

Not all fixed income is created equal: The role of fixed income sectors in liability-driven investing

- Over the last decade, many U.S. corporate plans have adopted a liability-driven investing (LDI) program. Allocations to fixed income, therefore, play a vital and unique role in corporate pension portfolios.
- A key component of an LDI program is the design of the investment portfolio's liability-hedging assets, typically composed of fixed income securities. All fixed income sectors, however, are not created equal; their hedging properties relative to U.S. corporate pension liabilities vary when considered in isolation. U.S. Treasury and U.S. investment-grade credit bonds are the optimal choices for plan sponsors to mitigate risk.
- Ultimately, the key to effective pension risk management is to ensure that the main risk characteristics of a plan's liability-hedging portfolio remain in line with those of the liability. Attention to risk management is critical; maintaining a strategic focus and understanding all potential risks can help plan sponsors navigate uncertainty.

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Introduction

Fixed income plays a vital and unique role in corporate pension investment portfolios. Over the last decade, many U.S. corporate plans have adopted a liability-driven investing (LDI) program. This helps hedge the interest rate and credit spread risk inherent in a traditional pension plan's liability by working to protect against funding status losses due to rate and credit spread changes.

A key component of an LDI program is the design of the investment portfolio's liability-hedging assets, typically composed of fixed income securities. Not surprisingly, corporate pension allocations to fixed income have increased along with the rising adoption of LDI (Dion and Gannon, 2019).

In this paper, we will use regression analysis to assess the hedging properties of some common types of fixed income to determine whether they exhibit meaningfully different hedging properties. Using this analysis, we will demonstrate that hedging properties relative to U.S. corporate pension liabilities vary among fixed income types when considered in isolation. We will explore these differences and outline our views on how best to use each type of fixed income in an LDI context.

Notes on risk

All investing is subject to risk, including possible loss of principal. Diversification does not ensure a profit or protect against a loss.

Past performance does not guarantee future results. Bond funds are subject to interest rate risk, which is the chance bond prices overall will decline because of rising interest rates, and credit risk, which is the chance a bond issuer will fail to pay interest and principal in a timely manner or that negative perceptions of the issuer's ability to make such payments will cause the price of that bond to decline. While U.S. Treasury or government agency securities provide substantial protection against credit risk, they do not protect investors against price changes due to changing interest rates. Unlike stocks and bonds, U.S. Treasury bills are guaranteed as to the timely payment of principal and interest. While U.S. Treasury or government agency securities provide substantial protection against credit risk, they do not protect investors against price changes due to changing interest rates. Unlike stocks and bonds, U.S. Treasury bills are guaranteed as to the timely payment of principal and interest. There is no guarantee that any particular asset allocation or mix of funds will meet your investment objectives or provide you with a given level of income. The performance of an index is not an exact representation of any particular investment, as you cannot invest directly in an index. High-yield bonds generally have medium- and lower-range credit quality ratings and are therefore subject to a higher level of credit risk than bonds with higher credit quality ratings. Investments in securities issued by non-U.S. issuers are subject to risks including country/regional risk and currency risk. These risks are especially high in emerging markets. Currency hedging transactions incur extra expenses, may not perfectly offset foreign currency exposures, and may eliminate any chance to benefit from favorable fluctuations in those currencies.

Background

For our analysis, we gathered data covering a 25-year period ended September 30, 2021.¹ Using benchmark proxies based on Bloomberg and FTSE indexes, we regressed monthly returns for various fixed income types against monthly returns of the FTSE Pension Liability Index.² The FTSE index calculates monthly returns using a hypothetical pension liability and a full discount rate curve representing high-quality credit bond yields, designed to estimate the effective settlement value of a plan's liability.

