Session 090 PD - Cushions in Defined Benefit Pension Plan Funding Targets

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Cushions in Defined Benefit Pension Plan Funding Targets

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Canada’s 30-year experiment with solvency funding

Since 1986, Canadian DB plans have been required to fund towards the greater of solvency and going concern

- Solvency deficits and going concern surpluses
- Plan members are still losing benefits in wind-ups
- Employers can’t handle the contribution volatility
- Trend to liability-driven investing and away from DB

- Multiple rounds of temporary solvency relief since 2003
Recent Regulatory Activities

• Letters of Credit
• Piecemeal elimination of solvency funding requirements
• Target Benefit Plans
Provision for Adverse Deviations (PfAD)

Best Estimate Assumptions
• Gains and losses are equally likely
• Median outcome in Economic Scenario Generator (ESG)

Going Concern Funding Target
• Gains are more likely than losses
• Margin in assumptions or PfAD on balance sheet
• Value at Risk (VaR) in ESG

Examples:
• Gains are 3 times as likely as losses over a 20-year time horizon (75\textsuperscript{th} percentile)
• Gains are 50\% more likely than losses over wind-down of plan liabilities (60\textsuperscript{th} percentile)
• 85\% chance of full funding after 3 years (Quebec stabilization reserve)
Sources of Gains and Losses

Economic
- Investment returns vs discount rate
- Inflation vs assumed (affects COLA and salary)
- Changes in discount rate and inflation assumption

Plan-specific events
- Pay increases vs inflation plus assumed real wage growth
- Layoffs, changes turnover plans

Systemic events
- Mortality improvement vs improvement scale

Statistical Fluctuations
- events in individual plan members’ lives consistent with assumptions

Refinements to Estimates
- Data, programming, best-estimate demographic assumptions
Bond Yields Foreshadow Fund Returns

Averages of median annual pension fund returns from CIA Survey of Economic Expectations
Combining Asset & Liability Experience

Traditional Asset Mix (60/40)  Liability-Driven Asset Mix

- Investment Gain
- Discount Rate Gain
- Funded Status vs. median

Legend:
- 75%-95%
- 50%-75%
- 25%-50%
- 5%-25%
Illustrative Research Results

Provisions for Averse Deviation (PfAD) required to achieve pre-determined confidence levels

- Minimum Risk
- Conservative
- Balanced
- Moderate Risk
- Aggressive
A PfAD can cancel out the Equity Risk Premium

Discount Rate Adjusted for PfAD

- 13-Year duration of liabilities
- 85% likelihood of being fully funded after 3 years

<table>
<thead>
<tr>
<th>Asset Mix</th>
<th>Expected Return</th>
<th>Discount Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>LDI long bonds</td>
<td>5.7%</td>
<td>5.5%</td>
</tr>
<tr>
<td>Conservative</td>
<td>5.8%</td>
<td>5.4%</td>
</tr>
<tr>
<td>Traditional</td>
<td>6.6%</td>
<td>5.6%</td>
</tr>
<tr>
<td>Aggressive</td>
<td>7.1%</td>
<td>5.7%</td>
</tr>
</tbody>
</table>
Economic Scenario Generator Results

![Scatter plot showing economic scenario generator results.](chart)

- **Average Plan Asset Mix: Traditional**

  - Stochastic Trials
  - Full Funding without PfAD
  - Full Funding with 75% PfAD
  - Full Funding with 85% PfAD
  - Full Funding with 95% PfAD

  **Axes:**
  - X: Going Concern Liability More (or Less) than Expected
  - Y: Assets More (or Less) than Expected
Best Estimates must be Calibrated
A going concern PfAD is no substitute for solvency funding

Outcomes below this line would have solvency ratios less than 100%, even with a going concern PfAD set at the 85% confidence level.
An LDI strategy can reduce both going concern and solvency risk.
How Big a Cushion?
Some Considerations
The importance of a PfAD depends on the risk-sharing deal.
How big a cushion do you need?

Very Important Considerations

- Risk-sharing deal
- Strength of sponsor guarantee
- Balance amongst competing funding objectives

- Allocation to return-seeking assets

Confidence level & time horizon
How big a cushion do you need?

Somewhat Important Considerations

• Post-retirement indexation
• Non-economic risks
• Duration matching
• Model risk
• Implementation of investment strategy
  • Geographical diversification
  • Credit quality
How big a cushion do you need?

Less Important Considerations

- Benefit accrual formula
- Plan maturity
- Market conditions on valuation date
- Overlay strategies
- Method of varying best estimate assumptions
Research Reports

• Determining Discount Rates Required to Fund Defined Benefit Plans
  https://www.soa.org/research-reports/2017/determining-discount-rates/
• Provisions for Adverse Deviations in Going Concern Actuarial Valuations
  https://www.soa.org/research-reports/2017/adverse-deviations-actuarial-valuations/

Other Society of Actuaries reports
  https://www.soa.org/research/topics/pension-res-report-list/

Research in Progress
  • Liability-Driven Equity Investing & Economic Scenario Generators
  • Impact of Low Interest Rate Environment on Canadian Retirement System
  • Impact of Low Interest Rate Environment on U.S. Retirement System
  • Population Aging, Implications for Asset Values & Impact for Pension Plans: An Int'l Study
  • Comparison of Solvency and Going Concern Liabilities in Ontario Pension Plans
DETERMINING DISCOUNT RATES REQUIRED TO FUND DEFINED BENEFITS PLANS

Speaker: John Turner¹

Joint work with Humberto Godínez Olivares,² David D. McCarthy¹ and María del Carmen Boado-Penas².

