

Investing in global bonds part IV:

The role of global bonds in institutional investment policies

So far in our *Investing in Global Bonds* series, we have demonstrated that there are many potential advantages to adopting a global perspective when it comes to the fixed income opportunity set. However, establishing the case for an allocation at the investment policy level requires more than a favourable historical profile as a standalone asset class. Institutional investors manage multi-asset portfolios that are designed to support specific objectives, some of which are not wholly based on investment returns. Furthermore, making investment policy decisions by looking through a rear-view mirror can potentially result in the creation of portfolios that are ill-suited for the future environment. Therefore, the purpose of this article is to examine the potential role of a global fixed income opportunity set in institutional portfolios by considering a forward-looking, objective-oriented context.

INVESTING IN GLOBAL BONDS PARTS I, II, AND III: KEY TAKEAWAYS

- Institutional investors tend to have a strong home country bias in their fixed income allocations, potentially resulting in unintended constraints, biases, and risks.
- A global perspective provides meaningful diversification opportunities by gaining exposure to different economic, fiscal, inflationary, and demographic environments.
- Different segments of the global fixed income landscape are characterized by varying degrees of interest rate and credit risk, resulting in different risk/return characteristics.
- Managing currency risk is a critical part of investing in, and realizing the potential benefits of, global bonds.

For more information, read the previous articles in the *Investing in Global Bonds* series: **The Global Fixed Income Landscape, Developed Market Sovereign Bonds, and Global Credit.**

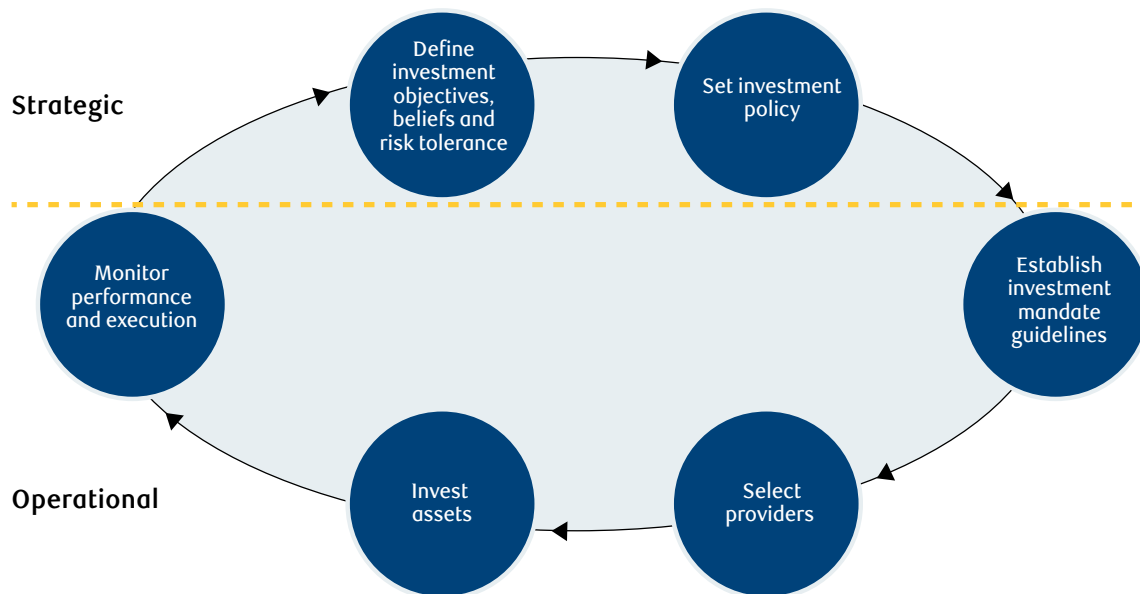
Background

Institutional investors typically have very specific objectives associated with the pool of assets under their care, for which they often act as fiduciaries. An endowment fund, for example, is typically interested in achieving a long-term return that will support its inflation-adjusted spending commitments, while preserving capital during short-term downside events – in other words, they are investing in an “asset-only” context. A pension fund, on the other hand, is typically most concerned with the performance of its assets in relation to its liabilities, which can result in a myriad of different objective-oriented trade-offs, from closing a funding gap to total liability defeasance – they are investing in an “asset-liability” context. Therefore, when it comes to making **long-term strategic decisions**, such as introducing a new asset class into the investment policy asset mix, it is critical to evaluate the risk/reward trade-off through the correct lens. It is also important to evaluate the decision at the total portfolio level, where the different asset mix exposures interact with each another to support these risk and reward objectives.

STRATEGIC VS. OPERATIONAL DECISIONS

As illustrated in Figure 1, setting investment policy is a decision that is **strategic** in nature. An example of such a decision would be determining the broad asset class exposures that are expected to best support the investor's long-term objectives, such as the amount of fixed income, equity, and alternatives in the policy asset mix. This is in contrast to an **operational** decision, such as choosing between multiple implementation avenues that involve different considerations; for example, the amount of target added value over a policy benchmark. While these types of operational decisions will ultimately impact overall outcomes, they are a separate consideration from long-term policy decisions. We therefore do not consider implementation in analyzing the potential benefits of global fixed income at an institutional investment policy level in this article.

