Chapter 25 – Analysis of Profit

Additional Space for Notes

Introduction

Chapter 21 covered the valuation of policy liabilities for the purposes of determining the profits of a life insurance company. Analysis of the actual profit reported during the period, compared to the profit that was expected to emerge under the valuation methodology and assumptions, is a critical step in understanding the financial performance of the company.

For insurance contracts, shareholder profits are expected to emerge smoothly over the duration of the policy as services are provided, i.e. in line with the profit carrier. Actual profits will differ from expected profits due to the underlying experience of the portfolio being different to the valuation assumptions. Interest on retained profits will also form a component of the actual profit. Analysis of profit analyses the actual profit into its components: interest on retained profits, expected profit release and experience variations.

For investment contracts, the main source of profit variance will arise from experience affecting the management services element, i.e. the value of deferred entry fee revenue less deferred acquisition costs. The main experience item affecting the recovery of deferred acquisition costs will be lapses, but renewal expenses and investment performance can also be significant factors. Investment experience is particularly important for term annuity profits.

This chapter illustrates the concept of analysis of profit, explains why it may be undertaken and provides a number of worked examples for different products.

Analysis of Profit for an Insurance Contract

For life insurance contracts with policy liabilities valued consistently with Australian accounting and APRA standards, the expected profit margin is determined at the point of sale of the contract and is recalculated at the end of each year. The expected profit margin is expressed as a percentage of the profit carrier (e.g. premiums or claims).

The expected profit in a period is the expected net cash flow including interest and the change in policy liability, or equivalently the profit margin percentage multiplied by the expected profit carrier cash flow emerging during the period.

If experience is as expected, the profit that emerges is the expected profit release plus interest on retained profits.

In practice, experience will not be as anticipated by the valuation process. The main items of experience variance will be:

- Investment – the investment experience profit is the difference between the discount rate and the actual rate of investment return on the policy liability at the beginning of the period and the policy cash flows over the period, and any change in policy liability due to changes in the discount rate;
- Decrements (claims and lapses) – the claims or lapse experience profit is the difference between the expected and actual benefit payments (e.g. death benefit or surrender benefit) less the difference between expected and actual policy liabilities released, accumulated with interest to the end of the year;

- Expenses – the expense experience profit is the difference between the expected and actual expenses, accumulated with interest to the end of the year;
- Tax – generally each experience item would be adjusted for tax at the expected tax rate. There would be an additional item for the difference between expected tax payable on the actual profit (net cash flow and change in policy liability) and the actual tax payable. This may also include an item for changes to tax legislation that were not anticipated in the best estimate assumptions.

There may also be an experience variance due to loss recognition or loss reversal. These items could arise from new business being sold at a loss or from assumption changes on existing business that is in loss recognition either at the start or end of the year.

APRA reporting form LRF 430 is a useful reference as it shows the format of the analysis of profit that is required for the purpose of reporting to APRA. Different formats with more or less detail might be used for other purposes such as internal management reporting and reporting in the general purpose accounts. More detail might be provided for larger items. For example, if claims experience was poor, management would expect to see greater detail and explanation with regard to this item.

Simple Example

The table below shows a 3 year cash flow projection for a term life insurance policy which has been in-force for a number of years. Premiums and expenses are paid at the start of the year, and benefits and profit margins are paid at the end of the year. The amount of assets in excess of policy liabilities at the start of year 1 is 100. Tax is ignored, and the discount rate is 5% p.a.

Year	Premium (start of year)	Expense (start of year)	Benefit (end of year)	Profit Margin (end of year)
1	500.00	50.00	1,100.00	110.00
2	550.00	55.00	1,210.00	121.00
3	605.00	60.50	1,331.00	133.10

The policy liability at the start of year 1 is 2,209 and the policy liability at the end of year 1 is 1,582 as calculated in the following table:

	Policy Liability at the start of year 1	Policy Liability at the end of year 1
PV benefits	3,295	2,360
+ PV expenses	+ 157	+ 112
- PV premiums	- 1,573	- 1,126
+ PV profit margins	+ 330	+ 236
= Policy Liability	= 2,209	= 1,582

If experience is as expected, the year 1 profit of 115 is derived as follows:

	Year 1 Profit
Premiums	500
Investment income = (100 + 2,209 + 500 – 50) x 5%	138
Claims	(1,100)
Expenses	(50)
Increase in policy liability = - (1,582 – 2,209)	627
Profit	115

The components of the year 1 profit would be as follows:

Investment income on assets in excess of policy liabilities = 100 x 5%	5
Expected profit margins emerging	110
Total	115

Now consider the situation where experience in year 1 varies from the original projection assumptions as follows:

- investment income is 110 rather than 138;
- benefit payments are 1,000 rather than 1,100; and
- expenses are 80 rather than 50.

