

# TESTIMONY

## Manitoba Public Insurance 2019/20 GRA Valter Viola

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# Overview and Recommendations

This presentation consists of two parts.

## Part I. Overview

The Overview distinguishes between **problems** and **symptoms**, and provides context for the recommendations in Part II. The Overview includes materials presented two years ago, with some *additional comments* in some cases. The Overview:

- defines key **terms**;
- describes some inconvenient **truths** (and consequences) re: portfolio/risk management;
- acknowledges **barriers to excellence** commonly faced by all institutional investors; and
- describes the **beliefs** and **other considerations** that support the recommendations.

## Part II. 8 Recommendations

The **recommendations** are then reviewed, along with the rationale (e.g., beliefs from Part I).

# SYMPTOMS VS PROBLEMS<sup>1</sup>



SYMPTOMS	SHAKY GOALIE	<b>No Real Return Bonds</b> <ul style="list-style-type: none"> <li>• Poor liability protection against unexpected inflation, <u>real</u> rate risk</li> <li>• Less effective duration management</li> </ul>
	PUCK HOG	<b>Canadian Equities</b> <ul style="list-style-type: none"> <li>• Larger-than average home bias</li> <li>• Concentrated sectors/stocks</li> </ul>
	SHORT-HANDED	<b>No International Equities</b> <ul style="list-style-type: none"> <li>• Missed opportunities to add value, diversify portfolio</li> </ul>



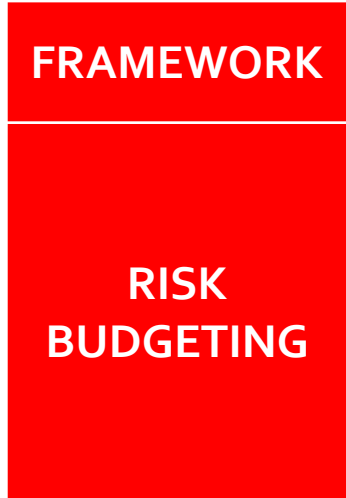
PROBLEMS	FOCUS	<b>Short-term Rate <u>Stability</u></b> <ul style="list-style-type: none"> <li>• At cost of lower long-term <u>level</u></li> </ul>
	PROCESS	<b>"Smoothed" Accounting</b> <ul style="list-style-type: none"> <li>• Rather than "volatile" market value</li> </ul> <b>Asset-Based Rebalancing</b> <ul style="list-style-type: none"> <li>• Rather than risk</li> </ul> <b>A-L Studies Every 4 Years</b> <ul style="list-style-type: none"> <li>• Rather than annual/quarterly risk-informed discussions</li> </ul>

Note 1:  
As presented 2 years ago  
(2017/18 GRA)



**BARRIERS TO EXCELLENCE**

**REMEDIES** →



# CHANGES (MADE OR PLANNED)<sup>2</sup>

SYMPTOMS	<input checked="" type="checkbox"/>	SHAKY GOALIE	<b>No Real Return Bonds</b> <ul style="list-style-type: none"> <li>• Poor liability protection against unexpected inflation, <u>real</u> rate risk</li> <li>• Less effective duration management</li> </ul>
	<input checked="" type="checkbox"/>	PUCK HOG	<del>Canadian Equities</del> <ul style="list-style-type: none"> <li>• <del>Larger than average home bias</del></li> <li>• <del>Concentrated sectors/stocks</del></li> </ul>
	<input checked="" type="checkbox"/>	SHORT-HANDED	<b>No International Equities</b> <ul style="list-style-type: none"> <li>• <del>Missed opportunities to add value, diversify portfolio</del></li> </ul>

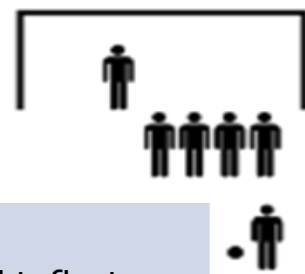
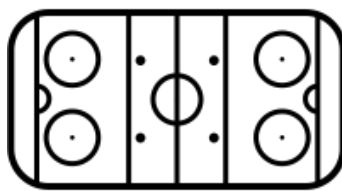
Note 2:  
 MPI made or plans to make changes (since 2017/18 GRA):

- Less Canadian equity concentration
- More international diversification

PROBLEMS	<input checked="" type="checkbox"/>	FOCUS	<b>Short-term Rate <u>Stability</u></b> <ul style="list-style-type: none"> <li>• At cost of lower long-term <u>level</u></li> </ul>
	n/a	PROCESS	<del>"Smoothed" Accounting</del> <ul style="list-style-type: none"> <li>• <del>Rather than "volatile" market value</del></li> </ul> <b>Asset-Based Rebalancing</b> <ul style="list-style-type: none"> <li>• <del>Rather than risk</del></li> </ul> <b>A-L Studies Every 4 Years</b> <ul style="list-style-type: none"> <li>• <del>Rather than annual/quarterly risk-informed discussions</del></li> </ul>

Accounting less of a concern if market values inform investment/risk decisions (not accounting)

# TODAY



SYMPTOMS	Carry Over	SHAKY GOALIE	<b>No Real Return Bonds</b> <ul style="list-style-type: none"> <li>Poor liability protection against unexpected inflation, <u>real</u> rate risk</li> <li>Less effective duration management</li> </ul>
	New	FEWER "STRONG" DEFENSEMEN	<b>Fewer Real Assets</b> (real estate, infrastructure) <ul style="list-style-type: none"> <li>Less diversification</li> </ul>
		CROWDING OUR NET	<b>Risk Concentrated in Fixed Income</b> <ul style="list-style-type: none"> <li>Inflation risk, credit risk, some illiquidity</li> </ul>
		UNDER-ESTIMATING OPPONENT	<b>No RRBs in Liability Benchmark Portfolio (LBP)</b> <ul style="list-style-type: none"> <li>Understates risk of inflation and <u>real</u> interest rate risk</li> <li>Makes duration management less effective</li> </ul>
PROBLEMS	Carry Over	FOCUS	<b>Short-term Rate <u>Stability</u></b> <ul style="list-style-type: none"> <li>At cost of lower long-term <u>level</u></li> </ul>
	New		<ul style="list-style-type: none"> <li>At risk of higher long-term rate <u>instability</u></li> </ul>
	New	PROCESS	<b>LBP Composition should <u>not</u> Depend on Capital Market Expectations</b> <ul style="list-style-type: none"> <li>LBP: long term and inflation-sensitive</li> <li>Decision to accept or hedge risk quite separate</li> </ul>

