Actuaries Institute Australia

# LIFE INSURANCE AND RETIREMENT VALUATION

## MODULE 6: LIFE INSURANCE PROFIT

Education Program
ACTUARIES INSTITUTE

Education that Counts

Fellowship Program

Module 6

# LIFE INSURANCE PROFIT

Education that Counts

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# 6. Life insurance profit

This module addresses the measurement of profit and methodologies for controlling the release of profit over time. The techniques covered apply to both proprietary and mutual life companies. The determination and monitoring of retirement fund liabilities is covered in Module 9 (Retirement valuation).

The module addresses the following learning objectives:

| Item | Unit/Key Performance Objective/Learning Objective |
|---|---|
| **3.5** | **Examine the concept of planned profit margins and calculate profit arising under different valuation approaches** |
| 3.5.1 | Differentiate between actual and estimated profit |
| 3.5.2 | Explain the impact of the valuation basis on the timing of release of profit |
| 3.5.3 | Demonstrate the use of planned margins as a mechanism for the smooth release of profit |
| 3.5.4 | Determine distributable profit and understand the distinctions between accounting and distributable profit |
| 3.5.5 | Apply methodologies for the deferment of acquisition costs |
| 3.5.6 | Develop models for recognising the emergence of profit for various product types |

# 6.1. Introduction

## 6.1.1. What is profit

Profit can be defined as the total income less outgo over the entire life of a portfolio of policies. If all obligations and payments from business conducted were settled in a single year, profit would simply be income less outgo for that year. However, the timing of inflows and outflows under life insurance policies is mismatched and cash flows can continue for many years after a policy is issued.

For savings policies, premiums are received over many years and payments may be made at a later date, often on retirement. The premiums received need to be invested and the proceeds used to meet benefit payments at some point in time in the future. In contrast, for annuity policies, a single premium is paid to the company by the policy owner, who then receives regular annuity payments from the company for a contracted term or for the policy owner's lifetime.

A further cash flow mismatch arises from premium rates for level premium term insurance contracts being averaged so that the premiums charged do not increase over time, despite mortality costs increasing with age. On a strictly cash flow basis, these contracts would report a profit in earlier years and losses in later years.

Mismatches also arise due to initial commissions and acquisition costs on new policies that are expected to be recovered from loadings in future premiums. For a life insurance contract, expenses related to the sale of a contract, including upfront sales commissions, are often more than 100% of the first-year premium. If profit for each period was measured on a cash flow basis, these contracts would report a loss in the first year and profits thereafter.

Companies cannot effectively manage their business by only calculating profit after all obligations under contracts have been settled. They need ways to measure and report their financial performance and determine distributions to policy owners and shareholders on a frequent, ongoing basis.

Actuaries have therefore developed techniques to estimate and report profits on a regular basis. These techniques are discussed throughout the rest of this module.

Profits arising each year are a result of both **expected profits** for the year (from profit margins included in the price of the product) and **unexpected profits**, or **experience variations**, such as those arising when actual experience turns out to be better (or worse) than expected. The focus of this module is primarily on expected (or planned) profits. Unexpected profits are the focus of Module 12 (Analysis of surplus).

## 6.1.2. Australian context

Throughout this module, the term 'profit' is used in relation to planned profit margins and the measurement or estimation of profit arising in a period. The examples and methodologies draw to some extent on Australian legislation. That legislation would have been outlined in the Core Actuarial Management subject (Part II Control Cycle).

A brief recap is that profitable contracts have negative best estimate liabilities at the point of sale. The Australian accounting regulator requires companies to set liability values so that the emergence of profit is spread over future years. This means that the liability basis can be viewed as conservative and, as a consequence, profit is expected each year. Future profit, which is reflected in a negative liability on a best estimate or realistic basis at point of sale, is released evenly over the term of the contract as a function of a metric chosen by the company. Profit is divided by this metric (e.g. expected premiums, expected claims or other business drivers) to derive a 'profit margin'. This profit margin can measure the expected or anticipated release of profit each year. Methodologies for understanding unanticipated profit are described in Module 12 (Analysis of surplus).

## 6.1.3. Module examples

There are worked examples presented throughout this module to illustrate the application of methodologies and techniques. You should focus on how the various items in the examples affect the profit calculation. The derivation of underlying assumptions in calculating premiums, claims and expenses are provided under each example, but these are not the focus of the exercises.

