Managing Pension Liability Credit Risk: *Maintaining a Total Portfolio Perspective*

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Widening credit spreads during the 2007–2008 credit crisis significantly impacted pension fund liabilities and funding ratios. U.S. interest rates fell over 100 basis points (bps) in the 15-month period ending September 30, 2008, while pension discount rates rose. Pension discount rates increased over this period because corporate bond credit spreads widened over 200 bps—more than offsetting the drop in interest rates—and pension liabilities are discounted using yields on high-quality corporate bonds. Rising pension discount rates caused the present value of pension liabilities to decrease, buoying pension funding ratios as equity markets fell severely. Plan sponsors who implemented liability hedges via interest rate swaps and/or Treasuries saw their liability hedge appreciate in value as interest rates fell. Their liability has actually decreased in value, however, as corporate bond yields and the corresponding pension discount rates rose, causing, in this case, a liability-hedging gain.

The widening of credit spreads during the credit crisis has raised a very important question for those who have implemented a liability-driven investing (LDI) solution or are considering LDI: How should a plan sponsor manage the risk of corporate bond credit spreads widening or narrowing? I believe many practitioners have taken too narrow a view of this question and have evaluated liability credit risk as a pure liability-hedging issue. The main point of this article is that in order to construct efficient LDI solutions and avoid poor funding ratio outcomes, it is essential to view the liability credit risk from a total portfolio perspective inclusive of the "risky" asset component (i.e., equities) of an LDI solution.

This article is not an endorsement for including a credit spread in pension liability discount rates. I agree with the economists who argue that there is no economic justification for doing so. In fact, incorporating a credit spread leads to chronic underfunding on a riskless basis and, as discussed in detail throughout this article, makes it more difficult to hedge liability discount rate risk. However, the current regulatory environment does utilize a credit spread in pension discount rates, and this article should be viewed as a guide for how best to manage credit spread risk for plan sponsors who choose to incorporate it.

UNDERSTANDING PENSION LIABILITY DISCOUNT RATE RISK

I start with an in-depth discussion of pension liability discount rate risk. The present value of a liability is determined in two steps—establishing the cash flow profile of expected benefit payments and then discounting the future payments at the appropriate discount rate. Liability return is the change in the present value of liabilities from one period to the

next and is primarily attributable to two sources: 1) the passage of time and 2) changes in the discount rate. Liability risk is the volatility of liability returns and is primarily driven by changes in the discount rate.[1]

Of course, the liability return will depend on the discount rate used. According to the Pension Protection Act (PPA) and the Financial Accounting Standards Board (FASB), expected pension benefit payments are to be discounted using a discount curve that is based on the yields of high-quality corporate bonds. Any change in the high-quality corporate bond yield curve will change the discount curve, which in turn will change the present value of the liability. Changes in the corporate bond yield curve can be decomposed into changes in the LIBOR interest rate swap curve and in the corporate bond credit spread curve, relative to LIBOR. Therefore, I can split liability discount rate risk into interest rate risk (i.e., the risk of the LIBOR interest rate swap curve changing) and credit risk (i.e., the risk of corporate bond credit spreads, relative to LIBOR, changing).

I define interest rate risk as the risk of any change in the LIBOR interest rate swap curve. I chose the LIBOR interest rate swap curve instead of the Treasury curve because it is an extremely liquid, customizable, and capital-efficient tool for implementing interest rate hedges for pension liabilities. Further, I believe the LIBOR interest rate swap curve is sufficiently free of credit risk for my purposes.[2] Exhibit 1 highlights, for the period from January 1, 1998, to September 30, 2008, the liability returns for a typical pension liability profile based on a corporate bond discount curve and compares them with the LIBOR interest-rate-swap-based component of liability returns. I will refer to this same roughly 10-year period throughout the article as the aggregate period. Ideally, the swap-based liability return should match the corporate-bond-based liability return. If it did, interest rate swaps could be used to hedge corporate-bond-based pension liabilities. However, Exhibit 1 indicates that swaps are a good hedge in most periods, but not a perfect match. The correlation between the two returns was approximately 0.78 for the entire period.

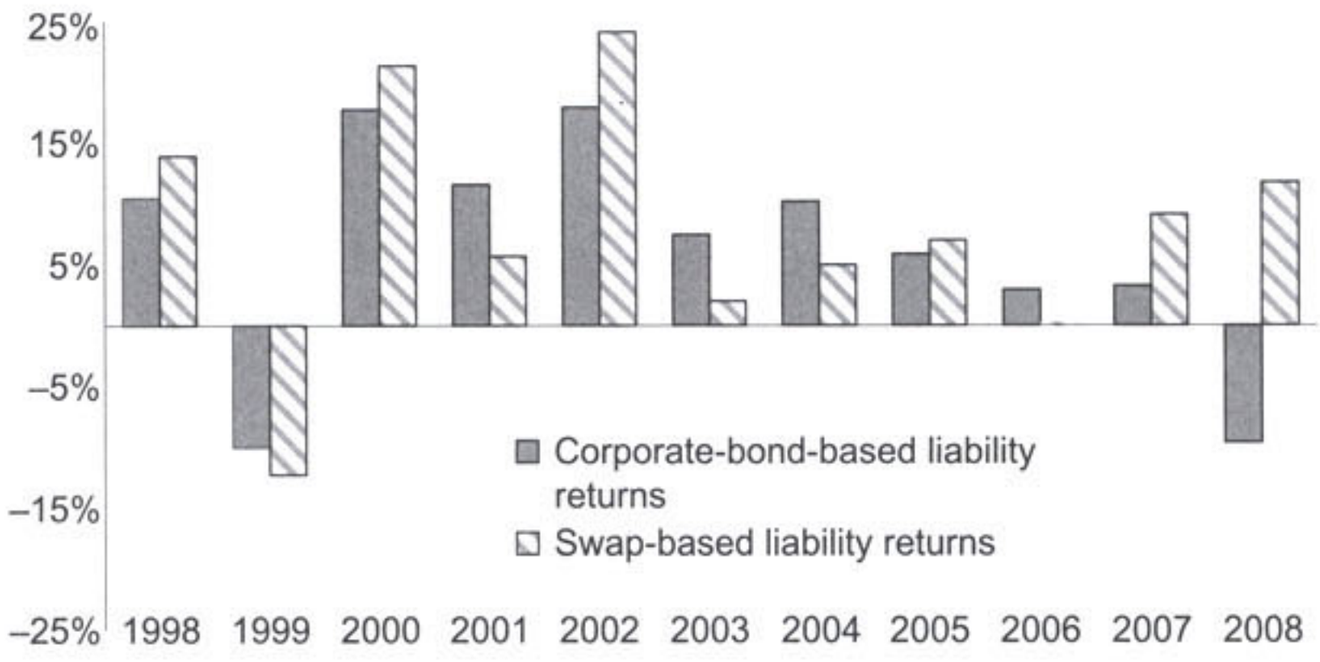
The difference between the corporate-bond based liability returns and the swap-based liability returns in Exhibit 1 is attributable to the corporate bond credit risk embedded in the liability discount curve, which does not exist in the LIBOR interest rate swap curve. I refer to this component of corporate-bond-based liability return as liability credit return and the volatility of these returns as liability credit risk.