Figure 1: The fiduciary governance cycle



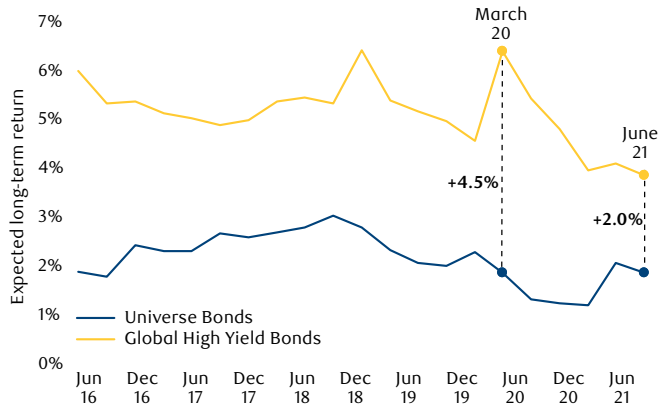
Source: PH&N Institutional

The challenge universally faced by institutional investors is that while the future capital markets environment is unknowable and fraught with risks, decisions must be made in real time despite the uncertainty. Forward-looking portfolio modelling can be a very powerful source of information to assist with this type of strategic decision making, but requires making assumptions about the **future** risk/return profile of different asset classes, which can be very different from what might have been observed over historical periods. These parameters are often referred to as forward-looking capital market assumptions (CMAs).

While a set of CMAs will inevitably be influenced by subjective views that can vary among investors, a consistent and robust methodology will tend to produce credible information that supports sound decision making and governance. Furthermore,

while CMAs will change as markets evolve, views are revised, and new information is acquired, certain characteristics related to the fundamental nature of the asset classes remain relatively stable across time. For example, Figure 2 illustrates PH&N Institutional's quarterly forward-looking CMAs on Canadian universe bonds and global high yield bonds over the past five years. While infrequent periods of market extremes can have a material impact on a forecast at a specific date (e.g., onset of the pandemic in March 2020), the relative return differences exhibit a certain stability through time. High yield bonds are fundamentally characterized by higher spread risk, producing more volatility but also a return premium relative to investment grade bonds. Despite the changing level of the return premium based on refreshed information and views, forward-looking portfolio modelling will typically always reflect this fundamental characteristic of high yield.

Figure 2: PH&N Institutional capital market assumptions (2016-2021)



Source: PH&N Institutional. Please refer to the end of this article for information about our capital market assumptions. There is absolutely no guarantee that future performance will occur according to any ex-ante expectation.

Optimal asset allocation

In order to assess the potential benefits of a global fixed income opportunity set at the investment policy level, we will consider the risk/reward trade-off in a variety of different situations under two objective-oriented frameworks: “asset-only” and “asset-liability.” The analysis will be from the point of view of a Canadian institutional investor with a traditionally domestic fixed income allocation. Importantly, the objective of all forthcoming analyses is not to propose specific portfolios or asset class combinations as being optimal for a given situation.

Rather, the objective is to investigate whether working with a global fixed income opportunity set (comprising global government bonds, global investment grade corporate bonds, global high yield bonds, and emerging market debt) at the strategic asset mix level could lead to a superior risk/return proposition over a purely domestic one.

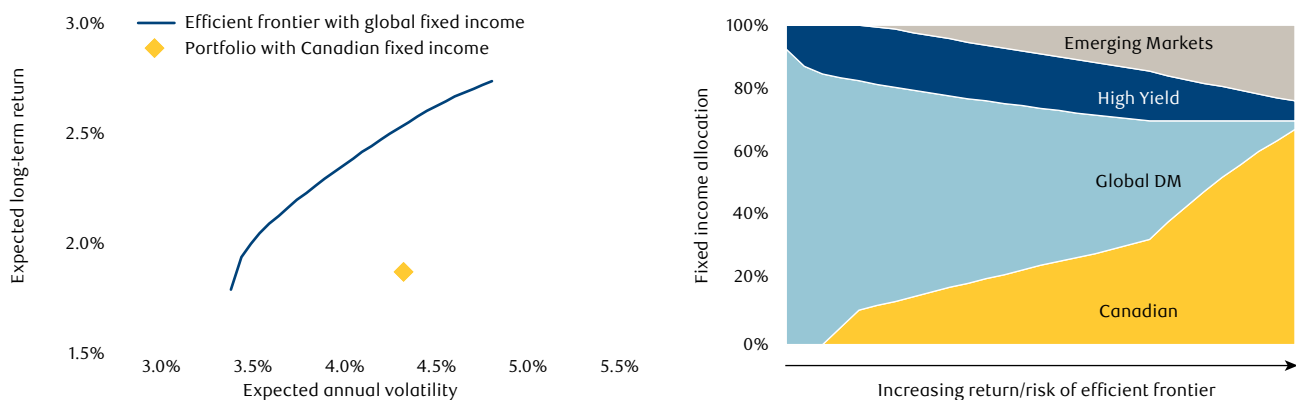
Finally, we note that all non-domestic exposures are modelled as CAD-hedged. In the case of developed market investment grade bonds, our prior papers in this series demonstrated that currency exposure adds undesirable volatility. When it comes to high yield and emerging market debt, we observed that an investor’s domestic currency and its correlation with the inherently higher credit risk in these asset classes could have different effects. However, since we wish to isolate the asset class benefits from a strategic standpoint, we also consider the CAD-hedged versions in the modelling work.

Global bonds in an “asset-only” context

The “asset-only” investor is typically concerned with maximizing the risk-adjusted return profile of their total portfolio; diversification and efficient use of the available risk budget are key to accomplishing this task. Different institutional investors will have different risk/return objectives, as well as different investment beliefs and constraints that can result in very different investment policies. Therefore, in order to examine the optimality of a global fixed income opportunity set versus the traditional domestic bias, we will consider three different asset mix cases that vary in complexity, risk profile, and strategy diversification.

