Discounting Pension Liabilities: Funding versus Value

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When accounting for defined-benefit pension plan liabilities, U.S. state and local governments discount their future promised benefit payments using rates equal to the rates of return that they expect to earn on their pension funds' assets. This practice is supported by the Government Accounting Standards Board (GASB), but is condemned by virtually all financial economists. While economists agree that the GASB standard is inconsistent with basic financial theory, there is less of a consensus on what the correct discount rate should be. The goal of our paper is to clarify the issues relevant to discounting pension liabilities. We argue that the appropriate rate for discounting liabilities depends on the objective of doing so. In particular, if the objective is to account for pension under- or over- funding, a default-free discount rate should always be used. If, instead, the objective is to determine the market value of pension benefits, then it is appropriate that discount rates incorporate default risk. Our paper also shows how special pension provisions can be accounted for and valued, such as benefit write-downs and limits on cost-of-living adjustments (COLAs). This latter issue is particularly important for gauging the impact of recent public pension plan reforms.

Prior research analyzing the financial condition of public pension funds often fails to distinguish between accounting for pension liabilities to compute a pension fund's level of (under-) funding and determining the market value of a pension fund's liabilities. We demonstrate that these are distinct exercises, though previous work frequently treats them as being the same. Specifically, it has been common in academic studies to justify the use of a pension discount rate based on the likelihood that a state or local government will default on its pension obligations: a higher probability of default would warrant a higher discount rate.

For example, Novy-Marx and Rauh (2011) consider two candidate rates as being potentially appropriate for discounting state pension liabilities.[1] One is a tax-adjusted general obligation municipal bond rate. They argue that such a rate is appropriate if a state is just as likely to default on its pension obligations as it is to default on its general obligation bonds. Their second candidate discount rate is based on the logic of Brown and Wilcox (2009) who document that a majority of states' pension obligations are protected by state constitutional guarantees. It is argued that these states have a lower probability of defaulting on their pension obligations than of defaulting on their municipal bonds.

[1] For simplicity, we initially focus on a pension plan's Accumulated Benefit Obligation (ABO) liability which covers only benefits that a participant has accrued at the current date. Our paper will also address how broader liability concepts, such as the Projected Benefit Obligation (PBO) which depends on future wage uncertainty, should be treated accounted for and valued. However, the choice of ABO or PBO does not affect whether discount rates should or should not reflect default risk.

Therefore, the appropriate discount rate for pension liabilities should be less than a municipal bond rate and closer to a nearly default-free zero-coupon U.S. Treasury rate.

As we argue below, for the purpose of measuring a pension fund's level of over- or under-funding, the likelihood that a state or local government defaults on its pension liabilities is irrelevant. With few exceptions, finance theory supports the discounting of promised pension obligations by a default-free rate, whether the pension fund sponsor is the U.S. government, the State of Illinois, or the City of Detroit.[2] Consequently, there is no need to justify the choice of liability discount rate based on the municipality's likelihood of default. This is in sharp contrast to the separate exercise of estimating the market value of pension liabilities for which incorporating default risk is both appropriate and necessary.

To illustrate this important distinction, we apply the standard Merton (1974) structural credit risk model to the context of a defined-benefit pension fund. To make our point transparent, we consider a highly simplified case in which a pension plan promises a single lump-sum benefit payment at one future date.[3] The model makes the following four assumptions:

1) The pension fund has risky assets having a current date t market value of A_t and a rate of return volatility (annual standard deviation) of σ.
2) The pension fund promises a single retirement benefit equal to X payable at date $t+\tau$.
3) The (continuously-compounded) default-free interest rate is constant and equal to r.
4) The pension fund makes no contributions to, or redemptions from, its assets until date $t+\tau$. If at date $t+\tau$ the pension fund has sufficient asset value, pension participants receive their promised payment of X. If, instead, $A_{t+\tau}$ is worth less than X, the pension fund defaults and the participants are paid only $A_{t+\tau}$.

