



How bond overlay strategies might help pension funds manage their liability risk



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Key Takeaways

- In liability-driven investing (LDI), the liability risk profile of a pension plan drives the asset policy mix. Liabilities are susceptible to interest rate changes: when rates fall, pension liabilities increase.
- Fixed income derivative indexing solutions, known as Bond Overlay strategies, can potentially serve as an interest rate hedging tool for pension funds.
- Bond Overlay strategies use leverage to gain unfunded bond exposure, and fixed income derivative instruments are the source of Bond Overlay leverage.
- Other common uses of Bond Overlay include liquidity management and portfolio rebalancing.

Fixed income derivative indexing solutions, or Bond Overlay, can potentially help institutions, particularly pension funds, in many ways. These solutions can create a better match between the assets and liabilities of a plan, while maintaining allocation to higher-yielding assets, by providing an efficient hedge against changes in long-term interest rates. This primer discusses the rationale behind using Bond Overlay, the concepts behind it, and the management of overlay strategies, with a particular focus on its risk management and real-world applications.

1. Bond Overlay: The rationale

a. Historical context

The Bond Overlay concept is intrinsically linked to the development of LDI techniques for defined benefit (DB) pension plans starting in the mid-1990s. The UK was at the forefront of this evolution after changes to two accounting standards – the Financial Reporting Standard 17 (FRS 17)¹ and the International Accounting Standard 19 (IAS19)². These changes gradually transferred pension deficits to corporate balance sheets starting in the late 1990s.

These developments were preceded by a breakthrough academic paper³ which made the case for a shift from traditional pension actuarial valuation to the modern market-based approach. Under this liabilities valuation framework, the authors argued, a pension liability is economically equivalent to

a stream of cash flows which should be discounted at the prevailing market rates and its risk managed accordingly. Under FRS 17, DB schemes' assets must be measured at fair market value and liabilities must be discounted at the equivalent of the current rate of return on a high-quality corporate bond.

After these regulatory changes, corporate treasurers were forced to take on not only the management of DB pension deficits, but also their risks, which arose from variations in the value of liabilities due to bond market volatility. The early 2000s backdrop of equity market turbulence and the enduring trend of longer life expectancy further accelerated the industry shift from open growth to liabilities-driven investing.

¹ Financial Reporting Standard 17 issued December 1999 and effective January 2005 deals with the accounting treatment of pension schemes.

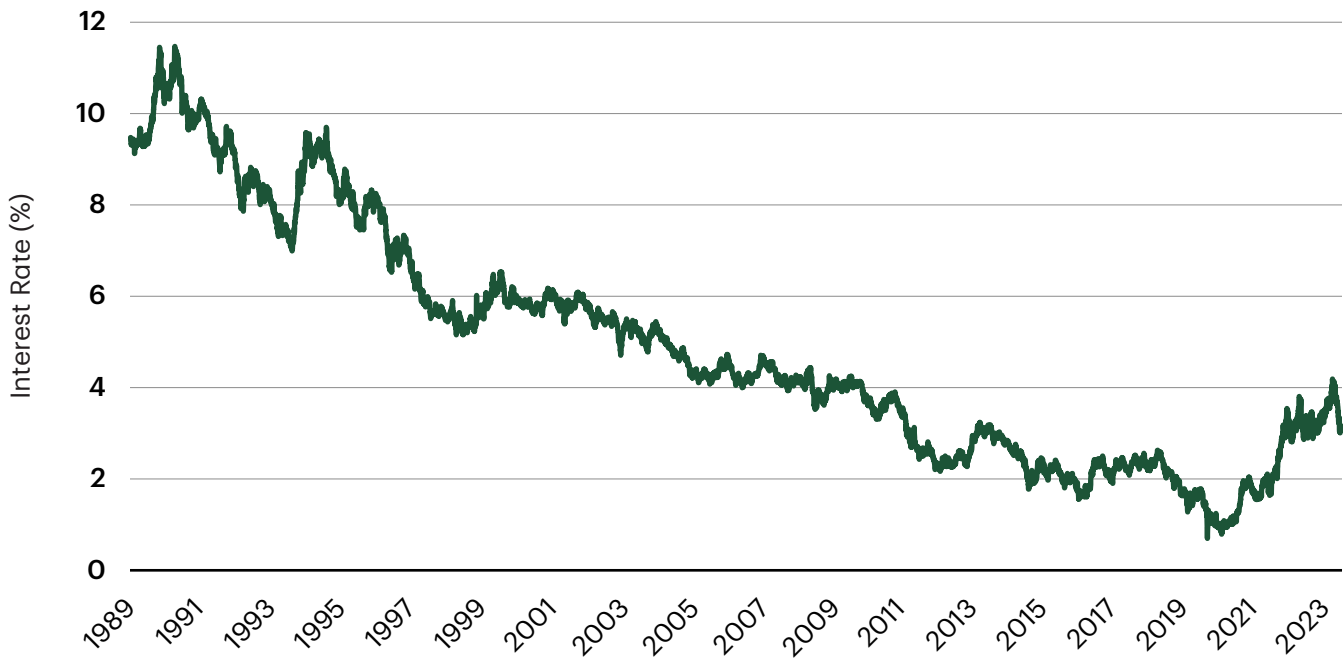
² IFRS IAS 19: Prescribes the accounting for all types of employee benefits requiring an entity to recognize a liability when an employee has provided service in exchange for employee benefits to be paid in the future.

³ The Financial Theory of Defined Benefit Pension (1997), C.J. Exley, S. J. B. Mehta and A D. Smith.

b. Interest rate market cycle

Transitioning over to the Canadian context, where the trend of offloading DB pension risk took hold in the mid-2000s, **figure 1** shows the historical interest rates of the Government of Canada bonds' 20-year note index from June 1989 to October 2024. The index peaked at 11.47% on September 9, 1990, and reached a low of 0.78% on August 4, 2020.

Figure 1: Canada's 20-year interest rate



Source: Bloomberg Finance L.P. As of October 31, 2024.

The long-term secular bond bull market that started in the 1980s with double-digit interest rates and culminated with rates below 1% in 2020 complicated the situation of Canada's DB pension plans in two ways. First, a drop in interest rates increases liabilities and decreases a plan's funded status ratio⁴ – unless it is offset by an equivalent gain on a plan's assets.

