ACTUARIAL RESEARCH CLEARING HOUSE
1981 VOL. 1

Bond Immunization Strategies

by

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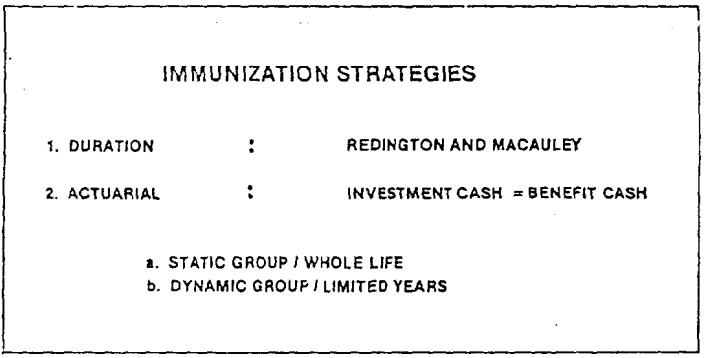
The search for certainty has an eternal appeal for anyone who acknowledges his fear or anxiety about unpredictable future events. The investor - greedy fellow that he is - yearns not only for certainty in investment returns, but the highest possible total return on his capital. In today's atmosphere, the high returns available on bonds have attracted much investor interest, and it is only natural that fixed income investors look for ways to assure the maintenance of high returns on their bond portfolios. Bond immunization offers that potential.



The first American author on bond immunization was the economist Frederick Macauley writing in 1938. Fourteen years later, in 1952, the idea was described by a British actuary, F.M. Redington, an officer for an English life insurance company. The premise, which they proved for a simplified model, was that a portfolio with a duration equal to its investment horizon would have a highly predictable total rate of return over that investment horizon, regardless of any subsequent changes in coupon rates. Under this condition, any changes in current yields - which determine the reinvestment rates for income and principal repayments - are exactly offset by changes in the market value of the portfolio.

(The "duration" of a portfolio is the average time that must elapse before the owner receives the cash due on the portfolio assets, with each cash payment weighted by its present value and the time remaining before that cash payment is due.) We know now that the proofs by Redington and Macauley were only special cases of a much more complicated environment. The yield curve is neither flat nor rigid and our understanding of immunization theory and implementation tactics is still evolving. Marty Leibowitz and Salomon Brothers deserve much credit for their splendid technical and theoretical work in this field. The experiments and investigations help us deal with the real world of constantly changing yield curves, and achieve the goals of an immunization strategy with remarkable accuracy.

The other major approach to reducing uncertainty in future bond returns could be called actuarial immunization or cash matching. Its basic premise is that the uncertainty associated with the reinvestment of coupons or principal payments will be eliminated if the portfolio's cash requirements exactly match the cash generated by the investments.

This concept has particular significance for pension funds. My remarks will focus on its application to two situations: paying the benefits for a defined group of pensioners, with a cash requirement that declines from year to year as these pensioners die, but continues for many decades into the future. The second example focuses on a dynamic group of pensioners, in other words, a group that constantly being replenished by new retirees.

When immunization is applied to an expanding group of pensioners, it cannot reach to the end of their lives. An immunized bond portfolio must necessarily be limited to a few years into the future -- perhaps five or ten -- since the pension fund is simply not large enough to protect payments that extend for any longer period.

Using a bond portfolio to match a set of actuarial liabilities is more complex than it appears at first glance. The cash flows themselves can only be estimated, since they depend upon forecasts of future mortality and, for dynamic groups, upon the prediction of the retirement dates and future salary increases for employees not yet retired, since these events determine the amount of annual payments.

Furthermore, if a plan has a cost-of-living feature or some other formula for increasing benefits after retirement, the projected cash flows are subject to the accuracy of an inflation forecast. In addition, benefit payments are due monthly, whereas bond coupons are typically paid semi-annually. For these and other reasons we must realize that the practical world prevents immunization in the absolute sense. Fortunately, we can achieve a close approximation to our goal of removing uncertainty in future rates of return.

In the ecumenical and scientific spirit that brings us together today, we should acknowledge that the substance of an immunization strategy can be implemented in many ways. The choice among them requires judgments about the desired degree of certainty, opportunity costs, administrative efficiency and constraints on future investment policy.

IMPLEMENTATION TECHNIQUES

1. IMMUNIZED BOND PORTFOLIOS
   - DURATION/HORIZON
   - MATCHED LIABILITIES
2. TERMINAL FUNDING ANNUITY
   - SINGLE PREMIUM
   - 5 YEAR PAYMENT
3. GUARANTEED INVESTMENT CONTRACTS
   - DISCOUNT INSTRUMENT
   - COMBINED WITH IMMUNIZED PORTFOLIO
4. MORTGAGES
   - DIRECT OWNERSHIP
   - INSURED POOLS

Through bond portfolios we can remove most of the uncertainty about future returns on the portfolio. There is only one way in which absolute certainty can be achieved: through contractual relationships with an insurance company that is willing to accept responsibility for all or part of a pension plan's liabilities in exchange for a specified capital transfer or premium.