In particular, the pricing bases and assumptions used are not necessarily indicative of those used in practice. You are encouraged to talk to pricing and valuation teams within your organisation and to refer to life company published reports to gain more insight into the range of realistic assumptions used.

Unless otherwise specified, for each example:

- the assumed cash flows exactly follow the pricing basis;
- a deterministic gross premium projection valuation is used;
- premiums are assumed to be received at the start of the year;
- expenses are assumed to be incurred at the start of the year;
- claims are assumed to be incurred at the end of the year;
- tax is ignored;
- profit is assumed to be earned or released at the end of each year;
- in some of the examples, profit in a year is expressed as a percentage of the premium for that year. For this calculation, profit is discounted to the start of the year at the assumed discount rate. The reason for this approach is explained in the description before Table 6.7, Section 6.3.2;
- t = 0 represents the assumed commencement date of the policies;
- reserves at t = 0 are calculated before cash flows due at inception;
- reserves at the end of the year are calculated after claims have been paid; and
- business experience is assumed to follow the best estimate basis, with no experience variation over the projection period.

In the examples, reference is sometimes made to the projection and run-off of a single policy. The results are really for a projection of a large number of similar policies, where the proportion of the portfolio that continues or terminates each period represents the conditional probabilities of death or lapse each policy year. The projections summarise expected cash flows each year for a portfolio of identical policies all written at the start of Year 1 (i.e. at t = 0).

Detailed calculations behind each of the examples are contained in the spreadsheet LI&RV_Module6.xlsx. As you work through each example, you should refer to the modelling spreadsheet for further details of the valuation bases and how they are applied in the model.

# 6.2. Estimating profit

## 6.2.1. Actual and expected profit

Ultimately, the actual profit earned will be driven by the experience of the business (claims, expenses and income) over the entire life of a portfolio of policies. The calculation of profit in any period is therefore only an estimate. In arriving at this estimate, companies need to allow for future obligations arising from their current portfolio of policies. This is in recognition of the long-term nature of life insurance contracts. Companies make this allowance by taking into account the value of policy liabilities at the end of the period and comparing this to policy liabilities at the start of the period.

The profit arising in any period can be measured as income less outgo for the period, less the change in the value of outstanding policy liabilities over the period. This is represented by Formula 6.1:

6.1 $$P = I - O - (L_1 - L_0) = I - O - \Delta L$$

where:

P is profit for the period

I is income for the period

O is outgo for the period

($L_1$ - $L_0$) or $\Delta L$ is the change in liabilities between the start and end of the period.

An increase in the value of policy liabilities over a period will therefore reduce the size of profits estimated for the period and a decrease in the value of policy liabilities will increase profits.

From Formula 6.1, it is apparent that the methodology and approach adopted in the calculation of policy liabilities affects the estimation of profit in a period. However, the value of liabilities does not affect the underlying business experience (claims, expenses and income) which drives the actual profit earned over the lifetime of a portfolio.[1]

[1] One exception is that income includes investment earnings on assets or reserves supporting liabilities. Where a more conservative valuation basis is used, reserves will be higher and investment earnings on those reserves will therefore also be higher.

Formula 6.1 will be used as the basis for calculating profit in each of the examples presented throughout this module.

The example presented in Table 6.1 demonstrates, in a simplified way, a timing mismatch. The example is the same as used in Table 5.1 for a 5-year level premium term policy with a sum insured of $100,000.

**Table 6.1: Profit with liability values set to zero**

| Year | Premiums | Claims | Expenses | Net Cash Flow | Liability | Profit |
|---|---|---|---|---|---|---|
| 1 | 781 | -620 | 0 | 161 | 0 | 161 |
| 2 | 659 | -591 | 0 | 68 | 0 | 68 |
| 3 | 589 | -598 | 0 | -9 | 0 | -9 |
| 4 | 526 | -605 | 0 | -78 | 0 | -78 |
| 5 | 469 | -611 | 0 | -142 | 0 | -142 |

**Product:** 5-year level premium term insurance
**Liability basis:** set to zero
**Sum insured:** $100,000
**Expenses:** $0
**Investment earnings:** 0%
**Discount rates:** 0%
**Profit margin:** $0

The policy in Table 6.1 is priced to exactly break even (there is no planned profit margin). In addition, liability values are set to zero; that is, the value of future obligations is ignored.