When the spread between the corporate-bond-based liability discount curve and the LIBOR interest rate swap curve widens or narrows it causes either a positive or negative liability credit return. For example, when corporate bond spreads widen, the liability credit return will be negative because, all else equal, higher corporate bond credit spreads increase pension discount rates and lower the present value of liabilities. The large negative liability credit returns in 2007–2008 highlight the impact of credit spreads widening during the 2007–2008 credit crisis. In contrast, when corporate bond credit spreads narrow, liability credit returns will be positive as, all else equal, lower corporate bond credit spreads decrease pension discount rates and increase the present value of liabilities. This was the case in 2003–2004.

Exhibit 2 tracks the liability discount rate spread over the aggregate period for the same typical liability profile analyzed in Exhibit 1. This spread represents, for a typical liability profile, the difference between the corporate-bond-based liability discount rate and a LIBOR interest-rate-swap-based discount rate. If this liability discount spread were stable no volatility would be observable in liability credit returns. However, the liability discount spread is not stable and is the cause for the volatility of the mismatch in returns shown in Exhibit 1.

EXHIBIT 1

Corporate-Bond based vs. Swap-based Liability Returns, January 1, 1998–September 30, 2008

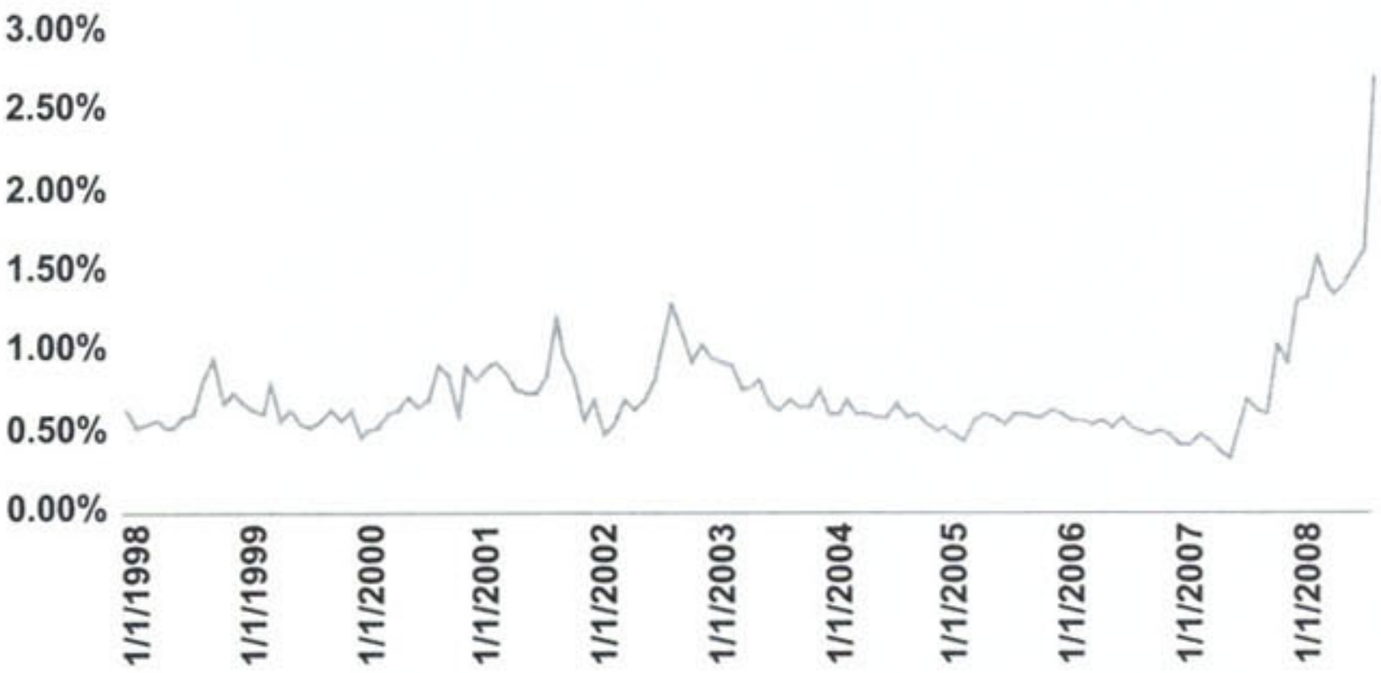


Notes: Liability returns are based on the cash flows underlying the iBoxx U.S. Pension Liability Index-Aggregate Member; the cash flows have a duration of approximately 13 years when a 6% discount rate is used. For discounting, the corporate-bond based liability returns utilize a simulated A–AAA corporate-bond based yield curve, and the swap-based liability returns utilize the interest rate swap curve.

