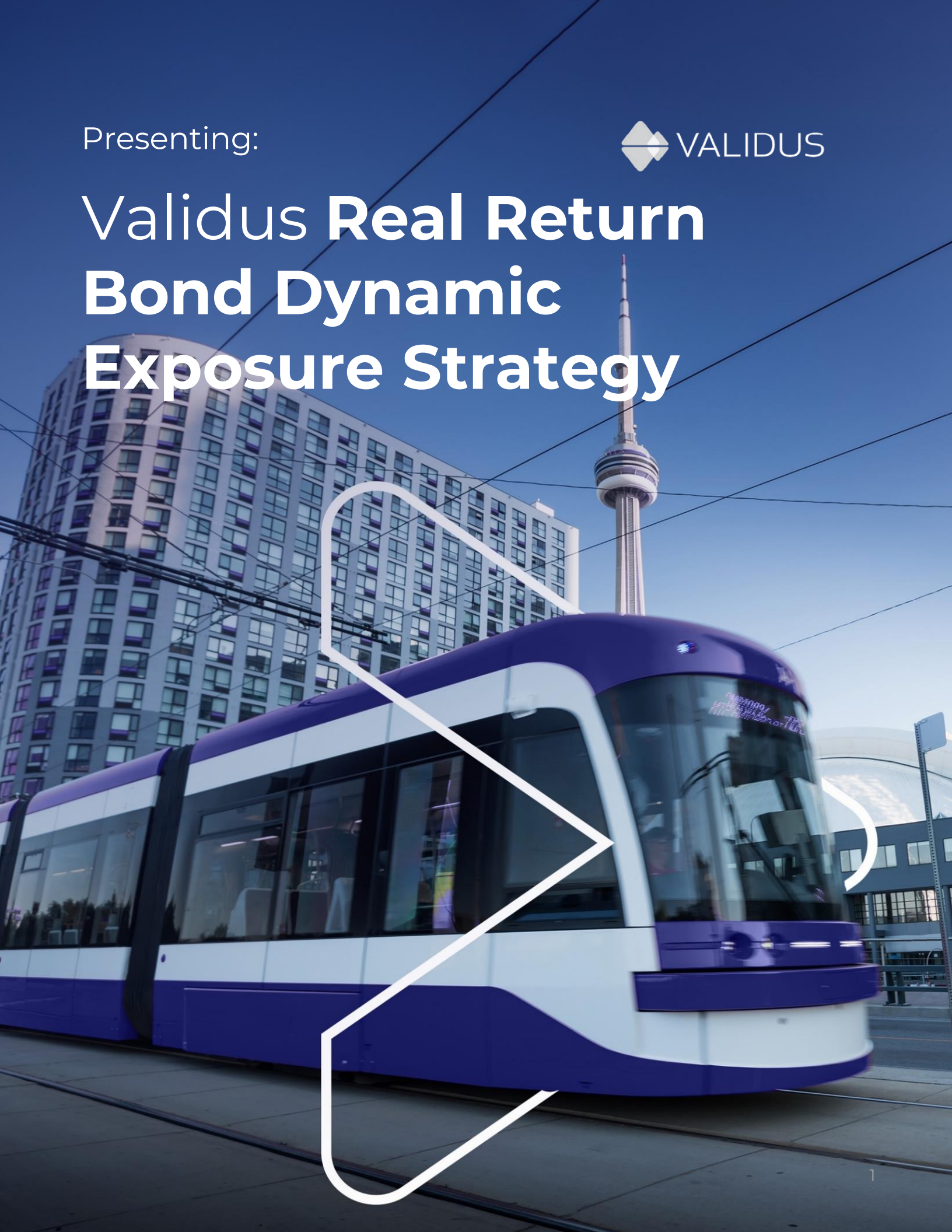
Presenting:

VALIDUS

Validus **Real Return Bond Dynamic Exposure Strategy**



Validus **RRB Dynamic Exposure Strategy**

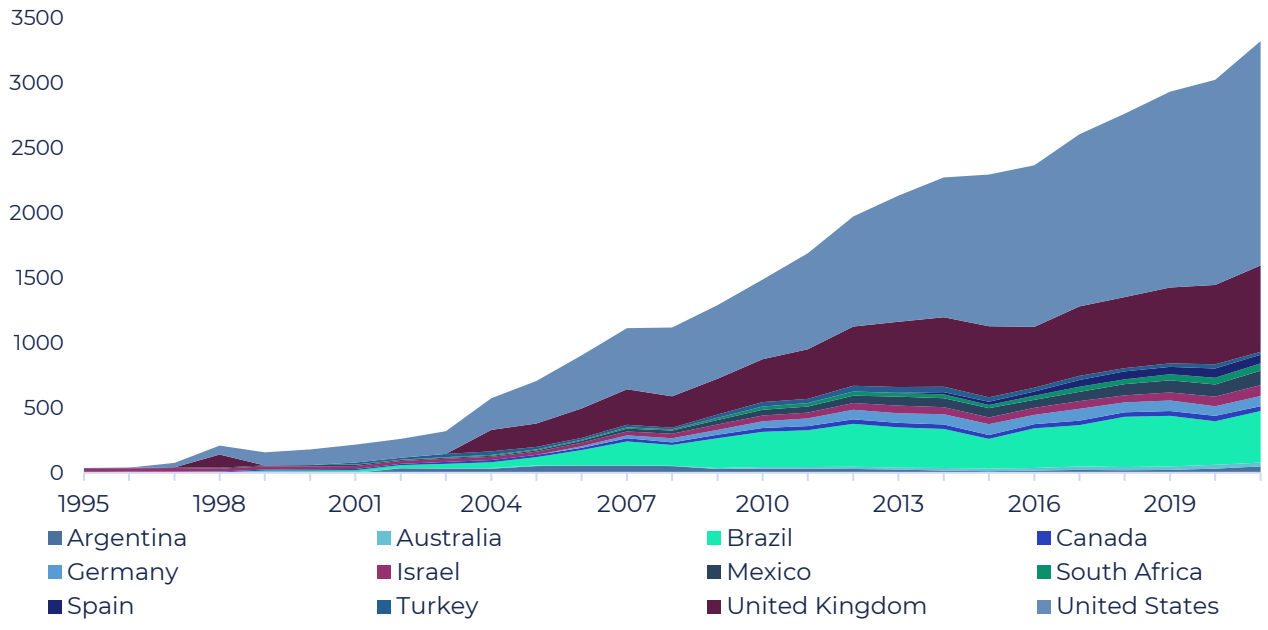
What is it?

The Validus RRB Dynamic Exposure Strategy ("the Strategy") is a strategy that aims to provide an exposure to the performance of the now discontinued Inflation-Linked Bonds (ILBs) formerly issued by the government of Canada.

Background:

Real Return Bonds (RRBs) are Government of Canada bonds that protect against inflation by maintaining the purchasing power of cash flows. RRBs have had stable issuance since 2010 while ILB markets in other countries have grown noticeably. The market value of RRBs is adjusted for changes in CPI, and both principal and interest are guaranteed by the government. RRBs are less liquid and have limited demand compared to other bonds. The government decided to stop issuing RRBs in November 2022, citing poor demand. Many investors continue to hold to their existing positions, while generally investors are seeking alternatives well aware of the risk that high inflation represents to their ALM.

Figure 1. **Outstanding Notional of ILBs per Country in Billion USD (only if >20 billion USD)**



Source: BIS, Debt Securities Statistics, February 2023, Table C2

Alternative Inflation-Linked Strategies:

- ### Inflation Swaps

An investor enters a swap contract to pay fixed and receive floating, with the floating leg linked to an inflation index, such as the Consumer Price Index. The main issue with this approach, is that the counterparties to these swaps would often hedge their resulting inflation risk by buying inflation-linked products, such as RRBs. With little to no RRB market, counterparties will find it much more challenging to hedge this risk, which will directly impact their appetite for these types of products. If there is appetite, additional charges for taking on this risk will likely negate much of the investor's benefit of using inflation swaps to hedge Canadian CPI.

- ### US TIPS

Another alternative could be to look at various inflation-linked products issued by countries with economies highly correlated to Canada as a means of proxy hedging against Canadian CPI. The most obvious would be to look to our neighbours to the south, specifically at Treasury Inflation Protected Securities (TIPS).

However, while the US and Canadian economies are closely linked, inflation rates may differ (and have historically) due to a variety of factors such as differing economic conditions, monetary, and fiscal policy. These differing inflation rates may also be due to the relatively significant differences in each countries CPI calculation and basket weightings.

Additionally, TIPS are USD-denominated securities, USDCAD currency fluctuations will have an impact on the overall return for Canadian investors. This risk may be partially managed through currency hedging; however, this would also expose the investor to additional costs, which can decrease the effectiveness of the strategy and increase the tracking error to Canadian CPI. The interest rate differentials between the two countries, which will inform the cost of hedging, is also more than just a function of inflation, potentially further distorting the desired outcomes.

- ### Commodities

Another avenue explored by both academic and practitioners is to consider a natural and intuitive inflation hedge such as investment in commodities, which may offer appealing characteristics, including a strong positive long-term correlation to inflation.

