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“RISK-FREE” LIABILITIES EFFICIENT PENSION MANAGEMENT REQUIRES THE RIGHT BENCHMARK

By Chad Hueffmeier and Shirley Cheung

Traditional pension asset allocations contain so much risk that the details of the “liability benchmark” have been largely ignored. In the new pension paradigm, private plan sponsors (sponsors) are considering immediate reductions in risk and/or developing dynamic de-risking strategies that reduce risk as their plan becomes better funded. In either case, sponsors need to build their strategies around a “risk management liability” benchmark because it drives both risk allocation and de-risking decisions.

Neither accounting nor funding liabilities should be used to manage risk. Although these measures have migrated toward “mark-to-market” liabilities, the rules are still somewhat arbitrary and do not facilitate efficient risk management. In fact, the methodologies used to develop hypothetical spot curves, the survivor bias, the credit spread duration, and the smoothing mechanisms embedded in these measures are impossible to hedge.

Furthermore, a risk management liability should not arbitrarily contain credit spread risk. As sponsors “de-risk” their plans, the inclusion of credit spreads in the benchmark would essentially deem credit as “riskless” and would artificially bias sponsors toward taking only one type of risk—credit risk.¹ In fact, sponsors should use a risk management liability benchmark based on accumulated benefits that are measured with “risk-free” rates. This would avoid the unnecessary bias towards credit risk and allow sponsors to continue taking advantage of diversification as pensions are de-risked.

PENSION RISKS

There is a clear distinction between the two primary types of risk within defined benefit pension plans—*demographic* risks, which are inherent in liabilities, and *investment* risk, which is driven by the sponsor’s financing strategy. These risks are ultimately addressed in two distinct ways:

- **Demographic risks²**—Sponsors can pay a premium to a counterparty to transfer the risk. Note that arbitrary regulations and/or negotiations (e.g., lump sum rules) can sometimes lead to artificially low prices, which could be considered negative risk premiums.

- **Investment risks**—Sponsors can invest in a manner that *guarantees* a given asset will be available to pay a given benefit payment. For purposes of managing investment risks, the benefit payments are presumed to be certain.

CAPITAL REQUIRED TO “DEFEASE” PENSION RISKS

Sponsors may fully “defease” the financial risk of pensions by either transferring pension liabilities to a third party in exchange for a premium (e.g., group life annuities); or retaining pension liabilities, paying a third party to transfer demographic risks (hence, “locking in” required benefit payments), and hedging benefit payments with pension assets. While transferring liabilities currently requires the lesser capital³ of these two options, relatively few sponsors may have the opportunity to transfer liabilities because we estimate the annual U.S. annuity capacity to be less than 2 percent of outstanding U.S. corporate pension liabilities.⁴ Consequently, the majority of sponsors will likely retain their liabilities and manage investment risk more deliberately.

In addition, demographic risks tend to be recognized over decades, not within the time horizon in which management is typically concerned about risk. Consequently, a third strategy many sponsors might consider is to retain pension liabilities and hedge *expected* benefit payments. (If sponsors target the capital required to hedge expected benefit payments, they could still monitor their ability to use the liability transfer option as their funded status improves.) For the rest of this discussion, we can ignore demographic risk and treat expected benefit payments as certain.

PENSION PROTECTION ACT (PPA) LIABILITIES DO NOT FACILITATE CASH FLOW MANAGEMENT

In the past, U.S. contribution requirements for qualified plans provided sponsors with relatively stable contributions compared to the amount of risk that was being taken in plans. Contributions were still quite volatile, but not nearly as volatile as mark-to-market gains/losses. Funding regulations accom-

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plished this by masking risk with smoothing mechanisms (e.g., asset smoothing, amortization of gains and losses and plan amendments over periods ranging from five to 30 years, etc.).

In the new pension paradigm, economic risk related to pensions is relatively transparent due to the migration toward marking-to-market assets and liabilities. This leads sponsors to make more conscious decisions about risk, which often results in taking less risk. When that happens, the smoothing mechanism in funding regulations can be counterproductive and actually increase cash flow volatility. Hence, U.S. funding regulations have evolved to give sponsors the ability to use or not to use some limited smoothing. However, the regulations still make it impossible to fully manage the plan's cash flow risk.

