Managing Profits in a MoS Environment

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Appendices

① Introduction

The life industry is in the throes of a reporting revolution. It is preparing to report its annual profit on a realistic basis for the first time. The reporting method is known as Margin on Services ("MoS"). Though final standards have not yet been issued by the Life Insurance Actuarial Standards Board ("LIASB"), the basics of MoS are well known. They have been developed by the industry, actuaries and accountants over a number of years. Life companies have provided their 1994 MoS policy liabilities to the ISC and, by the time this paper is published, are due to have submitted their 1995 MoS policy liabilities. These results have not been published. The first published MoS results are due in respect of valuation dates on or after 31 December 1996. Some companies have already published MoS results and there are others which have been using other realistic reporting methods, in some cases for a number of years.

We believe that the use of the same realistic profit reporting regime by all life companies will herald many changes for life company management. These will be driven by:

- comparisons of company profitability in the press and by financial analysts
- owners, policyholders, boards and management focussing on published profit in the current year.

We have written this paper to anticipate these changes and to suggest the management information which life companies will need in order to deal with them. The theme of this paper is that the published profit will become *the key indicator* of a company's success. This internal use of published profits is both good and bad. In this paper we deal with the minimisation of some of the bad aspects as well as highlighting the good.

② The Current Situation In Australia

2.1 The Use of Embedded Values

Over the last ten to fifteen years, many companies have developed in-house forms of reporting which have been based around embedded values. Embedded value profits (i.e. increase in embedded value, removing the effect of capital injections and dividends paid) have been a key internal indicator of success for these companies.

This focus on embedded value profits for management reporting was due to four main factors –

● the absence of an appropriate statutory profit regime

● the view of embedded value profits as the "actuarially correct" measure of success

● the use of embedded values in mergers and acquisitions

● the publication of embedded values in some companies' annual reports.

On the whole, however, companies have not published their embedded value profit and therefore it has attracted little public comment or understanding.

The arguments for using embedded value profit have been well documented, and include -

● it is a realistic measure that reflects the amount and cost of capital

● it gives management the right signals, including showing the value added by new business.

2.2 The Value of MoS as a Management Tool

When US GAAP became the standard for life company reporting in the USA, life companies took to using it for internal management reporting too. This aligned the internal and external focus on profitability. Therefore it is likely that the same will occur in Australia with MoS profit reporting.

A small informal survey of Australian actuaries has shown that they fall into two broad categories -

- those who intend to move the focus of their management reporting to MoS based results, with perhaps annual embedded value calculations to assess value; and

- those who intend to keep embedded values as the focus of their management reporting, with annual MoS calculations for statutory purposes.

The features of MoS which make it suitable for internal management purposes, apart from it being the external measure, are:

- *it is largely objective - profit* does not depend much on actuarial judgement and therefore it can be accepted easily

- *it is easily understood - the* results are a realistic measure of profit. It need not bother management that the technique for calculating the policy liabilities was complex

- it is comparable between companies - which should help MoS to gain acceptance.

2.3   Criticisms of MoS as a Management Tool

MoS profit alone is not a good internal management tool. Cant and French, in their paper "Margin on Services Reporting: The Financial Implications" concluded – "We believe it is not appropriate to manage a company primarily on the basis of MoS Operating Earnings" (Ref 1).

They suggested an extension to MoS profit, which was expanded by Robert Clark in his paper "Margin on Services Value Added" (Ref 2).

Broadly, the criticisms of MoS have come under five headings -

- provides no information on the cost of capital

- does not demonstrate distributable earnings

- fails to show the value added by new business

- gives incorrect signals on experience variance, especially for lapses and disability incidence

- gives no information about the actuary's changed view of the future.

In this section we address these matters one-by-one.

1.   Provides no information on the cost of capital

We do not believe this is a valid criticism of a profit reporting tool. Capital management is an important subject but one which is different from profit reporting. A trading company would not reflect its cost of equity capital in its profit. It would measure its return on capital and make its own judgements about whether the returns were good enough or fell short of expectations. MoS profit reporting puts a life company in the same position.

2. *Does not demonstrate distributable earnings*

In all industries, including life insurance, there is a wide gulf between distributable and reported earnings. Financing the increase in capital adequacy reserves from profits is no different from a mining company provisioning profits to purchase a new ore extractor, rather than paying dividends. Measuring distributable earnings is an important management tool and useful information for valuing a company, but it is not a necessary profit management tool.

3. *Fails to show value added by new business*

It is useful to consider this criticism in the light of the reported profits of any other trading company. A trader will show a profit from selling business if it is a simple cash transaction in which the payment is made at the same time as the sale is made. This is equivalent to a life company making initial expense profits on single premium business. A cleaning company, for example, would not show a profit for winning the contract for cleaning a large office block. The profit would be made over the course of the contract. The mining industry provides another example. A mining company would not show a profit for discovering a new body of ore. The profit would emerge as the ore was mined and sold.

These examples illustrate that the life industry is not the only one whose profit reporting does not immediately reflect changes in the economic value of the business. Other industries have addressed this feature with financial models for valuing a company's business. Life companies use embedded values. We consider this to be quite appropriate as an adjunct to profit measurement but not a reason to change the method of profit reporting itself.

4. *Gives incorrect signals on experience variance*

Both the Cant & French and Clark papers have documented well the incorrect signals that may be given by the current year's MoS profit, and identified that focussing on the variance in profit margins is a way of overcoming this problem. In Sections 4 and 5 we have detailed how to calculate and present the analysis of profit in a way that does give the full

information which management needs. We also stress that, while current year's MoS profits may give the wrong signals, MoS profits over the next two or three years will certainly present the right story. We will show how management can understand the position better through the impact on next year's profits than through the capitalised value of the change in all future profits.

5.   *Does not reflect changes in assumptions*

Consider a life company which suffers a deterioration in its expense position. Under MoS, it will have suffered a small reduction in its profit in the year in which the change occurred and thereafter, all other things being equal, it will continue to underperform its target return on capital. Thus the company gets reminded every year that it is not doing well enough.

To extend the mining example from above, the mining company would only show a profit from introducing new ore recovery methods which greatly reduced its costs when the savings were actually achieved. The impact would, instead, be shown through projections of the annual dollar savings and their impact on return on capital. Similarly, in Section 5, we give examples of projections of MoS profits that show the impact of the actuary's changed views. This example shows how MoS puts life companies in the same position as other businesses.

③ A Proposed Management Approach

3.1 Philosophy

The essence of profit reporting is that if a company does well its profit is positive and if it does badly then it will show a loss. That may represent too low a hurdle for some and a better starting point for measuring good or bad performance is the profit expressed as a rate of return on capital. Thus a company which does well has a return on capital which exceeds shareholders' expectations and one which performs badly fails to meet them. Either way, profit is used as a, if not the, measure of performance. It becomes particularly meaningful when analysed to its sources. Therefore it is important that a company's profit measurement and analysis system gives the right signals to management so the right actions are both encouraged and recognised while the wrong actions are discouraged but also recognised. For these purposes we will treat the right actions as those which increase the profits of the business over the life of the business. It is important to remember at this point that a profit reporting system only affects the timing of the emergence of profit. It does not alter the total amount of profit made. (We note that this is not true for participating business under MoS, for which the profit depends on the basis for valuing the cost of bonus.)

The philosophy behind this paper is a three-tiered approach to management reporting:

1. Calculate and monitor a target return on capital, i.e.

$$\frac{\text{MoS operating earnings attributable to shareholders}}{\text{shareholder capital employed}}$$

and

$$\frac{\text{MoS operating earnings attributable to policyholders}}{\text{policyholder capital employed}}$$
(excluding cost of supportable additions)

where

shareholder capital employed is share capital plus retained MoS profits attributable to shareholders

policyholder capital employed is retained MoS profits attributable to policyholders.

Companies will judge whether they had a good or bad year by whether they achieved their target.

2. An analysis of MoS profits that shows the impact of experience on the current year's profit, presented in a way which gives management the right signals.

3. Also expressing the consequences of the current year's experience in terms of its effect on the next year's profit.

This fast aspect, expressing the impact of this year's experience on next year's profit, is critical in sending the right message to management. The point should also be made that it is not only next year's profits that are impacted, but that it is indicative of a long term shift in profitability. Management needs to understand that, under MoS, experience variance effects persist (gradually diminishing) for many years into the future.

3.2   Presentation of Results to Management

The presentation of MoS results to management presents the actuary with a dilemma. On the one hand, the results should be presented in a simple format; on the other, a detailed breakdown is required to give the right signals.

We have argued that MoS profit will become the key indicator of a company's success, both externally and internally. In this case any management report will need to include, for both MoS profit and return on capital -

●   the results of the current period

●   comparison against budget

●   comparison with prior periods

●   impact on next year's profit.

