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DETERMINATION OF THE RATE OF INVESTMENT RETURN FOR THE DISCOUNTING OF GENERAL INSURANCE OUTSTANDING CLAIMS

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Summary

The paper concerns the situation in which an evaluation of outstanding claims is discounted, in anticipation of investment return earned by the funds supporting that liability. Factors bearing upon the choice of an appropriate rate of return to be assumed in this evaluation are considered.

The 'standard approach' to this problem is criticized in two main respects:

(i) there is usually no statement (indeed, no consideration) of whether the discounted value of outstanding claims is to be associated with assets at book, market, or some other value;
(ii) the discounting of outstanding claims is often performed by means of an assumed 'inflation gap', i.e. an assumed difference between future rates of inflation and investment return.

Various other matters germane to the determination of an appropriate rate of investment return are listed in Section 2.

Sections 3 and 5 deal particularly with points (i) and (ii) raised above. It is suggested that, in certain circumstances, an evaluation of outstanding claims which fails to address (i) or is carried out on an 'inflation gap' basis will be virtually meaningless.

Section 4 deals with the case of an insurance fund in which assets are matched with technical liabilities by amount and term. The considerations which would cause the rate of investment return projected in these circumstances, to differ from that projected in the case of an absence of matching are discussed.

Section 6 deals with the issue of exactly which assets are to be regarded as supporting the liability for outstanding claims. It is apparent that the identification of such assets will affect the rate of return to be regarded as referable to outstanding claims. Particular matters considered include:

(i) assets to be associated with acquisition of new business (and hence not with outstanding claims);
(ii) debtor and creditor items, particularly outstanding premiums and inwards loans.

Section 7 gives a numerical example of the projection of future rates of investment return. This is done by means of a computer projection of various items of a hypothetical insurance fund, taking into account projected future:

(i) interest rates;
(ii) rate of growth of new premium;
(iii) the required distribution of assets by sector;
(iv) profitability of business underwritten.

Conclusions on the various matters considered are dotted through the paper. For convenience, they are collected together in Section 8.

1. INTRODUCTION

1.1. *Scope of the paper*

Statistical estimation of outstanding claims of a general insurer usually consists of the following major steps:

(i) the determination of some model of the claims payment process;
(ii) on the basis of (i), the projection of future cash flows generated by claims outstanding at the date of evaluation;
(iii) (optional) the discounting of cash flows in (ii) to produce present values at the date of evaluation.

The propriety of step (iii) is often controversial, and a couple of brief comments are directed towards it in Section 1.2 below. The present paper is concerned with situations in which step (iii) is applied. In such situations a determination of the rates of investment return to be assumed in this discounting process is clearly necessary. The paper is concerned with the various considerations upon which the decision as to these rates should be based.

1.2. *Discounted and undiscounted estimates of outstanding claims*

The most prominent public manifestations of estimates of outstanding claims occur in company accounts. As far as such estimates are concerned, the position in Australia is currently as follows:

(i) some companies explicitly discount their outstanding claims for future investment income, while some explicity do not;
(ii) some companies, while not explicitly discounting their outstandings, fairly clearly include an implicit discount in the sense that their estimates are quite inadequate when assessed against any reasonable undiscounted standard;
(iii) in the case of the Liability classes of business (such as Employers Liability and Compulsory Third Party (the Australian name for Motor Third Party Bodily Injury)), where the average term of outstanding claims would typically be of the order $2\frac{1}{2}$–3 years, the discount for future investment income can easily amount to 25% or 30% of total outstandings, so that companies writing large volumes of business at premium rates, which include a discount for investment income, suffer heavy new business strain if outstandings are not discounted.

The debate as to the appropriateness of discounting outstandings, and more generally the role of investment income in insurance company accounts, continues in Australia as elsewhere. In my discussions with British colleagues, the appropriateness of such discounting for company accounting purposes has often been hotly denied. It would be a distraction from the purpose of the present paper to reopen that debate at this point. However, the following points are suggested as relevant to the present discussion:

(i) in Australia (presumably not unique outside the United Kingdom) discounting the outstandings is established, if not universally, at least as a respectable option (and one which has, within limits, the approval of the supervisory authorities);
(ii) irrespective of one's point of view as to published company accounts, it is

assumed that *at some stage* most insurers will need to carry out some discounting of outstanding claims for management accounting purposes.

As to (ii), it is not proposed to go into detail here concerning the management accounting issues which might be addressed. Relevant cases are dealt with in, for example, Benjamin (1976). If this assumption is correct, then it follows that those insurers will need to consider the questions raised here concerning the rates of future investment return to be used in the discounting process.

It should be stated at the outset, that the paper is intended to deal with the case in which a *realistic* discount for investment income, is to be incorporated in the provision for outstanding claims. Often, it is all too easy to avoid conceptual difficulties by the adoption of a sufficiently conservative approach. However, heavy-handed conservatism is of little value in the compilation of figures upon which managerial decisions are to be based. Nor may the interests of shareholders be best served by undue conservatism. In any event, it is to be emphasized that the following discussion addresses the situation in which a 'best estimate' is sought of the appropriate discount of the value of outstanding claims. Only against this standard can the degree of any conservatism in a valuation be assessed.

1.3. *The 'standard approach'*

The actuarial literature on the magnitude of rates of investment return to be assumed in discounting outstandings seems to be virtually non-existent. However, discussion with colleagues and observation of some of their professional work enables one to formulate what amounts to the commonly accepted current practice, or 'standard approach'.

The approach usually taken is similar to that used in calculations concerned with employee benefit funding. It is based upon the concept of an 'inflation gap', i.e., the difference between future rates of claims escalation and investment return respectively. As with employee benefit funding, it is simple to demonstrate that it is this gap which is the essential determinant of the magnitude of liability. That is, if i_t and r_t denote the rates of claims escalation and investment return respectively in year t, then these two rates can be varied over wide ranges, without substantial effect on the estimated liability provided that the gap $(i_t - r_t)$ is maintained for each t.

Typically, it is argued that variables of the economy, such as the rate of inflation and interest rates, are so uncertain that one can achieve no more reliable result than the assumption of a constant inflation gap over the period during which the outstanding claims are to run off.

Reasons for rejecting this view are given in Sections 2 and 5.

A further characteristic of the 'standard approach' is that it pays no heed to the assets side of the balance sheet. The liability for outstanding claims is calculated as a single figure (possibly expressed in conjunction with some margin of uncertainty) which, it is implied, is suitable for inclusion in any balance sheet,

irrespective of how assets are treated there. Once again, it is suggested that such practice slurs over one or two questions of substance. These are discussed in Section 2.

It is interesting that both of these objections appear to have parallels recently identified by Redington (1982) in the life insurance field. For example, in repudiating the views which were held some 30–50 years previously, he says:

"... *we were starting from the assumption that the value of assets was right* and that it was then our duty as actuaries to find the right value of the liabilities" [his emphasis].

He also refers to the then prevailing view:

"that one may pay regard to the income on the existing assets so far as they are 'married' to the liabilities and for the rest must use the estimated long-term rate of interest."

Yet another parallel is pointed out in Section 2.

If these parallels are valid ones, as I believe them to be, it would indeed be tragic for the accumulated wisdom of thinkers in the life insurance field, to fail to prevent the ensnarement of general insurance actuaries, in the very same traps from which life insurance actuaries have laboured so heavily to liberate themselves.

1.4. *Stochastic variation of investment return*

A recent paper (Coutts, Devitt and Ross, 1984) recommends the recognition of future stochastic variation in asset values, and rates of investment return in the construction of balance sheets containing estimates of outstanding claims. Moreover, that paper incorporates a dynamic valuation of assets taking into account the strategy according to which funds are reinvested or disinvested.

The present paper does not comment further on the association of a stochastic component with projected future rates of return. This is not intended to imply that such a concept is rejected. In the present paper, attention is confined to what are seen as the principles underlying the determination of the *expected value* of future rates of investment return. A stochastic component can then be added to those rates of return along the lines suggested by Coutts, Devitt and Ross.

2. DETERMINANTS OF PROJECTED FUTURE RATES OF INVESTMENT RETURN

It is suggested that the determination of the rate of investment return for discounting outstanding claims, quite contrary to the simple and straightforward 'standard approach' described in Section 1.3, in fact involves reflection on a number of questions. These include at least those exhibited in the following list, which may not be exhaustive:

(i) does the balance sheet into which the value of liabilities being calculated in the present exercise is to be inserted, include assets at book, market or some other value?
(ii) does the investment policy of the insurer incorporate an objective of

specific matching, by amount and outstanding term to maturity, of assets to outstanding claim liabilities:

(a) more or less exactly, both in respect of existing assets and liabilties and future assets and liabilities?
(b) partially, but not as extensively as in (a)?
(c) not at all?

(iii) what are the details of the insurer's assets, and in particular:

(a) in the event of a policy of exact matching (case (ii)(a) above), what is the average coupon rate being returned by existing assets, separately for each oustanding term to maturity?
(b) in the event of less than exact matching (cases (ii)(b) and (ii)(c) above), what are the details of the existing investment portfolio (including information as in (a)), what is the intended future investment policy, and what levels of new business are expected in future years?

(iv) what level of claims escalation is anticipated for future years?
(v) in the case of less than exact matching (cases (ii)(b) and (ii)(c) above), what are the anticipated investment conditions for 'new money' of future years (N.B. this information is not required in the case of exact matching)?
(vi) does the balance sheet contain any unusual asset items, particularly large debtor items producing a nil or low rate of investment return?
(vii) does the balance sheet contain any unusual liability items, particularly inwards loans to the insurer?

It is intended to deal specifically with each of these questions in subsequent sections. However, there are a couple of matters which are sufficiently fundamental to call for broad comment immediately.

Firstly, the basis of valuation of assets has been raised in (i). This basis will presumably depend upon the form in which the balance sheet containing the assets is to be presented. In other words, the values to be assigned to assets and liabilities is dependent upon the purpose of the evaluation.

