

HEALTH WEALTH CAREER

ASSET LIABILITY STUDY

EFFICIENT FRONTIER ANALYSIS FOR BASIC
INSURANCE & PENSION COMPONENTS

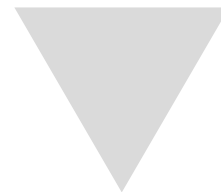
ASSUMPTIONS BASED ON
FORWARD YIELD CURVE &
REAL LIABILITY BENCHMARKS

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

Manitoba Public Insurance

SEPTEMBER 25, 2018

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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**

ASSET CLASSES CONSIDERED

	Return Seeking	Inflation Sensitive	Interest Rate Sensitive
Broad Markets	<ul style="list-style-type: none"> <input type="checkbox"/> Canadian Equity <input type="checkbox"/> US Equity <input checked="" type="checkbox"/> EAFE Equity 	<ul style="list-style-type: none"> <input checked="" type="checkbox"/> Real Return Bonds <input checked="" type="checkbox"/> 3x Real Return Bonds 	<ul style="list-style-type: none"> <input type="checkbox"/> Cash <input type="checkbox"/> MUSH Bonds <input type="checkbox"/> Provincial Bonds <input type="checkbox"/> Federal Bonds <input type="checkbox"/> Canadian Corporate Bonds <input checked="" type="checkbox"/> 3X Long Provincial Bonds
Other Markets	<ul style="list-style-type: none"> <input checked="" type="checkbox"/> Emerging Markets Equity <input checked="" type="checkbox"/> Global Low Volatility Equity 		<ul style="list-style-type: none"> <input checked="" type="checkbox"/> Global Bonds <input checked="" type="checkbox"/> High Yield Bonds <input checked="" type="checkbox"/> Emerging Market Debt
Alternative Investments	<ul style="list-style-type: none"> <input type="checkbox"/> Private Equity <input checked="" type="checkbox"/> Diversified Growth Fund 	<ul style="list-style-type: none"> <input type="checkbox"/> Infrastructure – Direct Global <input type="checkbox"/> Real Estate - Direct Cdn 	<ul style="list-style-type: none"> <input checked="" type="checkbox"/> Private Debt – Universe <input checked="" type="checkbox"/> Private Debt – Long <input checked="" type="checkbox"/> Commercial Mortgages <input checked="" type="checkbox"/> 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)

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 ACWI¹ 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.

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

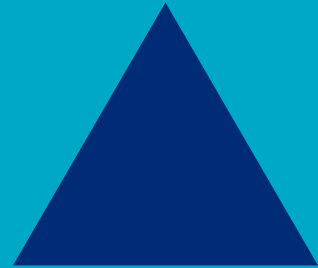
Asset Class	Single	Group
MUSH Bonds Private Debt Commercial Mortgages	Min. 10% of total portfolio	Max. 25% of total portfolio
Real Estate Infrastructure Private Equity Growth Fixed Income		Not exceed Equity portfolio

ANALYSIS

EFFICIENT FRONTIERS

BASIC INSURANCE

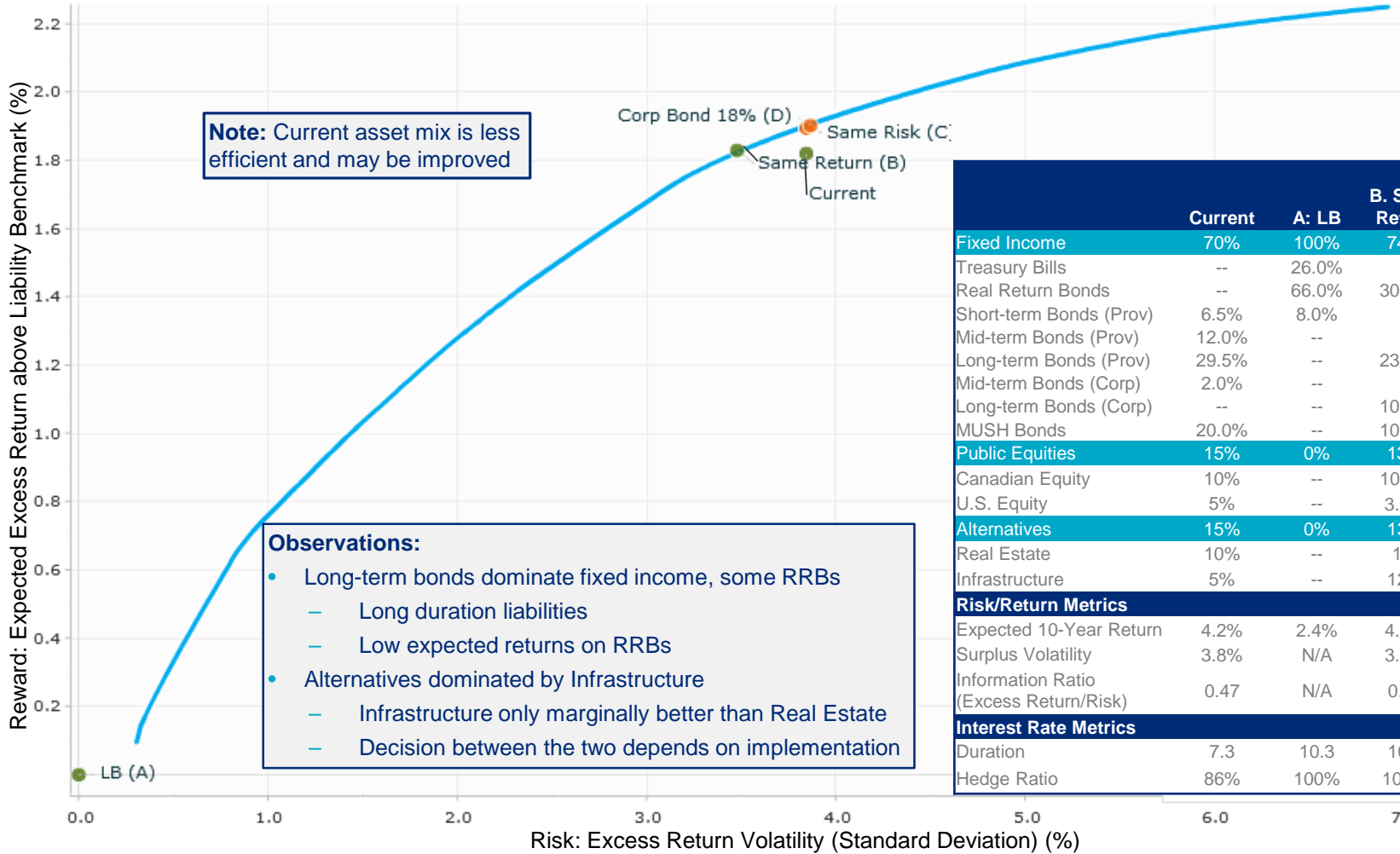
– REAL LIABILITY BENCHMARK



EFFICIENT FRONTIERS (MINIMALLY CONSTRAINED) CURRENT ASSET CLASSES ONLY

1-84 (f)

Frontier: Current Asset Classes



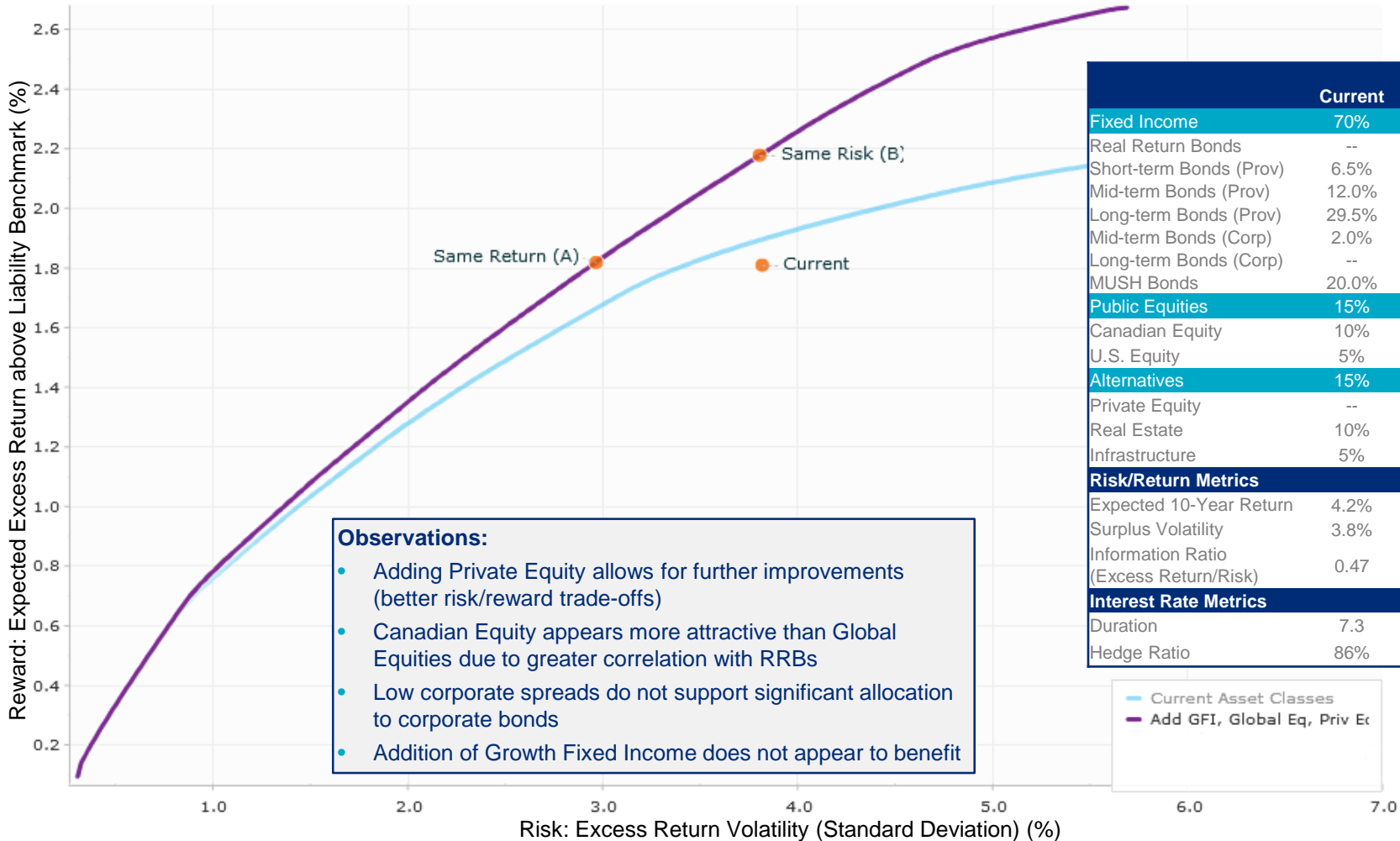
	Current	A: LB	B. Same Return	C. Same Risk	D. Corp Bond 18%
Fixed Income	70%	100%	74%	75%	75%
Treasury Bills	--	26.0%	--	--	--
Real Return Bonds	--	66.0%	30.0%	18.0%	18.0%
Short-term Bonds (Prov)	6.5%	8.0%	--	--	--
Mid-term Bonds (Prov)	12.0%	--	--	--	--
Long-term Bonds (Prov)	29.5%	--	23.5%	30.0%	29.0%
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 EQUITY