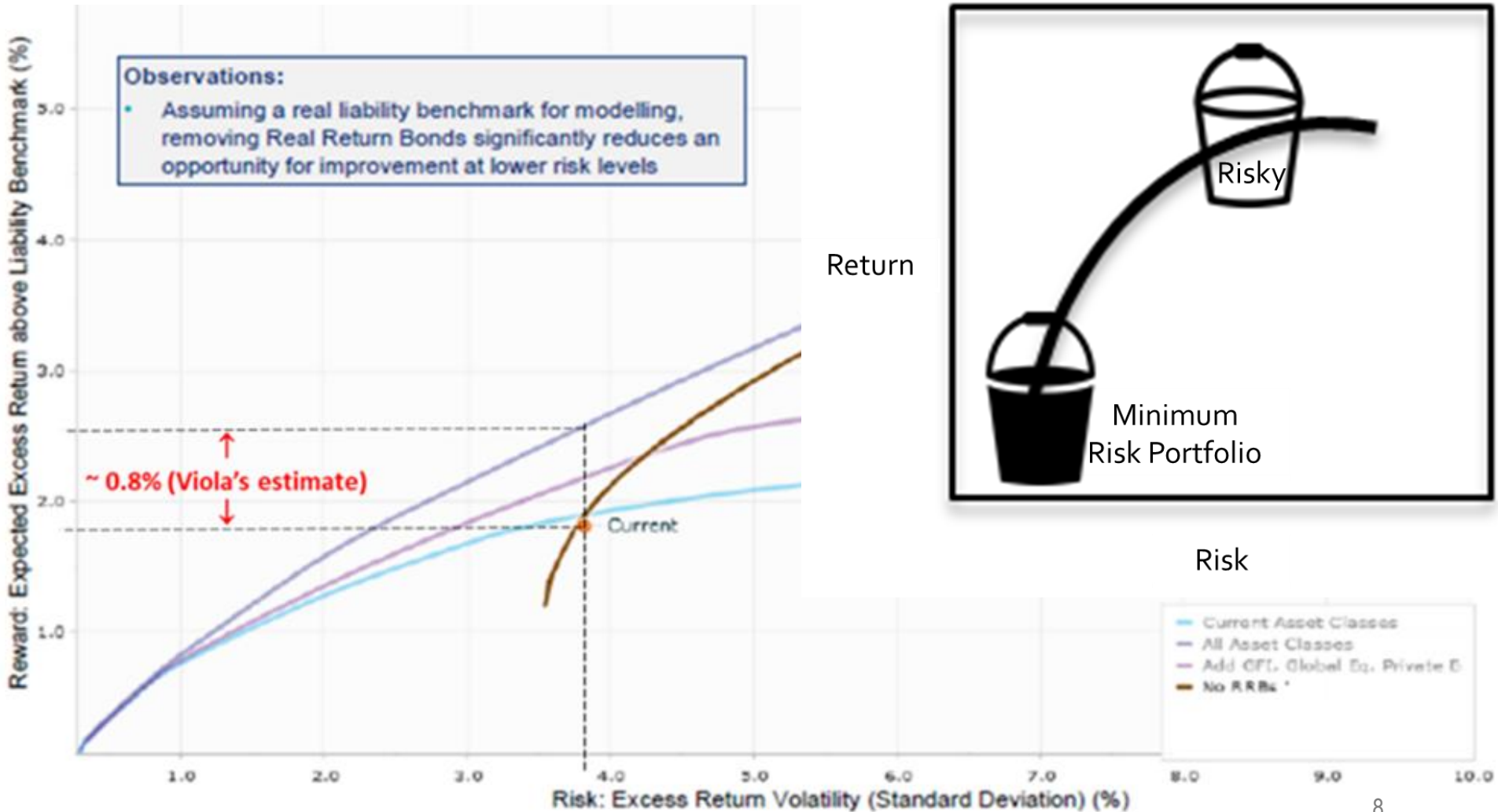
# TERMINOLOGY: RATES AND RISKS

Term	Definition
Risk	Potential <u>future</u> adverse outcome (absolute or relative)
Duration	<p>Measure of interest rate risk</p> <ul style="list-style-type: none"> <li>• % <math>\Delta</math> in asset (A) or liability (L) <math>\sim - \Delta \text{Yield} \times \text{Duration}</math></li> <li>• 10 year duration: 1% increase in interest rate causes a <math>\sim 10\%</math> decrease in A or L (accurate for small changes)</li> <li>• Weighted average “time” of future cash flows, where weight reflects proportional % of future cash flows in present value terms</li> <li>• Implication: Basic Pension Liability duration (<math>\sim 10</math> years) has <math>\sim 1/2</math> of cash flows <u>beyond</u> 10 years</li> </ul>
Inflation ( $\pi$ )	Annualized rate of change of prices (expected or realized)
Nominal Interest Rate ( $n$ )	<p><math>\sim</math> Sum of real rate (<math>r</math>) and expected inflation (<math>\pi</math>) (Fisher Equation)</p> <p><math>n \sim r + \pi</math>; e.g., <math>3\% = 1\% + 2\%</math></p>
Real Interest Rate ( $r$ )	Rate, net of expected inflation ( $r \sim n - \pi$ ; e.g., $1\% = 3\% - 2\%$ )
Volatility ( $\sigma$ )	Standard deviation, a common measure of risk
Correlation ( $\rho$ )	Statistic measuring the strength of a relationship between 2 variables
Nominal Interest Rate Volatility ( $\sigma_n$ )	<p><math>\sigma_n = \sqrt{(\sigma_r^2 + \sigma_\pi^2 + 2\rho_{r,\pi}\sigma_r\sigma_\pi)}</math>, where volatility of nominal interest rate depends on:</p> <ul style="list-style-type: none"> <li>• volatility of real interest rates (<math>\sigma_r</math>);</li> <li>• volatility of inflation (<math>\sigma_\pi</math>); and</li> <li>• correlation between real interest rates and inflation (<math>\rho_{r,\pi}</math>)</li> </ul>

# TERMINOLOGY: ASSETS AND LIABILITIES

Term	Definition
Nominal Bond	Bond (without inflation protection) <ul style="list-style-type: none"><li>• Market value changes with <u>nominal</u> rates</li></ul>
Real Return Bond (RRB)	Bond with inflation protection <ul style="list-style-type: none"><li>• Market value changes with <u>real</u> rates</li><li>• Principal “indexed to inflation” (e.g., \$100 principal rises to \$102 after 1 year if inflation = 2%); real coupon applies to (rising) indexed base, assuming inflation &gt; 0%</li></ul>
Liability Benchmark Portfolio (LBP)	<ul style="list-style-type: none"><li>• aka “Minimum Risk Portfolio” or “Risk-free Portfolio” (more generic)</li><li>• In MPI context, LBP is (per Mercer) “fixed income portfolio that reproduces fluctuations of liabilities”</li><li>• Purpose: “Evaluate financial risks, portfolios that minimize them”</li></ul>
Excess Return Volatility	Risk metric used in Mercer’s A/L Study (assets vs. Liability Benchmark)
Tracking Error	Standard deviation of return difference between two groups of assets or liabilities (e.g., actual portfolio vs. benchmark)
Basis Risk	Risk that two portfolios (including liability benchmarks) experience different performance/growth, arising from imperfect correlations (not = 1.0), for example

