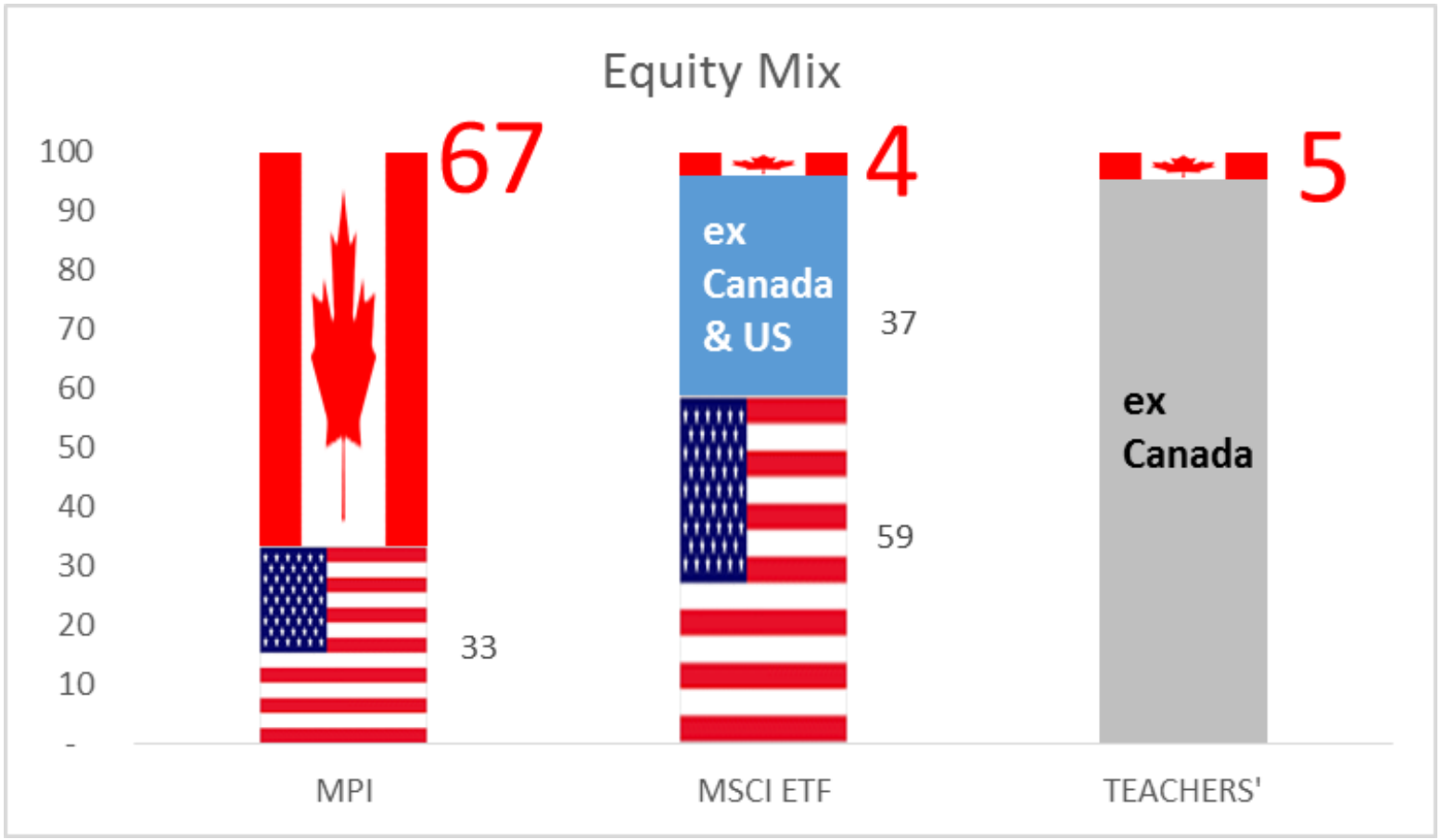
- Common home country bias
- Canada small (3 - 5% of world) and concentrated
- MPI's concentration particularly high
- See Nortel example earlier and 5th belief (constraints)

12. NO INTERNATIONAL EQUITIES

having no exposure to International … should be reconsidered, given … large size of … foreign markets, … return opportunities … and … diversification …	
Portfolio Theory	• Theory: funds should be close to global market cap
Unique Allocation	• Most investors have significant International • SGI: ~ ¼ of public equities • PIAC > ⅓ of equites • See next page

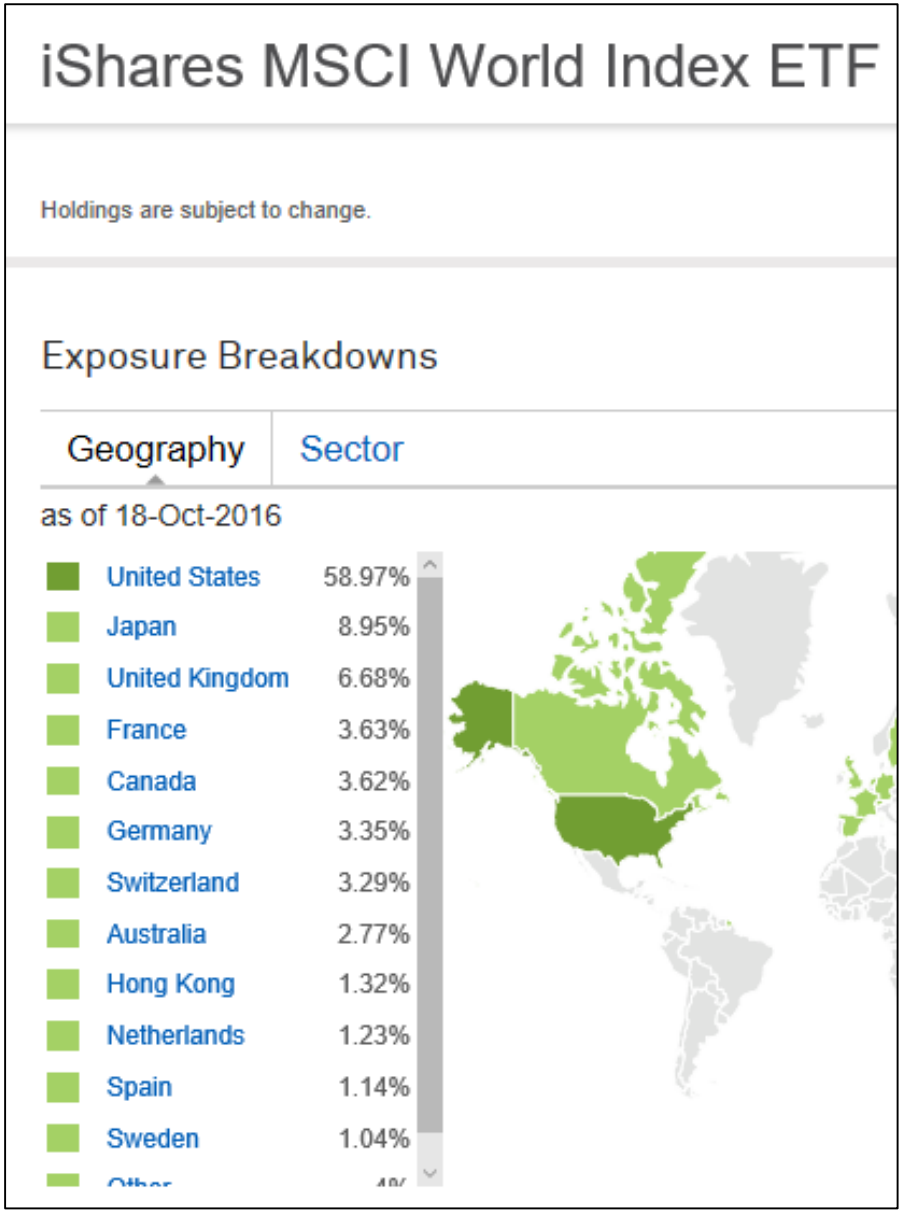


GLOBAL EQUITY MARKET CAPS: 59/37/4 US/INTERNATIONAL/CANADA



Source: Graphed using data from Teachers' 2015 Annual Report, page 71 and iShares MSCI World Index ETF (Oct 18, 2016) on next page

MSCI WORLD INDEX



Source: iShares MSCI World Index ETF (Oct 18, 2016)

1. CLARITY OF ACCOUNTING CHOICES

clarify … flexibility … regarding … accounting for assets and liabilities, while remaining GAAP-compliant, and … factors it takes into account in electing to use one method/assumption over others

- See #5. RETURN/RISK DEFINITIONS FOR ASSET MIX DECISION

- Market risk understated by use of accounting metrics
  - Volatile equities
  - Volatile pension remeasurement

2. ADOPTION OF MORE COMPARABLE ACCOUNTING PRINCIPLES

consider adopting … principles, where GAAP allows … elections, that reduce … discrepancy between net income and comprehensive income …, to improve comparability … by accounting for more … at … "FVTPL"

- Important for portfolio/risk management only if return/risk for asset mix decision-making is based on accounting (without "adjustments") rather than market value

3. AFS AND HTM ACCOUNTING

Unrealized gains and losses for AFS assets … are reported as "… OCI …" and … excluded from net income until realized, making … net income recognition … inconsistent with FVTPL assets …

HTM Bonds … at amortized cost, should also be re-considered.
Market valuations are … more comparable, relevant, transparent, understandable and subject to less … bias than valuations … based on … current accounting

- Unrealized gains and losses are the largest component of total returns on equities (the other being dividend yield), and the most volatile component

4. PENSION LIABILITY ACCOUNTING

Reconsideration should … include … remeasurement of employee benefits … which is … OCI …

remeasurement … is large (… long duration of pension liabilities), but OCI … from changing interest rates that impact … liabilities is not recognized through … net income

- Make "adjustments", for portfolio/risk management purposes, for differences between market and accounting risk

17. REMOVAL OF 105% RULE IN INVESTMENT POLICIES

remove … ability to request … managers to realize gains (losses) …, which MPI says "… no longer relevant" …

remove … ability … to cause a manager to realize gains (losses) for … sole purpose of having … impact on net income, without yielding … economic value, reducing risk or … conferring … benefit …

- Applaud that MPI agrees to make change

13. NO OVER-RELIANCE ON QUANTITATIVE MODELING

be vigilant about … over-reliance on quantitative considerations, given … high sensitivity of optimal asset allocations to … assumptions (returns, volatilities and correlations) and … large number of inputs	
44 Assumptions	• optimal solutions from quantitative portfolio optimizations are very sensitive to the capital market assumptions used; and • there are at least 44 such assumptions in the Asset-Liability Study, involving MPI's 8-asset class portfolio, as calculated below. **44 Important Assumptions (estimates, but "unknowns")** 8 average return assumptions (1 for each asset class) 8 volatility assumptions 28 correlations (= 8 x 7 ÷ 2) 44 "unknowns" Source: Evidence, page 41
A-L Studies Every 4 Years	• Too infrequent, considering "dynamic risks" in static asset mix

18. PENSION FUND

interests of … stakeholders should inform decisions regarding … accounting for and management of … assets and liabilities related to … pension plan … desirable outcome is … greater clarity around … appropriateness and prudence of assets and liabilities commingled	
Risky Component not Considered	• Material market risk from employee benefits (re-measurement) not reflected in return/risk in A-L Study • Not appropriately considered in asset mix decisions • See next page

Unbundling Pensions	• Pension plan "unbundling" may result in <u>accounting</u> recognition of material remeasurement losses (to be confirmed by accountant(s))
	• Recognition depends on:
	  • **Pension liability** (~ 18% of assets on accounting basis)
	  • **Duration** (> 16)
	  • **Change in discount rate** (adoption of different accounting)
	  • **Convexity/other** (bigger for larger rate changes, lower rates)

MATERIALITY

Change in Pension Liability	Net Income	OCI
Current service cost	Low Volatility	
Interest cost		
Benefits paid		
Remeasurement (gains) losses recognized in OCI		**High Volatility**

"OCI not reflected in return/risk in A-L Study, not considered in asset mix decisions

Source:
MPI's financial statements, Note 16

"not reflected"

assumptions adopted by the Civil Service Superannuation Board. The weighted average duration of the defined benefit obligation is 16.29 years (February 28, 2015 – 17.15 years). Results from the most recent actuarial valuations, projected to February 29, 2016 and the corresponding economic assumptions are as follows:

Assumptions:	Pension Benefit Plan		Other Benefit Plans	
	2016	2015	**2016**	2015
Discount rate	**4.05%**	3.60%	**4.05%**	3.60%
Inflation rate	**2.00%**	2.00%		
Expected salary increase	**2.75%**	2.75%		
Expected health care cost increase (out of scope)			**4.90%**	5.50%
Expected health care cost increase (in scope)			**2.00%**	2.00%

Change in benefit obligations:

(in thousands of Canadian dollars)	Pension Benefit Plan		Other Benefit Plans	
	2016	2015	**2016**	2015
Balance at March 1	**339,334**	285,326	**51,785**	47,812
Current service cost	**14,103**	12,054	**5,414**	5,059
Interest cost	**12,760**	12,349	**931**	780
Benefits paid	**(10,832)**	(9,659)	**(2,983)**	(2,701)
Remeasurement (gains) losses recognized in OCI	**(26,975)**	39,264	**(5,420)**	835
Balance at February 29/28	**328,390**	339,334	**49,727**	51,785
Employee contribution for the year	**9,679**	8,909	**-**	-

HEALTH WEALTH CAREER

ASSET LIABILITY STUDY

EFFICIENT FRONTIER ANALYSIS FOR BASIC INSURANCE & PENSION COMPONENTS

ASSUMPTIONS BASED ON FORWARD YIELD CURVE & REAL LIABILITY BENCHMARKS

CAC (MPI) 1-84(f) , 1-85(g) RESPONSES

Manitoba Public Insurance

SEPTEMBER 25, 2018

Dave Makarchuk
Pawel Piesowicz
Angelo DiNoto

INTRODUCTION

The analysis provided in this document is in accordance with:

Order No. 124/18

Motion by Consumers' Association of Canada (Manitoba) Inc. for an Order Compelling Certain Responses to Information Requests in the 2019/2020 General Rate Application

September 14, 2018

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ASSET CLASSES CONSIDERED

	Return Seeking	Inflation Sensitive	Interest Rate Sensitive
Broad Markets	**Canadian Equity** US Equity **EAFE Equity**	Real Return Bonds 3x Real Return Bonds	Cash MUSH Bonds Provincial Bonds Federal Bonds Canadian Corporate Bonds 3X Long Provincial Bonds
Other Markets	Emerging Markets Equity Global Low Volatility Equity		Global Bonds High Yield Bonds Emerging Market Debt
Alternative Investments	Private Equity Diversified Growth Fund	Infrastructure – Direct Global Real Estate - Direct Cdn	Private Debt – Universe Private Debt – Long Commercial Mortgages Long Comm. Mortgages

Asset classes already included in the target asset mix

Additional asset classes included in the analysis as suggested by Mercer (approved by MPI Investment Committee)

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ASSET CLASSES TO CONSIDER
CONSTRAINTS

- Practical and reasonable modelling approaches and constraints are necessary. Mercer recommendations on modelling are as follows:

  ✓ U.S./EAFE/Emerging Markets Equity should be bundled into a single ACWI[1] equity mandate
  - Single ACWI mandate provides greater mandate efficiency, affordability
  - Expands equities to include Emerging Markets Equity (note: Samsung is an example)
  - Allows the manager to select best in class stocks without artificial geographic boundaries (i.e., attaching a multinational company to a single country)

  ✓ Global Bonds/High Yield Bonds/Emerging Market Debt (one-third each), hereafter referred to as Growth Fixed Income
  - Diversified package of liquid bonds which diversifies return and risk sources of the Growth Portfolio

ACWI is All Country World Index. MSCI ACWI is currently about 54% US, 32% EAFE, 12% Emerging Markets and 3% Canadian Equity.