The gains of bond portfolios did not make up for the increased liabilities, given the industry-wide deficits of pension plans' interest rate hedge ratios⁵. On aggregate, the assets' interest rate sensitivity was lower than that of the liabilities, creating sustained losses amid the structural market shift to lower rates.

⁴ The Funded Status Ratio is the ratio of a pension plan's assets to liabilities.

⁵ Interest Rates Hedge ratio measures how closely a pension plan assets and liabilities move in response to a parallel shift in interest rates. Mathematically, it is equal to the funded status times the allocation to fixed income times the ratio of the asset over liabilities duration.

c. Liability-Driven Investing and interest rate hedging

The core tenet of LDI is the consideration it gives to the contractual commitment of a plan against its assets. LDI seeks to balance out the risks within a plan, including the interest rate risk, while targeting an asset mix that can generate the return necessary to meet the plan's long-term funding status objective. Increasing the risk of the asset mix usually implies a lower bond allocation. If all else is equal, this decreases the plan's interest rate risk hedge ratio by leaving the liability rate risk underhedged.

In the context of the 1990s bond bull market, lower interest rates suppressed the asset growth prospects of plans. Further, with the gradual adoption of the market-based liability valuation framework, additional

bonds (duration) are needed to hedge the rate risk. But there's a caveat: in a lower-yielding environment, bond yields might not generate sufficient returns to meet a plan's long-term objectives.

Amending a plan's features is difficult. Inertia is high when it comes to alternatives such as changing a plan's contribution rate. One way to improve the interest rate hedge ratio is to extend the duration of the portfolio's bond exposure. Using the modern finance toolkit, strategies were developed with the goal of increasing the effectiveness of each dollar allocated to a fixed income instrument. This family of derivative-based fixed income solutions is referred to as Bond Overlay.

d. Financial derivatives: a solution builder toolkit

Financial derivative instruments get their value from the relationship to an underlying asset and are used for various purposes, including market speculation and risk hedging. Derivatives enable market participants to obtain exposure to assets with less capital than would otherwise be required by acquiring the asset outright.

Derivatives can be centrally cleared on an exchange or traded over the counter (OTC) in bilateral contractual agreements. The realized gains and losses of derivatives are either exchanged daily or covered by collateral to mitigate the credit risk between counterparties. OTC derivatives are flexible instruments, as the terms of the contracts can be negotiated between trading partners. The highly customizable nature of derivative instruments makes it possible to design bespoke derivative-based strategies that meet a wide range of investment objectives across the risk-return spectrum.

Solution

e. Bond Overlay: introduction

Overlays use derivatives to gain exposure to various asset classes with a smaller requirement to allocate physical cash. In Bond Overlay, derivatives are used to finance bond exposure. Bond Overlay is also referred to as a levered or synthetic bond exposure because it is structured synthetically by using derivatives, rather than with fully cash-funded bond exposure.

A Bond Overlay leverage ratio is defined as its total bond exposure divided by its capital base. A Bond Overlay net cost of carry corresponds to the yield of its bond portfolio exposure less the financing yield of the derivative exposure. The cost-benefit of each Bond Overlay solution depends on the type of derivative instrument used and the investment profile of the bond portfolio exposure, subject to fixed income market conditions. In most instances, Bond Overlay is used to achieve one or several of four objectives:

- **Interest rate hedging:** Interest rate risk management within LDI and other portfolios
- **Liquidity management:** Cost-effective answer to the liquidity needs of portfolios
- **Portfolio rebalancing:** Cost-efficient rebalancing to help minimize the tracking error of portfolios against an asset mix policy benchmark
- **Capital efficiency:** Aims to achieve investment results, including the management of tactical market views

These are only a few examples of ways that portfolios can potentially benefit from the addition of Bond Overlay. We next explore two of the most common Bond Overlay applications through hypothetical examples.

f. Bond Overlay user case 1: interest rate risk hedging (LDI)

Bond Overlay is an integral component of the modern LDI toolkit, given its potential to deliver effective interest rate exposure per dollar invested. In LDI, assets are divided into two buckets: Liability-Hedging Assets (LHA) and Return-Seeking Assets (RSA). The capital effectiveness of Bond Overlay might help better hedge liabilities' interest rate risk profile while staying invested in the RSAs. This can potentially generate the growth required to meet a plan's long-term funding status objective.

For illustration purposes, let's consider a hypothetical DB plan which aims to better control its liability risk by doubling its interest hedge ratio. An overlay program targeting two times its current bond portfolio exposure is employed, using the existing bond portfolio as a capital base. The overlay is designed to replicate the existing bond portfolio profile and is added to the LHA, doubling its duration. **Figure 2** illustrates the benefit that adding overlay has on the hedging ratio for a given level of RSA.

Figure 2: Impact of adding overlay

	Target Asset Mix 1	Target Asset Mix 2
Fixed Income	50%	100%
Equities	30%	30%
Commodities	5%	5%
Alternatives	15%	15%
Bond Overlay	0%	-50%
Total Allocation	100%	100%
Hedge Ratio	40%	80%

In this example⁶, the fixed income target allocation is effectively doubled by adding a two-for-one levered Bond Overlay, which raises the plan hedge ratio from 40% to 80%. The levered nature of Bond Overlay under Asset Mix 2 enables an effective fixed income portfolio allocation of 100% (Fixed Income + Bond Overlay exposure) of notional value. The interest rate hedge ratio thus increases without impacting the RSAs (equities, commodities and alternatives).

⁶ For illustrative purposes only. Assumes a plan has an 80% funded status and a duration of assets equal to that of liabilities.

Policy asset mix rebalancing

After the overlay exposure is calibrated and put in place to achieve the desired 80% hedge ratio, it is managed over time. A strategic policy mix and target hedge ratios are designed for the plan to help it meet its long-term investment goals and to keep risk within a certain level. When the plan hedge ratios diverge from the policy, the Bond Overlay exposure is adjusted to rebalance to target.

Figure 3: Management Policy for an Interest Hedge Ratio

Liabilities Hedging Objective	Hard Min (rebalance)	Target	Hard Max (rebalance)
Interest Hedge Ratio (IHR)	75%	80%	85%

Figure 3 shows an example of an interest hedge ratio management policy. A tolerance band is established around the 80% target. A breach of the policy’s threshold triggers action to rebalance the hedge ratio to target. Bond Overlay exposure is added to increase the hedge ratio or removed to reduce it.