Sources: Citigroup, Markit, UBS.

EXHIBIT 2

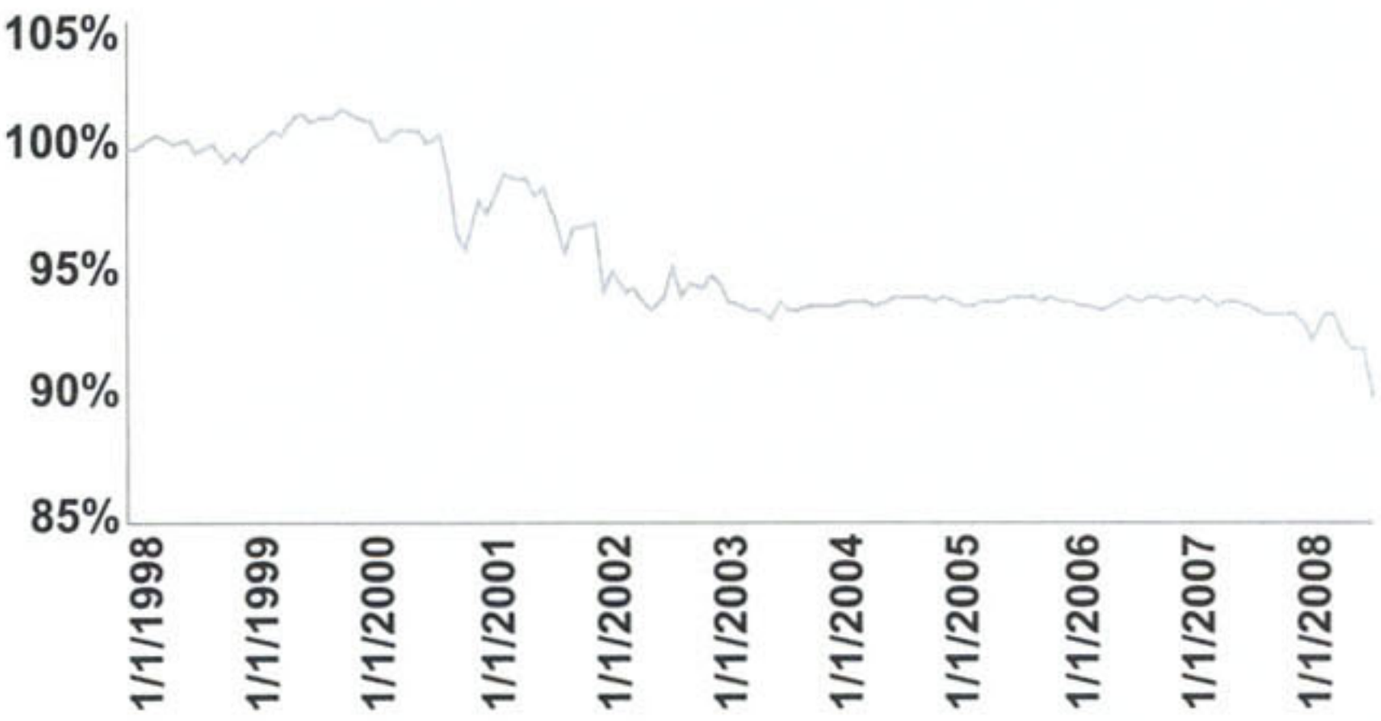
Liability Discount Rate Spread, January 1, 1998–September 30, 2008



Sources: Citigroup, Markit, UBS.

EXHIBIT 3

Funding Ratio for Long-Duration Corporate Bond Immunization Strategy



*Notes: Funding ratio (end of year) = Funding ratio (beginning of year) * (1 + Funding ratio return). The funding ratio return is equal to the annualized monthly funding ratio returns. The monthly funding ratio returns are calculated as (asset return – liability return)/(1 + liability return). For more details on measuring and interpreting funding ratio performance, see Leibowitz, Kogelman, and Bader [1991]. Asset returns are equal to the returns of the Barclays Capital Long Credit Index, which includes bonds rated A or better. Liability returns are based on the cash flows of a blend of 70% iBoxx U.S. Pension Liability Index-Retired Member and 30% iBoxx U.S. Pension Liability Index-Active Member, which produces a duration of approximately 11 years when a 6% discount rate is used. For discounting, the liability returns utilize a simulated A–AAA corporate-bond-based yield curve. Benefit payments are ignored and no service cost or contributions are assumed.*

Sources: Barclays, UBS, Citgroup.

Interestingly, credit spread risk tends to partially offset interest rate risk. In other words, in most periods when interest rates have risen (fallen), credit spreads have narrowed (widened). For example, during the 2000–2002 recession, pension discount rates fell approximately 160 bps due to interest rates falling approximately 240 bps. The drop in interest rates was partially offset by an 80 bps widening in corporate bond spreads. For the period between the 2000–2002 recession and the 2007–2008 credit crisis, pension discount rates remained roughly the same. However, during this period, interest rates rose by approximately 100 bps. Coincidentally, credit spreads narrowed by an almost perfectly offsetting amount resulting in no change to pension discount rates. As previously mentioned, the 2007–2008 credit crisis witnessed pension discount rates rising by 100 bps despite interest rates falling by an equal amount (100 bps). This is explained by a credit-spread widening of 200 bps, more than offsetting the drop in interest rates. So although credit spread risk tends to offset interest rate risk, importantly, it is difficult to tell whether it will partially, fully, or more than offset interest rate risk.

Liability credit risk can be thought of as corporate bond credit risk. However, there is one very important difference: *corporate bond returns are investable whereas liability credit returns are not*. This point is relevant for any pension liability benchmark that uses corporate bond yields to discount liabilities (i.e., the Pension Protection Act discount curve or the Citigroup Pension Liability Discount Curve). Essentially, the issue is that corporate-bond-based liability returns are not subject to default and downgrade risk, whereas any investment in corporate bonds certainly is.