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%	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%

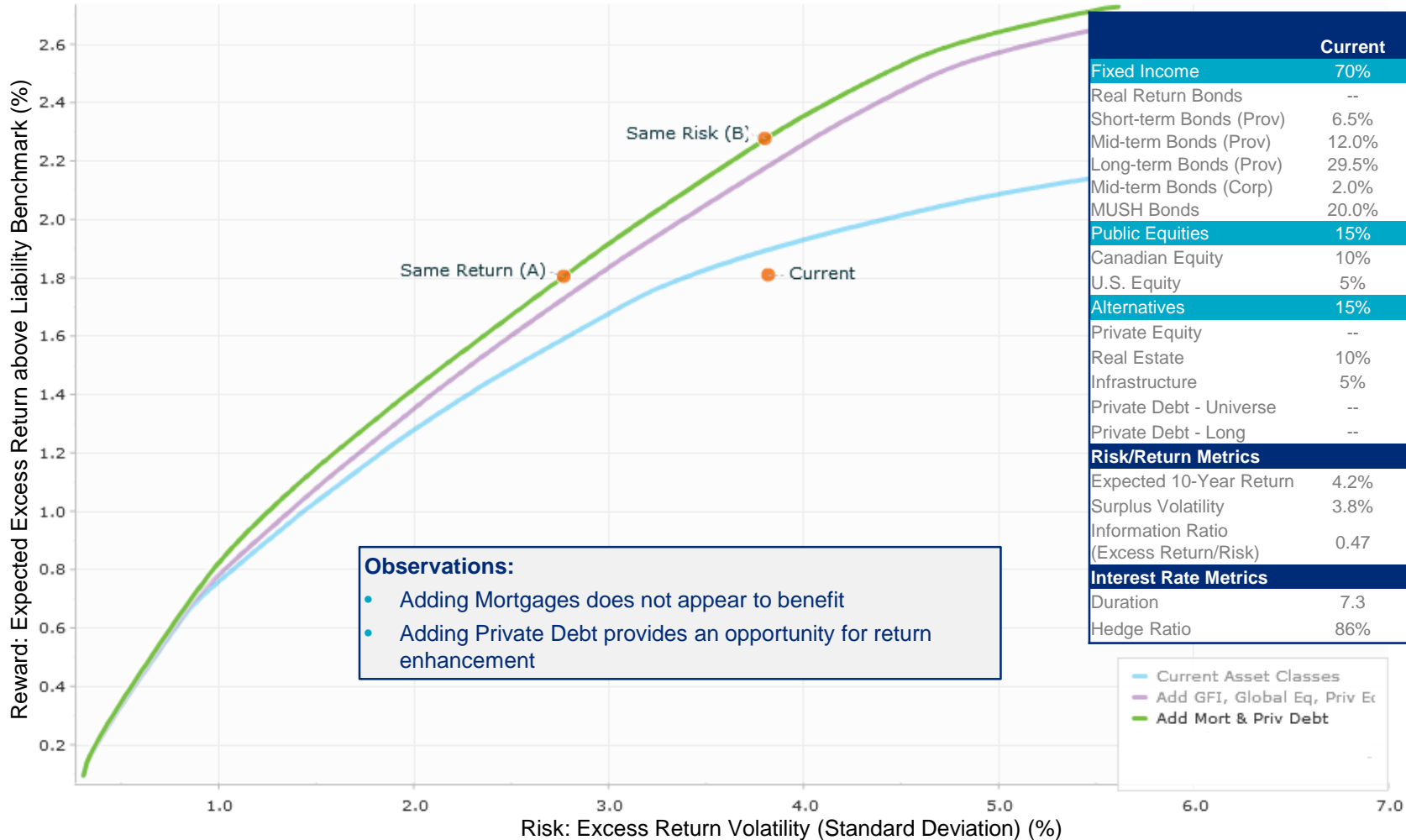
— Current Asset Classes
— Add GFI, Global Eq, Priv Eq

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EFFICIENT FRONTIERS (MINIMALLY CONSTRAINED) ADDING MORTGAGES AND PRIVATE DEBT

1-84 (f)

Frontier: Add Mort & Priv Debt



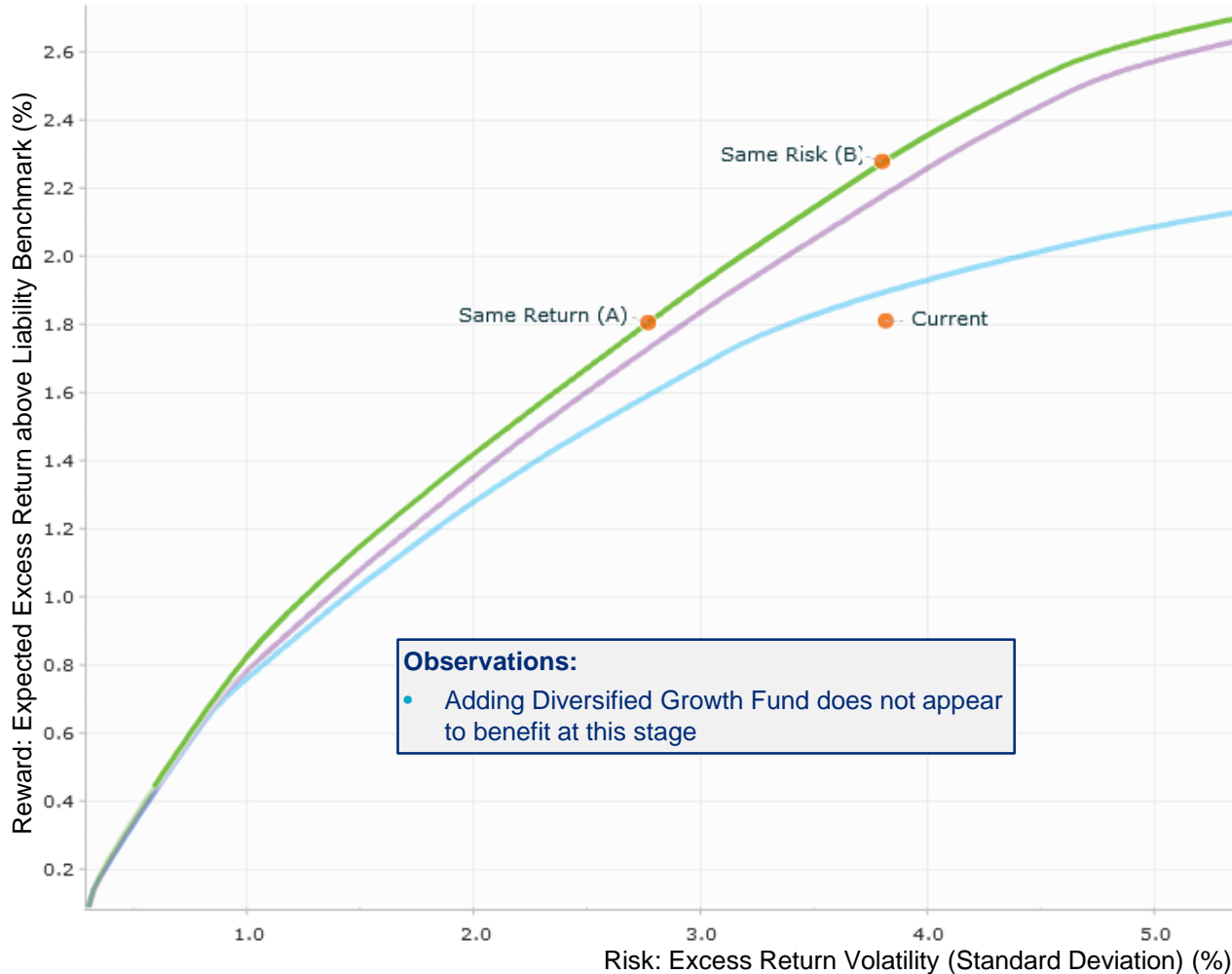
	Current	A. Same Return	B. Same Risk
Fixed Income	70%	64.5%	58.5%
Real Return Bonds	--	46.0%	40.5%
Short-term Bonds (Prov)	6.5%	--	--
Mid-term Bonds (Prov)	12.0%	8.5%	--
Long-term Bonds (Prov)	29.5%	--	8.0%
Mid-term Bonds (Corp)	2.0%	--	--
MUSH Bonds	20.0%	10.0%	10.0%
Public Equities	15%	10%	13%
Canadian 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)