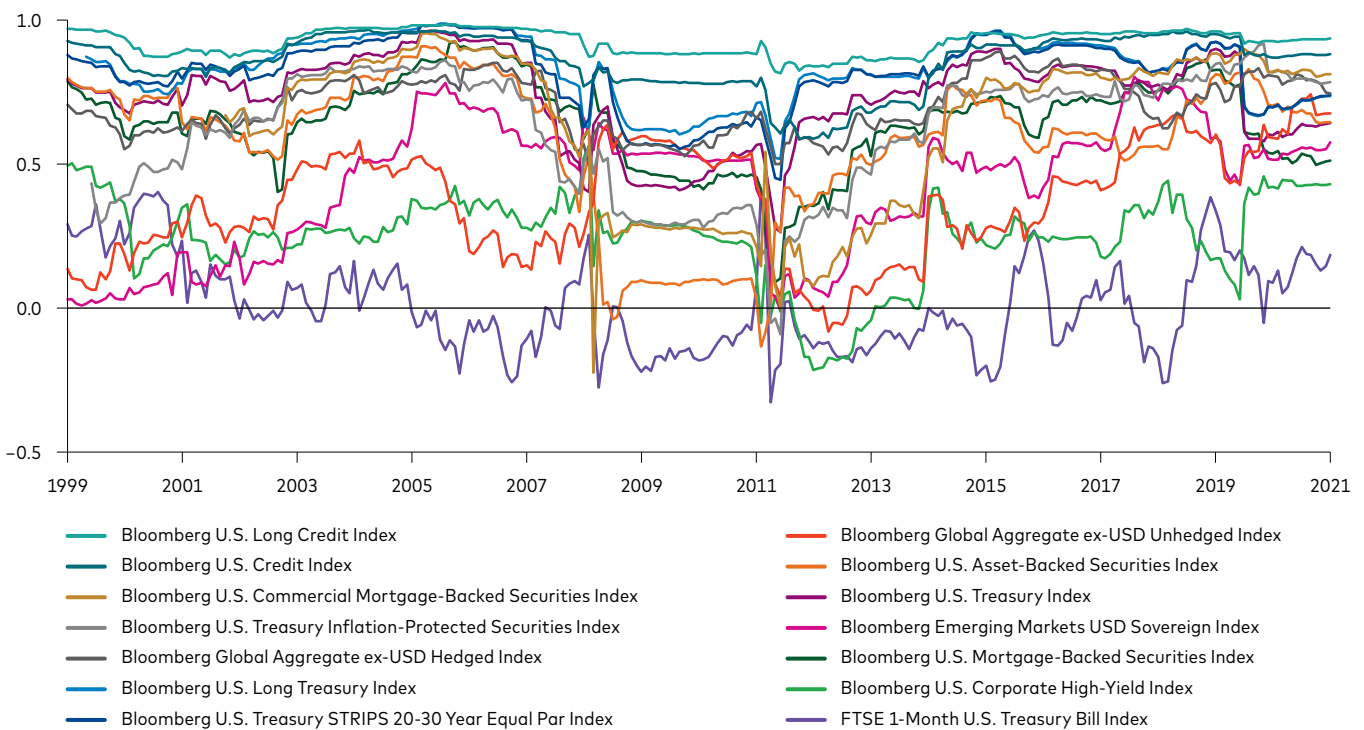
Figure 1 shows the historical three-year rolling correlation of monthly returns of each fixed income sector to the FTSE Pension Liability Index. As shown, each fixed income sector displays varying degrees of hedging impact and that impact can vary over time, which can make liability risk management challenging.

In addition to correlation, which measures the strength of a relationship between two variables, we also analyzed the R-squared and annualized tracking error of each investment type. R-squared measures how much of the variance in the FTSE Pension Liability Index can be explained through the return variance of each fixed income sector. Annualized tracking error measures the historical difference between asset and liability returns in a typical year.

Using these statistics, we show that U.S. Treasury and investment-grade credit bonds have historically provided the most efficient liability hedges. While other fixed income types may be less optimal from this perspective, exposures to broader fixed income could improve a portfolio's expected absolute risk/return profile.

FIGURE 1.

Three-year rolling monthly correlation of fixed income sectors to FTSE Pension Liability Index



Sources: Vanguard calculations based on data from Bloomberg and FTSE.

- 1 The data are based on monthly returns for each fixed income sector using benchmark proxies from October 1, 1996, through September 30, 2021, or the longest period available.
- 2 The Citi Pension Liability Index was acquired in August 2017 by FTSE Russell, a unit of the London Stock Exchange Group, and was renamed the FTSE Pension Liability Index.