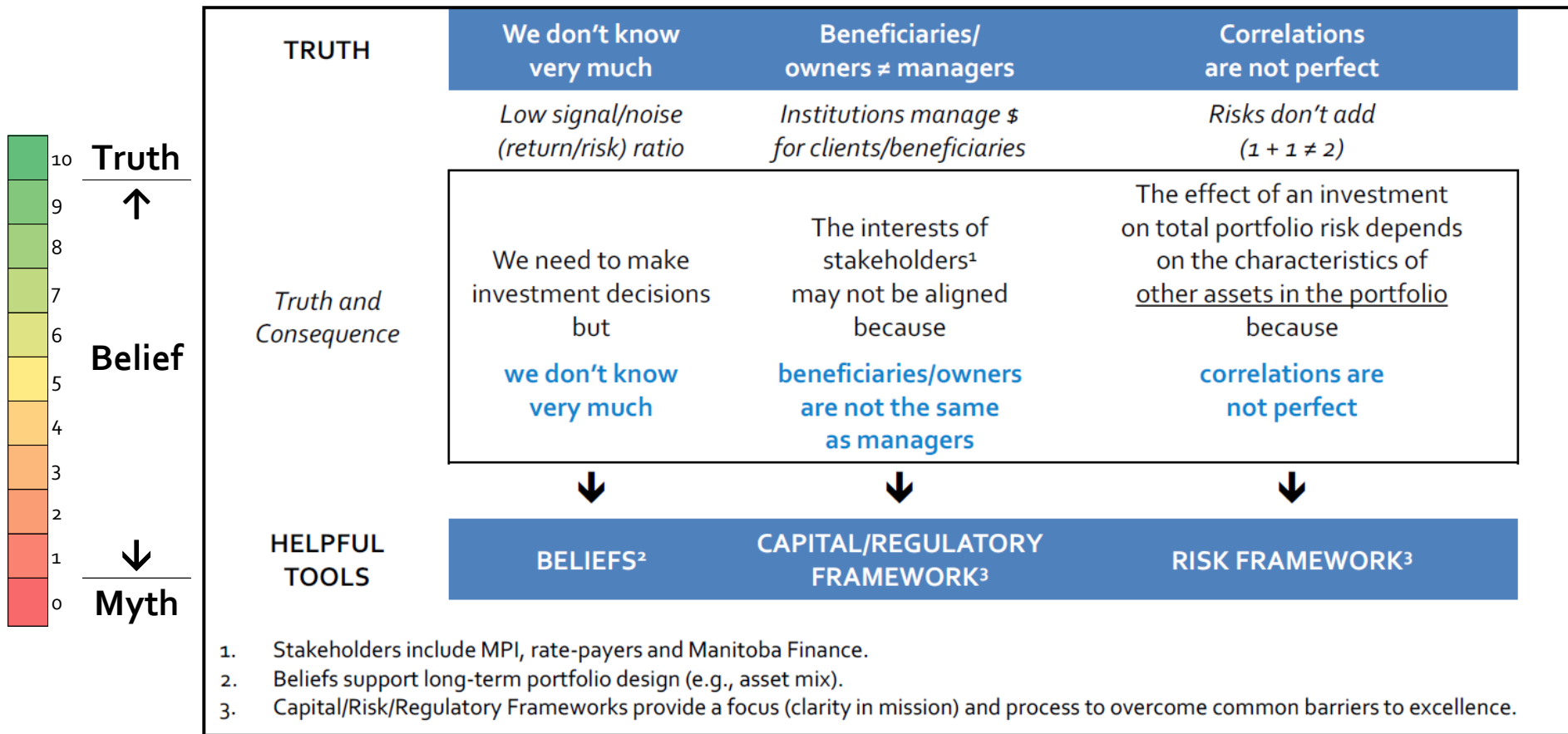
# BIG PICTURE: 2 BUCKETS





# TRUTHS AND CONSEQUENCES

*Correlations make investing a "team sport"  
(no "I" in TEAM) ↓*



↑  
**"Risk Framework" an outstanding issue**  
*from 2017/18 Recommendations*

## BARRIERS TO EXCELLENCE

Lack of focus or clear mission

Poor process

- Structure
- Communication
- Inertia

Inadequate resources

*Barriers are common  
to all institutional investors  
(not unique to MPI)*

*LBP determined 1<sup>st</sup> (Belief #1 and #2) and independently of:  
i) capital market expectations, and ii) risk tolerance (Belief #3, etc.)*

## INVESTMENT BELIEFS

**SUSTAINABILITY:** 1. Major risk is provisions will not be **sustainable**

**MRP/LBP:** 2. Determining **Minimum Risk Portfolio** (MRP) is first step (i.e., Liability Benchmark Portfolio (LBP) composition)

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**ADDITIONAL RISK:** 3. Taking **additional risk** beyond LBP 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 LBP is taken

- “Marginal” concept, not viewed in isolation (i.e., correlations/betas matter)

**CONSTRAINTS:** 5. **Constraints** never increase expected risk-adjusted returns

## #2 MINIMUM RISK PORTFOLIO BELIEF

Determining the Minimum Risk Portfolio  
is the first step towards responsible  
long-term management of the portfolio.

- MRP defined as “Liability Benchmark Portfolio” (LBP) in Mercer Study
- LBP should include some RRBs, given liabilities (long term, inflation exposure)
- Belief #2 simply supports definition of MPI’s primary investment risk
- Says nothing about whether to buy assets that make it up (e.g., RRBs)
- Belief says nothing about how much risk should be taken in relation to LBP
- Answers to these questions requires additional beliefs

### ***BIG*** SIMPLIFICATIONS BY BOTH MPI AND MERCER:

***MPI:*** based ... low risk assessment of inflation primarily upon ... expected **level** rather than ... **volatility** of inflation (CAC (MPI) 2-2);

***Mercer:*** support to “hedge **nominal** ... risk before ... **real** ... driven more by ... views on ... expected **level** of future inflation than ... **volatility**” (CAC (MPI) 2-4)

***But*** risk depends on **volatilities and correlations** (not **levels/averages**);

***4.5% tracking error*** from simplification material, especially given MPI’s low risk tolerance (i.e., 4.5% error ÷ ~ 3.8% volatility or risk = 118% difference)

# #3 ADDITIONAL RISK AND #4 TOTAL PORTFOLIO

#3 Taking additional risk beyond the Liability Benchmark Portfolio (LBP) should be done only if the expected additional returns justify doing so.

#4. The additional risk to the Total Portfolio is the relevant risk to consider if risk beyond the LBP is taken.

- Rationale for taking a total portfolio approach from “inconvenient truth”
  - Effect of investment on total portfolio risk depends on characteristics of other assets (e.g., equities, real estate, and infrastructure) because correlations not perfect
- Correlations harder to interpret, perhaps harder to estimate accurately, but critical
- Particularly important in defining LBP (i.e., correlation of inflation with real rates), especially over longer horizons

# #6 MARKET EFFICIENCY BELIEF

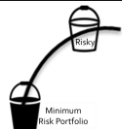
Markets are very efficient at pricing securities relative to one another, but are not perfectly efficient due to information and execution costs

2 Years Ago

- 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

Today

- “Risk-free” assets (LBP) should reflect risks in liabilities (e.g., duration, inflation)
- Allocation **between** LBP (risk-free) and riskier assets (equities, etc.) should reflect risk tolerances and return/risk tradeoffs (i.e., capital market assumptions)
- **Composition** of LBP should **NOT** depend on capital market assumptions
- See Belief #2 (MPI/Mercer simplifications re: LBP and material implications)



- Significance of Belief #6 discussed 2 years ago (equity mix in “**Risky** Bucket”)
- MPI’s process for defining contents of “**Risk-free** Bucket” very questionable

## FRAMEWORK (CPPIB CASE STUDY)

- 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 (CPPIB CASE STUDY)

### 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)



# “SURPLUS RISK” FOCUS (TEACHERS’ CASE STUDY)

*“main source of liability risk is a drop in **real** interest rates, which increases ... present value of ... pensions ..., and ... upward pressure on contribution rates. Higher ... rates ... opposite effect”.*

## **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.

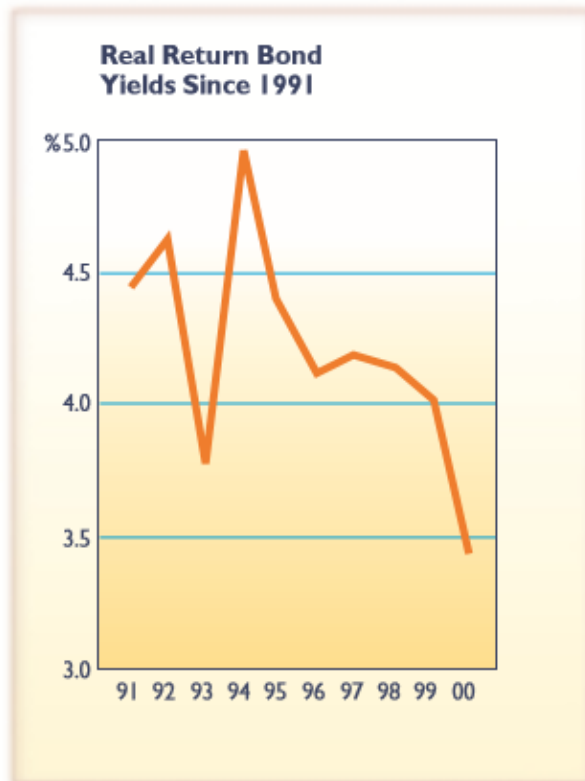
The main source of **liability risk** is a drop in real interest rates, which increases the present value of future pensions accumulated up to that point. It makes new pension liabilities more difficult to finance, and puts upward pressure on contribution rates. Higher real interest rates have the opposite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