For example, consider a plan that, in an effort to immunize itself, invests in the corporate bonds that underlie the pension discount curve. What happens if a bond in the portfolio defaults during the next month? The asset portfolio certainly takes a loss on that position. The liability return will not be exposed to the loss, however, because the pension discount curve simply kicks that bond out of its universe and the discount curve used at the end of the month to revalue the liability may actually decrease (as the weakest bond is dropped from the index), causing the liability to increase in value.

To illustrate the uninvestable nature of corporate-bond-based liability returns, I tracked the funding ratio over the aggregate period for a hypothetical pension plan that invested 100% of plan assets in long-duration corporate bonds with the same duration and credit profile as their liability. Exhibit 3 highlights the performance of this hypothetical plan's funding ratio, which starts at 100% and finishes at 90%. It is evident that this corporate bond investment strategy, which is subject to default and downgrade risk, will not be able to keep up with the uninvestable corporate-bond-based liability benchmark that is not subject to default and downgrade risk. The point to be made is not that corporate bonds have no place in managing liability risk, but rather that they are far from risk free.

IMPROVING THE EFFECTIVENESS OF THE LIABILITY HEDGE

There is no simple solution to the liability credit risk problem. Because liability credit returns are not investable, liability credit risk can only be managed as opposed to eliminated. To show how it can be managed, I will start by analyzing two options for adding investment-grade corporate bond credit risk to the portfolio to improve the effectiveness of an interest-rate-swap-based liability hedge. I will analyze investment-grade corporate bonds and an investment-grade credit default index (CDX).

In addition to analyzing these assets and their liability credit risk management potential over the aggregate time period, I split the aggregate period into three subperiods, which isolate three credit events, and analyze each of the assets within these three subperiods:

1. April 1, 2000–September 30, 2002, liability discount spread widened 80 bps.
2. October 1, 2002–June 30, 2007, liability discount spread narrowed 100 bps.
3. July 1, 2007–September 30, 2008, liability discount spread widened 240 bps.

To evaluate the increase in effectiveness of the liability hedge, I used, as a frame of reference, the effectiveness of the swap-based hedging strategy illustrated in Exhibit 1. Exhibit 4 summarizes the performance of the swap-based strategy over the entire period as well as the three subperiods and compares it with a corporate-bond-based hedging strategy and a swap-plus-CDX hedging strategy.

As discussed earlier and illustrated in Exhibit 3, corporate bonds will not perfectly match liability returns. Exhibit 4 summarizes the performance of the same long-duration corporate bond portfolio relative to the same liability returns over the aggregate period as well as the three subperiods. Because the bond portfolio was constructed to match the interest rate risk and credit risk profiles of the liability benchmark, the difference in

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EXHIBIT 4

Comparison of Hedge Effectiveness, January 1, 1998–September 30, 2008

		Swap-Based Hedge			Corporate Bond Hedge			Swaps + CDX		
Period	Liability Return	Return	Correlation with Liability Return	Tracking Error	Return	Correlation with Liability Return	Tracking Error	Return	Correlation with Liability Return	Tracking Error
4/1/00–9/30/02	41%	50%	77%	5.7%	34%	87%	3.7%	N/A	N/A	N/A
10/1/02–6/30/07	30%	11%	97%	2.6%	27%	99%	1.0%	N/A	N/A	N/A
7/1/07–9/30/08	–4%	23%	–10%	12.6%	–8%	99%	2.3%	7%	15%	12.7%
Aggregate	83%	113%	78%	6.0%	65%	96%	2.1%	N/A	N/A	N/A

Notes: Liability returns are based on the cash flows underlying a blend of 70% iBoxx U.S. Pension Liability Index-Retired Member and 30% iBoxx U.S. Pension Liability Index-Active Member, which produces a duration of approximately 11 years when a 6% discount rate is used. For discounting, the liability returns utilize a simulated A–AAA corporate-bond-based yield curve. The swap-based hedge returns utilize the same cash flow profile that underlies the liability returns and utilizes the interest rate swap curve for discounting purposes. The corporate bond hedge returns are equal to the returns of the Barclays Capital Long Credit Index, which includes bonds rated A or better. The swaps + CDX returns are equal to the swap-based hedge returns plus the return of a 5-yr investment-grade CDX scaled to match the duration of the liability. Correlations are based on monthly returns and tracking errors are annualized based on monthly differences between the various hedge returns and the liability returns.

Sources: Barclays, UBS, Citgroup, Markit, Bloomberg.

performance is attributable to differences in the uninvestable component of liability credit returns.

During economically stressful periods such as the 2000–2002 recession and the 2007–2008 credit crisis, corporate bonds underperformed the liability benchmark as downgrades and defaults inflicted a drag on the assets, but not the liabilities. Overall, the tracking error to liabilities is relatively low across all periods of time compared to a swap-based hedge and, in an absolute sense, very low during relatively good economic periods. For the aggregate period, corporate bonds would have increased the effectiveness of a liability hedge as the tracking error, which can be thought of as funding ratio volatility, fell from 6.0% to 2.1%. Essentially, the vast majority of the risk that remains was attributable to the uninvestable nature of corporate-bond-based pension liability returns.

Thus far, the analyses of corporate-bond-based hedges have been limited to investment-grade bonds with a credit rating that is representative of the credit risk in pension discount curves—an A or better credit rating. In order to improve diversification or yield, some may consider expanding to incorporate weaker-rated bonds. Generally, weaker credit in hedging assets is expected to offer worse relative performance during bad economic environments and should be utilized with caution. Most importantly, weaker credit will experience more defaults and downgrades during bad economic periods, such as the 2000–2002 recession, precisely the time when sponsors can least tolerate hedging losses.[3]

In summary, a corporate-bond-based hedge would have clearly improved the effectiveness of the liability hedge. However, more importantly, a corporate-bond-based hedge only improved funding ratio outcomes during good economic periods and resulted in far worse outcomes during the economically stressful periods. Further, and most importantly, for plans that are heavily invested in risky return-generating assets (i.e., equities) that perform poorly during economically stressful periods, investing liability-hedging assets in corporate bonds would have exacerbated the funding ratio pain during these stressful periods. This issue is discussed in more detail later.