In comparing MoS profits against budget, the situation arises where short term expectations differ from long term MoS assumptions. (For example, where withdrawal experience is expected to be high in the year ahead due to factors particular to the company at the present time). In this case, the budgeted MoS profit will include a component for 'expected variance'. This item should be clearly identified and explained in management reports and become, effectively, the first item in the MoS analysis of profit.

The company's budgeting process will have been important for setting the target return on capital for the year, which will not necessarily be the same as the company's long term target. This is because MoS profits on a policy

would not emerge at a constant rate on the capital employed, but rather as service is provided over the policy's life. Thus a company's expected rate of return in a year will depend on the age and mix of its business. Many trading companies would find themselves in the same position. Assuming that the difference between the rate of return for the year and the target was understood at the time of setting the budget, management reporting over the year can concentrate on the reasons for any differences from the budget rate of return.

Because MoS profits emerge slowly, management needs to understand the impact of recent events and actions on future profits. Capitalising future values, of course, is the ultimate in incorporating long time periods, however we think it detracts from the basic message - it is earnings, not capitalised values, that drive success.

In Section 5 we have provided a sample set of management reports to illustrate these points.

3.3   Applicability

There is value in disseminating the results of the MoS investigations throughout the organisation. In particular public focus on published MoS results will mean agents, brokers and staff may be questioned on the company's results. The more they understand the results, the more they can comment appropriately. For example, all staff could usefully be shown Graphs 5.1 and 5.2, and Table 5.1 to coincide with release of the profit result. As with any internal management system, the question of remuneration based on profit results arises. The analysis of profit gives the ability to build a remuneration system based on the controllable components of the variance (See Section 4.3 for definitions of the components). Items to incorporate may include -

Expenses

Cashflow variance against expected (both acquisition and maintenance)

Discontinuances

Profit margin variance next year, arising from this year's experience

Underwriting

Profit arising from this year's experience

New Business Volumes

Additional profit margin release added to next year's expected MoS profits.

While these amounts will be lower than the capitalised impact, they relate remuneration to a short term, measurable impact.

3.4   Frequency

Companies will wish to calculate MoS profits more frequently than annually, in order to -

● give early signals of likely year end published profits

● provide numeric analysis which will be useful in managing the business

● integrate MoS reporting into the regular management control cycle.

How often are such calculations required? Some companies have contemplated monthly reporting. While this can be justified on the grounds of giving ongoing indicators of likely published profits, its limits include -

● MoS profits without the analysis of profit can give incorrect messages - but a monthly analysis of profit may be overly time-consuming

● monthly MoS profits may provide spurious results due to seasonal impacts, low volumes and timing impacts of claims.

At present, a quarterly MoS profit calculation, with a profit analysis and revised forecasts, seems an appropriate aim. Monthly reporting may become the norm later on. In Section 6 we discuss the requirements of mid-year valuations, particularly relating to resetting assumptions and recalculating profit margins.

④ The MoS Analysis of Profit

4.1 The General Approach

The analysis of profit is a comparison between actual and expected profit. It gives a breakdown of the difference into meaningful components that separate cash flows, liabilities and profit margins. We recommend a two-tiered attack on the analysis, using -

● a series of model office projections,

● supported by simple arithmetic rules of thumb.

This is a pragmatic approach which uses a series of projections on different assumptions. It involves changing the assumptions for the period, being analysed one at a time from 'expected' to 'actual'. While these successive runs can, eventually, be automated, we believe that actuaries can gain considerable insight by working through the projections we describe.

The method described applies to both the projection and accumulation methods for valuing MoS policy liabilities. In the case of the accumulation method, one year projections of cash flows and policy liabilities are required. These would not have been necessary for the valuation of policy liabilities but could have been created for business planning purposes.

We have developed a simple model office to demonstrate the basic principles and management reports comprising the MoS analysis of profit. Full details are given in Appendix A. We are using it to carry out the analysis of profit for a company analysing its profit over 1996.

Table 4.1 shows a summary of the model office analysis we have used. The aim of this Section is to help actuaries calculate, understand and explain the 'variance in operating earnings' component.

Table 4.1 – Analysis of Profit

	In Force	New Business	Total
	$m	$m	$m
Operating Earnings	152.8	1.7	154.5
Represented by:			
Planned interest on capital assets	59.8	0.0	59.8
Plus:			
Planned release of MoS profit margins	10.6	3.2	13.8
Gives:			
Expected operating earnings	70.4	3.2	73.6
Plus:			
Variance in operating earnings	82.4	-1.5	80.9
Gives:			
Actual operating earnings	152.8	1.7	154.5

The following are required to perform the analysis

- actual cash flows over the period

- projections of cash flows and policy liabilities for business in force at the start of the period

- projections for new business written during the period

- actual policy liabilities at the end of the period.

The process we describe applies at any level of detail. It simply requires that actual and projected results be available to the same level of detail. In fact, it is quite possible to do the analysis at different levels of detail for different parts of the analysis, e.g.

- expense profit could be analysed at business line level

- interest profit could be analysed at statutory fund level, and

- claims profit could be analysed at product level.

The actual cash flows over the period need to be expressed as

> Premium income less SCT
> Investment income, less tax
> Acquisition expenses* net of tax deductibility
> Maintenance expenses* net of tax deductibility
> Surrenders
> Claims

> *including commissions*

To achieve this presentation requires actual expenses to be split between acquisition and maintenance and for tax to be split between investment income and expenses. Both of these tasks would, in many cases, be carried out for the setting of assumptions and, if so, would not represent extensive additional work.

The projections need to project actual cash flows as well as projecting policy liabilities. As explained below, they need to accept assumptions for the period being analysed different from the assumptions for subsequent periods. The projections include investment earnings on assets in excess of policy liabilities in the statutory funds and on the shareholders' fund. We expect companies would find it better to use modelled data for the projections than individual policy data.

4.2   The Analysis Projections

In this Section we describe a series of model office projections to perform the analysis and supply the full management information. We have assumed that short term budgets are based on MoS best estimate assumptions. Where this is not the case, an additional variance item should be calculated at the start – "expected variance". This shows the difference between long term MoS assumptions and short term budgets. We do not believe that MoS assumptions need to reflect such short term variants - better signals may be sent if the long term view is taken and short term variance simply emerges. The analysis then proceeds as follows.

The analysis starts with a projection of business in force at the start of the period. This is combined with a projection of the expected new business to obtain the expected profit for the period. The assumptions in the projection of business in force are the MoS valuation assumptions used at the end of the previous period (the old assumptions). Thus the expected profit is the profit that would be earned if the MoS valuation assumptions are borne out in practice.

The new business projections would also use the old assumptions except for acquisition expenses. An appropriate assumption is needed for expected acquisition expenses in the period under review. In order to provide a useful benchmark against which to measure actual experience, the assumption should be consistent with pricing or with the company's business plan.

The new business projection has to calculate the profit margins on new business. The in force projection would use the profit margins calculated at the previous valuation. The analysis then proceeds with a series of projections.

The projections required are -

P_1 Projected profits in respect of business in force at the start, plus expected new business during the period, both using old assumptions

P_2 As P_1, changing to actual volume and profile of new business

P_3 As P_2, changing to actual new business expenses (still using expected new business profit margins)

P_4 As P_3, using recalculated new business profit margins

P_5 As P_4, changing to actual discontinuance rates for the period (lapses, surrenders and premium dormancy)

P_6 As P_5, changing to actual claim rates for the period (both mortality and morbidity)

P_7 As P_6, changing to actual net investment earnings rates for the period

P_8 As P_7, changing to actual maintenance expenses for the period, net of tax deductibility.

Projections P_2 to P_8 above are needed specifically for the analysis. P_1 is simply the valuation of policy liabilities at the start of the period. P_2 would use a different new business model from that in P_1. The new model would reflect the profile of the new business actually written (i.e. age distribution, average premium, etc) whereas P_2 would have used the expected profile.

In addition to the above projections, the company would have its MoS valuation at the end of the period on its new assumptions. As a check on the projected end-of-period policy liabilities in P_8, a valuation on the old assumptions could be run.

P$_8$ is important. It provides a projection for the period under review using hindsight. In a perfect world the projected cash flows from P$_8$. would be the same as the actual ones. In practice they will not be.

The differences need to be brought into the analysis. They also provide a useful check on the analyses of the company's experience and on the model office. We believe that material differences in premium income, expenses and claims should be investigated. Differences in investment earnings, surrenders and the change in policy liabilities are more likely to occur. This is particularly so for unit linked business, for which the model would not reflect the daily or weekly changes to unit prices and their impact on surrender payments. Generally we would expect the differences to offset each other. If their net total was small we would treat it as an untraced difference. Otherwise its investigation would depend on insight into a particular company's model and products which is outside the scope of this paper. This feature is a potential weakness of the analysis, although we believe that in practice it is manageable.

4.3   Components of Analysis

The above analysis needs to be checked and understood. To do this, we believe it is helpful to analyse the variance into three components. These components are easy for the actuary to understand and some of them help with the messages to be given to management.