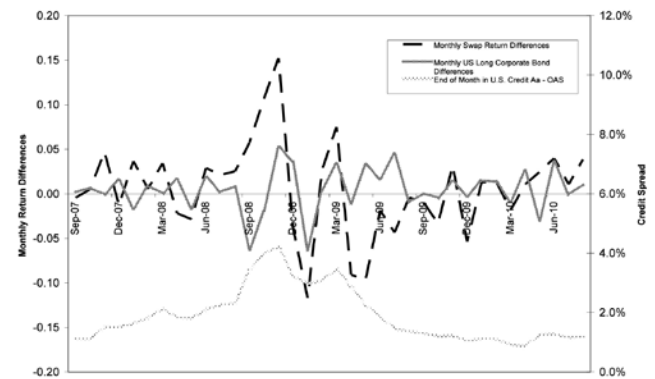
The Pension Protection Act (PPA) of 2006 lets sponsors use "spot rates" to measure pension liabilities. In theory, measuring pension liabilities using spot rates should enhance sponsors' ability to manage cash flow risk and economic risk. However, the methodology used to develop the "PPA curve" blends Aaa-, Aa- and A-rated corporate bond yields averaged over the previous month. This means PPA liabilities, and hence contribution requirements, cannot be fully hedged for the following reasons:

- **Hypothetical spot curve:** The PPA curve is a product of methodology and does not reflect an investible portfolio.⁵
- **Survivor bias:** The PPA curve only contains "survivors." As bonds are downgraded, they are simply no longer incorporated when developing the PPA curve. An actual asset portfolio would experience losses from defaults and downgrades.
- **Credit spread duration:** There simply are not enough long maturity corporate bonds available for sponsors to get long maturity credit exposure.
- **Smoothing:** By definition, "market smoothing" does not reflect market values, so the averaging methodology used over the previous month cannot be hedged.

The graph below illustrates how monthly returns of "duration matched" asset portfolios deviated from the monthly returns on a PPA liability⁶ from September 2007, the first month for which the IRS published the PPA spot curve, through August 2010. We have illustrated two hypothetical asset portfolios:

1. Swap Portfolio, a portfolio of cash plus fixed-for-floating swaps with notional exposures aligned with projected benefit payments, and
2. Long Corporate Bond Portfolio, a portfolio perfectly replicating the Barclay's U.S. Long Corporate Bond Index. Note that the Barclays U.S. Long Corporate Index tracked closer to our PPA liability than other long duration fixed income benchmarks over this period.

Using the PPA Liability as a Benchmark



A perfect hedge for the PPA liability on this graph would show a 0 percent deviation. Any deviations above and below the horizontal axis indicates the portfolio would have "tracking error"⁷ relative to the PPA liability. The tracking error of the Swap Portfolio and the Long Corporate Bond Portfolio was 18- and 9-percent, respectively, over this period.

In addition, the graph shows the option-adjusted Aa spread over the same period. This illustrates the inverse relationship

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between changes in credit spreads and portfolio performance relative to the PPA liability. Although both asset portfolios are “duration matched,” they have less “credit spread duration” than the PPA liability. Consequently, when credit spreads widen, these asset portfolios tended to outperform liabilities and vice versa.