TIPS Study

Things to Consider (TIPS Proxy Replication):

1. Total cash flow received by an investor who holds an ILB is a function of CPI levels observed throughout the life of the ILB (and thus is path dependent) as well as the total inflation over the life of the ILB, via the adjustment of the principal.

2. The market value of the ILB throughout its life will be affected by parameters other than inflation expectations, including liquidity premium and potential supply/demand imbalances and the perception of volatility of future inflation.

3. The effect of the currency (hedging).

4. Cost of financing: as the investor will use CAD to borrow USD to purchase TIPS.

Why Not TIPS?

Using TIPS on a maturity matched basis does not provide a compelling alternative to investing in Canadian RRBs of similar maturity. Even with higher average long-term CPI in the US, a perfectly currency-hedged proxy underperforms this benchmark once financing costs are considered. Potential explanations for this underperformance include higher demand for RRBs, resulting in a price premium, and the premium of US long-dated rates over their Canadian counterparts, leading to lower ILB prices.

Investors are exposed to divergences in inflation paths and absolute values between the US and Canada. They also face exposure to differences in the shape of the yield curve and varying duration and convexity, which are not easily able to be hedged. Attempting to improve replication by hedging these exposures incurs additional costs and operational complexities.

Figure 1. **TIPS as a proxy for Bloomberg Canada Govt Inflation-Linked All Maturities TR**

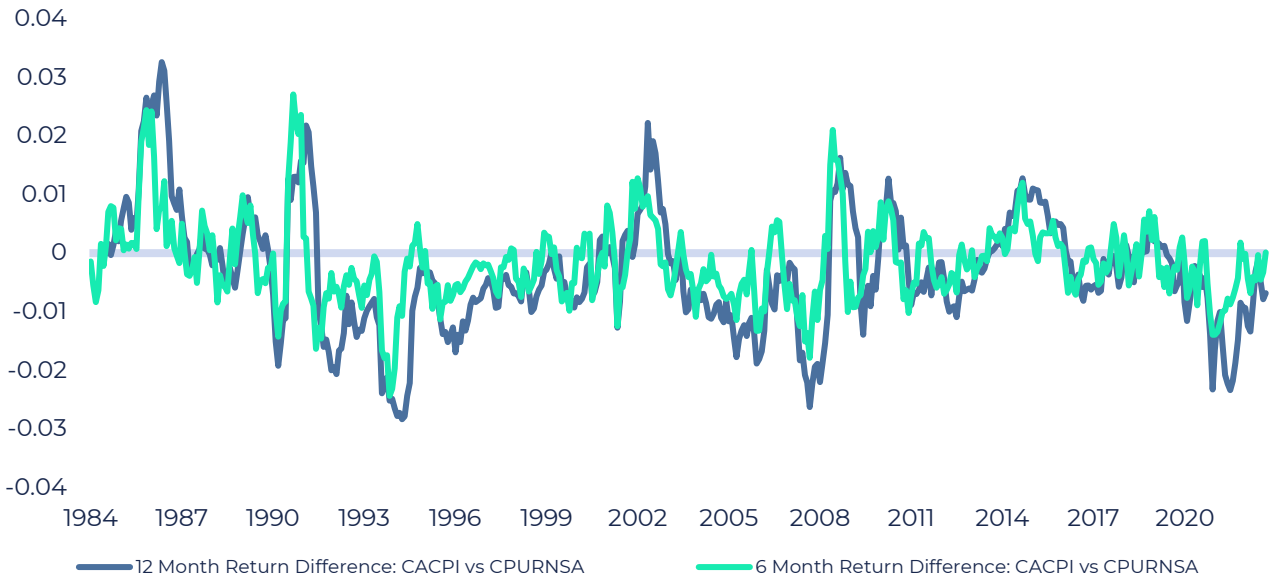
	CANADA (benchmark)	USA
	BCIC1T Index	**TIPS Proxy**
Annual Return	4.82%	4.52%
Standard Deviation	8.99%	11.41%
Information Ratio	0.54	0.40
Max Draw Down	-23.3%	-33.45%

Source: Validus, Bloomberg (Oct 2002 – Dec 2023)

** Benchmark: Bloomberg Canada Govt Inflation-Linked All Maturities TR*

TIPS Study

Figure 2. **CACPI vs CPURNSA Returns Difference**



Source: NOT UPDATED

A Tale of Two Economies:

Analyzing the CPI-U NSA time series for TIPS and Canada CPI NSA time series for RRBs, it is found that the two series have a high average correlation of nearly 80% since 1982. However, the slope of the regression between the two is 0.77, indicating that changes in CPI are not identical. Despite this difference, one could potentially explore a replication strategy considering that RRB cash flows are 0.77 times that of similar maturity TIPS.