U.S. Treasury bonds and STRIPS

U.S. Treasury bonds are debt instruments issued by the U.S. government. They are considered essentially free of default risk but still carry other risks associated with bond investing, particularly interest rate risk, frequently measured by a bond's duration. Interest rate risk associated with a U.S. corporate pension liability is strongly correlated to changes in Treasury rates; therefore, U.S. Treasury bonds are generally seen as effective liability-hedging instruments and are used for this purpose by many corporate plans (Gannon and Dutton, 2019).

Based on our analysis, as summarized in **Figure 2**, the historical correlation of returns of broad U.S. Treasuries with the FTSE Pension Liability Index is 0.69. This indicates a relatively strong, positive relationship. Furthermore, approximately 47% of the index's return can be explained purely through the returns of broad U.S. Treasuries.

Since many pension plans have longer durations than the broad Bloomberg U.S. Treasury Index, we also explored the relationship of a typical liability to long U.S. Treasury bonds and long-duration U.S. STRIPS (STRIPS). STRIPS are zero-coupon bonds created by separating a bond's principal and interest cash flows into individual securities. Because STRIPS are not coupon-bearing, their high duration closely matches their maturity. Because of their high duration, our research indicates that both long U.S. Treasuries and STRIPS have a stronger correlation and a higher explanatory value relative to broad U.S. Treasury bonds. **Figure 3** shows the three-year rolling correlation of the U.S. Treasury benchmarks to the FTSE Pension Liability Index.

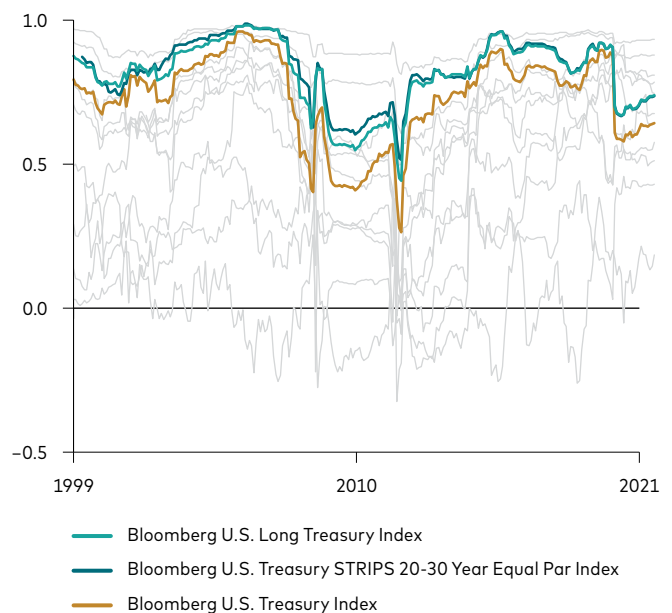
Practically speaking, many plan sponsors use a combination of long U.S. Treasury bonds and STRIPS in their liability-hedging portfolio (together with investment-grade credit, discussed next), with the specific mix customized to optimally mitigate risk from parallel and non-parallel interest rate changes (Gannon and Dutton, 2019).

FIGURE 2.
Hedging properties of U.S. Treasury bonds and STRIPS versus FTSE Pension Liability Index

	U.S. Treasury bonds	U.S. long Treasury bonds	U.S. long-duration STRIPS
R-squared	0.47	0.60	0.62
Correlation	0.69	0.77	0.79
Annualized tracking error	10.7%	8.4%	12.0%

Sources: Vanguard calculations based on data from Bloomberg and FTSE as of September 30, 2021. See Figure 1 for indexes used.

FIGURE 3.
Three-year rolling correlation of monthly returns to FTSE Pension Liability Index



Note: Three-year rolling correlations are based on returns from October 1, 1996, to September 30, 2021, using representative indexes and the FTSE Pension Liability Index.

Sources: Vanguard calculations based on data from Bloomberg and FTSE.

U.S. investment-grade credit bonds

U.S. credit consists of bonds issued by U.S. corporations or other entities perceived to have credit risk. It is commonly bifurcated into investment-grade (IG) and below-investment-grade (high-yield). IG bonds have a rating of BBB³ or higher and are generally characterized by lower default risk, higher liquidity, lower coupons, lower yields, and less price volatility than their below-investment-grade counterparts. U.S. credit bonds are issued across the maturity spectrum, traditionally ranging from 1 to 30 years.

