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IMMUNIZATION

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In recent years there has been an increasing interest in the practical application of immunization theory to North American Funds. There is a lack of literature on this subject and this article is written to give a clear and concise description of the theory, and of its role in the framing of investment policy.

If we start with a simple liability, being a single sum of $1,000 due in, say, 10 years time, there being no further obligations on either party, then investment policy can be framed as follows:

Ideally: Find a risk-free no-coupon bond, without options, maturing for $1,000 in 10 years time. This will give an absolute match and the fund is free of investment risk; current yield is then locked-up for the life of the liability.

But: Since all bonds carry coupons, find a risk-free bond, without options, of a somewhat longer term than 10 years. If interest rates move, the shift in market value of the asset will be offset by the change in the rate of interest that can be obtained when the future coupons are re-invested. This will give an immunized position, which is potentially active since the term of the bond must continually be changed. The equations necessary to locate the immunizing asset at any point in time were given by Reddington, and again, *current yield* is locked-up for the life of the liability.

Nevertheless: The investment manager is expected to seek investment situations which go beyond the risk-free position, in the expectation of a higher return. For example, if he is of the viewpoint that interest rates are going to go up, he would forego the 10-year risk-free bond in the above example and move money into the short end of the market.

Furthermore, he may seek anomaly positions in the market: he may invest his funds in lower grade bonds or in bonds with wide options, or in less marketable or even illiquid assets. And he may go into real estate and common stocks. All of these and other decisions rest on the two basic premises: (i) the investment manager feels he can improve upon the basic immunizing position and (ii) such investments are relatively more attractive than alternative risks.

All of which: Can be summarized by saying that, with known liabilities, the immunized position is free of risk; but, unless there is complete negation of the investment function, there will be, and should be, departure from this position, in search of more attractive situations, constrained only by the freedom allowed to the investment manager. In turn, this freedom is restricted by the amount of surplus which is placed at risk by his actions.

Correspondingly, an actuary evaluating a non-immunizing fund is, in his treatment of the investment element, quantifying these very same risks, and this is true whether the fund is deliberately not immunizing out of choice, or out of ignorance, or because the required immunizing assets are not available.

Now the above analysis fits most U.K. Life Funds very well, since the obligations for sums insured are not cluttered by guaranteeing surrender values. In the event of policy termination the office will quote an amount which reflects the market value of the assets underlying the policy. Thus any projection of liability flow in these funds can be made without allowing for withdrawal, and errors in this projection are of a statistical nature only. Similar comments apply to the typical North American immediate annuity fund.

Turning to the typical North American life fund, there will be guaranteed surrender values. It would be nice if we could assume that withdrawal is also statistical in nature since we can then project liability flow on multiple decrement bases and take that projection as the basis for being immunized. But this is obviously unrealistic; the decision to surrender for a guaranteed value is potentially much influenced by rates of return elsewhere, and if interest rates move to very high levels, surrenders occur at a time when the assets are least able to cope with the guaranteed values. To some extent this concern may be mitigated by the presence of blocks of business where there are no surrender values *if* the related funds stand to gain from high rates of interest on re-investment; also by the presence of riders on basic policies without further surrender value. But on the other hand this concern must be accentuated by the possibility of mortality anti-selection, and this may well be one reason why not all policies surrender.

We must conclude then, that there is no risk-free investment position for business with guaranteed surrender values. For if we hold short notes against surrender tomorrow, there is risk of the policy remaining in force (through a long period of low interest rates), and if, on the other hand, we hold the long immunizing assets on the presumption that the policy does not terminate, there is risk of surrender in a period of low market values.

Between these two extremes we can estimate, using a multiple-decrement projection, a more reasonable position, which represents a mix of the short and long positions on some assumed termination basis. There is still risk, and there is still a need for surplus protection, but, with these qualifications, it is an acceptable basis for framing investment policy.

Having introduced the principles of risk-free funding, we turn now to pension funds. Can immunization theory be applied to these funds? Well, in most cases the pensioner and deferred vested liabilities can be regarded as a known liability with corresponding risk-free funding patterns. Furthermore, the accrued benefits in flat benefit and career-average type plans also give rise to known liabilities, but, just as the insurance fund with guaranteed values is subject to the uncertainties of termination, so the pension plan is buffeted by the various consequences of termination.

Pension plan members can terminate service, entitling them either to no benefit at all, or to a cash refund (generally on a guaranteed basis), or to a deferred pension. Since employee turnover is affected by economic conditions, we cannot presume that this element is statistical, but again we can estimate, on some assumed basis for termination, the qualified-risk funding patterns. In fact, contrary to popular belief, these patterns can sometimes be achieved in practice.