It's also important to note the distinctions in the composition and weights of CPI components between the US and Canada, particularly in healthcare and personal care. The definition and calculation of housing and shelter prices also differ. The year-over-year difference in CPI between the two countries exhibits a wide range of variation, with the US CPI generally growing faster than the Canadian CPI.

These observations lead to the conclusions that, all else being equal, the market-to-market value of TIPS and RRBs of the same maturity will deviate over their lifetime, and the total cash flow received by an investor holding similar maturity TIPS and RRBs will differ. Over the past four decades, TIPS holders have received higher total cash flows (in USD) due to higher average CPI.

The TIPS market is more liquid and extensive than RRBs, offering a wide range of maturities and diversified indices for investors. Using US TIPS as a proxy can provide a similar total return, but the volatility of a maturity-matched TIPS portfolio is 20% higher. From 2002 to 2020, the TIPS portfolio consistently underperformed but started to catch up in 2020. The TIPS portfolio also exhibits more significant drawdowns, particularly in the latter half of 2022.

Conceptual Framework

Valuing ILBs

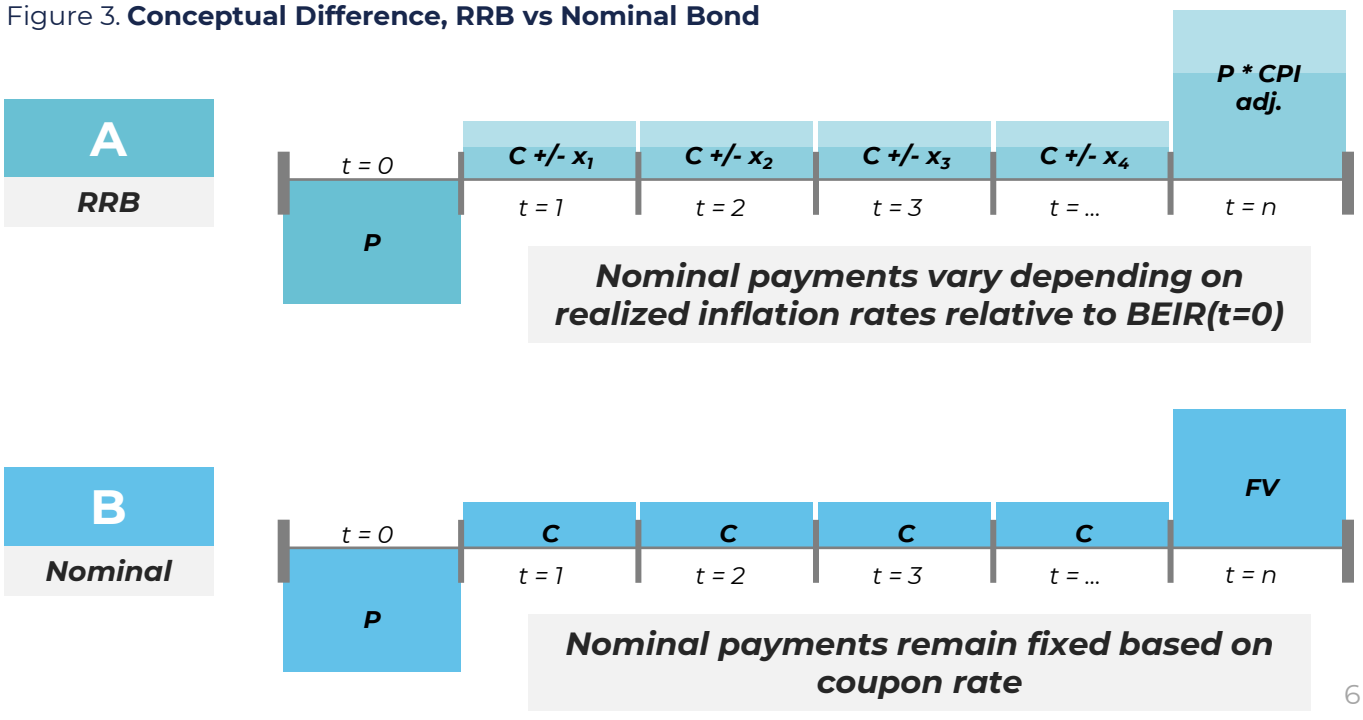
- The goal of an ILB is to provide investors with protection against inflation. When comparing ILBs to nominal bonds over long holding periods, two perspectives need to be considered: the total final profit and loss (P&L) and the mark-to-market variations. The latter is important because institutional investors may adjust their asset allocation over time, and if they do so when nominal bonds have dropped in value, it can negatively impact performance and risk profile.