# LIABILITY BENCHMARK AND RRBS

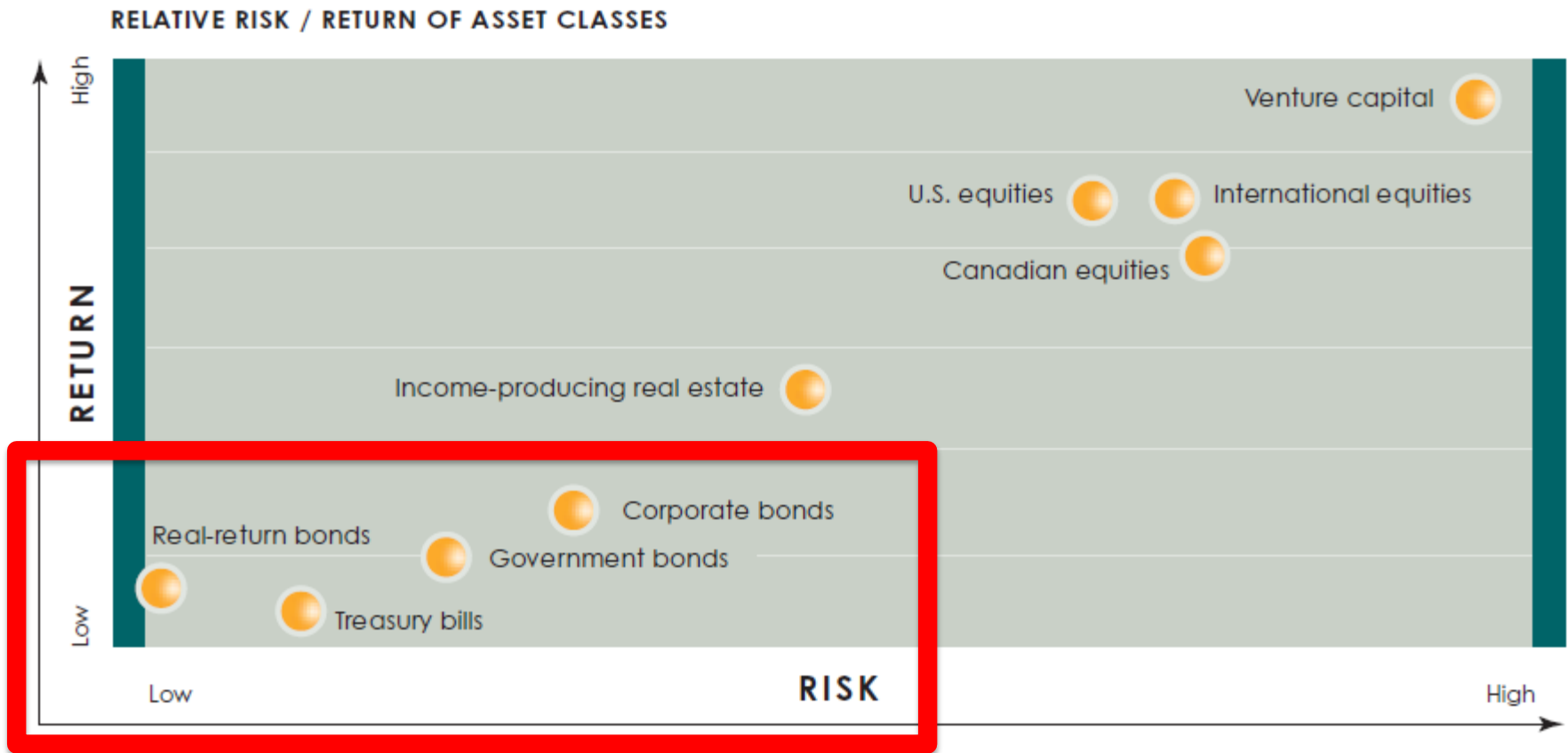
- Some liabilities resemble RRBS (zero-coupon real cash flows)
- RRBS could closely match risks in real liabilities
- “Insurance” cost varies with yield
- **Nominal bonds only good fit if inflation stable**

## **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**

# RETURN/RISK FRAMEWORK AT CPPIB (2001)

Note Return/Risk  
of RRBs vs. Bonds

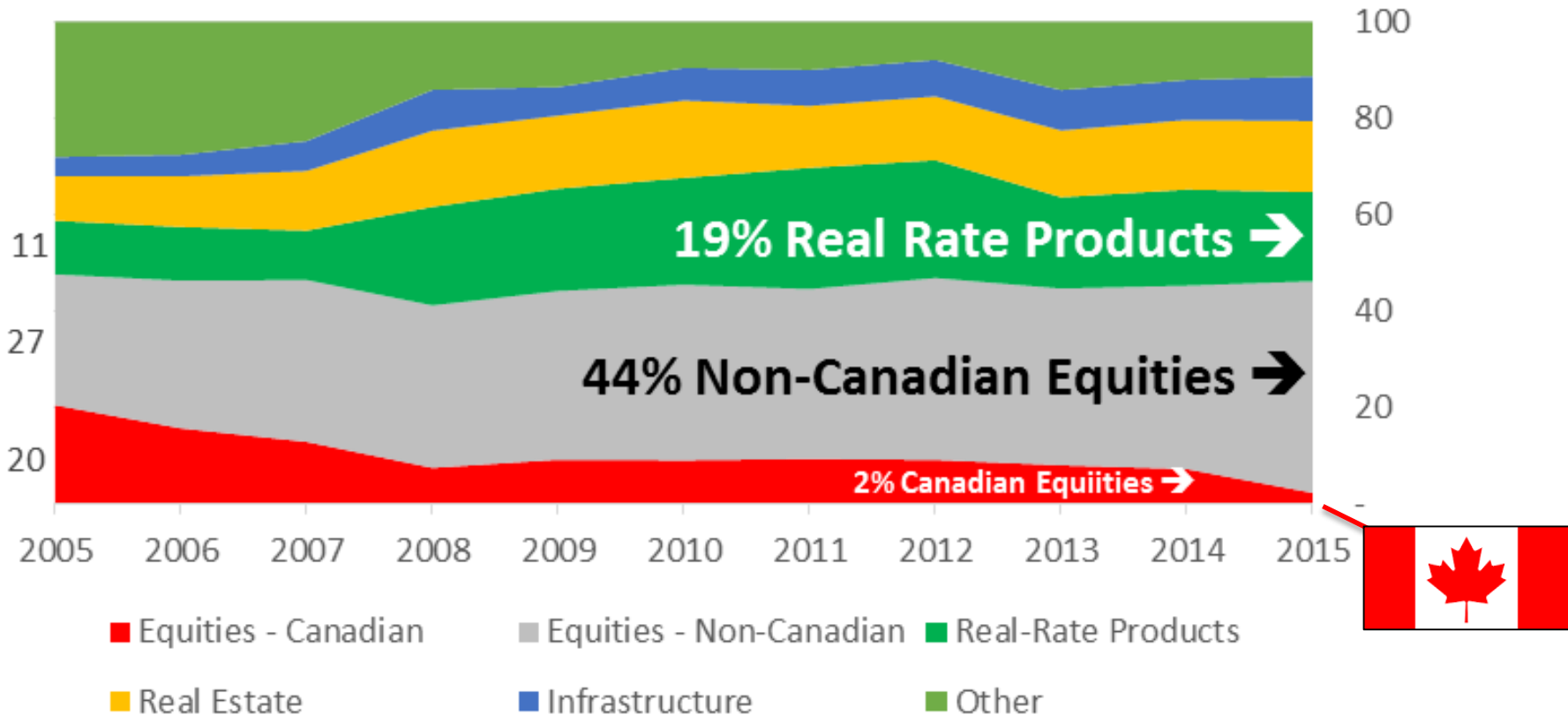


Source: CPPIB's Annual Report (March 2001), page 11

# TEACHERS' IN 2015

Note High RRB allocation, even at higher risk

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



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

# 2019/20 RECOMMENDATIONS

## FRAMEWORK

1. Real Liability Benchmark
2. Leverage Constraint

## PORTFOLIO

3. Duration Policy "Basis" Risk
4. Lengthening Nominal Duration
5. Real Return Bonds
6. Other Real Assets
7. Fixed Income Risk Concentration