The analysis of profit is completed in a step by step process where each of the expected components of profit is replaced by the actual outcome.

Step 1

Benefit payments are 1,000 in year 1 instead of 1,100 assumed in the original projection. This increases the profit to 215. Note this example is simplified as it assumes no change in the policy liability at the end of the year even though there are fewer than expected claims. For a term insurance policy the impact of a variation in claims experience on the end of year policy liability is small relative to the impact on claim payments. The movement in the liability would be greater for traditional policies. In practice there will also be a movement in the policy liability due to lapses being different from expected.

	Year 1 Profit
Premiums	500
Investment income	138
Claims	(1,000)
Expenses	(50)
Increase in policy liability	627
Profit	215

The components of year 1 profit are now:

Investment income on assets in excess of policy liabilities = 100 x 5%	5
Expected profit margins emerging	110
Claims experience profit = 1,100 – 1,000	100
Total	215

Step 2

Expenses are 80 instead of 50 in the original projection. This causes expected investment income to reduce as the expenses are assumed to be paid at the beginning of the year. The overall impact is to reduce the profit to 183.5:

	Year 1 Profit
Premiums	500
Investment income (= 138 – 30 x 5%)	136.5
Claims	(1,000)
Expenses	(80)
Increase in policy liability	627
Profit	183.5

The components of the year 1 profit are now:

Investment income on assets in excess of policy liabilities = 100 x 5%	5
Expected profit margins emerging	110
Claims experience profit = 1,100 – 1,000	100
Expense experience profit = (50 – 80) x (1 + 5%)	(31.5)
Total	183.5

The expense experience loss reflects the difference between the actual and expected expenses at the start of the year accumulated at the expected rate of investment return to the end of the year.

Step 3

Investment income is 110 as compared with 138 in the original case. The overall impact of all experience items is to reduce the profit to 157:

	Year 1 Profit
Premiums	500
Investment income	110
Claims	(1,000)
Expenses	(80)
Increase in policy liability	627
Profit	157

The actual rate of investment income earned is determined by solving for i in the equation: (100 +2,209 + 500 – 80) * i = 110. The solution to this equation is i = 4.03%. The calculation of this rate allows the actual investment income to be split between excess assets and the assets backing policy liabilities. Note that this equation uses the actual rather than the expected cash flows for the year.

The components of the year 1 profit are now as follows:

Investment income on assets in excess of policy liabilities = 100 x 4.03%	4
Expected profit margins emerging	110
Claims experience profit = 1,100 – 1,000	100
Expense experience profit = (50 – 80) x (1 + 5%)	(31.5)
Investment experience profit = (2,209 + 500 – 80) x (4.03% - 5%)	(25.5)
Total	157

The investment experience loss reflects the difference between the actual and expected investment return on the policy liability at the start of the year plus the actual net cash flows (premiums less expenses). Again, this example is simplified as it assumes no change to the policy liability at the end of the year due to changes in the discount rate. In practice an accurate analysis would track the movement in end of year policy liabilities from expected to actual due to lapses, deaths, changes in the discount rate and changes in other assumptions.

The analysis is based on one particular order of analysis - claims, expenses and investment experience. Different orders of analysis are equally valid, but may give slightly different results. For example if we started with investment experience, we would have calculated this item using expected expenses and then calculated the expense experience loss using the actual rate of investment return.

The analysis of profit for participating business can be performed in a similar manner to non-participating business. The main difference is that there is no investment experience profit as actual investment returns are included in the value of supporting assets (VSA) and hence the end of year policy liability.

For policies valued using an accumulation method, the expected profit can be calculated using the best estimate assumptions that applied at the previous valuation date. Although best estimate assumptions may not be used in calculation of the policy liability, the actuary will still need to derive these assumptions in order to verify that these policies are not in loss recognition.

As well as performing a numerical analysis, the actuary also needs to be able to explain the underlying causes of each of the experience items. Investment experience can usually be explained by examining the performance of each of the main asset sectors that the life company invests in. Reports from investment managers can assist in this explanation. Changes to discount rates will reflect movements in risk-free interest rates. Claims experience could be attributable to random fluctuations, single events causing multiple claims, mis-estimation of the mean, adverse trends or changes in underwriting or claims management practices. If a life company has high retentions (i.e. low levels of reinsurance), claims experience can be quite volatile as it will be affected by the number of claims incurred for policies with high sums insured. The expense experience for a product will depend on the total expenses for the life company, how they are allocated to products and how they are split between acquisition and maintenance categories. If the allocations change during the year there can be significant expense experience profits at product level.

