Discount Rate Revisited

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(note: The quotations appearing in this monograph are exact, except where capitalization and punctuation were changed in keeping with modern style and grammar guidelines.)

Abstract

The paper examines actuarial pension models and the methodologies those models offer. I introduce a new liability concept that eliminates certain inconsistencies that exist in the models. The paper also attempts to clarify the source of "The Great Controversy."

1. Introduction

I would like to join a number of authors in welcoming the initiative taken by Bader (2001) and Bader and Gold (2003). Their efforts to jump-start a debate on the basics of the pension model have already produced stimulating discussion. A scrutiny of the methodologies of our work is beneficial to both the pension industry and the actuarial profession.

Bader (2001, p. 15) observed that "traditional actuarial models and techniques stumble over questions about pension cost and asset allocation" for a simple pension scheme. Bader and Gold (2003) produced a more detailed treatment of the subject, and the first set of discussions was published along with their article.

The results of the first discussion were mixed. Although the participants scored a number of good points, no consensus was achieved. In this paper, I will:

- Define major types of pension commitments and valuations.
- Analyze basic actuarial assumptions.
- Discuss measurements of pension commitments.
- Introduce a new type of liabilities.
- Clarify the source of "the great controversy."

2. Actuaries vs. Economists

Bader and Gold (2003) have revealed serious disagreements between economists and actuaries. We should spell out those disagreements in order to settle this and possibly other controversies cordially.

The economists believe there is a high level of "murkiness" in the actuarial model. They are unhappy when the actuary uses a high discount rate in the actuarial valuation. Economists don't accept the line of reasoning that the high discount rate is justified by high equity allocation in the asset policy. Higher equity returns, they argue, might or might not materialize, and should not be recognized at the present time anyway. The model that utilizes the expected return as the discount rate, as Bader (2001) contends, "has no clothes."

Another area of discontent seems to be the "ongoing-concern valuation" concept. The active liabilities don't seem to fit to the "everything-has-a-market-value" mindset. Think of a new pay-related pension plan. Would the economists allow the actuary to proceed with the valuation using the entry age normal method, or would they force him or her to use the unit credit method?

As a solution to the problem, Bader and Gold (2003) propose eliminating the asset risks from the liability calculations. The "asset risk-free" liability is equal to the price of the portfolio of Treasuries that has the same payout as the plan's benefit stream, assuming the plan is terminating. I propose an alternative solution that is based on the "ongoing-concern" actuarial model and recognizes the risks on the asset side. I will also try to separate the concerns the economists have from the solution their theory implies.

Bader and Gold (2003) have called for changes in the actuarial model to fit it into the Procrustean bed of financial economics. I am confident that, as a result of this debate, the APM will prove itself as an effective methodology significant enough to be regarded in its own right.

3. Definitions

Clear definitions are essential for a well-organized discussion. In this section, I will define the financial commitments of a conventional defined benefit (DB) plan and the models to value those commitments.

The *pension commitment* of a DB plan is a stream of payments to the beneficiaries of the plan. *Accrued pension commitment* is a stream of payments the beneficiaries are entitled to, assuming the plan is terminating.

The accrued pension commitment is based on current compensation and accrued service. *Ultimate pension commitment* is a stream of payments the beneficiaries will be entitled to, assuming the plan is continuing indefinitely. The ultimate pension commitment is based on compensation and service at retirement. The pension commitments can be further classified as active and inactive.

The *actuarial pension model* (APM) is a methodology used to evaluate the pension commitments. APM uses the following categories as input parameters:

1. A benefit package.
2. *Population assumptions* that include, but are not limited to, the rates of mortality, disability, retirement, turnover, percentage of married members, age difference between spouses and joint and survivorship options.
3. *Economic assumptions* that include, but not limited to, salary growth rate, cost of living adjustment (COLA), discount rate and funding method.
4. Population data.
5. Asset data, including market value of assets, asset class assumptions and asset allocation.

I'd like to define the APM in a very broad sense and have as much freedom as reasonably possible. The benefit package is a set of benefit formulas, eligibility requirements, etc. normally described in the plan document. In addition, the package might include benefit improvements that have not been contracted yet, but are expected to be enacted in the future. There are no restrictions on the assumptions in the model. The assumptions can be deterministic, stochastic or of any other type the actuary finds suitable. In particular, the actuary is free to assign any value to the discount rate should he or she choose to define it in a deterministic way.