ACCOUNTING LIABILITIES—BETTER BUT STILL UNHEDGEABLE

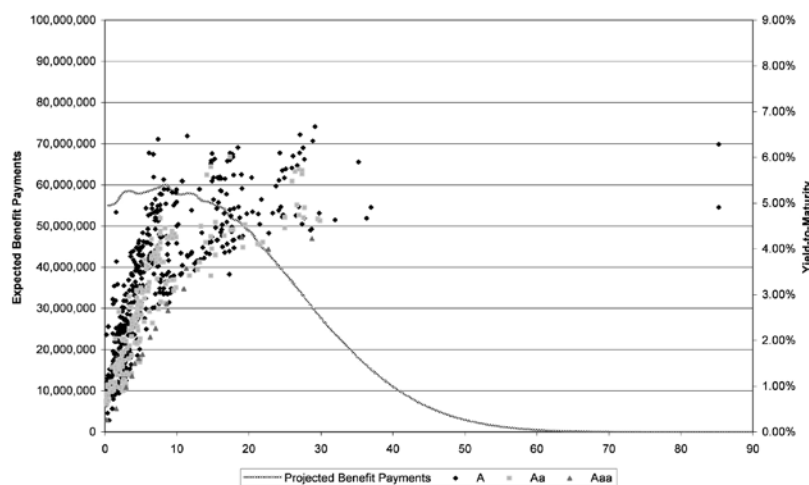
Absence of smoothing: Accounting standards measure pension liabilities on a basis that is more representative of the current economic environment than PPA, because the standard does not require smoothing over the previous month. Pension assets used for balance sheet purposes are reported at market value, and liabilities are measured using rates derived from the prevailing high quality corporate bonds.⁸

The key difference in the rates used to measure accounting liabilities from PPA rates is the absence of smoothing and the methodology used to estimate the spot curves.⁹ In order to provide a direct comparison of how well the Swap Portfolio and the Long Corporate Bond Portfolio track accounting liabilities (measured with the Citigroup Pension Liability curve) versus PPA liabilities, the summary below reflects only the period from September 2007 through August 2010. While these portfolios better track accounting liabilities, a considerable amount of tracking error still exists.

Benchmark	Portfolio Tracking Error (Sept '07 – Aug '10)	
	Swap	Long Corporate Bond
PPA Liability	18%	9%
Accounting Liability	15%	5%

Inability to hedge “credit spread duration”: A significant portion of the residual tracking error is driven by the “credit spread duration” mismatch. The graph below illustrates the number of high-quality U.S. corporate bonds that existed as of Aug. 31, 2010. The vast majority of corporate pensions would need bonds of at least 20 years to maturity to hedge liabilities. At the time, there were only 57 bonds issued with a total par value of \$49 billion that had a maturity greater than 20 years.¹⁰ This amount pales in comparison with the estimated pension liabilities for the S&P 500 of \$1.6 trillion as of Aug. 31, 2010.¹¹

High Quality U.S. Corporate Bonds



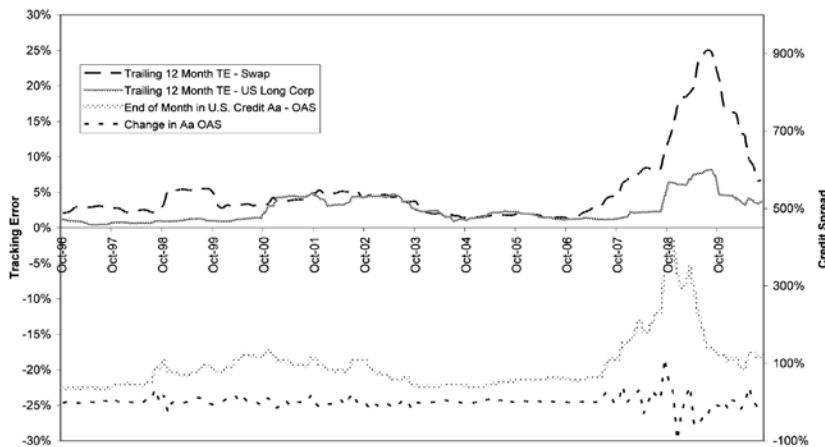
Source: Bloomberg as of Aug. 31, 2010

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// THERE IS OFTEN A MISPERCEPTION THAT THE PROJECTED BENEFIT PAYMENTS COULD BE HEDGED WITH A PORTFOLIO OF HIGH-QUALITY CORPORATE BONDS WITH A MARKET VALUE EQUAL TO ACCOUNTING LIABILITIES. //