For example, published company accounts may well present assets only at book values; if sale of the insurer is under consideration, then the most relevant balance sheet will usually be that containing assets at market value; if supervisory authorities are considering the prospects of an insurer in imminent danger of insolvency, then they may wish to examine a balance sheet containing assets valued on a winding-up basis.

The relevance of this issue is discussed briefly in Appendix C.

Contrary to the suggestion made above and argued in Section 3 below there is perhaps a tendency in general insurance circles to regard *the* value of outstanding claims liabilities as unique (albeit of uncertain magnitude), and in particular

independent of the basis of valuation of assets. This leads to another parallel with experience in the field of life insurance. Again selected quotations from Redington (1982) on the pitfalls recognized long after the event in that field appear relevant:

"At the heart of our difficulties was the fact that the valuation problem is not one question but two; is the office solvent? and, is the surplus fair? [page 86] . . . But the human mind hates ambivalence and the profession continued to search for the Holy Grail of a single omnipotent system of valuation [page 87] . . . If he had added that the Holy Grail of one single omnipotent valuation did not exist and that the two separate questions required two separate answers, then the profession might have settled down to accept that untidy but inescapable conclusion [page 87] . . . to have any validity the photograph of the assets and liabilities must be taken from the same place [i.e. assets and liabilities must be valued consistently]. I think this is the first law of valuation" [page 93].

To summarize this point then, in general insurance as in life insurance the value to be assigned to assets must depend upon the purpose for which the evaluation of assets and liabilities is being carried out, and the value of assets so decided, will hold implications for the rate of investment return, to be assumed in any discounting for investment return of the liabilities for outstanding claims. By this line of reasoning is the nexus between value of assets and liabilities established.

The second fundamental matter requiring some coverage in the present section concerns the concept of an 'inflation gap'. The separate listing of future rates of claims escalation and investment return in (iv) and (v) above may suggest that no nexus between these two is contemplated. Such is not the case. It is in fact recognized that, over the medium to long term, one can seldom do better than assume a constant 'gap' between claims escalation during a given period and the rate of investment return available on funds *invested during the same period.* It should also be recognized, however, that this latter rate of return will not be identical to, and may differ widely from, the rate of return provided during that same period by *all funds then invested.*

It is this difference in timing between the point of investment of new money, and the point of receipt of the resulting investment income (unless the investment policy requires all funds to be dead short) which is suggested here to indicate a major fallacy in the use of an 'inflation gap' as described in Section 1.3. This subject is taken up again in Section 5.

3. BASIS OF VALUATION OF ASSETS

3.1. *The difference between 'book value and market value of outstanding claims'*

It was suggested in Section 2 that there is not (even in principle) a unique value of outstanding claims, when allowance is made for anticipated future investment income, but that the value assigned to this liability must depend upon the basis of valuation of the assets and hence on the purpose of valuation. Resounding phrases were quoted from Redington in support of this view. However, in order to put the matter beyond doubt, it is perhaps helpful to consider a simple example.

Consider the case of an insurer, underwriting no new business, and whose claims portfolio has run-off entirely with the exception of one remaining claim whose settlement it is known will cost exactly \$1000 in exactly one year's time (It is hoped that the unrealistic nature of this example will not distract the reader from its pertinence). Suppose also that the insurer holds a single asset which provides proceeds of \$1000 in one year's time but no investment income in the meantime. This asset was purchased one year ago at a price of \$826·45 (discounted at 10% per annum for two years) and is currently valued on the market at \$909·09 (discounted at 10% per annum for one year). The insurer has a policy of setting book value equal to cost. Consequently, the book value of the asset is \$826·45 and the market value \$909·06. Expenses of operation during the next year are ignored, and it is assumed that there are no assets and liabilities other than those described above.

It is anticipating Section 4 somewhat, but this insurer's assets and liabilities are perfectly matched. It seems difficult to conclude other than that net tangible assets are precisely nil. If so, then a balance sheet containing assets at book value should appear as follows.

BALANCE SHEET
(Book value)

Liabilities	\$	*Assets*	\$
Outstanding claims	826·45	Investments	826·45
Net tangible assets	·00		
	826·45		826·45

A balance sheet containing assets at market value, on the other hand, should appear as follows.

BALANCE SHEET
(Market value)

Liabilities	\$	*Assets*	\$
Outstanding claims	909·09	Investments	909·09
Net tangible assets	·00		
	909·09		909·09

The conclusion is straightforward. If the 'book value of outstanding claims' and 'market value of outstanding claims' are taken to be the same, then one or both of the book value and market value balance sheets must be grossly misleading.

The significant conclusion from a professional point of view is the following.

Proposition 3.1.1. Any valuation of outstanding claims discounted in anticipa-

tion of future investment return, should be accompanied by a statement of whether it is suitable for inclusion in a balance sheet containing assets at book, market or some other value.

The discussion of this subsection has distinguished only between book and market valuations of assets. Section 2 contemplated a winding-up basis of valuation. Other possibilities may be conceivable. However, in order to confine the discussion of this section to manageable proportions, only book and market valuation bases will be considered. This should be sufficient to establish the fundamental principles involved and indicate the manner in which they should be extrapolated to other situations.

3.2. *Magnitude and incidence of capital appreciation*

The reason for such a clear emergence in the example of Section 3.1 of the anomaly under discussion there, was that the entire return on the investment portfolio took the form of capital appreciation rather than income. A market valuation of assets recognizes such capital appreciation gradually, while a book valuation defers its entire quantum to the maturity or sale of the asset concerned. It follows that the magnitude and incidence of capital appreciation is at the heart of any discussion of the distinction between book and market value of outstanding claims.

There is one counter-argument to the market valuation of outstanding claims conducted in the example of Section 3.1 which should be disposed of forthwith. An examination of the incidence of capital appreciation will assist in doing so.

One can foresee an argument running as follows:

"In the example of Section 3.1 the book value of assets was a patent understatement of their true (market) worth. It is open to a company to set book value equal to market value in their accounts. If a choice is made not to do so and to understate assets deliberately then the consequences of that decision, in particular the emerging deficiency in assets, must be borne by the company."

Leaving aside the practical auditing issues which would arise in the case of a large public company's change from cost to market value in its balance sheet accounting for investments, the above argument is in any event fallacious. Consider the case in which assets are taken at book value. Returning to the numerical example of Section 3.1, what rate of return will be achieved during the next year? Clearly, it is $173{\cdot}55/826{\cdot}45 = 21\%$ (c.f. 10% in the case of market valuation of assets). Thus, it would appear, due to the larger component of deferred capital appreciation contained in the book valuation of assets, that the appropriate rate of investment return to be assumed in calculating the book value of outstanding claims is correspondingly greater (and hence the value of outstandings lower) than in the case of market value.

Before proceeding further it will be as well to state precisely what is meant by rate of investment return. Suppose that the insurer's investment portfolio

(exactly what constitutes the relevant portfolio is a matter for consideration in Section 6) consists of various sectors labelled by subscript i. Let

$A_i(t)$ = the value (on whatever basis) of assets held in sector i at time t (in years);

$I_i(t)\,dt$ = the amount of investment income generated by sector i in the infinitesimal time interval $(t, t + dt)$;

$C_i(t)\,dt$ = the amount of capital appreciation accruing to sector i in the infinitesimal time interval $(t, t + dt)$.

Then the rate of investment return earned by sector i during the infinitesimal time interval (t, dt) is defined as:

$$r_i(t) = [I_i(t) + C_i(t)]/A_i(t), \tag{3.2.1}$$

and the corresponding rate of return in respect of the total portfolio:

$$r(t) = [I(t) + C(t)]/A(t), \tag{3.2.2}$$

where

$$I(t) = \sum_i I_i(t),$$

and similarly for $C(t)$ and $A(t)$.

The corresponding rates of return earned over the finite time interval (u,v) are defined as:

$$r_i(u,v) = [I_i(u,v) + C_i(u,v)]/A_i(u,v), \tag{3.2.3}$$

and

$$r(u,v) = [I(u,v) + C(u,v)]/A(u,v), \tag{3.2.4}$$

where

$$I_i(u,v) = \int_u^v I_i(t)\,dt,$$

$$I(u,v) = \int_u^v I(t)\,dt = \sum_i I_i(u,v),$$

and $C_i(u,v)$, $C(u,v)$, $A_i(u,v)$ and $A(u,v)$ are defined similarly.

All of the rates of return defined in (3.2.1) to (3.2.4) are annualized.

It is suggested that the rate of return corresponding to any particular basis of valuation of assets is obtained by substitution in these formulas for C and A computed on that basis of valuation. Clearly, the values of the I terms are independent of the basis of valuation of assets. Thus, for example, the rate of investment return consistent with market value of assets is obtained by

evaluation of these formulas with market value of assets inserted in the denominator, and capital appreciation on the basis of market values in the numerator.

The difficulty involved in this definition of the book rate of investment return is that projection of this rate over future periods requires a projection of movements of book values of assets. If the book value is equal to cost, then these movements will depend upon dates of maturity and sale of investments. A projection of dates of sale is then required. Even worse, book values might be reviewed from time to time by management, in which case the projection of future book values of investment return requires an anticipation of the manner in which management will exercise this discretion in future.

This all seems to amount to a rather vague and unsatisfactory basis for the assessment of the book value of outstanding claims. In the numerical example of Section 3.1 it was apparent that the book value of outstanding claims was unaffected (at \$826·45) by the incidence of recognition of capital appreciation. It is of interest to investigate the extent to which this independence occurs in other situations.

Consider a more general situation than that of the example of Section 3.1, but still limited by the assumptions that:

(i) the insurer's fund is *closed* in the sense of receiving no future income except that generated by what remains of the current investment portfolio (including income generated by reinvestment of that income);
(ii) the current investment portfolio is subject to gradual depletion over future years as the proceeds of sale and/or maturity of investments are required to pay claims as they fall due.

Let

$P(t)\,dt$ = the amount of claims to be paid during the infinitesimal time interval $(t, t + dt)$.