Tactical interest rate hedging

Interest rate risk hedging is a long-term strategic decision for most plans. While it’s not the norm, plan administrators occasionally consider tactical interest rate hedging, most often in the form of glide paths⁷. The merits of dynamic hedge ratio strategies are assessed by comparing their expected marginal return against the funded status volatility risk they add. New plans with a small funding status are more likely to consider a tactical approach, while the balance of risks is harder to justify for mature fully funded plans.

Bond
Overlay

⁷ An interest rate hedge ratio glide path refers to the alteration of a plan’s interest rate hedge ratio according to interest rates trigger points.

g. Bond Overlay user case 2: liquidity management

Bond Overlay can also boost the liquidity of portfolios by enabling them to stay invested in the markets while raising cash. The opportunity cost of a traditional structural cash allocation can be high, but it can be mitigated with a liquidity pool. In liquidity pools, cash is generated by borrowing from capital markets using fixed income derivatives because of their cost advantage compared to other asset class derivatives. Cash is raised by moving portfolio bond exposure from physical to overlay. Conversely, cash is drained by moving exposure away from overlay into physical.

This process can be initiated on an ad hoc basis or according to a pre-established cash management policy. A liquidity policy specifies a target cash allocation with tolerance thresholds. The cash balance is managed to stay within the boundaries. **Figure 4** provides an illustration of the form that such a liquidity management policy can take.

Figure 4: Liquidity management

	Min	Target	Max
Cash Balance	1%	3%	5%

After the initial cash position is established, liquidity is managed so that the cash position stays within target by trading between physical bonds and Bond Overlay exposure.

Figure 5: Cash positions

Scenario	Action
Cash Balance < 1%	Sell physical bonds add overlay
Cash Balance > 5%	Buy physical bonds, reduce overlay

Strategy

The cost of running a liquidity pool, or its cost of carry, is the difference between the derivative's financing cost and the money market yield earned on the cash balance. Because derivatives are often financed at a low-risk premium, the net cost of a liquidity pool can be competitive against alternatives such as forced sales of assets at times of market stress.

Liquidity pools can potentially allow portfolios to operate with efficiency. From an operational perspective, this can help with payments to pensioners, administrative fees and other miscellaneous expenses. From an investment standpoint, the liquidity can be used to meet margin calls or to fund tactical

investments such as allocation to less liquid private assets. Readily available liquidity adds optionality to portfolios by providing the firepower to take advantage of time-sensitive market opportunities.

The effective management of Bond Overlay requires an understanding of the bond market and its derivative instruments, as well as deep expertise in the risk management of bond derivatives. The nuances related to the availability and liquidity of derivative instruments in the Canadian marketplace also play a role in overlay implementation. We will address these subjects by first diving into the fixed income derivatives used to manage Bond Overlay strategies.

2. The Bond Overlay toolkit

a. Fixed income derivatives

Since no two portfolios' investment objectives, constraints and risk tolerance are the same, neither is the optimal derivatives mix of their Bond Overlay. The overlay structuring process aims to provide an optimal result which includes leveraging the features of the most advantageous financial derivatives for the task. The fixed income derivative instruments available in Canada include Total Return Swaps (TRS), Interest Rate Swaps (IRS), and repurchase (bond repo) agreements, also known as Delayed Settlement Bonds (DSBs). A swap simply refers to the derivative contract where two parties exchange the cash flows or value of one asset for another.

Interest Rate Swaps (IRS)

In an interest rate swap, cash flows based on a fixed rate are exchanged against cash flows linked to a periodically observed variable market rate. The variable interest rate is determined with reference to a spread above the interbank lending rate. In Canada, that rate is the Overnight Index Swap⁸. IRS can offer exposure across the yield curve. The swap contract notional is not exchanged between parties.

Total Return Swaps on bond indices (TRS)

In this swap agreement, a bond index return is exchanged for a stream of floating payments. The FTSE Canada Long Term Provincial Index is often used as the reference asset because this index is often the benchmark of the Bond Overlay.

One of the main advantages of TRS is that they contractually guarantee the exact return of the index, thus eliminating the possibility of any tracking error between the portfolio and the benchmark. TRS can offer operational benefits given their set-and-forget, low-maintenance nature. Once contracted for a long-dated maturity, a TRS does not have to be rolled over periodically. The only required maintenance is the daily settlement of the mark-to-market gains and losses. TRS also feature clean single-line reporting entries.

These advantages are balanced by the generally higher financing costs of TRS, their cumbersome set-up phase, which involves legal documentation⁹, their limited liquidity, and the inability of netting TRS mark-to-market exposure collateral across counterparties.

Inflation Swaps

In this agreement, the swap economic quantity exchanged for fixed payments is linked to the realized rate of inflation over a period. Typically, a non-seasonally adjusted consumer price index (CPI) is linked to the contract. At the swap's maturity, only the net cash flows – that is, the difference between the fixed leg's rate and the actual inflation rate – are swapped. The fixed rate indicates the market's anticipated inflation rate over the contract period. The inflation swap is thus a form of interest rate swap in which the payoff is defined as the difference between the expected and realized rate of inflation, as measured by the cumulative change in the headline CPI over the swap's term.

Bond futures

A bond futures contract is an agreement traded on an exchange that obligates the contracting parties to buy or sell a fixed number of bonds at a future date, at a price agreed upon in advance. An initial margin is required and deposited at a central clearinghouse. Cash and liquid government securities serve as eligible collateral. The gains and losses of a futures contract are calculated daily and collateral is exchanged accordingly. In Canada, future markets are limited to the 2-, 5-, 10- and 30-year Government of Canada bonds.

⁸ The Overnight Index Swap (OIS) is a low-risk, secured rate that corresponds to a fixed for float interest rate swap where the floating leg is computed using a published overnight index rate. The index rate is typically the rate for overnight lending.

⁹ TRS require custom bilateral International Swap and Derivatives Association (ISDA) and Credit Support Annex (CSA) agreements.

Repurchase agreements (bond repos) / Delayed Settlement Bonds

DSBs are also referred to as bond forwards. Bond repos amount to collateralized borrowing. A bond is purchased in the open market and simultaneously sold to a dealer to generate the cash to settle the original bond purchased. An agreement is struck with a dealer to buy back the bond at a later date. The trade is executed at the prevailing market rate with the repurchase forward price reflecting the bond coupon accrual and the dealer financing rate.