As mentioned, U.S. corporate pension plans will generally estimate their liability settlement values (and calculate their liability values for financial reporting purposes) using a discount rate representing yields on high-quality, investment-grade bonds (typically, AA-rated corporates). An IG credit bond portfolio properly aligned to a liability's implied AA credit quality will therefore exhibit a strong correlation to that liability's returns.

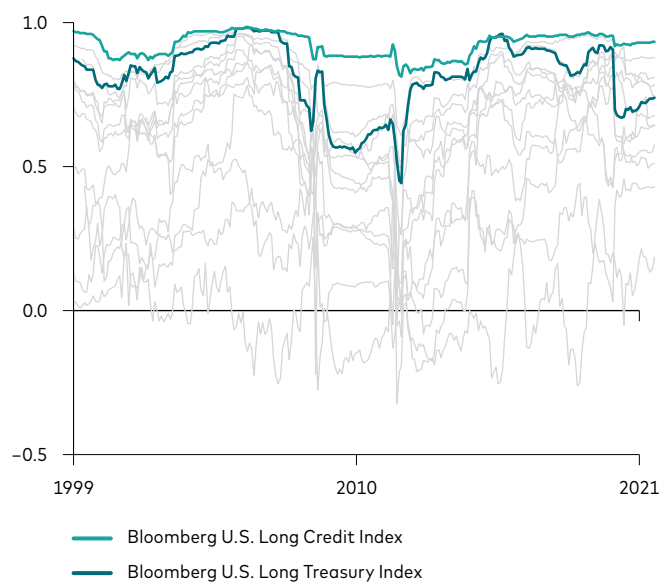
Figure 4 summarizes our analysis, showing that the historical returns of broad U.S. credit and long U.S. credit explain approximately 72% and 85% of the return variance of the FTSE Pension Liability Index. These results, particularly for long U.S. credit, are stronger than those for long U.S. Treasuries, as illustrated in **Figure 5**. This makes sense because IG credit bonds can help hedge a typical liability's interest rate and credit spread risks, whereas Treasury bonds will only hedge its interest rate risk. Pension liabilities are inherently sensitive to changes in not only risk-free interest rates but also yield spread between investment-grade credit and Treasury bonds. We refer to this risk as "credit spread risk"; allocations to credit securities help mitigate it.

FIGURE 4.
Hedging properties of U.S. investment-grade credit versus FTSE Pension Liability Index

	U.S. broad credit bonds	U.S. long credit bonds
R-squared	0.72	0.85
Correlation	0.85	0.92
Annualized tracking error	9.2%	6.0%

Sources: Vanguard calculations based on data from Bloomberg and FTSE as of September 30, 2021. See Figure 1 for indexes used.

FIGURE 5.
Three-year rolling correlation of monthly returns to FTSE Pension Liability Index



Note: Three-year rolling correlations are based on returns from October 1, 1996, to September 30, 2021, using representative indexes and the FTSE Pension Liability Index.

Sources: Vanguard calculations based on data from Bloomberg and FTSE.

³ We use Standard & Poor's rating terminology and nomenclature throughout this paper.

Blending Treasury and credit bond exposures

General industry consensus is that U.S. Treasury bonds and IG credit should play substantial roles in a typical plan's LDI program. Opinion differs about the optimal amount of Treasury bonds to include. Vanguard's view is that these bonds play a critical role in helping to avoid overexposure to credit spread risk. While a plan sponsor might want to invest the fixed income portfolio primarily in AA-rated credit bonds, this narrow approach is generally neither feasible nor desirable (Dutton and Plink, 2018). Since most IG U.S. credit is rated below AA, plan sponsors can better match a liability's implied credit quality by using a blend of credit and Treasury bonds. The proper balance will help achieve an implied level of credit spread risk similar to that of the liability and therefore best mitigate it.

Less applicable fixed income investments

In addition to U.S. Treasury and credit bonds, the fixed income sectors we explore next frequently compose a typical total return fixed income portfolio. Whether passively or actively managed, they provide diversification benefits and, at

times, give investors the ability to generate additional returns. Although these sectors can be found in LDI strategies, our research indicates that they do not provide the same level of hedging efficiency in isolation as do U.S. Treasuries and credit.