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ASSET CLASSES TO CONSIDER
MINIMALLY CONSTRAINED APPROACH - PARAMETERS

Current

Asset Class	Single	Group
MUSH Bonds	Max. 25% of total portfolio	
Real Estate and Infrastructure		Not exceed 50% of U.S. Equity, Real Estate, Infrastructure

Proposed by Mercer

Asset Class	Single	Group
MUSH Bonds Private Debt Commercial Mortgages	Min. 10% of total portfolio	Max. 25% of total portfolio
Real Estate Infrastructure Private Equity Growth Fixed Income		Not exceed Equity portfolio

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ANALYSIS
EFFICIENT FRONTIERS
BASIC INSURANCE
– REAL LIABILITY BENCHMARK

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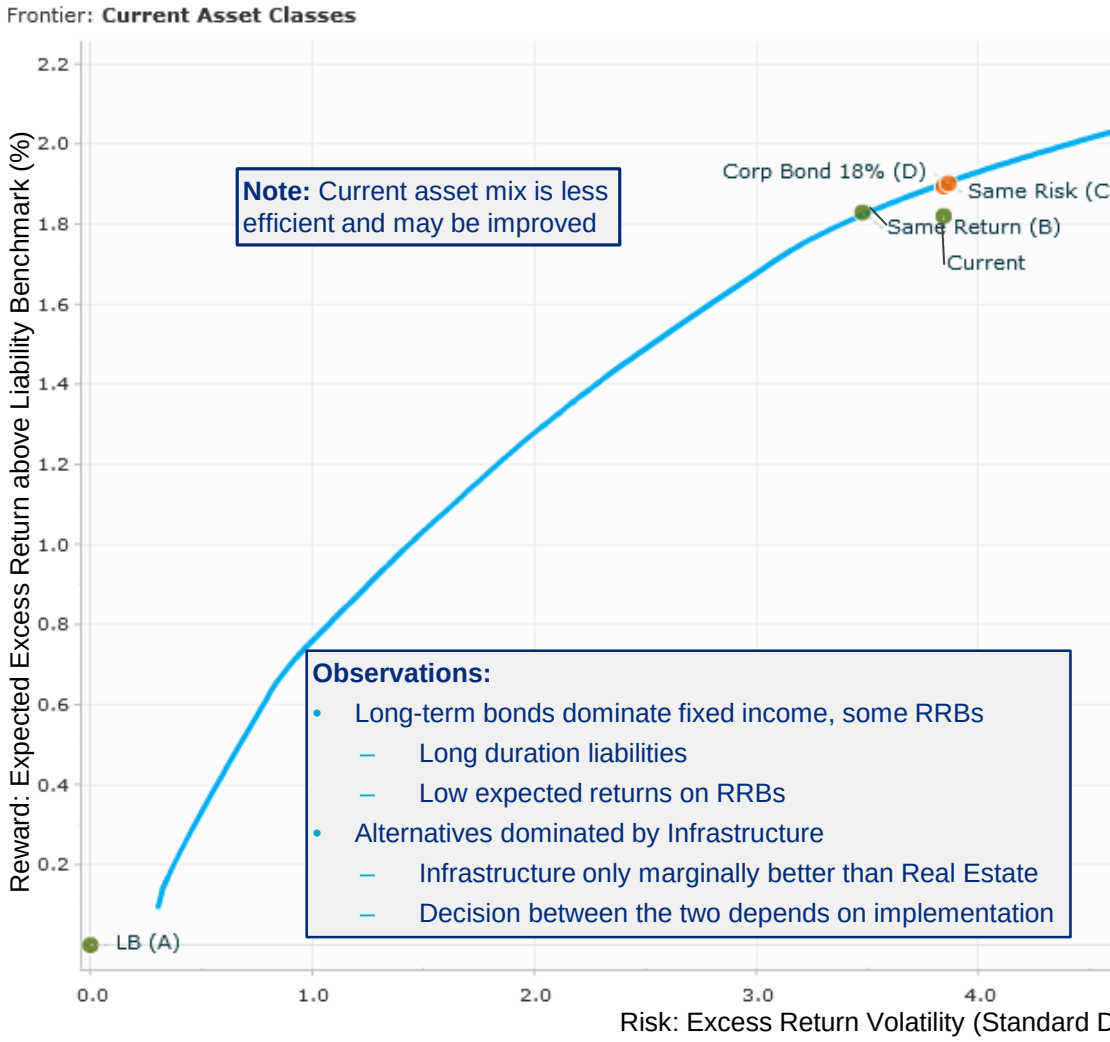
EFFICIENT FRONTIERS (MINIMALLY CONSTRAINED)
CURRENT ASSET CLASSES ONLY

1-84 (f)



	Current	A: LB	B. Same Return	C. Same Risk	D. Corp Bond 18%
Fixed Income	70%	100%	74%	75%	75%
Treasury Bills	--	26.0%	--	--	--
Real Return Bonds	--	66.0%	30.0%	18.0%	18.0%
Short-term Bonds (Prov)	6.5%	8.0%	--	--	--
Mid-term Bonds (Prov)	12.0%	--	--	--	--
Long-term Bonds (Prov)	29.5%	--	23.5%	30.0%	29.0%
Mid-term Bonds (Corp)	2.0%	--	--	--	--
Long-term Bonds (Corp)	--	--	10.5%	17.0%	18.0%
MUSH Bonds	20.0%	--	10.0%	10.0%	10.0%
Public Equities	15%	0%	13%	12.5%	12.5%
Canadian Equity	10%	--	10.0%	11.5%	11.5%
U.S. Equity	5%	--	3.0%	1.0%	1.0%
Alternatives	15%	0%	13%	12.5%	12.5%
Real Estate	10%	--	1%	--	--
Infrastructure	5%	--	12%	12.5%	12.5%
Risk/Return Metrics					
Expected 10-Year Return	4.2%	2.4%	4.2%	4.2%	4.2%
Surplus Volatility	3.8%	N/A	3.5%	3.8%	3.9%
Information Ratio (Excess Return/Risk)	0.47	N/A	0.53	0.49	0.49
Interest Rate Metrics					
Duration	7.3	10.3	10.3	10.3	10.3
Hedge Ratio	86%	100%	100%	100%	100%

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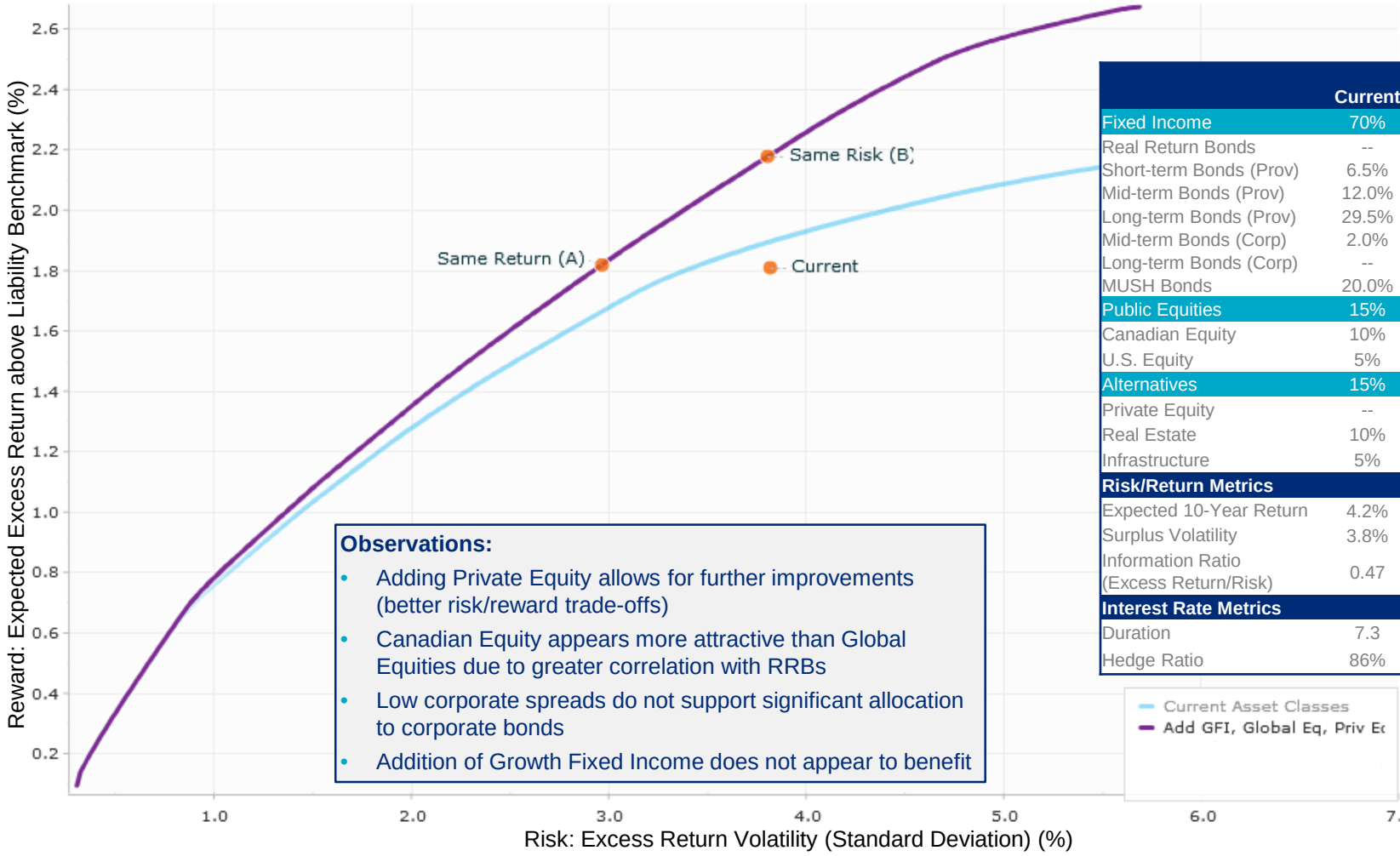
EFFICIENT FRONTIERS (MINIMALLY CONSTRAINED)

ADDING GROWTH FIXED INCOME, GLOBAL EQUITIES & PRIVATE EOUITY

1-84 (f)

Frontier: **Add GFI, Global Eq, Priv Eq**



	Current	A. Same Return	B. Same Risk
Fixed Income	70%	79.5%	74.5%
Real Return Bonds	--	48.0%	41.5%
Short-term Bonds (Prov)	6.5%	--	--
Mid-term Bonds (Prov)	12.0%	1.0%	--
Long-term Bonds (Prov)	29.5%	9.5%	20.0%
Mid-term Bonds (Corp)	2.0%	--	--
Long-term Bonds (Corp)	--	1.0%	1.0%
MUSH Bonds	20.0%	20.0%	12.0%
Public Equities	15%	10%	12.5%
Canadian Equity	10%	10.0%	12.5%
U.S. Equity	5%	--	--
Alternatives	15%	10.5%	13%
Private Equity	--	7%	9%
Real Estate	10%	--	--
Infrastructure	5%	3.5%	4%
Risk/Return Metrics			
Expected 10-Year Return	4.2%	4.2%	4.5%
Surplus Volatility	3.8%	3.0%	3.9%
Information Ratio (Excess Return/Risk)	0.47	0.61	0.57
Interest Rate Metrics			
Duration	7.3	10.3	10.3
Hedge Ratio	86%	100%	100%

Observations:

- Adding Private Equity allows for further improvements (better risk/reward trade-offs)
- Canadian Equity appears more attractive than Global Equities due to greater correlation with RRBs
- Low corporate spreads do not support significant allocation to corporate bonds
- Addition of Growth Fixed Income does not appear to benefit

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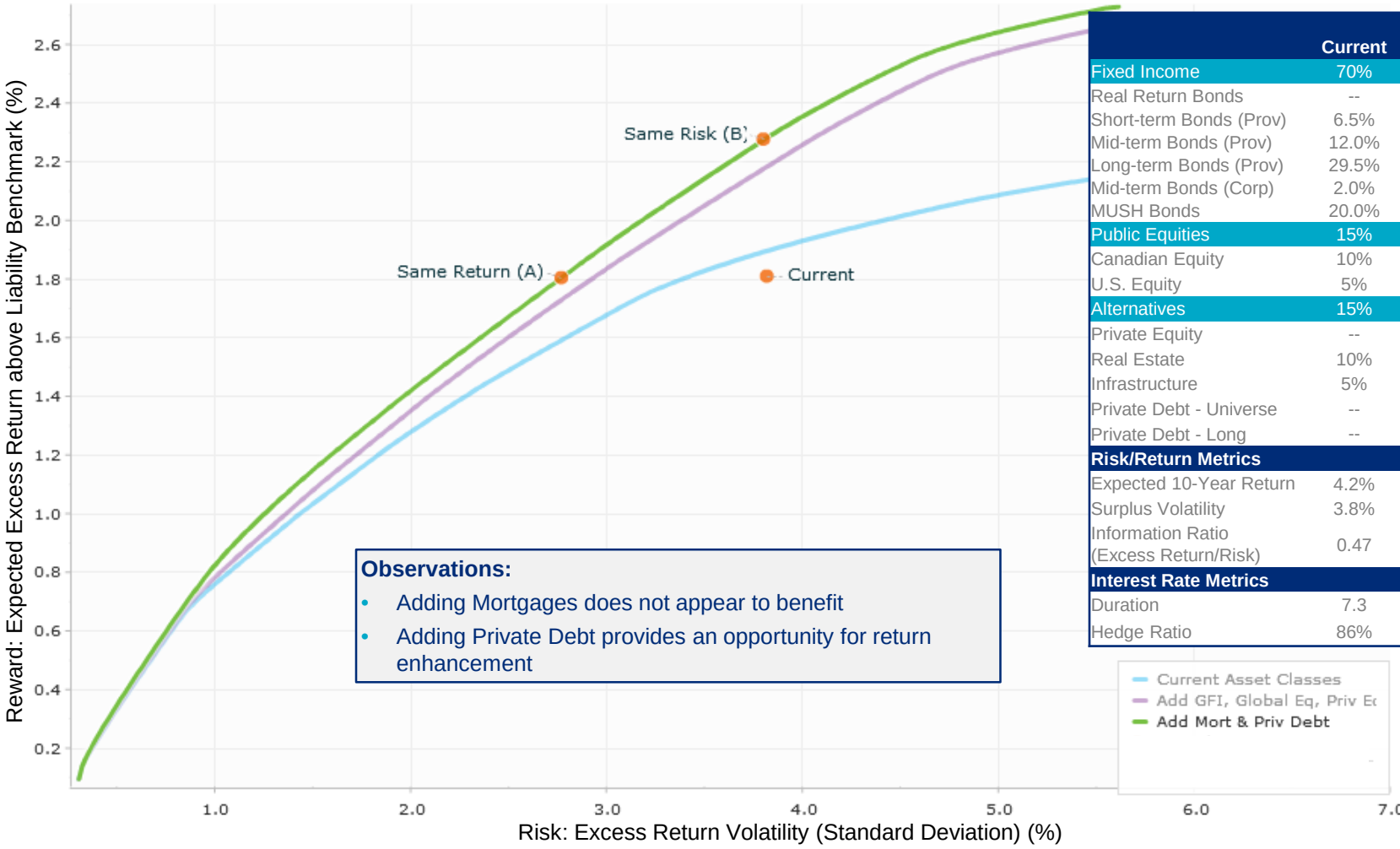
EFFICIENT FRONTIERS (MINIMALLY CONSTRAINED)
ADDING MORTGAGES AND PRIVATE DEBT