Then

$$\begin{aligned} A(t + dt) &= A(t) + I(t)\,dt + C(t)\,dt - P(t)\,dt \\ &= A(t) + A(t)\,r(t)\,dt - P(t)\,dt, \end{aligned}$$

by (3.2.2). Hence

$$dA(t)/dt = A(t)\,r(t) - P(t),$$

whose solution is:

$$A(t) = A(o) \exp\left[\int_o^t r(u)\,du\right] - \int_o^t P(S)\,ds \exp\left[\int_s^t r(u)\,du\right]. \tag{3.2.5}$$

This is no more than a statement that the amount of assets held at any

particular time is equal to the initial amount of asset holding less subsequent claim payments with adjustment for investment income (on the present occasion at a possibly fluctuating rate).

It is apparent from (3.2.2) that the rate of investment return can be decomposed into income and capital appreciation components, thus:

$$r(t) = r_I(t) + r_C(t), \tag{3.2.6}$$

where

$$r_I(t) = I(t)/A(t),\ r_C(t) = C(t)/A(t).$$

Substitution of (3.2.6) in (3.2.5) gives:

$$\mathrm{A}(t) = A(o)\, R_I(o,t)\, R_C(o,t) - \int_o^t P(s)\, ds\, R_I(s,t)\, R_C(s,t), \tag{3.2.7}$$

where R_I, R_C are the accumulation factors:

$$R_X(s,t) = \exp\left[\int_s^t r_X(u)\, du\right],\ X = I,C.$$

Now consider the situation in which the following conditions are added to (i) and (ii) above:

(iii) all assets are of a fixed interest type and are held to maturity (it is assumed that it is possible to do this and make the required claim payments simultaneously), whence the total amount of capital appreciation ultimately to be realized in respect of the initial asset holding is known at time zero;
(iv) all assets carry a zero coupon rate, whence $R_I(s,t) = 1$ for all s and t;
(v) all proceeds of investment maturity, surplus to payment of claims, are reinvested at a nil rate of investment return, i.e. $R_I(s,t) = R_C(s,t) = 1$ for all s and t in respect of these new investments.

This set of assumptions is quite unrealistic but does elicit one significant feature of (3.2.7). By Assumption (iv), (3.2.7) simplifies to:

$$A(t) = A(o)\, R_C(o,t) - \int_o^t P(s)\, ds\, R_C(s,t). \tag{3.2.8}$$

Note that this relation has been established without any specific mention of book or market values. It is therefore equally applicable to either. Certainly, if the function $P(s)$ is supposed known, the final member of (3.2.8) will depend upon the incidence of capital appreciation through the function R_C. But so will the first member of the right side in a way that will compensate for the second.

An elaboration of the numerical example given in Section 3.1 may be of help. Suppose that, in addition to the asset and claims liability described there, the insurer also:

(i) holds an asset which will mature and provide proceeds of \$1000 in six months' time;
(ii) has liability to pay a claim which, it is known, will be settled for \$500 in six months' time.

It is assumed that the additional investment, like the one described in Section 3.1, was purchased 1 year ago at a discount of 10% per annum, that it is currently valued that way by the market, and that the best available prediction is that it will continue to be valued so by the market.

The book value of the additional asset is \$866·78, and the market value \$953·46. Thus, for total assets, book value is \$1693·23 and market value \$1862·55. According to the definition of rate of return given earlier in this subsection, the rates of return over the ensuing year are as follows.

	Rate of investment return on	
Period	Book value % p.a.	Market value % p.a.
1st six months	16·4	10
2nd six months	27·9	10

Application of (3.2.8) (strictly, the discretized form of it) on either a book or a market value basis produces remaining assets with a value of \$500 after payment of the outstanding claims has been completed. The example shows that the final accumulation of assets is independent of whether capital appreciation is recognized only at maturity or continuously in line with market values.

Analysis shows that, more generally, the final accumulation is quite independent of the profile of recognition of capital appreciation. This result still holds quite generally when conditions (i) to (v) are relaxed.

In other words, despite the fact that book rates of investment return depend upon book values of assets which might be altered capriciously over the future period of relevance, this does not present difficulties of principle because one is free, in the accumulation of net assets after payment of claims, to assume any profile of recognition of capital appreciation. The simplest approach will usually be to proceed on the hypothetical basis, that book values are adjusted to market values instantaneously at the point of evaluation of outstanding claims, and thereafter adjusted in line with market values. The corollary of this result is the following proposition.

Proposition 3.2.1. The book value of outstanding claims may be calculated by the following steps:

(i) project future market rates of investment return, including realized and unrealized capital appreciation calculated on the basis of changes in market value;
(ii) discount the cash flow associated with the payment of outstanding claims at these market rates of return, thus obtaining the market value of outstanding claims;
(iii) adjust the result of (ii) by the ratio of book value to market value of assets at the date of valuation, thus obtaining the book value of outstanding claims.

It is to be noted that, while one is free to choose any profile of recognition of capital appreciation in the evaluation of book value of outstanding claims, the procedure outlined in Proposition 3.2.1 has one great advantage over others. The simple example given above showed (see the associated table) that book rates of return can vary in conditions of stationary market rates of return. Naturally, this variation relates partly to the incidence of capital appreciation on a book value basis. However, it also relates partly to the incidence of claim payments. For example, if the claim payable in six months' time had been \$1000 rather than \$500, the book rate of return would have been 46·4% per annum rather than 27·9% per annum in the subsequent six months. Thus, if one attempts to calculate the book value of outstanding claims from any basis other than that set out in Proposition 3.2.1, then future book rates of return different from market rates need to be projected, and these will depend upon cash flows in and out of the insurance fund. Whereas it is possible to project future market rates of return independently of the detail of outstanding claims, it is not possible to do the same with book rates of return.

The drawback in working with market rates of return (including capital appreciation) is that, when changes are predicted in 'new money' rates, the resulting capital appreciation (or depreciation) on *existing* investments must be calculated and included in the market rate of return projected as applicable to the whole investment portfolio.

4. MATCHING OF ASSETS AND LIABILITIES

4.1. *Definitions*

This section will consider a conceptual *insurance fund.* It is supposed that this fund is responsible for meeting claim payments as they fall due. It is also supposed that a particular subset of the insurer's assets has been identified as supporting the liabilities associated with the fund. The fund will be subject to cash inflow in respect of premiums and investment income (possibly including notional flow in respect of unrealized capital appreciation) and cash outflow in respect of claim payments and expenses. The extent to which future premiums

and the related investment income, claims and expenses are brought to account in this fund is considered in Section 4.3.

It is supposed that a projection of the expected distribution of each of the four components of inflow and outflow to the fund has been carried out as at the date of evaluation of outstanding claims. The assets and liabilities will be said to be *exactly matched* if, at each future point of time, cash inflow from maturing investments and investment income is exactly equal to cash outflow in respect of claim payments (in respect of claims presently outstanding) and associated expenses.

In practice, even an insurer pursuing a policy of matching will wish to retain some assets surplus to liabilities. Assets and liabilities will be said to be *surplus-matched* if, for each future point of time, the cash inflow from maturity of investments and investment income is at least as great as the projected cash outflow due to claim payments (in respect of presently outstanding claims) and the associated expenses. According to this concept, the insurer matches assets to liabilities and is at liberty to deploy any additional assets in any manner he thinks fit.

In the definitions of exact matching and surplus-matching, it is envisaged that those assets used as matching liabilities consist only of fixed interest investments and that these are all held to maturity. Only on this basis is the cash inflow provided by those investments completely predictable as assumed in the definitions. The surplus investments involved in surplus-matching are, of course, not subject to this constraint.

In the case of a fund in which assets and liabilities are not surplus-matched (*a fortiori* not exactly matched either), assets and liabilities will be said to be *unmatched.*

It is not the purpose of this paper to discuss the merits of matching relative to not matching. What is intended, however, is to discuss the consequences of these different investment policies for the projection of future rates of investment return.

4.2. *The general insurance context*

Since matching of assets and liabilities and the associated concept of immunization are often spoken of as theoretical curiosities with no place in the hard-headed business world, a few words about their applicability to the general insurance context are in order.

It is apparent from the definitions of exact matching and surplus-matching in Section 4.1 that they are possible only if, at any point of time, the cash flow to the fund other than that produced by premiums in respect of new policies and by investments is zero or negative. Similarly, a strategy of immunization is feasible only if such negative cash flows are sufficiently dominant in the sense described in Immunization Theory (see e.g. Fisher and Young, 1965, pp. 167–170).

It is well-known (Fisher and Young, 1965, pp. 170; Redington, 1952, pp. 310–313) that for most life insurance funds the dominance of annual premium policies

generates positive future cash flows, and so exact matching cannot be implemented. These annual premium policies, with their associated positive cash flows to the fund for many years into the future, will also often render matching and immunization inoperable. Similarly, special circumstances would normally be required before a policy of matching or immunization could be implemented in respect of a retirement fund. This is in contrast with the case of a general insurance fund. The claims liabilities in this case will normally be generated by what amount to single premium policies. Thus, at a balance date, expected claims liabilities consist of just a sequence of future cash outflows. Future premium income (in respect of the policies to which these liabilities relate) is nil. It is, therefore, possible to arrange a portfolio of assets which will match the projected liabilities by both amount and term.

In a situation such as that applying to general insurance, in which matching is feasible, immunization is feasible *a fortiori*. The following sections will, for the sake of simplicity, discuss only the former of these two cases. However, virtually all that is said applies equally to the more general case of immunization.

Despite its feasibility, matching is not at present widely practised by general insurers. It is interesting to consider the reasons for this.

Naturally, the restriction of such an investment strategy to fixed interest investments eliminates a significant part of an investment manager's discretion. Not only that, but available data suggest fairly convincingly that, at least in Australia, such a constraint diminishes the rate of investment return obtained over the long term.

One compromise, adopted by some insurers, is the use of fixed interest investments to match technical provisions and investment of net assets in media such as equities and property which, though more volatile, are expected to provide higher returns over the long term.