The bond sits on the dealer's balance sheet, collateralizing the loan, while the bond economic exposure remains with the buyer. This feature is key, because it is the legal ownership of the bond held by the party financing the bond purchase that drives a repo's cost advantage.

Repos are rolled over periodically into new contracts ahead of maturity. Gains and losses on the bonds accrue to the buyer and they are collateralized up and until the repo roll-over dates, where they are netted and exchanged between parties. Eligible securities for bond repos in Canada are bonds issued by the federal and provincial governments as well as investment-grade corporate bonds. In Canada's fixed income derivative market, bond repos offer potential advantages to fund bond exposure, given their low financing cost and deep liquidity.

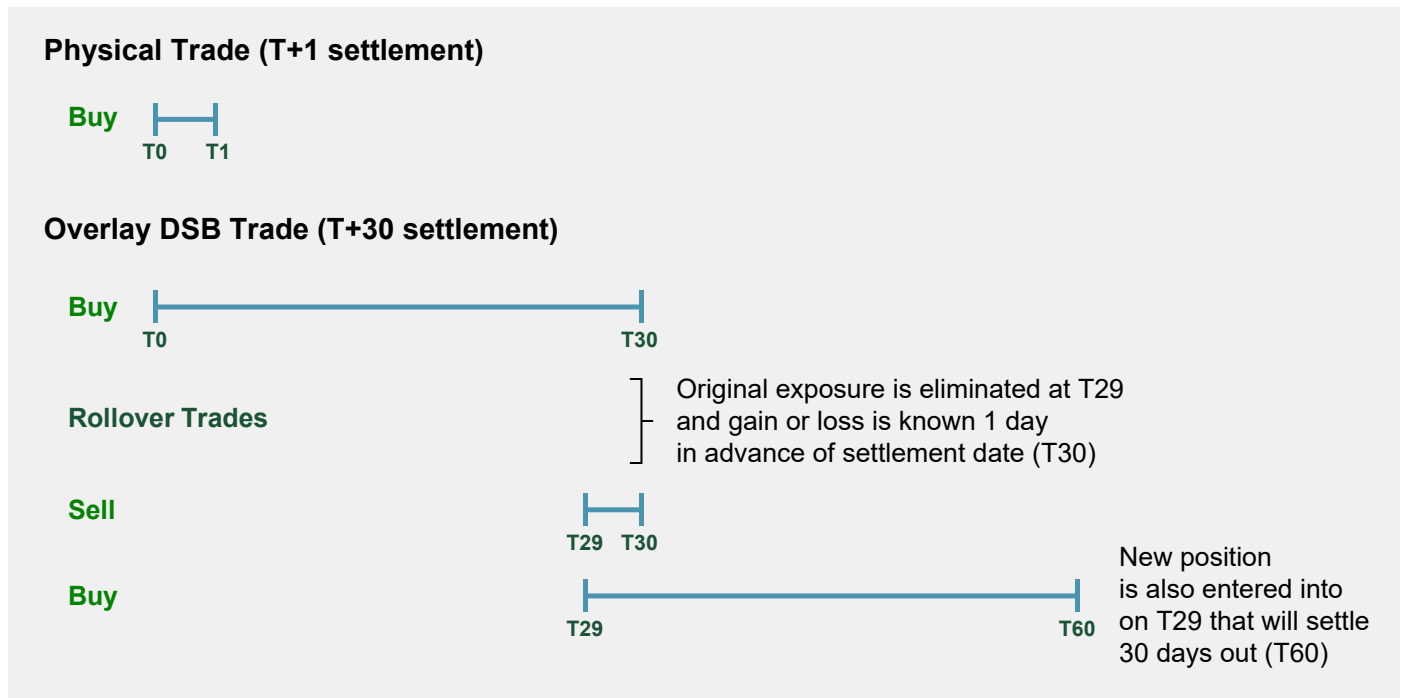
b. Bond repo mechanics

In cash trades, a bond is bought in the open market and settled the following business day. The custodian exchanges cash for the physical bond. In a repo transaction, one agrees to buy the bond in a manner similar to a cash-settled trade, but both parties agree not to settle the transaction until a later date. Below are the stages of a bond repo:

- Bonds are purchased in the open market, settling at T+1 (Trade A).
- Trade A bonds are used in a repo trade. Bonds are sold to a dealer for a T+1 settlement, generating the cash to pay for trade A (Trade B).
- Simultaneously to trade B, the bond seller agrees with the repo dealer to buy back the bonds (Trade C) later. The agreed repurchase forward price reflects the repo rate (financing) cost charged by the dealer and the bond coupons accrual.
- The previous three trades (A, B, C) constitute a classical repo transaction. Bonds are bought in the cash market, but the sell-and-buy-back agreement converts the transaction into an unfunded form. Trade A bonds are pledged as collateral in exchange for the cash to settle Trade A bonds. Trade A bonds sit on the dealer's balance sheet, diminishing the risk of the loan. The bonds' economic exposure remains with the bond seller.
- Under A+B+C, the long party has synthetic exposure to Trade A bonds. The exposure is unfunded since the cash required to settle the trade is borrowed from the dealer via B+C. The long Trade A party has economic exposure to the bonds (Trade A) in exchange for the financing cost of the money lent by the repo dealer in Trade B+C.

- In **figure 6**, one day before the repo settlement date on Day 29, the bond mark-to-market is calculated and realized by offsetting Trade C with a sell. A new Trade D forward-purchase agreement is entered into for settlement 31 days later.

Figure 6: Bond repo mechanics



c. Legal documentation for derivatives: GMRA, GMSLA and ISDA

Derivative contracts are set with an initial value of zero. After inception, a derivative value fluctuates based on economic factors such as interest rates, credit spreads and inflation. Market volatility creates derivatives' gains and losses. Exchange-traded derivatives are standardized and settled via a clearing house, while the OTC derivatives discussed so far are bespoke and negotiated privately, and they involve counterparty risk. For OTC derivatives, the contract gains and losses create credit risk exposure between counterparties. A legal documentation framework exists to limit such counterparty risk.

The Global Master Repurchase Agreement (GMRA) is a product-specific legal agreement designed for parties which are transacting bond repos. The GMRA governs the terms of the trade, default events and collateral eligibility. Overlay managers can diversify bond repo exposure across multiple counterparties to spread out liquidity and credit risk.