The investigation into the causes of experience items could also expose operational issues such as:

- previously undiscovered errors in the company's administrative, accounting or investment systems;
- previously undiscovered errors in the methodology or systems used to calculate the values of in-force and new business;
- identification of areas where actual transactions differ from stated company practice (possibilities include payment of policy owner benefits or refunding of policy premiums and commissions); and
- poor management of underwriting or claims.

Algebra

As the previous simple example demonstrated, an analysis of profit involves analysing profit into its components: the interest on assets in excess of policy liabilities, the profit margins emerging and the experience profits or losses.

This section demonstrates an algebraic derivation of the items of experience profit or loss.

Irrespective of the type or method of valuation, the same basic equation of value structure underlies the valuation process. For a group of simple and identical policies, over a one-year period, the equation will be of a form similar to:

$$l_x V_0 (1+i) + l_{x+\frac{1}{2}} (P - E)(1+\frac{i}{2}) - d_x B(1+\frac{i}{2}) - l_{x+1} V_1 = 0$$

where:

l_x	Number of policies at the start of the year
V_0	Liability of a policy at the start of the year
i	Interest rate assumed
P	Premium payable for each policy
E	Expected expenses to be incurred for each policy
d_x	Number of policy exits expected
B	Benefit payable on policy exit
l_{x+1}	Number of policies in force at end of year
V_1	End of year liability per policy in force

That is, the reserves at the start of the year plus expected premiums and interest will be just sufficient to meet expected expenses and benefit payments and set up the end of year reserves.

The precise formula will vary in different situations:

- for a valuation of an insurance contract consistent with Australian accounting and APRA standards, an extra term must be included for the expected profit margins emerging "M";
- the component "d_x B (1+i/2)" may be replaced by a series of components for each type of benefit, for example: death " d_x S (1+i/2)" where S is the death sum insured; surrender "w_x SV (1+i/2)" where SV is the surrender value and disability "i_x T (1+i/2)" where T is the TPD sum insured;
- more precision could be obtained by using a monthly projection, rather than simply assuming cash flows occur on average in the middle of the year.

Other products and valuation approaches will require other adjustments. However, the overall equation structure is the same and most variations involve only minor modification to the basic equation above.

In practice, experience will not be as anticipated by the valuation assumptions. If the actual experience is designated with a dash, the result will be:

Equation 1

$$l_x V_0 (1+i') + l'_{x+\frac{1}{2}} (P - E')(1+\frac{i'}{2}) - d'_x B(1+\frac{i'}{2}) - l'_{x+1} V_1 = X$$

That is, an amount of experience profit "X" has arisen.

The objective of the analysis of profit is to split the experience profit "X" into components for investment experience (X_i), expense experience (X_e) and decrement experience (X_q), such that $X_i + X_e + X_q = X$.

One approach to the derivation of these items is as follows.

First the interest item is derived. Logically, if the investment experience had been as expected (i.e. equal to the discount rate), only the expense and decrement items would have emerged, thus:

Equation 2

$$l_x V_0 (1+i) + l'_{x+\frac{1}{2}} (P - E')(1+\frac{i}{2}) - d'_x B(1+\frac{i}{2}) - l'_{x+1} V_1 = X_e + X_q$$

Equation 1 less equation 2 above therefore gives X_i as follows:

$$(i' - i) . (l_x V_0 + l'_{x+\frac{1}{2}} \frac{(P - E')}{2} - d'_x \frac{B}{2}) = X_i$$

Thus, the interest experience profit is given by the extra rate of interest earned on the initial liability and the actual policy cash flows over the year. There will be an additional item for any change in the end of year liability resulting from changes to the discount rate.

Next the expense item is derived. If expenses, as well as interest, had been as anticipated, then only the decrement experience profit would have emerged, thus:

Equation 3

$$l_x V_0 (1+i) + l'_{x+\frac{1}{2}} (P - E)(1+\frac{i}{2}) - d'_x B(1+\frac{i}{2}) - l'_{x+1} V_1 = X_q$$

Equation 2 less the above equation 3 therefore gives X_e:

$$l'_{x+\frac{1}{2}} (E - E')(1 + \frac{i}{2}) = X_e$$

Thus the expense experience profit is given by the difference between the expected and actual expense rate for the actual number of policies, accumulated with expected interest to the end of the year.