## METRICS

See Duration Policy "Basis" Risk

## OVERSIGHT

8. Quantitative Models

# 1. REAL LIABILITY BENCHMARK

Re-examine ... Nominal Liability Benchmark, rather than ... Real ..., given ... understatement of ... long-term risk of inflation and ... real ... rates

<i>Basic (Real)*</i>	Duration ~ 10	66% RRBs 26% T Bills 8% <u>short</u> -term (nominal) provincial bonds
<i>Pension (Real)*</i>	Duration ~ 16	81% RRBs 30% <u>long</u> -term (nominal) provincial bonds -11% (short) T Bills
<i>Inflation- hedges</i>		<ul style="list-style-type: none"> <li>• <b>T Bills</b> hedge <b>very well</b> <u>short-term</u> inflation risk (mature in &lt; 1 year; duration &lt; 1), and better when inflation volatility is low</li> <li>• <b>RRBs</b> hedge <b>perfectly (100%)</b> inflation risk over all maturity horizons (longest RRB matures in &gt; 30 years)</li> </ul>
<i>No RRBs in Nominal</i>		No RRBs in nominal LBP understates risk of unexpected inflation and real risk, making duration management less effective <small>(under-estimate opponent)</small>
<i>Constraint</i>		No "requirement" to replicate FTSE TMX Canada RRB Index (custom benchmarks widely used)

\* See next slide for comparison of Real vs. Nominal LBPs

# MATERIAL TRACKING ERROR

- 4.5% tracking error between Real/Nominal LBPs for Basic “material” (Mercer agrees)
- Could be bigger for Pensions, given longer duration (~ 16 vs. ~ 10), and larger differences in weights (below)

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



# FOCUS/PROCESS CONCERN

- Policy focused more on shorter-horizon and inflation component (less risky), rather than capital gain/duration effects from longer-term changes related to both inflation and changing “real” interest rates (“really” risky)
- Like focusing on dividend yield component of stock returns (low and stable), rather than capital gain component (larger and more volatile), per below

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

return on stocks	=	capital gain (loss)	+	dividend yield
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↑ “Really” Risky      ↑ Less Risky

(4): Dividend Discount Model (“DDM”)

# MPI (CAC) 1-9 (Real Interest Rate Risk)

b) ... provide ... documentation ... that supports ... assertion ... real yields are "really risky"

Table shows standard deviation ("volatility") in inflation, Bonds, and RRBs (yellow) (see next page for enlarged image)

Over ~ 25 years:

- Inflation volatility ~ 0.8% (well below prior ~ 3% to ~ 4% in prior 1/4 centuries)
- 10.1% RRB volatility
- 9.6% Canada Long Bond volatility

Over 5-year periods:

- Falling volatility in Bonds (14.5% to 8.8%)
- Falling inflation volatility
- No trend in RRB volatility (12.5% by 1997, 13.3% by 2017)

STANDARD DEVIATIONS OF NOMINAL ANNUAL PERCENTAGE RATES OF CHANGE/RETURN										
PERIOD	CONSUMER PRICE INDEX	CANADA COMMON STOCKS	CANADA LONG BONDS	CONVENTIONAL MORTGAGE INDEX	91 DAY TREASURY BILLS	REAL RETURN BONDS	U.S. COMMON STOCKS IN CANADIAN \$	GDP WITH EMPLOYED	WAGE AND SALARY INDEX	
1933 - 1937	2.54	24.31	6.74	-	-	-	-	-	7.47	2.34
1938 - 1942	2.54	24.48	6.22	-	-	-	-	-	5.06	2.08
1943 - 1947	3.27	12.66	4.29	-	0.08	-	15.97	-	6.76	2.05
1948 - 1952	4.21	15.37	1.27	-	0.05	-	20.35	-	5.34	3.98
1953 - 1957	3.23	19.04	3.27	-	0.26	-	9.54	-	4.01	1.47
1958 - 1962	2.27	23.12	6.31	3.88	1.04	-	26.24	-	3.89	0.89
1963 - 1967	0.99	19.18	6.66	3.24	1.01	-	20.25	-	2.20	0.94
1968 - 1972	0.96	12.47	5.47	2.76	0.42	-	19.46	-	1.44	1.13
1973 - 1977	1.72	12.78	10.24	6.97	1.74	-	20.93	-	1.52	1.67
1978 - 1982	2.49	17.38	8.01	4.55	1.45	-	27.80	-	1.91	3.27
1983 - 1987	3.42	21.99	19.41	9.75	4.15	-	35.54	-	1.40	2.11
1988 - 1992	0.33	15.35	9.24	4.01	1.27	-	14.95	-	2.27	1.97
1993 - 1997	0.22	4.04	9.74	4.74	0.97	-	13.54	-	1.22	0.84
1998 - 1999	0.79	10.94	14.43	7.03	1.51	12.33	14.14	0.62	0.75	-
2000 - 2002	0.76	16.33	9.56	3.41	1.44	9.73	24.23	3.01	1.94	-
2003 - 2007	0.25	6.93	4.95	1.80	0.95	10.77	9.75	2.33	0.71	-
2008 - 2012	0.45	24.93	30.52	2.89	0.94	17.45	14.27	2.33	0.90	-
2013 - 2017	0.23	10.77	9.76	1.27	0.22	13.24	13.43	2.11	0.49	-
15 YRS	1933 - 1947	4.98	29.44	7.44	-	-	-	-	0.88	3.37
1948 - 1962	4.70	14.75	3.00	-	0.13	-	19.19	-	7.43	3.27
1963 - 1977	4.15	20.13	4.42	-	1.23	-	19.71	-	4.95	2.25
1978 - 1992	3.43	14.72	10.23	3.23	0.89	-	16.20	-	1.95	1.60
1993 - 1997	3.43	15.34	9.49	3.86	1.59	-	19.93	-	2.71	2.81
1998 - 1999	3.28	15.10	14.74	7.17	0.49	-	14.14	-	2.75	3.28
2000 - 2002	1.72	14.30	10.46	5.83	3.40	-	13.54	-	1.59	1.41
2003 - 2007	0.96	15.45	10.76	2.91	1.15	8.50	17.20	-	2.94	1.21
2008 - 2012	0.47	14.94	9.91	2.52	0.65	11.45	14.43	-	2.10	0.72
20 YRS	1943 - 1962	6.18	24.96	6.18	-	-	-	-	1.33	-
1963 - 1982	4.74	15.19	3.93	-	1.04	-	14.40	-	5.09	2.04
1983 - 1992	1.41	13.92	4.18	4.18	1.44	-	14.98	-	1.21	2.48
1993 - 1997	3.12	14.44	12.83	4.39	0.71	-	19.70	-	3.19	1.48
1998 - 2002	1.57	15.76	10.53	5.46	3.40	-	18.85	-	1.81	1.84
2003 - 2007	0.49	16.21	10.45	3.26	1.05	10.73	14.60	-	2.21	0.82
25 YRS	1943 - 1967	7.75	16.44	4.29	-	-	-	-	1.39	4.19
1968 - 1992	3.19	14.14	11.91	6.42	1.63	-	17.39	-	4.19	2.50
1993 - 2017	0.80	16.49	9.37	4.15	2.02	10.14	17.40	-	2.14	0.99
30 YRS	1943 - 2012	3.22	16.10	10.42	5.29	0.59	-	-	17.00	3.25
35 YRS	1943 - 2017	1.43	14.43	9.33	-	0.24	-	-	13.14	3.74
ALL YRS	1933 - 2017	1.22	16.22	9.72	5.11	0.21	9.90	-	21.24	5.20

