

PUTTING Risk FIRST

Reversing the asset-liability equation.

BY JOSEPHINE E. MARKS

Asset-liability management should probably be renamed liability-asset management. After all, liabilities come first, whether they are insurance company products or pension plan obligations. Any attempt to manage portfolios relative to the liabilities must start with an understanding of them. This article, the second in a series of three on liability-driven investing (LDI), will examine the nature of the risks inherent in pension plan liabilities and thus provide a picture of some of the issues faced under a liability-driven investment approach.

Pension plan obligations are often described as being fixed income in nature and, as such, interest-sensitive. Interest-sensitivity is usually measured using duration and it may be useful to review the determination of duration in this context. The original concept of duration was developed by Frederick MacAuley in 1938 and was defined as the time-weighted series of discounted cash flows. It is usually expressed in years and broadly represents the average length of time it takes for cash flows to emerge. Using MacAuley's definition, a duration value may be calculated for just about any asset or liability that can be expressed as a series of potential or expected cash flows. Unfortunately this has encouraged the use of duration as a risk measurement tool where it is of limited practical application. As Robert C. Merton observed, "It's a wrong perception to believe that you can eliminate risk just because you can measure it."

For interest-sensitive obligations, the concept of

"modified" duration is more instructive. Modified duration is essentially equivalent to MacAuley duration but is a more precise mathematical construct, where duration is equal to the change in price or value of a financial instrument (or payment stream) relative to a change in interest rates. Modified duration may only be calculated for an instrument whose value specifically fluctuates as interest rates change. Mathematically it is a powerful tool, as it may also be used to measure key rate durations across the yield curve to assess the price sensitivity of the instrument to non-parallel yield curve shifts.

Technically speaking, any cash flow stream may be assigned a MacAuley duration. However, the calculation of a modified duration requires the cash flows to be valued by discounting them at various interest rates, thus measuring their actual interest rate sensitivity. In practice, although many assets could be valued this way (equities using a dividend discount model or real estate using capitalization rates on rental income) it is generally conceded that many other factors (such as franchise value for equities and land values for real estate) affect the valuation. So, in practice, these assets are not viewed as being interest rate-sensitive and do not have a duration value attached to them.

PENSION OBLIGATIONS

So what about pension plan obligations? Are they interest-sensitive? In the life insurance world, financial products may be viewed as fitting into a benefit spectrum ranging from least interest-sensitive to most interest-sensitive, as

depicted in Figure 1. At one end of the spectrum, GICs are extremely interest-sensitive, with a value that depends almost entirely on current interest rates. Market value adjustments are applied to any policyholder seeking to commute the benefit prior to maturity, although book value withdrawals may be permissible on death, where the policyholder is not expected to be selecting against the insurance company for financial advantage.

At the other end of the benefit spectrum are participating life insurance products, where the experience is affected by mortality, lapse rates, experience rating refunds or dividends and other non-financial factors. Other products are affected by morbidity, recovery rates or inflation rates. The value of these products is dependent on so many factors that the level of interest rates plays a very small role in setting the investment policy or pricing.

A closed pension plan with only retired plan members with fixed benefits falls towards the interest-sensitive end of the spectrum, with mortality being the only other contingency that can affect the value unexpectedly. For a large enough group, mortality risk is relatively predictable. Managing a portfolio for such a group would be analogous to managing the portfolio that a life insurer might use to back the sale of a block of immediate annuities.

A closed pension plan with both active and retired members would be similar to a combination of immediate and deferred annuities. Insurance companies generally shy away from selling deferred annuities. One reason for this is that deferred annuities are very long-term and it is hard to find matching fixed income assets beyond 30 years. Another factor is the risk that the annuitant may later wish to alter the form of the benefit or even commute the benefit, thus forcing the insurance company to rebalance or liquidate the portfolio due to non-economic factors. Thus the risks inherent in managing such a portfolio extend beyond interest rate risk.

At the other end of the spectrum is a going concern final average pension plan with indexed benefits. Such an obligation would be affected by inflation and wage escalation, as well as demographic factors such as termination rates, disability rates, new entrants, marital status, retirement rates and mortality. In this instance, a cash flow stream could be projected and discounted, but would likely fluctuate over time due to factors other than the current yield curve. While economic factors may still

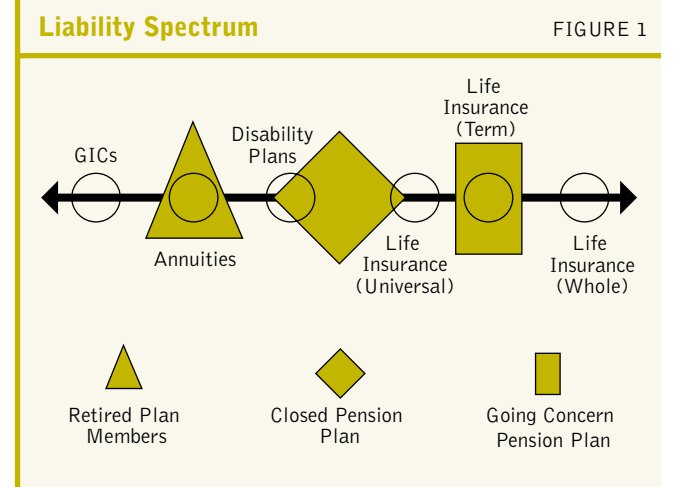
dominate the risk, they are but part of the overall risk profile. Thus a going concern final average plan falls towards the least interest-sensitive end of the benefit spectrum.