Cashflow variance (CF)	The effect of experience differences on cashflows over the period (excluding changes in policy liability)
Best estimate liability variance (BEL)	The effect of experience differences on the BEL at the end of the period
Profit margin variance (PM)	The effect of experience differences on the value of profit margins at the end of the period.

This three way split can be shown as follows -

Table 4.2 – MoS Analysis of Variance

	Cash Flow Variance	BEL Variance	Profit Margin Variance	Total
	$m	$m	$m	$m
Capital Asset Variance				
Interest – on capital assets	21.8	0.0	0.0	21.8
In Force Variance				
Lapses	-159.5	117.2	10.4	-31.9
Mortality	27.9	-15.4	-0.1	12.4
Morbidity	-4.1	-9.2	-1.9	-15.2
Interest	55.8	-04.1	-0.4	41.4
Maintenance Expenses	-16.0	0.0	0.0	-16.0
Total In Force Variance	-95.9	78.5	8.1	-9.3
New Business Variance				
Acquisition Expenses	-5.1	0.0	4.1	-1.0
Volumes	2.4	-4.8	1.9	-0.5
Total N.B. Variance	-2.7	-4.8	6.0	-1.5
Change in Assumptions	0.0	72.5	-2.6	69.9
Total Variance	-76.8	146.2	11.5	80.9

The actual and expected experience used in our example are set out in Appendix A.

The following sections describe how to calculate the components of Table 4.2. They are in the nature of 'rules of thumb', giving results which are accurate enough for the purposes of providing information to management and checking the analysis.

4.4 Analysing New Business

New Business Volume: $(P_2 – P_1)$

The new business volume variance is calculated by comparing the actual volumes (on expected expenses) with the expected volumes (on expected expenses). In most cases, with a reasonably homogenous cohort, this can be done through rationing all items in line with new business volumes, by product.

In the example, the variance is simply -

$$\frac{(17,000 - 20,000)}{20,000} \quad \text{expected values}$$

More useful information can be obtained if the company splits its acquisition expenses between the fixed and variable components. Then the profit or loss arising from spreading the fixed acquisition expenses over the actual new business volume can be included in the variance due to new business volume. This has not been done in the example in the paper.

Acquisition Expenses (P_4 - P_2)

Any under- or over-spending on acquisition expenses will frequently have only a small impact on profit. This will be the case when there are no actual or expected losses to be capitalised on new business. In this case the difference between actual and expected acquisition expenses (on actual new business volumes) will be exactly matched by a higher or lower value of future profit margins at issue. The profit variance will be only the profit margin released in the period.

In the example, acquisition costs exceeded the pricing assumption by $300 per policy. The cashflow impact was

$$-\$300 * 17,000 \text{ policies} = -\$5.1 \text{ m}$$

The expected profit margin was 32% of claim outgo. The revised profit margin to absorb the extra costs at acquisition was 20% of claim outgo. This loss is partially released over the remainder of the year, the balance results in a lower value of future profit margins at the end of the year and is calculated as -

$$(32\% - 20\%) * \text{value of profit carrier at end}$$
$$= 12\% - \$2,000 - 17,000$$
$$= \$4.1 \text{ m}$$

These results are respectively P_3 - P_2 and $P_4 - P_3$.

The acquisition expenses have no affect on the best estimate liability and so the acquisition expense variance only affects two components of the analysis. These components are important to management which needs to know the amount of under- or over-spending on acquisition costs (the cash flow variance) rather than be given the impression that acquisition expenses have little effect on profit.

4.5   Analysing Discontinuance Rates(P_5 - P_4)

In the example, actual discontinuances were 30%, not 20% for disability or 10% for the other products as expected. Rerunning the model, with the actual lapse rate, gives the following results -

Table 4.3 – Analysis of Discountinuances

	Cash Flow Variance	BEL Variance	Profit Margin Variance	Total
	$m	$m	$m	$m
Term	0.0	-50.7	5.2	-45.6
Disability	0.0	40.9	1.6	12.5
Annuity	0.0	0.0	0.0	0.0
Unit Linked	-159.5	157.0	3.6	1.2
Total	-159.5	117.2	10.4	-31.9

The total profit arising from the difference between actual and expected discontinuance experience can be understood by considering the marginal discontinuance. It has a surrender value (SV) paid out and the policy liability (PL) released at the time of discontinuance, i.e.

$$\text{MoS Profit} = PL - SV$$

This gives a means of checking the analysis above. Assuming discontinuances occur on average in the middle of the period, the estimated discontinuance profit variance is:

$$[\tfrac{1}{2}(PL_0 + P_1) - \tfrac{1}{2}(SV_0 - SV_1)] * [N_a, - N_e] * (1 + \tfrac{1}{2}i)$$

where PL_0, P_1* = Average polity liability per policy at the start and end

SV_0, SV_1* = Average surrender value per policy at the start and end

N_a = Actual number of discontinuances

N_e = Expected number of discontinuances

i = Expected rate of investment earnings.

*   *Note that for interest sensitive business, PL_1 and SV_1 depend on the investment earnings in the period. Since the analysis of discontinuances is being done before the analysis of investment earnings, PL_1 and SV_1 should be on the expected interest basis and not the actual one. They could be obtained from the projection run P_4.*

For greater accuracy, this check would best be done for each product line, separately for in force and new business. In practice, new business would most likely contribute little to the discontinuance variance and could be ignored.

For our example, this formula gives –

Product	Estimated Discountinuance Profit
	$m
Term	-48.7
Disability	10.1
Unit Linked	3.3

The differences between the above figures and those in Table 4.4 are due to the cash flows not being at the mid-year and to the very large difference between the actual and expected discontinuance rates. In practice, smaller discrepancies would be expected.

To gain insight into the discontinuances profit variance, the above formula can be re-expressed as:

$$\begin{aligned} \text{MoS Profit} \quad &= \quad \text{PL - SV} \\ &= \quad \text{(BEL + PVPM) - SV} \\ &= \quad \text{PVPM - (SV - BEL)} \end{aligned}$$

where BEL   =   Best Estimate Liability

PVPM   =   Present Value of future Profit Margins

Thus the discontinuance profit variance represents the bringing forward of future profits to the date of discontinuance, offset by the excess of the surrender value paid over the value of future liabilities.

The component of profit, PVPM, would have been earned later if the policy had remained in force. It does not represent good performance by the company. The second component (SV - BEL) represents the value added or subtracted by discontinuances. Most usually SV>BEL and, if so, higher discontinuances represent poor performance.

Looking at our example in this way:

● *Term Insurance* - had a negative BEL (an asset) and so the extra terminations represented a loss of this asset. It was only partially offset by the advancing of future profits.

● *Disability* - had a positive BEL, meaning that the extra discontinuances saved on claims which could not have been met from future premiums alone. The profit shown does represent good performance by the company. This situation could arise on level premium business. It would be unlikely to arise on stepped premium business, unless the product was particularly unprofitable.

- *Unit linked - showed* a profit even though SV>BEL. Nevertheless the profit was generated by the advancing of future profits and so represented poor performance by the company.

The variance items are read off as the difference between the two runs - the important item is the reduction in the value of future profit margins by $10m.

4.6 Analysing Mortality Rates ($P_6 - P_5$)

The general approach is similar to that for discontinuances.

Because sums insured are less homogenous over the portfolio, an alternative approach is to calculate the excess of actual death payments over expected death outgo. This can be used directly in the cash flow variance column and the BEL and PM impact derived from the projection.

In this case, the office experienced nil deaths over the year, and the actuary has rerun the model on this basis. The result is clearly higher profits on the term insurance portfolio.

For the annuity portfolio, poor mortality experience (i.e. few deaths) leads to a compounding effect we have called the loss multiplier effect. This is because the increased number of lives in force at the year end increases the value of the profit margin reserved, despite poor experience. This is described fully in Section 6.1.

4.7 Analysing Morbidity Rates ($P_6 - P_5$)

Disability income claims behave differently from mortality and TP1) claims. This is because the difference between actual and expected claims experience has to be spread over the term of the claims. Thus an increase in claim incidence will first be taken up in a reduction in the profit margin attaching to open claims and so may have a small effect in the year it occurs.

This is discussed further in Section 6.1, where the means of determining the profit margin for open claims is given.

The impact of variance in incidence and termination rates should be assessed separately. We believe this is a vital part of the analysis for companies with a significant disability portfolio.

The actuary has determined that the incidence rate was 3% against an expected 2% rate. Running the model with the revised incidence rate gives the following values-

Variance In:	$m
Disability Outgo	4.1
Active Lives BEL Reserves	(0.7)
Open Claims BEL Reserves	9.9
Value of Profit Margins	1.9
MoS Profit	(15.2)

As with annuities, the impact of higher inception rates has led to an increase in the value of profit margins. This gives a "double hit" for the inception experience, and gives management the wrong indicators. In Section 6.1 we have proposed a solution to this loss multiplier effect", through recalculating profit margins on open claims.