- Assuming both nominal and ILBs have the same issuance and maturity date, the decision to hold one over the other depends on the total cash flows received during the holding period (so long as pricing at issuance is arbitrage free). If subsequent realized inflation matches the Breakeven Inflation Rate (BEIR) at issuance, there is no difference between cash flows, making the investor indifferent to buying either bond.

- However, if future realized inflation turns out to be lower than the pricing at issuance, the holder of ILBs will receive lower cash flows compared to the holder of nominal bonds. This scenario corresponds to deflation. ILBs, such as JGBs and TIPS, have embedded protection against deflation through a minimum par value at maturity, acting as a "floor." RRBs, contrarily, do not provide this protection.

- In a conceptual sense, holding a long ILB position can be seen as a long position on a nominal bond combined with a long call option on future realized inflation ratio (or a long swap on inflation ratio in the case of RRBs).

Figure 3. **Conceptual Difference, RRB vs Nominal Bond**



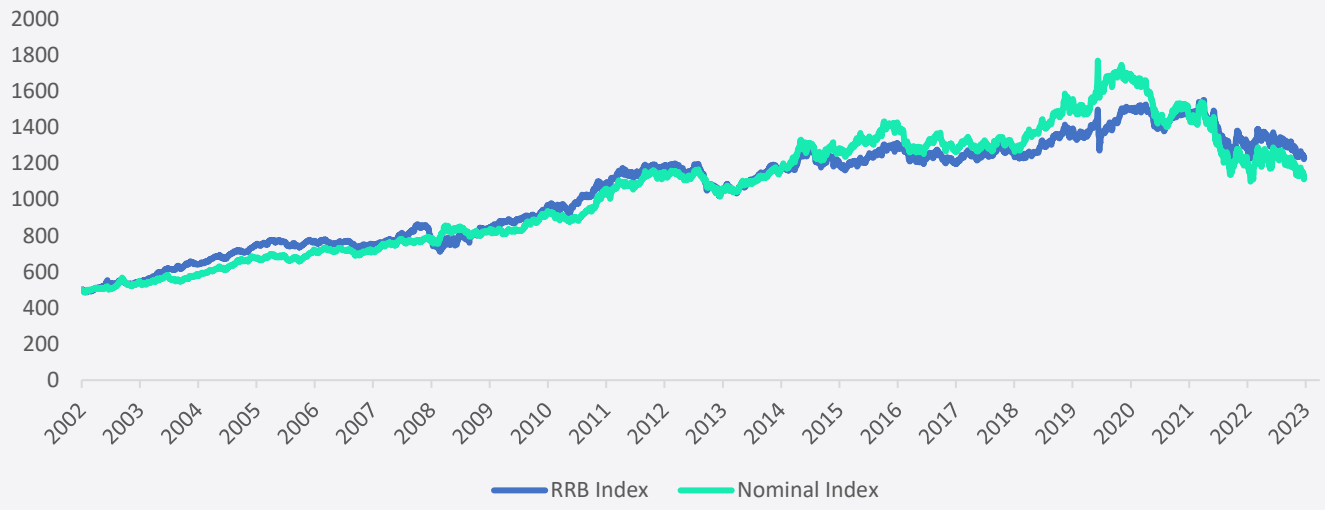
Empirical Observations

Some Findings From Research

Our in-depth review of the valuation of ILBs, their sensitivity to key inputs such as nominal rates and CPI, as well as the interdependency and predictability of these inputs using other measures of inflation expectations, brings us to conclude that:

- Nominal rates have a very close relationship to real rates over the long run and move in tandem, although there are important periods of performance divergence (see figure 4).
- ILBs can be effective tools in hedging an exposure to inflation and to the CPI, in particular. This is especially true in the short to medium term.
- Long-term inflation expectations are not predictable and as such hedging any exposure to inflation, be it actual or actuarial, is appropriate and wise.
- It is important to bear in mind, that the post pandemic inflationary episode is the only such episode since the issuance and trading of ILBs in developed countries started (1990s).
- While one might have seen somewhat limited hedging effects through this episode – as mark to market of long-term ILBs did correlate closely with nominal bonds - it is very important to remember that we are only two years into this episode and long-term inflation expectations remain well anchored. Hedging an exposure would present further benefits should inflation be sustained for longer or in case long-term expectations start shifting.
- It is therefore relevant and prudent to be prepared for such scenarios of higher realized or expected inflation.