Finally, the decrement experience profit is derived. If decrements, as well as expenses and interest had been as anticipated, then we are back to the basic equation of value of:

$$l_x V_0 (1+i) + l_{x+\frac{1}{2}} (P - E)(1+\frac{i}{2}) - d_x B(1+\frac{i}{2}) - l_{x+1} V_1 = 0$$

Equation 3 less the equation above therefore gives X_q. Noting that $l_{x+1} = l_x - d_x$ and $l_{x+1/2} = l_x - d_x/2$:

$$(d_x - d'_x) . (B(1+\frac{i}{2}) + \frac{(P - E)}{2}(1+\frac{i}{2}) - V_1) = X_q$$

or, with some rearrangement:

$$(d_x - d'_x) . (B - [\frac{V_1}{(1+\frac{i}{2})} - \frac{(P - E)}{2}])(1+\frac{i}{2}) = X_q$$

Thus, the decrement experience profit is the saving on the expected strain on exit (say, death) accumulated with expected interest to the end of the year. The expected exit strain is given as the benefit payable less the "mid-year reserve", where "mid-year reserve" is given as the end year reserve discounted to the middle of the year less half the premium less expenses due (i.e. assuming half the benefit payments occur before the premium is due and half after).

The equations above assumed no change in the liability valuation basis between the start and end of the year. If the valuation basis changes there may also be an experience variation equal to the impact of the basis change on the end of year policy liability.

Analysis of Surplus

The previous sections described the analysis of profit where policy liabilities are valued on a "realistic" basis in accordance with Australian accounting and APRA standards.

Where policy liabilities are valued using a net premium valuation method (or another "non-realistic" method that does not utilise best estimate assumptions), the assets in excess of policy liabilities are termed the surplus, and the surplus emerging over a year must be analysed.

The methodology for an analysis of surplus is similar to the analysis of profit, with surplus arising during the year replacing profit, and some adjustments to analysis items consistent with the valuation method.

An analysis of surplus tends to be less useful than an analysis of profit. The assumptions used for the valuation are not best estimates, hence the experience profits are expected to be non-zero. The fact that a mortality or expense surplus is greater than zero does not necessarily indicate good performance by a life company since the surplus is being calculated relative to an unrealistic conservative assumption. If a net premium method is used one of the items of surplus will be the difference between the actual and net premiums.

Analysis of Profit for an Investment Contract

The policy liabilities for Investment-linked contracts, term annuity contracts and investment account contracts that are not entitled to discretionary additions consist of a life investment contract liability (LICL) and a management services element (MSE). The MSE is the net amount of deferred entry fee revenue and deferred acquisition expenses.

There is no equivalent to "profit margins emerging" for investment contracts. Instead, APRA form LRF 430 requires profit to be split between:

- investment earnings on assets in excess of policy liabilities;
- the Financial Instrument Profit;
- the Management Services Profit;
- changes in valuation methods and assumptions affecting the MSE.

The Financial Instrument Profit is the sum of all cash flows relating to the financial instrument element of life investment contracts, including investment earnings on the underlying assets, less the change in the value of the Life Investment Contract Liability.

The Financial Instrument Profit reflects any mismatch between the LICL and the assets that back it. For investment-linked business there should normally be an exact match, so this item of profit will be zero. An exception could occur for investment-linked policies that have performance guarantees. For term annuities and investment account business there would usually be some degree of mismatch between the assets and the LICL, so the Financial Instrument Profit will be non-zero.

The Management Services Profit is the difference between fees and expenses, including changes to the MSE. In other words, fees include reductions in deferred fee revenue and expenses include reductions to deferred acquisition costs.

For investment-linked contracts a projection would generally only be required to determine the run-off of the MSE. The expected change in the MSE can be calculated using this projection and compared with the actual change. In making this comparison, allowance needs to be made for the impact of new business, either by allowing for new business within the expected MSE, or by removing the impact of new business from the actual MSE.

It can be useful to analyse the Management Services Profit by subdividing it between new and existing business. If acquisition costs cannot be deferred, new investment contracts may produce a loss in the first year, even though the contract is expected to be profitable over its full term. In this case the profit in the first year will be reduced by the amount of acquisition costs that are not deferred.