Frontier: Add Div Growth Fund



Observations:

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

	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%

— Current Asset Classes
— Add GFI, Global Eq, Priv Et
— Add Mort & Priv Debt
— Add Div Growth Fund

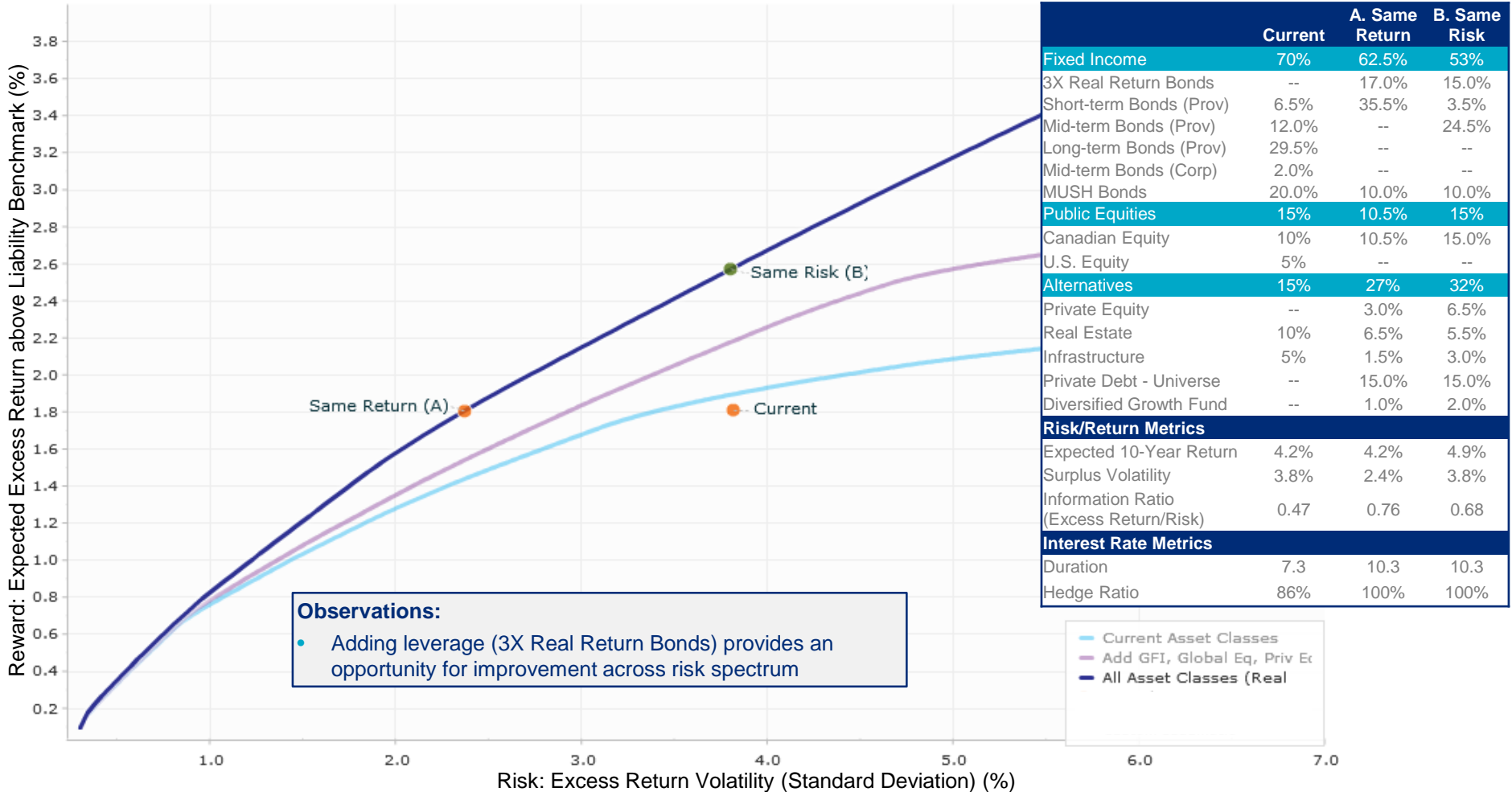
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EFFICIENT FRONTIERS (MINIMALLY CONSTRAINED) ADDING LEVERAGE (BOND OVERLAY)

1-84 (f)

1-85 (g) i

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

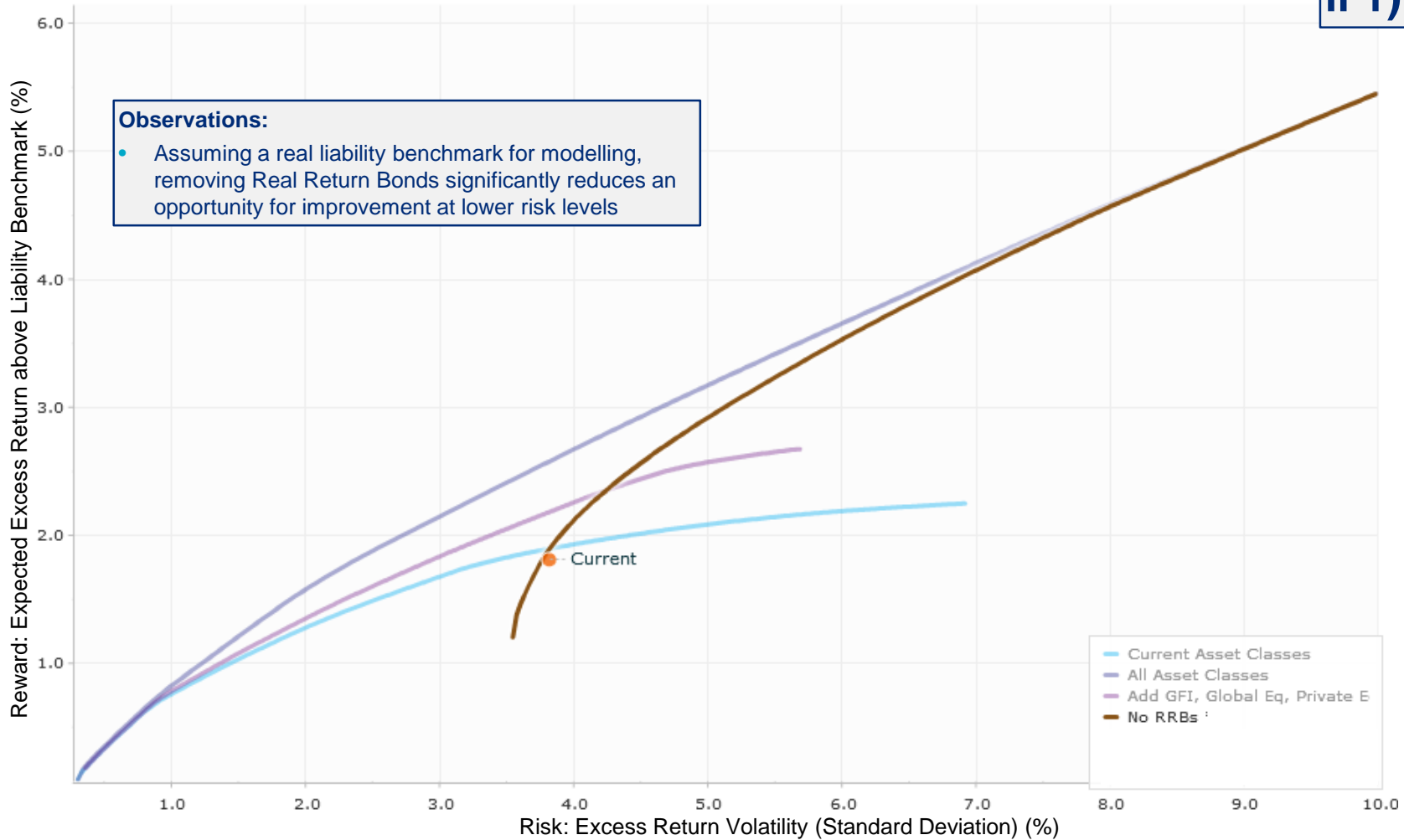


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EFFICIENT FRONTIERS (MINIMALLY CONSTRAINED) REMOVING RRBS

1-85 (g)
ii 1)