When fixed income managers construct long-duration portfolios, they are largely limited to long-duration treasuries/agencies and/or interest rate derivatives that contain inadequate credit spread exposure to hedge accounting liabilities. Hence, there is a credit spread duration mismatch.¹² The graph below illustrates the relationship between Aa credit spreads¹³ and the tracking error of the Swap Portfolio and the Long Corporate Bond Portfolio relative to accounting liabilities from October 1996 through August 2010.¹⁴

Using the Accounting Liability as a Benchmark



When credit spreads are “tight,” changes in credit spreads are relatively small, so both portfolios track accounting liabilities fairly well. This indicates the majority of liability volatility is driven by risk-free rates when credit spreads are tight. Even during moderate credit spread environments (e.g., January 1999 through September 2003), both portfolios hedge the majority of liability volatility.

On the other hand, when credit spreads are wide (e.g., July 2007 through December 2009), they can vary significantly.

Hence, a significant amount of liability volatility is driven by credit spreads and the Swap Portfolio no longer tracks liabilities well.

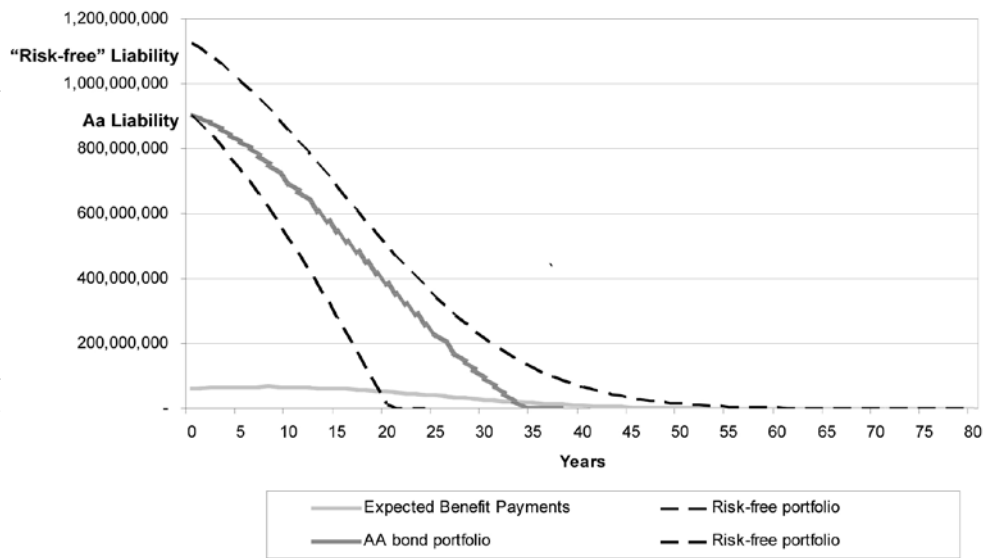
Although the Long Corporate Bond Portfolio does track accounting liabilities better when credit spreads are wide, the higher tracking error associated with the Swap portfolio could be considered “good tracking error.” If credit spreads were hedged with the Long Corporate Bond Portfolio prior to credit spreads widening, the asset portfolio and liabilities would both decrease. On the other hand, if credit spreads were not hedged, only the liabilities would have decreased as a result of credit spreads widening so the tracking error in the Swap Portfolio would have been beneficial.

Survivor bias: The PPA curve and accounting curves are developed independently from one period to the next. As a result, they don’t reflect losses that would have been created by bonds that were downgraded over the period. There is often a misperception that the projected benefit payments could be hedged with a portfolio of high-quality corporate bonds with a market value equal to accounting liabilities. However, this portfolio would be insufficient to pay for the projected benefit payments, because the portfolio would inevitably have defaults and/or downgrades (i.e., technical defaults).

In order to illustrate this concept, we have modeled portfolios invested in Aa bonds and in risk-free bonds in connection with our sample pension liabilities, on both a deterministic basis (using assumptions for defaults on Aa bonds published by Moody’s¹⁵) and a stochastic basis using the GEMS® Economic Scenario Generator.¹⁶ The first graph is based on the deterministic forecast. In this example, the liability for this stream of payments measured on a Aa basis is approximately \$900 million. If a \$900 million portfolio could be cash-flow matched with Aa bonds, the portfolio would be expected to run out of money in 35 years (assuming no future contributions).