For today's purpose, it is most useful to concentrate on terminal funding annuity contracts. For those not familiar with that term, let me explain that terminal funding annuities are typically purchased for a group of pensioners who are receiving benefits on the date the contract is issued.

The insurance company agrees to pay all of the benefits to which they are entitled in exchange for a single premium. The pension fund is simultaneously relieved of its obligation to pay future benefits to those participants and separated from part of its portfolio. A pension plan may also use terminal funding on a continuing basis. As each person reaches retirement the insurance company is paid a lump sum and thereupon becomes responsible for future payments to that pensioner.

One disadvantage of a terminal funding contract is that it imposes spiking demands for cash on the pension portfolio. Under some conditions the terminal funding premiums may exceed the total of new contributions and the current income on the portfolio. This would require a forced liquidation of the plan's assets. This possibility could lead to security sales in depressed markets or force the plan to adopt a more conservative investment policy.

One way to minimize or eliminate this hazard, while retaining the advantages of insuring retired life liabilities, is to pay the insurance company a level annual premium over several years after each participant retires, rather than a lump sum at the time of retirement. Such contracts are not generally available from insurance companies today, but the idea has been around for at least 20 years. I remember exploring this concept with one major insurance company as far back as 1959. If bond immunization becomes a major thrust of pension fund investment policies, I would predict that level premium terminal funding will be a significant source of business for enterprising companies in the group annuity business.

Guaranteed investment contracts get much of the credit for the current interest in immunized bond portfolios. They have been enormously successful for attracting pension fund capital, as well as the assets of profit sharing and thrift plans. Here again, we see that the concept is different from the practical reality. Only the bullet form of guaranteed investment contract can achieve to the fullest degree the goals of immunization. The bullet form involves a single deposit with the insurance company and a single repayment date at which time both the original capital and the accumulated interest are paid.

If the GIC rate of investment return is subject to future market forces or either income or capital are returned before the ultimate payment date, plan sponsor has not completely escaped the uncertainty associated with forecasts of future coupon yields.

Immunization concepts and strategies can also be implemented through a blend of techniques, such as a combination of GICs and an immunized bond portfolio, and by using other financial instruments, such as mortgages.

I would like to draw your attention to two other variations of the immunization cheme.

A plan sponsor who is interested in reaching for the higher returns that may be available on common stock portfolios can use an immunized bond portfolio to dampen the overall volatility of his portfolio. Knowing that the immunized bond portfolio has a highly predictable rate of return over its investment horizon and knowing that ERISA will permit him to value the bond portfolio at book value, thus assuring zero volatility for actuarial purposes, a plan sponsor who believes that the equity risk premium is worth pursuing can pose this question: "If I am prepared to accept a standard deviation of X% for my total portfolio return, what fraction of my pension fund assets must be committed to an immunized portfolio?"

The issue of maximum common stock exposure in a pension fund can be addressed in another fashion. A plan sponsor might make this statement: "We want to be completed satisfied that the cash generated on our fixed income portfolio will closely match the projected benefit payments to plan participants in the next five or ten years. Once our liquidity requirements for the next five or ten years have been satisfied, all

of the remainder of the plan's assets may be allocated to stocks or other variable assets." This concept of five to ten year forward coverage of benefit payments implies a program for annually adding to the fixed income portfolio in anticipation of the benefit payments coming due five or ten years in the future. Thus, the plan sponsor who adopts this principle must set aside out of each year's contribution an amount adequate, along with accumulated interest, to cover the projected payments at that future date. Having done so, he has additional degrees of freedom in choosing the investment policy for the remainder of the plan's assets.

Let me give you now two illustrations of actuarial immunization and then show how immunization techniques can justify a reduction in the plan sponsor's current contributions.