Some contributory career-average and flat benefit plans can have surprisingly short liability mean terms when valued on an accrued benefit method, using "realistic" valuation assumptions, and

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Immunization

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using *current* interest rates as is required in applying immunization theory. This is because a major part of the benefits paid will simply be refunds of contributions on termination of service. Even non-contributory plans, where actual employee turnover is high, can have short liability mean terms.

It will be found in these situations that the old rule of thumb that "an increase in investment return of 1% will reduce liabilities by 25%" is way off target, the reduction being closer to 10%. Also, in these situations the actuary must of course beware of the mean term of the assets being longer than the mean term of liabilities, in which case prudence would lead him to contemplate the effect on the fund if interest rates were to *increase*.

Final average plans are a completely different matter. The benefits themselves are very sensitive to future economic conditions just as interest rates are. Immunization can in theory protect a fund with fixed benefits from future changes in interest rates, but when the benefits themselves are subject to the same economic forces as interest rates, immunization in its traditional form is not applicable. That is not to say that immunization theory cannnot be applied to certain categories of liabilities under a final average plan, the pensioner and deferred vested liabilities being the most obvious candidates for risk-free funding. However, the risk-free position for a final average plan can be shown to be investment in assets which will give a rate of return correlated with salary escalation, and one type of asset that will do this is money-market notes if there is a constant difference between rates of interest and salary escalation.

Nice in theory, but for any fund we would like to caution against the indiscriminate application of immunization theory, and to stress that there are significant differences between pension and insurance funds. Generally speaking, pension funds can live with deficiencies where insurance funds cannot. Furthermore, an insurance fund is never in a position to take credit for the profitability of its future new business.

This discussion demonstrates that precision in the application of immunization theory is not appropriate, but as with any actuarial theory it is extremely important to be precise about the theory itself. It should also be clear that, as actuaries, we must be aware of the relative structures and therefore volatilities of the asset and liability portfolios we meet with in practice. Perhaps the most important practical application of immunization theory is not to say whether a fund should be investing shorter or longer (that's the job of the investment manager) but to point out and quantify the implications of and risks involved in adopting any particular investment strategy and policy. This very clearly is the job of the actuary. □

Actuarial Notation Errata

In the table on page 5 of the March issue it was not clear from the printing that in the linearized symbols the bracketed (x) should appear on the same line as the parameter symbols a and A. Only in the Halo notation is x a subscript. Further, the word "Synthesis" (corrected) belongs with the line below and the second author's name should be spelled "Engelfriet." □

Encyclopedic Social Security

(*Continued from page* 1)

Interwoven with the technical detail from the book the author has many an insight into the legislative process involved in its development. Here and there he provides justifiable and pointed criticism of a defect or inconsistency that needs correction. There have been many critics of the system holding diverse and at times opposite viewpoints. In presenting their sometimes conflicting arguments, Bob shows the consideration of a good moderator, incidentally at times showing up the weakness of a demonstrably unsound position.

The vast coverage of the book includes a treatment of basic concepts, present provisions of the system, its evolution, financing, directions of change and many of the various issues which presently exercise its critics and advocates. Medicare is covered with careful attention to detail, principles, evolution, financing, and future change. Actuarial costs and statistical summaries are provided.

In the latter part of the book, Bob covers various related programs, including public assistance (food stamps, SSI, state public assistance, and proposals for a Family Assistance plan), the Railroad Retirement plans, Unemployment Insurance, Workmen's Compensation, Cash Sickness, and other special programs for government employees and veterans. Finally, some foreign social security programs are briefly covered. Appendices include material on early basic concepts and a most valuable summary of the Social Security system as it exists today.

This is the author's own special field. He is uniquely qualified to write this book, and we are all deeply indebted to him for placing his wealth of knowledge in such compact and useful form. This book is a must for anyone seriously involved with employee benefits.

It is inevitable that in writing about a subject as fluid as the Social Security system, the wisdom of today is superseded by the research and new perspective of tomorrow. This book was printed in 1975, which seems recent enough. But even as these words are being written only a few months later, the report of the Consultant Panel appointed by the Congressional Research Service is nearing completion. This will certainly present new perspectives and point to new directions of change with a view to stabilizing the finances of the system and restoring a measure of control over benefit levels by Congress.

Though this will not detract from the value of Bob Myers' excellent book, it may serve to remind us that nothing in this field remains up-to-the-minute for very long. The Social Security System, if it is to survive, will have to be stabilized, strengthened, and brought into line with social changes such as the rise in the proportion of married women in paid employment. When these changes are made we will all have to hope that Bob Myers will follow them with a new edition. For now the present one does very well. □