But first, a quick side note: Active management strategies, particularly in fixed income, continue to have merit, and the industry remains committed to them.⁴ Talented active managers have deep credit research teams, focus on security selection, and seek diversified alpha sources to achieve outperformance. This means that they may allocate portions of portfolios intended for liability hedging to fixed income securities that do not exhibit strong liability-hedging characteristics.

We believe this approach has value as long as the main risk characteristics of the overall strategies are transparent and behave like the asset classes they represent. An investment committee or outsourced chief investment officer must not only choose skilled active managers but also identify the proper benchmarks so the risk characteristics of the liability-hedging portfolio remain in line with underlying liability.

⁴ Source: Morningstar, Inc. One-year cash flows from traditional institutional clients into actively managed long investment-grade and long government collective trusts and U.S. open-end and exchange-traded funds totaled approximately \$2.5 billion as of September 30, 2021, and approximately \$3.5 billion as of November 30, 2021, respectively.

Non-U.S. fixed income

The risk factors that affect bond prices in the U.S. apply similarly to debt issued by entities (governments, corporations, etc.) outside of the country. An additional risk for a U.S.-based buyer of bonds denominated in other currencies to consider is currency impact, regardless of whether the investor hedges the currency risk. Since income is the largest component of long-term return in a fixed income instrument, a bond not hedged back to U.S. dollars (USD) receives a greater portion of its return from currency appreciation and depreciation and therefore will exhibit more return volatility (Dinucci et al., 2019).

Hedging a bond to USD will create an additional return component, positive or negative, that can also lead to additional tracking error. Another substantial risk associated with non-U.S. bonds stems from geopolitical or idiosyncratic country risk, especially when purchasing from less-developed countries or those facing economic and political instability. In the case of quasi-sovereign agencies, awareness of the degree of support from the guarantor is very important to understanding the inherent credit risk.

Interest rate changes in the U.S. can sometimes be correlated to rate changes in other countries, but government yields outside of the U.S. also move based on idiosyncratic regional factors. Our quantitative analysis shown in **Figure 6** indicates weaker liability-hedging characteristics for non-U.S. bonds relative to U.S. Treasuries and credit.

FIGURE 6.

Hedging properties of non-U.S. fixed income versus FTSE Pension Liability Index

	Non-U.S. bonds (hedged)	Non-U.S. bonds (unhedged)
R-squared	0.44	0.15
Correlation	0.67	0.39
Annualized tracking error	11.6%	12.4%

Sources: Vanguard calculations based on data from Bloomberg and FTSE as of September 30, 2021. See Figure 1 for indexes used.

Two additional observations:

- Correlation to the FTSE Pension Liability Index is higher for non-U.S. bonds with currency hedging than without. This is to be expected because of the index's USD orientation.
- Correlation to the FTSE Pension Liability Index is higher for hedged non-U.S. bonds than we initially expected. The vast majority of the broad aggregate ex-U.S. index is made up of government or government-related issuers.⁵ Most are invested in well-established, developed countries where credit and/or default risk is relatively low. Furthermore, since global interest rates are interconnected, and interest rate risk drives most of the risk associated with a liability, some return correlation exists. Nevertheless, from a plan sponsor's standpoint, the added risks associated with investment outside of the U.S. may make it unsuitable for an LDI program.

⁵ Source: Bloomberg as of September 30, 2021.

U.S. Treasury Inflation-Protected Securities (TIPS)

TIPS are a type of fixed income security issued by the U.S. government structured to provide investors with protection against inflation. At issuance, they provide a fixed coupon payment based on a percent of principal, similar to other standard fixed income instruments, but their principal value adjusts based on changes to the Consumer Price Index (CPI). For example, if a nominal bond is issued at par (\$1,000) with a 2% coupon paid annually, the investor will receive income of \$20 per year, even if the CPI rises by 3%. With TIPS, if the CPI rises by 3%, the price of the bond will rise to \$1,030, and the fixed coupon of 2% will then produce annual income of \$20.60 per year, allowing investors to retain purchasing power.