The Global Master Securities Lending Agreement (GMSLA) is a standard agreement typically used for international securities lending transactions. The GMSLA can facilitate long/short strategies consisting of the borrowing of a security which is then immediately sold short. The money from the short sale finances the purchase of another security. Both securities are turned over to the dealer under the GMSLA because the long physical security is pledged as collateral against the short security.

ISDA has published The ISDA Master Agreement, which is part of a framework designed to characterize OTC derivatives. The ISDA Credit Support Annex (CSA) defines the rules and terms that the parties must abide by to collateralize OTC derivatives exposure. Bilateral ISDA documentation can be cumbersome to put in place and is required to transact IRS and TRS.

d. Financing cost¹⁰

Financing cost is an important factor to consider when choosing between fixed income derivative instruments. In Canada, bond repos offer the lowest financing cost and deepest liquidity. The spread at which bond repos trade to the risk-free rate is a function of the type of underlying securities and market conditions. In normal market environments, we estimate the financing costs for various types of bond repos, quoted as spreads to the Canada OIS rate, in the following way:

- **Federal bonds:** 15 bps to 25 bps
- **Provincial bonds:** 20 bps to 30 bps
- **Provincial strips:** These are security-specific and the cost will be higher compared to regular provincial bonds.

The corporate bond repo market is a relatively new development in Canada and liquidity is improving. Still, the financing cost will be higher than for Federal or Provincial bonds.

Swaps will generally trade at a financing cost higher than that of bond repos, whose collateralized nature reduces the risk of the loan.

- **IRS trade** at around OIS + 25 to 40 bps
- **TRS on bond indices** trade at OIS + 30 to 40 bps and transactions incur a significant counterparty fee.

Cost is not everything. At times, it may be advantageous to consider TRS and IRS for the specific features they offer. For example, TRS allow investors to secure funding for longer periods of time, they reduce tracking error and they lower the operational burden associated with maintaining bond exposure by rolling repo positions.

e. Yield curve shape and Bond Overlay carry

Bond Overlay is most often used as an interest rate risk hedging vehicle for pension plans. This form of overlay consists of borrowing on the short end of the interest rate curve and reaching for duration on the long end of the curve. This trade has a positive carry in normal upward-sloping yield curve environments.

In Canada, since 2023, the yield curve has been inverted, pushing Bond Overlay strategies into negative carry. Historical data shows that the yield curve inversion recently experienced in Canada is not the norm. In the data spanning the period from January 1935 to February 2023, we find that the spread between long maturity yield and short-term yield is positive about 91% of the time. During that period, the average level of that spread was +155 bps (median 174 bps)¹¹.

Given the above empirical evidence and the strategic long-term investment horizon of LDI hedging policies, the sporadic negative carry should not be of much concern when weighted against the risk control benefit of Bond Overlay strategies. The capital efficacy of the overlay as a hedging vehicle to manage liability risk remains an advantage even at times of slight negative carry. It's also important to remember that episodes of inverted yield curve do not have to result in negative overlay cash flows. An overlay structured with long-dated IRS or TRS could potentially be suitable for the investor sensitive to the possibility of negative flows associated with a repo-based overlay MTM settlement.

¹⁰ Financing cost estimates as of time of writing and is subject to fluctuation.

¹¹ Based on the difference between yields of bonds with a maturity average of 10+ years and 3-month average yields. Average and median differences were 1.58% and 1.74% respectively from January 1935 to February 2023. About 91% of the time, the difference was positive. Based on data from the Bank of Canada before 2020. After January 2020, the calculation is based on a 3-month generic T-bill yield and a 20-year generic Canadian bond yield as provided by Bloomberg Finance L.P. Source: TDAM calculations based on monthly frequency data from January 1935 to February 2023.

f. Summary: Fixed income derivative instruments

DSBs offer several advantages over TRS and IRS for bond overlay implementation. The financing cost embedded in a DSB trade is based on the government repo rate and is lower than the inter-banking financing rate associated with TRS and IRS. DSBs are operationally easier to access as they do not require an ISDA and are traded under the simpler GMRA. The trade-off with using TRS and IRS is a tighter benchmark tracking error versus financing costs and liquidity constraints.

Figure 7: Comparison of Bond Overlay instruments

	Total Return Swaps (TRS) on Bond Indices	Interest Rate Swaps (IRS)	Delayed Settlement Bonds (DSBs)
Financing Cost	Highest	Middle	Lowest
Documentation	ISDA/CSAs required	ISDA/CSAs required but IRS moving towards central clearing	Least cumbersome (traded under GMRA)
Liquidity	Limited, only a few counterparties providing indexed exposure	Improving at all yield curve points but limited in the curve long end	Very high, similar to physical. Corporates increasingly available.
Sector Exposure	Government and Corporate	Corporate (Bank)	Government, Provinces, Strips and Corporates
Liability Term Structure Matching	Optimal	Good	Very good
Collateral Requirements	Required	Required	Required
Tracking Error	None (in some instances)	Small	Very small
Operational burden	Less rollover for long contract maturities	Low rollover risk if centrally cleared	Periodical position rollover and mark-to-market settlement operations
Risk	Lowest rollover and tracking risk	Low rollover risk	Highest rollover risk
Overall	Minimizes tracking and operational risk against higher financing cost and lower liquidity	Middleman in terms of tracking, funding cost and liquidity. Central clearing lowers risk.	Best combination of low tracking, cheapest funding and controlled operational risk

3. Bond Overlay risk management I: instrument level

Derivative risk management is at the core of the day-to-day responsibilities of Bond Overlay portfolio managers. This is for a good reason - derivatives are powerful financial instruments, but mistakes in that area can be costly. The viability of derivative-based levered bond strategies depends on risk management practices. These are particularly important during times of financial market stress.

There are three categories of fixed income derivative risks as they pertain to Bond Overlay strategies at the instrument level.

a. Credit risk

OTC bilateral derivative contracts can expose two counterparties to each other's credit risk once the derivative's mark-to-market swings with market gyrations. The daily collateralization process of a derivative contract's mark-to-market is the main mitigator of credit risk between counterparties. The OTC derivative's legal documentation (ISDA/CSA or GMRA) defines the terms and conditions under which counterparties must exchange collateral.

There are mitigation pillars for some of the key types of derivative credit risk.