Figure 3-A illustrates the substantial sub-optimality of the home country bias for a portfolio comprised entirely of fixed

Figure 3-A: Optimal fixed income allocation (Case: Portfolios with 100% fixed income)



Source: PH&N Institutional. “Canadian fixed income” and “Canadian” is represented by Universe Bonds. “Global DM” is represented by Global Bonds (CAD-H). “High Yield” is represented by Global High Yield Bonds (CAD-H) and “Emerging Markets” is represented by Emerging Market Debt (CAD-H). Refer to the end of this article for modelling assumptions and disclosures. Hypothetical performance analyses are for illustrative purposes only and there is no guarantee that hypothetical returns or projections will be realized.

income. Using the global fixed income opportunity set, it is possible to lower risk while achieving a similar expected return, or to increase expected return with similar levels of risk. Lower-risk-profile portfolios rely heavily on the greater diversification inherent to global developed market bonds, while higher-returning portfolios take on more credit risk in the form of high yield and emerging market debt.

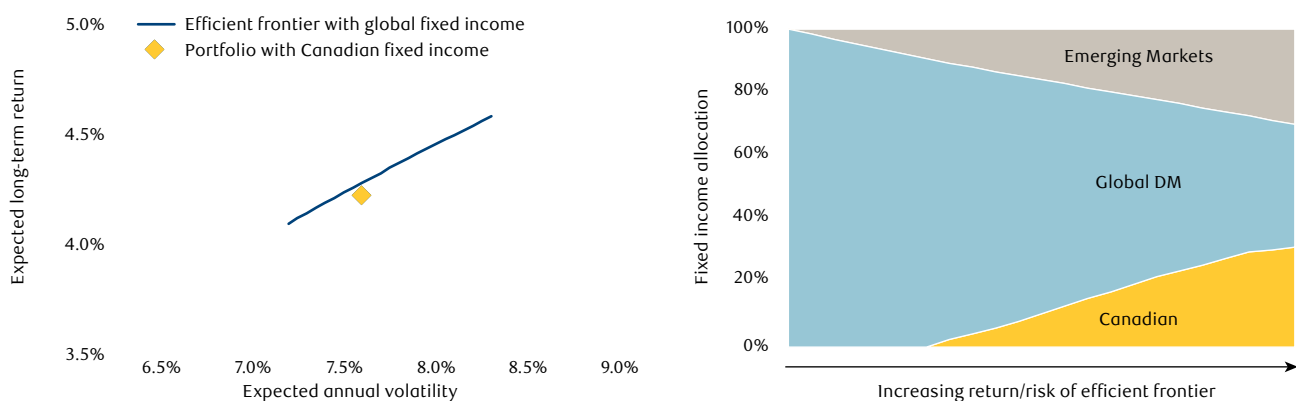
Higher risk/return portfolios along the efficient frontier also increase the allocation to Canadian fixed income because the asset class is currently expected to have a slight return premium despite its higher inherent risk. This serves to highlight an important point: depending on overall objectives and risk tolerance, as well as forward-looking views, **explicitly allocating to (or even overweighting) domestic fixed income is not necessarily suboptimal**. The sub-optimality arises when a home country bias – that is, when an investor focuses on their domestic market while ignoring the larger opportunity set – **inevitably** leads to an exclusively domestic allocation.

In reality, institutional portfolios comprised entirely of fixed income investments are very rare; most “asset-only” institutional investors will have sizeable allocations to equities in their portfolios, and it is therefore important to consider the interaction between fixed income (especially credit risk) and equities before generalizing the observations from Figure 3-A to all “asset-only” situations. Figure 3-B illustrates that, for a portfolio with a 50% allocation to equities, a global fixed income opportunity set can still lead

to an improved risk/return trade-off. However, the materiality of this improvement is small (the domestic baseline is close to the efficient frontier), primarily because of the dominant influence of equities on overall portfolio risk. That said, it is possible to optimally target lower risk / higher return without changing the equity allocation by moving along the globally diversified frontier, though the incremental return-for-risk is largely the same.

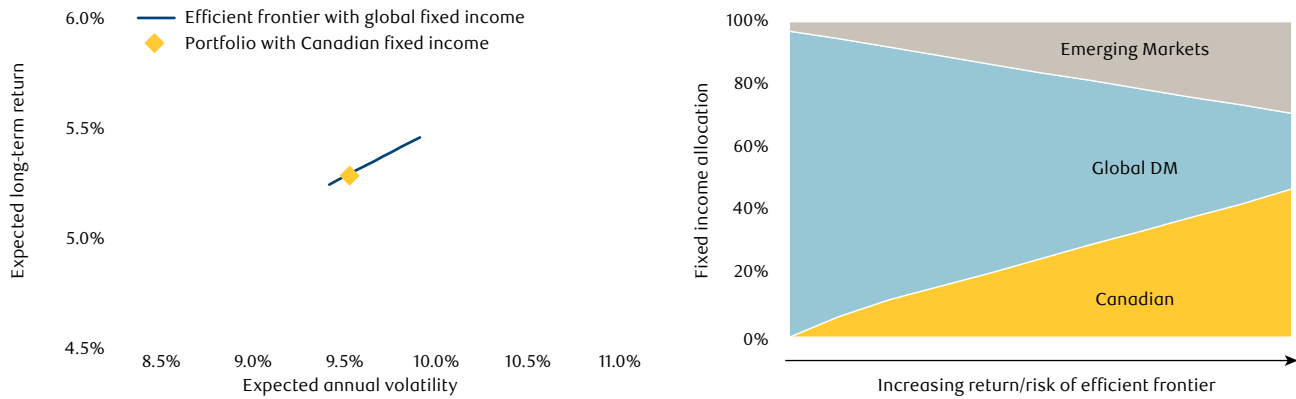
It is also interesting to note how the composition of the fixed income component changes when optimized in the presence of a large equity allocation. Firstly, the allocation to Canadian fixed income in riskier portfolios is much smaller, suggesting that the greater degree of diversification inherent to global developed market bonds better offsets equity market risk. Secondly, optimal portfolios currently favour emerging market debt over high yield. If we refer back to Figure 1, we can see that current long-term forward-looking return views on high yield bonds are at their lowest levels in recent years (primarily due to the significant spread compression that this market has experienced). Furthermore, high yield bonds exhibit relatively strong correlations with equities, especially during moments of market stress, resulting in less diversification at a total portfolio level. The current risk/return profile of high yield is therefore not as compelling as that of emerging market debt, which is predominantly government bonds. That said, this situation can change as markets evolve and long-term views adjust accordingly; different views can also lead to different conclusions and decisions on specific asset classes.