Similarly, if it is thought that long term bonds will provide higher yields than short term over the medium future, an insurer may wish to bias the fixed interest investment portfolio towards the long term. This motivation may be sufficiently strong to preclude matching. Alternatively, it may be accommodated with matching by means of the deployment of net assets, as described in connection with equities and properties.

The main reasons why matching is not more widespread appear to be:

(i) it is perceived as simply an unnecessary theoretical device with a possible deleterious effect on rate of return;
(ii) a common view, perhaps now in the process of weakening, in the general insurance industry, that to a large extent investment income belongs to shareholders, and that it is no matter for concern, on the part of the insurer to arrange his asset portfolio in any way other than that which appears likely to be most profitable in the long term (though with due regard to short-term liquidity).

It should be noted that, in cases in which liabilities for outstanding claims are

being discounted for future investment income, this very practice is inconsistent with (ii) above. Apart from pointing this out, it is not proposed to enter here into the debate on the role of investment income in a general insurance operation. The point at issue is really the propriety with which, an insurer should trade off the security of his ability to meet claims liabilities, against his desire to produce profits for shareholders. Or, expressed in more profit-motivated terms, the extent to which exposure to investment risk is compatible with the public image of security and stability, which the insurer perceives as necessary for the successful prosecution of his business. Decisions in such affairs are necessarily matters for judgement.

Matching of assets and liabilities, though not widespred among general insurers, is by no means unknown. For example, the following appears in the public policy statement of one large Australian insurer with respect to its investments.

"As a matter of policy, technical insurance provisions comprising unearned premiums and outstanding claims are matched by fixed interest investments which have a known maturity date."

Note that, while expressing general sympathy with the concept of matching, this statement is not entirely committal. It states that technical liabilities will be matched by fixed interest assets *in amount but not necessarily by term.*

It is probably fair to say that the tendency towards matching is currently on the increase. At least two reasonably large insurers have recently decided to establish matching funds in respect of particular components of their business. The reasons for this may be partly connected with the increasing use of statistical or actuarial control of provisions for outstanding claims. It is interesting to reflect on whether actuarial involvement in the estimation of outstanding claims has hastened this trend towards matching.

When an actuary is involved, the matching of liabilities with fixed interest assets will probably lead to valuation of outstanding claims, at the rates of investment return which will be earned by the currently existing fund. This is explained further in Section 4.3.1 below. If a policy of matching is not pursued, the actuary may reflect the extra risk induced by the mismatch in the form of a margin in his assumed rates of future investment return.

Thus, paradoxically, despite the fact noted above that over the long term a matching strategy is likely to reduce the rate of investment return achieved, the absence of matching can easily lead to a higher valuation of liabilities. This in turn locks up funds which could otherwise function as working capital. For example, it might advance the date on which the insurer needs to raise further share or loan capital for expansion.

If the insurer is able to employ working capital more efficiently than in technical provisions, then it follows in this case that his efficiency is indirectly impaired by the failure to match assets and liabilities.

4.3. *Implications of matching for the evaluation of outstanding claims*

4.3.1. *Matched funds.* It is suggested that whether or not an insurer adopts a policy of matching assets and liabilities may be a major determinant in the actuary's choice of the rate of investment return to be assumed.

If the insurer is pursuing a policy of matching, and there appears a reasonable likelihood that this will continue during the period of run-off of the currently outstanding claims then the actuary would be entitled to regard an appropriate part of the assets as forming a *closed* (in the sense of Section 3.2) notional fund supporting the provision for outstanding claims.

This insurer, in his management policy, has made a clear identification of the assets currently held with currently outstanding claims. Because of the matching of the cash flows generated by that fund with the claim payment cash flows, future rates of return on the fund will be known exactly *now*. Apart from the possibilities that:

(i) the matching policy may be discontinued;
(ii) claims experience may not be as predicted, and may therefore generate a mismatch (this issue is dealt with by Coutts, Devitt and Ross (1984));

the rates of investment return to be assumed for the future are completely defined by the existing asset portfolio. It is difficult, in fact, to conceive of arguments for treating the outstanding claims provision as credited with investment income at other than these rates.

Proposition 4.3.1.1. In the case in which outstanding claims liabilities are surplus-matched as a matter of continuing policy, the valuation of those outstanding claims should proceed on the basis of a closed fund. The rates of investment return included in the discounting of outstanding claims should be those rates earned from time to time, by the remainder of those assets which, initially, matched liabilities exactly.

It is to be noted that matching (or immunization) provides protection against only movements in new money rates of return. No protection is provided against deviations of claims escalation from those anticipated in the evaluation of outstanding claims.

4.3.2. *Unmatched funds*

The situation of the matched fund of Section 4.3.1 can be contrasted with the one which arises in the case of an insurer who has no specific matching policy at all. The assets which he currently holds can be expected to be turned over during the period of run-off according as total profitability appears likely to benefit. In this situation it is not appropriate to regard any part of the current asset portfolio as earmarked for support of the outstanding claims provision. The notional fund supporting this provision must be regarded as *open*.

The collection of assets supporting in future those of the currently outstanding claims which then remain outstanding will change from time to time, as the

currently oustanding claims run-off and new claims are incurred. This produces quite a different situation from that involving matching. In the case where a policy of matching is followed, a closed fund is established, at least conceptually, in respect of each generation of claims. In the case of no matching, all of these funds are merged into a single one supporting all of the generations of claims.

One may view the dynamics of this situation in terms of continuous sale and resale between the owners of the insurance business and different generations of policyholders. For example, at time t a certain portfolio of investments may be identified with technical provisions (unsettled claims and unearned premiums) and therefore regarded as the property of those policyholders associated with these provisions. During the interval $(t, t+dt)$ some of the claims allowed for by these provisions will be settled, thereby consuming a part of the aforementioned investments. In addition, new premium income will be received during the same period and become available for investment. In practice, of course, only the difference between this premium income and the claims outgo of the same interval will be realized in terms of new investment or disinvestment. After these various processes have taken place during the interval $(t, t+dt)$, there will be a set of technical liabilities slightly different from that which existed at time t; and these liabilities will be supported by an investment portfolio which has also changed slightly from that held at time t. It is possible to view the investments held at time t as being sold at that instant by the policyholders concerned to the owners of the business, who use the funds to pay the relevant claims and expenses, augment the remaining assets with the new premium and investment income, and then resell this slightly restructed portfolio of investments to the new group of policyholders associated with technical provisions at time $t+dt$.

It is to be noted that the above view of the dynamics of the situation, is made possible by the fact that there is no reason for a *permanent* identification of any of the assets held at time t with the liabilities then existing. Those assets are held at time t because they are seen by management as maximizing profit during some relatively small time interval containing t. They may continue to be held, of course, and possibly for quite lengthy periods. However, if they are, this will be due not to any view taken at time t but to a continuation of the view that they remain worthwhile investments at subsequent times.

Consider the progress of a liability arising on the occurrence of a particular claim and being discharged on settlement of that claim. During the intervening period the assets supporting that liability will attract investment income. The rate of investment return which should be credited in respect of that claim during an infinitesimal time interval, is the average rate of return on all assets which can be associated with the liability for outstanding claims *during that infinitesimal interval.* For these assets are held during that interval because they are seen by management to be the most profitable *during that interval.*

The situations as to the investment income to be associated with claims outstanding at time t in the cases of open and closed funds respectively can now be compared:

(i) in the case of a closed fund, a particular bloc of assets is identified with claims outstanding at time t; these assets are held to maturity, and the cash flow which they provide (and hence the rate of investment return which they provide) and no other supports the liability in question;
(ii) in the case of an open fund, the bloc of assets to be identified with claims outstanding at time t changes continually over the period of run-off of those claims, the bloc of assets at time s ($> t$) being simply a proportion of the entire asset portfolio associated with the total outstanding claims liability at that time.

While this may all sound extremely obvious, (ii) has an interesting corollary for the evaluation of outstanding claims. Since this value, if discounted for investment income, depends upon rates of return over future periods, and these depend in turn upon the total asset portfolios then held, it follows that the value of outstanding claims at time t depends upon the predicted volumes of business underwritten in subsequent years. This is a concept which may well be repugnant to some. Indeed, it may well be unacceptable for supervisory authorities or any other party interested in carrying out a reasonably stringent test of solvency.

It is submitted, however, that *from a management accounting viewpoint* appropriate decision-making ought usually to be based on the premise that the insurer is a going concern and that the method for determination of investment return described above is the correct one. A numerical illustration is given in Section 7.

Proposition 4.3.2.1. In the case of an insurer who has no stated policy of matching assets and liabilities, the valuation of outstanding claims liability should proceed on the basis of an open fund. The rates of return included in the discounting of this liability should be those projected as earned by the open fund. These rates are essentially a moving average of the rates being earned by the assets held at the date of evaluation and the rates available on future new investments. The discounting of outstanding claims thus depends partly upon future investment and underwriting (e.g. premium volumes, profitability, etc.) conditions.

The ideas presented here simply reinforce Proposition 3.1.1. They indicate that an evaluation of outstanding claims for management accounting purposes may be quite unsuitable for the supervision of solvency of an insurer.

5. THE TIMING OF INVESTMENT INCOME IN AN OPEN FUND

Section 2 gave brief treatment of one reason why the concept of an 'inflation gap' is often invalid. The present section expands somewhat on that discussion.

The 'inflation gap' concept needs to be considered separately for the cases of open and closed funds. However, the latter of these two cases can be disposed of quite easily. Section 4.3.1 noted that the rates of investment return to be used in discounting outstanding claims in this case were fixed by the portfolio of

investments held at the date of evaluation. The claims escalation, on the other hand, which will bear upon those claims currently outstanding will be the claims escalation of future years. It is quite apparent, therefore, that matching of assets and liabilities 'decouples' claims escalation and investment return as functions of time and that, consequently, the 'inflation gap' concept is quite irrelevant to the problem. The only unknown parameters are the future rates of claims escalation.