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# MPI (CAC) 1-9 (Real Interest Rate Risk)

STANDARD DEVIATIONS OF NOMINAL ANNUAL PERCENTAGE RATES OF CHANGE/RETURN									
PERIOD	CONSUMER PRICE INDEX	CANADA COMMON STOCKS	CANADA LONG BONDS	CONVENTIONAL MORTGAGE INDEX	91 DAY T-BILLS	REAL RETURN BONDS	U.S. COMMON STOCKS IN CANADIAN \$	GDP PER EMPLOYED	WAGE AND SALARY INDEX
5 YRS	1928 - 1932	5,51	26,51	6,94	.	.	.	7,67	3,54
	1933 - 1937	2,54	24,48	8,22	.	.	.	3,06	2,88
	1938 - 1942	3,37	12,66	4,29	.	0,08	19,87	6,75	2,85

9

10 YRS	1943 - 1947	6,21	15,37	1,27	.	0,05	.	20,35	5,34	3,98
	1948 - 1952	5,23	18,04	3,27	.	0,26	.	9,94	4,01	1,47
	1953 - 1957	1,27	23,13	5,31	3,98	1,06	.	26,16	3,89	0,89
	1958 - 1962	0,99	18,18	6,86	3,24	1,01	.	20,25	2,20	0,96
	1963 - 1967	0,96	12,47	3,47	2,76	0,62	.	13,45	1,44	1,13
	1968 - 1972	1,72	13,78	10,24	6,97	1,76	.	10,93	1,52	1,67
	1973 - 1977	2,49	17,38	8,01	4,55	1,45	.	27,80	1,91	3,27
	1978 - 1982	1,42	21,99	19,61	9,75	4,18	.	15,54	1,40	2,11
	1983 - 1987	0,33	15,35	9,26	4,01	1,27	.	14,35	2,27	1,97
	1988 - 1992	1,22	14,01	7,74	4,74	2,97	.	13,91	1,28	0,64
	1993 - 1997	0,79	12,94	14,49	7,03	1,51	12,53	14,14	0,62	0,75
	1998 - 2002	1,36	18,33	8,86	3,61	1,16	6,73	24,23	3,01	1,34
	2003 - 2007	0,25	6,93	4,85	1,90	0,90	10,77	8,75	2,33	0,71
2008 - 2012	0,69	25,93	8,93	2,59	0,94	7,88	14,17	2,33	0,90	
2013 - 2017	0,23	10,77	8,76	1,27	0,22	13,34	12,41	2,11	0,40	
15 YRS	1928 - 1937	4,99	29,84	7,44	.	.	.	.	8,08	3,83
	1938 - 1947	4,78	14,79	3,00	.	0,13	.	19,19	7,43	3,27
	1948 - 1957	4,13	20,13	4,42	.	1,13	.	18,71	4,91	2,25
	1958 - 1967	1,18	14,71	5,13	3,23	0,89	.	16,33	1,95	1,60
	1968 - 1977	3,43	15,34	8,68	5,86	1,89	.	19,93	2,71	2,81
	1978 - 1987	3,28	18,10	14,74	7,17	3,68	.	14,11	2,75	3,29
	1988 - 1997	1,72	14,30	10,96	5,83	3,60	.	13,84	1,03	1,61
	1998 - 2007	0,93	15,55	6,75	2,91	1,15	8,50	17,18	2,54	1,21
	2008 - 2017	0,49	18,94	8,91	2,52	0,68	11,46	16,42	2,10	0,72
	25 YRS	1928 - 1942	4,88	24,96	6,48	.	.	.	10,38	4,16
1943 - 1957		4,74	18,18	3,83	.	1,04	.	18,60	5,09	2,84
1958 - 1972		1,61	13,92	7,15	4,58	1,44	.	14,95	2,19	2,45
1973 - 1987		3,12	18,61	12,83	6,39	3,71	.	19,78	3,19	3,68
1988 - 2002		1,57	15,76	10,53	5,46	3,40	.	18,85	1,81	1,56
2003 - 2017		0,48	16,71	7,65	2,26	1,35	10,89	14,60	2,23	0,82
50 YRS	1943 - 1967	3,75	16,64	4,29	.	1,68	.	17,38	4,15	2,50
	1968 - 1992	3,19	16,54	11,36	6,42	3,77	.	17,08	3,21	3,31
	1993 - 2017	0,80	16,49	9,57	4,15	2,02	10,14	17,40	2,14	0,98
75 YRS	1968 - 2017	3,27	16,35	10,42	5,79	4,50	.	17,08	3,55	3,59
ALL YRS	1943 - 2017	3,45	16,43	9,33	.	4,24	.	17,16	3,74	3,26
ALL YRS	- 2017	3,91	18,29	8,72	5,61	4,21	9,96	17,24	5,29	3,60

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# CORRELATIONS (CAC (MPI) 1-84(F))

- 0.57 correlation between RRBs and federal bonds (row 4)
- Lower correlation between RRBs (column 5) and other bonds (e.g., federal long-term bonds in column 4) → **inflation volatility matters**
- Using “nominal” bonds to hedge “real” liabilities may be fine over very short horizons if **both inflation level and volatility** reasonably predictable, but long-term “basis risk” material

Asset Class	Correlations				
	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

## 2. LEVERAGE CONSTRAINT

Re-examine ... constraint prohibiting ... “leverage”, given ... lower risk-adjusted returns that would result

*Not a major concern in the context of prohibiting bond/RRB leverage  
(should be addressed in duration policy; next slides)*

**CONFIDENTIAL ADDITIONAL COMMENT**

### 3. DURATION POLICY “BASIS” RISK

Re-examine ... <u>duration</u> ..., which uses (nominal) bonds ... for matching ... inflation and real ... rate sensitivity ..., ... inflation <u>volatility</u> ... not zero	
<i>MPI's View</i>	MPI agreed duration matching not as effective if inflation differs from expectations; “Accepted short term inflation risk and ... accounted for risk through margins and reserve; Excess portfolio ... designed to provide some protection against inflation” (2017/18 GRA Evidence)
<i>Rate Risk</i>	$\sigma_n = \sqrt{(\sigma_r^2 + \sigma_\pi^2 + 2\rho_{r,\pi}\sigma_r\sigma_\pi)}$ ; depends on <b><u>volatility/correlation</u></b> , not <b><u>levels</u></b>
<i>4.5% Error</i>	4.5% “tracking error” between Nominal and Real Liability Benchmark Portfolios a big number (especially given low risk tolerance)
<i>Customized Policy?</i>	Would a <b><u>customized</u></b> duration policy be more effective, reflecting: 1. less predictable <b><u>long-term</u></b> risks, 2. more predictable <b><u>short-term</u></b> ?
<i>Constraints?</i>	No “requirement” to be “indexed” to FTSE TMX Canada RRB Index; Many institutional investors have custom benchmarks to reflect needs

