THE OPERATION OF UNITISED FUNDS INCORPORATING MINIMUM BENEFIT GUARANTEES

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ABSTRACT

The paper starts by considering earlier work on the cost of minimum benefit guarantees for unit-linked contracts, and then discusses the difference between such contracts and with-profit contracts. The results of modelling a particular form of contract using a stochastic model of the stock market are then presented. This identifies the expected cost of the guarantee, and a practical system for taking an appropriate charge out of the fund for investment in stock options is described. Finally this system is tested against a scenario based on the actual performance of the UK stock market over the five years 1987 to 1991. It is demonstrated that the proposed system would have kept the performance of the fund closely in line with that of the underlying assets after allowing for the specific charges.

1. INTRODUCTION

1.1. When unit-linked life assurance policies were first developed in the UK some 30 years ago, it was common practice for the policy to guarantee that the proceeds payable on maturity would not be less than the total that had been paid in premiums. Historical evidence of stock market behaviour appeared to indicate that the risk of the guarantee being operative was negligible, and companies did not charge explicitly for it. Nor did they see any necessity to put up additional reserves to cover the risk.

1.2. The late Sidney Benjamin felt that this risk could not simply be ignored, and produced some figures based on a random walk model of stock market prices which gave alarming results. There was considerable discussion of the validity of the model and the approach, which considered a single generation of policies only, but it was clear that however small the probability, a scenario could be constructed that would
cause companies to become insolvent as a result of the existence of the guarantees.

1.3. The Institute and the Faculty of Actuaries set up working parties to examine the matter further, and in 1980 the working party chaired by Alan Ford reported on its work. This was based on a model of stock market behaviour developed by Professor David Wilkie, that has subsequently been used for extensive stochastic modelling, which assumes that in the long term prices follow dividends.

1.4. The conclusions of the working party were generally accepted by the profession, and the UK Government Actuary made it known that he would expect actuaries to reserve for minimum benefit guarantees on this basis. Most companies have now ceased to give these guarantees in their policies because of the level of the reserves required, and the subject has ceased to be a major concern for the profession.

1.5. The stock market crash of 1987, and subsequent economic problems have however made the public more chary of equity investment and revived interest in guarantees. Companies have had considerable success in selling special single premium bonds that pay a stated proportion of the capital gain that would have been obtained from investment in the stock market, with money back if this would have resulted in a loss. They have also sold substantial amounts of single premium with-profits business.

2. WITH-PROFIT POLICIES

2.1. As far as the investor is concerned, the with-profit contract has the desired qualities of equity participation plus guarantee. The key difference between this and the unit-linked contract with a guarantee, is the fact that the company has control of the investment decisions. The investment objectives will be to optimise the return subject to the overriding requirement to cover the guaranteed benefits, and anyone buying the product has to accept this position.

2.2. In 1990, John O’Neill and the author presented a paper to the Institute of Actuaries entitled “A Unitised Fund Approach to With-Profit Business”. That paper describes a form of with-profit contract
under which there is a terminal bonus calculated by reference to the asset share and discusses an approach to determining the investment policy for these contracts. A key feature is that unit-linked policy systems are used to calculate an explicit asset share for each policy.

2.3. The fundamental assumption was that the fund would be invested in equities except to the extent that it was necessary to invest in dated fixed-interest securities in order to cover the guarantees sufficiently to avoid prejudicing the interests of the continuing policyholders. It is inherent in this approach that the expected dividends are taken into account. This is important for two reasons. First, because it is generally accepted that the level of dividend income earned on a portfolio of ordinary shares is more stable than its market value. Secondly, because in a mature with-profit fund the dividend income earned on the whole investment portfolio is substantial by comparison with the guaranteed sums payable on a single generation of maturing policies.

2.4. This approach is described in the paper as being a long-term strategy to secure the basic stability of the business, with the intention that this would be supplemented by a short-term strategy using derivative instruments. Both strategies are essentially intended to protect the fund against violent falls in the market value of the investments at the price of some reduction in the expected return.

2.5. In a fund operated on this basis each generation of policyholders is effectively receiving a guarantee paid for by succeeding generations in return for having provided a guarantee to preceding generations. It is important that this is clearly spelt out to the policyholders, but it is equally important that the fund is managed so that at no time is the cost of providing the guarantee too large. On the other hand the manager would not wish to impair the expected return on the fund by holding such a large proportion in fixed interest securities that he could be sure that in no circumstances would the guarantees operate. It is a matter of balance.