Figure 3-B: Optimal fixed income allocation (Case: Portfolios with 50% fixed income and 50% equities)



Source: PH&N Institutional. “Canadian fixed income” and “Canadian” is represented by Universe Bonds. “Global DM” is represented by Global Bonds (CAD-H). “Emerging Markets” is represented by Emerging Market Debt (CAD-H). Refer to the end of this article for modelling assumptions and disclosures. Hypothetical performance analyses are for illustrative purposes only and there is no guarantee that hypothetical returns or projections will be realized.

Figure 3-C: Optimal fixed income allocation (Case: Portfolios with 25% fixed income, 60% equities, and 15% alternatives)



Source: PH&N Institutional. “Canadian fixed income” and “Canadian” is represented by Universe Bonds. “Global DM” is represented by Global Bonds (CAD-H). “Emerging Markets” is represented by Emerging Market Debt (CAD-H). Refer to the end of this article for modelling assumptions and disclosures. Hypothetical performance analyses are for illustrative purposes only and there is no guarantee that hypothetical returns or projections will be realized.

While a traditional blend of fixed income and equities remains relatively common among institutional portfolios, more and more institutional investors are allocating to alternative asset classes in order to improve the long-term risk/return profile of their portfolios, especially since there are many perceived performance headwinds in traditional asset classes. Figure 3-C considers a portfolio comprised of 75% non-fixed income exposures, of which 15% is made up of a diversified blend of alternatives. In this case, we once again observe a significant allocation to non-domestic bonds in the fixed income component of optimal portfolios. However, the improvement in the total portfolio’s risk/return is very small; at a 15% allocation, an increase in the optimality of the fixed income component will, in most situations, result in only a minor impact on overall outcomes.

“ASSET-ONLY” SUMMARY:

Working with a globally diversified fixed income opportunity set will likely lead to superior strategic asset allocation decisions, but the materiality of the improvements at a total portfolio level will depend on how meaningful the allocation to fixed income is in relation to the other assets.

Global bonds in an “asset-liability” context

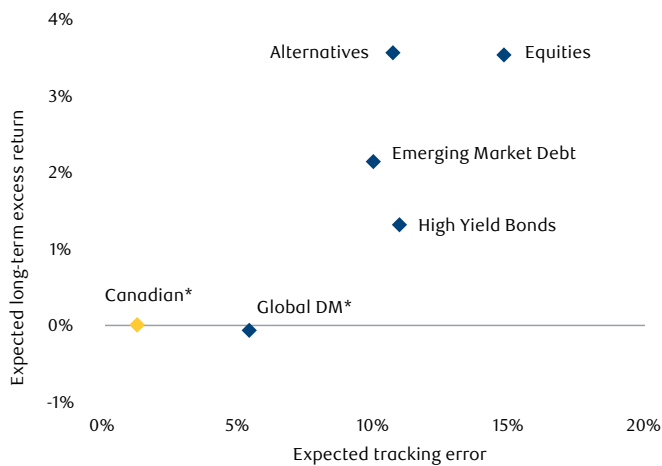
The “asset-liability” investor is typically concerned with managing their assets in relation to some sort of liability from which a myriad of different risks can arise. For example, the sponsor of a defined benefit pension plan is required to periodically value their benefit obligations and determine the plan’s funded status, a process that will directly impact cash contributions and drive the evolution towards the plan’s end state, be it sustainability or termination. To complicate matters further, there are multiple liability valuation bases that can present non-overlapping sources of risk, and these can vary depending on the regulatory jurisdiction of the plan’s registration.

In order to examine the optimality of global fixed income for an “asset-liability” investor, we adapt our risk/return lens to explicitly incorporate the impact of the liabilities’ risk exposures. To this end, our analysis considers the trade-off of the **excess** return distribution (i.e., assets minus liabilities) by working with a market representation of a CAD-denominated pension liability having a duration of approximately 13.5 years³. We note that the “asset-liability” context has significantly more dimensionality to it than the “asset-only” context, and that different benefit provisions, demographic profiles, regulatory frameworks, and valuation bases will potentially lead to different observations than those resulting from our analysis.

³Illustrative pension plan cash flows discounted using a blend of 2/3 provincial yield curve and 1/3 corporate yield curve as a representation of the settlement cost for the pension obligations at a given point in time, i.e., solvency.

“Asset-liability” portfolio construction must not only consider the interaction between the different exposures comprising the strategic asset mix, but also how those exposures interact with the fundamental liability benchmark. An exposure that behaves differently from the liabilities will invariably introduce relative risk (e.g., tracking error). However, that risk could be justified if it is accompanied by an expected excess return that is desirable or necessary given the sponsor’s objectives.

Figure 4: Asset-liability risk/return trade-off



“Canadian” is represented by 60% long-term provincial bonds, 15% long-term corporate bonds, and 25% corporate bonds. “Global DM” is represented by 3% long-term global government bonds, 79% long-term global corporate bonds, and 20% global corporate bonds. “High Yield Bonds” is represented by Global High Yield Bonds (CAD-H). “Emerging Market Debt” is represented by Emerging Market Debt (CAD-H). *Canadian and global DM (developed market) exposures are assumed to be duration-matched to the liabilities.

Source: Refer to the end of this article for modelling assumptions and disclosures. Hypothetical performance analyses are for illustrative purposes only and there is no guarantee that hypothetical returns or projections will be realized.