Key features to note in Table 6.1 are:

- mortality rates increase with age but premiums are level, so initially premiums exceed claims and this turns around in future years;
- profit each year is equal to net cash flows as liability values are zero. Because of the level premiums, profits therefore arise in earlier years and losses are observed in later years;
- total profits over the 5 years are $0.

The example in Table 6.2 builds from this, with policy liabilities each year calculated as the amount needed to meet future claims less future premium income (i.e. a realistic basis).

**Table 6.2: Profit with realistic valuation basis**

| Year | Premiums | Claims | Expenses | Net Cash Flow | Liability | Change in liability values | Profit |
|---|---|---|---|---|---|---|---|
| 1 | 781 | -620 | 0 | 161 | 161 | 161 | 0 |
| 2 | 659 | -591 | 0 | 68 | 229 | 68 | 0 |
| 3 | 589 | -598 | 0 | -9 | 220 | -9 | 0 |
| 4 | 526 | -605 | 0 | -78 | 142 | -78 | 0 |
| 5 | 469 | -611 | 0 | -142 | 0 | -142 | 0 |

**Product:** 5-year level premium term insurance
**Liability basis:** realistic
**Sum insured:** $100,000
**Expenses:** $0
**Investment earnings:** 0%
**Discount rate:** 0%
**Profit margin:** $0

By using a realistic valuation basis, profit each year in Table 6.2 is zero. This approach is effectively setting aside the positive cash flows in Years 1 and 2 and releasing these as needed in Years 3, 4 and 5.

**Exercise 6.1**

What is the total amount of profit earned under each of Table 6.1 and Table 6.2? Why is this the same for both examples?

## 6.2.2. Planned profit

In the examples for Table 6.1 and Table 6.2, planned profits were zero. That is, the policy was priced to exactly break even. In practice, companies design and price their products to make a profit. At the point of sale of a policy, the present value of future income received by the life company is expected to be greater than outgo paid by the life company. Without adjustment, policies priced to make a profit therefore generate negative liability values on issue if a realistic valuation basis is used. The negative liability (that is, an asset) represents the value of planned margins. If profit in a period is estimated as $I - O - \Delta L$, all planned profit is recognised or 'released' immediately on issue.

However, there are different ways that this planned profit could be released over time, ranging from recognising it all up front to recognising it all at the end of the policy term. For example, assume a 5-year term policy is priced to provide a planned profit (or 'margin') of $1,000. A number of options available for recognising this total profit are shown in Table 6.3.

**Table 6.3: Planned profit recognition options**

| Planned profit recognition option | Year 1 | Year 2 | Year 3 | Year 4 | Year 5 |
|---|---|---|---|---|---|
| 1. Up front | 1,000 | 0 | 0 | 0 | 0 |
| 2. Evenly spread over time | 200 | 200 | 200 | 200 | 200 |
| 3. In line with annual cash flows | -500 | 360 | 370 | 380 | 390 |
| 4. After the end of the policy term | 0 | 0 | 0 | 0 | 1,000 |

Under international accounting standards and in many jurisdictions such as Australia, when the policy is expected to continue for many years, it is not considered appropriate to recognise the value of margins immediately on the issue of a policy (Option 1 in Table 6.3). A more meaningful alternative is to recognise the planned profit margin gradually over the term of the policy (e.g. Option 2 in Table 6.3). Different valuation methodologies address this issue in different ways, as illustrated in the examples in Section 6.3.

Many types of contracts also have large initial or acquisition costs which are recovered through future margins. Those acquisition costs have been spent by the time business is included in the valuation. Accounting standards tend to allow acquisition costs to be deferred for profit reporting purposes, providing adequate future margins are expected for their recovery. Measurement of profit in a period when large acquisition costs are incurred is covered in Section 6.4. The examples in Section 6.3 assume no large acquisition costs.

### 6.2.3. Profit and surplus

The examples provided in Section 6.3 show how the liability valuation basis affects the way that planned profit is recognised each year. Conservative valuation bases, which were introduced in Module 5 (Life valuation), provide a mechanism for more gradual release of planned profit over time.

Profits released under a particularly conservative liability valuation basis are sometimes referred to as 'surplus' rather than profit. Surplus in this context refers to both the release of true profit and the release of contingency margins built into the conservative liability valuation. Because release of surplus also includes the release of contingency margins, it may not provide a meaningful measure of profit. On the other hand, the surplus arising in a year provides a meaningful measure of the assets of a fund that are no longer required to meet liabilities or provide contingency margins thereon. This is discussed further in Section 6.3.4.