Frontier: No RRBS

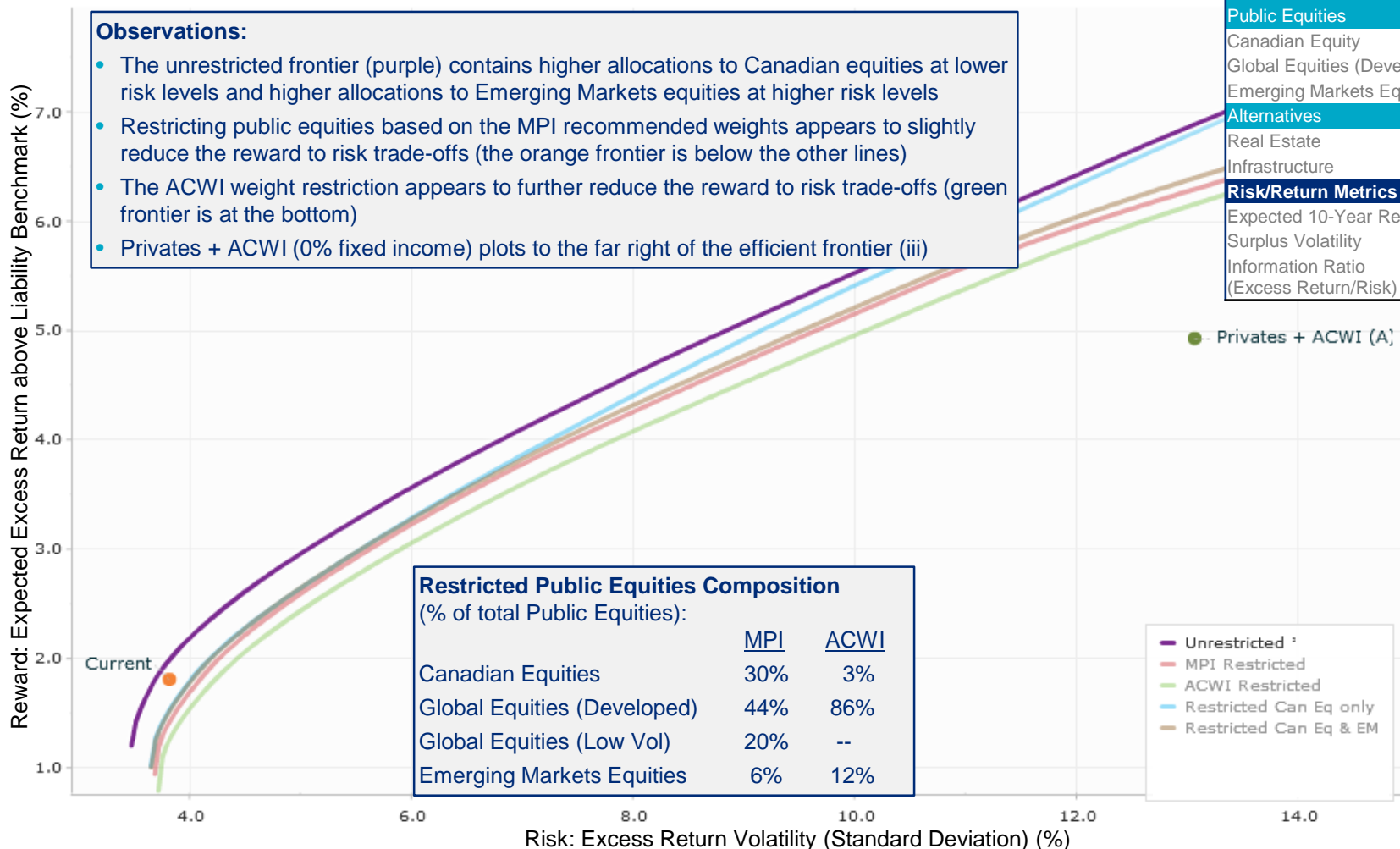


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1-85 (g)
ii 2), iii)

EFFICIENT FRONTIERS (NO RRBS) RESTRICTING PUBLIC EQUITIES

Frontier: **Unrestricted**



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%

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ASSET MIX OPTIONS BASIC

**1-85 (g) iv
1790 of GRA**

	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

1-85 (g) iv

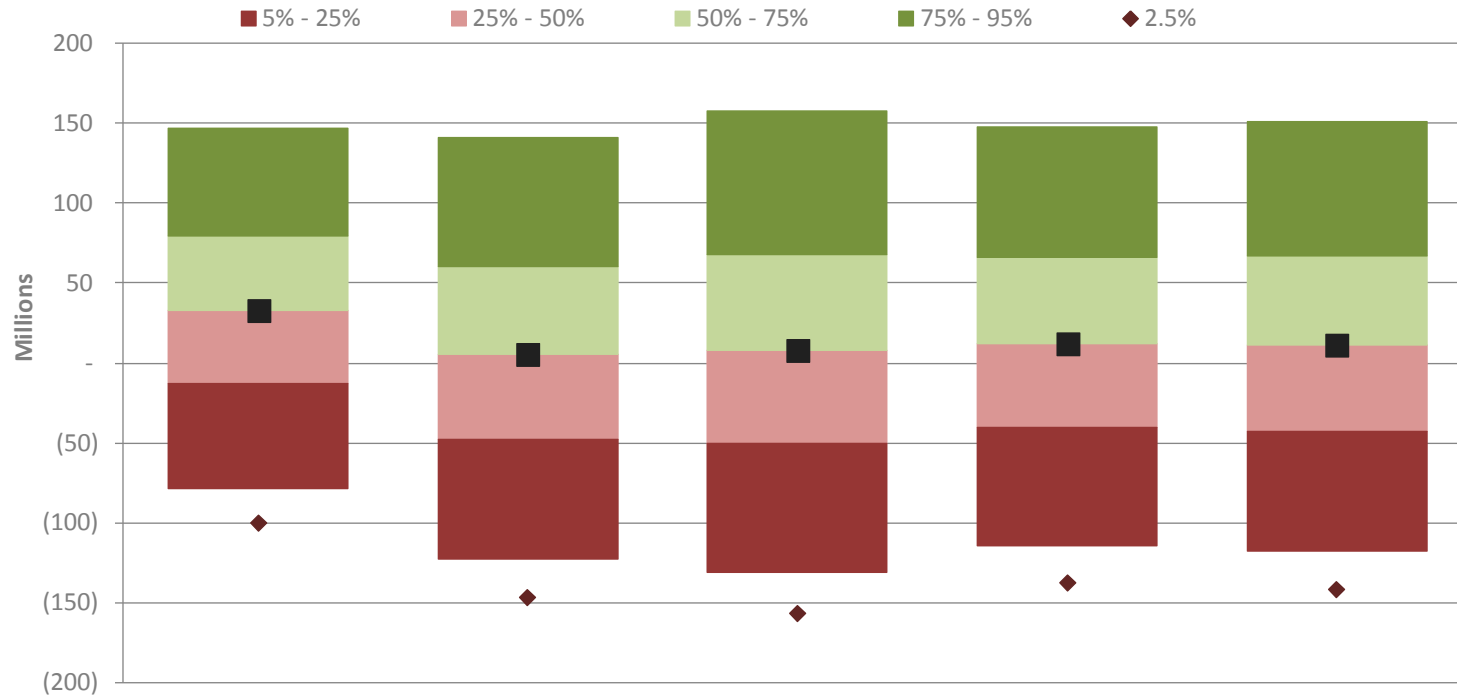
ASSET MIX ANALYSIS – SUMMARY RESULTS

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%	Return Metrics
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	Risk Metrics
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%	

1-85 (g) iv

EXPECTED SURPLUS GROWTH BASIC- 1 YEAR PROJECTIONS



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

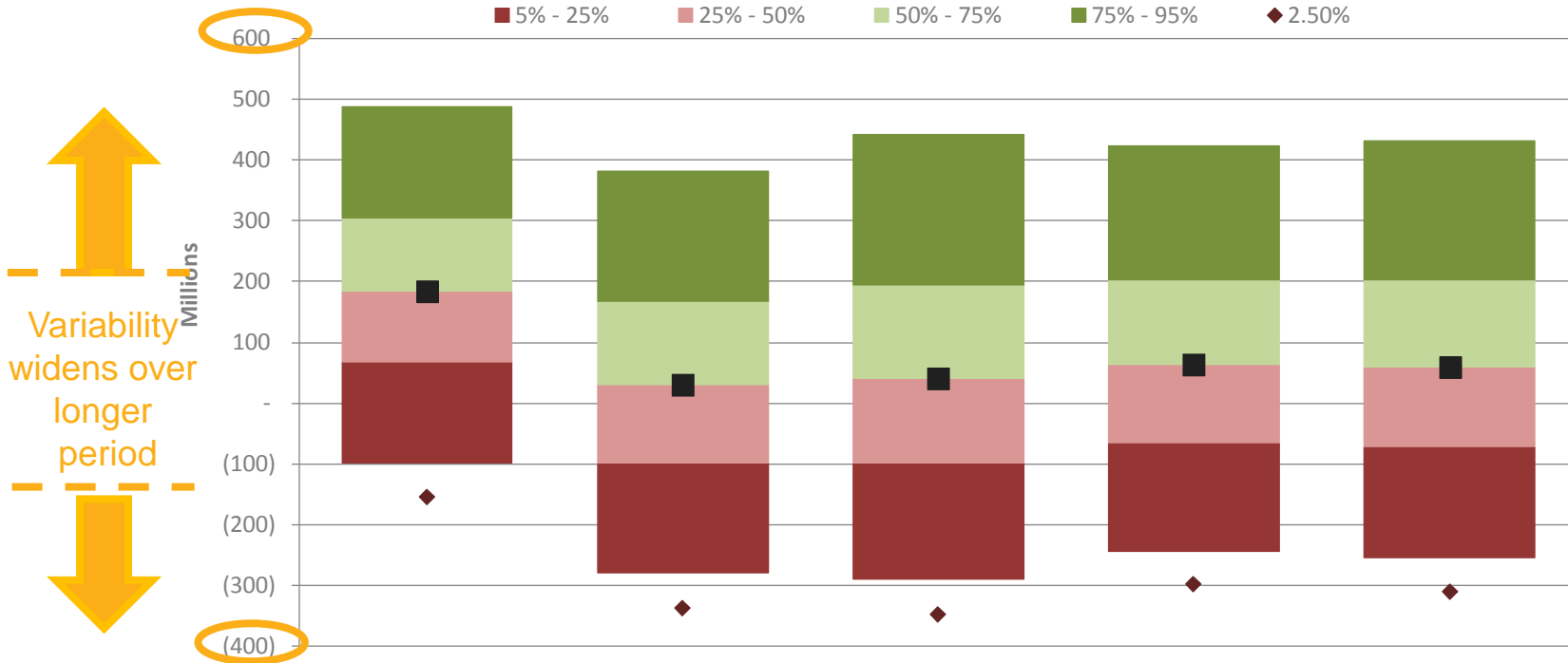
Median

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).