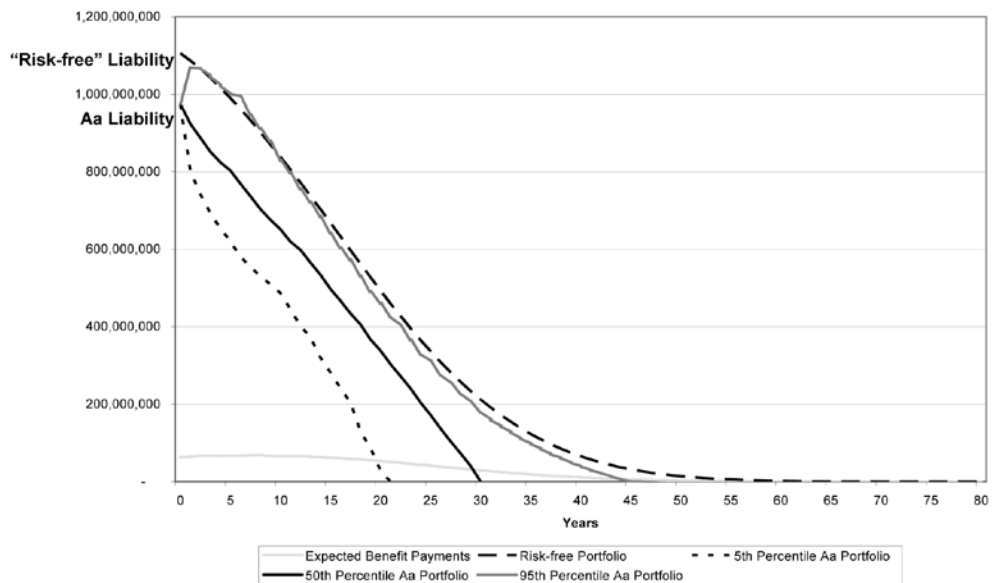
On the other hand, if the \$900 million portfolio were invested in a “Risk-Free” Portfolio, it would be projected to run out of money in 20 years (bottom dotted line). In order for a Risk-Free Portfolio to pay all benefit payments, additional capital of approximately \$200 million (totaling to \$1.1 billion) would be required to offset the lower expected returns (top dotted line). (See chart, top, left).

The stochastic projection shown on the graph below provides similar results. In this projection, a \$900 million portfolio would be expected to run out of money in 32 years. In the worst 5 percent of scenarios, the portfolio is projected to run out of money in under 20 years. In the best 5 percent of scenarios, the portfolio is projected to be sufficient for at least 45 years. But there are no scenarios where the portfolio is able to pay for all projected benefit payments. (See chart, bottom, left).



PROPOSED RISK MANAGEMENT LIABILITY

Accumulated Benefits Organizations need to manage compensation holistically so they provide competitive total compensation packages to employees. It is important not to manage components in isolation because independent decisions tend to allocate resources inefficiently. For example, the impact on pension benefits has not typically been considered when awarding salary increases. These uninformed decisions can cause sponsors unintentionally to provide a disproportionate amount of capital to longer service employees. Sponsors have control of pay increases and should make informed decisions.