TIPS' characteristics do not align well with the objectives of a typical liability-hedging portfolio. Their price movement is not driven solely by changes to nominal interest rates but rather by real rates and actual inflation. Since these factors are not the main drivers of a typical pension plan's liability, the hedging characteristics are suboptimal and the tracking error is elevated relative to the plan. As shown in **Figure 7**, TIPS only explain approximately 31% of the return of the FTSE Pension Liability Index, with a correlation of less than 0.60.

FIGURE 7.
Hedging properties of TIPS versus FTSE Pension Liability Index

Inflation-protected securities	
R-squared	0.31
Correlation	0.56
Annualized tracking error	11.1%

Sources: Vanguard calculations based on data from Bloomberg and FTSE as of September 30, 2021. See Figure 1 for indexes used.

TIPS may have merit in a pension portfolio when there is an explicit need to hedge inflation risk in the liability. One example is when retiree benefit payments are indexed to inflation (which is not common in private-sector plans). Even then, TIPS may not be the most efficient approach. Over the long term, research indicates that because equities have outperformed inflation, they may offer the best way to protect against it (Bosse, 2019).

Securitized products

Securitized products are fixed income securities composed of underlying debt obligations packaged together and sold to investors in the open market. Primary types include mortgage-backed and asset-backed securities (MBS and ABS). The underlying debts in MBS, for example, are individual homeowner mortgages with similar characteristics packaged together and sold as a bundled security. As households pay their mortgages, those payments are passed through to investors in the form of interest and principal.

As shown in **Figure 8**, the historical strength of the liability hedge varies among different types of securitized instruments. The R-squared values range from 0.15 to 0.36, with an average correlation of less than 0.50. The risk associated with these investments is similar to that of other fixed income securities. However, they also have prepayment risk.

This risk results in negative convexity, which is generally not present in a typical liability. Convexity along with duration helps convey the magnitude of price change relative to changes to interest rates, particularly large ones. Pension liabilities, like most bonds, exhibit positive

convexity, while securitized products such as MBS can have negative convexity. As interest rates decline, borrowing costs fall, and individual homeowners have more of a propensity to refinance. This accelerates the principal payment paid to MBS investors sooner than expected, thereby limiting price appreciation in a declining rate environment. That dynamic tends to decrease the correlation of MBS to a typical liability, making this investment type less efficient in the context of an LDI program.

FIGURE 8.
Hedging properties of securitized products versus FTSE Pension Liability Index

	Mortgage-backed securities	Asset-backed securities	Commercial mortgage-backed securities
R-squared	0.36	0.15	0.17
Correlation	0.60	0.39	0.41
Annualized tracking error	11.9%	12.3%	12.4%

Sources: Vanguard calculations based on data from Bloomberg and FTSE as of September 30, 2021. See Figure 1 for indexes used.

Emerging-market sovereign debt

Emerging-market (EM), U.S. dollar-denominated (USD) debt is a subset of non-U.S. bonds that consists of fixed income securities issued by emerging-market governments or government agencies. Some of the largest issuers include Brazil, China, and Mexico. As of September 30, 2021, approximately 55% of the Emerging Market USD Sovereign Index was composed of investment-grade securities.⁶

Compared to broad developed-market (DM) fixed income, EM bonds are generally lower in duration and have higher yields. These characteristics, along with EM countries' improving economic fundamentals and imperfect correlations with DM bonds, can be attractive to investors. With the benefits come unique risks. Some of these include the potential for capital flight from EM—hurting country fundamentals—due to tighter monetary policy in the developed world and the risk of lower exports during a global slowdown. In other words, the overall health of the global economy is influential on EM performance.

As shown in **Figure 9**, EM debt exhibits the lowest historical correlation shown thus far with the FTSE Pension Liability Index. Again, this does not

preclude it from being included in a portfolio. In fact, many popular fixed income benchmarks tracked by liability-hedging pooled funds contain EM bonds. For example, as of September 30, 2021, the Bloomberg U.S. Long Credit Index had an allocation of approximately 6% to EM USD bonds.⁷ (EM bonds can also be denominated in a currency other than USD, although they will contain currency risk.) When a plan is underfunded, most active risk is better sourced from larger allocations to equities with the purpose of closing the funding gap.