1-84 (f)

Frontier: **Add Mort & Priv Debt**



Observations:

- Adding Mortgages does not appear to benefit
- Adding Private Debt provides an opportunity for return enhancement

	Current	A. Same Return	B. Same Risk
Fixed Income	70%	64.5%	58.5%
Real Return Bonds	--	46.0%	40.5%
Short-term Bonds (Prov)	6.5%	--	--
Mid-term Bonds (Prov)	12.0%	8.5%	--
Long-term Bonds (Prov)	29.5%	--	8.0%
Mid-term Bonds (Corp)	2.0%	--	--
MUSH Bonds	20.0%	10.0%	10.0%
Public Equities	15%	10%	13%
Canadian Equity	10%	10.0%	13.0%
U.S. Equity	5%	--	--
Alternatives	15%	25.5%	28.5%
Private Equity	--	5.5%	8.5%
Real Estate	10%	1.0%	--
Infrastructure	5%	4.0%	5.0%
Private Debt - Universe	--	1.5%	--
Private Debt - Long	--	13.5%	15.0%
Risk/Return Metrics			
Expected 10-Year Return	4.2%	4.2%	4.6%
Surplus Volatility	3.8%	2.8%	3.8%
Information Ratio (Excess Return/Risk)	0.47	0.65	0.60
Interest Rate Metrics			
Duration	7.3	10.3	10.3
Hedge Ratio	86%	100%	100%

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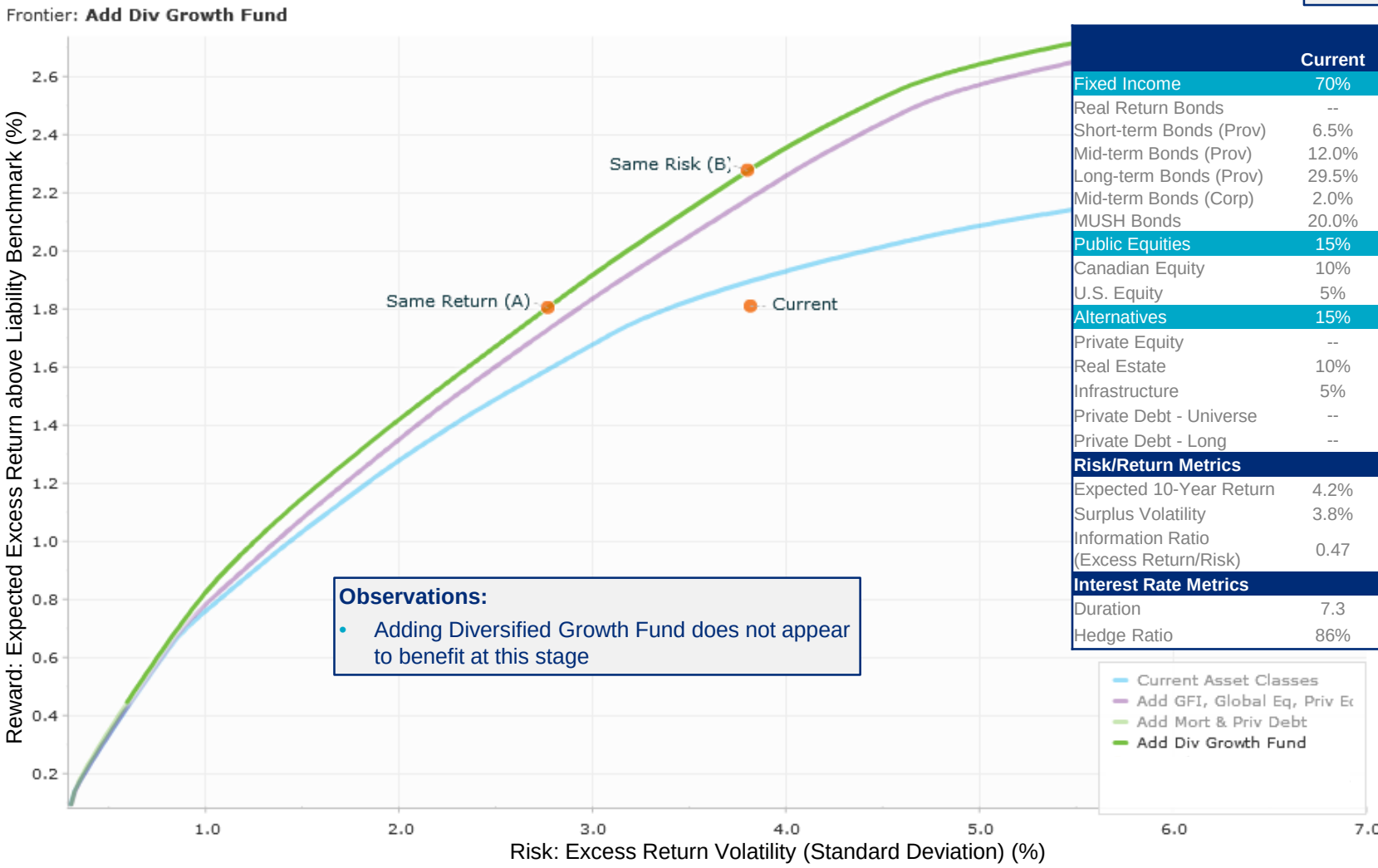
EFFICIENT FRONTIERS (MINIMALLY CONSTRAINED)
ADDING DIVERSIFIED GROWTH FUND

1-84 (f)



	Current	A. Same Return	B. Same Risk
Fixed Income	70%	64.5%	58.5%
Real Return Bonds	--	46.0%	40.5%
Short-term Bonds (Prov)	6.5%	--	--
Mid-term Bonds (Prov)	12.0%	8.5%	--
Long-term Bonds (Prov)	29.5%	--	8.0%
Mid-term Bonds (Corp)	2.0%	--	--
MUSH Bonds	20.0%	10.0%	10.0%
Public Equities	15%	10%	13%
Canadian Equity	10%	10.0%	13.0%
U.S. Equity	5%	--	--
Alternatives	15%	25.5%	28.5%
Private Equity	--	5.5%	8.5%
Real Estate	10%	1.0%	--
Infrastructure	5%	4.0%	5.0%
Private Debt - Universe	--	1.5%	--
Private Debt - Long	--	13.5%	15.0%
Risk/Return Metrics			
Expected 10-Year Return	4.2%	4.2%	4.6%
Surplus Volatility	3.8%	2.8%	3.8%
Information Ratio (Excess Return/Risk)	0.47	0.65	0.60
Interest Rate Metrics			
Duration	7.3	10.3	10.3
Hedge Ratio	86%	100%	100%

Observations:

- Adding Diversified Growth Fund does not appear to benefit at this stage

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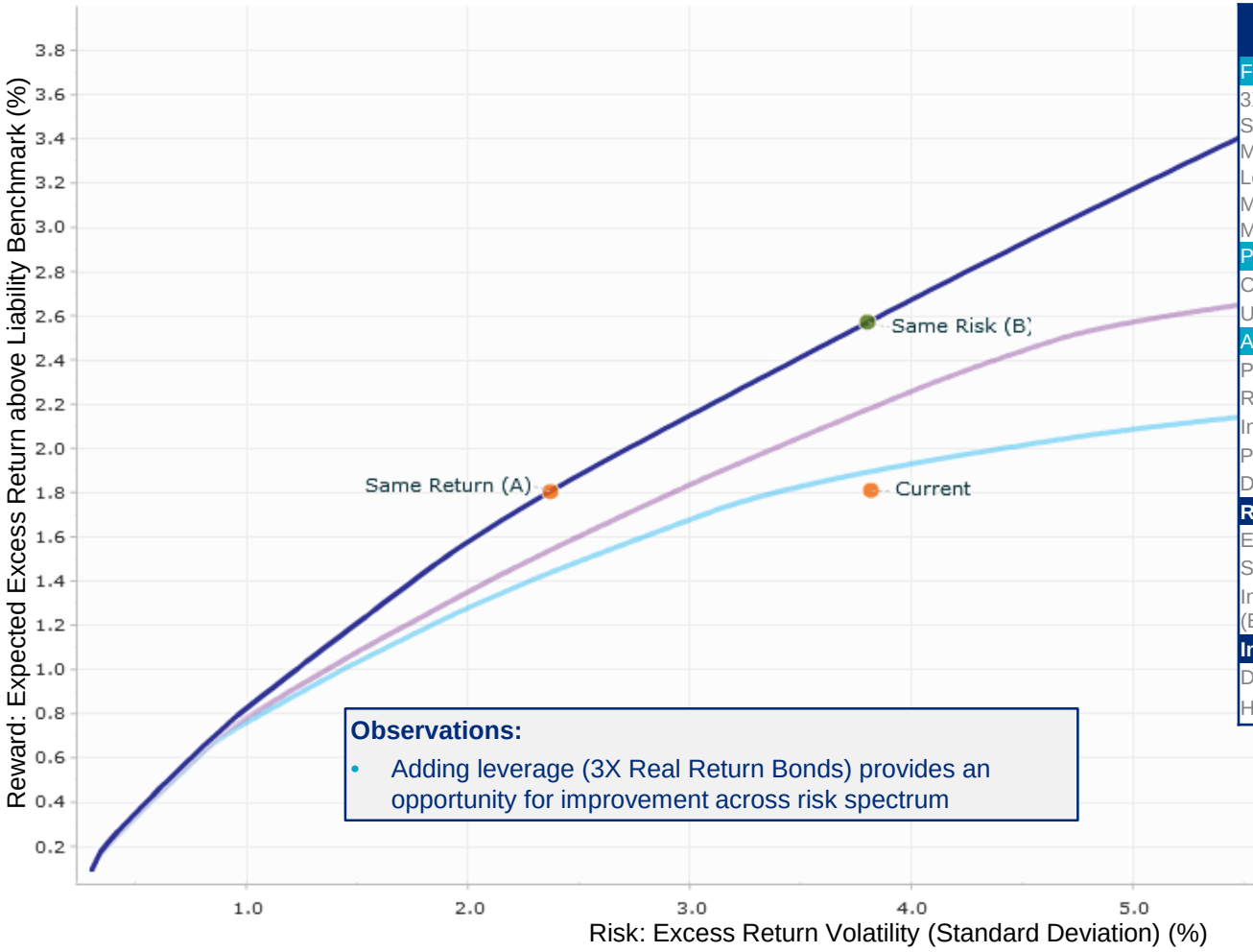
EFFICIENT FRONTIERS (MINIMALLY CONSTRAINED)
ADDING LEVERAGE (BOND OVERLAY)

1-84 (f) **1-85 (g) i**

Frontier: **All Asset Classes (Real)**



	Current	A. Same Return	B. Same Risk
Fixed Income	70%	62.5%	53%
3X Real Return Bonds	--	17.0%	15.0%
Short-term Bonds (Prov)	6.5%	35.5%	3.5%
Mid-term Bonds (Prov)	12.0%	--	24.5%
Long-term Bonds (Prov)	29.5%	--	--
Mid-term Bonds (Corp)	2.0%	--	--
MUSH Bonds	20.0%	10.0%	10.0%
Public Equities	15%	10.5%	15%
Canadian Equity	10%	10.5%	15.0%
U.S. Equity	5%	--	--
Alternatives	15%	27%	32%
Private Equity	--	3.0%	6.5%
Real Estate	10%	6.5%	5.5%
Infrastructure	5%	1.5%	3.0%
Private Debt - Universe	--	15.0%	15.0%
Diversified Growth Fund	--	1.0%	2.0%
Risk/Return Metrics			
Expected 10-Year Return	4.2%	4.2%	4.9%
Surplus Volatility	3.8%	2.4%	3.8%
Information Ratio (Excess Return/Risk)	0.47	0.76	0.68
Interest Rate Metrics			
Duration	7.3	10.3	10.3
Hedge Ratio	86%	100%	100%

Observations:

- Adding leverage (3X Real Return Bonds) provides an opportunity for improvement across risk spectrum

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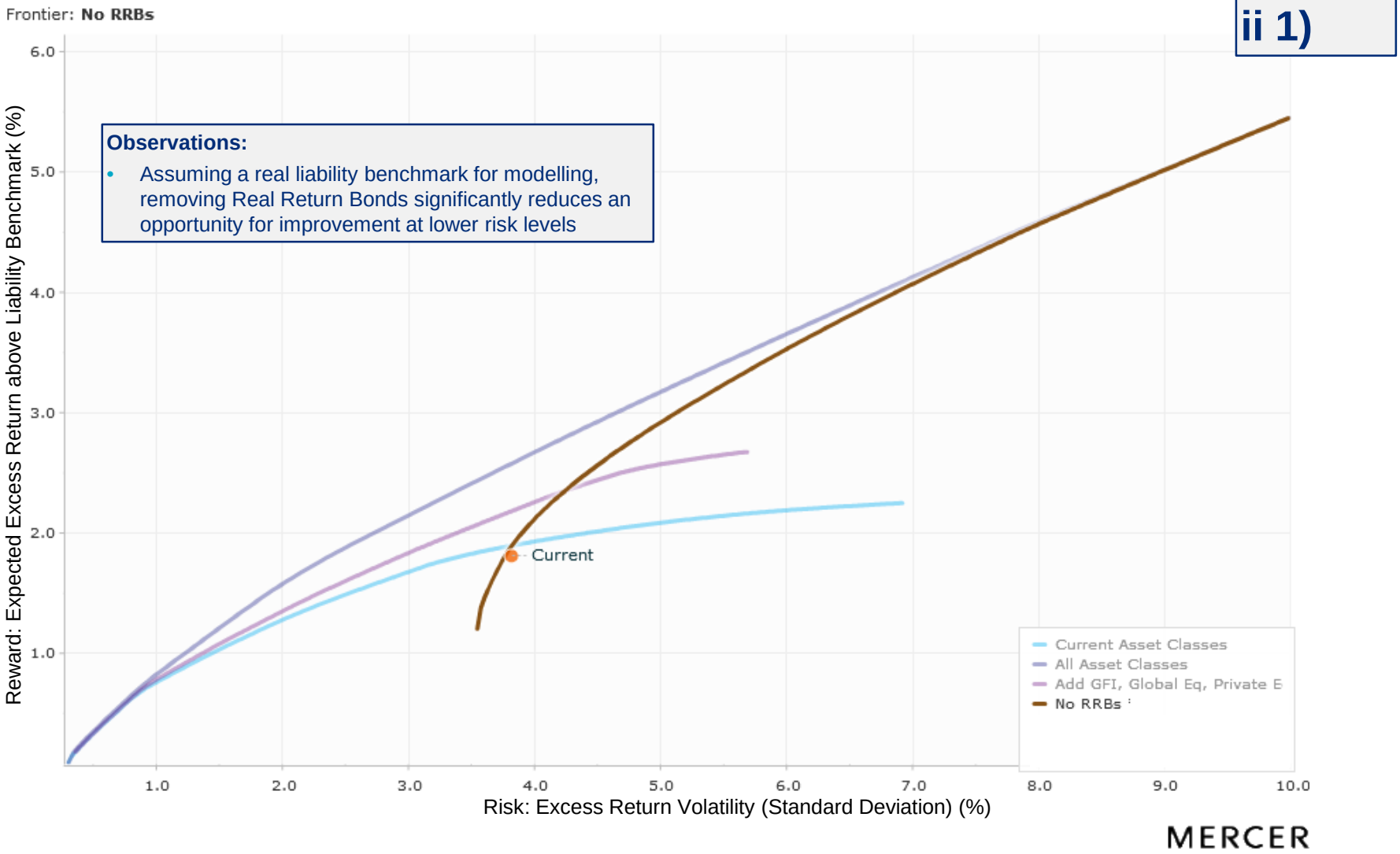
EFFICIENT FRONTIERS (MINIMALLY CONSTRAINED)
REMOVING RRBS