Consider now the case of the open fund. It is perhaps best discussed in terms of a simple example.

Suppose than an insurer has underwritten a constant premium volume, on constant profit terms, for many years and anticipates continuing to do so in future years. A constant investment strategy has been followed in this stable situation whereby, at any given time, the total portfolio of assets is equally distributed over fixed interest investments with outstanding terms of 1, 2, 3, 4 and 5 years to maturity, all having had original terms of 5 years. For simplicity, we suppose that there is no inflation. In past years the interest rate for all fixed interest terms has been 2% per annum. Outstanding claims are to be evaluated at 31/12/83 and it is anticipated that interest rates will rise to 4% per annum on 31/12/85, 6% per annum on 31/12/87, and remain at that level indefinitely.

Consider the rate of return on this fund over the years 1984–1989. It is supposed, for simplicity, that all investment of new money takes place on 1 January.

The following facts concerning the rate of investment return obtained during the years concerned are clear:

(i) the rate of investment return obtained during 1984 will be 2% per annum;
(ii) the rate of investment return obtained during 1992 will be 6% per annum, all investments held during that year having been purchased on 1/1/88 or later;
(iii) during the years 1985–1992 the proportion of investments bearing the higher coupon rates will increase, as a result of which the average coupon rate will increase from 2% in 1985 to 6% in 1992;
(iv) there will be considerable capital depreciation during 1985 and 1987 as a result of the changes of interest rate on 31/12/85 and 31/12/87;
(v) the 1985 and 1987 capital depreciation will be restored progressively by capital appreciation in the years 1986 and 1988, and later as the depreciated investments progress towards and finally reach maturity.

The complete set of figures relevant to the calculation of rates of return over the period 1984–1989 are given in Appendix A. The following table summarizes the results.

The concept of the 'inflation gap' involves the gap between claims escalation experienced in each period and the rate of investment return *available on new money in the same period.* To deny this definition would make a nonsense of the concept. For example, it could be asserted that the 'inflation gap' refers to the gap between claims escalation in a given period and the rate of return on total funds

Year	Average coupon rate % p.a.	Rate of return on fund % p.a.	Rate of return based on 'inflation gap' % p.a.
1984	2·0	+2·0	2
1985	2·0	−1·7	4
1986	2·4	+4·0	4
1987	2·8	+ ·4	6
1988	3·6	+6·0	6
1989	4·4	+6·0	6

employed during that same period. For this latter rate of return is dependent upon the extent of any capital appreciation or depreciation in the period concerned. This in turn depends on the history of past rates of return on new money and the nature of deployment of new funds in past periods (as illustrated by the example in Appendix A), and is not at all in the nature of a fundamental economic constant.

The column in the table headed "Rate of return based on 'inflation gap' " is the difference between inflation and new money rates of return in the relevant periods. The table shows that in each of the years 1985 and 1987 the 'inflation gap' concept leads to overstatement of the rate of return to be used in discounting outstanding claims. The overstatement is by no means minor.

As noted in Section 2, this anomaly arises effectively by virtue of the difference in timing between the point of investment of new money and the point of receipt of the resulting investment income. Each time a change occurs in market rates of interest, capital appreciation or depreciation occurs in respect of the market value of assets. This is carried to the market rate of investment return. As is obvious, and is illustrated by the example discussed above, while market rates of interest on new money remain constant, the market rate of investment return on a portfolio of assets remains constant and equal to the new money rate.

A numerical example, more realistic than the simple one presented above, is given in Section 7. As noted in Section 4.3.2, the rates of investment return appropriate for discounting outstanding claims can depend upon rates of growth of new business. An assumption as to the rate of growth is also illustrated in Section 7.

If future interest rates are predicted to remain constant at the present level, then the above type of difficulty in respect of capital appreciation does not arise. In these circumstances, the concept of an 'inflation gap' will be applicable provided that predicted inflation also remains constant. This, however is a rather trivial example of 'inflation gap'.

It is noteworthy that, if the 'inflation gap' concept held exactly, then immunization against changes in the rates of both claims escalation and investment return on new money would be provided by a strategy of dead short investment. To the extent that this concept does not hold true, some movement away from dead short investment towards matching may be desirable. In circumstances other than dead short investment, it is suggested that the following holds.

Proposition 5.1. Unless a strategy of dead short investment is being pursued, or future inflation and interest rates are predicted to remain constant at their present levels, the concept of an 'inflation gap' should not be applied directly in the evaluation of outstanding claims discounted for future investment income.

The significance of the word 'directly' is that although the 'gap' concept may be accepted as more or less valid in respect of new money rates of return, and therefore serve as an underpinning of the projection of rates of return on total funds employed, it should not be applied in the naive sense described in Section 2 and earlier in this section.

6. ASSET PORTFOLIO TO BE IDENTIFIED WITH LIABILITY FOR OUTSTANDING CLAIMS

6.1. *General*

Outstanding claims will not constitute the only liability in an insurer's balance sheet. Unless underwriting has ceased, there will be at least a further liability in respect of unearned premium. Therefore, provided that the insurer is solvent, the value of total assets will exceed the value of outstanding claims liability. It is then necessary to consider whether any particular subset of the total (unmatched) asset portfolio is to be identified with the outstanding claims liability; for different subsets will produce different rates of investment return.

To decide this question it will be necessary to consider the major items appearing in the balance sheet. These will vary from one insurer to another and it is impossible to achieve complete generality. However, in the common cases the relevant structure of the balance sheet will be as follows.

Liabilities	*Assets*
Technical provisions:	Cash
Premium provisions	Investments
Outstanding claims provision	
Creditors:	Debtors:
Inwards loans	Premiums due from brokers and agents
Premiums due to reinsurers	Sundry
Sundry	
Other	Other
Shareholders funds	

Some of these items have the potential for a considerable effect on rate of investment return. For example, it is common for all debtor items to produce no return at all. Similarly, premiums due to reinsurers may attract a nil or low rate of interest.

One can, of course, assume that the assets supporting the liability for outstanding claims are simply a cross-section of all assets. However, it is not obvious that this is the proper course of action, and indeed the following subsections will argue that certain balance sheet items should not be treated in

this fashion. However, apart from the specific exceptions dealt with below, this identification of assets with liabilities seems quite reasonable.

Proposition 6.1.1. Apart from specific exceptions discussed subsequently, it is reasonable to identify the outstanding claims liability at any point of time with a constant proportion of all assets held at that time, the proportion being the ratio of the outstanding claims liability to total liabilities including shareholders funds.

6.2. *Assets and liabilities related to the acquisition of new business*

To simplify the initial discussion, consider the simple case in which an insurer's balance sheet appears as follows:

Liabilities		*Assets*	
Technical provisions:		Investments	\$70M
Premium provision	\$40M	Debtors:	
Outstanding claims provision	\$60M	Premiums due from brokers and agents	\$30M
	\$100M		\$100M

It is assumed that the investments have been earning a steady rate of return of 10% per annum and are expected to continue to do so. The premium balances attract no interest charges.

Of the myriad combinations of assets totalling \$60M in value (i.e. being identified with the outstanding claims liability), two stand out as obvious:

(i) 60% of each asset sector, i.e.
investments \$42M
premium balances \$18M
in which case the rate of return is 7% per annum;
(ii) \$60M of the income-earning investments, in which case the rate of return is 10% per annum.

The arguments which follow can be anticipated somewhat by a statement that, subject to some qualification dealt with below, the asset portfolio identified with the liability for outstanding claims should exclude all items related to the acquisition of new premiums.

In justification of this proposition, consider the position of an insurer who underwrites just two groups of policies, one group on 30/6/83 and the second group on 29/6/84. Premiums are collected by brokers and 50% of the collected premium remitted on the date of attachment, the remaining 50% three months later. All policies have a term of one year.

Consider the position of the insurer on 30/6/84. The unearned premium provision will be approximately 100% of premium written on 29/6/84. The

outstanding premium balance will be 50% of this. The outstanding claims provision will relate virtually entirely to the policies underwritten on 30/6/83. There are no premiums outstanding in respect of these policies. All premiums due in respect of these policies will have been invested and, to the extent that they have not been diverted to claim payments or declared profit, will be earning investment income. It appears that the assets to be identified with those outstanding claims are the income-earning investments rather than the outstanding premium balances.

The example demonstrates that the loss of investment income due to delay in receipt of premium from intermediaries is a cost born at the front end of a policy. It should be reflected in the accounts in a manner consistent with this incidence. That is, the rate of return anticipated in the premium provisions should be sufficiently low to reflect such a loss, but (again subject to the qualification below) the rate of return anticipated in the provision for outstanding claims should be unaffected. This is a particularly convenient conclusion since, in practice, it is virtually universal to apply *no discount* for investment income to the premium provisions.

We come now to the foreshadowed qualification of this conclusion. Note that, in the example given, the unearned premium exceeded the outstanding premium balance. In general, this means that, on the average, premiums are being remitted to the insurer at least as rapidly as they are being earned. As long as this remains the case, it will be possible for the outstanding claims provision to be supported fully by investments, and for the premium provisions to be supported partly by investments and partly by premium balances.

If, however, the delay in remittance of premium is so great that outstanding premium balances exceed premium provisions, then the latter must be regarded as supported totally by premium balances and the remainder of these balances must be treated as part of the support of the outstanding claims provision.

The above discussion is summarized by the following.

Proposition 6.2.1. Any asset item which, by its nature, is directly related to the acquisition of new premium should be identified with premium provisions and not outstanding claims provisions, provided that the total of the asset items concerned does not exceed premium provisions. If the total does exceed premium provisions, then the excess should be identified with liabilities (including outstanding claims) other than premium provisions. The rate of return to be used in discounting the outstanding claims liability for future investment income should be consistent with this identification of assets and liabilities.