To avoid confusion, we reference 'profit' in this module, rather than 'surplus', even when a conservative valuation basis is used.

## 6.3. Profit under different valuation approaches

As described above, profit calculated in any given period is an estimate only. Actual profit, which is impacted by both profits that are planned at the commencement of a policy and experience which emerges over the policy duration, will not be known until all obligations under an insurance contract have come to an end.

The choice of valuation methodology and basis is an important factor in the recognition of profit arising in a given period. When selecting a valuation approach, it is important for the actuary to be aware of the impact of the valuation approach on the emergence of profit from period to period. The actuary will be guided by, amongst other things, the purpose of the valuation, regulatory requirements, professional guidance and accounting standards. The principles for consideration in determining a valuation approach were discussed in Module 4 (Liabilities). In setting regulatory standards, regulators and standards boards consider matters such as the pattern of emergence of planned margins, the extent to which actual experience is recognised in profit as it emerges and the impact of the valuation basis on volatility of profits emerging from period to period.

The following sections provide examples of the impact of various valuation approaches on the timing of profit from period to period. It is important to emphasise that in these examples, experience is assumed to exactly follow valuation assumptions. Actual profit for a portfolio of policies will be the sum of planned profit margins and experience. For instance, planned profit in a year may be $500,000 based on planned expenses of $800,000. If actual expenses are $1,100,000, then total profit for the year would be $200,000, assuming all other experience followed assumptions.

## 6.3.1. Profit release under different liability bases

The timing of profit release is impacted by the valuation basis chosen. This concept will be illustrated below through an example based on a 10-year stepped premium term contract, with the policy priced to provide a planned profit margin of 10% of premiums. Pricing for a margin of 10% of premiums means that, if experience follows assumptions, a planned profit margin of 10% of the present value of premiums will be earned over the life of the policy.

The example presented below illustrates the impact of the valuation basis on the timing of profit by calculating liability values on three different bases:

- **Best Estimate (BE) Basis** with no adjustments, under which all planned profit is released at the outset
- **Conservative Basis 1** with mortality assumed to be 25% higher than under the best estimate basis
- **Conservative Basis 2** with expenses assumed to be 220% higher than under the best estimate basis

The company would hold balance sheet reserves equal to the value of policy liabilities, which differ according to the valuation basis chosen. The margins under the conservative bases may be higher than would be used in practice, but serve to illustrate the concepts.

Under all three bases, the expected value of future cash flows are those shown in Table 6.4. These cash flows are used in determining profit each year.

**Table 6.4: Cash flows with profit margin of 10% of premium**

| Year | Premiums | Claims | Expenses | Net Cash Flow |
|---|---|---|---|---|
| 1 | 667 | -428 | -203 | 35 |
| 2 | 638 | -409 | -189 | 39 |
| 3 | 614 | -394 | -178 | 42 |
| 4 | 607 | -390 | -172 | 45 |
| 5 | 605 | -388 | -167 | 49 |
| 6 | 603 | -387 | -163 | 53 |
| 7 | 603 | -387 | -160 | 56 |
| 8 | 604 | -388 | -156 | 60 |
| 9 | 607 | -390 | -154 | 63 |
| 10 | 609 | -391 | -152 | 66 |

**Product:** 10-year stepped premium term insurance
**Liability basis:** n/a
**Mortality:** 85% of IA95-97 ultimate rates for a male age 45 exact at policy commencement
**Lapses rates:** 12% in years 1 & 2 and 10% p.a. thereafter
**Initial expenses:** $70
**Renewal expenses:** $70 p.a. from Year 2 onwards with an expense inflation rate of 2% p.a.
**Initial commission:** 20% of the initial premium
**Renewal commission:** 20% of subsequent premiums
**Interest and discount rates:** 3% p.a.
**Profit margin:** 10% of premiums

Liabilities under the Best Estimate Basis are calculated, at each future point in time, as the present value of expected future cash flows from Table 6.4 with no adjustments. In determining liabilities under Conservative Bases 1 and 2, more conservative liabilities are held by either explicitly holding back profit margins (covered in Section 6.3.2) or by assuming higher mortality rates or higher expenses. Under these more conservative bases, required reserves are higher, as is the interest earned on these reserves. The value of liabilities at each future point in time, under each of these bases, is shown in Table 6.5.