1-85 (g) ii 1)



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1-85 (g) ii 2), iii)

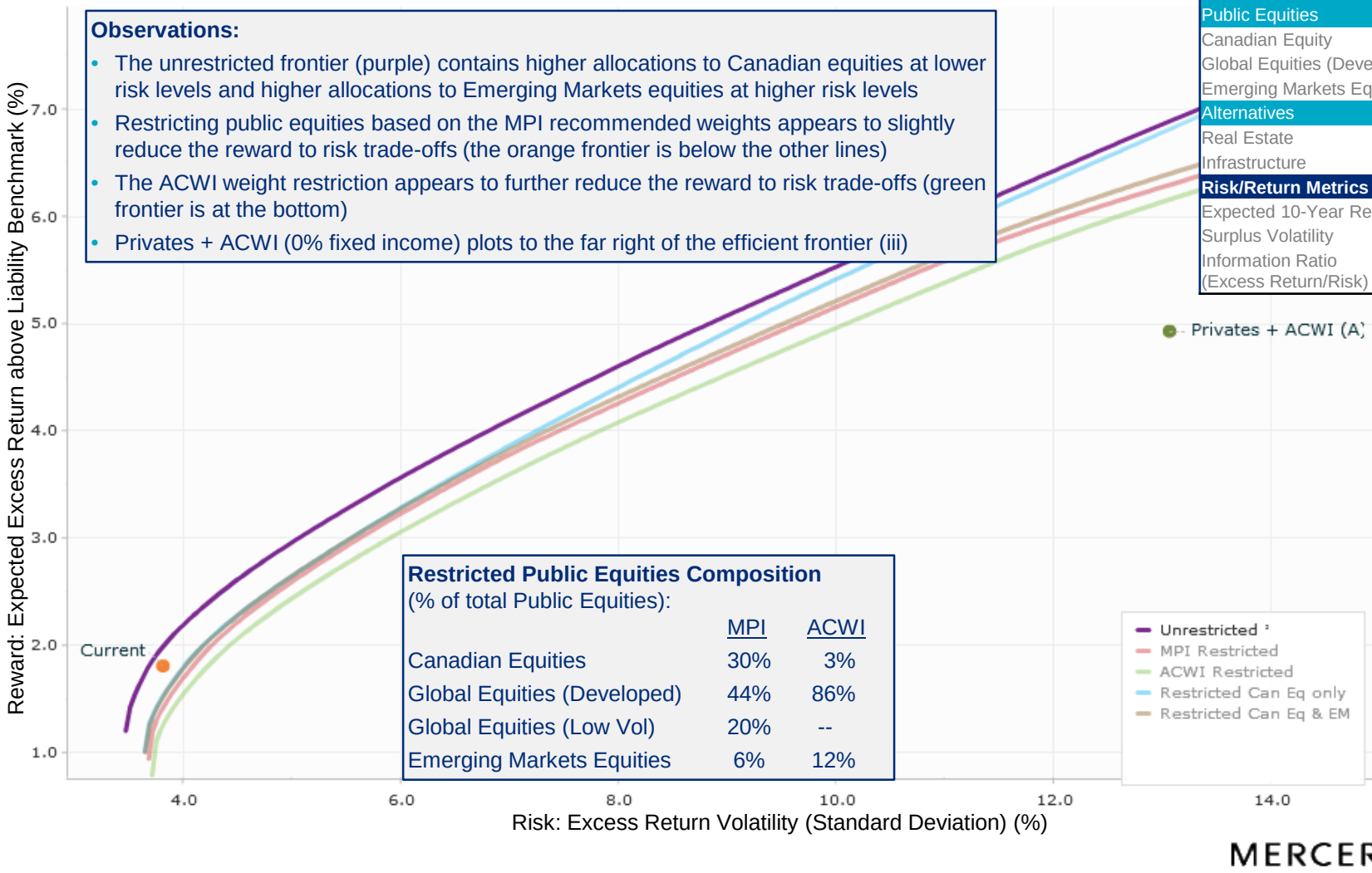
EFFICIENT FRONTIERS (NO RRBS)
RESTRICTING PUBLIC EQUITIES

Frontier: **Unrestricted**

Observations:

- 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
- 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)
- The ACWI weight restriction appears to further reduce the reward to risk trade-offs (green frontier is at the bottom)
- Privates + ACWI (0% fixed income) plots to the far right of the efficient frontier (iii)

	A:Privates + ACWI
Fixed Income	--
Public Equities	62.5%
Canadian Equity	1.9%
Global Equities (Developed)	53.4%
Emerging Markets Equities	7.2%
Alternatives	37.5%
Real Estate	25.0%
Infrastructure	12.5%
Risk/Return Metrics	
Expected 10-Year Return	6.8%
Surplus Volatility	13.1%
Information Ratio (Excess Return/Risk)	0.38



Restricted Public Equities Composition
(% of total Public Equities):

	MPI	ACWI
Canadian Equities	30%	3%
Global Equities (Developed)	44%	86%
Global Equities (Low Vol)	20%	--
Emerging Markets Equities	6%	12%

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1-85 (g) iv
1790 of GRA

ASSET MIX OPTIONS
BASIC

	Current	Basic.1	Basic.2	Basic.3	Basic.4
	Commingled	Min. Risk Portfolio (No MUSH)	80% Provis, 20% MUSH	60% Provis 20% Corps 20% MUSH	60% Provis 10% Corps 20% MUSH 10% Prv Dbt
Fixed Income	**70%**	**100%**	**100%**	**100%**	**100%**
Short-term Bonds (Prov.)	6.5%	28%	0%	0%	0.0%
Mid-term Bonds (Prov.)	12.0%	18%	40%	28%	28%
Long-term Bonds (Prov.)	29.5%	54%	40%	32%	32%
Short-term Bonds (Corp.)	0.0%	0%	0%	0%	0%
Mid-term Bonds (Corp.)	0.0%	0%	0%	9%	0%
Long-term Bonds (Corp.)	2.0%	0%	0%	11%	10%
MUSH Bonds	20.0%	0%	20%	20%	20%
Private Debt - Universe	0%	0%	0%	0%	10%
Public Equities	15%	0%	0%	0%	0%
Alternatives	15%	0%	0%	0%	0%

100% Fixed Income

All options match nominal Basic liability duration.

No Growth Assets proposed to Basic

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1-85 (g) iv

ASSET MIX ANALYSIS – SUMMARY RESULTS

BASIC.3 VS REAL LIABILITY BENCHMARK PRODUCES THE HIGHEST RETURN VS THE PREVIOUSLY ANALYSIS ASSET MIX OPTIONS

	Current Mix	Alternative Asset Mixes			
		Basic.1	Basic.2	Basic.3	Basic .4
		No MUSH	Add MUSH	Add Corps	Add PD
Expected return	4.29%	2.80%	2.93%	3.12%	3.09%
Excess return over liability benchmark	1.86%	0.38%	0.51%	0.70%	0.67%
1-Year Surplus volatility	3.84%	4.48%	4.91%	4.45%	4.57%
Excess return/Surplus volatility	0.484	0.085	0.104	0.156	0.146
1-year Median Surplus	$33.3 M	5.7 M	7.7 M	12.1 M	11.6 M
1-year 90th Percentile VaR	-87 M	-100 M	-109 M	-99 M	-102 M
1-year 95th Percentile VaR	-112 M	-128 M	-139 M	-126 M	-130 M
1-year 97.5th Percentile VaR	-134 M	-152 M	-164 M	-150 M	-154 M
Interest Rate Risk Hedge Ratio	85%	**100%**	**100%**	**100%**	**100%**
Median Surplus in 5 years	$185 M	30 M	42 M	63 M	60 M
5-Year Surplus volatility	10.00%	11.26%	12.48%	11.39%	11.68%
Prob. of Surplus in 5 years	86%	56%	58%	63%	62%
Prob. of 5-year positive real return	83%	60%	61%	64%	63%
Non-MUSH Yield	2.75%	2.55%	2.71%	2.92%	2.91%

Return Metrics

Risk Metrics

Interest Rate Risk Hedge Ratio = [Portfolio Duration] / [Liability Duration]

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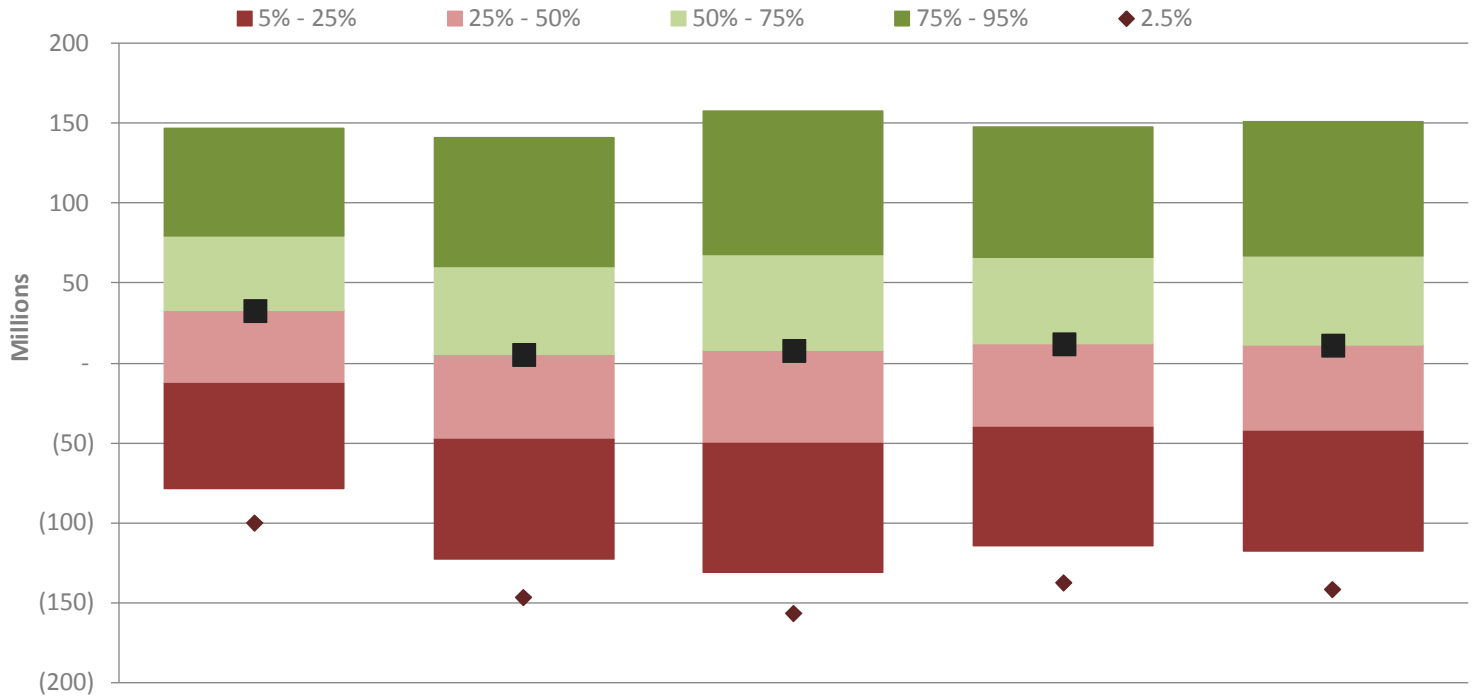
EXPECTED SURPLUS GROWTH
BASIC- 1 YEAR PROJECTIONS

1-85 (g) iv



Percentile	Current	Basic.1	Basic.2	Basic.3	Basic.4
95th	147.1 M	140.9 M	158.0 M	147.7 M	150.8 M
75th	79.6 M	60.1 M	67.7 M	66.4 M	67.4 M
50th	33.3 M	5.7 M	7.7 M	12.1 M	11.6 M
25th	-12.9 M	-47.6 M	-50.4 M	-40.7 M	-42.6 M
5th	-79.0 M	-122.5 M	-130.9 M	-114.4 M	-118.0 M
2.5th	-100.5 M	-146.4 M	-156.4 M	-137.8 M	-142.1 M

Median

Downside

Assets are assumed to equal liabilities at the start of the projection period. Liabilities are modelled using the Real Liability Benchmark. It implies that the expected inflation assumption will be changing in line with the BEIR (the difference between Canada nominal and RRB yields).

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1-85 (g) iv

EXPECTED SURPLUS GROWTH
BASIC- 5 YEAR PROJECTIONS

Percentile	Current	Basic.1	Basic.2	Basic.3	Basic.4
95th	488.5 M	381.5 M	441.2 M	424.1 M	430.8 M
75th	305.8 M	167.2 M	194.8 M	202.1 M	202.8 M
50th	185.2 M	30.3 M	41.8 M	62.7 M	59.9 M
25th	67.8 M	-99.6 M	-99.7 M	-67.4 M	-73.3 M
5th	-99.2 M	-279.2 M	-289.3 M	-243.4 M	-253.4 M
2.5th	-153.8 M	-336.9 M	-349.0 M	-299.1 M	-310.4 M

Median

Downside

Assets are assumed to equal liabilities at the start of the projection period. Liabilities are modelled using the Real Liability Benchmark. It implies that the expected inflation assumption will be changing in line with the BEIR (the difference between Canada nominal and RRB yields).