Figure 4. **Canada RRBs Index versus Nominal Bond index (2002 - 2023)**



Source: Validus, Bloomberg (Oct 2002 – Dec 2023)

Replicating Exposure

Our goal is to provide a cost-effective implementable solution that would mimic an exposure to the benchmark index.

How Does It Work?

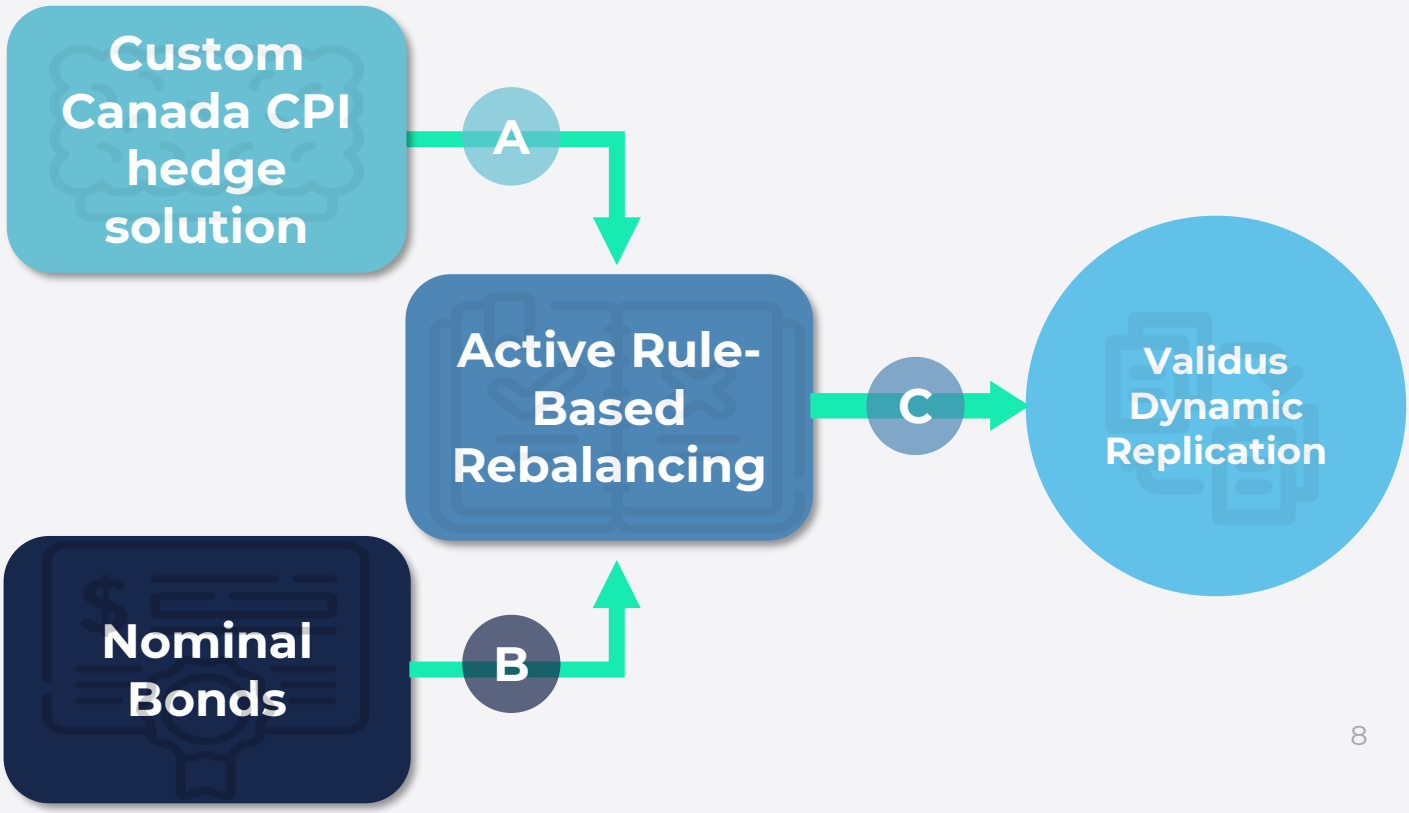
Validus has conducted analytical work that shows an ILB can be seen as an investment in a nominal bond and a call on future realized CPI. In order to provide a proxy exposure to RRBs, we build a portfolio composed of a position in nominal bonds and a proxy hedge for CPI.

Intuitively one can suggest that an ILB bond has the closest relationship to a nominal bond of the same maturity. Additionally, we took a closer look at the components and sub-components of the Canadian CPI and mapped them to a basket of liquid commodity-sensitive securities to create the Validus Custom Canada CPI Hedge Basket.