Given the input data, APM provides the tools to calculate both accrued and ultimate pension commitments and subsequently measure them. *Actuarial valuation* is a process for calculating the pension commitments, their present values and related objects. *Termination valuation* is the actuarial valuation based on the *accrued* pension commitment. The accumulated benefit obligation and the current liabilities belong to the termination valuation area. *Ongoing-concern valuation* is the actuarial valuation based on

the *ultimate* pension commitment. The present value of future benefits, normal cost and projected benefit obligation belong to the ongoing-concern valuation area.

APM imposes no requirements on contributions. The plan sponsor is free to adopt any contribution policy in the APM framework. Therefore, many elements of a traditional actuarial report (e.g., asset-smoothing formulas and amortization bases) do not belong to APM.

The *regulated pension model* (RPM) is defined as the APM plus a collection of regulations imposed by various government bodies. RPM does contain requirements on timing and amount of contributions to the pension fund. In addition, it may:

- Require the plan sponsor to apply the APM several times using different sets of assumptions.
- Utilize the results of those calculations to restrict the plan sponsor's choice of the contribution policy and determine the tax status of the contribution.
- Allow various smoothing procedures in order to avoid extreme volatility of contributions.
- Limit the actuarial valuation to the existing benefit structure only.

Different types of pension plans may have different RPMs. For instance, a public plan could have a RPM that contains just one APM (the funding side) as well as an asset-smoothing formula and a contribution rule (e.g., normal cost plus amortization payment on the unfunded liability). A corporate pension plan normally requires several APMs. Those include the funding APM, current liabilities APMs and APM for FASB statements. The issues of correctness and suitability of the RPMs and embedded APMs are outside the scope of this article.

4. Pension Commitments vs. Liabilities

In this paper, I will try to differentiate between streams of benefit payments (pension commitments) and their measurements (liabilities).

The primary objective of the plan sponsor is to fund the plan's pension commitment, as defined above. The pension commitment can be considered

as a random vector; it is a stream of payments that may depend on the wage inflation and a CPI-related inflation measure. If we adopted a deterministic approach to the population assumptions, as well as the assumptions for salary growth and COLA, the pension commitment would be a stream of fixed payments. That stream of payments is the main object of the actuarial analysis.

Here's a brief review of the essential steps in the pension commitment calculations, along with the assumptions the calculations require:

- To calculate when the members leave the active status and enter the in-pay status (population assumptions).
- To calculate the benefit amount the members will receive (salary growth, COLA, joint and survivor options).
- To calculate the number of payments the members and beneficiaries will receive (population assumptions).

The discount rate plays no role in these calculations. It comes into play for entirely different reasons. It is our desire to *measure* the pension commitment that requires the recognition of the time value of money. The need to *measure* the pension commitment comes up because proper management of the pension plan requires:

1. Compliance with relevant laws, and the laws mandate those measurements.
2. Monitoring funding progress.
3. Allocating the assets prudently, and those measurements are exceedingly helpful in that regard.

I intentionally separate items 1 and 2 because, while it is true that the law requires monitoring funding progress, not all the measurements mandated by the law are useful and not all useful measurements are mandated by the law. In other words, the actuary may want to make use of a nontraditional liability figure for his or her analysis. The Treasury-matching liability (defined in Section 5) would be a good example of such a liability.

A common method to put all the payments on the same footing is to discount the pension commitment payments by the asset returns. The most

convenient way to do so is to use a single discount rate in all years. The rate is supposed to be related to the asset returns, for example, to be equal to the expected return on assets (this is only an example; I do not advocate using the expected return as the discount rate). The main advantages of a single discount rate are its simplicity and transparency.

Having chosen the discounting procedure, we calculate the present values of the pension commitments. These present values are commonly called *liabilities*. In the case of ongoing-concern valuation, the present value of the pension commitment is called the *present value of future benefits* (PVFB). To fund the PVFB, we also select a methodology (*funding method*) of assigning a portion of PVFB to a given year (*normal cost*). Then we can calculate the scheduled value of assets to date (*accrued liability*) for the funding methods that allow such a calculation.