Corporate bonds require full capital investment, but a credit default swap provides a capital-efficient way to introduce investment-grade corporate credit into a portfolio. To illustrate this, exposure to an investment-grade CDX was added to the swap-based hedge to evaluate any incremental improvement in hedging effectiveness. Exhibit 4 summarizes the results for the 2007–2008 credit crisis (because the CDX started in March 2004, data is not available for the other time periods).

Adding the CDX actually offers little improvement to the effectiveness of a swap-based hedge. During the 2007–2008 period, although correlation has increased, the tracking error actually increased modestly to 12.7%. And, for the sake of a fair comparison, over the entire March 2004–September 2008 period, the tracking error of a swap-based hedge and a swap-plus-CDX hedge were 7.2%, and 6.8%, respectively. Although the addition of the CDX to the swap-based hedge improved the effectiveness of the hedge over the March 2004–September 2008 period, it does so by a very modest amount. This is a bit surprising given that CDX exposure is meant to be representative of corporate bond credit. However, there are a few reasons why using the CDX has its limitations for improving the effectiveness of a pension liability hedge.

First, a significant amount of basis risk exists between the CDX and its underlying corporate bonds. During the 2007–2008 credit crisis, as seen in Barclays [2008], this basis risk has taken the form of a very large negative basis where corporate bond yields are approximately 250 bps higher when compared to the equivalent credit default swaps (CDS) on the same names. Second, CDX instruments are only liquid up to 5-year maturity periods, while pension liabilities exist well past 30 years. Therefore, when using a CDX to duration-match the credit exposure of pension liabilities, the credit hedge will be significantly exposed to changes in the shape and slope of the credit spread curve. Lastly, the CDX investment-grade index has a great deal of exposure to BBB-rated bonds. These BBB bonds are of weaker credit than the average corporate bonds underlying pension discount curves, which typically do not include bonds below an A rating. In summary, thus far, the CDX has not been able to increase the effectiveness of a swap-based hedge.

MAINTAINING PERSPECTIVE

Portfolio theory says the optimal manner for managing LDI solutions in an ideal world is to split the asset portfolio into two separate components: 1) a liability-hedging component and 2) an efficient-return-generating component. The liability-hedging component can be implemented in a capital-efficient manner via derivatives, allowing the majority of capital to be deployed in excess-return-generating strategies. And, if all of the liability risks are perfectly hedged, the return generation

component can be constructed, in isolation, in an asset-only framework.

However, corporate-bond-based pension liabilities cannot be perfectly hedged in a capital-efficient manner. In addition, the return generation portfolio often contains exposures to risks that are correlated with the interest rate risks and credit risks of the liability benchmark—this is especially true during periods of economic stress. So, the return-generating assets have some hedging characteristics, and the line between the liability-hedging component and the return-generating component must be blurred. A plan sponsor must manage LDI solutions in a total portfolio context, while considering the risks of return generation and how they correlate with the risks of the liability. Staying within the scope of this article, I will focus my attention on how return-generating assets correlate with the credit risk component of pension liabilities. To do so, I will analyze two common return-generating strategies that, I believe, should be considered when managing liability credit risk: high-yield bonds and equities.

I would expect returns on both high-yield bonds and equities to have a positive correlation with liability credit returns. High-yield bond returns behave like liability credit returns because high-yield spreads are positively correlated to investment-grade bond spreads. And equity returns tend to be poor in economic environments where credit spreads widen, as investors price in a higher equity-market risk premium. I will begin by evaluating, for a typical liability profile, how effectively equities and high-yield bonds would have hedged liability credit risk by analyzing the correlation of equity and high-yield bond returns with liability credit returns over all periods (Exhibit 5).

Correlations for equities and high-yield bonds were positive for all periods and quite high during the 2007–2008 credit crunch. For the aggregate period, correlation of equities and high-yield bonds to liability credit returns were 0.36 and 0.42, respectively. However, in order to better understand the hedging effectiveness, I squared the correlations and translated these into R-squared statistics of 0.13 and 0.18, respectively. The R-squared statistics indicate that equity and high-yield bond excess returns explained just 13% and 18%, respectively, of the variance in liability credit returns. These low R-squared statistics indicate that neither equities nor high-yield bonds are an effective hedge for liability credit risk.

But what should a plan sponsor do if they have a large allocation to equities or high-yield bonds? In my view, it is crucial to understand and incorporate the behavior of equities and high-yield bonds in a plan sponsor's liability credit-risk management program, because, even though the short-term connection between equities, high-yield bonds, and credit is not stable, it does tend to be positive and, during periods of economic stress, equities often fall and credit spreads often widen. Understanding and managing what happens to pension liabilities and assets during periods of economic crisis is essential to effective pension risk management. After all, facing a declining funding ratio in a weak economic environment is an uncomfortable scenario for both plan participants and plan sponsor.

EXHIBIT 5

Performance of Risky Assets Relative to Liability Credit, January 1, 1998–September 30, 2008

			Equities—Excess returns over cash					High-Yield Bonds—Excess returns over cash				
					Spread Duration (yrs)					Spread Duration (yrs)		
Period	Change in Liability Discount Spread	Liability Credit Return	Return	Correlation with Liability Credit	Estimate	90% Confidence Interval		Return	Correlation with Liability Credit	Estimate	90% Confidence Interval	
4/1/00–9/30/02	0.8%	−8%	−49%	0.40	12	1	22	−13%	0.17	12	−3	9
10/1/02–6/30/07	−1.0%	18%	74%	0.48	20	10	29	52%	0.16	20	−2	10
7/1/07–9/30/08	2.4%	−27%	−24%	0.68	9	4	15	−15%	0.83	9	5	10
Aggregate	2.1%	−20%	−7%	0.36	10	5	14	2%	0.42	10	4	8

Notes: Liability credit returns are equal to the compounded monthly differences between corporate-bond-based liability returns and swap-based liability returns. Liability returns are based on the cash flows underlying the iBoxx U.S. Pension Liability Index-Aggregate Member, which have a duration of approximately 13 years when a 6% discount rate is used. For discounting, the corporate-bond-based liability returns utilize a simulated A–AAA corporate-bond-based yield curve and the swap-based liability returns utilize the interest rate swap curve. Excess equity returns and excess high-yield bond returns are equal to the compounded monthly returns of the S&P 500 Total Return Index and Merrill Lynch High Yield Bond Index, respectively, over LIBOR. Correlations are based on monthly returns. Spread duration statistics were determined using regression analyses. The dependent variable was the monthly excess return of the respective asset class over LIBOR and the independent variable was the monthly change in the pension discount spread as illustrated in Exhibit 2.