Our **Canada-centric** solution portfolio is built by **rebalancing** these two components based on a **proprietary methodology** that takes into account the inflation **environment**. Thus, achieving two main goals:

- To avoid market-to-market losses and drawdowns suffered by nominal bonds in a rising interest rates regime.
- To capture the increase in CPI via the Custom Canada CPI Hedge Basket.

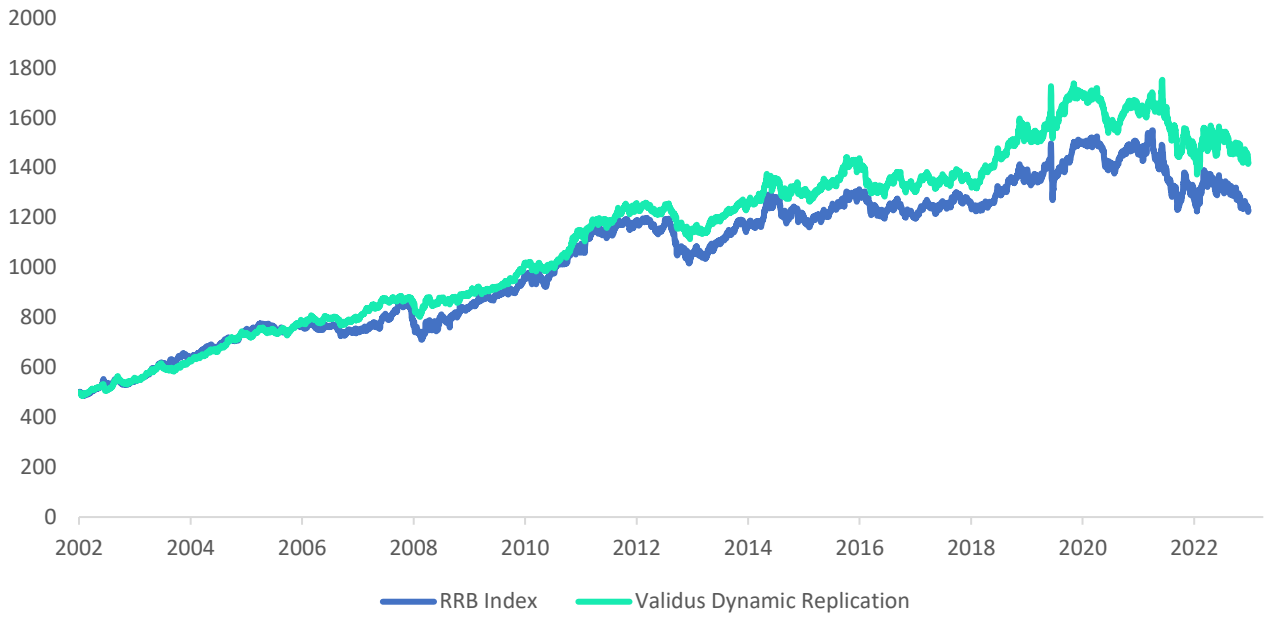
$$Solution\ Portfolio = Bond_{nominal} + CPI_{Hedge\ Solution}$$



How has the Strategy performed?

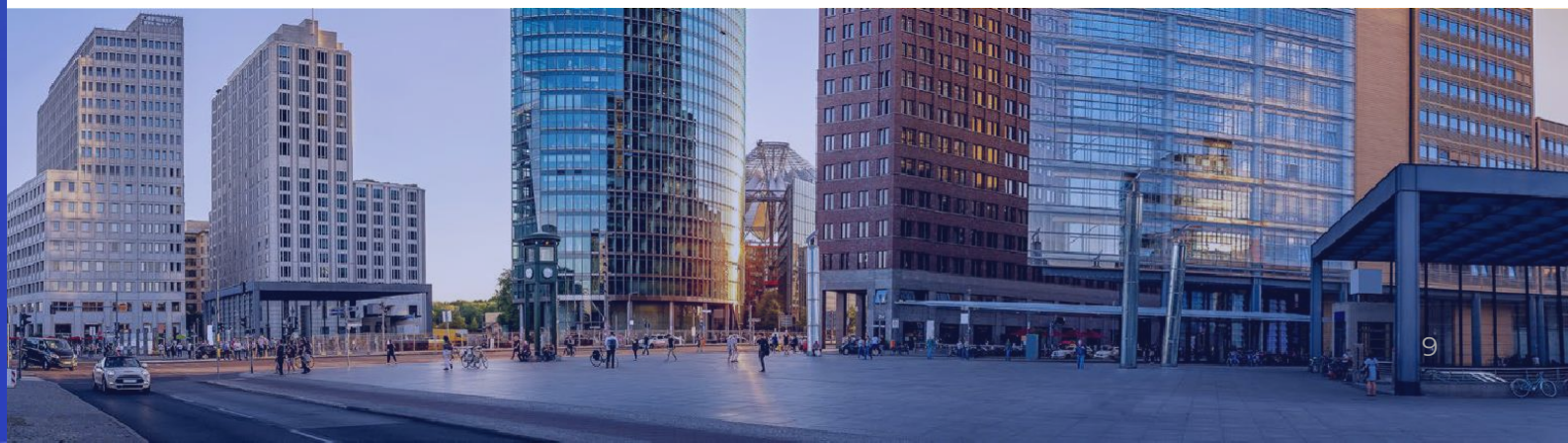
The historical performance profile of the Validus Real Return Bond Dynamic Exposure Strategy is shown in figure 1 below, illustrating the improved annualized return, annualized volatility and drawdown characteristics, when compared to TIPS, Nominal Bonds and the BCIC1T Index benchmark.