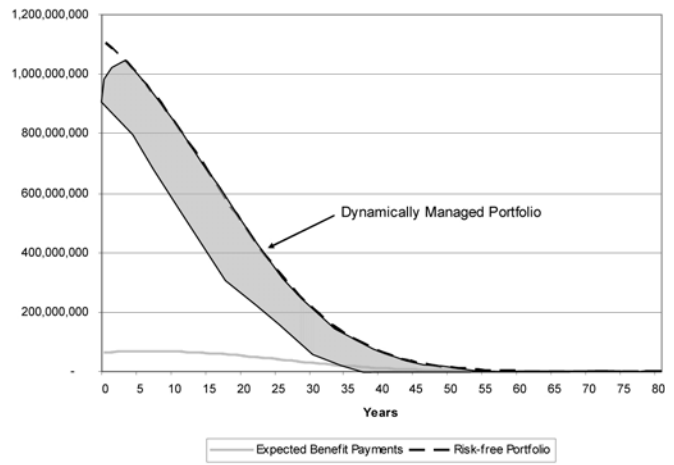
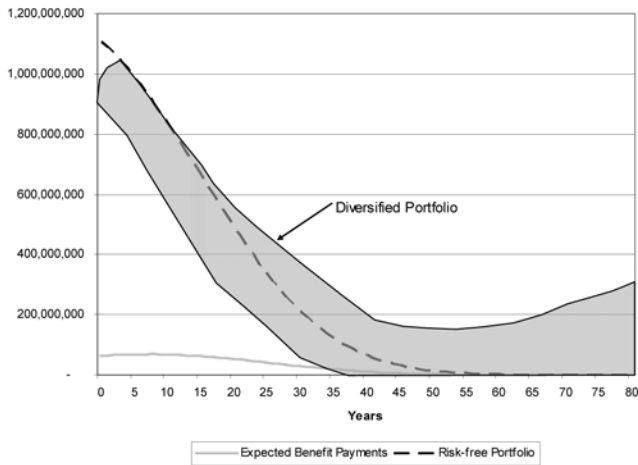
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Furthermore, investment managers should not be held responsible for factors controlled by the sponsor. Including future salary increases in the risk management liability benchmark mistakenly classifies those increases as an uncontrolled risk, which often leads to the artificial bias towards real assets (i.e., assets providing some protection against the inflation component of salary increases). Because of this bias, the risk management liability benchmark should be limited to accumulated benefits.

Risk-free Interest Rates There is risk associated with offering credit to borrowers (or buying non-treasury bonds). The fact that funding regulations and accounting standards encourage sponsors to take credit risk over other types of investment risk is completely arbitrary. Sponsors must recognize the risk associated with providing credit (or owning non-treasury bonds), both to improve understanding of the amount of capital required to defease liabilities, and to force a conscious decision to be made about taking credit risk relative to taking other risks.

Consequently, it is important for risk management liabilities to *exclude* credit spreads.

In general, there are two primary types of spot curves that could be used to develop a risk management liability benchmark: (a) a treasury curve, and (b) an interest rate swap curve. In either case, excluding credit spreads from the measurement of liabilities will avoid biasing the investment process. A description of portfolio construction belongs in a different article; however, the chart on the left side below illustrates how a diversified portfolio of risk would be expected to significantly outperform a portfolio limited to high-quality corporate credit (as illustrated in the previous section) which would never exceed the dashed risk-free line. Furthermore, understanding the capital required to actually defease liabilities allows the sponsor to properly develop de-risking strategies (e.g., hedging projected benefit payments with treasuries, transferring assets and liabilities to a life insurer).



// ... A DIVERSIFIED PORTFOLIO OF RISK WOULD BE EXPECTED TO SIGNIFICANTLY OUTPERFORM A PORTFOLIO LIMITED TO HIGH-QUALITY CORPORATE CREDIT ... //

Inflation protected benefits Although few U.S. corporate pensions provide inflation indexation, many public pensions and corporate pensions outside of the U.S. provide protection against inflation. The risk management liability benchmark for these plans should be measured with real rates implicit in sovereign inflation-protected securities (where possible) or other types of inflation-protected products.

Cash balance plans Funding regulations and accounting standards can be seen as severely flawed with regard to valuing cash balance liabilities. The minimum liability should be at least the sum of the account balances. Although the economic liability is often significantly higher¹⁷, the sum of the balances provides a reasonable risk management liability benchmark because a return based on this benchmark would equal the interest crediting rate. Note this approach should only be applied to participants with account balances.

CONCLUSIONS

As sponsors begin to reduce risk in their plans, it is important that they build their strategies around a “risk management liability” benchmark, since it influences both risk allocation and de-risking decisions. Ideally, this benchmark would be able to concurrently manage cash flow, accounting, and economic risk. However, the methodology used to develop spot curves, smoothing mechanisms, credit spread duration, and survivor bias makes this an impossible task.