# 4. LENGTHENING NOMINAL DURATION (PUBLIC INFORMATION)

Re-examine ... decision to lengthen ... nominal duration in ... Basic ..., given: ... lower risk ... strategy; ... return assumptions for bonds and RRBs; ... concerns about ... effectiveness of ... duration policy ... (“basis” risk)

<i>Return Scenarios:</i> better worse		Inflation > Expected		Real Yields Rise	Nominal Yields Rise
	<i>RRBs</i>	RRBs do well (inflation protected)			
	<i>T Bills</i>	T Bills do well (reinvest short-term maturities at  rates)			
	<i>Bonds</i>	Bonds do poorly (worse if longer)			
<i>Mercer's 10Y Forecast: Rising Rates</i>		Yield Change	Annualized Return	Conclusions (Details Confidential)	
	<i>RRBs</i>	<b>CONFIDENTIAL</b>		<i>Do we expect a better goalie (RRBs) to both make <u>more saves</u> and also score <u>more goals</u> than some players in the next period (10 years)?</i>	
	<i>T Bills</i>				
	<i>Bonds</i>				
<i>Conclusions</i>	Lengthening <u>nominal</u> duration increases long-term rate instability if liabilities are inflation-sensitive				

**APPENDIX 17, ATTACHMENT C, SLIDE 8  
(CONFIDENTIAL INFORMATION)**



**PUB (MPI) CSI 2-6**  
**(CONFIDENTIAL INFORMATION)**

**PUB (MPI) CSI 2-6**  
**(CONFIDENTIAL INFORMATION)**

# 5. REAL RETURN BONDS

Re-examine ... decision to exclude RRBs from ... portfolios, given ... better hedging ... of RRBs (compared to bonds), recognizing ... long-term inflation and real interest rate risks ... in ... liabilities

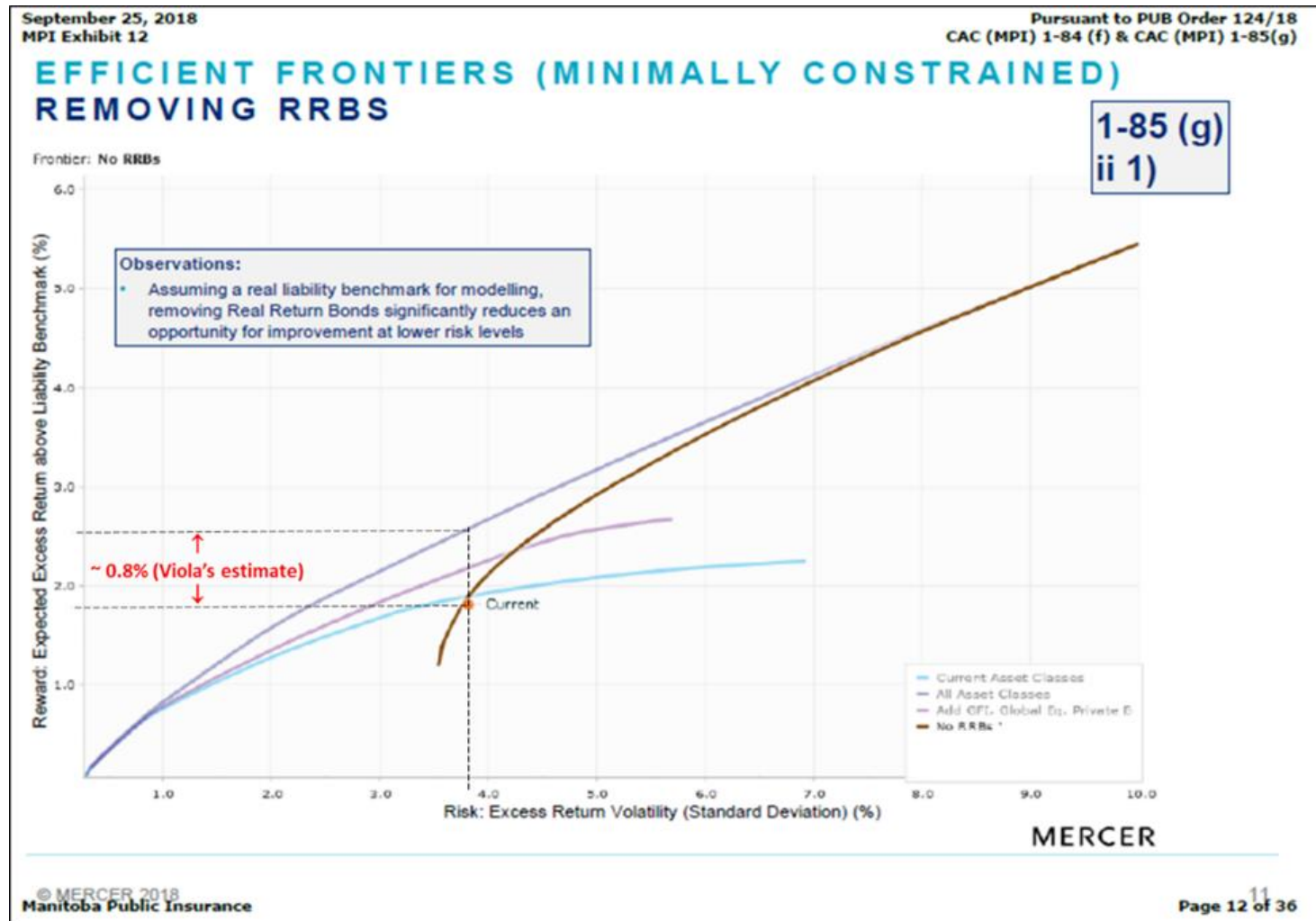
*Mercer's  
Observations*

- “Assuming a real liability benchmark for modelling, removing Real Return Bonds significantly reduces an opportunity for improvement at lower risk levels” (see next slides)
- Removing RRBs reduces returns at current risk levels (~ 0.8% in Basic, ~ 0.2% in Pension)