4.8 Analysing Investment Earnings ($P_7 - P_6$)

Investment earnings are an important source of profits and can cause volatility in profit from year to year. They contribute to profit in two ways -

- investment earnings on assets in excess of policy liabilities (retained earnings and shareholders' funds)

- investment earnings on policy liabilities to the extent they do not belong to policyholders.

Retained Earnings and Shareholders' Funds

All of the investment earnings on retained earnings and shareholders' funds fall into profit. They can be calculated as:

$$\left(A_0 - PL_0 + A_1 - PL_1\right) * \frac{i}{1 + 1/2\,i}$$

where
A_0, A_1	=	Assets at start and end of period
PL_0, PL_1	=	Policy liabilities at start and end of period
i	=	Actual rate of investment earnings.

In the example, the profit from this source was $81.6m, which exceeded the expected profit of $59.8 m by $21.8 m.

Policy Liabilities

The policy liability can be considered in two components. One component ($PL^\$$) represents the part of the policy liability which does not vary with the rate of investment earnings. This component would include premiums, dollar based

fees and charges, expenses except investment expenses and possibly claims. The other component (PL^1) would include unit linked and investment account surrender benefits, maturities and asset based charges. These items do vary with the investment earnings.

The profit variance arises from $PL^\$$ alone. $PL^\$$ is the value of the relevant cash flows $CF^\$$. Assuming these cash flows occur on average in the middle of the period, the investment earnings variance is

$$(PL^\$ - \tfrac{1}{2}CF^\$) \times (i^a – i^e)$$

where i^a =   actual investment earnings rate
                i^e =   expected investment earnings rate

The model illustrates the components of this variance formula, as explained below:

Term insurance, disability insurance and annuities: These have only fixed dollar components so the variances are:

			$m
Term	$(-243 - \tfrac{1}{2} \times 36) \times .03$	=	-7.8
Disability	$(60 - \tfrac{1}{2} \times 12) \times .03$	=	1.6
Annuity	$(1504 - \tfrac{1}{2} \times 101) \times .03$	=	43.6

Unit linked.. This has expenses which do not vary with the investment earnings rate. The opening value of maintenance expenses was $80m and the year's maintenance expenses were $15m so the profit was:

$$(80 - \tfrac{1}{2} \times 15) \times .03 \qquad = \qquad 2.2$$

The sum of the above profit variances for the four products is $39.6m. This gives a good check on the model's figure of $41.4m. The difference is due to the timing of cash flows, which were not mid-year.

Matching

The paragraphs above dealt with investment earnings in the period being different from expected. The effect of the change in the investment earnings assumption on the policy liabilities is covered in Section 4.11. This variance, together with the above variance due to investment earnings on the assets supporting policy liabilities, represents the mismatching profit.

4.9 Analysing Expense Rates ($P_8 - P_7$)

The cash flow variance is simply the difference between actual and projected net maintenance expenses over the period. Projection P_8 is then not required to calculate this, which can be read directly off P_7 but is included for completeness.

4.10 Analysing Participating Business

Participating business is different under MoS in one important way. For non-participating business, the method of reporting profits only affects the timing of profits emerging. It does not affect the quantum of profit in aggregate over all years. This is not the case for participating business, for which the profit depends on the cost of bonus which in turn depends on the method used to calculate it.

Under MoS, interest profits are rolled up in the VSA and not reported as profit. Instead, the cost of supportable bonuses is reported as profit. All non-interest profit can be analysed as for non-participating business.

There is a practical issue with the calculation of participating business profits. It is that it is desirable to calculate the VSA and proceed to the calculation of the supportable bonus first and to do the analysis of profits second. Our formula for VSA is shown in Section 6.3 and enables the actuary to take this approach.

Thus the analysis for participating business will look like:

	Interest on retained earnings
+	Non-interest profits
-	Cost of supportable bonus
+	Interim and terminal bonuses paid in year
=	Profit

which is split between policyholders and shareholders (say 80/20):

Policyholders' Retained Earnings		Shareholders' Retained Earnings (Participating)	
=	Policyholders' Retained Earnings B/F	=	Shareholders' Retained Earnings (Participating) B/F
+	80% of Profit	+	20% of Profit
-	Cost of Declared Bonus	-	Transfer to Shareholders' Retained Earnings (Non-participating)
-	Interim and Terminal Bonuses Paid in Year		
=	Policyholders' Retained Earnings C/F	=	Shareholders' Retained Earnings (Participating) C/F

4.11   Changes in Assumptions

Under MoS, changes in assumptions have no impact on this period's profits, other than:

● a change in the investment earnings rate due to a change in market conditions

● changes that lead to reversal of previous capitalised losses or to capitalised losses.

However, by changing an assumption, the actuary is signalling that something has occurred over the period which is expected to impact future profits. The analysis of profit is an appropriate place to give an indication of this change.

The change in assumptions can be calculated as in Table 4.3, below, which shows separately the impact on the BEL carried forward and the profit margins carried forward.

Table 4.4 – Change in Assumptions

	Impact on BEL Carried Forward	Impact on Profit Margins Carried Forward	Impact on Policy Liability Carried Forward
	$m	$m	$m
Interest	-81.1	-2.9	-84.0
Expenses	-4.3	2.8	-1.5
Mortality	15.5	0.0	15.5
Morbidity	0.0	0.0	0.0
Lapse Rates	-2.7	2.7	0.0
Total	-72.5	2.6	-69.9

While the total impact on profit is often zero, the actuary needs to understand the implications of the changes for future expected profits. This is shown through the capitalised value of the change in profit margins carried forward. For presentation purposes, as we explain in Section 5, it may be better to show the expected impact of each item on next year's profit.

Calculation notes

The analysis should be performed on a modelled data set. The analysis is performed on the period end data, changing one assumption at a time.

The interest variance is often the largest single item and reflects the decrease in policy liability due to the increase in the assumed future earnings rate. This impact is expected to relate to the change in the market value of assets, to the extent that assets and liabilities are matched, as discussed in Section 4.8.

The actuary has also reduced the expense maintenance assumption, leading to a reduction in the BEL carried forward of $4.3m. Normally the profit margin would be increased by a corresponding amount to fully offset this reduction. However part of this reduction is a reversal of a previous capitalised loss (a loss of $1.5m) and therefore the profit margin is only partially increased to absorb this change.

The actuary has become more pessimistic about future mortality rates and has worsened the assumptions. This has increased the BEL carried forward and this loss is fully recognised at the valuation date - there is no offsetting reduction in the profit margins.

Finally, the actuary has become more optimistic about the lapse rates on the unit linked product, leading to a reduction in the BEL carried forward of $2.7m. There are no previous capitalised losses and therefore this amount is fully offset by an increase in the profit margin carried forward.

⑤ Presentation To Management

5.1 Management Focus/Indicators

We stressed in Section 3 that the prime focus should be on giving management the correct signals, both about the current year's performance and the revised estimates of next year's performance. While the full details could be shown in Table 4.2, it may be appropriate to develop a report which focuses on the important numbers. These are now given for each variance item.

New Business Volumes

The focus item is the variance in the value of 1997 profit margins added by new business. This will show not only volume variance but changes in the mix of high margin/low margin sales. In our example:

Expected 1997 Margins from Sales	Revised 1997 Margins from Sales	Variance
$m	$m	$m
2.5	2.1	(0.4)

In reporting this result, the actuary may relate the profit margins on new business to the amount of capital invested in the new business.

Acquisition expenses

It is critical that management be shown the amount of over- or under-spending on acquisition costs in the period under review, not the MoS profit variance. While this can be shown as a variance in margins, it is easiest shown as a dollar amount. This should be related back to next year's expected profit from new business, viz:

	1996 Acquisition Expenses	Impact on 1997 Profit
	$m	$m
Budget	20.4	-
Actual	25.5	(1.4)

Discontinuance Profit

In Section 4.5 we described a way of dividing discontinuance profits into two components - profit margins brought forward, and surrender value losses (the

excess of the surrender value paid over the best estimate liability). This is also a useful way to present the results to management.

	Profit Margins Released 1996	Surrender Value Losses	Impact on 1997 Profits
	$m	$m	$m
Budget	9.3	21.9	-
Actual	19.7	64.2	(2.7)

Mortality Profit

This can be shown in a similar way to discontinuance profit.

Investment Profits

The profit variance due to investment earnings is:

	$m
Investment earnings on shareholders' retained earnings and shareholders' funds	21.8
Excess investment earnings on assets supporting policy liabilities	41.4
	63.2

Change in Assumptions

There are three aspects to show, as demonstrated below:

Capitalised Losses	$15.5m
Reversal of Previous Losses	$1.5m
Estimated Reduction in 1997 Profit	$0.8m

5.2   Presentation Examples

In Section 3 we described a three-tiered approach to management reporting:

● tracking the return on capital

● analysing MoS profit into its components

● showing projected impacts on profit of any experience variance or change in assumptions.