Sources: Barclays, UBS, Citgroup, Markit, Bloomberg.

To this end, Exhibit 5 also includes the excess returns and spread durations of equities and high-yield bonds across all periods. During the 2000–2002 period, credit spreads widened by 80 bps while equities and high-yield bonds performed poorly. During this period, if a plan sponsor had hedged its liability with interest rate swaps, it would have had a hedging gain of 8% as a swap-based hedge outperformed the corporate bond-based liability; this may have raised questions about the effectiveness of the liability hedge. It is crucial, however, to maintain perspective and to also incorporate what happened to the return generation portfolio. Consider a sponsor with a significant allocation to equities. That sponsor would have had equity losses, which more than offset the hedging gain. If the same sponsor had added significant credit risk to its hedging portfolio, it could have experienced a hedging loss at the same time equities were falling—a very unfavorable funding ratio outcome.

Another example is the 2007–2008 credit crisis, which was a more extreme case of how a high credit-quality hedge could have helped sponsors in a difficult time. As reported in Exhibit 5 and discussed earlier, credit spreads widened over 240 bps from July 2007 through September 2008, causing a swap-based hedge to outperform the corporate-bond-based liability by 27%. Some have asserted this swap-based hedge was ineffective, but my view is that, with equities returning 24% below cash during this stressful period, a swap- or Treasury-based hedge provided funding ratio protection to plan sponsors with large allocations to equities just when they needed it the most.

On the flip side, a good example of a period with little economic stress is the years from 2002 through 2007. During this time, credit spreads narrowed by 100 bps and, not surprisingly, risky assets performed well. Spread narrowing led to, for swap-based hedges, a hedging loss of approximately 18%. Such a loss would certainly have been painful if viewed in isolation, but when viewed in a total portfolio context, the returns to risky assets, such as equities, more than made up for the hedging loss experienced; the period was actually quite kind to plan sponsors.

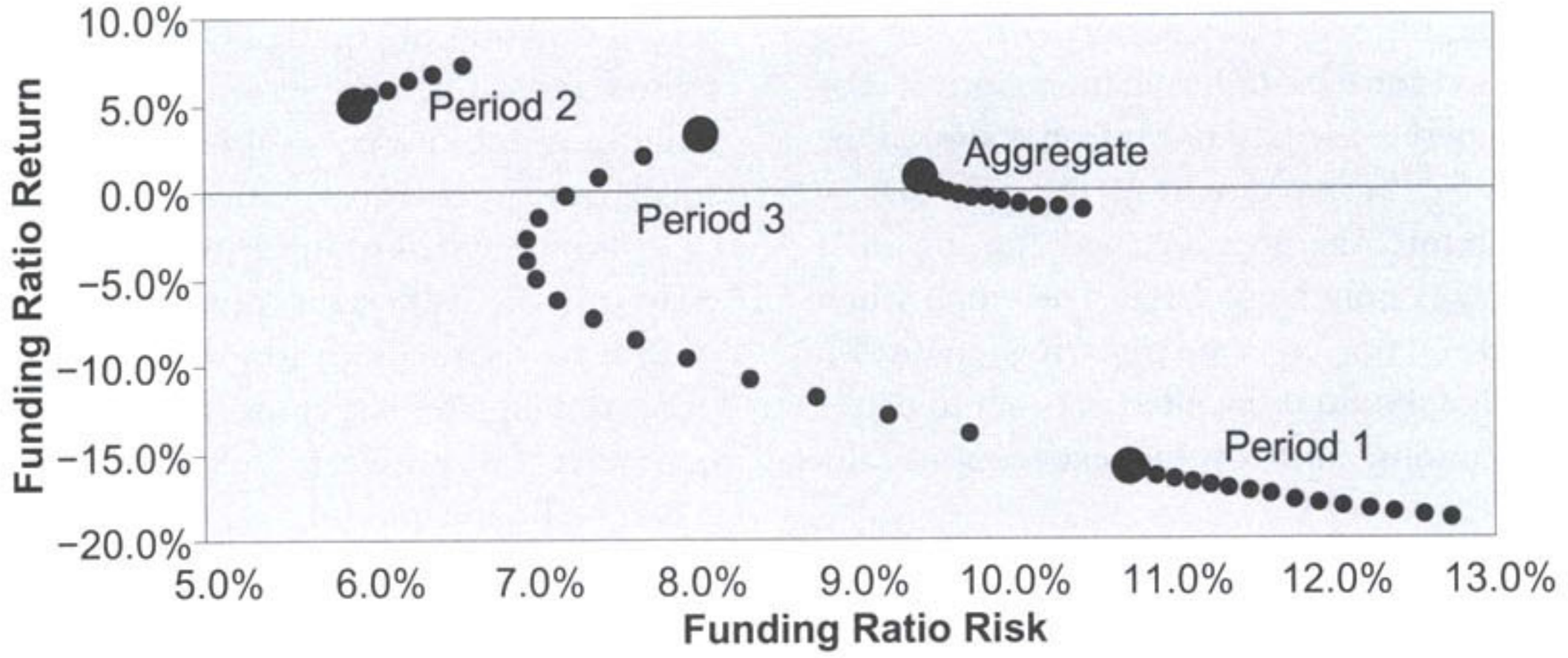
In addition, the spread durations of equities and high-yield bonds are positive across all time periods. This supports the idea that risky assets, such as equities and high-yield bonds, should not be ignored when setting a liability credit-hedging strategy. However, even though the data support assuming a positive spread duration for equities and high-yield bonds, the wideness of the 90% confidence intervals indicates that spread duration is not determinable with a high degree of certainty. In the case of equities, the spread duration has been consistently large and roughly in line with the 10–15-year spread duration of most pension liabilities. Thus, for sponsors with the majority of their assets allocated to equities, I can hypothesize that the equities would have offset the majority of liability credit returns and that adding credit exposure to the liability-hedging portfolio may have offered little in terms of reducing total portfolio risk relative to the liability.