Changes in valuation methods and non-economic assumptions should not normally affect the MSE. These changes would normally only affect the future run-off of the MSE. However if a contract becomes onerous (i.e. it is expected to make losses in the future) there will be an immediate impact. Investment-linked contracts could become onerous if high rates of termination or poor investment performance make it unlikely that future fees will be sufficient to recover the existing deferred acquisition costs and future maintenance expenses. Changes to economic assumptions (e.g. the discount rate) would have an immediate impact on the MSE.

For term annuities a projection method needs to be used to calculate both the LICL and the MSE. The MSE includes an allowance for profit margins. It is possible to analyse the profit for term annuities in a similar way to the methods used for life insurance contracts. The main item of experience will most likely be investment experience arising from the mismatch of assets and liabilities. Mortality is usually ignored (deaths would be treated as withdrawals). Withdrawal and expense experience will normally be of relatively minor importance.

Example

Consider the 10 year investment-linked single premium policy example from Chapter 21.

For a fully in force policy in year 1:

Premium	10,000
Commission	500
Expenses	180
Account Balance: 10,000 * (1 – 3%) * (1 + 6% - 1%)	10,185
Surrender Value: 10,185 x (1 – 2%)	9,981

Fees: 10,000 * (1 – 3%) * 1%	97

Using the expected withdrawal rate of 20% the cash flows in the first year are:

Premium	10,000
Commission	500
Expenses	180
Surrender payments: 9,981 * 20%	1,996
Account Balance: 10,185 * (1 – 20%)	8,148
Fees: 97 + (10,185 – 9,981) * 20%	138

The present value of ongoing fees is 522. The deferrable acquisition cost in excess of the entry fee is 200, which is 38.3% of the value of the ongoing fees. At the end of year 1, the value of ongoing fees has reduced to 456 and the DAC to 175, giving an MSE of (175).

The LICL at the end of year 1 is the account balance of 8,148. The policy liability is the LICL plus MSE and equals 7,973. The contract makes a loss in the first year (and profits in subsequent years) because part of the acquisition costs cannot be deferred.

If experience is as expected the Financial Instrument Profit will be zero and the Management Services Profit will be a loss of 90.

If the actual withdrawal rate in year 1 is 30%, the value of ongoing fees at the end of year 1 reduces to 399 and the DAC to 153 (applying the 38.3% to the value of ongoing fees), giving an MSE of (153). There will also be an extra 20 of exit fees charged.

The Management Services Profit will be a loss of 92, of which 2 is attributable to the higher than expected withdrawals.

Reasons for Analysing the Profit

The principal reason for an analysis of profit (or surplus) is to disclose the sources of the emerging profit. Such analysis is carried out:

- to enable the actuary to advise management on the factors affecting the profit;
- as a semi-independent check on the accuracy of the valuation and of the data in the company accounts;
- to compare the valuation assumptions to actual experience, thus signalling the need for a review of the best estimate assumptions or for management to take action to address areas where experience has deteriorated (this does not apply to an analysis of surplus as the assumptions used are not best estimates);
- to comply with requirements for a basic analysis of profit to be disclosed in the general purpose financial statements and in APRA reporting form LRF 430.

Note that the analysis is not a complete check. It may not be possible to explain all experience profits. However any unexplained profit should be within acceptable limits.

The analysis will not provide a foolproof verification that the valuation data is correct. For example, consistently wrong policy data over time may not be identified.

Some items of experience profit may be estimated based on the valuation results themselves. This does not give an independent check.

Examples of errors that might be picked up include:

- premiums that have been recorded correctly in the policy administration system and valuation of liabilities, but double counted in the accounting system;
- failure to reverse a manual provision for contributions tax liability after annual contributions tax processing has occurred.

The analysis of profit for a single period is not an ideal indicator of the financial performance of a life insurance company, and some experience variances may give misleading signals. For example, higher than expected lapse rates for a level premium term insurance will result in experience profits if the policy liability is greater than zero. However if the best estimate liability is less than zero the loss of future profit margins will exceed the experience profit and the company will actually be worse off. An embedded value analysis gives a better measure of financial performance. This topic is discussed in the next chapter.

Analysis of Changes to Profit from Year to Year

The analysis of profit discussed above splits the current year profit into its various components. Another type of analysis which is very useful in explaining the performance of a life company is an analysis of the change in profit from the previous year to the current year. Management and shareholders will be particularly interested in understanding the drivers of trends in profit, and whether these trends are expected to continue in future.