There are quite a few so-called liabilities scattered around various actuarial reports. Those liabilities are important and have attracted a lot of attention lately. However, the presence of a relatively large number of liabilities in the actuarial reports has not resulted in reporting transparency and a good understanding of the financial burden the pension plans impose on their sponsors. Each of those liabilities uses a discount rate[1], along with an appropriate pension commitment, and represents a measurement, or a snapshot, of the pension commitment. Even a large number of snapshots may not truly reflect the complexity of the underlying object.

5. "The Great Controversy"

Bader and Gold have urged actuaries "to reexamine and redesign the model" (Bader and Gold 2003, p. 1). They have properly assessed the negative role ERISA's enactment has played in halting the evolution of the pension methodology. Many would agree that the RPM in this country is "a myriad of overlapping, all but contradictory, rules that have made the operation of DB plans excruciating" (p. 1). If Bader and Gold had been questioning some specific pension regulations, they would have been part of a large and already vocal group of actuaries, plan sponsors and many others who are unhappy with the current state of affairs in the pension

[1] Depending on the purpose of the liability, the actuary has full or limited discretion over the choice of the discount rate.

industry. What sets Bader and Gold apart from the others is their call for reinventing the basic pension model, the one I refer to here as the APM. That's the reason we are having "The Great Controversy".

Let's take a look at aspects of the Bader-Gold proposal.

"Financial economics measures a liability by using a discount rate curve embedded in a reference portfolio—a portfolio that matches the liability" (Bader and Gold 2003, p. 5). In other words, the liability that they advocate is equal to the price of a portfolio of Treasury securities ("the reference portfolio") that has the same payout as the plan's accrued pension commitment. They also noted, "The actuarial pension model discounts liabilities at expected return on the assets held to fund those liabilities; it ignores the risk" (p. 5). Well, the Treasury matching liability is "riskless" as well.

If Bader and Gold had their way, a conventional actuarial report would have another liability—"the Treasury matching liability"—that belongs to the termination valuation universe[2]. Although the Treasury matching liability is an informative measurement of the pension commitment, I am unenthusiastic about its value to practitioners in the pension industry. It has not been demonstrated that the Treasury matching liability is helpful in areas where pension funds face major challenges: the funding policy and asset allocation. A new termination liability is of limited use to a plan that is not contemplating the termination. The "market value of liabilities" may be a great theoretical concept, but it is an inadequate tool for a pension plan that has no intention to realize that market value. As McCrory and Bartel (2003) said, "In case of a capped or terminating pension plan … this is not a bad model to use. … However, in the case of an ongoing plan, … we feel the debt model has serious limitations."

Bader and Gold have eloquently argued that if we wanted to measure the pension commitments in compliance with financial economics, we would end up in the termination valuation. Only current benefit structure, service and compensation would be allowed. But we have to anticipate

[2] Once the Treasury matching liability is calculated, the actuary can find a single discount rate that, if used for the current liability calculations, produces the current liability equal to the Bader-Gold liability. Most likely, that rate will be within the allowable range. Therefore, the actuary is at liberty to include the Bader-Gold liability in the actuarial report even under existing regulations.

future salary growth, fund future plan improvements and manage future spikes in wage inflation, among many other things that may happen in the future. These are essential parts of prudent pension plan management. If financial economics cannot help us in that respect, we will use something else. Fortunately, actuarial science is readily available.

Even though the solution proposed by Bader and Gold is imperfect, their concerns are well-founded. Pension plan regulations do need many improvements. Pension accounting does allow a high degree of risk concealment. And the most important question still remains: What is an appropriate measure of pension commitments?

The traditional liability calculations hide away the risk and volatility by means of a fixed discount rate. Convenience and simplicity are the major virtues of the discount rate, but those virtues disappear if we leave the "asset risk-free" world of traditional pension valuation. It is appropriate to use a single discount rate as long as we are in the area of the conventional measurements of pension commitments and allowed to ignore the risks on the asset side. Once we expand our universe to include a meaningful asset model, the assumption of "the same return in all years" becomes too restrictive. The major conflict the discount rate creates is that future benefit payments are discounted at actual returns on the asset side and at a fixed rate on the liability side. A similar conflict takes place when the contributions receive actual returns on the asset side, but the normal costs receive the fixed return on the liability side.