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ANALYSIS
EFFICIENT FRONTIERS
PENSION PLAN
– REAL LIABILITY BENCHMARK

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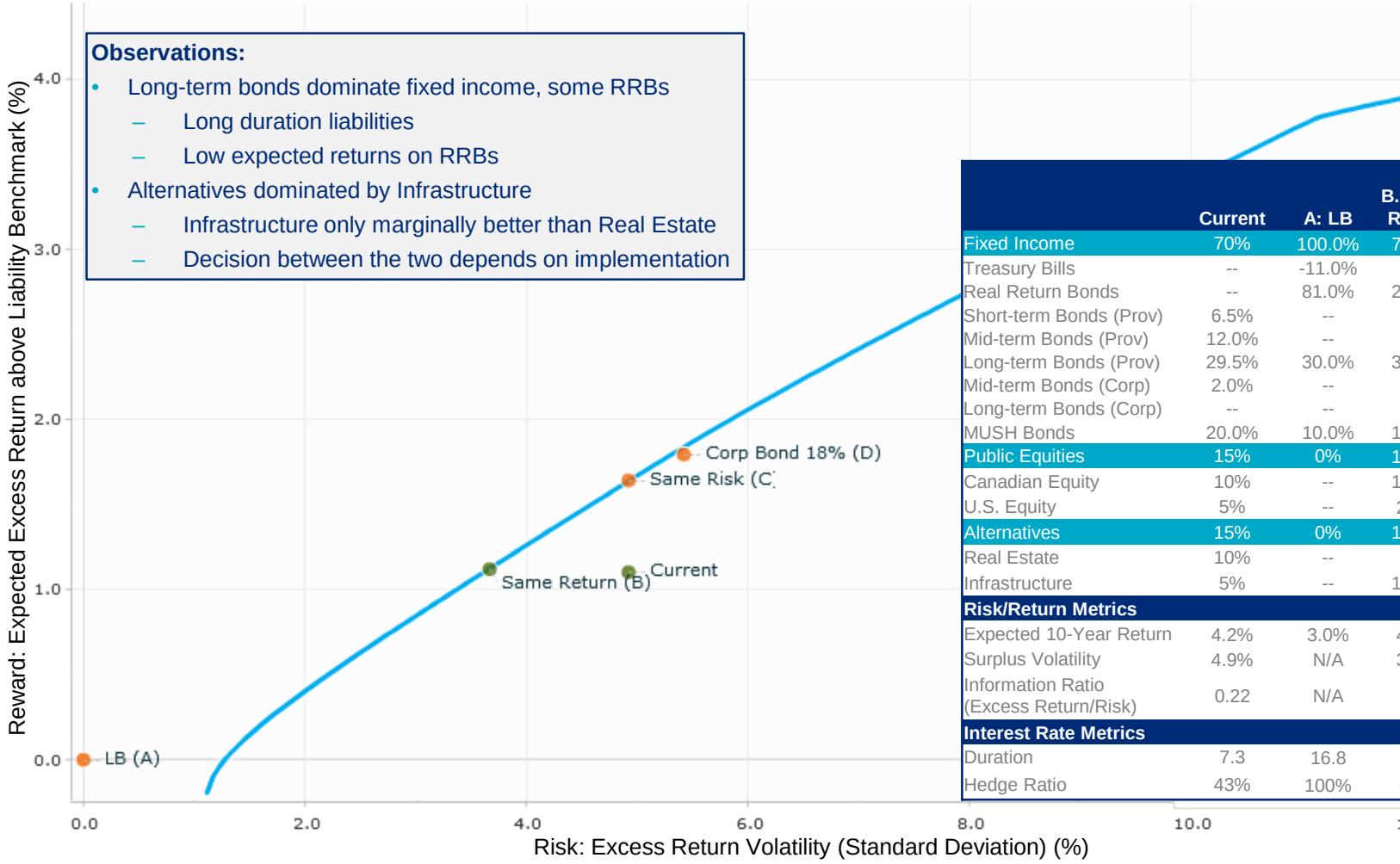
EFFICIENT FRONTIERS (MINIMALLY CONSTRAINED)
CURRENT ASSET CLASSES ONLY

1-84 (f)

Frontier: **Current Asset Classes**

Observations:

- Long-term bonds dominate fixed income, some RRBs
  - Long duration liabilities
  - Low expected returns on RRBs
- Alternatives dominated by Infrastructure
  - Infrastructure only marginally better than Real Estate
  - Decision between the two depends on implementation



	Current	A: LB	B. Same Return	C. Same Risk	D. Corp Bond 18%
Fixed Income	70%	100.0%	72.5%	61.5%	61.5%
Treasury Bills	--	-11.0%	--	--	--
Real Return Bonds	--	81.0%	23.5%	3.5%	3.5%
Short-term Bonds (Prov)	6.5%	--	--	--	--
Mid-term Bonds (Prov)	12.0%	--	--	--	--
Long-term Bonds (Prov)	29.5%	30.0%	39.0%	48.0%	30.0%
Mid-term Bonds (Corp)	2.0%	--	--	--	--
Long-term Bonds (Corp)	--	--	--	--	18.0%
MUSH Bonds	20.0%	10.0%	10.0%	10.0%	10.0%
Public Equities	15%	0%	14.0%	19.0%	19.0%
Canadian Equity	10%	--	11.5%	15.5%	15.5%
U.S. Equity	5%	--	2.5%	3.5%	3.5%
Alternatives	15%	0%	13.5%	19.5%	19.5%
Real Estate	10%	--	--	--	--
Infrastructure	5%	--	13.5%	19.5%	19.5%
Risk/Return Metrics					
Expected 10-Year Return	4.2%	3.0%	4.2%	4.7%	4.8%
Surplus Volatility	4.9%	N/A	3.7%	4.9%	5.4%
Information Ratio (Excess Return/Risk)	0.22	N/A	0.31	0.33	0.33
Interest Rate Metrics					
Duration	7.3	16.8	10.3	8.7	8.3
Hedge Ratio	43%	100%	61%	52%	49%

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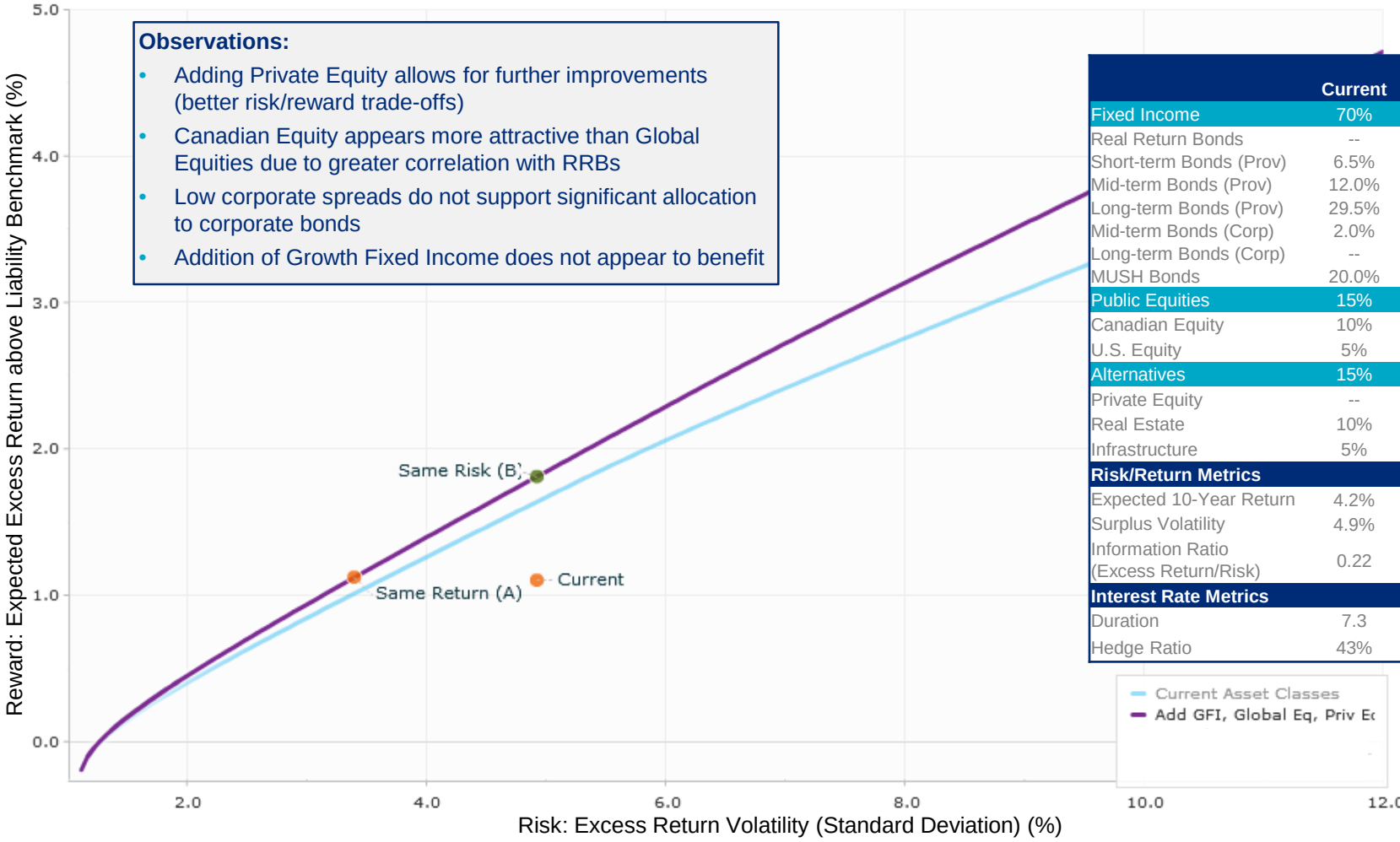
EFFICIENT FRONTIERS (MINIMALLY CONSTRAINED)
ADDING GROWTH FIXED INCOME, GLOBAL EQUITIES & PRIVATE EOUITY

1-84 (f)

Frontier: **Add GFI, Global Eq, Priv Eq**

Observations:

- Adding Private Equity allows for further improvements (better risk/reward trade-offs)
- Canadian Equity appears more attractive than Global Equities due to greater correlation with RRBs
- Low corporate spreads do not support significant allocation to corporate bonds
- Addition of Growth Fixed Income does not appear to benefit



	Current	A. Same Return	B. Same Risk
Fixed Income	70%	78.5%	67.0%
Real Return Bonds	--	34.0%	14.5%
Short-term Bonds (Prov)	6.5%	--	--
Mid-term Bonds (Prov)	12.0%	--	--
Long-term Bonds (Prov)	29.5%	34.5%	42.5%
Mid-term Bonds (Corp)	2.0%	--	--
Long-term Bonds (Corp)	--	--	--
MUSH Bonds	20.0%	10.0%	10.0%
Public Equities	15%	10.5%	16.5%
Canadian Equity	10%	10.5%	16.5%
U.S. Equity	5%	--	--
Alternatives	15%	11.0%	16.5%
Private Equity	--	5.5%	8.0%
Real Estate	10%	--	--
Infrastructure	5%	5.5%	8.5%
Risk/Return Metrics			
Expected 10-Year Return	4.2%	4.2%	4.9%
Surplus Volatility	4.9%	3.4%	4.9%
Information Ratio (Excess Return/Risk)	0.22	0.33	0.37
Interest Rate Metrics			
Duration	7.3	11.2	9.5
Hedge Ratio	43%	66%	56%

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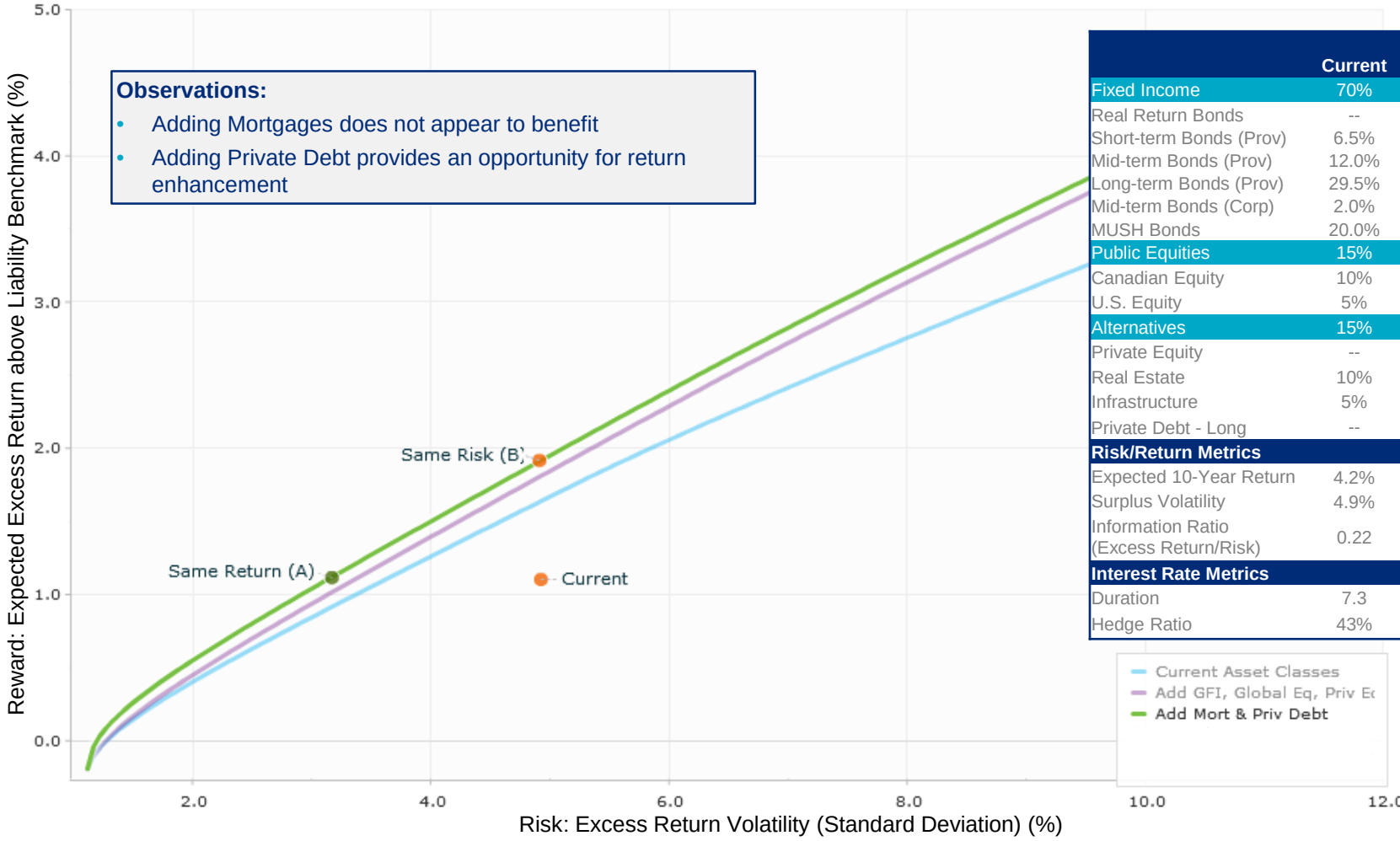
EFFICIENT FRONTIERS (MINIMALLY CONSTRAINED)
ADDING MORTGAGES AND PRIVATE DEBT

1-84 (f)

Frontier: **Add Mort & Priv Debt**



	Current	A. Same Return	B. Same Risk
Fixed Income	70%	64.5%	51.5%
Real Return Bonds	--	35.5%	13.5%
Short-term Bonds (Prov)	6.5%	--	--
Mid-term Bonds (Prov)	12.0%	--	--
Long-term Bonds (Prov)	29.5%	19.0%	28.0%
Mid-term Bonds (Corp)	2.0%	--	--
MUSH Bonds	20.0%	10.0%	10.0%
Public Equities	15%	10.5%	16.5%
Canadian Equity	10%	10.5%	16.5%
U.S. Equity	5%	--	--
Alternatives	15%	25.0%	32.0%
Private Equity	--	4.5%	8.0%
Real Estate	10%	--	--
Infrastructure	5%	5.5%	9.0%
Private Debt - Long	--	15.0%	15.0%
Risk/Return Metrics			
Expected 10-Year Return	4.2%	4.2%	5.0%
Surplus Volatility	4.9%	3.2%	4.9%
Information Ratio (Excess Return/Risk)	0.22	0.35	0.39
Interest Rate Metrics			
Duration	7.3	11.2	9.3
Hedge Ratio	43%	67%	56%