This type of analysis builds on the analysis of profit performed for each year in isolation. For insurance contracts, the profit margins emerging in the current year will differ from those emerging in the previous year because of changes in the volume of business and the best estimate assumptions. They will also be affected by differences between the profit margins (as percent of profit carrier) for new business as compared with existing business. For participating business the profit margins emerging will also be affected by investment experience. A comparison of profit between current and previous years should attempt to identify and explain all of these factors to the extent that they are material.

Experience profits for the current and previous years will not be directly comparable if the best estimate assumptions for each year are different. A change in assumptions at the end of the previous year will typically have an opposite effect on profit margins emerging and experience profits for the current year. For example, a reduction in the best estimate claim rates at the end of the previous year will increase profit margins emerging for the current year and reduce the experience profits. However, the two effects will not cancel each other precisely as profit margins are spread over the terms of the policies.

For investment-linked contracts, profit is likely to be sensitive to investment returns. For these products the majority of fee income is usually based on assets under management. Other key factors affecting profit will be new business, withdrawals and changes to the level of expenses.

It is particularly useful to identify large one-off items in a year by year analysis as they can distort trends in profit emergence. Examples of one-off items include loss recognition, loss reversals and losses that arise from operational risks (e.g. fraud or compensation to policy owners for mis-selling). Repricing of risk products and investment-linked products can cause a significant shift in profits emerging. For participating business, changes to the asset mix will affect the profit margins emerging if they result in changes to the discount rates used in determining the best estimate liabilities and the value of future bonuses and shareholder profits.

Analysis of Profit and the Control Cycle

The Control Cycle is the process whereby a life insurance company monitors the experience emerging for a product and the implications this has for valuing and pricing that product going forward.

The analysis of profit provides a feedback mechanism to indicate which of the best estimate assumptions might need reviewing. It can also highlight those products which need to have their premium rates and charging structures reviewed in order to maintain an adequate level of profitability. For example if the analysis of profit showed significant lapse experience losses, this may indicate the need for a thorough investigation of lapse experience by various rating factors (distribution channel, benefit type, policy size, etc) which in turn may feed into a revision of the premium rates, charges and commissions.

The analysis of profit may also suggest other management actions that could be taken to reduce profit volatility. For example if claims experience is adversely affected by a few large claims the life company might consider reducing its retentions and making more use of reinsurance. Volatility in investment experience could be reduced through better matching of assets and liabilities or the use of derivatives.

Worked Examples

The worked examples are included in an excel file accompanying this text.

Example 1 – Term Life Insurance Policy

This example shows an analysis of profit for a portfolio of term life insurance policies. The related calculations are in sheet "Ex1 Term Life AoP". Investment returns on assets in excess of policy liabilities (e.g. retained earnings) are ignored.

The following valuation assumptions are made:

- premium of $1000 payable yearly in advance
- sum insured payable on death
- no surrender value
- initial expenses of $1,200 per policy
- death claims of 35% of premiums in the first year, increasing by 8% p.a.
- renewal expenses of 10% of premiums in the first year, increasing by 6% p.a.
- the lapse rate is 15% p.a.

- the discount rate is 5% p.a.
- premiums and initial expenses are paid at the start of the year, claims are paid mid-year and renewal expenses are paid at the end of the year

From these assumptions a projection of premiums, claims and expenses is calculated, as follows:

Year	Premium	Claims	Initial Expenses	Renewal expenses
1	1,000	350	1,200	100
2	850	321		90
3	723	295		81
4	614	271		73
5	522	249		66
6	444	228		59
7	377	209		53
8	321	192		48
9	272	177		43
10	232	162		39

The above cash flows are discounted to determine the best estimate liability and the present value of expected profits. For this product, premiums are used as the profit carrier. The profit margin is 19.1% of premiums, being the present value of profits (882), divided by present values of premiums (4,615).

Cash Flow	Present Value
Premiums	4,615
Claims	(2,008)
Initial expenses	(1,200)
Renewal Expenses	(526)
Expected profit	882

At the beginning of the policy, before any premiums are received or expenses incurred, the policy liability (calculated as the present value of premiums less claims, expenses and profit margins) is zero. This can be checked from the calculations given above.

The expected profit in year 1 is calculated as the profit margin percentage applied to the premium cash flow, ie, 1,000 x 19.1% = 191, plus interest on the profit margin of 10, totalling 200.

This can be verified from the cash flow (premiums less claims and expenses) accumulated with interest to the end of the year, less the increase in the policy liability over the year, ie, (1,000 – 1,200) x 1.05 – 350 x $\sqrt{1.05}$ – 100 – (-869 – 0) = 200.