We have developed four key graphs and tables that will illustrate these points.

MoS Profits

Graph 5.1 shows actual and expected profits alongside historic and projected results. The key aspect is that two sets of forecast 1997 values are shown

1.   the forecast 1997 profit as at the start of 1996

2.   the forecast 1997 profit as at the end of 1996, impacted by actual experience and the change in assumptions.

In this case, the revised forecast is $11 m lower than the start of year forecast, due to the combined impact of 1996 experience and the changed assumptions. Showing this change is a strong control cycle discipline.

More generally it is critical that projected numbers are shown alongside actual

●   to put this period earnings in context

●   to show the gradual emergence of profit from new business sales and release of profit margins

●   to provide management with their own expectation of profit against which to monitor emerging experience.

We cannot stress enough that an analysis of variance has the greatest value when management knows, at *the* start of *the period,* the profit expected to emerge.

Graph 5.1
Actual and Forecast Profits
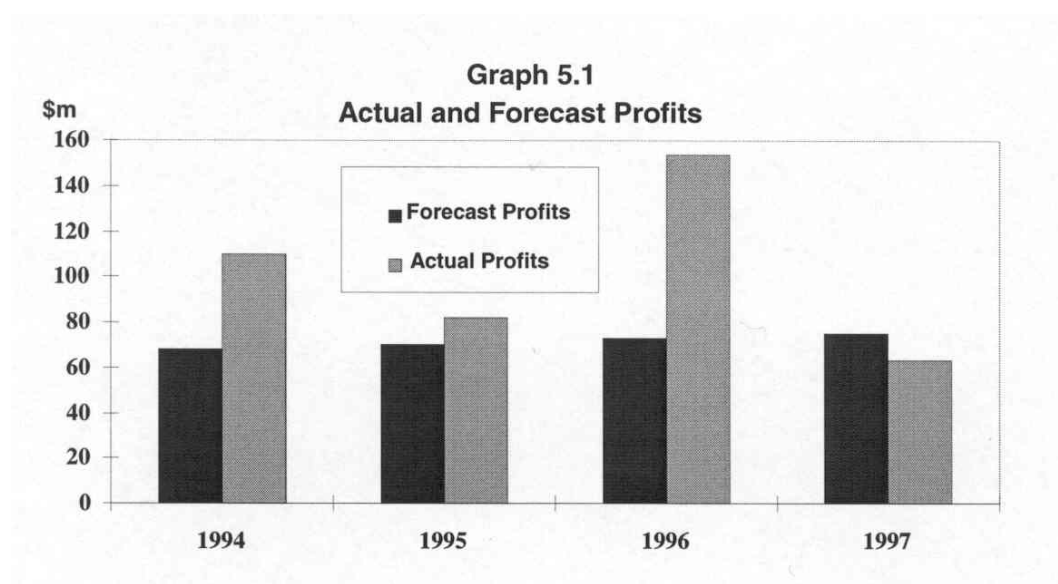
Return on Capital

Graph 5.2 is similar to Graph 5.1, except that it shows the values expressed as rates of return on capital. In this case we are showing

<u>MoS operating earnings attributable to shareholders</u>
 shareholder capital employedwhere capital employed is taken straight from the 1996 balance sheet.

Graph 5.2
Return on Capital

	Forecast return on capital	Actual return on capital
1994	4.05%	6.55%
1995	3.70%	4.35%
1996	3.95%	8.40%
1997	3.65%	3.10%
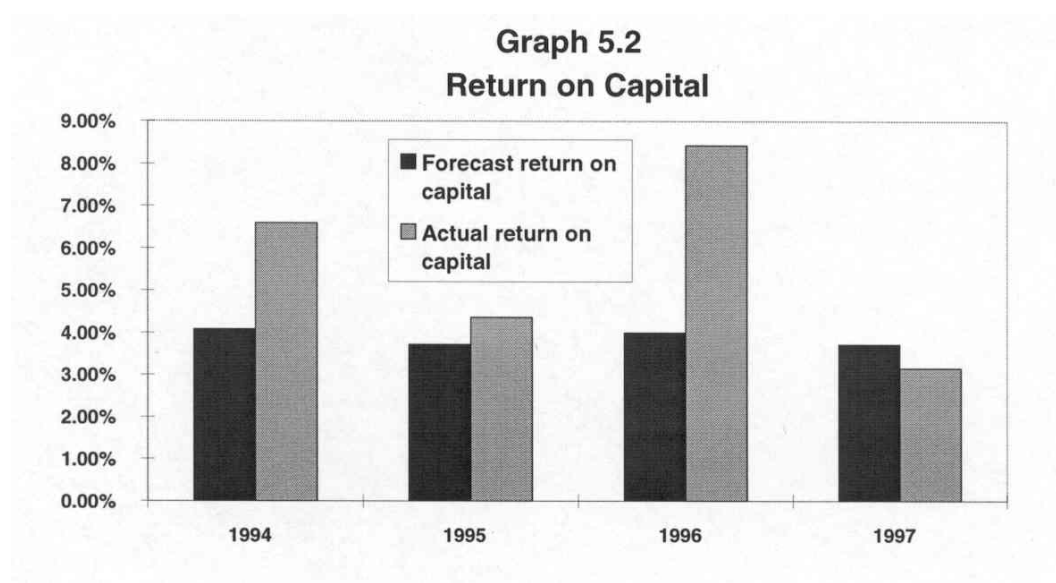
Analysis of 1996 Experience Variance

Management needs to understand more fully this year's result, and at this stage the analysis of variance results are shown. We believe that two tables should be shown. The first shows the impact on this year's profit from the experience variance, and the second shows the expected impact on next year's profit from the variance. This second table will also incorporate the impact of the change in assumptions on expected profits.

Table 5.1 – Analysis of 1996 Profits

	1996 Profit Variance
Lapses	-31.9
Mortality	12.4
Morbidity	-15.2
Interest	63.1
New Business Volumes	-0.5
Acquisition Expenses	-1.0
Maintenance Expenses	-16.0
Change in Assumptions	69.9
Total Variance	80.9

Table 5.2 – Impact on 1997 Profits

	1997 Projected Variance
Lapses	-2.7
Mortality	0.0
Morbidity	0.6
Interest	-0.8
New Business Volumes	-0.4
Acquisition Expenses	-4.1
Maintenance Expenses	0.9
Total Variance	-3.8

We are only showing the impact on 1997 profits. Management also needs to understand that the 1997 effects are indicative and will persist for some years into the future.

Where the 1996 and 1997 impacts are different, this will naturally lead management to seek further explanation, promoting an understanding of the drivers of MoS profits.

6 Aspects of MoS Arising from the Analysis

6.1 The Loss Multiplier Effect

The analysis of variance highlights the earnings distortions under MoS when there is significant variance in an assumption which is closely linked to the profit carrier. Consider the following example for a disability portfolio - the profit margin is 16% of expected disability outgo. For simplicity there is no interest.

Policy Liabilities	Active Lives	Open Claims	Total
	$m	$m	$m
BEL at Start	(20.0)	10.0	(10.0)
PM at Start	1.0	1.6	2.6
Policy Liability	(19.0)	11.6	(7.4)
BEL at End	(18.0)	10.5	(7.5)
PM at End	0.68	1.68	2.36
Policy Liability	(17.32)	12.18	(5.14)
Change in Policy Liability	1.68	0.58	2.26

Revenue Accounts	Active Lives	Open Claims	Total
	$m	$m	$m
Premium Income	4.0	-	4.0
Disability Outgo	(0.5)	(1.0)	(1.5)
Change in Policy Liability	(1.68)	(0.58)	(2.26)
Profit	1.82	(1.58)	0.24

The expected profit is $240,000 which is, as expected, 16% of disability outgo.

Now, suppose that the inception rate increases with the impact on profit being be an additional loss of

Additional disability outgo for Active Lives at start of year	$0.5m
Additional BEL reserve in respect of new Open Claims	$1.0m
Total	$1.5m

However, the actual MoS loss for the year is increased by another

$$\$1.0m * 16\% = \$160,000$$

due to holding a profit margin of 16% on the additional open claims reserve. The revised revenue account is then

	Expected	Actual
	$m	$m
Premium Income	4.0	4.0
Disability Outgo	(1.5)	(2.0)
Change in Policy Liability	(2.26)	(3.42)
	0.24	(1.42)

This additional $160,000 loss is because the value of future profit margins on the carrier has *increased* due to the greater number of open claims. This would clearly seem to send the wrong signals to management, as well as giving a "double hit" to the company in the year of poor experience.

The same phenomenon can occur on an annuity portfolio when mortality rates are lower than expected. Not only does the value of the BEL increase, the value of *profit margins* on the future annuitant payments increases. Again this gives the wrong signal to management (who may be tracking the change in the value of profit margins) and gives a "double hit" in the year of experience.