FIGURE 9.
Hedging properties of emerging-market sovereign debt versus FTSE Pension Liability Index

Emerging-market bonds	
R-squared	0.12
Correlation	0.35
Annualized tracking error	14.0%

Sources: Vanguard calculations based on data from Bloomberg and FTSE as of September 30, 2021. See Figure 1 for indexes used.

⁶ Source: Bloomberg.

⁷ Source: Bloomberg.

Fixed income sectors that miss the LDI mark

Based on our research, high-yield fixed income and cash provide little to no hedging capabilities relative to a typical U.S. corporate pension liability. However, like the sectors highlighted in the previous section, they can play a role in a total return strategy, and high-yield can, to a small degree, be added to an LDI strategy to increase alpha potential.

U.S. corporate high-yield bonds

High-yield bonds are debt securities that carry a credit rating of below-investment-grade. Also known as junk bonds, they offer higher yields than investment-grade bonds to incentivize investors to assume greater credit risk. Their issuers are deemed less creditworthy based on financial metrics and other assessments.

Although high-yield bonds are issued by corporations, they are priced by the market much differently than investment-grade bonds because different factors drive their long-term performance. Investment-grade credit can be materially affected by movements in both credit spreads and interest rates. In contrast, interest rate changes usually have less effect on high-yield bonds.

In fact, high-yield bonds have historically had a higher correlation to equity⁸ because, like equity, their performance is primarily based on the viability of the issuer. This makes them suboptimal for liability hedging. We also believe they are suboptimal as return-seeking assets relative to equity. If they are held to maturity, an investor's return will be capped at interest and principal while remaining fully exposed to downside risk.

High-yield debt has a low historical correlation to the FTSE Pension Liability Index, as shown in **Figure 10**, explaining less than 10% of the index's return. Because it is less sensitive to changes in interest rates and has a higher correlation to equity, it is a suboptimal liability hedge.

FIGURE 10.
Hedging properties of U.S. corporate high-yield bonds versus FTSE Pension Liability Index

High-yield bonds	
R-squared	0.07
Correlation	0.26
Annualized tracking error	13.8%

Sources: Vanguard calculations based on data from Bloomberg and FTSE as of September 30, 2021. See Figure 1 for indexes used.

⁸ Sources: Vanguard calculations are based on data from Bloomberg. From October 1, 1996, to September 30, 2021, the correlation of high-yield bonds to U.S. equities was 0.67. This calculation is based on monthly returns. U.S. high-yield debt is represented by the U.S. Corporate High-Yield Index. U.S. equities are represented by the Dow Jones U.S. Total Stock Market Index (formerly known as the Dow Jones Wilshire 5000 Index) through April 22, 2005, the MSCI U.S. Broad Market Index through June 2, 2013, and the CRSP U.S. Total Market Index thereafter.

Cash

Cash and cash equivalents are often viewed as the most conservative investments. They provide capital preservation but low return expectations over time. The biggest risk to cash is a loss of purchasing power. While they can provide nominal stability in times of rising inflation, cash positions may not be able to keep pace. Their primary use in total-return portfolios is for capital preservation. This does not, however, apply to a liability-driven investment strategy for a corporate pension plan. In fact, based on our analysis, shown in **Figure 11**, cash historically has had one of the highest tracking errors relative to the index. Furthermore, it is the only investment analyzed that shows no statistical significance with 95% confidence.

Cash is a low-risk asset in a total return framework but not in an LDI program. A pension plan's liability continues to increase over time, holding changes to market rates constant. As each year passes, the liability accretes, or grows, by the plan's discount rate, which is based on the market rates of high-quality corporate bonds.

Because credit bonds carry more risk than cash, the annual growth of the liability will generally be greater than that of cash (Bosse and Klein, 2018). Plan sponsors may be fully funded and have

enough assets to pay liabilities today, but the return of cash likely won't keep pace with the return of the liability, eroding funding status over time.

Additionally, cash is the ultimate short-duration investment. When interest rates fall, the liability value will likely increase while the cash portfolio remains unchanged. Even moderate moves lower in longer-maturity interest rates could have a substantial negative impact on funding status. Generally, plan sponsors hold cash for short-term liquidity to cover benefit payments or to adjust risk exposure when using a derivatives overlay strategy (Dion and Dutton, 2020).