Let us denote the date t market value of the pension fund's liabilities as L_t. L_t is the current fair market value that investors are would pay for the possibility of receiving the default-risky cashflow of $\min\left[X, A_{t+\tau}\right]$ at the future date $t+\tau$. Merton (1974) shows that the market value of this default-risky pension liability equals

$$L_t = Xe^{-r\tau}N\left(d_2\right) + A_t N\left(-d_1\right) \tag{1}$$

[2] One exception is the case where pension benefit promises contain explicit provisions for write-downs if pension asset values are insufficient.

[3] The assumption of a single benefit payment is not critical. The qualitative results are the same if the model is extended to multiple future promised payments.

where $d_1 = \left(\ln\left[A_t / \left(Xe^{-r\tau}\right)\right] + \frac{1}{2}\sigma^2\tau\right) / \left(\sigma\sqrt{\tau}\right)$, $d_2 = d_1 - \sigma\sqrt{\tau}$, and $N(\cdot)$ is the standard normal distribution function. Note from equation (1) that L_t is a function of four quantities: 1) the current market value of assets, A_t; 2) the volatility of assets, σ; 3) the time until the pension's benefit is due to be paid, τ; and 4) the promised pension benefit discounted at the default-free interest rate, $Xe^{-r\tau}$.

Equation (1) provides several insights. One is that the market value of liabilities, L_t, can never be worth more than the promised payment discounted at the default-free rate, $Xe^{-r\tau}$. However, as the value of the pension fund's assets grow, L_t converges to $Xe^{-r\tau}$:

$$\lim_{A_t \to \infty} L_t = Xe^{-r\tau} \tag{2}$$

In addition, the quantity $Xe^{-r\tau}$ plays a natural role in the concept of a fully-funded pension plan for at least two reasons. First, if the current value of pension assets equals $A_t = Xe^{-r\tau}$, then there exists an investment strategy that can guarantee to participants their full payment of X, namely, investing all of the pension assets at the default-free (Treasury security) rate, r. Second, since the ratio of the default-risky market value of liabilities to its default free value is an arguably a good measure of the relative risk faced by a pension participant, this quantity $L_t / Xe^{-r\tau} = N\left(d_2\right) + \left[A_t / \left(Xe^{-r\tau}\right)\right] N\left(-d_1\right)$ is a function of only three factors: σ, τ, and $A_t / \left(Xe^{-r\tau}\right)$. Thus, the pension funding ratio where liabilities are discounted at the default-free rate, $A_t / \left(Xe^{-r\tau}\right)$, emerges as the natural factor for measuring pension risk. It is straightforward to show that this definition of a funding ratio delivers the sensible result that as the value of pension assets declines, the funding ratio goes to zero:

$$\lim_{A_t \to 0} A_t / \left(Xe^{-r\tau}\right) = 0 \tag{3}$$

If, instead, pension liabilities were discounted at a default-risky rate, say R, that reflected their true default risk, then $Xe^{-R\tau} = L_t$. However, using this liability measure, A_t / L_t, to account for the pension plan's funding ratio is problematic. It is also straightforward to show that such a value of liabilities leads to the illogical result that the pension plan becomes fully funded as the value of assets shrink:

$$\lim_{A_t \to 0} A_t / L_t = 1 \tag{4}$$

The second half of our paper addresses how to account for and value special provisions in pension plan contracts that can change the promised payment to participants without triggering a legal

default. Increasingly, state and local governments institute such provisions as part of reforms that seek to lower future pension liabilities. One type of provision found in a minority of plans limits the payment of future benefits based on the plan's funding ratio. We analyze how to account for such a provision and how this provision can affect the market value of pension liabilities. Another, more common, provision concerns pension plans with COLAs. Recently, many municipalities have placed stricter limits on the degree of inflation protection received by pension participants. Unlike prior research that values COLAs by making ad hoc assumptions regarding future inflation, we show particular types of limited pension COLAs can be replicated and valued using the market prices of recently available inflation derivatives, such as inflation swaps, inflation caps, and inflation floors. Examples of the cost savings associated with particular types of COLA limits are presented.

References:

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