Let us assume that actual experience in year 1 differed from the projection assumptions as follows:

- claims are 400 instead of 350;
- lapses are 17% instead of 15%. As a result, the closing policy liability is (849) instead of (869);
- renewal expenses are 110 instead of 100;
- the investment return equals the assumed discount rate.

The claims experience loss is the difference between the expected and actual claims, accumulated with interest to the end of the year, ie, $(350 - 400) \times \sqrt{1.05} = (51)$. The claims experience will also have a minor impact on the policy liability as the policies remaining in force will differ from expected. However this effect has been ignored on grounds of immateriality.

The lapse experience loss arises because there are fewer policies remaining in force at the end of year 1 than expected. The lapse loss is (869) – (849) = (20). In effect, this loss arises because the acquisition costs for the extra lapsed policies must be recognised in full, rather than continuing to be deferred. This is not an assumption change, rather it is applying the original valuation assumptions to reduced in-force premium volumes due to higher lapse experience.

The expense experience loss is the difference between the expected and actual expenses, i.e. 100 – 110 = (10).

The actual profit in year 1 is now 119 compared to expected profit of 201.

This can be verified from the cash flow (premiums less claims and expenses) accumulated with interest to the end of the year, less the increase in the policy liability over the year, i.e. $(1{,}000 - 1{,}200) \times 1.05 - 400 \times \sqrt{1.05} - 110 - (-849 - 0) = 119$.

The analysis of profit can be presented as:

Profit margins emerging	200
Claims experience profit	(51)
Lapse experience profit	(20)
Expense experience profit	(10)
Actual profit	119

In this example, the valuation assumptions were not revised. However in practice, consideration would need to be given as to whether claims, lapse or expense valuation assumptions were increased at the end of year 1. This may lead to loss recognition if the recalculation of the components of the policy liability means that the value of future profits falls to zero, and the policy liability increases. This in itself would be an item of experience loss in year 1.

Example 2 – Group Salary Continuance Insurance (Accumulation Method)

This example shows an analysis of profit for statutory fund consisting of group salary continuance insurance policies. The policies do not have any profit sharing

entitlements, there is no reinsurance and tax has been ignored. The calculations are in sheet "Ex2 GSC AoP". This example includes the investment return on the retained earnings of the statutory fund in the analysis.

An accumulation method is used in this example, hence the value of future shareholder profits is not explicitly calculated as a component of the policy liabilities. However, profit margins are implicitly released at the time that premiums are earned and expected claims are incurred.

The policy liabilities are calculated as:

- unearned premium reserve (UPR); plus
- incurred but not reported claims reserve (IBNR); plus
- reported but not admitted claims reserve (RBNA); plus
- disabled lives claims reserve (DLR, also known as Claims in Course of Payment, CICP); less
- deferred Acquisition Costs (DAC)

The profit margins emerging are calculated using expected loss ratios for claims and maintenance expenses determined at the beginning of the year. The loss ratio for claims is the expected value of claims incurred during the year, divided by the earned premium. The loss ratio for maintenance expenses is determined in a similar way. The profit margins emerging also include expected interest on the UPR and DAC, and are net of expected releases from the DAC.

The claims profit compares actual and expected claims. The actual claims include increases in the claim reserves net of expected interest on the claims reserves.

The lapse profit is the residual change in the DAC. In this example there is a loss from lapses, presumably arising because actual lapse rates were higher than expected.

The claims loss ratio is the expected ratio of incurred claims to earned premiums. The expense loss ratio is the expected ratio of maintenance expenses to earned premiums.

The acquisition expenses are $21,680 (in this example all commissions are paid on commencement of new group policies and are therefore classified as an acquisition cost). This leaves $2,570 in maintenance expenses.

The Budgeting/Planning Process

Prior to the start of each financial year a company will set an expense budget for each area or department within the company, for the amount it can spend during the coming year.

The first step in this process is generally for each department to review the previous budget and identify changes to the business or particular plans that will result in lower or higher costs. The department then reworks the budget to provide the following year's estimate of expenses.