FIGURE 11.
Hedging properties of cash versus FTSE Pension Liability Index

	Cash
R-squared	0.00
Correlation	0.04
Annualized tracking error	13.2%

Sources: Vanguard calculations based on data from Bloomberg and FTSE as of September 30, 2021. See Figure 1 for indexes used.

Private credit

Interest in private credit (debt) has gained momentum over the last several years as global investors search for yield in a low-interest-rate environment. In the private debt market, assets are lent to private companies by nonbank institutions, and capital commitments are generally required for a number of years. As with traditional fixed income, lenders invest capital in companies in exchange for interest payments and the eventual return of principal.

Private debt is generally less liquid and ranges in structure and credit risk. Furthermore, the market is relatively small, with an inefficient secondary market often resulting in poor price discovery and therefore opaque valuations. Certain investors are drawn to private debt

because of the higher yields demanded to compensate for higher credit and liquidity risks. Depending on the segment of the market, they can pursue improved diversification or capital appreciation strategies.

Despite the range of strategies in private debt and questions about its potential meaningful correlation with standard liability, its illiquid nature often makes its inclusion in a pension plan with a finite life difficult. Because of higher liquidity risk, allocations to private credit may be disruptive for plans contemplating derisking strategies, plan termination, or significant changes in strategy. Because of the complexity and idiosyncratic risks of these instruments, investors should complete rigorous due diligence when selecting private credit for a traditional pension plan.

FIGURE 12.

Hedging properties of fixed income sectors in relation to FTSE Pension Liability Index

Fixed income sector		R-squared	Correlation	Annualized tracking error
U.S. Treasury bonds and STRIPS	U.S. Treasury bonds	0.47	0.69	10.7%
	U.S. long Treasury bonds	0.60	0.77	8.4
	U.S. long-duration STRIPS	0.62	0.79	12.0
U.S. investment-grade bonds	U.S. broad corporate bonds	0.72	0.85	9.2
	U.S. long corporate bonds	0.85	0.92	6.0
Non-U.S. fixed income	Non-U.S. bonds (hedged)	0.44	0.67	11.6
	Non-U.S. bonds (unhedged)	0.15	0.39	12.4
U.S. Treasury Inflation-Protected Securities (TIPS)	Inflation-protected securities	0.31	0.56	11.1
Securitized products	Mortgage-backed securities	0.36	0.60	11.9
	Asset-backed securities	0.15	0.39	12.3
	Commercial mortgage-backed securities	0.17	0.41	12.4
Emerging-market sovereign debt	Emerging-market bonds	0.12	0.35	14.0
U.S. corporate high-yield bonds	High-yield bonds	0.07	0.26	13.8
Cash	Cash	0.00	0.04	13.2

Sources: Vanguard calculations based on data from Bloomberg and FTSE as of September 30, 2021. See Figure 1 for indexes used.

Conclusion

Private corporate pension plan sponsors have a range of potential portfolio strategies and products from which to choose. Vanguard believes that these plans should consider adhering to an LDI program in the fixed income portion of their portfolio to mitigate asset liability risk. Based on our analysis, a mix of U.S. credit bonds and U.S. Treasuries customized to the interest rate and credit spread characteristics of a specific pension liability will align well with that liability. Such a customized mix has historically helped plan sponsors reduce asset-liability tracking error.

While other types of fixed income, managed either actively or passively, have less optimal liability-hedging characteristics on a standalone basis, they may still have merit in a pension portfolio. Although they can increase asset-liability tracking error, they also provide an opportunity to outperform the liability's growth to improve funding status over the long term. Similarly, cash embodies a different risk profile than that of a standard liability. While it can help a plan meet liquidity needs, it will likely fail to keep up with liability growth over time and is a poor interest rate hedge.

Ultimately, the key to effective pension risk management is to ensure that the main risk characteristics of a plan's liability-hedging portfolio remain in line with those of the liability. Attention to risk management is critical; maintaining a strategic focus and understanding all potential risks can help plan sponsors navigate uncertainty.

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