MATCHING RETIRED LIFE LIABILITIES

Year	Benefits	Investment Cash	Net Cash
1980	$25.6	25.6	0.0
1985	21.2	21.2	0.0
1990	16.4	16.4	0.0
1995	11.5	11.5	0.0
2000	7.2	7.2	0.0
2005	3.9	3.9	0.0
2009	2.1	0.0	8.2
2010 & Beyond	8.2	0.0	0.0
Total	388.8	388.8	0
Portfolio Market Value:			$185.1 million
Duration:			5.95 years
Internal Rate of Return:			10.56%

This slide illustrates the principle of actuarial immunization for an existing group of retired employees. In this particular plan employees now retired are receiving payments that total approximately $26 million. In 1980 they will receive $25,600,000 in monthly benefit checks. By 1985, annual payments to the survivors from the original group will be $21.2 million. Each year the payments will decline and, by the 30th year, will be down to $2.1 million. Payments in the year 2010 and thereafter will total $8,200,000. The total cash payments received by these retirees will be $388,800,000. Dr. Leibowitz and his staff identified several portfolios of government or corporate bonds that would generate cash from coupons and maturities closely matching this series of annual benefit payments. The cash created by the portfolio and the cumulative net cash after making all benefit payments are illustrated in the last two columns of the slide.

I should alert you that the matching is not as neat as the slide suggests, for several reasons. Bond coupons are paid semi-annually and it is necessary to accumulate cash in advance of the monthly benefit requirements. This creates a float which has to be invested in cash equivalents at the prevailing rate and this rate is not predictable. Also, in the later years of the analysis, particularly for government bond portfolios, there is not a wide enough array of maturities to provide exact matching. This means that the float can be fairly large.

Finally, it is not practical to extend the matching process beyond thirty years. However, the present value of the payments due beyond the 30th year is only about 1/3 of 1% of the total value of the portfolio, so this error is insignificant. At the bottom of the slide we see that the market value of a portfolio of government securities with these cash characteristics is $185,000,000. It has an internal rate of return of 10½% and a duration, calculated at 8½%, of 5.95 years. For the sake of comparison the duration would be 5.4 years, if the discount rate were 10½%, and 9.6 years at a zero discount rate.

FIVE YEAR FORWARD PROTECTION

Year t	Contribution	Payments, year t + 5		% of Portfolio	
		$	% of Contribution	Bonds	Stocks
1	$42.5	$26.5	62%	33%	67%
2	44.8	29.1	65	.	.
3	47.1	31.9	68	.	.
4	49.6	35.1	71	.	.
5	52.2	38.6	74	.	.
6	54.9	42.2	77	.	.
7	57.8	45.7	79	.	.
8	60.9	49.5	81	.	.
9	64.1	53.3	83	.	.
10	67.4	57.2	85	25%	75%

The next slide gives an example of dynamic actuarial matching. In this situation we have an expanding population of retirees. The new retirees more than offset those who die. Furthermore, their benefit payments are considerably larger. The plan sponsor's projected annual contributions over the next ten years are indicated in the second column. They will rise from $42 million to $67 million. This example assumes that the projected payments over the next five years will always be covered by short term fixed income securities. The present value of

benefit payments in the first five years, using a discount rate of 9%, equals 33% of the original portfolio. To maintain five year forward protection of the projected benefit payments, it is necessary to set aside out of each year's contribution an amount equal to the discounted value of the payments that will be due five years hence. The third column shows the discounted value in each year of the estimated benefit payments five years later. The discount rate is also 9%. For example, in the first year, $26.5 million -- which is 62% of the plan sponsor's contribution in that year -- is dedicated to the benefit payments in the sixth year. The amount of those projected benefit payments -- which is not shown on the slide -- is $41 million. As we see in the fourth column, this program ties up a large -- and rising -- part of each year's contribution.

By the tenth year, 85% of the current contribution is committed to the short term portfolio. The fifth column shows that the mandatory commitment to the shorter end of the debt market declines from 33% of total plan assets in the first year to 25% in the 10th year, leaving 2/3rds to 3/4 of the portfolio available for investment in common stocks or other variable assets. This is an apparent anomaly, in view of the fact that an increasing part of each year's contribution is allocated to the debt portfolio. The explanation for this relationship is that the short term debt portfolio is constantly being depleted by benefit payments, whereas the remainder of the portfolio has no cash strain and all of its income and capital appreciation are accumulating. In today's environment -- with an inverted yield curve and very high short term rates -- five year immunization of projected benefit payments is an attractive idea.

This technique is also helpful in making a judgment about a plan's tolerance for volatility and its ability to reach toward common stocks, if the perceived return on stocks provides sufficient compensation for the greater investment risk and volatility of the stock market.

My last example illustrates the potential for an immediate improvement in pension costs as a result of adopting a bond immunization strategy. This can be accomplished by increasing the actuarial investment return assumption by an amount which represents the economic value of the immunization strategy. This is achieved by comparing the investment return on the immunized portfolio with the investment return underlying the plan's present actuarial basis. This is not an easy task for several reasons, the principal one being that most plans have an actuarial investment return assumption that does not look realisticially at the economy and the capital markets. This situation is vividly and dismally illustrated by a survey recently conducted by my Firm. We gathered data on the actuarial bases of 235 pension plans that use Peat, Marwick, Mitchell & Co. as audutors, but not as actuaries. 180 of these plans have benefits based on final salary. Their average investment return assumption is 5.9%. This understatement of the investment return assumption -- which on the surface suggests that these costs are extremely conservative -- is offset by a tendency to understate their projections of future salary increases. The average annual salary increase assumption for these 180 plans is 4½%.