In other words, provided that outstanding premium balances are not excessive, they can be excluded from consideration in the determination of the rate of investment return to be assumed in discounting outstanding claims. The remaining assets can then be treated as allocable to the outstanding claims liability and other liabilities (including shareholders' funds) in proportion to these various liabilities. Note the lack of distinction here between outstanding

claims liability and shareholders' funds. This is quite inappropriate in cases in which assets and liabilities are matched. However, as Section 4.3 pointed out, the identification of assets with outstanding claims liability is explicit in this case, and none of the discussion in the present section applies to it.

Now consider liabilities related to the acquisition of new premium income, e.g. premiums due but not paid to reinsurers. It is common for these to attract interest at a low rate. By exactly the same arguments as used above in respect of asset items, the following conclusion is reached.

Proposition 6.2.2. In the application of Proposition 6.2.1, all liability items directly related to the acquisition of new premium should be treated as negative assets. Similarly, the depletion of the insurer's investment income which they cause should be treated as negative investment income.

6.3. *Other debtor and creditor items*

The remaining items of assets and liabilities are perhaps most clearly dealt with by considering inwards loans first. These appear in the balance sheet as liabilities, and servicing them depletes income. The question to be considered is whether they should be treated as negative assets, in which case the relevant rate of investment return would be based on assets net of inwards loans.

Consider the case of a hypothetical insurer who contracts with a finance company to channel all inwards loans to that company. The loans are to be transmitted on exactly the same terms as those contracted with the insurer.

In this case, the loans generate exactly balancing items in the balance sheet assets and liabilities; and also in the investment income and interest charge outgo items of the profit and loss account. The net effect of the inwards loans on the insurer's operations is thus nil.

Note, however, that if:

(i) the calculated rate of return were based upon only the assets side of the balance sheet;

and (ii) the interest rate associated with the inwards loans differed substantially from the rate of return obtainable in respect of other investments;

then such rate of return *would* be affected by the presence and the volume of the inwards loans. Such a result seems anomalous.

It appears reasonable therefore to base the calculated rate of investment return upon assets net of liabilities due to inwards investment.

Similar arguments can be stated in respect of debtor and creditor items generally. For example, if an insurer is able consistently to maintain approximate equality between sundry debtor and creditor items, so that the loss of investment income generated by the former is approximately offset by the gain generated by the latter, then it seems reasonable to calculate the rate of investment return to be

used in discounting outstanding claims, as if neither sundry debtor nor sundry creditor items existed.

Thus, it is suggested that, generally, this rate of return should be based upon assets net of creditor items (with the exception of any related to acquisition of new premium (Section 6.2)); and upon investment income net of any outgo in respect of such creditor items. This approach is realistic. Ultimately, of course, it is the insurer's *net* investment performance (i.e. net investment income related to net investments) which matters.

The above views concerning the treatment of debtor and creditor items are subject to qualification. The reason for qualification is most easily seen when it is recognized that the existence of any volume of inwards borrowing and outwards lending amounts to increased gearing, i.e. a scaling up of the insurer's operation without recourse to any broadening of the equity capital base. The classical property of increased gearing is that, there is an amplification between the profitability of the transactions used to achieve it and their effect on the total operation. Briefly, if favourable terms can be obtained in respect of the process of inwards borrowing and outwards lending, the favourable margin will magnify the rate of return on net funds employed; correspondingly, if the terms are unfavourable, a very poor rate of return on net funds employed will be produced.

It follows that large creditor items carrying low or nil interest charges (and, consequently, increasing the rate of investment return when treated as negative assets) must be viewed with caution as regards the likelihood of their continued existence.

For example, an insurer borrowing large volumes of short term funds and re-lending them in the form of long term mortgages carrying higher rates of interest, will be found to be generating a very favourable rate of investment return if a naive approach to net assets is taken. However, it is only commonsense to realize that this insurer would be operating from an extremely dangerous position, a position which has in fact caused the downfall of many financial operators in the past.

As a second example, suppose that, after operating a large quota share outwards treaty for many years, an insurer has just cancelled it. During these years the insurer has retained the reinsurance quota of premiums free of interest charges for some time before remitting them, and these amounts have enabled reasonable balance to be maintained between debtor and creditor items. With the cancellation of the reinsurance, however, this balance will, other things remaining equal, no longer be feasible. The insurer will now be in a position in which debtor items continue at their previous levels, but creditor items are significantly reduced. The rate of return on net assets will be correspondingly reduced.

The above discussion may be summarized by the following.

Proposition 6.3.1. In the calculation of the rate of investment return to be used in discounting outstanding claims, creditor items, other than those directly related

to acquisition of new premium, should be treated as negative assets. Any charges generated by those items should be treated as negative income. Such treatment should be modified, if necessary, to take account of any increase in exposure to investment risk, as a result of the effective increase in gearing which follows from the existence of creditor items.

6.4. *The relative security of policyholders and shareholders*

This subsection canvasses a view of the calculation of rate of investment return alternative to those presented above. It is presented here not because it is regarded as particularly worthwhile but rather it seems deserving of refutation.

The argument which has been proposed as supporting this alternative view, points to the ranking of the claims of policyholders and shareholders respectively on the assets of an insurer. It is pointed out that liabilities to policyholders are secured ahead of any obligation of pay dividends to shareholders, and indeed ahead of the claims of many other creditors. Therefore, it is argued, the investment income in respect of *all* assets, those supporting both liabilities and shareholders' funds, may be anticipated as a credit to technical provisions.

The following simple example illustrates the implications of such a suggestion.

Liabilities		*Assets*	
Technical provisions	\$60M	Investments	\$100M
Shareholders' funds	\$40M		
	\$100M		\$100M

Suppose that all investments earn 10% per annum. The preceding subsections have effectively suggested that each of the investments should be regarded as belonging 60% to policyholders and 40% to shareholders. On this basis, each of the two groups could be regarded as receiving investment return at a rate of 10% per annum on their respective funds. The suggestion being considered in the present subsection, however, would credit all \$10M annual investment income to the technical provisions of \$60M, giving a rate of investment return of 16·7% per annum.

It is quite clear that the suggestion under consideration here is substantially less conservative than the means of determining the rate of investment return proposed in earlier subsections.

While the theory described in the preceding few paragraphs may have an initial ring of plausibility, a brief scrutiny of some of the details involved reveals a number of difficulties.

Firstly, company accounts are almost invariably prepared on a 'going concern basis', i.e. on the assumption that the company will continue in business, and without great disruption to its business, for a reasonable period into the future. The suggestion that all investment income be diverted out of the hands of shareholders and into those of policyholders hardly seems consistent with the 'going concern basis'. Note that, once technical provisions are discounted in this

manner, the insurer is locked into a system which *requires* that all investment income generated in future years be credited to technical provisions in the manner assumed. This will be necessary to maintain adequacy of those provisions. If the upshot of all this were very small or non-existent dividends to shareholders, one cannot imagine those shareholders sitting idly by. The Board of the insurer might be sacked; the insurer might be taken over; fears as to the insurer's solvency might arise, with the result that sources of credit and new business decline. Such events could precipitate a crisis in the affairs of the Company, which might cease to operate. If this occurred, assets would need to be valued on a break-up basis, on which basis the insurer might well be insolvent.

Of course, the diversion of all investment income into the hands of policyholders does not necessarily imply zero dividends to shareholders. The level of dividends depends also upon the profitability of the insurance business underwritten. If this is sufficiently profitable, then such profits will generate dividends. However, a projection of such dividends requires assumptions as to:

(i) future volumes of written premium;
(ii) future profit per unit of written premium.

It would be necessary to exercise great care in order to ensure that the treatment of all investment income as referable to technical provisions did not, in effect, anticipate future profits to an extent inconsistent with proper accounting principles.

There are other difficulties with the suggestion quoted at the beginning of this subsection. If it is proposed that the high rate of return calculated be projected over the period of run-off of currently outstanding claims, then there is an implicit assumption that shareholders' funds will continue in future years to make a contribution to total investment income commensurate with their present contribution. This entails an assumption that the ratio of shareholders' funds to total assets will be maintained in future years; otherwise the equity ratio of the company is diluted and the rate of investment return similarly diluted. Maintenance of this equity ratio requires further assumptions as to future profitability. There must be serious doubts as to the propriety of a method of outstanding claims evaluation, which relies upon an assumption of consistently high profitability during a number of future years.

All things considered, it seems that discounting outstanding claims on a basis which anticipates the entirety of an insurer's investment income as credited to technical provisions would, in most circumstances, be unacceptably lacking in conservatism.

7. NUMERICAL EXAMPLE

The following example is intended to be reasonably realistic. Full details of the parameters involved are given in Appendix B.

The example concerns the position of a hypothetical insurer at 30/6/83. The

situation is intended to reflect Australian conditions approximately. The period leading up to 30/6/83 was characterized by high interest rates, semi-government loans having peaked in excess of 17% p.a. A number of insurers had stocked their asset portfolios with such high-yielding securities, and in so doing had generally lengthened the average outstanding term to maturity.

By 30/6/83 interest rates had fallen. Further falls were expected subsequently and did in fact occur. At the time of writing (June 1984) further falls are anticipated for 1984/85.

Because of the anticipated reduction in new money rates on fixed interest securities, the hypothetical insurer has decided to change the balance between these and equity and property investments. The fixed interest proportion, currently 60% is to be decreased to 40% during the next four years. Future investment in fixed interest securities has been over-simplified in the example by the assumption that all such new securities purchased will have a term of three years.

The insurer has experienced modest growth in real terms during the past few years but does not anticipate any further growth. Operations are currently profitable and it is anticipated that the profit margin will be maintained in future years at approximately its current level. Claims escalation is assumed to be equal to the rate of return available on three-year fixed interest investments, though there is assumed to be some disturbance to this in 1985/86 and 1986/87 when interest rates are assumed to peak again without any similar response in inflation. The mix of different classes of business is assumed to be more or less typical of a large Australian non-specialist insurer.

Two versions of the example are carried through. In the first it is assumed that the rate of return on equities is 13% p.a. (including capital appreciation) in all future years. In the second case it is assumed that falling interest rates during 1983/84 and 1984/85 will induce a further 5% p.a. capital appreciation during those years.