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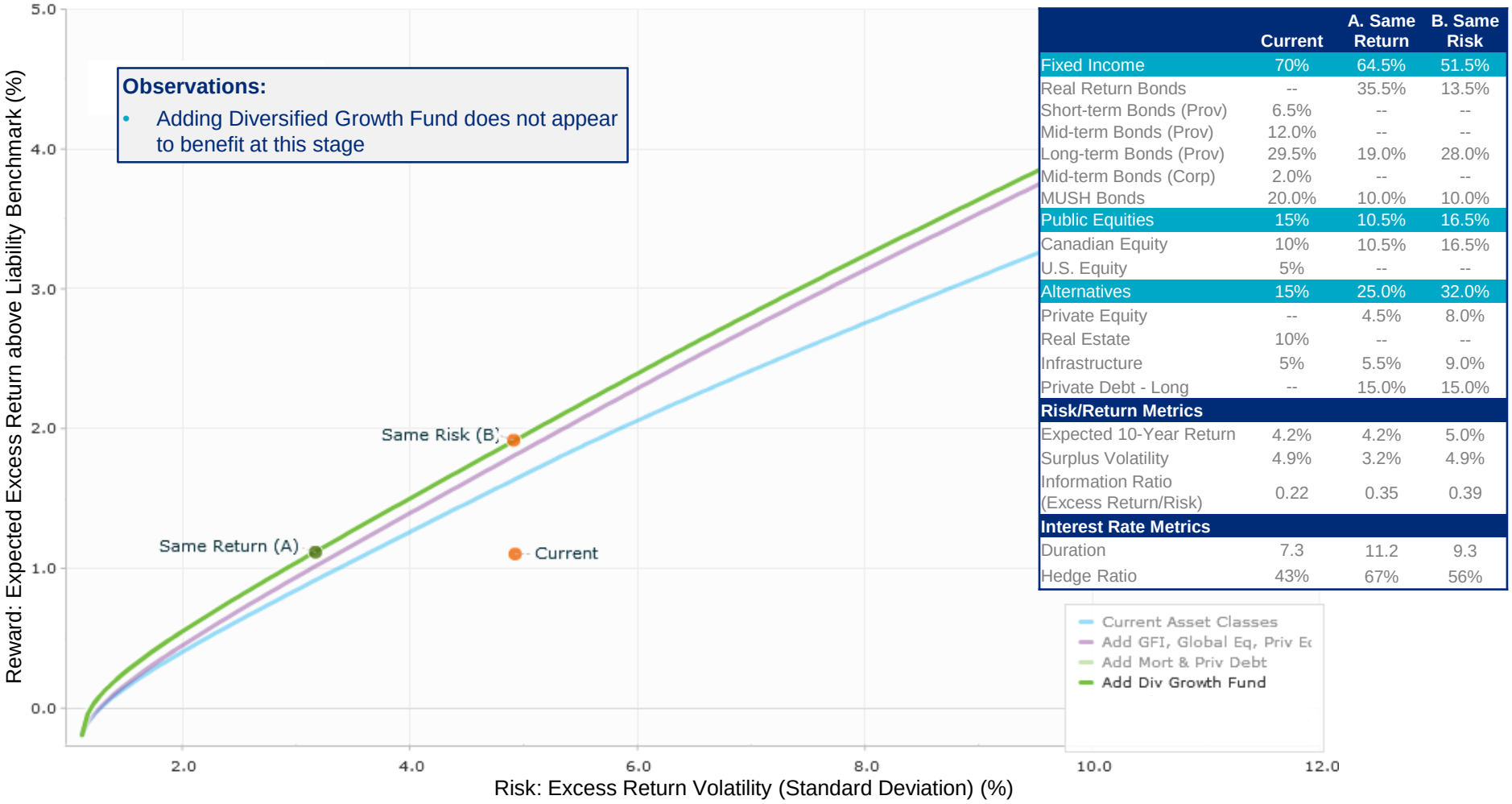
EFFICIENT FRONTIERS (MINIMALLY CONSTRAINED)
ADDING DIVERSIFIED GROWTH FUND

1-84 (f)

Frontier: **Add Div Growth Fund**



	Current	A. Same Return	B. Same Risk
Fixed Income	70%	64.5%	51.5%
Real Return Bonds	--	35.5%	13.5%
Short-term Bonds (Prov)	6.5%	--	--
Mid-term Bonds (Prov)	12.0%	--	--
Long-term Bonds (Prov)	29.5%	19.0%	28.0%
Mid-term Bonds (Corp)	2.0%	--	--
MUSH Bonds	20.0%	10.0%	10.0%
Public Equities	15%	10.5%	16.5%
Canadian Equity	10%	10.5%	16.5%
U.S. Equity	5%	--	--
Alternatives	15%	25.0%	32.0%
Private Equity	--	4.5%	8.0%
Real Estate	10%	--	--
Infrastructure	5%	5.5%	9.0%
Private Debt - Long	--	15.0%	15.0%
Risk/Return Metrics			
Expected 10-Year Return	4.2%	4.2%	5.0%
Surplus Volatility	4.9%	3.2%	4.9%
Information Ratio (Excess Return/Risk)	0.22	0.35	0.39
Interest Rate Metrics			
Duration	7.3	11.2	9.3
Hedge Ratio	43%	67%	56%

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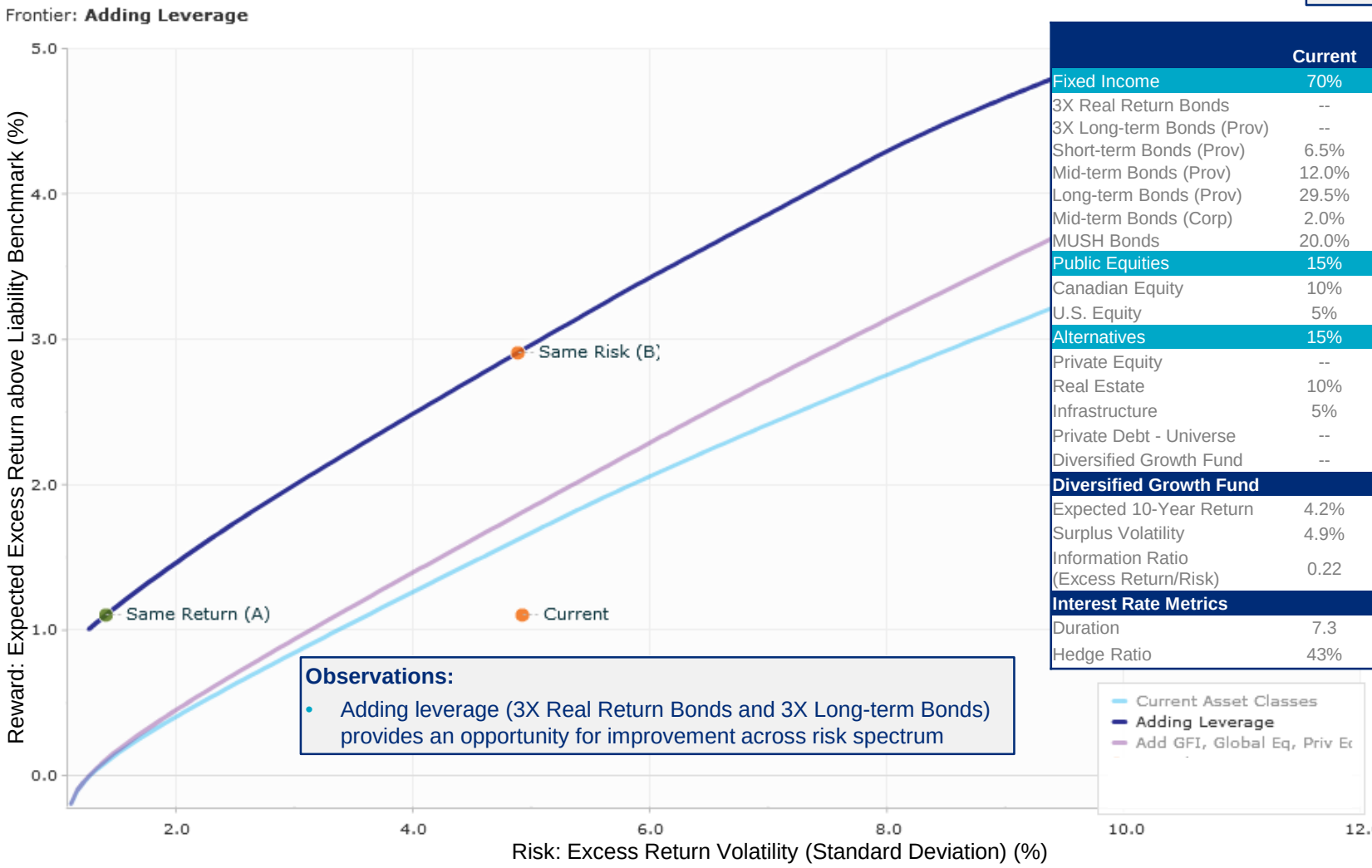
EFFICIENT FRONTIERS (MINIMALLY CONSTRAINED)
ADDING LEVERAGE (BOND OVERLAY)

1-84 (f)



	Current	A. Same Return	B. Same Risk
Fixed Income	70%	69.0%	47.5%
3X Real Return Bonds	--	23.0%	15.0%
3X Long-term Bonds (Prov)	--	6.0%	15.0%
Short-term Bonds (Prov)	6.5%	29.0%	--
Mid-term Bonds (Prov)	12.0%	--	6.5%
Long-term Bonds (Prov)	29.5%	1.0%	1.0%
Mid-term Bonds (Corp)	2.0%	--	--
MUSH Bonds	20.0%	10.0%	10.0%
Public Equities	15%	7.5%	18.5%
Canadian Equity	10%	7.5%	18.5%
U.S. Equity	5%	--	--
Alternatives	15%	23.5%	34%
Private Equity	--	1.5%	10.5%
Real Estate	10%	5.0%	1.0%
Infrastructure	5%	1.0%	7.5%
Private Debt - Universe	--	15.0%	15.0%
Diversified Growth Fund	--	1.0%	--
Diversified Growth Fund			
Expected 10-Year Return	4.2%	4.0%	5.7%
Surplus Volatility	4.9%	1.4%	4.9%
Information Ratio (Excess Return/Risk)	0.22	0.78	0.59
Interest Rate Metrics			
Duration	7.3	15.8	16.0
Hedge Ratio	43%	94%	95%

Observations:

- Adding leverage (3X Real Return Bonds and 3X Long-term Bonds) provides an opportunity for improvement across risk spectrum

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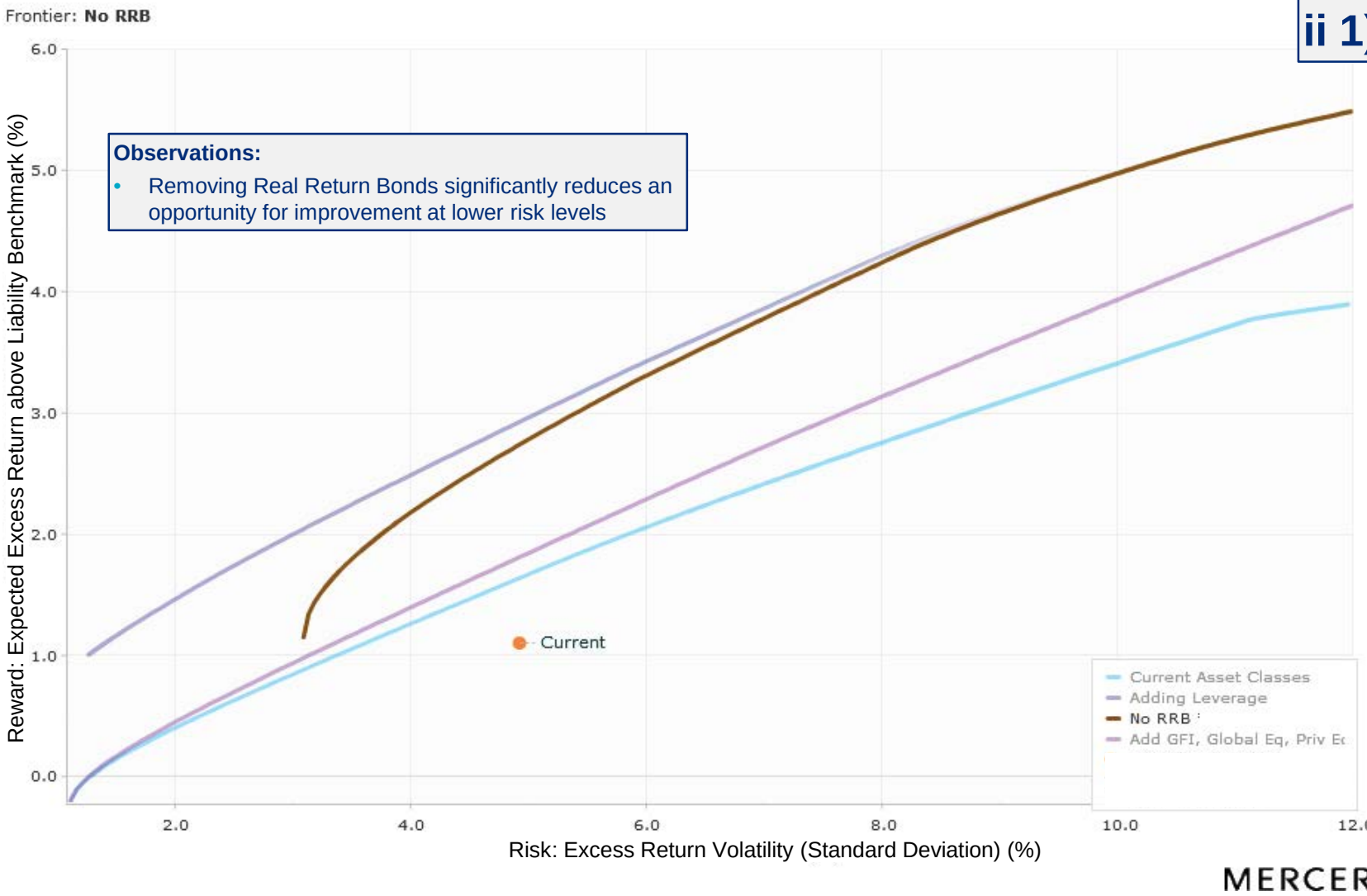
EFFICIENT FRONTIERS (MINIMALLY CONSTRAINED)
REMOVING RRBS

1-85 (g) ii 1)