DUAL DURATION

How would one even attempt to create a matching portfolio to manage the risk in a going concern pension plan? As noted in my previous article in the summer 2007 issue of *Canadian Investment Review*, the conversion of defined benefit pension plans to a final average benefit plan design, with benefit indexation post-retirement, changed the nature of the risk. Pension plan sponsors responded by hedging the inflation risk with equity investments. However, equity investments do not provide a true matching portfolio and cannot be used to guarantee the obligation.

Defining a matching portfolio for inflation-sensitive obligations requires the calculation of two durations—price sensitivity to changes in real interest rates (real duration) and price sensitivity to changes in expected inflation (inflation duration). Recall that nominal interest rates may be expressed as the sum of real interest rates and expected inflation. This concept was explored in respect of pension plan funding by Siegel and Waring in 2004.¹ Figure 2 shows these two durations for certain nominal bonds and real return bonds.

Unless a pension liability is 100% linked to inflation, both before and after retirement, it will fall between the two lines. Thus, the matching portfolio will be a combination of nominal bonds and real return bonds. Real return bonds provide a hedge against inflation, although there would still be basis risk between the level of inflation



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and wage escalation. Note that if one accepts the argument that equities have a low inflation duration and a high real duration, as proposed by Leibowitz et al in 1989, equities may be substituted for real return bonds in the matching portfolio.² This defends the rationale of the traditional mix of equities and nominal bonds.

It may be that certain financial institutions or governments would be willing in the future to intermediate this risk, either through sufficient issuance of real return bonds (wage escalation bonds) or by providing derivative instruments whose value is derived from the same risks that affect pension plan obligations. This of course would involve the transfer of risk between entities and not the elimination of the risk. But the fact remains that going concern pension plans include very long-term obligations for which very few institutions can provide credible risk mitigation. After all, there are good reasons why investors demand a risk premium for long corporate bond issues.

As for creating a portfolio which matched the other risks in a pension fund, it would be virtually impossible to do so, barring the very creative use of catastrophe bonds or longevity bonds. The only risks that can conceivably be managed using traditional assets are interest rate risk, inflation risk and wage escalation risk.

FINANCIAL ECONOMICS

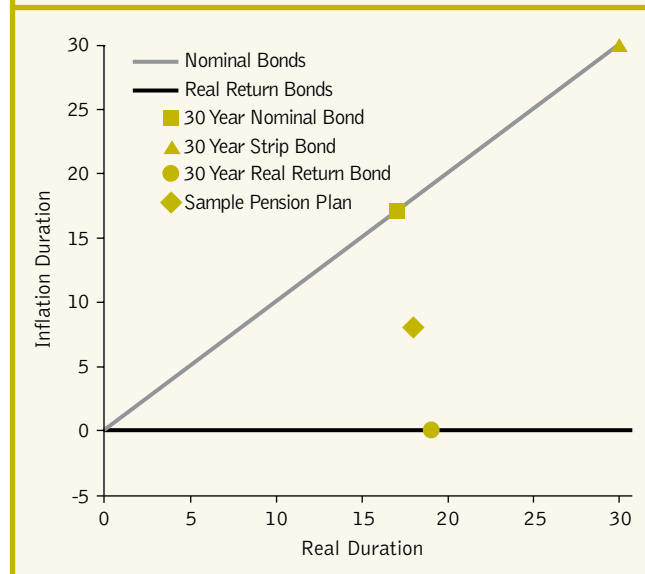
Recognizing the many factors that impact pension liabilities, it is clearly essential to understand how these liabilities may be valued, especially since current accounting standards and actuarial practice for pension plan valuation have contributed to the recent interest in liability-driven investing. The valuation process may be used for many purposes, including performing a review of funding status, setting contributions, or determining the impact of pension plan funding on corporate financial results. How might the valuation be used as a guide for setting the investment strategy of the fund?