2.6. It will be seen that there is a very fine line between a contract of the type described, namely a with-profit contract where the terminal bonus is determined by a precisely calculated asset share, and a unit-linked contract. There are in fact two significant differences. The first is
that for a with-profit contract the manager has control of the investment policy, whereas with a linked contract the investment policy of the linked fund is normally defined independently. The second is that the asset share is in fact only used as a guide to the terminal bonus. An element of smoothing is incorporated, and the final decision is under the control of the company, and the actuary can have some influence on the decision.

2.7. The latter point may be regarded as a technicality, with which the policyholder will not generally be greatly concerned. If the investment policy of an internal fund is defined so as to incorporate some form of guarantee, and provides that the investment managers would have regard to the need to cover this guarantee when determining their investment strategy, then that strategy can be considered in the same way as would be appropriate for a with-profit fund.

3. UNITISED FUNDS WITH GUARANTEE PROVISIONS

3.1. The author has recently been involved in the development of unit-linked money-purchase pension contracts which provide a guaranteed minimum benefit at the vesting date by the device of defining a minimum unit price at which the fund would be valued on that date. In one case the minimum price was the average of the prices over the previous 24 months; in another it was 90% of the highest previous price.

3.2. In each case the fund is managed on the same mutual basis as a with-profits fund, namely that the fund bears the cost of the guarantee, so that each generation effectively provides the guarantee for previous generations, and benefits from a guarantee provided by succeeding generations. The shareholders are ultimately responsible for the guarantee to the last generation of policyholders in the fund.

3.3. The objective of the investment managers in such a fund is to produce the best possible return consistent with reasonable equity between the generations. They will improve this equity by ensuring that no one generation costs the fund substantially more than its asset share calculated on market value as a result of the guarantee. Effectively they will be accepting a reduction in the expected performance of the fund in order to reduce the expected variance.
3.4. It is important that the managers retain the right to invest the fund as they see fit, within the legal constraints. In particular, if the fund is closed to new business and run down, it may be necessary to shift the investments increasingly into fixed interest dated securities chosen to match the liabilities measured by the guarantees.

3.5. When the fund is active and has reached a mature state, it will be found that the dividend income on the whole fund provides a large proportion of the proceeds payable on maturities in any one year. Strategies can then be devised for improving the protection by investing a small amount of the fund in put options. Alternatively, switches can be made into fixed interest stocks, and the relative performance secured by the purchase of call options. Unfortunately, in the UK these strategies are not available to the fund manager directly, as share options are not included in the list of investments to which a unit-linked contract may be linked.

3.6. As a result it is necessary to identify the expected cost of the required options and express this as an additional management charge which is then taken out of the fund and credited to a separate reserve account. Options can then be purchased at the appropriate time, and the proceeds used to defray the costs of the guarantees. Any shortfall will fall on the fund and affect the unit price. Any excess will be retained in the reserve account and reinvested in options to match later guarantees.

4. Cost of the Guarantee

4.1. In order to determine the appropriate additional charge that should be made if the price on vesting is guaranteed not to be less than 90% of the highest price achieved by the fund some simple stochastic models were constructed. These were based on Professor Wilkie's model of stock market behaviour with parameters appropriate for UK equities. The central forecast assumptions were 5½% per annum inflation and a 5½% per annum real rate of return. The fund was assumed to operate with a 5% bid/offer spread and a 1% annual management charge.

4.2. The first stage was to look at a single premium investment, measure the yield allowing for the guarantee and hence the excess of that
yield over the yield on the underlying fund, which can be taken as a measure of the value of the guarantee. The results of 10,000 simulations for 5 and 10 year terms are set out below:

<table>
<thead>
<tr>
<th>Term</th>
<th>Mean</th>
<th>Standard Deviation</th>
<th>Lower Quartile</th>
<th>Median</th>
<th>Upper Quartile</th>
</tr>
</thead>
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<tr>
<td>5</td>
<td>1.22</td>
<td>2.44</td>
<td>0.05</td>
<td>0.05</td>
<td>1.35</td>
</tr>
<tr>
<td>10</td>
<td>0.67</td>
<td>1.38</td>
<td>0.05</td>
<td>0.05</td>
<td>0.75</td>
</tr>
</tbody>
</table>

It will be seen that the distribution is significantly skewed. In fact on a one year projection, the mean at 3.10% is greater than the upper quartile at 1.65%.

4.3. Clearly it is important if such a guarantee is to be given to impose a minimum term of membership of the fund, and to limit the ability to contribute additional lump sums shortly before the vesting date. The averaging effect of regular premiums and the effect of overlapping generations are also likely to be significant. A more elaborate model was therefore constructed assuming steady sales of 10 year policies each month over the last ten years and continuing over the next ten years.