FOCUS ON THE FUNDING RATIO

As suggested earlier, in order to achieve the best funding ratio outcomes, the construction of the liability-hedging component of the portfolio must be integrated with the construction of the return generation component. This is true for any of the manageable liability risks—interest rate, credit, inflation, or wage growth risk. I will focus on the credit risk component of liability risk. In order to analyze liability credit risk in a total portfolio context, I will evaluate the performance, across all four periods, of various approaches to credit risk management by focusing on what matters most—the plan's funding ratio.

Consider a pension fund that has an asset allocation of 65% equity and 35% liability-hedging assets. I assume the liability-hedging assets are invested in cash plus interest rate swaps that hedge 75% of the liability's interest rate risk.[4] While maintaining the 65% allocation to equities, I then evaluate the impact on the plan's funding ratio risk and return of adding credit risk to the liability-hedging portfolio until I attain a 75% credit hedge. I do this by first moving the physical hedging assets from cash to the long-duration corporate bond strategy I have been modeling throughout the article. Then, when the 35% physical liability-hedging assets are exhausted, I assume it is possible to get synthetic exposure to long-duration corporate bonds via a total return swap where the pension fund pays LIBOR and receives the total return on the long-duration corporate bond strategy. In the current environment, based on my knowledge, no investment bank today is willing to offer such a total return swap on a long-duration corporate bond portfolio. However, I assume I can implement this hypothetical total return swap in order to analyze the potential impact of adding additional credit exposure beyond the fixed-income allocation. Results for all four time periods are summarized in Exhibit 6.

EXHIBIT 6
Impact of Adding Credit Risk to the Liability Hedge



Notes: Funding ratio risk is the annualized standard deviation of monthly funding ratio returns. Funding ratio returns are equal to annualized monthly funding ratio returns. Monthly funding ratio returns are calculated as (asset return − liability return)/(1 + liability return). Equity returns are equal to the return of the S&P 500 Total Return Index. Returns of the long-duration corporate bond strategy are equal to the returns of the Barclays Capital Long Credit Index, which includes bonds rated A or better. Cash returns are equal to LIBOR. Interest rate swap returns are equal to the return of a blend of 70% iBoxx U.S. Pension Liability Index-Retired Member and 30% iBoxx U.S. Pension Liability Index-Active Member minus LIBOR. Liability returns are based on the cash flows of a blend of 70% iBoxx U.S. Pension Liability Index-Retired Member and 30% iBoxx U.S. Pension Liability Index-Active Member, which has a duration of approximately 11 years when a 6% discount rate is used. For discounting, the liability returns utilize a simulated A–AAA corporate-bond-based yield curve. Benefit payments are ignored and no service cost or contributions are assumed.

Sources: Barclays, UBS, Citgroup, Markit, Bloomberg.

Please note that each time period's starting point (0% credit hedge) is indicated on Exhibit 6 by large circles.

The large allocation to equities, which adds additional risk in the form of credit risk, actually increases the funding ratio risk for all of the periods analyzed except for the most recent period (Period 3), the 2007–2008 credit crisis. This may be surprising given that, in isolation, corporate bonds had a lower tracking error, relative to liability returns, than did interest rate swaps. This finding supports my previously stated hypothesis—for plans invested 65% in equities, adding credit risk to the hedging portfolio offers little in terms of reducing funding ratio volatility, because equities have enough spread duration to offset the vast majority of liability credit risk.

Although in Period 3 modest levels of credit hedging reduced funding ratio volatility, the funding ratio outcome was, as expected, much worse for all levels of credit hedging. In general, during times of economic stress, adding credit will make painful periods more painful and good periods even better (i.e., Period 2). Further, at very high levels of credit hedging, credit exposure exacerbated the bad outcomes during bad periods and the good outcomes during good periods.

Most importantly, regardless of the size and composition of the risky asset portfolio, adding credit risk to the liability hedge only leads to better funding ratio outcomes during good economic periods when credit spreads are narrowing, and leads to significantly worse outcomes when sponsors can tolerate it the least—during periods of economic stress. Therefore, I recommend that, from a long-term policy perspective in which I assume a world where credit spreads are fairly valued and not expected to narrow, plan sponsors should avoid credit risk in the liability hedge. I also recommend, from a tactical perspective, adding credit risk to the liability hedge in order to improve funding ratio outcomes when credit spreads are deemed wide and are expected to narrow.

TACTICAL CONSIDERATIONS

Essentially, regardless of the size and composition of the risky asset portfolio, adding credit to the liability hedge before credit spreads narrow and removing credit from the liability hedge before credit spreads widen will improve funding ratio outcomes. Late 2008 was a good example of a market environment when consideration should have been given to tactically adding credit to the liability hedge.

As of October 31, 2008, a corporate-bond-based discount rate would have been approximately 350 bps higher than an interest-rate-swap-based discount rate. This is extremely large relative to the historical average of 75 bps for the aggregate time period I analyzed. During more normal economic periods when the discount rate spread is around the historical average of 75 bps, credit spreads can only narrow so much and, therefore, the potential hedging loss on a swap-based hedge can only be so large. Therefore, when spreads are normal and not expected to narrow, credit risk in the liability hedge should be avoided in order to better protect the plan's funding ratio for the next economically stressful period.