In recent years, pension valuation actuaries have started to embrace the concepts of financial economics in the valuation of pension liabilities. The basic tenets of financial economics hold that an asset (or liability) can have only one value, that the market sets such fair value, and that valuation approaches that allow arbitrage to occur should not be permissible. In practice, this means that pension valuation actuaries should not be taking credit in advance for risks that will be assumed in the future (e.g. discounting the equity risk premium) or masking risk by smoothing values over long time horizons, as explained by Bader and Gold.³

Under financial economic theory, a pension plan should

Dual Duration

FIGURE 2



be valued using current market values for both assets and liabilities. Assets would be held at full market value, with no smoothing permitted. Liabilities would be valued using best estimate assumptions for all the demographic factors and a current discount rate (or a series of discount rates by term) that reflect the risk of the liabilities not being paid. Note that this valuation approach treats the pension obligations as a series of cash flows to be discounted at current interest rates, thus imparting interest rate sensitivity on the liabilities.

While such an approach could provide a meaningful perspective for a plan wind-up valuation, it is of limited use for the valuation of a going concern pension plan. For the valuation of a pension plan that is being wound up, this approach provides a proxy to the cost of annuities that might be purchased to meet the obligations. However, for the valuation of a going concern plan, where the asset portfolio does not and cannot perfectly match the liabilities, this approach fails to impart relevant information about the future potential risk profile of the plan. Understanding the full risk profile is essential to developing an appropriate investment strategy.

New accounting standards and actuarial practice focus on this market value approach. Any other valuation approach would appear to contradict the efficient market hypothesis and imply that the actuary can “discern a truer value than that set by a fair and active market.”⁴ However, more information is needed if one is to use the valuation to set investment policy.

It may be instructive for pension plan sponsors to consider valuation practice within the insurance industry. While a single reserve value is calculated to satisfy financial reporting requirements, the regulators and senior

management (who are taking a strategic view) pay more attention to the results of an exercise called Dynamic Capital Adequacy Testing. This involves stress testing the balance sheet under various adverse conditions to ensure that there is no risk of insolvency. These tests emphasize tail risk at the 95th or 99th percentile confidence level to ensure that investment policy will meet the obligations with a very high degree of certainty.

In setting investment policy, plan sponsors would do well to focus more attention on the tail risk. Unless the investment strategy allows the plan sponsor to truly match the liabilities, this downside risk is very relevant. This approach also means that, rather than focusing on a single market value for assets and liabilities, the sponsor should consider the funded ratio, or level of surplus, and consider how it behaves under various economic scenarios.

Even today's more sophisticated risk models do not integrate risk measures across multiple asset classes, let alone fully integrate asset behaviour and liability behaviour. Model risk has to be acknowledged as a fact of life. Nevertheless, scenario testing allows the identification of potentially material risks or undesirable trends from year to year. For a liability such as an actively managed going concern pension fund, liability-driven investing has to consider this range of risk outcomes, rather than naively assuming that the obligations are interest-sensitive and can be matched.

BENCHMARKING LIABILITIES

While in theory a target portfolio could be constructed that would match the cash flows of the liabilities, it would not demonstrate the same sensitivity to economic and demographic factors as the obligations. As time passed, such a portfolio would not behave the same way as the liabilities. Furthermore, it would not meet the criteria for a portfolio benchmark of being investible, reproducible and stable over time.

A portfolio benchmarking liabilities can nevertheless be useful to track progress of an asset portfolio strategy relative to liabilities. Such an approach may also be useful to attribute the funding costs of the plan to certain periods so that each generation of beneficiaries can be deemed to pay their fair share, thus introducing the concept of intergenerational equity.

Risks can be measured and sometimes risks can also be managed, but they can rarely be avoided altogether. If pension plan sponsors wished to eliminate all risks between their asset portfolios and their liabilities they would have to be willing to offer a much simpler and

more modest pension promise. Otherwise asset-liability mismatch is here to stay and cannot be magically wished away, despite the best of intentions.

Pension plan funding risks need to be identified, quantified, tested under various scenarios, and accepted by the parties who are ultimately bearing the risk. Liability-driven investing will not eliminate this fiduciary obligation for an ongoing plan, although consideration of alternatives may allow plan sponsors to develop a better investment strategy to meet their future needs. In the next issue of *Canadian Investment Review*, the final article in this series will examine some of the potential portfolio implications of assuming a liability-driven approach to investment management. ■

ENDNOTES

1. Laurence Siegel and Barton Waring, "TIPS, the dual duration and the pension plan," *Financial Analysts Journal*, Vol 60, No 5, pp 52-64, September/October 2004.
2. Martin L. Leibowitz, Eric H. Sorensen, Robert D. Arnott and H. Nicholas Hansen, "A Total Differential Approach to Equity Duration," *Journal of Portfolio Management*, Vol 45, No 5, pp 30-37, September/October 1989.
3. Lawrence N. Bader and Jeremy Gold, "Reinventing Pension Actuarial Science," *The Pension Forum*, Society of Actuaries, Vol 15, No 1, pp 1-13, January 2003.
4. *ibid.*