Figure 4 illustrates the risk/return trade-off of the key portfolio exposures we have considered in this paper relative to the liabilities. Unsurprisingly, duration-matched Canadian bonds produce the lowest tracking error, but do not provide any expected excess return over the liabilities. When looking at duration-matched global developed market bonds, the greater inherent diversification that is favourable on an “asset-only” basis works against the “asset-liability” investor because it introduces tracking error relative to the exclusively domestic liability reference point. Furthermore, there is no expected compensation for passively bearing

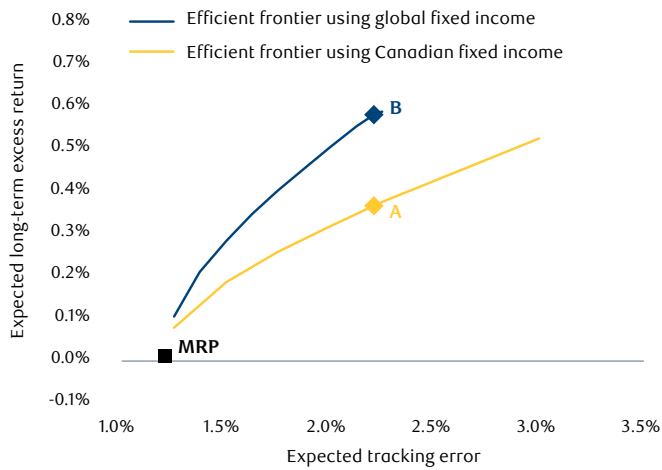
that tracking error on a standalone basis. On the other hand, higher yielding strategies like emerging market debt and sub-investment grade bonds are typically expected to earn higher returns in excess of the liability growth rate, but will introduce even more tracking error, especially because these asset classes are always short duration relative to liabilities and exposed to additional risk factors (with a similar observation for equities and alternatives). This leads us to two preliminary observations:

1. If the “asset-liability” objective is strict risk minimization, only domestic bonds are helpful to that end.
2. If there is appetite or necessity for well-compensated risk, there may be an “optimal” trade-off between tracking error and expected excess return when different global exposures are combined into a portfolio.

We note an important caveat to observation 1: Practical market constraints could preclude the exclusive use of domestic bonds in the construction of a liability-driven (LDI) fixed income portfolio under certain circumstances. For example, the Canadian corporate bond market exhibits capacity and liquidity constraints that would make it very challenging for a large pension plan to achieve its liability-matching credit exposures with only domestic bonds. Therefore, there could be a strategic role for global bonds at the investment policy level, not because of theoretical risk/reward optimality as illustrated in Figure 4, but because of practical implementation considerations that translate into an investment policy constraint.

Figure 5-A examines the risk/reward trade-off for a portfolio comprised exclusively of duration-matched fixed income. When limited to the Canadian fixed income market, it is possible to construct the minimum risk portfolio (“MRP”) that most closely matches the liabilities’ risk sensitivities by using exposures in the Canadian provincial government and corporate bond markets. Portfolio A shows that it is also possible to increase excess return from this reference point by tilting portfolios away from provincial bonds and towards higher corporate bond exposure than what is inherent in the liabilities. Moving to a global opportunity set can also have the effect of increasing excess return, and furthermore, the expanded selection of credit strategies with potentially higher return compensation can improve the risk/reward trade-off. This is illustrated by Portfolio B (where the allocation to global fixed income in this particular instance ends up favouring emerging market debt over the other possible exposures that were tested).

Figure 5-A: LDI fixed income portfolio optimization



Source: PH&N Institutional. Refer to the end of this article for modelling assumptions and disclosures. Hypothetical performance analyses are for illustrative purposes only and there is no guarantee that hypothetical returns or projections will be realized.

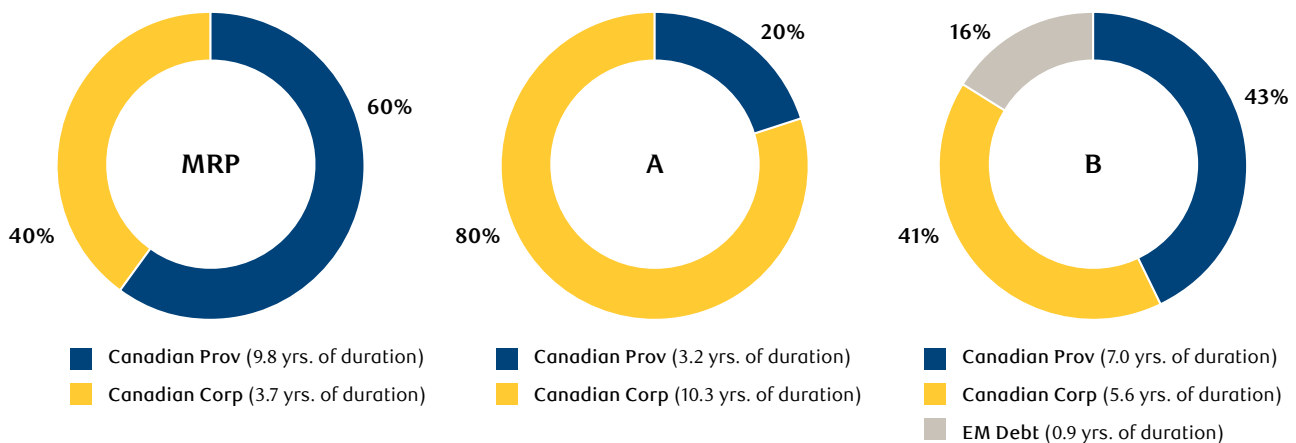
Figure 5-B compares the allocations of the three portfolios (MRP, A, and B) to show that while an LDI fixed income portfolio necessarily relies on domestic duration to mitigate key liability risk exposures, a small exposure to global fixed income can – with sufficiently high expected return-for-risk compensation – improve the risk-adjusted excess return profile. However, the contribution to relative duration of

the liability-matching exposures can be very different. For example, Portfolio B requires more Canadian provincial bond duration than Portfolio A to compensate for the emerging market debt allocation’s lower contribution to total portfolio duration.