- **Credit risk:** Derivative counterparty not delivering on its obligation (i.e., settlement of a derivative mark-to-market).
 - **Liquidity risk:** Bonds and their derivative liquidity (bid-offer spread) and market depth (volume available at different levels of transaction costs).
 - **Operational risk:** Derivatives' rollover risk, settlement, execution, collateralization process and cash management.
- OTC bilateral derivative contracts can expose two counterparties to each other's credit risk once the derivative's mark-to-market swings with market gyrations. The daily collateralization process of a derivative contract's mark-to-market is the main mitigator of credit risk between counterparties. The OTC derivative's legal documentation (ISDA/CSA or GMRA) defines the terms and conditions under which counterparties must exchange collateral.
- There are mitigation pillars for some of the key types of derivative credit risk.
- **Extensive credit analysis:** Bilateral dealers who act as derivative counterparties are selected based on an assessment of various criteria. This minimizes the default risk associated with weaker counterparties.
 - **Collateralization:** Except for futures-based exposure, this involves daily mark-to-market calculation and monitoring. All outstanding gains and losses between the overlay and its counterparties are fully collateralized with bonds. Thresholds for minimum daily collateral movements are personalized based on risk profile. The par value of the bonds posted as collateral less haircut is recorded by the custodian. Securities eligible to be used for collateral purposes are Government of Canada bonds, Provincial bonds and Treasury bills.
 - **Diversification:** This involves spreading the credit risk by using multiple counterparties.
 - **Maximum exposure limits:** This pertains to establishing a limit on the outstanding mark-to-market exposure to any counterparty.
 - **Increased frequency of rollovers:** This involves resetting the trades' mark-to-market collateralized exposure in volatile markets. By rolling the derivative contracts more often, the time between payments is shortened, reducing the likelihood of non-payment.

Regularly reviewing the creditworthiness of counterparties should be part of the framework for managing credit risk in the context of derivatives. Exposure to deteriorating counterparties should be removed.

b. Liquidity risk

Liquidity risk for Bond Overlay is defined as risk to bond market liquidity, risk to derivative market liquidity or risk to cash and collateral management. The first two categories are critical for a Bond Overlay's ability to provide economic exposure at a reasonable cost in the context of available market liquidity. The third category is important for sound operational management, ensuring the overlay's ongoing existence.

- **Bond market liquidity:** This is the ability to buy or sell bonds in the market without causing higher than normal transaction costs. It drives a Bond Overlay's capacity to absorb client flows within a reasonable timeframe and cost.
- **Cash and collateral management:** This refers to the sufficiency of liquid funds and collateral to guarantee operational viability, including the cash required to periodically settle the derivative's mark-to-market losses.

The amount of trading required to manage an overlay is directly proportional to its exposure size. The bond market liquidity must be aligned to the size of the overlay exposure. Techniques such as stratified sampling help replicate a benchmark at a lower cost by replacing full-index portfolio replication with a bond selection that has the greatest liquidity. Bond portfolios which are structured by using stratified sampling replicate the key attributes of the benchmark index (duration, sector, maturity, etc.) using a selection of bonds. Managers that offer a variety of fixed income mandates can leverage intersecting opportunities, potentially unlocking cost-effective liquidity hidden from market participants.

- **Market liquidity of derivatives:** This is the ability to finance synthetic bond exposure within a desired timeframe and cost.

Derivatives place a burden on a dealer's balance sheet. Liquidity is the availability of a competitive rate for a derivative trade of a given size. Derivative dealers with the strongest balance sheet offer the most consistent liquidity, a feature critical during periods of market turmoil when financing comes under pressure. The liquidity risk of derivatives is mitigated by diversifying exposure to bond derivatives over multiple quality counterparties. Focusing only on pricing may hinder the ability to access the derivative markets in times of stress.

This operational derivative liquidity risk is managed by ensuring that the overlay sits on adequate cash or collateral to service its operational liabilities. Cash balance optimization is an exercise of weighting the expected cash outlays for a derivative's mark-to-market settlement against the cost of cash. At the outset, there should be contingency plans to source additional collateral and funds for navigating extreme bond market selloffs.



c. Operational risk

Repo rollover risk

The weak link of repo-based overlays is the short-term nature of term-repos, which requires frequent settlement and rollover. On the repo rollover dates, the mark-to-market is calculated and cash is settled, unencumbering the bonds collateralizing the mark-to-market exposure. In times of stress, access to a dealer's balance sheet might become restricted, increasing the likelihood of costlier renewals or the inability to roll positions altogether. There are levers to mitigate repo rollover risk. They include:

- Managing counterparty risk
- Having robust overlay risk management guidelines, including contingency planning
- Having term repo diversification policies, specifically for diversifying across different maturities and counterparties

Dealers care about the creditworthiness of counterparties. Overlay managers with the strongest credit rating, the most robust risk management practices and the greatest size are most likely to avoid a termination event in the rare but expected instances of extreme market stress. Diversifying derivatives exposure across different counterparties helps, but managing dealer relationships is key. Finally, overlay risk management guidelines must allow the substitution of synthetic exposure with alternative instruments, should a derivative market cease to function.

Staggering term repo maturities can also lower rollover risk and collateral requirements. The process of layering repo exposure across maturities considers the operational burden, the size of trades and market liquidity. It is another commonly used technique for further mitigating repo rollover concentration risk.

Management

Additional thoughts on overlay cash liquidity management

The OTC fixed income derivatives' mark-to-market driven by the variation of the underlying bond portfolio is collateralized daily. In the case of bond repos, the unrealized mark-to-market cash settles periodically on rollover dates. The settlement process frees up the encumbered collateral but requires cash. As a result, bond repos' mark-to-market is calculated a few business days before the settlement date. This leaves sufficient time for

sourcing the funding of realized losses. Alternatively, the realized mark-to-market can be managed by using part of the overlay's existing physical collateral. For realized mark-to-market losses, physical bonds are sold to raise cash. For realized gains, the cash is drained by buying physical bonds. The liquidity requirements can also be managed with a liquidity pool.

4. Bond Overlay risk management II: portfolio level

We next provide an overview of the risk management conceptual framework for Bond Overlay at the portfolio level. Bond Overlay must be designed with attention to leverage and liquidity risks. We first review the main vehicles through which Bond Overlay strategies are offered: pooled funds and segregated accounts. Then we describe the specific overlay risk management principles for each.

a. Pooled Funds and Segregated Accounts

In an overlay Pooled Fund Trust (PFT), clients' money is pooled for the benefit of all through economies of scale. PFTs are managed with a common set of investment guidelines. Investors buy PFT units to get a share of the bond exposure the PFT provides.