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).

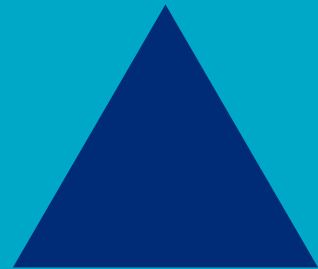
1-85 (g) v

ANALYSIS

EFFICIENT FRONTIERS

PENSION PLAN

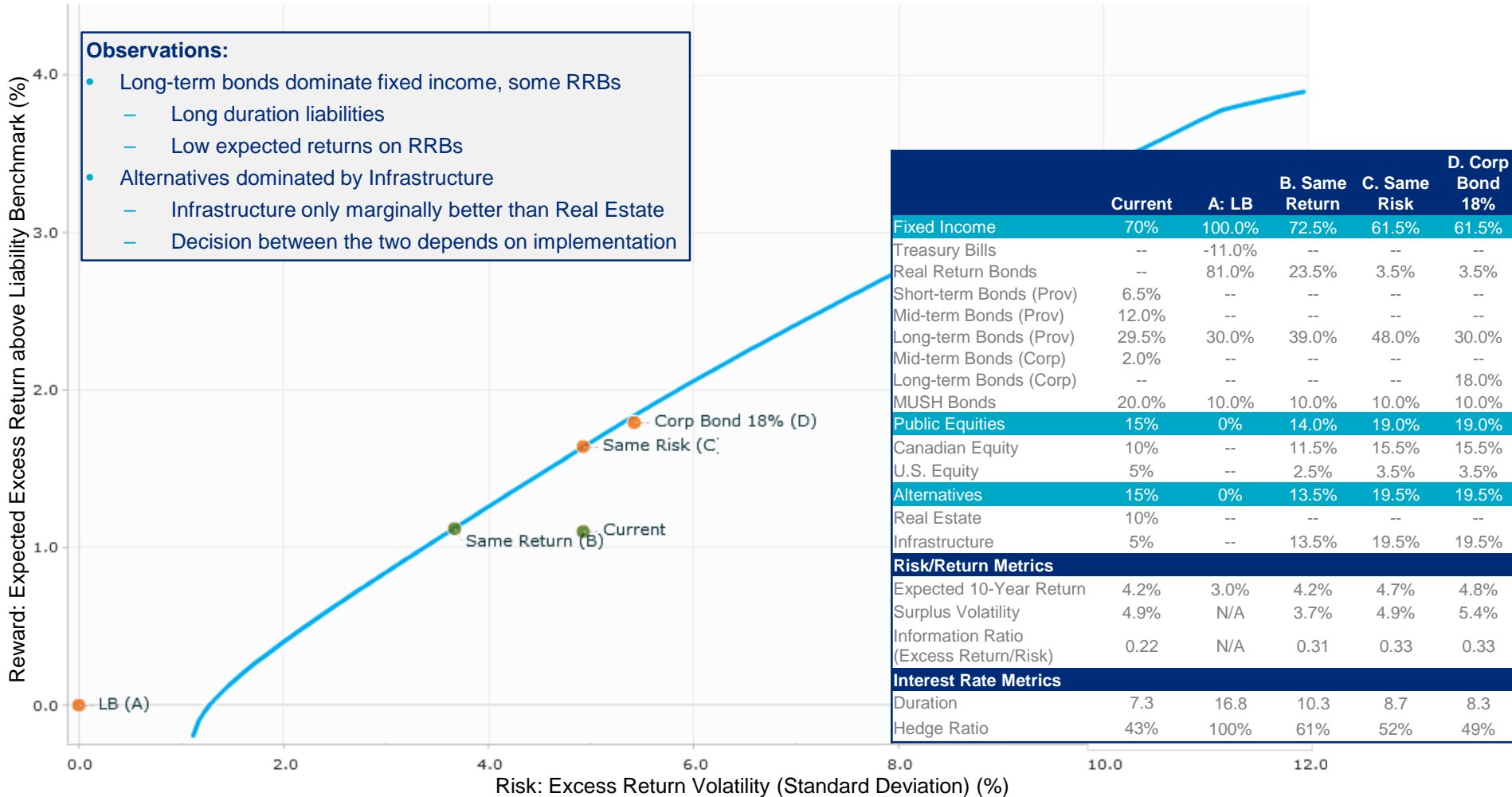
– REAL LIABILITY BENCHMARK



EFFICIENT FRONTIERS (MINIMALLY CONSTRAINED) CURRENT ASSET CLASSES ONLY

1-84 (f)

Frontier: Current Asset Classes

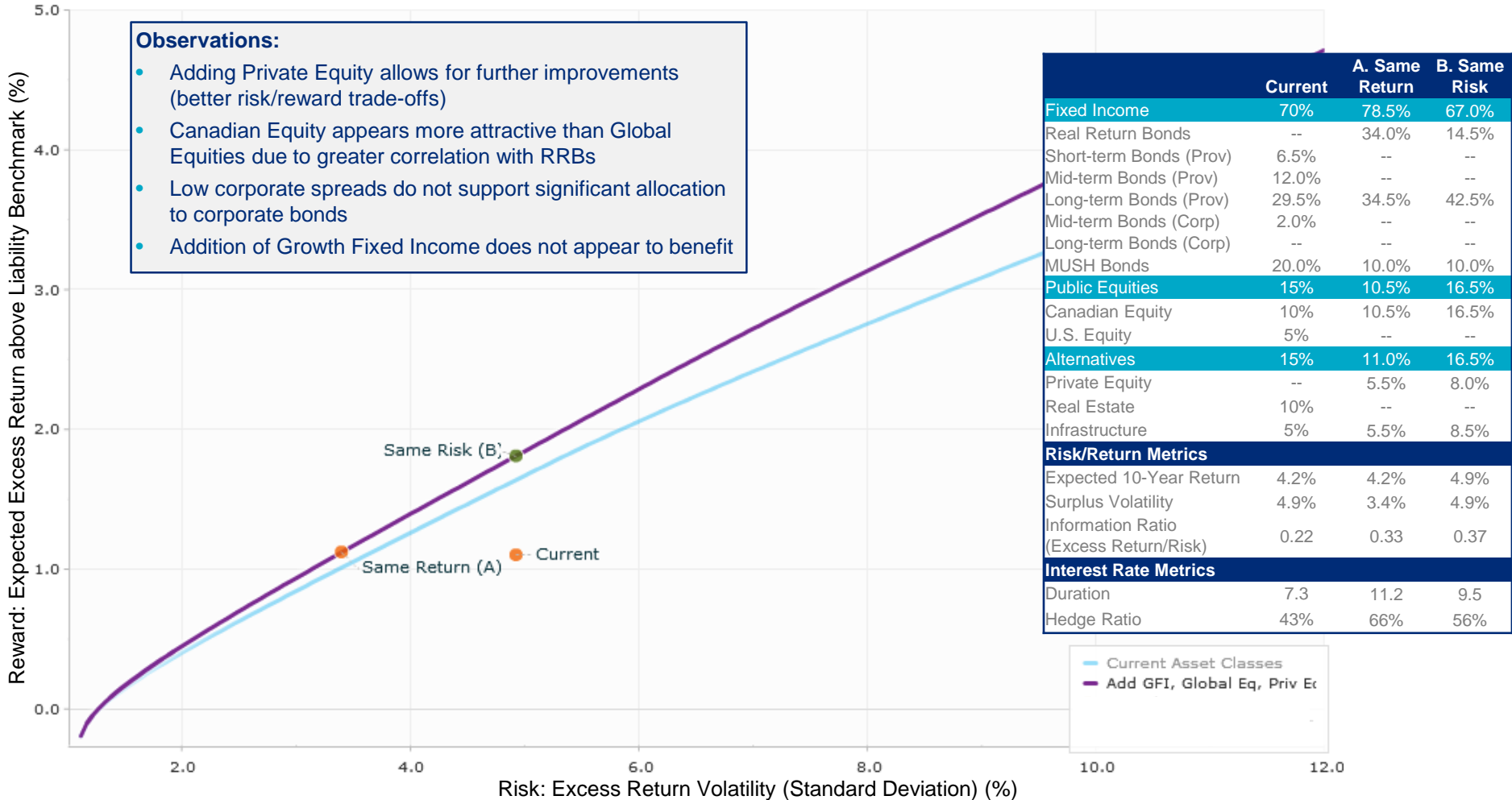


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EFFICIENT FRONTIERS (MINIMALLY CONSTRAINED) ADDING GROWTH FIXED INCOME, GLOBAL EQUITIES & PRIVATE EQUITY

1-84 (f)