While it is more common in practice for “asset-liability” investors to analyze their fixed income portfolio on a standalone basis, many pension plans continue to target/require exposure to return-seeking asset classes that can exceed the liability growth rate by more substantial margins, such as equities and alternatives. For example: if a plan is underfunded and seeking to close the gap, or if the plan has a young demographic profile continuing to accrue service. That said, the fundamental investment decision framework remains the same: seeking adequate and appropriate compensation for the inevitable tracking error that non-liability matching assets (i.e., non-domestic fixed income) introduce.

In Figure 6, we examine the optimal composition of the fixed income component for portfolios with higher levels of return-seeking assets when the fixed income opportunity set is global, as well as the impact on excess return (assuming maximum excess return for the same level of tracking error at each step). We observe that as the allocation to fixed income decreases and the allocation to equities and alternatives increases, both the relative allocation to global fixed income, as well as the corresponding improvement in total portfolio excess return, decreases and converges on 0%. There are two reasons for this:

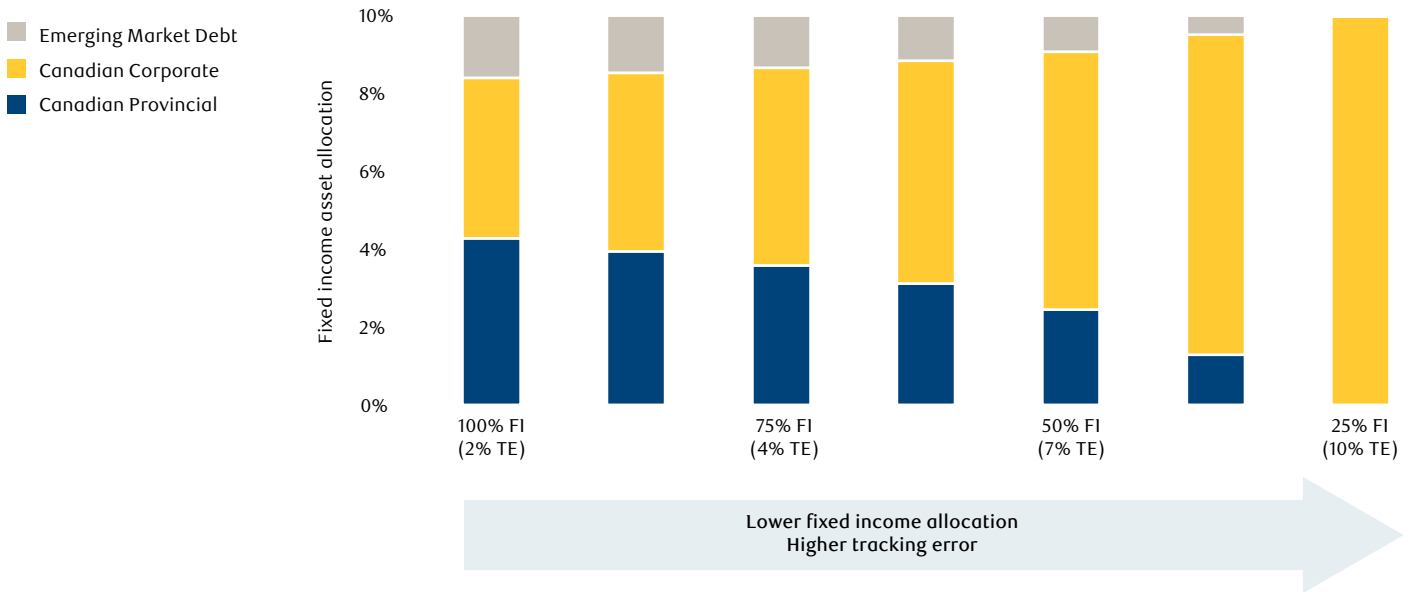
Figure 5-B: Portfolio allocations & contribution to duration



Source: PH&N Institutional. “Canadian Prov” represented by long term provincial bonds. “Canadian Corp” represented by a blend of corporate bonds and long term corporate bonds. “EM debt” is represented by “Emerging Market Debt (CAD-H)”. Refer to the end of this article for modelling assumptions and disclosures. Hypothetical performance analyses are for illustrative purposes only and there is no guarantee that hypothetical returns or projections will be realized.

Figure 6: Expected excess return comparison

	100% FI	87.5% FI	75% FI	62.5% FI	50% FI	37.5% FI	25% FI
Global Opportunity Set	0.58%	1.04%	1.47%	1.89%	2.28%	2.64%	2.99%
Canadian Opportunity Set	0.36%	0.91%	1.40%	1.85%	2.26%	2.64%	2.99%
Difference	0.22%	0.13%	0.07%	0.04%	0.02%	± 0%	± 0%



Source: PH&N Institutional. “Canadian Provincial” represented by long term provincial bonds. “Canadian Corporate” represented by long term corporate bonds. “Emerging Market Debt” represented by Emerging Market Debt (CAD-H). Refer to the end of this article for modelling assumptions and disclosures. Hypothetical performance analyses are for illustrative purposes only and there is no guarantee that hypothetical returns or projections will be realized.

- Equities and alternatives provide considerably more expected long-term return premium for the correspondingly higher tracking error they introduce. There is therefore little remaining risk budget for the additional tracking error introduced by global fixed income at these higher return-seeking allocations.
- The materiality of any changes within the fixed income component decreases when the overall allocation within the total portfolio is small.