4.4. An adjustment was then made to the proposed policy conditions. With a 90% guarantee it would be possible, following a sharp drop in stock market prices, for the offer price of units to be lower than the currently guaranteed price. It was felt that this would be unreasonable and that it could be made a policy condition that the price paid by a policyholder should not be less than the price he was guaranteed. The difference between this price and the normal offer price would be taken to reserve to increase the amount to be invested in options in due course.

4.5. With this adjustment the model was run with the same stochastic model of stock market behaviour, but in this case the cost of the guarantee was measured by the under-performance of the fund over the ten year period relative to the underlying investments expressed as a difference in annual yield. The results were a mean of 0.40% pa with a standard deviation of 0.38%, median of 0.35% pa and upper and lower quartiles of 0.55% pa and 0.15% pa.
4.6. The model was also run with the same existing business, but no new business. In this case the mean under-performance was 4.2% pa, but the results were not felt to be reliable because of the effect on the results of the cases where the fund collapses completely as a result of the passive investment policy assumed. They do however underline the importance of retaining the right to switch to a predominantly fixed interest investment policy if the fund is closed to new business.

4.7. There remained some concern as to how this system would work in practice. How, for example, would it have coped with the stock market crash of October 1987? It was decided to model the operation of a fund run on the proposed basis over the five year period from January 1987 to December 1991, measure the under-performance against the underlying assets, and see whether a simple strategy of investment in options would have provided adequate protection.

4.8. The model assumed a mature fund with a broadly level pattern of maturities. It was assumed that the fund would have been able to invest in a unit trust that would have matched the UK All Share index, with reinvestment of dividends and with a 1% annual management charge. The bid price of this unit would have increased from 100p at the start of January 1987 to 168.08p at the end of December 1991, an annual rate of growth of 10.94% per annum, having reached a price of 147.09p in September 1987, and fallen to a low of 97.43p two months later. The net asset value of a unit of the fund would have increased from 100p at the start of January 1987 to 161.70p at the end of December 1991, an annual rate of growth of 10.09% per annum, so the cost of the guarantee could be taken as 0.85% per annum over that period. In November 1987 the guaranteed price would have been 132.38p compared to 97.43 for the underlying fund.

4.9. Rather than an additional annual charge, it was decided to model the effect of an additional initial charge. This was partly because it was thought that this would be more equitable as between those who were in the fund for the minimum period and those who were in for a longer period. The appropriate rate of additional initial charge was found to be 5%. Thus the fund would have been operated with a 10% bid/offer spread, 5% of which would go to the managers, and 5% into the reserve account. The reserve account would then be invested to
match the fund so that the reserve would remain at 5% of the fund value until used to buy options.

4.10. For the purpose of the calculation it was assumed that the reserve would be held until 6 months prior to the month of vesting for each policy, and then invested in 6 month put options in the FTSE-100 index. The premium for this index was assumed to be constant at 3\%\,\text{\%}. It was unfortunately not feasible to find what the premiums would actually have been each month for the five years, but the range was known to have been from 2.09\% to 6.11\%, the high figure having been recorded during the Gulf war.

4.11. The result of the modelling showed that there would have been a reasonable correlation between the times when the effect of the guarantee would have reduced the net asset value per unit and the times when the value of the maturing options would have increased it. At the end of December, the bid price of a unit in the fund would have been 168.61p against 168.08p for the underlying assets indicating that 5\% was marginally more than enough to provide the required protection. The largest negative difference would have been in April 1988 when the fund's bid price would have been 113.59p against 115.06p for the underlying assets. The difference would have remained roughly constant until the end of 1990 when for a number of months the value of the maturing options would have been greater than the cost of the guarantee.

5. SUMMARY AND CONCLUSIONS

5.1. These experimental calculations show that a unitised fund incorporating a guarantee can be made to work. They also show that, even with the crude strategy outlined above, a system of investment in options can improve the equity between generations of unitholders in such a fund.

5.2. The theoretical cost of the option was calculated using a stochastic model of the stock market, and the proposed system was then tested against a particular scenario based on actual experience. It is still, of course, necessary to think through the practical implications of any such contract. These include the additional record-keeping required for each policy, the additional systems required in pricing the units of
the fund, calculating the reserve, and making the required investments in options, and not least considering whether the rules will allow any customer to operate to unfair advantage against the other policyholders.

5.3. If these questions can be resolved satisfactorily, there is no doubt that the element of protection provided by such guarantees will be attractive to a number of potential customers, and further developments along these lines can be expected.

5.4. It remains for me to thank Professor David Wilkie for his helpful advice, and Patrick Lee for writing and running the computer program required for the stochastic modelling.