Frontier: Add GFI, Global Eq, Priv Eq

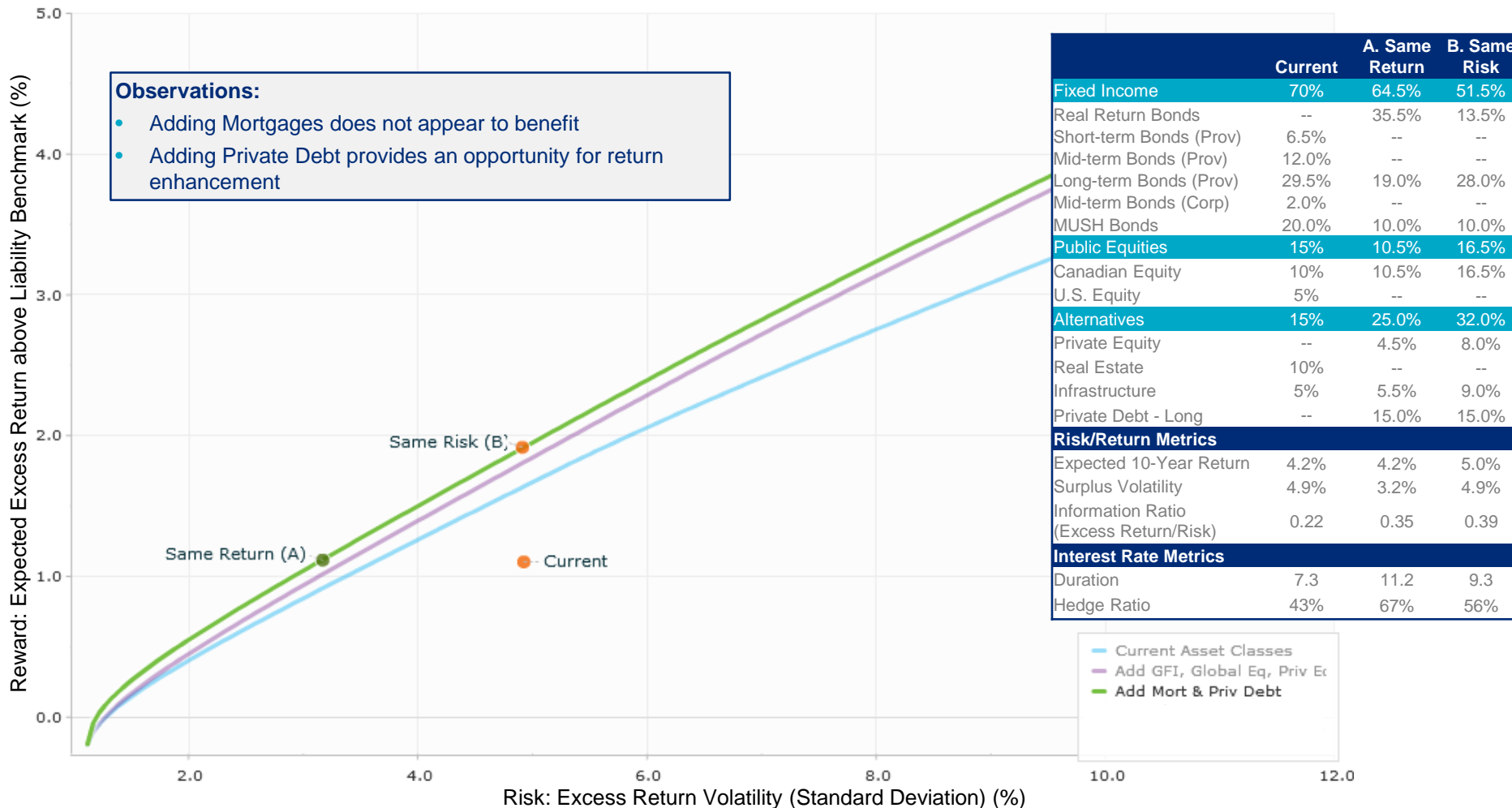


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EFFICIENT FRONTIERS (MINIMALLY CONSTRAINED) ADDING MORTGAGES AND PRIVATE DEBT

1-84 (f)

Frontier: Add Mort & Priv Debt

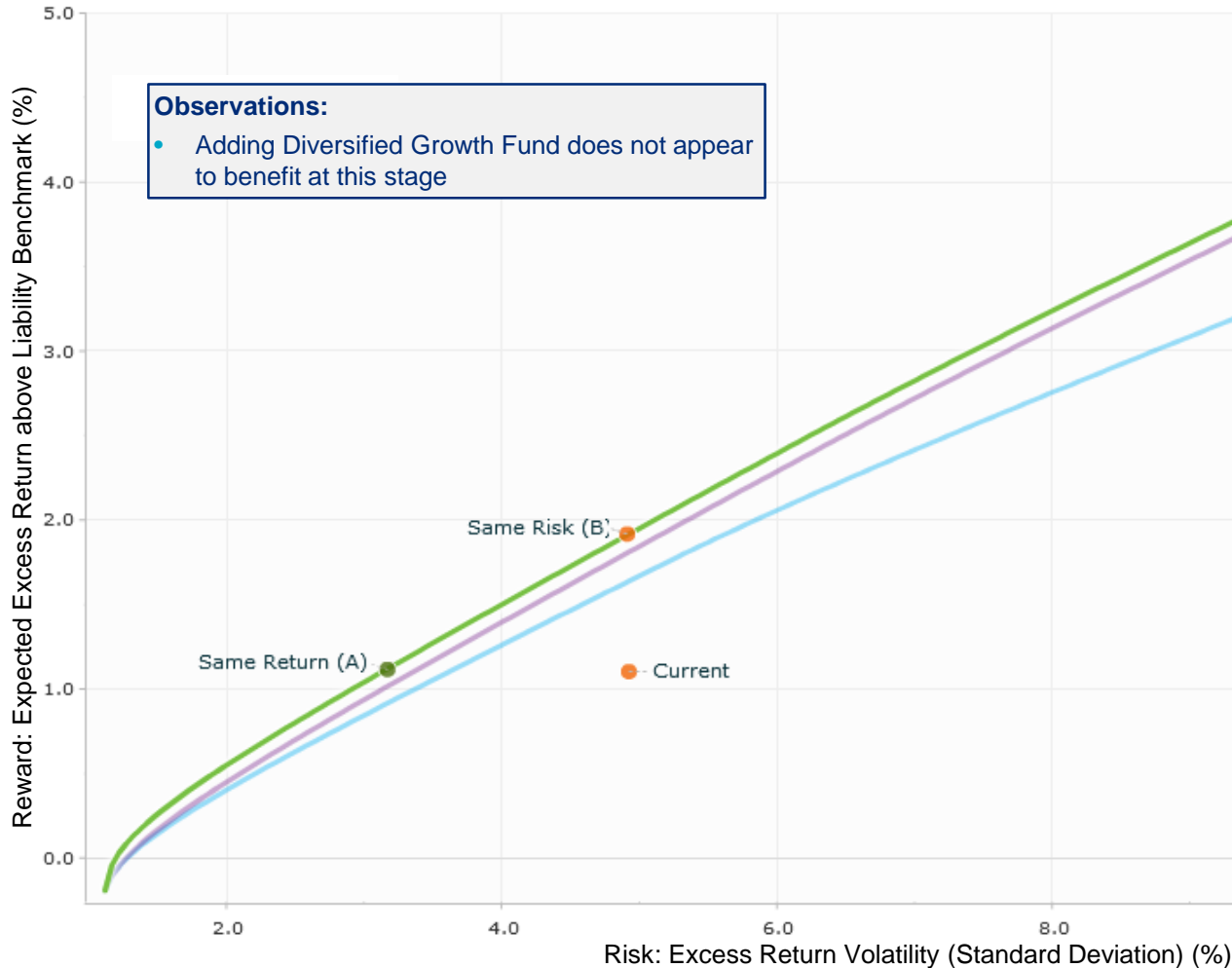


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EFFICIENT FRONTIERS (MINIMALLY CONSTRAINED) ADDING DIVERSIFIED GROWTH FUND

1-84 (f)

Frontier: Add Div Growth Fund



Observations:

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

	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%

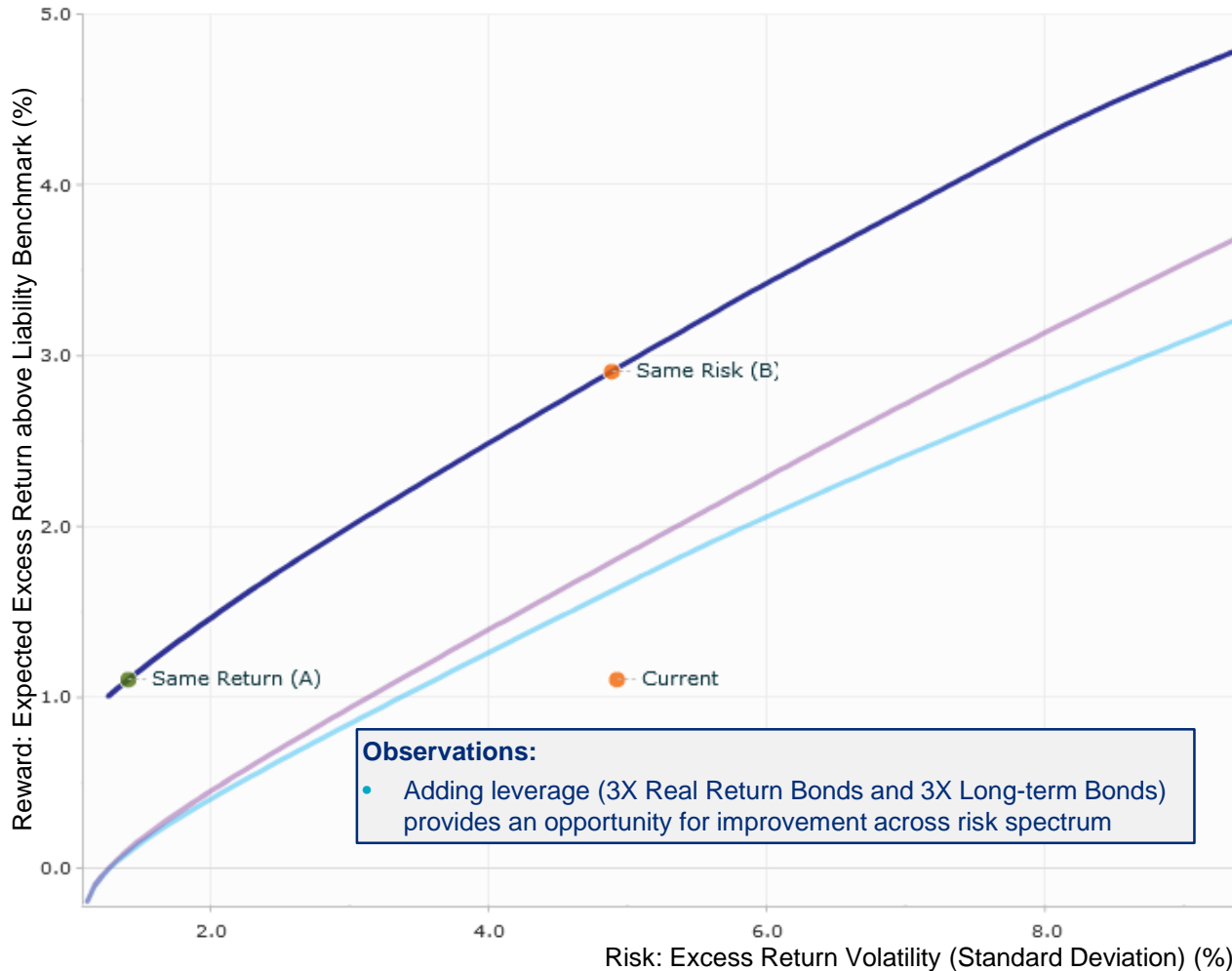
— Current Asset Classes
— Add GFI, Global Eq, Priv Et
— Add Mort & Priv Debt
— Add Div Growth Fund