You must measure the effect of an immunization strategy by comparing the return on the immunized portfolio with the plan's "true" investment expectation. One approach to analyzing the underlying investment return assumption for a pension plan is shown in the next slide.

LONG TERM EXPECTED RETURN

	Bonds	Stocks
Inflation	5%	5%
Real Return	2	6 (2)
Nominal Return (1)	7%	11%

Bond/Stock mix: 50/50

Stock Contingency Margin: 1%

Investment Return Assumption: 1/2 × 7.0% + 1/2 × 10.0% = 8.5%

(1) Net of management fees and trading costs
(2) Equity risk premium = 4%

You have to develop expected returns for the principal asset categories in the portfolio. This illustration assumes that the portfolio is restricted to bonds and stocks. The analysis begins with an estimate of the long term inflation rate. I have assumed a 5% inflation rate. This is, of course, materially lower than our current experience but is generally in line with the results of another Peat, Marwick survey recently conducted among 30 consulting economists and economists with major financial institutions.

Next you have to allow for the real returns on plan assets. I assumed that the real return on bonds, after allowing for management fees and trading costs, would be 2%. The real return on stocks was estimated at 6%.

This assumes an equity risk premium of approximately 4% over the return on a diversified portfolio of high quality bonds. These assumptions produce expected returns of 7% on bonds and 11% on stocks. To derive the actuarial investment return assumption we now make assumptions about the portfolio's asset

mix, then introduce a contingency margin to reflect the possibility that our expectations will be disappointed. On the assumption that the portfolio will be about equally divided between bonds and stocks and that the uncertainty in the forecast of stock returns requires a contingency margin of 1%, we can now derive the investment return assumption. One half of the portfolio will generate a net return of 7% and the other half will have a net return of 10%, after allowing for the contingency margin of 1%. The result is an actuarial investment return assumption of 8½%.

We now have a reference point for measuring the economic significance of an immunization strategy.

	INVESTMENT RETURN ASSUMPTION	
	7%	8½%
Retired Life Liability	$224.5	$205.4
Present Value at 10½%	184.7	184.7
Actuarial Gain	$ 39.8	$ 20.8
Amortized over 15 years	$ 4.1	$ 2.4
Annual Cost:		
Original	$ 42.5	$ 42.5
Adjusted	$ 38.4	$ 40.1
% Reduction	9½%	6%
$ in millions		

The top line of this slide shows the actuarial value of the benefits due to a group of retired employees using two different investment return assumptions: 7% and 8½%. Two rates are shown because there are two different ways in which you can look at the economic advantage of immunization. One way is to say

that the benefits from immunization should be compared to the expected return on the bonds in the portfolio, that is, the 7% developed in the previous slide. The other point of view is to say that the benefits from immunization should be compared to the composite expectation for plan assets, that is, the 8½% developed in our example. The second is obviously more conservative than the first.

The expected return on the immunized portfolio is assumed to be 10½%. This conclusion comes from the government bond portfolio noted on the third slide. We see that the true actuarial value of the future benefit payments to current retirees is only $185,000,000. This creates an actuarial gain of $40 million by reference to a 7% or $21 million if our reference point is an 8½% investment return assumption. The plan sponsor cannot immediately capture all of this prospective economic gain. Like other actuarial gains and losses, its effect must be amortized over the future life of the plan. If the gains from immunization are recognized over 15 years, using the period specified in ERISA for calculation of the minimum funding standard account, the current benefit from an immunization strategy is approximately one-tenth of the prospective economic gain. That is, $4.2 million if we compare to a 7% investment return assumption and $2.4 million if the comparison is with an 8½% investment return assumption.

The pension plan from which this example is drawn had a current pension cost of $42.5 million, as shown in the slide. An immunization strategy focused on the plan's liability for benefits to currently retired employees would have permitted the sponsor to cut contributions by 6 to 10%.

I believe that we can fairly conclude that immunization strategies are beneficial for many pension plans. They can reduce the uncertainty of investment returns, can influence the investment policy for the remainder of the pension fund and can be used to justify an immediate improvement in the plan sponsor's current pension expense. Each of the potential outcomes is appealing. They justify a careful results-oriented analysis by a thoughtful plan fiduciary.

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January 17, 1980