No one would ever suggest sponsors should stop taking advantage of arbitrary accounting standards and funding regulations which understate pension liabilities. However, managing risk relative to a “risk-free” benchmark would improve sponsors’ investment decisions; it would not arbitrarily bias sponsors to take credit risk, and it would provide the best estimate of the capital required to defease pensions.

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In absolute terms, domestic sovereign debt is the lowest-risk investment vehicle, so a purist would prefer a treasury curve. A liability measured with treasury rates could be hedged with a portfolio of treasury strips.¹⁸

In general, interest rate swap curves contain rates higher than treasury curves. That is, there is a positive swap spread.¹⁹ However, unlike the credit spreads embedded in the curves used for accounting and funding, swap spreads do not tend to be driven by credit because collateral can be rigorously managed to minimize any counterparty risk related to swaps. The swap spread is driven by supply-and-demand for less capital-intensive vehicles, liquidity, and the fact the floating rate (e.g., LIBOR) exceeds treasury rates.

If a sponsor had capital equal to the liability measured with swap rates (i.e., the swap liability) and a portfolio of fixed-for-floating interest rate swaps with notional exposures aligned with projected benefit payments, returns on the underlying assets must be at least equal to the floating rate (which would be exchanged for the fixed rate on a net basis) to assure assets are sufficient to pay for liabilities over time. Given the floating rates are based off of LIBOR and these rates exceed treasury rates²⁰; investment risk must be taken to try to achieve a return sufficient to service the float without prematurely depleting capital in this situation. Sponsors should understand the residual risk inherent in such a portfolio.

However, there are at least two potential advantages of using a risk management liability based off of a swap curve²¹: (1) it tends to provide a better estimate of the capital required to defease liabilities with an insurance company, and (2) it provides a benchmark that could be hedged with “interest rate overlay” portfolios. The latter is a practical consideration for plan sponsors that want to retain a substantial amount of capital for non-liability hedging assets. Ultimately, if the sponsor chooses to retain the liabilities and wants to minimize investment risk (i.e., restrict assets to liability hedging assets), the sponsor may want to migrate to a treasury measure of liabilities for the reasons indicated in the previous paragraph.



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END NOTES

- ¹ Technically, including credit spreads in the measurement of liabilities should only bias risk decisions toward credit spread risk, not default risk. However, in practice, there are limited ways to achieve this exposure so most portfolios containing credit spread risk also contain default risk.
- ² For simplicity, we will consider certain "hybrid" risks such as anti-selection that is potentially tied to the economic environment as a demographic risk.
- ³ In our opinion, this is only possible due to inefficiencies in insurance business models, resulting in underpriced annuities (i.e., shareholder value is destroyed when group annuity business is written).
- ⁴ Our estimate is based off of an informal survey conducted with several of the largest U.S. life insurers.
- ⁵ Per IRS Notice 2007-81 that provides guidance on the corporate bond yield curve and segment rates required to compute the funding target under IRC Section 430, the yield curve is "calculated for each business day of the month based on investment grade corporate bonds in the top three quality levels. ... The daily yield curve is expressed as the yield for a zero coupon bond at each maturity point from one-half year to 100 years, in half-year intervals. The value at any maturity point of the monthly yield curve is set equal to the arithmetic average for all of the business days in a month of the values for that maturity point from the daily yield curves. The monthly yield curve then is the set of values for each of the 200 maturity points."
- ⁶ Based on a generic set of projected benefit payments with duration approximately equal to 12.
- ⁷ Tracking error measures how closely a portfolio performs relative to a benchmark and is calculated as the standard deviation of the difference in returns between the portfolio and benchmark.
- ⁸ The guidance on discount rates in FAS 158 paragraphs B86 and B87 references paragraph 186 of FAS 106, which states, "The objective of selecting assumed discount rates is to measure the single amount that, if invested at the measurement date in a portfolio of high-quality debt instruments, would provide the necessary future cash flows to pay the accumulated benefits when due. Notionally, that single amount, the accumulated postretirement benefit obligation, would equal the current market value of a portfolio of high-quality zero coupon bonds whose maturity dates and amounts would be the same as the timing and amount of the expected future benefit payments."