We believe the correct approach is to recalculate the profit margin on the appropriate cohort (the annuitant portfolio or the open claims portfolio) so that the value of claims plus their profit margin, allowing for the year's experience, equals the expected value of claims plus their profit margin. The result will be profits emerging in proportion to claim payments, with no capitalised profit or loss at time of claim. A formula for this approach for disability business is shown below. Only annuities and disability products are subject to this loss multiplier effect.

Thus if -

EC^P =   Expected claim payments in the year from new claims

EC^r =   Expected claim reserves at the end of the year from new claims

OC^P =   Expected claim payments in the year from open claims (at the start of the year)

OC^r =   Expected claim reserves at the end of the year from open claims (at the start of the year)

P^a =   Profit margin on active lives

P_S^C =   Profit margin on open claims at the start of the year

AC^P =   Actual claim payments in the year

AC^r =   Actual best estimate claim reserves at the end of the year

The profit margin on open claims at the end of the year (Pec) can be calculated as:

$$(1 + P_e^c) = \frac{((EC^P + EC^r) * (1 + P^a) + (OC^P + OC^r) * (1 + P_S^C))}{(AC^P + AC^r)}$$

In our example above, we have

EC^P	=	\$0.5m	EC^r	=	\$1.5m
OCP	=	\$1m	OC^r	=	\$9m
P^a	=	16%	P^c	=	16%
AC^P	=	\$2.0m	AC^r	=	\$11.5m

giving a revised profit margin at the year end on open claims of

$P_e^c = 3.1\%$

The numerator is the expected cost of claims in the year, together with the associated profit margin i.e. it is the amount available on the best estimate assumptions for claims and profit. The denominator is the actual cost of claims in the year. Together they give the profit margin which spreads the profit over the actual claims.

The complication of this approach is that expected claim payments and reserves have to be calculated. The expected figures would come from projections of:

●   the in force policies at the start of the year

●   open claims at the start of the year

●   new business during the year.

These projections will be P,, as described in Section 4.

6.2   Choice of Discount Rate

In managing the volatility of MoS profits, management and actuaries must understand the impact of the assumption setting process on profits. In this

section, we discuss the impact of the investment earnings assumptions, particularly that component related to equity earnings.

There are two ways of setting the assumption for equities both of which we find reasonable -

1.   10 year bond yield + a margin for risk, or

2.   Dividend yield + capital gain inflation + a margin for a real return)

These two approaches can produce quite different results., The first approach has the discount rate dependent only on the fixed interest market. This means that equity gains and losses flow directly to profit and loss to the extent that they differ from the gains that would have been made on fixed interest alone. On the other hand the second approach offsets equity gains, to the extent they are not due to dividend increases, by causing a reduction in the valuation interest rate, i.e. it implies that future earnings will be lower because the market is high.

It is interesting to consider the situation of a rising equity market combined with a failing fixed interest (rising interest rates) market. The first method will result in a higher assumed yield on equities in the future whereas the second method will give a lower one (assuming no change in inflationary expectations). Just this difference may have a very material effect on policy liabilities and hence on profit.

6.3   VSA Formula for Traditional Business

We have developed the following formula for calculating the Value of Supporting Assets (VSA) for conventional participating business. Its derivation is in Appendix B.

$$VSA = V_1^a + (V_0 + \tfrac{1}{2}CF^e)\,(i^a - i^e) + \tfrac{1}{2}(i^a - i^e)\,(v_1^a - v_1^e)$$

where   VSA   =   value of supporting assets in force at year end

V_0 =   value of policy liabilities at the start of the year

V_1^a =   value of policy liabilities in force at year end using the assumptions from the previous valuation (Old Basis)

V_1^e =   expected value of policy liabilities at year end from a projection of the in force at the start of the period

$$CF^e \quad = \quad \text{expected cash flows (excluding investment income)}$$

$$i^a \quad = \quad \text{actual investment earnings rate}$$

$$i^e \quad = \quad \text{expected investment earnings rate}$$

A final adjustment to this result is to deduct the shareholder's profit margin on interim discretionary additions and terminal bonuses paid in the period (a known number.)

The benefits of this formula are that it uses valuations of in force business only and is based on actual investment earnings. No other actual experience analysis is required.

6.4   Mid-year Valuations

PS201 states "the Actuary should review the assumptions at each valuation of liabilities". When the actuary is performing a mid-year valuation for statutory purposes (say, for published half-yearly accounts) each assumption must be reviewed.

When, however, the valuation is for internal management purposes, the actuary can choose which assumptions to review. This choice will largely depend on the purpose of the valuation - to track MoS profits, or to provide management information.

Interest Rates

To the extent that management will also be reviewing market valued assets, it seems natural that the interest rate be adjusted to reflect the current underlying earnings rates. The arguments for doing so include

● no change to profit margins is required (i.e. ease of calculation)

● consistency between policy liabilities and asset values

● avoiding strange results where explicitly matched products are being sold e.g. new business annuities.

Where the underlying asset mix has changed over the period, the actuary should assess the extent to which the change is permanent. If the change is short term, the actuary should continue to use the intended asset mix. Where it is long term, the actuary may wish to incorporate the change, to give management early warning of the impact of the change.

Inflation Rates

Under PS201 the actuary should ensure "reasonable consistency" between the investment earnings and inflation rates. Therefore the inflation assumption would most likely change with the investment earnings assumption.

Taxation

The impact of a legislative change should be reflected immediately. The tax rate on investment earnings should be kept consistent with the assumed earnings mix. The tax assumption for expenses and commission relief should be kept constant at mid-year valuations, if only because it is only determinable with a complete tax year's experience.

Acquisition Expenses

At the previous year-end, the actuary has determined unit acquisition assumptions designed exactly to equate to actual acquisition costs for business sold over that year. To use these assumptions unchanged at a mid-year valuation would lead to a capitalised profit or loss on that new business, to the extent that actual costs diverged from the previous years' average unit cost. Seasonality of new business sales alone will tend to make this so.

This leads to a conflict -

● using the unit cost assumption gives a profit or loss on acquisition for that period's new business

● using the actual acquisition costs gives a new business profit margin which is heavily impacted by seasonal impacts.

Our proposed solution is to -

● determine a profit margin that reflects actual acquisition costs over the period

● at year end, determine a single unit acquisition cost for the year's new business, and recalculate profit margins for all the year's new business using this unit cost. The new profit margin, would be average profit margin for the year.

This leads to a smooth emergence of new business profits over the year. It resolves the potential problem of capitalising losses on new business in, say, the first half of the year but having profit margins on the second half's new business.

Maintenance Expenses

Maintenance expenses are less seasonally variable and likely to be fairly stable over the year. In a situation where, permanent cost savings have been achieved over the period, the actuary may wish to reflect the achievement in a mid-period valuation. We should emphasise however -

● a change in assumption will not in itself signal any change (other than if loss reversal occurs) because the change is amortised

● the change in assumption will be strongly shown if projected values are shown separately.

This again illustrates the principle that the impact of a change in assumptions is only a management tool under MoS where it is accompanied by projected values.

Discontinuance

The impact of seasonality would be difficult to remove from a mid-year discontinuance review. As few companies perform this, we believe it is sensible to review the lapse assumption at year end only.

Morbidity

We have discussed in Section 6.1 the alternative approach to profit margins on *open claims,* where the impact of inception losses is reflected in a changed margin on open claims. Because of the potential volatility of inception rates, it may be appropriate to reflect this revised open claim margin at mid-year valuations.

Appendices

(A) Model Office Details

To illustrate the ideas in this paper, we have developed a simple spreadsheet model office, comprising a portfolio of term, annuities, single premium bonds and disability products. New business is sold on the term portfolio only.

The model is designed to illustrate one year variance from expected - the underlying cashflows are therefore heavily simplified and have been derived using a stylised portfolio, rather than detailed product features.

The values in the paper can be traced from the following attachments:

Table A.1 - Actual and Expected Assumptions

Table A.2 - The term insurance projections, moving from runs P_1 (the expected best estimate projection) through to run P_8 (the final variance run, which therefore coincides with actual experience).

Table A.3 - As above, for the annuity portfolio.

Table A.4 - As above, for the disability portfolio.

Table A.5 - As above, for the bond portfolio.

Table A.6 - The new business projections. Only projections P_1, P_2 and P_4 are used.

Table A.7 - The total in force projections, i.e. the sum of A1.1 to A1.4.

The final projection shown, P_8, is **before** the change in actuarial assumptions as at the year end. The impact of the change in assumptions can be separately derived from Table 4.3.