# PUB (CAC) 1-7 (REAL RETURN BONDS)

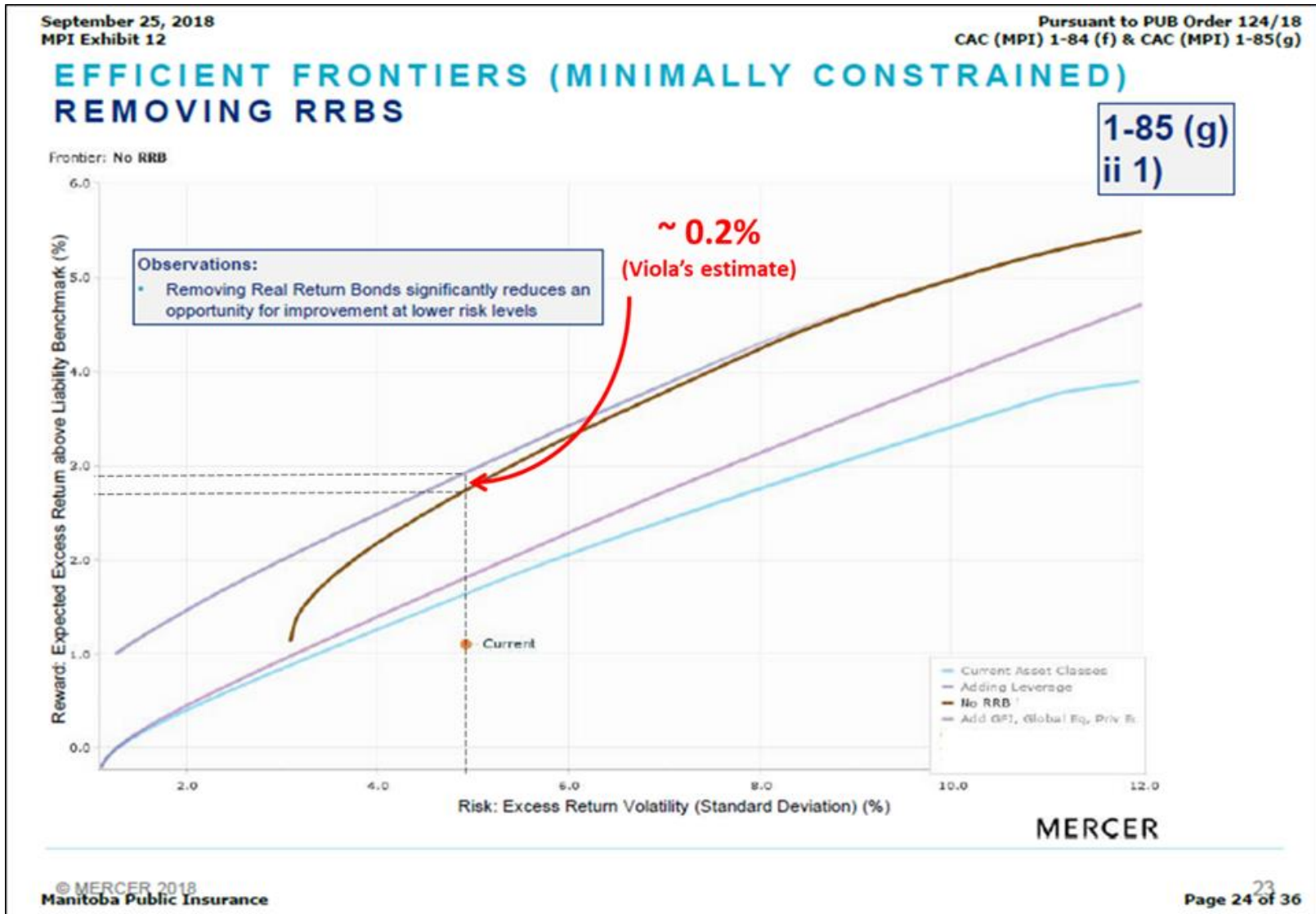
## Basic:

At “current” risks levels (vertically at  $x = \text{Risk} = 3.8\%$ ) Mercer’s efficient frontier suggests that the expected excess return above the Liability Benchmark drops by  $\sim 0.8\%$  when RRBs are removed, from a visual inspection of the graph



# PUB (CAC) 1-7 (REAL RETURN BONDS)

Pensions:



# PUB (CAC) 1-7 (CONTINUED)

a) ... any concerns about ... availability of RRBs for MPI's portfolio, ... now or ... future?

**Current Market Size:** 14 RRBs in FTSE TMX Canada RRB Index; \$84B market value; Average 25 year term; ~ 15 duration; Not as large as bond market; Trading/turnover likely lower ("buy-and-hold" RRBs as long-term hedge); As long-term, "buy-and-hold" investment, any "premium" cost to acquire RRBs initially small ("one time" cost "amortized" over decades); Small annualized extra cost; "Releases" risk capital in other areas to increase returns on total portfolio

	Index Level (TR)	# of Issues	MktVal (Billions)	Effective Term
Real Return Bond Indices				
Real Return Bond	559.0	14	84.2	25.00
Real Return Federal Non-Agency Bond	329.2	8	74.9	25.93

**Future Market Size:** No view on future RRB supplies nor investor demand;

Changes in annual demand limited to:

- i) rebalance (buy when RRBs underperform; small),
- ii) new capital to invest (small % of assets under management)

# PUB (CAC) 1-7 (REAL RETURN BONDS)

**b) ... any concerns about ... inclusion of RRBs on ... returns ... from ... Basic or Pension portfolios?**

No, when viewed on a total portfolio basis and after adjusting for the risk reduction that RRBs have on the portfolios, other things equal; PUB (CAC) 1-5 shows RRBs improve total portfolio returns at all levels of risk according to Mercer (efficient frontier that includes RRBs is higher than one that excludes them)

# 6. OTHER REAL ASSETS

Re-examine ... reduction in other real assets (real estate and infrastructure), given ... low inflation protection ... in ... current portfolio and lower diversification



# 7. FIXED INCOME RISK CONCENTRATION

Re-examine ... decision to concentrate risk in fixed income ... and ... “crowding out” risk-reducing RRBs

*Concentration*

- More concentrated risk within fixed income
  - Inflation
  - Credit
  - Liquidity risk
- See concentration on next page

# PUB (CAC) 1-4 (ASSET MIX)

Asset Class Breakdown				
	(C)	(B)	(P)	(P)-(B)
	Current	Same Risk	Proposed	Difference
Private Debt	-	15.0	-	- 15.0
Corporate Bonds	2.0	-	20.0	20.0
Provincial Bonds <sup>1</sup>	68.0	38.0	80.0	42.0
Federal Bonds <sup>2</sup>	-	-	-	-
Federal RRBs	-	45.0	-	- 45.0
T Bills	-	- 30.0	-	30.0
<b>Fixed Income</b>	<b>70.0</b>	<b>68.0</b>	<b>100.0</b>	<b>32.0</b>
				-
Equities <sup>3</sup>	15.0	23.5	-	- 23.5
Real Estate	10.0	5.5	-	- 5.5
Infrastructure	5.0	3.0	-	- 3.0
	<b>100.0</b>	<b>100.0</b>	<b>100.0</b>	<b>-</b>
Return	4.2	4.9		
Surplus Volatility	3.8	3.8		

# 8. QUANTITATIVE MODELS

... be vigilant about ... too much reliance on quantitative considerations, particularly if risk tolerances ... low, given ... high sensitivity of optimal asset allocations to ... assumptions and ... large number of inputs ...

*Long Time Horizon*

“Nobody can forecast interest rates (especially long term bonds) accurately and consistently” Mr. Cheng (GRA page 1,469)

*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: 2017/18 GRA Evidence, page 41

# 2019/20 RECOMMENDATIONS

## FRAMEWORK

### 1. Real Liability Benchmark:

Re-examine ... Nominal Liability Benchmark, rather than ... Real ..., given ... understatement of ... long-term risk of inflation and ... real ... rates

### 2. Leverage Constraint:

Re-examine ... constraint prohibiting ... “leverage”, given ... lower risk-adjusted returns that would result

### 3. Duration Policy “Basis” Risk:

Re-examine ... duration ..., which uses (nominal) bonds ... for matching ... inflation and real ... rate sensitivity ..., ... inflation volatility ... not zero

### 4. Lengthening Nominal Duration:

Re-examine ... decision to lengthen... nominal duration in ... Basic ..., given: ... lower risk ... strategy; ... return assumptions for bonds and RRBs; ... concerns about ... effectiveness of ... duration policy ... (“basis” risk)

### 5. Real Return Bonds:

Re-examine ... decision to exclude RRBs from ... portfolios, given ... better hedging ... of RRBs (compared to bonds), recognizing ... long-term inflation and real interest rate risks ... in ... liabilities

### 6. Other Real Assets:

Re-examine ... reduction in other real assets (real estate and infrastructure), given ... low inflation protection ... in ... current portfolio and lower diversification

### 7. Fixed Income Risk Concentration:

Re-examine ... decision to concentrate risk in fixed income ... and ... “crowding out” risk-reducing RRBs

## PORTFOLIO

## METRICS

See Duration Policy “Basis” Risk

## OVERSIGHT

### 8. Quantitative Models:

... be vigilant about ... too much reliance on quantitative considerations, particularly if risk tolerances ... low, given ... high sensitivity of optimal asset allocations to ... assumptions and ... large number of inputs ...