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Aim of the paper

- This paper analyzes the discount rate required for funding defined benefit pension plans.
- Current approaches used in the United States generally either base discount rates for determining funding solely on bond rates of return linked to the risk of the liabilities or solely on the expected rate of return on the pension plan’s portfolio.
Previous studies by U.S. economists have focused on the problem of valuing defined benefit liabilities, which is a problem they are expert at analyzing.

The key point of this presentation is that determining the discount rate for required funding is a different problem from valuing pension liabilities.
Valuing Liabilities

Valuing pension liabilities is key if a person wants to buy or sell those liabilities.

The problem for determining adequate funding has to do with the probability that enough money has been set aside to cover the liabilities.

That problem is affected by the risk to the assets as well as the risk to the liabilities, and the possible correlation of these risks.
In the United States, private sector and public sector defined benefit plans use different approaches for determining the discount rate used in calculating funding ratios. The approach private sector plans use is based on corporate bond rates. The approach state and local government plans use is based on the expected rate of return on their portfolios.
Our Approach

We present a model based on the acceptable probability of needing to make future contributions of a certain amount.
Contents

1. Analysis of Three Approaches of Discount Rates

2. A Model Based on the Acceptable Probability of Needing to Make Future Contributions for Currently Accruing Liabilities—The Stochastic Funding Parameter Approach

3. Final Remarks
Actuaries, economists and other financial analysts do not agree as to how the required level of funding for defined benefit plans should be determined.
2. Analysis of Three Approaches of Discount Rates

1. The Financial Economists’ Approach

2. The Portfolio Expected Return Approach

3. The Day Approach
2. Analysis of Three Approaches of Discount Rates

The Economists’ Approach: This approach is an exercise in determining the expected present value of a future payment.

This approach only considers the risk of the liabilities. It argues that at least for some state and local government DB plans, that risk is zero. This assumes the mortality risk can be completely diversified away.

While this approach is appropriate for valuing liabilities, we argue that is a different problem from determining the discount rate for funding a DB plan.
2. Analysis of Three Approaches of Discount Rates

The Expected Rate of Return Approach:

This approach only considers the expected rate of return on the asset portfolio. It does not consider the risk to the liabilities.

The expected rate of return on the person’s portfolio, which incorporates the risk of the portfolio, is used to calculate the value of the liability.
2. Analysis of Three Approach to Choice of Discount Rates

The Day Approach: *the plan sponsor engages in precautionary saving to try to assure having adequate resources set aside to make the future payment.*

This approach only considers the risk of the liabilities to the plan sponsor. It recognizes that there are various risks to the liabilities from the perspective of the plan sponsor, including undiversifiable mortality risk.

Because the plan sponsor needs precautionary savings beyond what the plan sponsor would save for a risk free liability, *the plan sponsor uses a lower discount rate than the risk free discount rate.* Thus, this result yields a lower discount rate than the other two approaches.
2. Analysis of Three Approaches of Discount Rates

- All three approaches are flawed in that they do not consider in sufficient detail the actual problem of funding defined benefit plans.

- In determining the discount rate, they do not consider the acceptable probability of success, defined as the outcome that plan sponsors will not need to make further contributions in the future to pay for liabilities already accrued.

- We argue that none of the approaches is asking the right question concerning required contributions for funding defined benefit plan liabilities. The right question needs to take into account the probability of success or the risk as to whether future contributions will be needed, and perhaps also the size of those future contributions.
3. Multi-Period Model: Risky Assets, Risky Liabilities

The stochastic funding requirement is that future assets $A_f$ will exceed the future liabilities $L_f$, with probability $c$. $P(A_f \geq L_f)$ could be rewritten as $P(A_f - L_f \geq 0) = c$

We select the pension discount rate (or hurdle rate) so that the above equation is satisfied.

The discount rate for determining the value of the initial liability is selected so that the plan sponsor using that rate would not have more than an $X$ percent probability of needing to make further contributions of $Y$ percent of the liability at the time of those additional contributions.
Table 1. Discount rate assuming expected portfolio rate of return of 7 percent. The discount rate is so that additional contributions of more than 10 percent of liabilities will not be required during more than 10 percent of the trials.

<table>
<thead>
<tr>
<th>Standard Deviation of Assets</th>
<th>Standard Deviation of Liabilities</th>
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<tr>
<td></td>
<td>0%</td>
</tr>
<tr>
<td>0%</td>
<td>7.00</td>
</tr>
<tr>
<td>3%</td>
<td>6.97</td>
</tr>
<tr>
<td>6%</td>
<td>6.83</td>
</tr>
<tr>
<td>9%</td>
<td>6.70</td>
</tr>
<tr>
<td>12%</td>
<td>6.20</td>
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</table>
Our calculations suggest that a portfolio with an expected rate of return of around 7 percent would have a standard deviation of around 11 percent, making the final row of Table 1 the most relevant.

Depending on the risk to liabilities, over the range simulated the discount rate would vary from 5.9 percent to 6.2 percent for a portfolio with an expected rate of return of 7 percent.
4. Final Remarks

- The analysis in this paper shows that for risky assets and risky liabilities, a discount rate lower than the expected or mean rate of return on the defined benefit plan portfolio is needed to provide a target funding cushion whenever the target probability of success exceeds 50%.

- With the stochastic funding parameter approach, the risk to both the assets and liabilities affect the discount rate used for determining required funding.

- Current approaches used in the United States and elsewhere that determine interest rates for funding defined benefit plan liabilities solely by valuing the liabilities or solely based on the expected rate of return on the assets are both flawed.

- The CAAT pension plan in Canada is an example of the approach advocated in this presentation.
Selected Bibliography