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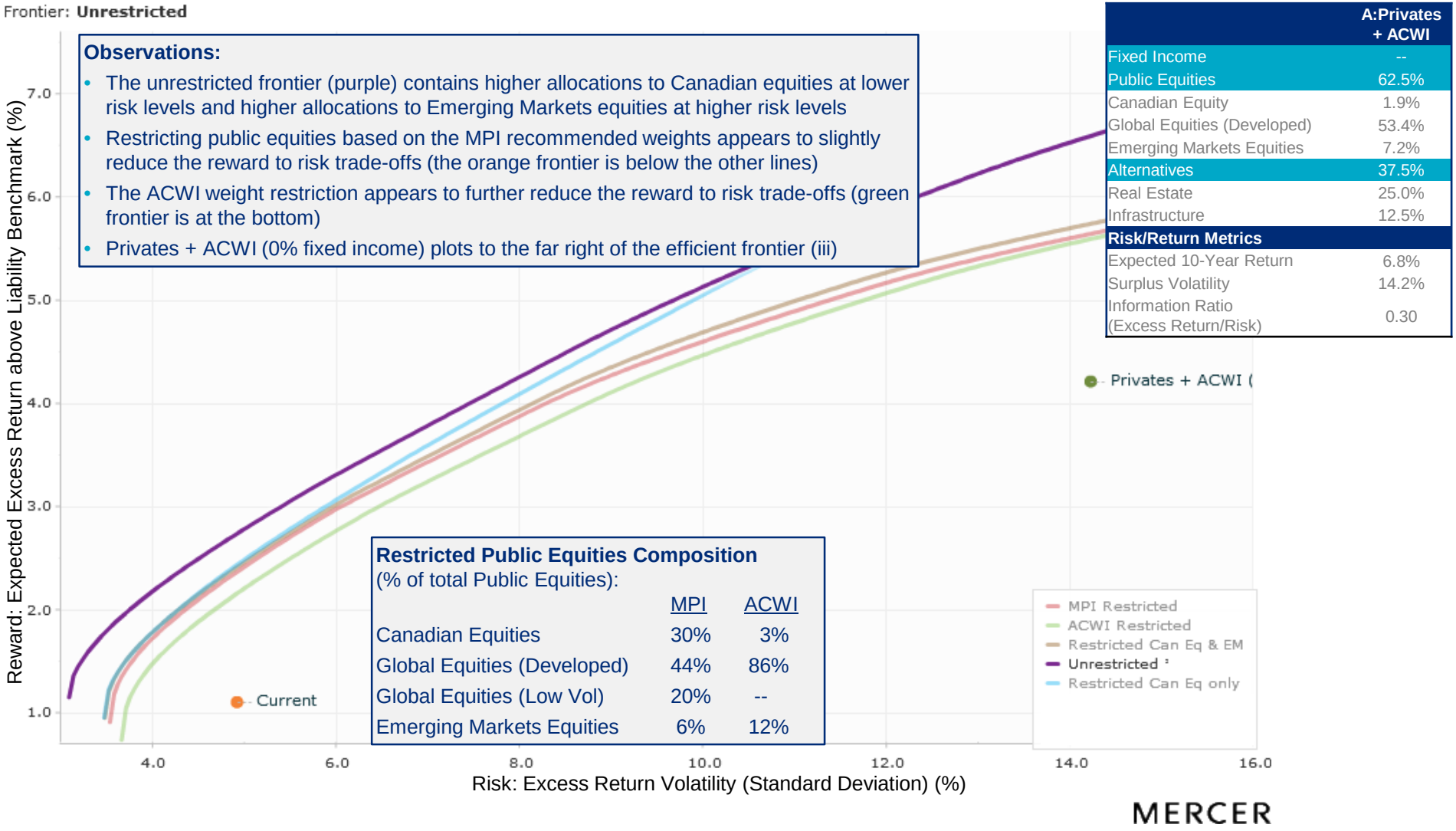
EFFICIENT FRONTIERS (NO RRBS)
RESTRICTING PUBLIC EQUITIES



	A:Privates + ACWI
Fixed Income	--
Public Equities	62.5%
Canadian Equity	1.9%
Global Equities (Developed)	53.4%
Emerging Markets Equities	7.2%
Alternatives	37.5%
Real Estate	25.0%
Infrastructure	12.5%
Risk/Return Metrics	
Expected 10-Year Return	6.8%
Surplus Volatility	14.2%
Information Ratio (Excess Return/Risk)	0.30

Restricted Public Equities Composition
(% of total Public Equities):

	MPI	ACWI
Canadian Equities	30%	3%
Global Equities (Developed)	44%	86%
Global Equities (Low Vol)	20%	--
Emerging Markets Equities	6%	12%

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ASSET CLASS OPTIONS
PENSION

GROWTH ASSETS INCREASE

1-85 (g) iv GRA pg.

	Current	CSSB	Pension.1	Pension.2	Pension.3
		For reference	Balanced	Growth	Aggressive
Fixed Income	70%	27%	40%	30%	20%
T-Bills	0%	1%	-	-	-
Mid-term Bonds (Corp.)	2%	-	-	-	-
Long-term Bonds (Corp.)	0%	-	20%	20%	20%
Short-term Bonds (Prov.)	6.5%	-	-	-	-
Mid-term Bonds (Prov.)	12%	-	-	-	-
Long-term Bonds (Prov.)	29.5%	-	-	-	-
MUSH Bonds	20%	-	-	-	-
Private Debt – Long	0%	-	20%	10%	0%
Overall – Universe	0%	17.5%	-	-	-
Overall – Long	0%	8.5%	-	-	-
Public Equities	15%	55%	35%	46%	55%
Canadian Equity	10%	19%	10%	13%	18%
U.S. Equity	5%	15%	-	-	-
EAFE Equity	0%	21%	-	-	-
All-Country World Equity	0%	-	18%	18%	20%
Global Equity (Low Volatility)	0%	-	7%	14%	17%
Alternatives	15%	18%	25%	25%	25%
Private Equity	0%	4%	0%	0%	0%
Real Estate	10%	10%	15%	15%	15%
Infrastructure	5%	4%	10%	10%	10%

Emphasize Corporate Bonds and Private Debt to enhance returns.

Remove MUSH.

Diversify Equities.

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ASSET MIX ANALYSIS – SUMMARY RESULTS
PENSION

1-85 (g) iv

Metric	Current Mix	Alternative Approaches			
		Reference CSSB	Balanced Pension.1	Growth Pension.2	Aggressive Pension.3
Expected return	4.3%	6.1%	5.7%	5.9%	6.2%
Excess return over liability benchmark	1.3%	3.2%	2.7%	3.0%	3.3%
Surplus volatility	4.9%	11.4%	8.4%	9.6%	11.1%
Excess Return / Surplus Volatility	0.26	0.28	0.32	0.31	0.29
1 Year Median Surplus	$0.4 M	8.4 M	7.3 M	8.2 M	9.2 M
90th Percentile VaR	-27 M	-58 M	-44 M	-50 M	-57 M
95th Percentile VaR	-35 M	-74 M	-57 M	-64 M	-73 M
97.5th Percentile VaR	-43 M	-89 M	-68 M	-77 M	-87 M
Interest Rate Risk Hedge Ratio	47%	17%	36%	27%	17%
Median Surplus in 5 years	$6.2 M	52.7 M	44 M	50 M	57 M
5-Year Surplus volatility	13.4%	32.1%	23.3%	27.1%	31.8%
Prob. of surplus in 5 years	55%	67%	68%	68%	68%
Prob. of 5-year positive real return	83%	84%	87%	86%	85%
Non-MUSH Yield	2.75%	2.48%	3.72%	3.77%	3.86%

Return Metrics

Risk Metrics

Interest Rate Risk Hedge Ratio = [Portfolio Duration] / [Liability Duration]

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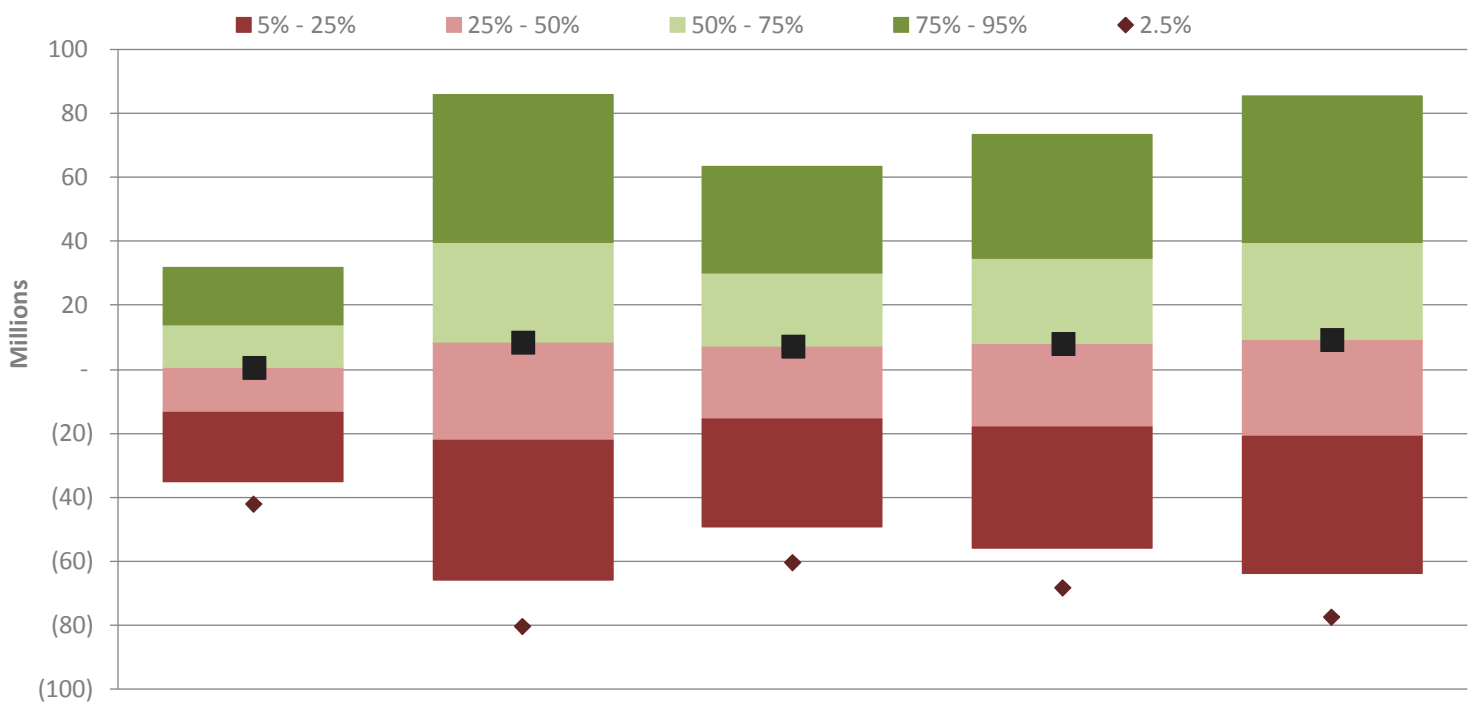
EXPECTED SURPLUS GROWTH
PENSION - 1 YEAR PROJECTIONS

1-85 (g) iv



Percentile	Current	CSSB	Pension.1	Pension.2	Pension.3
95th	32.0 M	85.8 M	63.5 M	73.3 M	85.4 M
75th	13.8 M	39.5 M	30.3 M	34.7 M	39.9 M
50th	0.4 M	8.4 M	7.3 M	8.2 M	9.2 M
25th	-13.6 M	-22.3 M	-15.7 M	-18.0 M	-20.9 M
5th	-35.0 M	-66.0 M	-49.4 M	-55.9 M	-63.7 M
2.5th	-42.4 M	-80.3 M	-60.5 M	-68.3 M	-77.6 M

Median

Downside

Assets are assumed to equal liabilities at the start of the projection period. Liabilities are modelled using the Real Liability Benchmark. It implies that the expected inflation assumption will be changing in line with the BEIR (the difference between Canada nominal and RRB yields).

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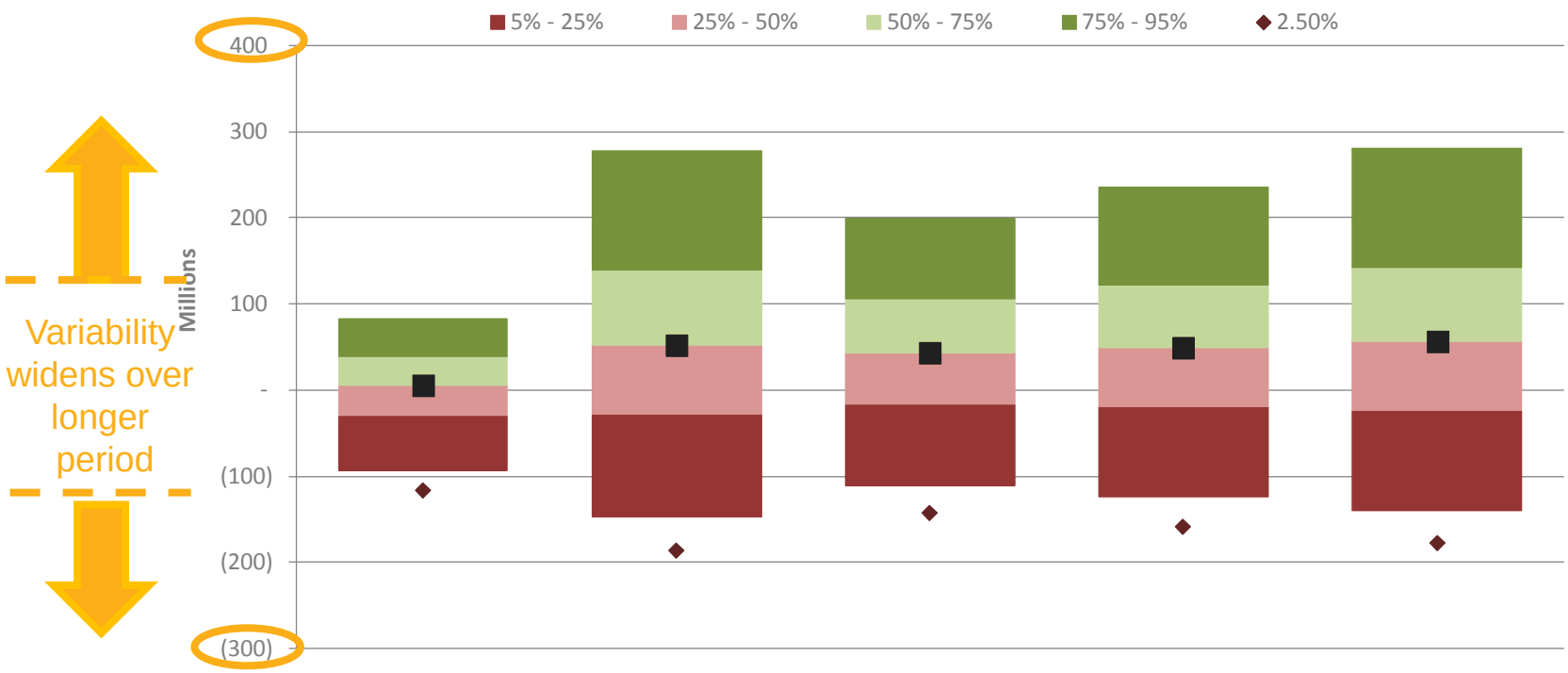
1-85 (g) iv

EXPECTED SURPLUS GROWTH
PENSION - 5 YEAR PROJECTIONS



Percentile	Current	CSSB	Pension.1	Pension.2	Pension.3
95th	83.3 M	278.3 M	199.2 M	235.3 M	281.1 M
75th	39.7 M	139.6 M	105.7 M	122.6 M	142.9 M
50th	6.2 M	52.7 M	43.7 M	50.0 M	56.9 M
25th	-31.3 M	-30.0 M	-18.0 M	-20.6 M	-24.5 M
5th	-93.9 M	-147.6 M	-110.5 M	-123.8 M	-139.7 M
2.5th	-116.9 M	-186.8 M	-142.3 M	-158.7 M	-178.0 M

Median

Downside

Assets are assumed to equal liabilities at the start of the projection period. Liabilities are modelled using the Real Liability Benchmark. It implies that the expected inflation assumption will be changing in line with the BEIR (the difference between Canada nominal and RRB yields).