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

1-84 (f)

Frontier: Adding Leverage



	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

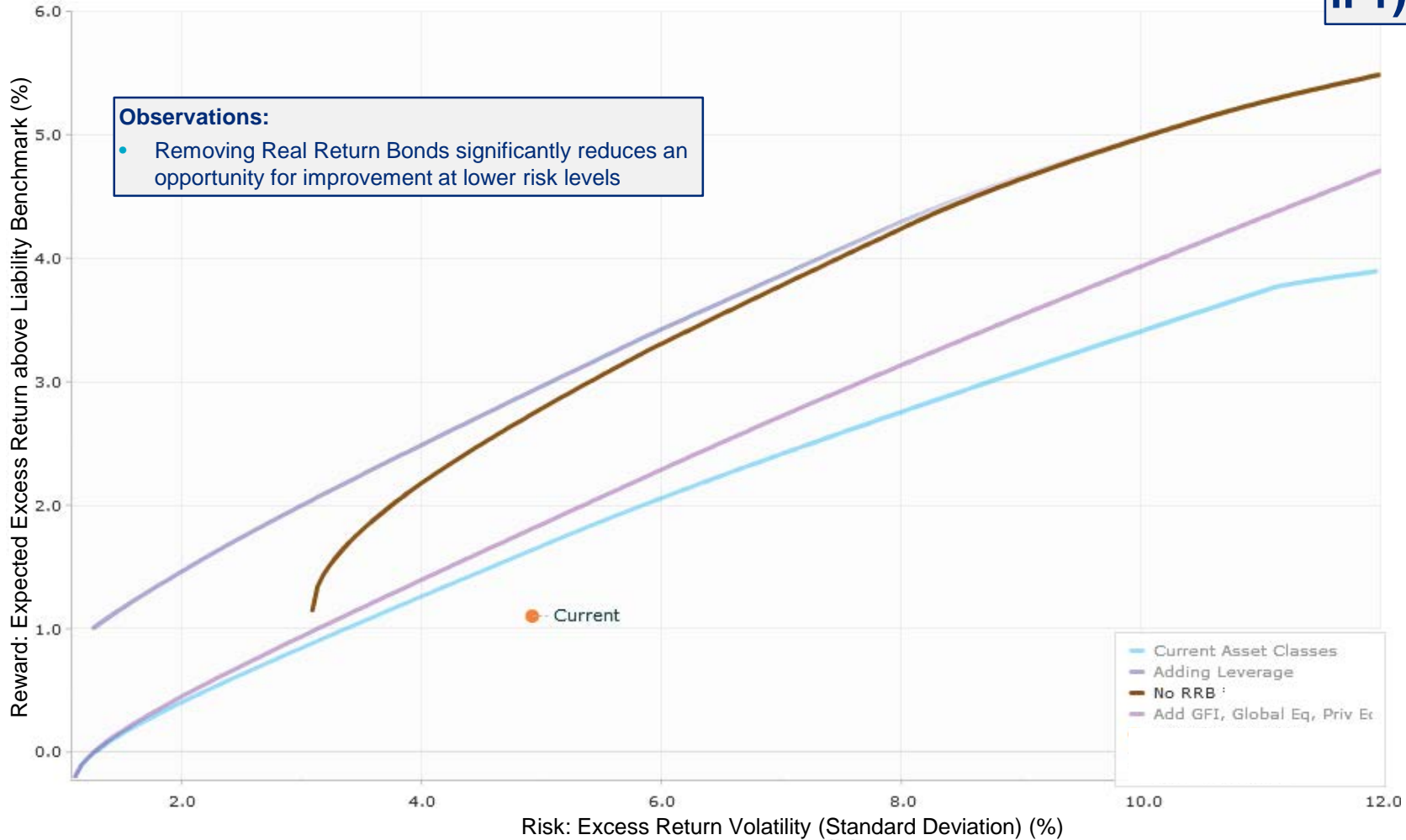
— Current Asset Classes
— Adding Leverage
— Add GFI, Global Eq, Priv Ec

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EFFICIENT FRONTIERS (MINIMALLY CONSTRAINED) REMOVING RRBS

1-85 (g)
ii 1)

Frontier: No RRB

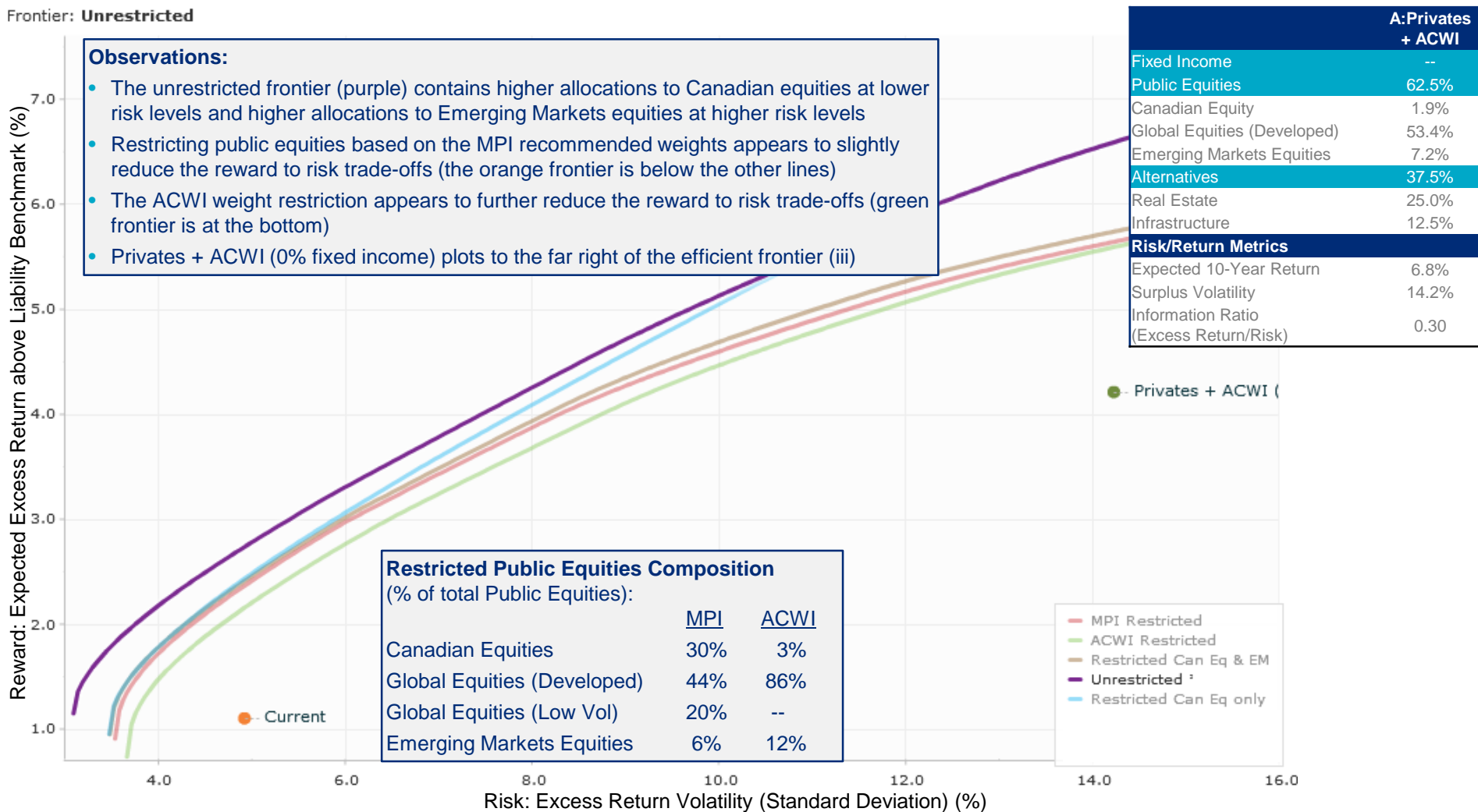


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EFFICIENT FRONTIERS (NO RRBS) RESTRICTING PUBLIC EQUITIES

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

Frontier: **Unrestricted**



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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.