Bader and Gold (2003) said, "It is incorrect to use the expected return on riskier nonmatching assets to discount the liability payments" (p. 5). I agree. As I mentioned earlier, I do not believe that the discount rate should always be equal to the expected return. The next obvious question is, "If the asset allocation is given, what is the most appropriate discount rate?" The answer depends on the plan sponsor's contribution risk tolerance. The higher the rate, the lower the short-term contribution requirements, which may lead to an increased chance of a substantial additional funding charge (for corporate plans). But regardless of the discount rate value, it will be in conflict with financial economics. It is incorrect to use *any fixed rate* to discount the liability payments, unless the assets do produce the same return in all years. In an internally consistent asset-liability model, we must

use the same discounting procedure on the liability side as on the asset side. The next section is an attempt to do just that.

6. The Asset Allocation Related Liabilities

In this section, I introduce a new class of liabilities in a qualitative way. Let us re-focus our attention away from the liability side to the asset side. Assume that the APM has a set of assumptions for various asset classes and an asset allocation policy. Now we can bring into play actual returns generated by the policy.

Asset allocation related liability (AARL) is defined as a pension commitment discounted at the returns produced by the asset allocation policy. If we have a series of returns that will happen in the next 100 years (a preexperienced return history), we use that series to discount the payments in the pension commitment. The resulting present value is an *observation* of AARL. I'd like to stress that the definition of AARL is within the framework of the APM. Note that we may utilize both accrued and/or ultimate pension commitments for the AARL, depending on the purpose of the calculation.

The asset allocation related liabilities differ from the traditional liabilities in many respects.

1. AARL is a random variable (we utilize a broadly recognized assumption that assets can be modeled as random variables).
2. AARL depends on the asset allocation policy.
3. AARL contains information about both the asset and the liability sides.
4. AARL reflects the risks embedded in the asset policy (think of the standard deviation of AARL).

I understand that the concept of AARL may produce further disagreements with the economists. According to Bader and Gold (2003), "the vast majority of thought leaders in the financial community agree" that "liabilities are measured without regard to the expected return on risky assets that may be used to fund these liabilities" (p. 33). I suppose the same is true about the riskiness of the "assets that may be used to fund these liabilities". In other words, financial economics requires the liability to be independent from the asset allocation. Our goal is quite the opposite. We

want the liability to "know" something about *both* the asset and the liability sides.

I believe the asset allocation related liabilities are free of at least some deficiencies criticized in Bader and Gold (2003). That alone would be a good justification for the introduction of the AARLs. But the main benefits of the AARLs are outside of the traditional "liability measurement" world. The need for such a concept comes from the asset allocation area.

Every "liability measurement" has its purpose and "constituency." After all, actuaries have the liabilities that fit their purposes (the funding side). The accountants have the liabilities designed for their purposes as well (the financial reporting side). If economists want to introduce a new class of liabilities that coincides with their own purposes, they should be free to do so. Even though I think that actuaries, accountants and economists will find AARLs remarkably helpful, *the primary reason* for introducing the concept of AARL is its usefulness for asset allocation purposes. In other words, AARLs are mainly designed *for practitioners involved in the asset allocation decision*.

At this time, I do not recommend introducing asset allocation related liabilities into actuarial reports and financial statements. There may be conceptual objections to a random variable that is used for financial reporting purposes. And there are some technical problems to be resolved as well. At this point, as far as traditional actuarial valuation is concerned, AARL is a valuable "behind-the-scenes" tool for selecting reasonable deterministic economic assumptions. I perceive a traditional deterministic liability as an observation of the corresponding AARL best suited for the liability's particular purpose, in the opinion of the actuary.

I believe this is the most promising direction in which the answers to various questions in this debate will be found.

7. Conclusion

The fundamental argument I wish to advance is the following. The simplification of a fixed discount rate (as well as salary growth rate and COLA) may not be acceptable in an asset-liability framework. Deterministic economic assumptions are the true source of "The Great Controversy."

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