The actuary and finance/accounts people will then get together and review these plans. The area of the company responsible for the payment of commission to advisors can be used as an example. This group may be part of a larger department in a real life scenario. Their budget would include the costs of calculating and paying

commission, but not the commission amounts paid. The inputs to this part of the process are:

- The new budgets set by the department – this indicates how much the area wishes to spend and what on. The budget would have included the cost of additional staff anticipated, salary increases, computer upgrades.
- The expense experience analysis – this indicates how expenses of the company were spent or are generally spent. The analysis would have information that would identify the costs of calculating and paying commissions from the previous year.
- It would also have numbers of advisors and total amount of business written, which allows the expense to be expressed as an amount per advisor, per contract or per sum insured amount.
- With a bit of work, the expense analysis should be able to tell the finance and actuarial people how this department performed against the expected (based on loadings in the expense assumptions on the contract) experience in the previous year.
- The strategy or business plan for the company. This will provide information about the anticipated additional costs, areas in which these costs are likely to occur and the anticipated new business and lapse experience expected given changes to aspects of the company from this plan.
- The analysis of profit – the information about actual to expected profit and the reasons for its variance will give information about the spending of the company in the previous year and also the environment in which the company is operating. This is explored further below.

This information is analysed for each department budget submitted. The budgets will be approved, reduced, increased in some cases, if it is felt that anticipated changes have not been budgeted for sufficiently, or altered in some way. An example of the last item here could be advertising expenses. If the analyses reveal that a large amount was spent on advertising in the previous year, without any increase in sales volume or quality, the department responsible for advertising would be likely to be provided with a reduced budget and a restriction on the total amount to be spent on advertising and promotion for the coming year.

Analysis of Profit and the Budgeting/Planning Process

The business plan includes budgets for expenses together with estimates of all other cash flows that will affect the company's profit for the coming year. At the end of the year the actual results will be compared with those forecast in the business plan. This creates further work for the actuary as the analysis against business plan will differ from the analysis of profit discussed previously.

Management are usually more interested in comparing the actual profit with budget forecasts than splitting actual profit into the profit margins emerging and experience profits. The budget profit may differ from the profit margins emerging for a number of reasons:

- The budget assumptions may allow for short term variances from the best estimate assumptions – for example lapse rates may be anticipated to be higher than normal because the company has just raised its premium rates.

- The expected investment return will most likely differ from the discount rates used in the policy liability valuations.
- The best estimate assumptions may change between preparation of the budget and the start of year liability valuation (e.g. discount rates will almost certainly change).

As new sales will differ from those assumed in the business plan, the first stage in the process would be to recalculate the plan using actual sales. It may also be necessary to restate the opening position due to different volumes of business being in force at the start of the year compared to the volumes forecast in the budget (remember that the budget is prepared some time before the start of the year).

The analysis is more useful if it is performed separately for each major operating division and for major products within each division. It can offer insights as to which products are profitable, which products need to be repriced or markets from which the company may wish to withdraw, enabling company management to take appropriate action.

Frequency of Analysis

A detailed analysis of profit by source will normally be carried out at year end. At other times during the year, the ability to carry out a detailed investigation will depend on the availability of data from the management information systems. Some of the necessary information may need to be estimated if an interim analysis is carried out. In order to avoid surprises, companies will generally want to complete the analysis at least quarterly, even if this must be on an approximate basis. Many companies perform a monthly analysis against budget. Most companies update their forecasts of full year profit as the year progresses.

Communication

The key messages coming out of the analysis of results must be highlighted to senior management. Care needs to be taken not to obscure important information; for example by presenting too many numbers, or by spending too much time on secondary details. It is important to write reports so that they are useful to the reader, rather than to regard them as documentation of the processes undertaken.

An understanding of the drivers of profit is essential if senior management are to make well-informed decisions regarding the future direction of the company.

Exercise

You have completed your analysis of profit calculations for the latest financial year, which show a considerable deterioration in results due to a maintenance expense overrun in a key product open to new business. Your appointed actuary is very concerned and has allocated one of the actuarial analysts to assist you in performing your investigation into the expense experience. The aim of this investigation is to determine the causes of the deterioration in results. Please provide the analyst with a list of things that need to be investigated together with reasons why.

Solutions to the Exercise

Investigation item	Reason
Expenses	
Check the payments process	To ensure no breakdowns in procedure that have led to expensive work-arounds or manual intervention
Check the expense apportionment from the current year and compare to previous years	To identify if any areas have changed their split up of expenses and this has resulted in more being attributed to this product than there should be.
Check for one-off expenses	To identify any unusual and non-recurring items that may affect the accounts.
Check the non-apportioned expense data	To make sure no large/repetitive entries have been put through to this product by mistake
Comparison of Actual to Budget	Highlight any areas of differences
Reconcile projected expense results	Are there any errors in the expense treatment within the valuation system?