Table A.1 – Actual and Expected Assumptions

	Expected Experience	Actual Experience
Net Investment	10% annuities	13% annuities
Earnings	7% other	10% other
Unit acquisition costs	$1,200	$1,500
Discontinuance Rate		
Disability	20% pa	30% pa
Other	10% pa	30% pa
Mortality Rate		
Annuities	1% pa	Nil
Other	0.1% pa	Nil
Morbidity Rate (incurred)	2% pa	3% pa
New Business Volumes	20,000 term policies	17,000 term policies

Table A.2 – Term Portfolio

Term Portfolio
($m)

REVENUE ITEMS	Projected Best Estimate P_1	Lapse Rerun P_5	Mortality Rerun P_6	Disability Rerun P_6	Interest Rerun P_7	Expense Rerun P_9
Income						
Premium income	90.0	90.0	90.0	90.0	90.0	90.0
Investment income (excl. capital assets)	-12.3	-12.3	-11.3	-11.3	-16.2	-16.7
Investment income on capital assets	25.5	25.5	25.5	25.5	36.5	36.5
Outgo						
Death outgo	27.0	27.0	0.0	0.0	0.0	0.0
Disability outgo	0.0	0.0	0.0	0.0	0.0	0.0
Surrender outgo	0.0	0.0	0.0	0.0	0.0	0.0
Annuity outgo	0.0	0.0	0.0	0.0	0.0	0.0
Acquisition expenses	0.0	0.0	0.0	0.0	0.0	0.0
Maintenance expenses	9.0	9.0	9.0	9.0	9.0	13.5
Change in policy liability	38.0	83.6	83.4	83.4	83.4	83.4
MoS profit	29.2	-16.3	11.8	11.8	17.8	12.9
BALANCE SHEET ITEMS						
BE reserve at start of year	-270.0	-270.0	-270.0	-270.0	-270.0	-270.0
MoS margins at start of year	27.0	27.0	27.0	27.0	27.0	27.0
MoS liability at start of year	-243.0	-243.0	-243.0	-243.0	-243.0	-243.0
BE reserve at end of year	-228.3	-177.6	-177.7	-177.7	-177.7	-177.7
MoS margins at end of year	23.3	18.1	18.1	18.1	18.1	18.1
MoS liability at end of year	-205.0	-159.4	-159.6	-159.6	-159.6	-159.6
CAPAD reserve at start of year	121.5	121.5	121.5	121.5	121.5	121.5
CAPAD reserve at end of year	102.5	79.7	79.8	79.8	79.8	79.8
Number of lives in force at start	90,000	90,000	90,000	90,000	90,000	90,000
Number of deaths	90	90	0	0	0	0
Number of surrenders	8,991	26,973	27,000	27,000	27,000	27,000
Number of disabilities	0	0	0	0	0	0
Number of new policies	0	0	0	0	0	0
Number of lives in force at end	80,919	62,937	63,000	63,000	63,000	63,000

Table A.3 – Annuity Portfolio

Annuity Portfolio
($m)

REVENUE ITEMS	Projected Best Estimate P_1	Lapse Rerun P_5	Mortality Rerun P_6	Disability Rerun P_6	Interest Rerun P_7	Expense Rerun P_8
Income						
Premium income	0.0	0.0	0.0	0.0	0.0	0.0
Investment income (excl. capital assets)	140.3	140.3	140.3	140.3	182.4	182.3
Investment income on capital assets	30.1	30.1	30.1	30.1	39.1	39.1
Outgo						
Death outgo	0.0	0.0	0.0	0.0	0.0	0.0
Disability outgo	0.0	0.0	0.0	0.0	0.0	0.0
Surrender outgo	0.0	0.0	0.0	0.0	0.0	0.0
Annuity outgo	100.0	100.0	100.0	100.0	100.0	100.0
Acquisition expenses	0.0	0.0	0.0	0.0	0.0	0.0
Maintenance expenses	1.0	1.0	1.0	1.0	1.0	1.5
Change in policy liability	39.2	39.2	54.8	54.8	54.8	54.8
MoS profit	30.2	30.2	14.6	14.6	65.7	65.2
BALANCE SHEET ITEMS						
BE reserve at start of year	1,500.0	1,500.0	1,500.0	1,500.0	1,500.0	1,500.0
MoS margins at start of year	4.0	4.0	4.0	4.0	4.0	4.0
MoS liability at start of year	1,504.0	1,504.0	1,504.0	1,504.0	1,504.0	1,504.0
BE reserve at end of year	1,539.3	1,539.3	1,554.8	1,554.8	1,554.8	1,554.8
MoS margins at end of year	3.9	3.9	3.9	3.9	3.9	3.9
MoS liability at end of year	1,543.2	1,543.2	1,558.8	1,558.8	1,558.8	1,558.8
CAPAD reserve at start of year	1,804.8	1,804.8	1,804.8	1,804.8	1,804.8	1,804.8
CAPAD reserve at end of year	1,851.8	1,851.8	1,870.5	1,870.5	1,870.5	1,870.5
Number of lives in force at start	10,000	10,000	10,000	10,000	10,000	10,000
Number of deaths	100	100	0	0	0	0
Number of surrenders	0	0	0	0	0	0
Number of disabilities	0	0	0	0	0	0
Number of new policies	0	0	0	0	0	0
Number of lives in force at end	9,900	9,900	10,000	10,000	10,000	10,000

Table A.4 – Disability Portfolio

Disability Portfolio
($m)

REVENUE ITEMS	Projected Best Estimate P_1	Lapse Rerun P_5	Mortality Rerun P_6	Disability Rerun P_6	Interest Rerun P_7	Expense Rerun P_8
Income						
Premium income	48.0	48.0	48.0	48.0	48.0	48.0
Investment income (excl. capital assets)	7.0	7.0	7.0	6.9	9.8	9.6
Investment income on capital assets	4.2	4.2	4.2	4.2	6.0	6.0
Outgo						
Death outgo	0.0	0.0	0.0	0.0	0.0	0.0
Disability outgo	8.0	8.0	8.0	12.0	12.0	12.0
Surrender outgo	0.0	0.0	0.0	0.0	0.0	0.0
Annuity outgo	0.0	0.0	0.0	0.0	0.0	0.0
Acquisition expenses	0.0	0.0	0.0	0.0	0.0	0.0
Maintenance expenses	4.0	4.0	4.0	4.0	4.0	6.0
Change in policy liability	40.0	27.5	27.6	38.7	38.7	38.7
MoS profit	7.2	19.7	19.6	4.4	9.1	6.9
BALANCE SHEET ITEMS						
BE reserve at start of year	44.0	44.0	44.0	44.0	44.0	44.0
MoS margins at start of year	16.0	16.0	16.0	16.0	16.0	16.0
MoS liability at start of year	60.0	60.0	60.0	60.0	60.0	60.0
BE reserve at end of year	87.0	76.1	76.2	85.4	85.4	85.4
MoS margins at end of year	13.0	11.4	11.4	13.3	13.3	13.3
MoS liability at end of year	100.0	87.5	87.6	98.7	98.7	98.7
CAPAD reserve at start of year	120.0	120.0	120.0	120.0	120.0	120.0
CAPAD reserve at end of year	200.0	175.0	175.1	197.4	197.4	197.4
Number of lives in force at start	40,000	40,000	40,000	40,000	40,000	40,000
Number of deaths	40	40	0	0	0	0
Number of surrenders	7,832	11,748	11,760	11,640	11,640	11,640
Number of disabilities	800	800	800	1,200	1,200	1,200
Number of new policies	0	0	0	0	0	0
Number of lives in force at end	31,328	27,412	27,440	27,160	27,160	27,160

Table A.5 – Unit Linked Portfolio

Unit Linked Portfolio
($m)

REVENUE ITEMS	Projected Best Estimate P_1	Lapse Rerun P_5	Mortality Rerun P_6	Disability Rerun P_6	Interest Rerun P_7	Expense Rerun P_8
Income						
Premium income	0.0	0.0	0.0	0.0	0.0	0.0
Investment income (excl. capital assets)	50.1	44.7	44.7	44.7	63.7	62.9
Investment income on capital assets	0.0	0.0	0.0	0.0	0.0	0.0
Outgo						
Death outgo	0.0	0.0	0.0	0.0	0.0	0.0
Disability outgo	0.0	0.0	0.0	0.0	0.0	0.0
Surrender outgo	77.0	231.1	231.1	231.1	234.5	234.5
Annuity outgo	0.0	0.0	0.0	0.0	0.0	0.0
Acquisition expenses	0.0	0.0	0.0	0.0	0.0	0.0
Maintenance expenses	15.0	15.0	15.0	15.0	15.0	22.5
Change in policy liability	-45.7	-206.4	-206.4	-206.4	-192.0	-192.0
MoS profit	3.7	4.9	4.9	4.9	6.1	-2.1
BALANCE SHEET ITEMS						
BE reserve at start of year	750.0	750.0	750.0	750.0	750.0	750.0
MoS margins at start of year	18.8	18.8	18.8	18.8	18.8	18.8
MoS liability at start of year	768.8	768.8	768.8	768.8	768.8	768.8
BE reserve at end of year	706.7	549.7	549.7	549.7	563.7	563.7
MoS margins at end of year	16.3	12.7	12.7	12.7	13.0	13.0
MoS liability at end of year	723.0	562.3	562.3	562.3	576.8	576.8
CAPAD reserve at start of year	768.8	768.8	768.8	768.8	768.8	768.8
CAPAD reserve at end of year	723.0	562.3	562.3	562.3	576.8	576.8
Number of lives in force at start	150,000	150,000	150,000	150,000	150,000	150,000
Number of deaths	0	0	0	0	0	0
Number of surrenders	15,000	45,000	45,000	45,000	45,000	45,000
Number of disabilities	0	0	0	0	0	0
Number of new policies	0	0	0	0	0	0
Number of lives in force at end	135,000	105,000	105,000	105,000	105,000	105,000