ASSET MIX ANALYSIS – SUMMARY RESULTS

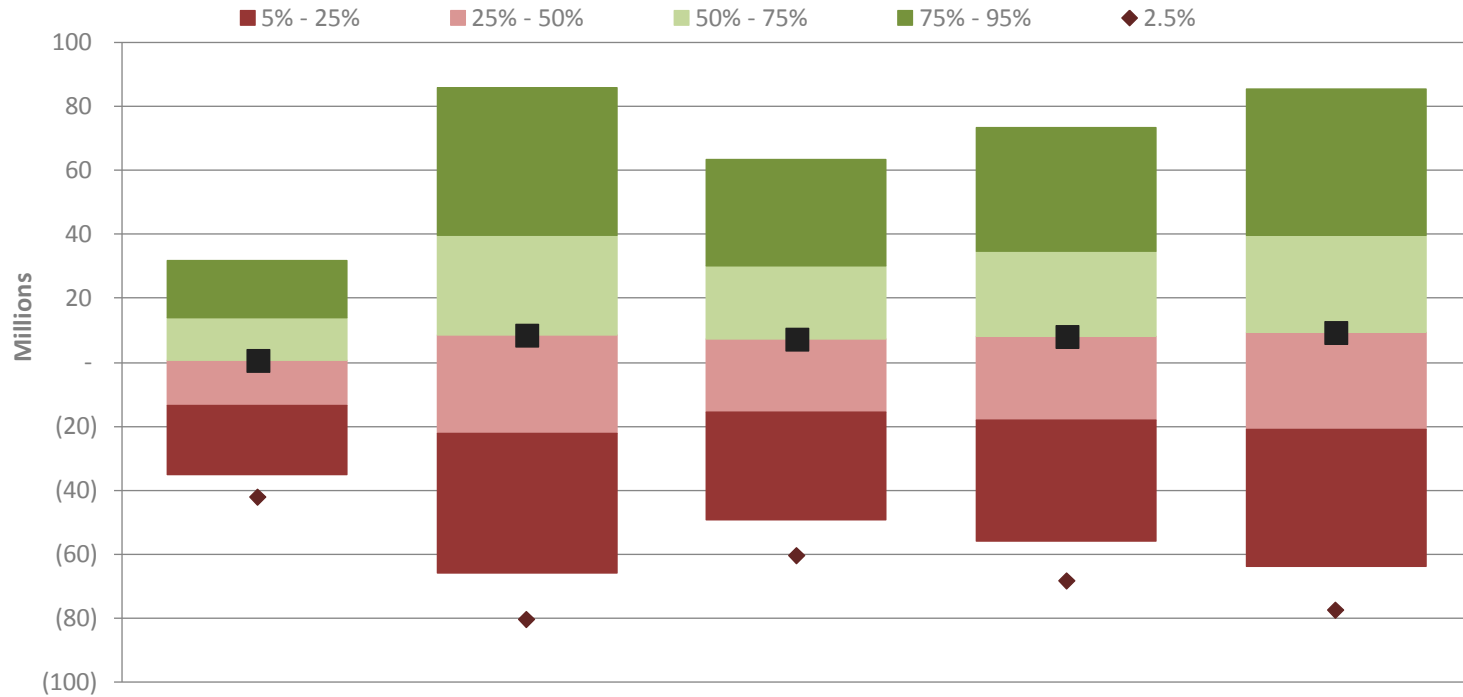
PENSION

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%	Return Metrics
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	Risk Metrics
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%	

1-85 (g) iv

EXPECTED SURPLUS GROWTH PENSION - 1 YEAR PROJECTIONS



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

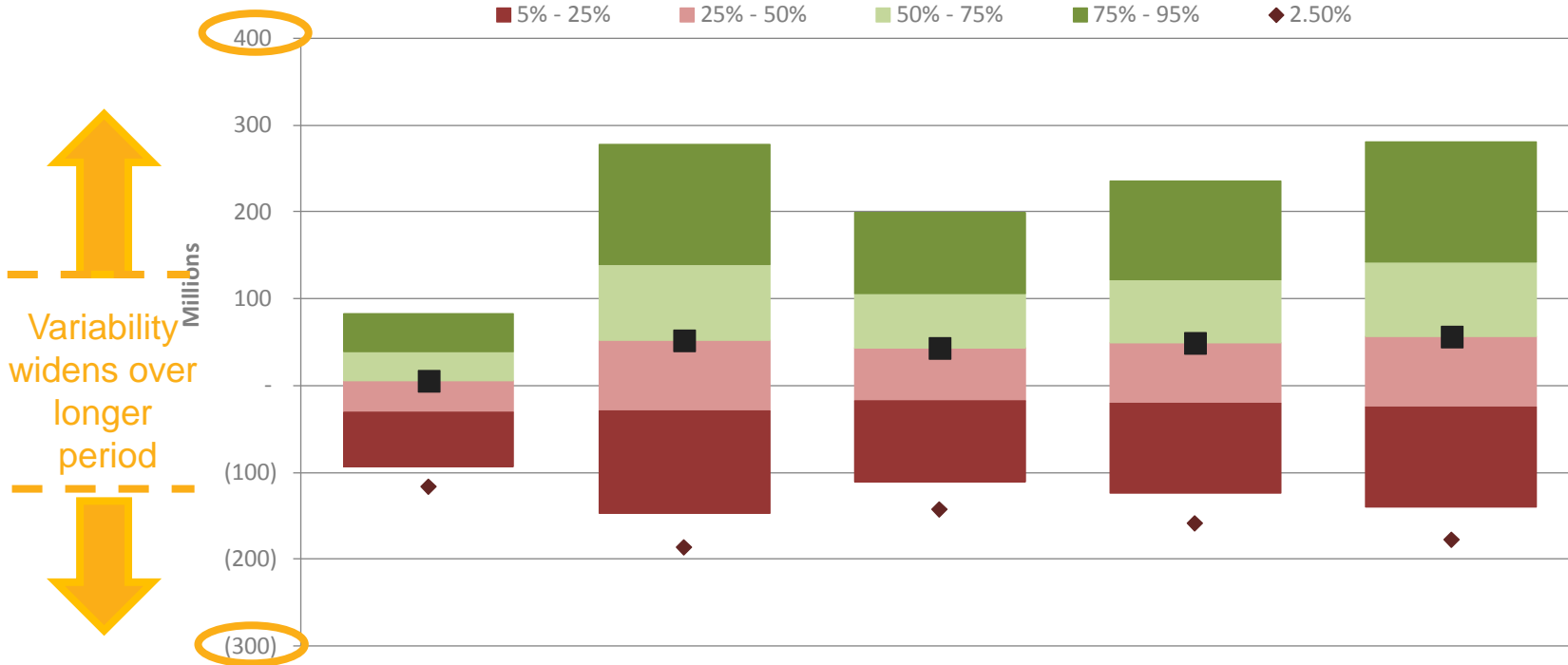
Median

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).

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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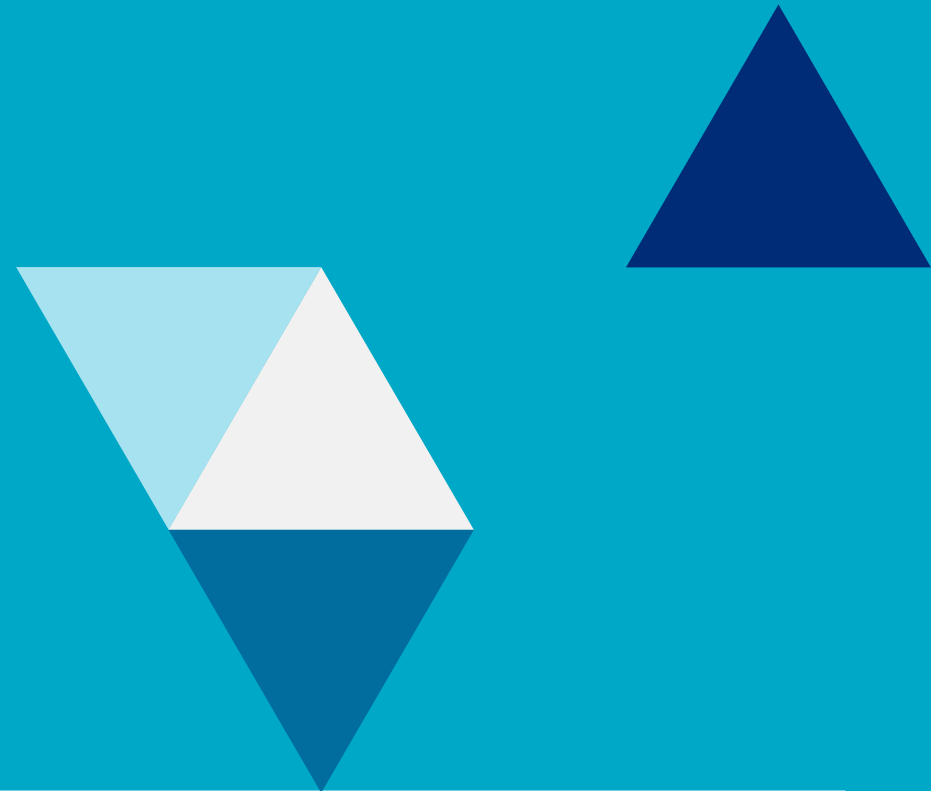
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APPENDIX

CAPITAL MARKET ASSUMPTIONS



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.

CAPITAL MARKET ASSUMPTIONS

STANDARD MERCER CORRELATIONS

Asset Class	Correlations																												
	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

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

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



MERCER

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