With segregated accounts, assets are held without co-mingling between clients. An agreement defines the management of the client's money according to guidelines, offering a more tailored overlay experience.

Here are the key differences between PFTs and segregated bond overlay mandates:

- PFTs are operationally easier to invest in. With PFTs, the Fund serves as the derivative counterparty on behalf of the client. PFTs trade under the asset manager's existing derivative agreements. Segregated accounts are traded on the client's own balance sheet and require operational preparedness (legal documentation, custodian accounts, risk systems and a collateral transfer process).
- For smaller investments, PFTs tend to be the cost-effective option. The larger the investment, the greater the relative value of segregated accounts, due to the benefits of customizing the overlay experience and the scaling of fees.
- A levered PFT is a standalone legal entity which requires investment leverage safeguard mechanisms to protect the capital base.
- The risk controls of PFTs can force ad-hoc leverage rebalancing trades. This impacts the PFTs' interest rate exposure and requires clients adjusting their PFT investment to restore the original exposure that matches liabilities. Segregated accounts provide better control of the collateral top-up process, allowing the Overlay Bond exposure to move in line with market volatility.

Portfolio

b. Conceptual framework of Bond Overlay risk management

The following are key components of a successful risk management framework for a Bond Overlay mandate:

- ✓ Sound replication of the overlay benchmark index with a focus on achieving a **minimum tracking error**.
- ✓ Rigorous **risk management practices when it comes to leverage**. Leverage is either investment leverage (bond market exposure divided by the invested capital base) or operational leverage - or the bond market exposure divided by its allocated collateral. Investment leverage is relevant to a standalone overlay PFT, while operational leverage is pertinent to custom segregated overlay mandates.
- ✓ A well-thought-out **collateral and liquidity contingency plan** that takes into account the whole portfolio, so that extreme bond market selloffs do not force termination of derivative trades due to lack of collateral or liquidity.
- ✓ **Risk monitoring** to ensure that the guidelines and risk limits for Bond Overlay are managed as expected.
- ✓ **Sound operational processes** built on a robust technology platform that would ensure front and back-end functions work smoothly around the clock and over the Bond Overlay's life cycle.

c. Investment process for Bond Overlay PFTs

Bond Overlay PFTs are designed for pension funds seeking to better manage the interest rate exposure associated with their pension liabilities by increasing their fixed income exposure. In its typical form, the PFT seeks to gain exposure to long-term government bonds approximately equal to three times its cash value to provide a hedge against liabilities that are sensitive to changes in long-term interest rates. Each dollar invested commands \$3 of exposure to an index such as the FTSE Canada Long Term Provincial Bond Index.

The targeted \$3 of index exposure is broken down into physical (1\$) and derivative (2\$) components. A PFT's effective leverage ratio - total exposure divided by net asset value (NAV) - is the sum of the derivatives and physical exposure divided by the physical exposure. The PFT effective leverage ratio fluctuates with market variations. As yields fall, the ratio decreases, and vice versa when yields rise.

Economy

d. Risk management of Bond Overlay PFTs

Bond Overlay PFTs must be managed by protecting the capital base of their investors first. The investment risk sharing feature of PFTs - due to the pooling of client money, along with the levered nature of Bond Overlay mandates – means that it is a portfolio manager’s fiduciary duty to ensure the robustness of the overlay PFT’s risk controls.

Risk management of levered funds is a forward-looking exercise centered around preparedness. Bond Overlay PFTs must be prepared for any market condition. Their main risk management safeguards are:

- A rigorous, threshold-based rebalancing framework to cushion against volatility
- Hard leverage limits
- Real-time leverage monitoring, including operational preparedness

A successful bond overlay PFT is designed with a systematic leverage rebalancing framework which aims to reduce risk in weak fixed income markets. The rebalancing mechanism benefits from allowing some leverage ratio float to organically absorb regular market volatility without incurring trade costs.

With a 3x leverage target, this can take the form of “soft” thresholds creating a band (say, 2.8 to 3.1). Within that band, leverage is allowed to fluctuate with no intervention. If on periodical rebalancing dates the leverage goes above 3.1, it is rebalanced to 3 by decreasing bond exposure. If on periodical rebalancing dates the leverage falls materially below the tolerance band floor, it is rebalanced to 2.8 by adding bond exposure.

The asymmetry of thresholds creates an extra buffer against bond yield spikes to help reduce the impact of upward reversal in bond yields from lower levels, which forces deleveraging by selling bond exposure via hard rebalances in a weak market. This approach creates a natural shock absorber that decreases the probability of hitting a costly hard rebalance. Asymmetric rebalancing provides potential advantages, particularly during episodes of highly volatile but range-bound rates, as was the case during the spring of 2020 when the COVID-19 pandemic hit.

Another layer of protection is required to guard overlay PFTs against adverse market events. This other risk management safety valve includes real-time monitoring of leverage against a hard threshold that forces deleveraging. A breach of the hard leverage threshold (say 3.5x) triggers immediate action to rebalance the leverage to target.

Dynamic leverage risk control mechanisms allow for a tight management of a PFT’s exposure and help mitigate NAV risk. Establishing the level at which a hard threshold should be set is an exercise that strives to achieve an equilibrium. It’s an equilibrium between controlling risk during rare but extreme bond market selloffs and minimizing the costs associated with the trading activity which is necessary to rebalance the leverage and is induced by the noise of regular range-bound markets.

Investment

e. Investment process for segregated Bond Overlay mandates

Each segregated Bond Overlay solution is tailored to specific investment objectives. The overlay structuring process originates from a thorough understanding of a client's needs to arrive at the optimal Bond Overlay parameters in terms of several key components:

- Benchmark and bond portfolio characteristics (duration, yield, credit, etc.)
- Fixed income derivative mix
- Management process of the mark-to-market derivative exposure (collateral and liquidity)
- Leverage rebalancing framework, risk controls, monitoring and operational capacity
- Holistic risk management guidelines

Two objectives receive great attention. One is providing the required type of bond exposure at the lowest cost while considering the client's operational constraints. The other objective is defining the adequacy of collateral and liquidity and its management over time with sound risk management rules.

f. Risk Management of segregated Bond Overlay accounts

Pre-live: initial collateral requirements and top-up preparedness

Collateral is the lifeblood of segregated Bond Overlay accounts as it maintains the derivative bond exposure and prevents forced selling during market selloffs. Collateral management frameworks are designed for capital efficiency and operational robustness, striking a balance between the mandate running optimally in normal markets and staying large enough to withstand the risk of volatile markets. A collateral allocation that is too large may be capital-inefficient, while stretching it thin increases the likelihood of costly margin calls.