Table A.6 – New Business Model

New Business Model
($m)

REVENUE ITEMS	Projected Best Estimate P$_1$	Lapse Rerun n/a	Mortality Rerun n/a	Disability Rerun n/a	Volumes Rerun P$_2$	Expense Rerun P$_4$
Income						
Premium income	20.0	20.0	20.0	20.0	17.0	17.0
Investment income (excl. capital assets)	0.0	0.0	0.0	0.0	0.0	0.0
Investment income on capital assets	0.0	0.0	0.0	0.0	0.0	0.0
Outgo						
Death outgo	10.0	10.0	10.0	10.0	8.5	8.5
Disability outgo	0.0	0.0	0.0	0.0	0.0	0.0
Surrender outgo	0.0	0.0	0.0	0.0	0.0	0.0
Annuity outgo	0.0	0.0	0.0	0.0	0.0	0.0
Acquisition expenses	24.0	24.0	24.0	24.0	20.4	25.5
Maintenance expenses	2.0	2.0	2.0	2.0	1.7	1.7
Change in policy liability	-19.2	-19.2	-19.2	-19.2	-16.3	-20.4
MoS profit	3.2	3.2	3.2	3.2	2.7	1.7
BALANCE SHEET ITEMS						
BE reserve at start of year	0.0	0.0	0.0	0.0	0.0	0.0
MoS margins at start of year	0.0	0.0	0.0	0.0	0.0	0.0
MoS liability at start of year	0.0	0.0	0.0	0.0	0.0	0.0
BE reserve at end of year	-32.0	-32.0	-32.0	-32.0	-27.2	-27.2
MoS margins at end of year	12.8	12.8	12.8	12.8	10.9	6.8
MoS liability at end of year	-19.2	-19.2	-19.2	-19.2	-16.3	-20.4
CAPAD reserve at start of year	0.0	0.0	0.0	0.0	0.0	0.0
CAPAD reserve at end of year	0.0	0.0	0.0	0.0	0.0	0.0
Number of lives in force at start	0	0	0	0	0	0
Number of deaths	0	0	0	0	0	0
Number of surrenders	0	0	0	0	0	0
Number of disabilities	0	0	0	0	0	0
Number of new policies	20,000	20,000	20,000	20,000	17,000	17,000
Number of lives in force at end	20,000	20,000	20,000	20,000	17,000	17,000

Table A.7 – Total In Force Portfolio

Total In Force Portfolio
($m)

REVENUE ITEMS	Projected Best Estimate P₁	Lapse Rerun P₅	Mortality Rerun P₆	Disability Rerun P₆	Interest Rerun P₇	Expense Rerun P₉
Income						
Premium income	138.0	138.0	138.0	138.0	138.0	138.0
Investment income (excl. capital assets)	185.1	179.7	180.6	180.5	239.6	238.2
Investment income on capital assets	59.8	59.8	59.8	59.8	81.6	81.6
Outgo	0.0	0.0	0.0	0.0	0.0	0.0
Death outgo	27.0	27.0	0.0	0.0	0.0	0.0
Disability outgo	8.0	8.0	8.0	12.0	12.0	12.0
Surrender outgo	77.0	231.1	231.1	231.1	234.5	234.5
Annuity outgo	100.0	100.0	100.0	100.0	100.0	100.0
Acquisition expenses	0.0	0.0	0.0	0.0	0.0	0.0
Maintenance expenses	29.0	29.0	29.0	29.0	29.0	43.5
Change in policy liability	71.4	-56.2	-40.7	-29.6	-15.1	-15.1
MoS profit	70.4	38.5	50.9	35.7	98.8	82.9
BALANCE SHEET ITEMS	0.0	0.0	0.0	0.0	0.0	0.0
	0.0	0.0	0.0	0.0	0.0	0.0
BE reserve at start of year	2,024.0	2,024.0	2,024.0	2,024.0	2,024.0	2,024.0
MoS margins at start of year	65.8	65.8	65.8	65.8	65.8	65.8
MoS liability at start of year	2,089.8	2,089.8	2,089.8	2,089.8	2,089.8	2,089.8
	0.0	0.0	0.0	0.0	0.0	0.0
BE reserve at end of year	2,104.7	1,987.5	2,003.0	2,012.2	2,026.3	2,026.3
MoS margins at end of year	56.5	46.0	46.1	48.0	48.4	48.4
MoS liability at end of year	2,161.2	2,033.6	2,049.1	2,060.2	2,074.6	2,074.6
CAPAD reserve at start of year	2,815.1	2,815.1	2,815.1	2,815.1	2,815.1	2,815.1
CAPAD reserve at end of year	2,877.3	2,668.8	2,687.8	2,710.0	2,724.4	2,724.4
Number of lives in force at start	290,000	290,000	290,000	290,000	290,000	290,000
Number of deaths	230	230	0	0	0	0
Number of surrenders	31,823	83,721	83,760	83,640	83,640	83,640
Number of disabilities	800	800	800	1,200	1,200	1,200
Number of new policies	0	0	0	0	0	0
Number of lives in force at end	257,147	205,249	205,440	205,160	205,160	205,160

B Formula for Value of Supporting Assets

Paragraph 5.7 of PS201 states:

> "The Value of Supporting Assets is determined as the build up of the Policy Liability brought forward as at the start of the year, allowing for the actual policy related experience during the year, and adjusted by the non investment Experience Profit for the year."

Thus:

> VSA = start year policy liability (including cost of bonus)
> + actual policy cash flows (including premiums etc)
> - non-investment experience profits

all rolled up using the actual rather than the expected investment earned rate.

We make two simplifying assumptions to work out a method of calculating the adjusted value of assets:

- cash flows (other than interest income) do not change during the year due to actual investment return; and

- cash flows occur on average half way through the year.

The formula becomes:

$$\text{VSA} = V_0 (1 + i^a)$$
$$+ (CF^a)(1 + \tfrac{1}{2} i^a)$$
$$- \text{experience profits} (1 + \tfrac{1}{2} i^a) \quad (1)$$

$$\text{Experience profits} = (CF^a - CF^e)(1 + \tfrac{1}{2} i^a)$$
$$- (VR^a - VR^e)(1 + \tfrac{1}{2} i^a - \tfrac{1}{2} i^e) \quad (2)$$

where
CF = cash flow items (excluding investment income)
VIR = end of year reserve released on decrements
a, e = actual or expected items.

We have added interest at the actual rate on experience cash flows because that is specified in paragraph 5.7.5 of PS201. The interest item shown for the reserve part of the experience profit formula is for a similar reason; the reserve release (either actual or expected) assumes that the expected rate of interest will be earned on assets. The philosophy used for VSA is that all items of interest will be actual, so we have to adjust this reserve item for actual rates of interest.

We now have the formula:

$$\text{VSA} = V_0(1 + i^a) + CF^a (1 + \tfrac{1}{2} i^a) - (CF^a - CF^e) (1 + \tfrac{1}{2} i^a)$$
$$+ (VR^a - VR^e) (1 + \tfrac{1}{2} (i^a - i^e)) \tag{3}$$

Now the information from the valuation is:

V_0 = value of policy liabilities at the start of the year

V_1^a = value of policy liabilities in force at year end using the assumptions from the previous valuation (Old Basis)

V_1^e = expected value of policy liabilities at year end from a projection of the in force at the start of the period

i^a = actual investment earnings rate

i^e = expected investment earnings rate.

We know that

$$V_1^e = V_0 (1 + i^e) + CF^e (1 + \tfrac{1}{2} i^e) \tag{4}$$

$$VR^a - VR^e = V_1^a - V_1^e \tag{5}$$

so if we substitute these items into the formula above, and manipulate it,

$$\text{VSA} = V_1^a + (V_0 + \tfrac{1}{2} CF^e) (i^a - i^e) + \tfrac{1}{2} (i^a - i^e) (V_1^a - V_1^e) \tag{6}$$

This formula is a relatively simple one to use, as it does not include any actual cash flow items. The only calculations which will have to be done to calculate the value of supporting assets will be the valuation of the expected and actual in force, the expected cash flow items, and the actual rate of interest.

The reasoning behind the formula is that the value of supporting assets is equal to the actual in force reserve, adjusted for the actual rate of interest earned. The second two items in the formula are items used to adjust the reserve for the actual rate of interest earned.

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