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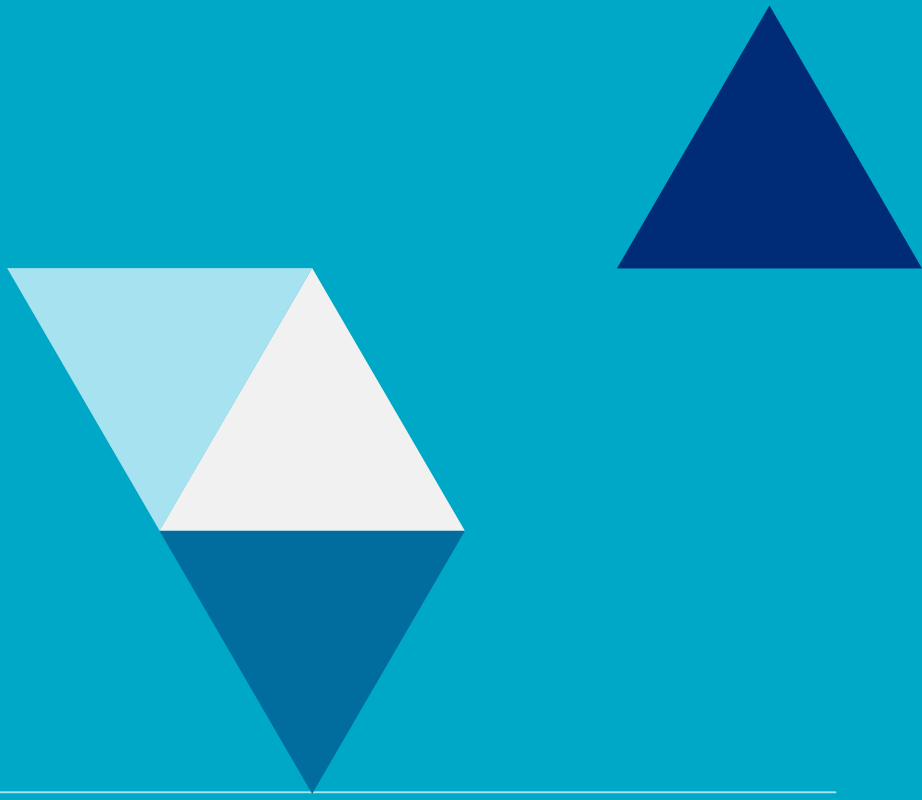
APPENDIX
CAPITAL MARKET ASSUMPTIONS



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CAPITAL MARKET ASSUMPTIONS
10-YEAR ASSUMPTIONS

	Asset Class	Median 10 year return	Standard deviation
1	Treasury Bills	1.4%	1.5%
2	Federal short-term bonds	1.9%	3.5%
3	Federal mid-term bonds	2.1%	6.5%
4	Federal long-term bonds	2.0%	8.5%
5	Real return bonds	2.7%	7.5%
6	Provincial short-term bonds	2.3%	3.5%
7	Provincial mid-term bonds	2.8%	6.5%
8	Provincial long-term bonds	3.0%	8.5%
9	Corporate short-term bonds	2.8%	3.5%
10	Corporate mid-term bonds	3.5%	6.5%
11	Corporate long-term bonds	3.8%	8.5%
12	Global bonds	0.8%	8.6%
13	High yield bonds	3.9%	9.5%
14	Emerging debt	6.8%	12.0%
15	Canadian equity (large cap.)	6.7%	19.5%
16	U.S. equity (large cap.)	6.7%	17.0%
17	Int'l equity (large cap.)	6.7%	17.1%
18	Global equity (large cap.)	6.7%	16.1%
19	Global low vol equity	6.1%	13.0%
20	Emerging equity	8.7%	25.0%
21	Private equity	10.1%	25.0%
22	Real estate	5.4%	13.0%
23	Diversified Growth Fund	4.9%	9.8%
24	Direct Infrastructure	6.2%	13.0%
25	MUSH Bonds	3.0%	6.5%
26	Commercial Mortgages	2.7%	3.5%
27	Long Commercial Mortgages	2.5%	5.3%
28	Private Debt - Universe	3.3%	5.4%
29	Private Debt - Long	3.5%	8.5%

Inflation: 2.0%

Fixed income returns based on projected yields implied by the current yield curve.

Source: Mercer's Canadian long-term capital market assumptions (August 31, 2017). Expected return represents expected return over the next 10 years.
Note: 3X Long Provincial Bonds is defined as 300% Provincial Long Bonds less 200% Treasury Bills and a 0.7% leverage cost. 3X Real Return Bonds is defined as 300% Real Return Bonds less 200% Treasury Bills and a 0.7% leverage cost.

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CAPITAL MARKET ASSUMPTIONS
STANDARD MERCER CORRELATIONS

	Correlations																												
Asset Class	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
1 Treasury Bills	1.00	0.38	0.18	0.01	(0.19)	0.31	0.02	(0.14)	(0.03)	(0.34)	(0.38)	0.16	(0.47)	0.10	(0.19)	(0.41)	(0.19)	(0.32)	(0.27)	(0.12)	(0.10)	0.27	(0.11)	0.15	0.02	0.10	0.10	0.00	(0.15)
2 Federal short-term bonds	0.38	1.00	0.91	0.76	0.25	0.96	0.79	0.52	0.47	0.07	(0.05)	0.86	(0.23)	0.27	(0.65)	(0.48)	(0.38)	(0.45)	(0.12)	(0.42)	(0.15)	(0.27)	0.14	0.03	0.79	0.41	0.41	0.75	0.54
3 Federal mid-term bonds	0.18	0.91	1.00	0.94	0.46	0.91	0.92	0.75	0.46	0.23	0.19	0.83	(0.14)	0.26	(0.62)	(0.40)	(0.38)	(0.41)	0.00	(0.44)	(0.07)	(0.19)	0.17	0.08	0.92	0.33	0.33	0.90	0.78
4 Federal long-term bonds	0.01	0.76	0.94	1.00	0.57	0.77	0.92	0.89	0.40	0.32	0.38	0.72	(0.02)	0.24	(0.50)	(0.27)	(0.29)	(0.30)	0.09	(0.33)	0.01	(0.13)	0.19	0.11	0.92	0.26	0.26	0.93	0.91
5 Real return bonds	(0.19)	0.25	0.46	0.57	1.00	0.39	0.65	0.70	0.53	0.62	0.62	0.13	0.35	0.22	0.22	(0.03)	0.04	0.01	0.08	0.21	(0.01)	(0.09)	0.04	0.47	0.65	0.48	0.48	0.66	0.70
6 Provincial short-term bonds	0.31	0.96	0.91	0.77	0.39	1.00	0.87	0.61	0.64	0.28	0.14	0.82	(0.08)	0.32	(0.53)	(0.41)	(0.28)	(0.36)	(0.05)	(0.30)	(0.16)	(0.32)	0.12	0.10	0.87	0.50	0.50	0.84	0.63
7 Provincial mid-term bonds	0.02	0.79	0.92	0.92	0.65	0.87	1.00	0.89	0.68	0.55	0.51	0.69	0.13	0.30	(0.34)	(0.24)	(0.14)	(0.20)	0.16	(0.15)	(0.08)	(0.21)	0.12	0.18	1.00	0.41	0.41	0.98	0.91
8 Provincial long-term bonds	(0.14)	0.52	0.75	0.89	0.70	0.61	0.89	1.00	0.53	0.60	0.69	0.48	0.24	0.26	(0.12)	0.00	0.03	0.02	0.32	0.04	0.04	(0.07)	0.15	0.23	0.89	0.26	0.26	0.92	0.99
9 Corporate short-term bonds	(0.03)	0.47	0.46	0.40	0.53	0.64	0.68	0.53	1.00	0.85	0.66	0.33	0.49	0.39	0.06	(0.10)	0.13	0.02	0.15	0.25	(0.22)	(0.41)	(0.02)	0.14	0.68	0.63	0.63	0.69	0.55
10 Corporate mid-term bonds	(0.34)	0.07	0.23	0.32	0.62	0.28	0.55	0.60	0.85	1.00	0.94	0.03	0.68	0.30	0.35	0.18	0.31	0.26	0.34	0.44	(0.09)	(0.28)	(0.01)	0.16	0.55	0.41	0.41	0.60	0.62
11 Corporate long-term bonds	(0.38)	(0.05)	0.19	0.38	0.62	0.14	0.51	0.69	0.66	0.94	1.00	(0.04)	0.66	0.25	0.38	0.25	0.33	0.31	0.42	0.45	0.01	(0.12)	0.01	0.17	0.51	0.21	0.21	0.58	0.69
12 Global bonds	0.16	0.86	0.83	0.72	0.13	0.82	0.69	0.48	0.33	0.03	(0.04)	1.00	0.00	0.41	(0.63)	(0.26)	(0.22)	(0.25)	0.09	(0.40)	0.21	(0.20)	0.48	0.08	0.69	0.37	0.37	0.67	0.52
13 High yield bonds	(0.47)	(0.23)	(0.14)	(0.02)	0.35	(0.08)	0.13	0.24	0.49	0.68	0.66	0.00	1.00	0.42	0.48	0.55	0.57	0.59	0.60	0.58	0.49	(0.03)	0.50	0.25	0.13	0.31	0.31	0.20	0.26
14 Emerging debt	0.10	0.27	0.26	0.24	0.22	0.32	0.30	0.26	0.39	0.30	0.25	0.41	0.42	1.00	0.20	0.28	0.47	0.40	0.45	0.42	0.39	0.09	0.39	0.52	0.30	0.42	0.42	0.34	0.28
15 Canadian equity (large cap.)	(0.19)	(0.65)	(0.62)	(0.50)	0.22	(0.53)	(0.34)	(0.12)	0.06	0.35	0.38	(0.63)	0.48	0.20	1.00	0.59	0.74	0.70	0.35	0.86	0.15	0.21	(0.03)	0.40	(0.34)	0.00	0.00	(0.30)	(0.17)
16 U.S. equity (large cap.)	(0.41)	(0.48)	(0.40)	(0.27)	(0.03)	(0.41)	(0.24)	0.00	(0.10)	0.18	0.25	(0.26)	0.55	0.28	0.59	1.00	0.78	0.94	0.80	0.60	0.56	0.27	0.35	0.19	(0.24)	(0.21)	(0.21)	(0.19)	(0.05)
17 Int'l equity (large cap.)	(0.19)	(0.38)	(0.38)	(0.29)	0.04	(0.28)	(0.14)	0.03	0.13	0.31	0.33	(0.22)	0.57	0.47	0.74	0.78	1.00	0.94	0.70	0.83	0.42	0.19	0.28	0.45	(0.14)	(0.02)	(0.02)	(0.11)	(0.01)
18 Global equity (large cap.)	(0.32)	(0.45)	(0.41)	(0.30)	0.01	(0.36)	(0.20)	0.02	0.02	0.26	0.31	(0.25)	0.59	0.40	0.70	0.94	0.94	1.00	0.79	0.76	0.52	0.25	0.33	0.34	(0.20)	(0.12)	(0.12)	(0.16)	(0.03)
19 Global low vol equity	(0.27)	(0.12)	0.00	0.09	0.08	(0.05)	0.16	0.32	0.15	0.34	0.42	0.09	0.60	0.45	0.35	0.80	0.70	0.79	1.00	0.43	0.62	0.19	0.49	0.27	0.16	(0.13)	(0.13)	0.19	0.29
20 Emerging equity	(0.12)	(0.42)	(0.44)	(0.33)	0.21	(0.30)	(0.15)	0.04	0.25	0.44	0.45	(0.40)	0.58	0.42	0.86	0.60	0.83	0.76	0.43	1.00	0.25	0.21	0.13	0.42	(0.15)	0.14	0.14	(0.10)	0.00
21 Private equity	(0.10)	(0.15)	(0.07)	0.01	(0.01)	(0.16)	(0.08)	0.04	(0.22)	(0.09)	0.01	0.21	0.49	0.39	0.15	0.56	0.42	0.52	0.62	0.25	1.00	0.48	0.81	0.30	(0.08)	(0.22)	(0.22)	(0.05)	0.04
22 Real estate	0.27	(0.27)	(0.19)	(0.13)	(0.09)	(0.32)	(0.21)	(0.07)	(0.41)	(0.28)	(0.12)	(0.20)	(0.03)	0.09	0.21	0.27	0.19	0.25	0.19	0.21	0.48	1.00	0.15	0.27	(0.21)	(0.36)	(0.36)	(0.23)	(0.11)
23 Diversified Growth Fund	(0.11)	0.14	0.17	0.19	0.04	0.12	0.12	0.15	(0.02)	(0.01)	0.01	0.48	0.50	0.39	(0.03)	0.35	0.28	0.33	0.49	0.13	0.81	0.15	1.00	0.20	0.12	0.13	0.13	0.18	0.19
24 Direct Infrastructure	0.15	0.03	0.08	0.11	0.47	0.10	0.18	0.23	0.14	0.16	0.17	0.08	0.25	0.52	0.40	0.19	0.45	0.34	0.27	0.42	0.30	0.27	0.20	1.00	0.18	(0.36)	(0.36)	0.17	0.19
25 MUSH Bonds	0.02	0.79	0.92	0.92	0.65	0.87	1.00	0.89	0.68	0.55	0.51	0.69	0.13	0.30	(0.34)	(0.24)	(0.14)	(0.20)	0.16	(0.15)	(0.08)	(0.21)	0.12	0.18	1.00	0.41	0.41	0.98	0.91
26 Commercial Mortgages	0.10	0.41	0.33	0.26	0.48	0.50	0.41	0.26	0.63	0.41	0.21	0.37	0.31	0.42	0.00	(0.21)	(0.02)	(0.12)	(0.13)	0.14	(0.22)	(0.36)	0.13	(0.36)	0.41	1.00	1.00	0.41	0.27
27 Long Commercial Mortgages	0.10	0.41	0.33	0.26	0.48	0.50	0.41	0.26	0.63	0.41	0.21	0.37	0.31	0.42	0.00	(0.21)	(0.02)	(0.12)	(0.13)	0.14	(0.22)	(0.36)	0.13	(0.36)	0.41	1.00	1.00	0.41	0.27
28 Private Debt - Universe	0.00	0.75	0.90	0.93	0.66	0.84	0.98	0.92	0.69	0.60	0.58	0.67	0.20	0.34	(0.30)	(0.19)	(0.11)	(0.16)	0.19	(0.10)	(0.05)	(0.23)	0.18	0.17	0.98	0.41	0.41	1.00	0.95
29 Private Debt - Long	(0.15)	0.54	0.78	0.91	0.70	0.63	0.91	0.99	0.55	0.62	0.69	0.52	0.26	0.28	(0.17)	(0.05)	(0.01)	(0.03)	0.29	0.00	0.04	(0.11)	0.19	0.19	0.91	0.27	0.27	0.95	1.00

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CAPITAL MARKET ASSUMPTIONS
BASIS OF MERCER'S ECONOMIC ASSUMPTIONS

- Mercer's capital market assumptions are intended to represent reasonable expectations for the next 10 to 20 years and incorporate a wide range of considerations including:
  - Historical return, risk and correlation statistics of broad indices
  - Fixed income returns based on projected yields implied by the current yield curve
  - Estimation of component returns to develop total equity returns, using as starting points such items as
    - Current level of equity earnings yield
    - Inflation expectations
    - Expected economic growth
  - Expected relative relationships between asset classes
  - Some forward-looking judgment
- In general, we assume that future returns will be consistent with assumed risk levels
- Our assumptions have not been developed in the sense of an economic forecast, but rather, to the extent possible, a reading of the market

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CAPITAL MARKET ASSUMPTIONS
BASIS OF MERCER'S ECONOMIC ASSUMPTIONS

- Note that:
  - All foreign asset class return, risk and correlation assumptions are based on unhedged foreign currency exposures
  - Publicly traded asset class returns are assumed to be index returns
  - Alternative asset class returns are assumed to be inclusive of median alpha (i.e., active management value-added) and net of median fees

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