However, with pension discount spreads at 350 bps, sponsors with swap- or Treasury-based hedges may experience a significant drop in the funding ratio if credit spreads narrow significantly. For example, for the typical liability profile I have analyzed in this article, all else equal, liability discount spreads narrowing 275 bps back to the historical average would result in a liability credit return of 43%. So, for plan sponsors concerned about the impact of spreads narrowing and large liability credit returns, how much credit risk should be added to the liability hedge in order to mitigate the damage?

Consistent with the analysis presented in the article, it is my view that this decision must be made in a total portfolio context and is, therefore, dependent on the size and composition of the risky asset portfolio. First, assume there is no risky asset portfolio and the sponsor is looking to immunize the plan's funding ratio. Consistent with the plan sponsor's level of conviction regarding the amount spreads will narrow, a commensurate amount of the asset portfolio should incorporate a liability credit hedge. If there is absolute conviction that spreads will narrow, then 100% of the asset portfolio should include a liability credit hedge. But what should a plan sponsor with only 35% of assets allocated to liability hedging and 65% allocated to equities do? In this case, the expected spread duration of equities must be factored into the decision of how much credit risk to add to the liability hedge.

Based on the spread duration statistics discussed in Exhibit 5, it is reasonable to assume that equities have a spread duration roughly equal to that of most pension liabilities; approximately 10 years. Using this assumption, I would limit the amount of assets allocated to liability credit hedging to the size of the liability-hedging portfolio. In other words, depending on the level of conviction regarding the amount spreads will narrow, I would allocate a commensurate proportion of the 35% liability-hedging assets to liability credit-hedging assets and assume the other 65% of liability credit returns are offset by the spread duration of equities. Of course, as previously discussed, it must be understood that the spread duration of equities is not known with certainty and that it may be smaller or larger than assumed.

It is clear that sponsors potentially face bad funding ratio outcomes if credit spreads narrow. And for those with little or no allocation to risky assets, the scenario of narrowing credit spreads is even scarier, because they have fewer risky assets to help offset large liability credit returns. Therefore, when credit spreads are deemed extremely wide and likely to narrow, I recommend integrating, on a tactical basis, credit risk as part of the liability-hedging component to mitigate the funding ratio damage that may occur in a narrowing credit spread scenario. The amount of credit risk to add is a function of the size and composition of the risky asset portfolio as well the level of conviction that exists that credit spreads will narrow. As mentioned earlier, however, plan sponsors must be aware of the risks that come with adding credit exposure to liability-hedging assets. If credit spreads continue to widen, defaults and downgrades increase, and equities perform poorly, having credit risk in the hedging portfolio will increase the funding ratio pain.

For plan sponsors who decide to tactically add credit risk, it is imperative that they have a strategy in place to reduce overall credit risk to policy levels as credit spreads narrow to normal levels. By having a strategy in place, plan sponsors can take advantage of opportunistic times to move from the tactical position into the policy position. For example, as credit spreads narrow and hit certain triggers, plan sponsors should move by predetermined amounts from corporate-bond-based hedging tools into interest swaps and Treasuries. By doing so, as conditions return to normal and credit risk is reduced, I believe plan sponsors will be better protected for the next economic downturn.

CONCLUSIONS

Whereas managing liability interest rate risk via interest rate swaps and/or Treasuries is relatively straightforward, managing liability credit risk is more challenging for three important reasons. First, liability credit is not investable, because corporate bonds are subject to default

risk and liability returns are not. Second, no capital-efficient risk management tool exists; synthetic exposure to a CDX has been an ineffective hedge of liability credit risk. And third, a stable connection exists between liability credit returns and the returns of risky assets, especially during periods of economic stress when risky assets perform poorly and credit spreads widen. Therefore, in order to construct efficient LDI solutions and avoid poor funding ratio outcomes, it is essential to view the liability credit spread risk from a total portfolio perspective inclusive of the risky asset component of an LDI solution.

As a general rule, regardless of the size and composition of the risky asset portfolio, from a long-term policy perspective, plan sponsors should avoid having credit risk in the liability hedge. For sponsors who wish to immunize or who hold few risky assets, adding credit should significantly increase the effectiveness of the liability hedge. But this reduction in tracking error comes with a cost—the exposure to bad funding ratio outcomes during periods of economic stress. For sponsors with large allocations to risky assets, adding credit to the liability hedge offers little in terms of funding ratio risk reduction and exacerbates the bad funding ratio outcomes during periods of economic stress, because risky assets perform poorly while, at the same time, the liability hedge underperforms.

From a tactical perspective, however, funding ratio outcomes can be improved by tactically managing the credit profile of the liability hedge; that is, adding credit to the liability hedge when conviction is strong that credit spreads will narrow, and then removing credit from the liability hedge as credit spreads narrow back to normal levels. Importantly, when adding credit, the amount of credit risk taken must be appropriately scaled in view of the total portfolio context.

ENDNOTES

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[1]For most pension plans, the biggest component of liability risk is the impact of a change in the discount rate. Changes in the expected benefits themselves as well as liability "noise" can also cause volatility in the liability. See Meder and Staub [2006], Bookstaber and Gold [1988], Ezra [1991], and Leibowitz, Kogelman, and Bader [1991] for details.

[2]Whether the interest rate swap curve is credit risk-free can be debated, but two big differences between corporate bonds and interest rate swaps allow me to assume interest rate swaps have little credit risk. First, unlike a corporate bond for which principal is at risk until maturity, swaps only exchange interest payments. Second, using Treasuries, the counterparty collateralizes any mark-to-market gain on a swap position within a few days of the gain.

[3]For example, for the 2000–2002 period, the aggregate default rate for A-rated bonds was 0.3% versus 1.8% for BBB-rated bonds. See Moody's [2008] for details.

[4]In general, for sponsors with large allocations to equities, hedging liabilities beyond 70% to 80% offers little incremental risk reduction benefits and can expose the fund to large collateral calls in rising interest rate environments.

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