- ⁹ Accounting liabilities also include the impact of projected future pay increases. Given we are essentially treating projected benefit payments as certain, we will only address the future pay increases issue with our final risk management liability benchmark recommendation.
- ¹⁰ Data on corporate bonds with a Moody's rating of A1 or higher were downloaded from the Bloomberg system as of Aug. 31, 2010. The data was then screened to eliminate bonds that are inappropriate for determining discount rates under ASC 715. Because corporate bonds are not traded on exchanges, information on some bonds can be thin or doubtful. Accordingly, we exclude from consideration bonds with insufficient liquidity, bonds with questionable pricing information, and bonds that are not representative of the overall bond market.
- ¹¹ Pension liabilities, service cost and benefit payments for the S&P 500 companies were downloaded from Factset and rolled forward to Aug. 31, 2010 assuming an average duration of 12 and reflecting the change in the discount rate based on the Citigroup Pension Liability Index.
- ¹² It is possible to leverage exposure to credit spreads using credit default swaps (CDS) or other credit derivatives. However, these instruments tend to have short maturities (most commonly five and 10 years), so they do not offer exposure to the correct portions of the "credit spread term structure." In addition, it would require amounts of leverage most sponsors have not been comfortable taking.
- ¹³ Option adjusted credit spread on U.S. Aa information was provided by Barclays Capital through August 31, 2010.
- ¹⁴ The tracking error was calculated based on a trailing 12-month difference in returns between the portfolios and the accounting liability determined using the Citigroup Pension Liability curve. Note that monthly Citigroup Pension Liability curves were only available back to Sept. 30, 1995.
- ¹⁵ An annualized recovery-adjusted default rate of -0.2% was estimated from the 20-year default rate on Aa bonds of 7% as published by Moody's in the January 1997 article "Historical Default Rates of Corporate Bond Issuers, 1920 - 1996" and an assumed recovery rate of 40%.
- ¹⁶ GEMS® is a registered trademark of DFA Capital Management Inc. GEMS® is a state-of-the-art Economic Scenario Generator developed by DFA Capital Management Inc.'s team of quantitative finance experts and its financial models are amongst the most technologically advanced in the industry. GEMS

enables users to simulate future states of the global economy and financial markets including the pricing of derivatives and alternative assets and is designed to do large-scale, distributed, scalable simulations. GEMS generates all the financial economic and macroeconomic variables necessary for risk management including multiple correlated common stock indices, equity derivatives, alternative investment classes, treasury bonds, corporate bonds, mortgage backed bonds and CMOs, municipal bonds, interest rate derivatives, real estate, actual and expected multiple inflation indices, nominal and real GDP growth rate, foreign exchange and the unemployment rate.

¹⁷ Cash balance plans generally provide embedded options (e.g., minimum interest crediting rates) and/or guaranteed future subsidies (e.g., above market returns such as one-year treasury rates plus 1%) so the economic value of the liabilities is often greater than the sum of account balance.

¹⁸ In the U.S., treasuries are only issued out to 30 years so benefit payments projected beyond 30 years could not be fully hedged with treasuries. Although this would not eliminate future investment risk, treasuries would provide the lowest risk investment option.

¹⁹ Note there has been a negative swap spread for long maturities since late 2008. This provides further support that the spread is driven by the indicated factors rather than credit.

²⁰ Over the past five, ten, and twenty years the average spread between 90-day U.S. LIBOR and 90-day treasuries has been 0.70%, 0.48%, and 0.44%, respectively.

²¹ More detail regarding the attractiveness of using swaps to measure pension liabilities is provided in the August 2002 edition of Morgan Stanley's "Global Pensions Quarterly" - "Discount Benchmarks For Defined Benefit Pension Plans" written by Michael Peskin and James Moore.



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