Figure 1. **Validus Dynamic RRB Replication Strategy**



Statistics	Annualized Return	Annualized Volatility	Information Ratio	Max Drawdown
Validus Dynamic Replication	5.51%	8.35%	0.66	-22.46%
TIPS Proxy	4.52%	11.41%	0.40	-33.45%
Nominal Bond Index	4.54%	9.89%	0.46	-39.95%
BCIC1T Index (Benchmark)	4.82%	8.99%	0.54	-23.32%

Source: Validus, Bloomberg (Oct 2002 – Dec 2023)



Validus Real Return Bond Dynamic Exposure Strategy

Observations:

- The solution portfolio offers, over the 2002 to 2023 period, generates an additional 70bps annualized performance compared to the benchmark.
- The solution portfolio offers, over the 2002 to 2023 period, similar volatility and drawdown to the benchmark.
- The solution portfolio has a noticeably higher information ratio (0.66 versus 0.44).
- An investor who held the replication since 2002 underperformed the benchmark by a maximum of 6% (in early 2000s) and it had outperformed it by 12% coming out of the GFC of 2008.
- The deviation of the Dynamic Strategy versus the benchmark appears in period of sudden change in inflation and we attribute it to a lag effect between changes in CPI and prices of commodity sensitive securities.
- However, it is important to note that from a perspective of a long-term holder (5 year plus holding horizon) these lag effects dissipate in performance statistics.
- The outperformance of the solution portfolio is due to the fact that the CPI hedge basket is akin to being long a call on CPI that can deliver higher than expected returns depending on the characteristics of each inflation shock.

	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
BCIC1T Index Benchmark	13.09%	17.31%	15.01%	-2.34%	1.78%	0.69%	13.42%	10.98%	18.37%	2.84%	-12.57%
Validus Dynamic	12.40%	12.19%	16.76%	4.36%	6.70%	4.51%	2.75%	12.58%	16.60%	5.01%	-8.71%
	2014	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**ALL**
BCIC1T Index Benchmark	13.58%	2.74%	2.55%	0.42%	-0.08%	8.07%	13.14%	1.69%	-14.22%	1.17%	168.99%
Validus Dynamic	12.69%	1.77%	1.05%	3.22%	1.56%	8.85%	14.20%	-0.99%	-13.48%	5.00%	209.23%

Source: Validus, Bloomberg (Oct 2002 – Dec 2023)

To Sum Up

Validus' hands-on market expertise combined with the strength of our quantitative group was key in conducting this project and devising solutions. Validus has leveraged its experience and existing analytical framework to tackle the issue of inflation hedging both generally and for Canada in specific. The solution comes virtue of:

- A deep dive into the relationship between nominal and RRBs was conducted.
- Understanding the drivers of RRBs and the interaction between break-even inflation with realized inflation.
- A close look at Canadian CPI and its component and drivers to devise a custom Canadian focused solution.

Overall, as a strategy that mimics the performance of ILBs, the strategy fills the hole of the now discontinued Canadian RRBs while delivering quality performance for those who require inflation protection in their portfolios.

The strategy is extremely versatile and can be adapted to specific benchmarks or duration requirements.

The Validus **Real Return Bond Dynamic Exposure Strategy** has many key risk/return characteristics, in particular:

- **Avoids market-to-market losses and drawdowns suffered by nominal bonds in a rising interest rates regime**
- **Captures the increase in CPI via commodity sensitive securities**
- **Adds noticeable risk-adjusted performance when compared to the benchmark (nearly 100bps per year)**
- **Maintains lower volatility**

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