A computer program has been used to project premium income, claim payments, new investments, etc. during the years 1983/84–1989/90. The results of the two projections are given in Appendix B6. The table at the top of the next page summarizes the rates of return derived there.

The table shows what would normally be regarded as the 'inflation gap' as being essentially 0 but with a couple of years of -2%. It also shows the gap emerging between claims escalation and the market rates of return actually obtained from the investment portfolio. These latter are seen to bear little resemblance to the 'inflation gap' figures on the new money basis.

Part of the difference is due to the assumption of a higher rate of return from equities and property than from fixed interest investments. The table indicates that this accounts for an inflation gap of $-1\frac{1}{2}\%$ in the years 1988/89 and 1989/90. However, if all of the new money 'inflation gap' figures are reduced by this $1\frac{1}{2}\%$, there are still marked differences between the results and the inflation gaps actually emerging. In any case, the correction of $1\frac{1}{2}\%$ in each year is not strictly

			Total investment portfolio			
			Additional equity appreciation in 1983/84, 1984/85			
	New money (a)		Excluded		Included	
Year ended 30 June	Rate of return %	Inflation gap (b) %	Rate of return %	Inflation gap (b) %	Rate of return %	Inflation gap (b) %
1984	14	0	16·4	−2·4	17·4	−3·4
1985	12	0	15·6	−3·7	16·7	−4·7
1986	14	−2	12·2	− ·2	12·2	− ·2
1987	14	−2	14·3	−2·3	14·3	−2·3
1988	12	0	15·1	−3·1	15·1	−3·1
1989	12	0	13·5	−1·5	13·5	−1·5
1990	12	0	13·5	−1·5	13·5	−1·5

Notes: (a) The assumed market rate of interest on 3-year fixed interest securities.

(b) Calculated as:

the rate of return shown in the preceding column

less

assumed claims escalation (Appendix B4).

accurate when the equity and property sectors account for less than 60% of the total investment portfolio.

The majority of the disparity discussed in the preceding paragraph can be accounted for by the decline in interest rates assumed to occur during 1983/84 and 1984/85, and the resulting capital appreciation with its favourable effect on market rate of investment return. If it were proposed to discount outstanding claims on the basis of an 'inflation gap' chosen on a rough-and-ready basis, some allowance would need to be made for this capital appreciation. Such a task may not be easy without a proper projection of the investment portfolio such as carried out in Appendix B. In practice, in dealing with investment portfolios, one is confronted with a very wide range of coupon rates and terms to maturity in the fixed interest sector. The total picture will usually be far from clear without some formal analysis. Moreover, it will not be easy to form intuitive conclusions as to the effects of the various interactions between future changes in:

(i) interest rates;
(ii) rate of growth of new premium;
(iii) the required distribution of assets by sector;
(iv) profitability of business underwritten;

to name a few of the factors involved.

8. CONCLUSIONS

Various conclusions have been noted at strategic points through this paper. For convenience, they are collated below.

Proposition 3.1.1. Any valuation of outstanding claims discounted in anticipation of future investment return should be accompanied by a statement of whether it is suitable for inclusion in a balance sheet containing assets at book, market or some other value.

Proposition 3.2.1. The book value of outstanding claims may be calculated by the following steps:

(i) project future market rates of investment return, including realized and unrealized capital appreciation calculated on the basis of changes in market value;
(ii) discount the cash flow associated with the payment of outstanding claims at these market rates of return, thus obtaining the market value of outstanding claims;
(iii) adjust the result of (ii) by the ratio of book value to market value of assets at the date of valuation, thus obtaining the book value of outstanding claims.

Proposition 4.3.1.1. In the case in which outstanding claims liabilities are surplus-matched as a matter of continuing policy, the valuation of those outstanding claims should proceed on the basis of a closed fund. The rates of investment return included in the discounting of outstanding claims should be those rates earned, from time to time, by the remainder of those assets which, initially, matched liabilities exactly.

Proposition 4.3.2.1. In the case of an insurer who has no stated policy of matching assets and liabilities, the valuation of outstanding claims liability should proceed on the basis of an open fund. The rates of return included in the discounting of this liability should be those projected as earned by the open fund. These rates are essentially a moving average of the rates being earned by the assets held at the date of evaluation and the rates available on future new investments. The discounting of outstanding claims thus depends partly upon future investment and underwriting (e.g. premium volumes, profitability, etc.) conditions.

Proposition 5.1. Unless a strategy of dead short investment is being pursued, or future inflation and interest rates are predicted to remain constant at their present levels, the concept of an 'inflation gap' should not be applied directly in the evaluation of outstanding claims discounted for future investment income.

Proposition 6.1.1. Apart from specific exceptions discussed in Section 6, it is reasonable to identify the outstanding claims liability at any point of time with a constant proportion of all assets held at that time, the proportion being the ratio of the outstanding claims liability to total liabilities including shareholders funds.

Proposition 6.2.1. Any asset item which, by its nature, is directly related to the acquisition of new premium should be identified with premium provisions and

not outstanding claims provisions, provided that the total of the asset items concerned does not exceed premium provisions. If the total does exceed premium provisions, then the excess should be identified with liabilities (including outstanding claims) other than premium provisions. The rate of return to be used in discounting the outstanding claims liability for future investment income should be consistent with this identification of assets and liabilities.

Proposition 6.2.2. In the application of Proposition 6.2.1, all liability items directly related to the acquisition of new premium should be treated as negative assets. Similarly, the depletion of the insurer's investment income which they cause should be treated as negative investment income.

Proposition 6.3.1. In the calculation of the rate of investment return to be used in discounting outstanding claims, creditor items, other than those directly related to acquisition of new premium, should be treated as negative assets. Any charges generated by those items should be treated as negative income. Such treatment should be modified, if necessary, to take account of any increase in exposure to investment risk as a result of the effective increase in gearing, which follows from the existence of creditor items.

A couple of further words on Proposition 5.1 may be in order since the concept of 'inflation gap' seems currently to be in reasonably wide use. For the reasons explained in Section 5, it is submitted that, although the 'inflation gap' concept may have some macro-economic validity, it can be virtually meaningless for the inclusion of net claims escalation (i.e. claims escalation less investment income) in an evaluation of outstanding claims. The only conceivable basis on which it could be made relevant to this issue (apart from the trivial one in which future rates of inflation and interest are projected to remain constant at their present levels) is one in which virtual total ignorance of future inflation and interest rates were asserted.

Undoubtedly, these are areas of great uncertainty. However, one's ignorance of likely events in the forthcoming one year (say) is usually not total. This is particularly true of investment return, since all coupon rates on fixed interest investments will be known. Taking into account the fact that the average period from date of valuation of outstanding claims liabilities to payment of those liabilities, is typically of the order of a few years or less (depending on the mix of classes of business involved), it seems unreasonable to conduct an evaluation on a 'total ignorance' basis.

Perhaps the most significant conclusion from the actuary's professional standpoint is Proposition 3.1.1. The concept of book and market values of a liability is a rather novel one and certainly not familiar to most insurers. Without this proposition's definition of the actuary's estimate of outstanding claims there is a real danger that that estimate will be unsuitably and misleadingly placed in accounts. Its placement could even involve the accounts in self-contradiction if, for example, a single estimate made by the actuary, and not qualified were

inserted in balance sheets containing assets at book and market value respectively. This self-contradiction would be particularly evident if the values of assets on these two bases differed markedly.

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APPENDIX A

Example of effect of changing new money yields on insurance fund rate of investment return

Year of experience	Investment income (a) in respect of investments purchased on 1 January 1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	Total	Rate of return (b) % p.a.
1984	20	20	20	20	20							100	+2·0
	0	0	0	0	0							0	
1985		20	20	20	20	20						100	−1·7
		0	−19·23	−37·72	−55·50	−72·60						−185·05	
1986			20	20	20	20	40					120	+4·0
			+19·23	+18·49	+17·78	+17·10	0					+72·60	
1987				20	20	20	40	40				140	+ ·4
				+19·23	− ·02	−17·84	−53·46	−69·30				−121·39	
1988					20	20	40	40	60			180	+6·0
					+37·74	+35·60	+16·79	+15·84	0			+105·97	
1989						20	40	40	60	60		220	+6·0
						+37·74	+17·80	+16·79	0	0		+72·33	

Notes: (a) Per 1000 units invested in each year for each term to maturity. Excluding maturity proceeds, but including interest and capital appreciation at market value. In respect of each year of experience, interest income is shown in the first line, and capital appreciation in the second.

(b) Ratio of total investment income for the year to market value of investments held on 1 January of that year.

APPENDIX B

Numerical examples

B1. *Structure of investment portfolio at 30/6/83*

Investment sector	Date of maturity	Amount held at 30/6/83 (a) $M	Coupon rate (b) % p.a.
Fixed interest	30/6/84	30	$14\frac{1}{2}$
	30/6/85	15	15
	30/6/86	5	$15\frac{1}{2}$
	30/6/87	5	16
	30/6/88	5	16
	Total	60	15·2
Equities		20	
Property		20	
Total		100	

Notes: (a) This is:
nominal value for fixed interest securities; market value for equities and property.
(b) Assumed paid annually on each 30 June.

B2. *Assumed future investment conditions (new money)*

Investment sector	Type of return	Assumed rate of return in year ended 30 June: 1983 % p.a.	1984 % p.a.	1985 % p.a.	1986 % p.a.	1987 % p.a.	1988 and thereafter % p.a.
Fixed interest (3-year)	Redemption yield (a)	16	14	12	14	14	12
Equities	Earnings yield (b)		8	8	8	8	8
	Capital appreciation (c)		10 (e)	10 (e)	5	5	5
Property	Earnings yield (d)		5	5	5	5	5
	Capital appreciation (c)		11	11	11	11	11

Notes: (a) On 30 June in the relevant year.
(b) Defined here as:

$$\frac{\text{dividend income for year}}{\text{opening market value}}.$$

(c) Defined here as:

$$\frac{\text{capital appreciation (market value) for year}}{\text{opening market value}}.$$

(d) Defined here as:

$$\frac{\text{income for year}}{\text{opening market value}}.$$

(e) Assumed in one projection of rate of return (Appendix B6.2). The other projection assumes 5% p.a. capital appreciation in each future year.