Combining sound initial collateral with rigorous operational top-up processes may help the mandate to function smoothly while potentially reducing the

risk of unencumbered collateral run-off. The collateral level is a function of the underlying asset's mark-to-market risk profile.

A portfolio manager sets up the target mix of physical bonds acting as collateral to the overlay exposure. Each mandate is designed with specific collateral features (target, limits, etc.), taking into consideration the portfolio's liquidity, its duration and credit risk, and operational constraints. Contingency planning is an integral component. It includes collateral and liquidity top-up operational plans (ad-hoc or systematic) to manage the requirements of the derivatives' mark-to-market collateralization and settlement processes.

Post-live date

This phase involves the monitoring and active management of the overlay derivatives' exposure, leverage, collateral and liquidity. Once the overlay unencumbered collateral falls below a certain level, the top-up process begins.

Raising collateral or liquidity is sometimes inevitable during severe bond market selloffs. It is crucial to have a well-thought-out plan for sourcing additional collateral or cash ready for swift execution. The robustness of a segregated overlay mandate's risk mitigation features and the rigour with which they are implemented determine the mandate's performance across the market cycle.

g. Bond Overlay collateral base

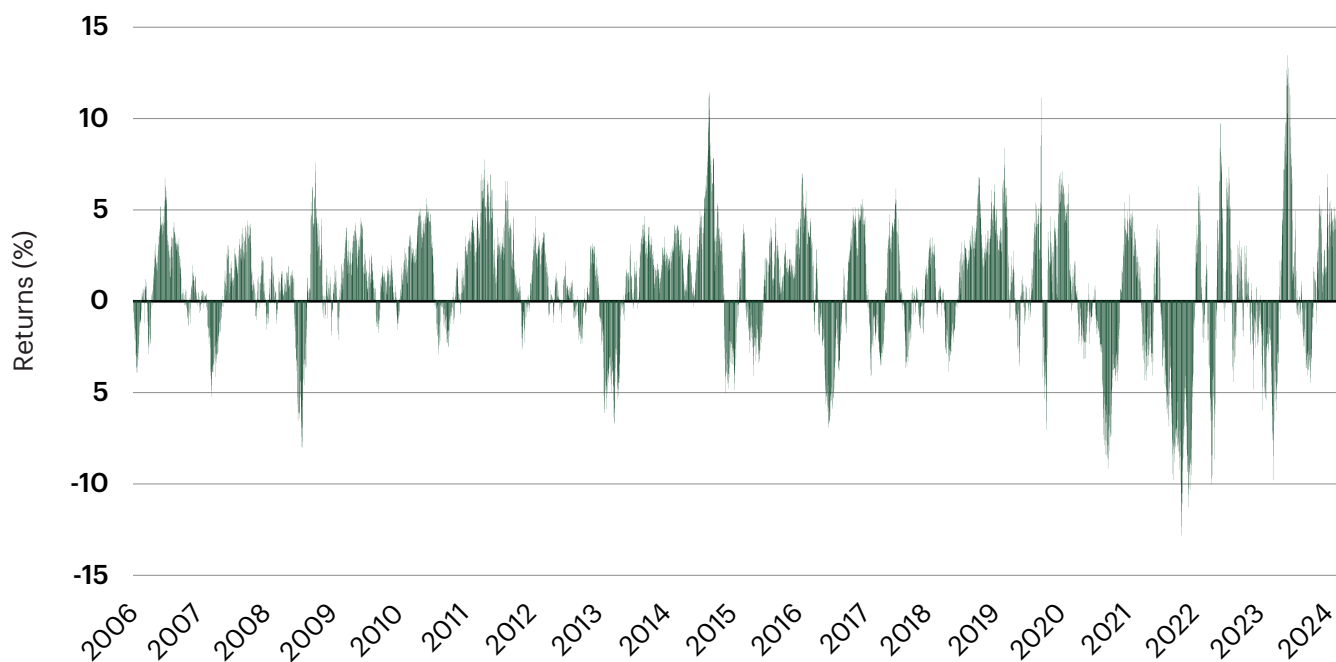
The allocated collateral level must be based on the mark-to-market risk of the underlying asset, which is a function of its expected return profile. A fixed-income derivative collateral base is impacted by the magnitude and velocity of interest rate variations. This is because the encumbered collateral backs unrealized gains or losses. Once the derivative positions are rolled (monthly or staggered on a quarterly basis), the mark-to-market is settled and collateral becomes unencumbered.

Layering derivative trades across maturities can help reduce the rollover concentration risk because

it prevents a situation where all contracts mature simultaneously. It also offers the potential benefit of lowering the assets' rolling return risk profile, in terms of volatility and amplitude of outlier returns. This property can help buffer an overlay collateral base against market volatility.

We illustrate the overlay collateral sufficiency rationale by looking at the FTSE Canada Long Term Provincial Bond Index. **Figure 8** shows the historical weighted average of staggered one-, two- and three-month index rolling returns from January 2006 to October 2024.

Figure 8: Weighted average of staggered 1-, 2- and 3-month rolling returns – FTSE Russell Long Provincial Bond Index



Source: Bloomberg Finance L.P., TDAM. As of October 31, 2024.
 Note: These numbers as estimates and approximations rather than exact calculations.

The index-staggered rolling average of the one, two- and three-month return tends to stay between +/-8%, with the outlier observations hovering around +/-12%. This analysis supports a Bond Overlay initial collateral base of about 15% of the full exposure

(physical + derivatives), where the physical bonds act as collateral for the derivative exposure and they are likely to withstand the index's normal volatility. Deeper bond market selloffs are managed by executing on the collateral top-up operational plans.

Conclusion

The world of bond derivatives is complex. However, this complexity should not deter DB pension funds from making allocations. In fact, these investors can potentially benefit from derivative-based fixed income exposure because it could help them better manage the interest rate risk of their liabilities while maintaining their return-seeking allocations. For smaller investors, PFTs might be appropriate, while larger institutions might benefit from a segregated mandate. Either way, risk management is key for unlocking the power of Bond Overlay over time and across market volatility. ■



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