Therefore, the advantages of working with a global fixed income opportunity set diminishes in the presence of substantial allocations to equities and alternatives.

“ASSET-LIABILITY” SUMMARY:

Domestic fixed income is the main source of liability risk mitigation, but well-compensated tracking error and/or practical constraints introduce opportunities to incorporate global exposures. However, high allocations to return-seeking assets increasingly reduce the benefits of a global fixed income allocation.

Conclusion

Establishing the strategic asset mix for an institutional pool of assets is one of the most important decisions undertaken by its fiduciaries. Evaluating different asset classes and portfolio options under a sound governance framework can be greatly aided by forward-looking risk/return modelling, provided that the objective-oriented trade-off is properly specified for the entity's unique situation.

Having identified several merits associated with a global fixed income perspective in the first three installments of this series, the focus of this article has been to investigate whether a global approach can also lead to better decisions and potentially better expected outcomes at a strategic asset mix level. We believe that the answer to this question is a resounding yes, because, as demonstrated by the various analyses in this paper, working exclusively with a domestic fixed income opportunity set can miss portfolio combinations with superior risk/reward trade-offs. That said, the "right" combination of exposures will ultimately depend on the unique circumstances, views, and preferences of the investor.

One of the most notable contrasts is between "asset-only" and "asset-liability" investors. In "asset-only" cases, the fixed income component of optimal portfolios can tend strongly towards global fixed income along an efficient frontier due to a combination of improved diversification

and/or enhanced return premiums. However, in an "asset-liability" framework, diversification introduces tracking error relative to the domestic liability benchmark, resulting in optimal portfolios that will tend to eschew global bonds unless there is sufficiently high compensation for the additional risk, or a practical constraint on the domestic exposure.

We also observed that the materiality of any improvements stemming from the introduction of a global fixed income opportunity set is highly influenced by the weight of other asset classes in the portfolio, such as equities and alternatives. For example: the incremental benefits of the global opportunity set are reduced as the overall target allocation to fixed income is lowered, implying that the additional cost and/or complexity of a global bond allocation would need to be carefully considered from a practical standpoint. That said, just because an investor may have a low target allocation to fixed income, or be operating under an "asset-liability" framework, does not mean that global fixed income should be ignored. Rather, our observations serve to highlight that different investors will face different risk/reward trade-offs, and the only way to make confident and well-informed strategic asset mix decisions as part of a robust governance framework is to avoid unnecessary constraints and biases, such as limiting the fixed income opportunity set to be exclusively domestic.

Appendix – Figure 5B

Portfolio	MRP	A	B
Long Term Provincial Bonds	60%	20%	43%
Corporate Bonds	25%	8%	0%
Long Term Corporate Bonds	15%	72%	41%
Emerging Market Debt (CAD-H)	0%	0%	16%

Appendix – Figure 6

Asset classes	Portfolios						
	100% FI	87.5% FI	75% FI	62.5% FI	50% FI	37.5% FI	25% FI
With Global Fixed Income							
Long Term Provincial Bonds	42.7%	34.5%	27.0%	19.6%	12.2%	4.8%	0.0%
Long Term Corporate Bonds	41.4%	40.1%	38.0%	35.6%	33.2%	30.8%	24.9%
Emerging Market Debt (CAD-H)	15.9%	12.9%	10.1%	7.3%	4.6%	1.9%	0.1%
Equities	0.0%	10.0%	20.0%	30.0%	40.0%	50.0%	60.0%
Alternatives	0.0%	2.5%	5.0%	7.5%	10.0%	12.5%	15.0%
With Canadian Fixed Income							
Long Term Provincial Bonds	19.8%	11.0%	5.4%	1.9%	0.0%	0.0%	0.0%
Long Term Corporate Bonds	71.7%	71.7%	67.1%	59.7%	49.8%	37.4%	24.9%
Corporate Bonds	8.5%	4.8%	2.5%	1.0%	0.2%	0.1%	0.1%
Equities	0.0%	10.0%	20.0%	30.0%	40.0%	50.0%	60.0%
Alternatives	0.0%	2.5%	5.0%	7.5%	10.0%	12.5%	15.0%

Appendix – Capital market assumptions

The RBC Global Asset Management Long-Term Expected Return (LTER) Committee is ultimately responsible for approving best estimate return assumptions. The LTER Committee is led by the Chief Investment Officer (CIO) and comprised of senior members of the CIO's office, as well as both fund managers and a representative from the Institutional Portfolio Solutions group.

Volatilities and correlations are estimated from historical data and adjusted as required to reflect expected future conditions. The forward-looking annual volatility assumptions are calibrated using a dual-state regime switching lognormal model and downside risk estimates are adjusted for the influences of excess skewness and kurtosis, if applicable.

Capital market assumptions

The capital market assumptions and data sources used in the modelling analysis are presented below:

Asset classes	Representative data series	Expected long term return	Expected annual volatility	Expected annual downside risk
Federal Bonds	FTSE Canada Federal Bond Index	1.4%	3.7%	-6.2%
Provincial Bonds	FTSE Canada Provincial Bond Index	1.9%	5.5%	-9.7%
Corporate Bonds	FTSE Canada All Corporate Bond Index	2.4%	4.3%	-8.2%
Universe Bonds	FTSE Canada Universe Bond Index	1.9%	4.3%	-7.7%
Long Term Federal Bonds	FTSE Canada Long Term Federal Bond Index	1.4%	8.3%	-15.3%
Long Term Provincial Bonds	FTSE Canada Long Term Provincial Bond Index	2.1%	7.9%	-14.3%
Long Term Corporate Bonds	FTSE Canada Long Term Corporate Bond Index	2.8%	8.0%	-16.7%
Global Government Bonds (CAD-H)	ICE BofA Global Government Index (CAD-Hedged)	1.3%	3.7%	-6.3%
Global Corporate Bonds (CAD-H)	ICE BofA Global Corporate Index (CAD-Hedged)	2.1%	5.5%	-12.7%
Global Bonds (CAD-H)	ICE BofA Global Broad Market Index (CAD-Hedged)	1.6%	3.5%	-6.3%
Long Term Global Government Bonds (CAD-H)	ICE BofA 10+ Global Corporate Index (CAD-Hedged)	1.5%	7.5%	-13.7%
Long Term Global Corporate Bonds (CAD-H)	ICE BofA 10+ Global Broad Market Index (CAD-Hedged)	2.2%	9.6%	-19.0%
Global High Yield Bonds (CAD-H)	ICE BofA Global High Yield Index (CAD-Hedged)	3.9%	10.4%	-18.8%
Emerging Market Debt (CAD-H)	Custom Index ²	4.6%	10.3%	-16.1%
Equities	Custom Index ³	6.1%	14.4%	-26.1%
Alternatives ¹	Custom Index ⁴	6.3%	8.0%	-11.6%
Liabilities	Illustrative cash flows discounted using 2/3 provincial yields and 1/3 corporate yields	2.3%	7.0%	-14.5%

¹ Expected return assumed to be net of fees.

² 27% J.P. Morgan Emerging Market Bond Index (CAD-Hedged), 22% J.P. Morgan Corporate Emerging Markets Bond Index (CAD-Hedged) and 51% J.P. Morgan Government Bond Index-Emerging Markets (GBI-EM) (CAD-Hedged) (weights according to the market capitalization of each individual index as at June 30, 2021).

³ 30% S&P/TSX Composite Index and 70% MSCI ACWI Index (CAD).

⁴ 35% MSCI RealPac Canadian Property Index, 25% Infrastructure (custom index), 20% Private Equity (Russell 2000 Index (USD) - Adjusted) and 20% Credit Suisse Leveraged Loan Index (USD).

Capital market assumptions represent the views of PH&N Institutional for the purposes of illustrating and understanding the potential risk-reward trade-off of different portfolio decisions and are established by considering a variety of qualitative and quantitative sources of information including: different forecasting models; internal and external research; existing and implied future conditions as priced by capital markets; and internal views of our fund managers. Expected long term annualized returns are for a 10 year forecast time horizon. Volatilities, downside risk and correlations are estimated from historical data and adjusted as required to reflect future market conditions. Investors should be aware of the limitations using forward-looking assumptions in that there is absolutely no guarantee that future performance will occur according to any ex-ante expectation.

Correlations

	Federal Bonds	Provincial Bonds	Corporate Bonds	Universe Bonds	Long Term Federal Bonds	Long Term Provincial Bonds	Long Term Corporate Bonds	Global Government Bonds (CAD-H)	Global Corporate Bonds (CAD-H)	Global Bonds (CAD-H)	Long Term Global Government Bonds (CAD-H)	Long Term Global Corporate Bonds (CAD-H)	Global High Yield Bonds (CAD-H)	Emerging Market Debt (CAD-H)	Equities	Alternatives	Liabilities
Federal Bonds	1																
Provincial Bonds	0.9	1															
Corporate Bonds	0.7	0.9	1														
Universe Bonds	0.9	1.0	0.9	1													
Long Term Federal Bonds	0.9	0.9	0.7	0.9	1												
Long Term Provincial Bonds	0.8	1.0	0.9	1.0	0.9	1											
Long Term Corporate Bonds	0.6	0.8	1.0	0.9	0.7	0.9	1										
Global Government Bonds (CAD-H)	0.9	0.8	0.6	0.8	0.8	0.7	0.5	1									
Global Corporate Bonds (CAD-H)	0.4	0.7	0.8	0.7	0.5	0.7	0.8	0.5	1								
Global Bonds (CAD-H)	0.8	0.8	0.7	0.9	0.8	0.8	0.7	0.9	0.8	1							
Long Term Global Government Bonds (CAD-H)	0.8	0.8	0.6	0.8	0.9	0.8	0.6	1.0	0.6	0.9	1						
Long Term Global Corporate Bonds (CAD-H)	0.4	0.8	0.9	0.8	0.6	0.8	0.9	0.6	1.0	0.8	0.6	1					
Global High Yield Bonds (CAD-H)	-0.1	0.2	0.4	0.2	-0.1	0.2	0.4	-0.2	0.6	0.1	-0.1	0.7	1				
Emerging Market Debt (CAD-H)	0.1	0.3	0.5	0.3	0.1	0.4	0.5	0.2	0.7	0.4	0.2	0.7	0.8	1			
Equities	-0.2	0.1	0.3	0.1	-0.1	0.2	0.3	-0.3	0.3	-0.1	-0.2	0.5	0.6	0.5	1		
Alternatives	-0.3	0.0	0.2	-0.1	-0.2	0.0	0.2	-0.4	0.3	-0.2	-0.3	0.5	0.7	0.6	0.8	1	
Liabilities	0.7	1.0	0.9	0.9	0.9	1.0	0.9	0.7	0.8	0.8	0.7	0.9	0.3	0.4	0.2	0.1	1

Capital market assumptions represent the views of PH&N Institutional for the purposes of illustrating and understanding the potential risk-reward trade-off of different portfolio decisions and are established by considering a variety of qualitative and quantitative sources of information including: different forecasting models; internal and external research; existing and implied future conditions as priced by capital markets; and internal views of our fund managers. Expected long term annualized returns are for a 10 year forecast time horizon. Volatilities, downside risk and correlations are estimated from historical data and adjusted as required to reflect future market conditions. Investors should be aware of the limitations using forward-looking assumptions in that there is absolutely no guarantee that future performance will occur according to any ex-ante expectation.

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