B3. *Investment strategy*

	Proportion of total assets (a) in sector				
		Objective at 30 June			
Investment sector	Actual at 30/6/83 %	1984 %	1985 %	1986 %	1987 and thereafter %
Fixed interest	60	55	50	45	40
Equities	20	$22\frac{1}{2}$	25	$27\frac{1}{2}$	30
Property	20	$22\frac{1}{2}$	25	$27\frac{1}{2}$	30

Note: (a) By market value.

B4. *Assumed future underwriting experience*

Year ended 30 June	Written premium $M	Premium acquisition expense rate (a) %	Amount of claims incurred (in 1982/83 values) (b) $M	Claims escalation (c) %
1984	67	15	55	14
1985 and thereafter	(d)	15	55	12

Notes: (a) Acquisition expenses as a percentage of written premium.
(b) Including expenses of claims administration.
(c) Between the financial year shown and the preceding one.
(d) Written premium increases by 12% p.a.

B5. *Past underwriting experience*

Year ended 30 June	Amount of claims incurred (in 1982/83 values) (b) $M	Development year (a)	Amount of claims paid (in constant dollar values) per $100 paid in development year 0 (c) $
1983	55	0	100
1982	52	1	40
1981	50	2	20
1980	48	3	14
1979	45	4	8
1978	45	5	6
1977	45	6	4
1976	45	7	2
		8	2

Notes: (a) The n-th development year is the n-th year after the year of origin of the claims.
(b) See preceding table.
(c) Applies also to claims incurred in 1983/84 and later.

B6. *Projection of future rates of investment return for a hypothetical insurer—open fund*

B6.1 Level capital appreciation on equities

Equities Year ending	30 6 83	30 6 84	30 6 85	30/6/86	30/6/87	30/6/88	30/6/89	30/6/90
Proportion of fund		·225	·250	·275	·300	·300	·300	·300
Market value	20·000	26·944	35·602	44·982	57·236	67·110	77·456	89·321
Earnings yield		·080	·080	·080	·080	·080	·080	·080
Rate of appreciation		·050	·050	·050	·050	·050	·050	·050
New investment		5·944	7·311	7·600	10·005	7·012	6·991	7·992
Dividend income		1·600	2·156	2·848	3·599	4·579	5·369	6·197
Capital appreciation		1·000	1·347	1·780	2·249	2·862	3·355	3·873

Property Year ending	30/6/83	30/6/84	30/6/85	30/6/86	30/6/87	30/6/88	30/6/89	30/6/90
Proportion of fund		·225	·250	·275	·300	·300	·300	·300
Market value	20·000	26·944	35·602	44·982	57·236	67·110	77·456	89·321
Earnings yield		·050	·050	·050	·050	·050	·050	·050
Rate of appreciation		·110	·110	·110	·110	·110	·110	·110
New investment		4·744	5·694	5·464	7·306	3·577	2·965	3·345
Dividend income		1·000	1·347	1·780	2·249	2·862	3·355	3·873
Capital appreciation		2·200	2·964	3·916	4·948	6·296	7·382	8·520

Fixed interest

Year ending	30/6/83	30/6/84	30/6/85	30/6/86	30/6/87	30/6/88	30/6/89	30/6/90
Proportion of fund		·550	·500	·450	·400	·400	·400	·400
Market value	59·315	65·863	71·204	73·607	76·315	89·479	103·275	119·095
Av. coupon rate on maturities		·145	·150	·155	·142	·128	·140	·140
Ruling rate of interest		·140	·120	·140	·140	·120	·120	·120
Amount maturing		30·000	15·000	5·000	40·085	23·959	9·935	42·666
Interest income		8·975	9·537	9·562	10·178	10·439	11·595	13·155
Capital appreciation		1·464	1·382	−2·533	·127	1·864	−·858	−·762
New investment		35·085	18·959	9·935	42·666	35·259	24·589	59·247
Term of new investment		3	3	3	3	3	3	3

Total Fund

Year ending	30/6/83	30/6/84	30/6/85	30/6/86	30/6/87	30/6/88	30/6/89	30/6/90
Claim payments (including claims expenses)	51·210	59·588	67·517	76·205	85·751	96·363	108·128	121·216
Premium income (net of acquisition expenses)		56·951	63·786	71·441	80·015	89·617	100·373	112·419
Investment income		11·575	12·313	12·688	13·515	14·210	15·244	16·502
Capital appreciation		4·664	5·320	2·796	6·119	8·729	7·386	8·136
Fund size	99·315	112·917	126·818	137·538	151·435	167·628	182·503	198·344
Rate of return		·164	·156	·122	·143	·151	·135	·135

B6.2 *Increased capital appreciation on equities in 1983/84 and 1984/85*

Equities

Year ending	30/6/83	30/6/84	30/6/85	30/6/86	30/6/87	30/6/88	30/6/89	30/6/90
Proportion of fund		·225	·250	·275	·300	·300	·300	·300
Market value	20·000	27·169	36·232	45·758	58·203	68·221	78·718	90·753
Earnings yield		·080	·080	·080	·080	·080	·080	·080
Rate of appreciation		·100	·100	·050	·050	·050	·050	·050
New investment		5·169	6·346	7·714	10·158	7·107	7·086	8·099
Dividend income		1·600	2·174	2·899	3·661	4·656	5·458	6·297
Capital appreciation		2·000	2·717	1·812	2·288	2·910	3·411	3·936

Property

Year ending	30/6/83	30/6/84	30/6/85	30/6/86	30/6/87	30/6/88	30/6/89	30/6/90
Proportion of fund		·225	·250	·275	·300	·300	·300	·300
Market value	20·000	27·169	36·232	45·758	58·203	68·221	78·718	90·753
Earnings yield		·050	·050	·050	·050	·050	·050	·050
Rate of appreciation		·110	·110	·110	·110	·110	·110	·110
New investment		4·969	6·074	5·540	7·412	3·615	2·993	3·376
Dividend income		1·000	1·358	1·812	2·288	2·910	3·411	3·936
Capital appreciation		2·200	2·989	3·985	5·033	6·402	7·504	8·659

Fixed interest

Year ending	30/6/83	30/6/84	30/6/85	30/6/86	30/6/87	30/6/88	30/6/89	30/6/90
Proportion of fund		·550	·500	·450	·400	·400	·400	·400
Market value	59·315	66·413	72·463	74·876	77·604	90·961	104·957	121·004
Av. coupon rate on maturities		·145	·150	·155	·142	·128	·140	·140
Ruling rate of interest		·140	·120	·140	·140	·120	·120	·120
Amount maturing		30·000	15·000	5·000	40·635	24·650	9·986	43·225
Interest income		8·975	9·614	9·722	10·345	10·608	11·783	13·367
Capital appreciation		1·464	1·401	−2·574	·138	1·896	−·868	−·772
New investment		35·635	19·650	9·986	43·225	36·110	24·850	60·044
Term of new investment		3	3	3	3	3	3	3

Total Fund

Year ending	30/6/83	30/6/84	30/6/85	30/6/86	30/6/87	30/6/88	30/6/89	30/6/90
Claim payments (including claims expenses)	51·210	59·588	67·517	76·205	85·751	96·363	108·128	121·216
Premium income (net of acquisition expenses)		56·951	63·786	71·441	80·015	89·617	100·373	112·419
Investment income		11·575	12·420	12·923	13·775	14·495	15·566	16·866
Capital appreciation		5·664	6·656	2·854	6·249	8·910	7·549	8·322
Fund size	99·315	113·917	129·261	140·273	154·561	171·220	186·579	202·970
Rate of return		·174	·167	·122	·143	·151	·135	·135

APPENDIX C

The use of book and market values in practice

Section 3.1 considers the alternative uses of book and market values of assets in the balance sheet, and the implications of each for the value of outstanding claims. It is appropriate to place this in some perspective relative to the practices of various countries.

Firstly, it may be noted that the distinction between book and market values of liability becomes an issue only when the liability for outstanding claims is discounted for investment income.

This makes the subject a topical one in Australia where many insurers effectively discount liabilities in respect of long tailed classes of business. Some do so explicitly, some implicitly.

The subject is perhaps currently less topical in the United States of America and the United Kingdom where the practice of discounting outstanding claims has not been widespread. However, it should be noted that the U.S.A. taxation authorities are now beginning to make an issue of discounting.

Secondly, practices of disclosure of asset and liability values are not always consistent from one country to another, or even between insurers in the same country.

The position in Australia, for example, is as follows. The two main sets of returns to be provided by an insurer are those to:

(i) the Corporate Affairs Commission;
(ii) the Insurance Commissioner.

If the insurer is listed on the stock exchange, its published accounts will normally be those in (i).

Companies are not required to disclose market values of all assets in published accounts or returns to the Corporate Affairs Commission, though they may do so. These accounts must include all assets at book value and, in addition, a statement of market values of *listed investments*. Some companies adopt the principle of periodic revaluation of assets in line with market value. On the basis of the argument presented in Section 3.1, it appears that the (discounted) value of outstanding claims which should be entered in these accounts, should depend on the practice adopted for valuation of assets.

The situation regarding returns to the Insurance Commissioner is different. Insurers must submit a balance sheet at book value (Form 3) and a statement of assets at market value (Form 4). Form 3 is a public document, whereas Form 4 is confidential.

The situation is made confusing by the fact that solvency calculations are carried out on Form 4. Since this form does not contain a statement of liabilities, the value of these is carried from Form 3. Thus, solvency calculations effectively compare:

(i) assets from a market value balance sheet;
(ii) liabilities from a book value balance sheet.

This situation is at best confusing, and at worst may lead to wrong decisions by supervising authorities as to the solvency or insolvency of particular insurers.