Note that the profit shown at t = 0 is negative under the Conservative Basis 1 and 2, representing the cost of establishing reserves at contract inception.

### Table 6.5: Projected profit under different liability bases

| Year | Best Estimate Basis | | | Conservative Basis 1 | | | | Conservative Basis 2 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Interest | Liability | Profit | Interest | Liability | Profit | Profit % Prem | Interest | Liability | Profit | Profit % Prem |
| t=0 | | -540 | 540 | | 304 | -304 | -44.2% | | 375 | -375 | -54.6% |
| 1 | -2 | -507 | 0 | 23 | 255 | 107 | 15.6% | 25 | 277 | 159 | 23.1% |
| 2 | -2 | -470 | 0 | 21 | 213 | 102 | 15.6% | 22 | 199 | 139 | 21.2% |
| 3 | -1 | -429 | 0 | 19 | 176 | 98 | 15.6% | 19 | 134 | 125 | 19.8% |
| 4 | 0 | -384 | 0 | 18 | 142 | 97 | 15.6% | 17 | 82 | 115 | 18.3% |
| 5 | 2 | -333 | 0 | 17 | 111 | 97 | 15.6% | 16 | 42 | 105 | 16.9% |
| 6 | 3 | -278 | 0 | 17 | 84 | 97 | 15.6% | 14 | 12 | 96 | 15.5% |
| 7 | 5 | -216 | 0 | 16 | 59 | 97 | 15.6% | 14 | -6 | 88 | 14.2% |
| 8 | 7 | -150 | 0 | 15 | 37 | 97 | 15.6% | 13 | -14 | 81 | 13.0% |
| 9 | 9 | -78 | 0 | 15 | 17 | 97 | 15.6% | 13 | -12 | 74 | 11.8% |
| 10 | 11 | 0 | 0 | 14 | 0 | 98 | 15.6% | 13 | 0 | 68 | 10.8% |

**Product:** 10-year stepped premium term insurance
**Liability basis:** BEB: realistic (as below), CB1: mortality + 25%, CB2: expenses + 220%
**Mortality:** 85% of IA95-97 ultimate rates for a male age 45 exact at policy commencement
**Lapses rates:** 12% in years 1 & 2 and 10% p.a. thereafter
**Initial expenses:** $70
**Renewal expenses:** $70 p.a. from Year 2 onwards with an expense inflation rate of 2% p.a.
**Initial commission:** 20% of the initial premium
**Renewal commission:** 20% of subsequent premiums
**Interest and discount rates:** 3% p.a.
**Profit margin:** 10% of premiums

When calculating a liability, all future expected movements should be in line with the valuation basis. However, if we want to calculate today a liability at a future date then we need to project from now until the future valuation date using best estimate assumptions. That will provide us with the best estimate of the number and amount of contracts in force at the future valuation date. Liabilities then calculated at that future valuation date will use the valuation basis in subsequent years.

We have used a modelling simplification in calculating the numbers in Table 6.5; the number of policies in force at the start of each year are derived from the particular valuation basis. However, actual cash flows used to calculate profit are the best estimate cash flows shown in Table 6.4.

For Conservative Basis 1, the basis has conservative mortality rates and hence the predicted in-force is lower than the best estimate basis. A consequence is that the liabilities shown under Conservative Basis 1 for Year 1 onwards are slightly understated relative to what they would be if we had projected forward using best estimate assumptions. A more accurate model would require two projections of mortality: one for survivals and the other for the conservative liabilities.

**Exercise 6.2**

Why doesn't the modelling simplification impact Conservative Basis 2?

The present value of planned profit is equal to $540, or 10% of the present value of premiums. This is the same under all three bases, with only the timing of profit release being different. As we have assumed the same investment earnings and discount rates, the present value of profit is unaffected by the timing of its release. You should verify that this is the case.

**Exercise 6.3**

A profit signature is a graph showing profit emerging each year. Graph the profit signatures under each of the three bases shown in Table 6.5. How might senior management react differently to each of these profit signatures?

Key features of the profit emerging under each of the three valuation bases in Table 6.5 are as follows:

- The policy is priced to achieve a planned margin of 10% of premium. Under none of the bases, however, does the profit in a year equal 10% of the premium received for that year.
- Under the Best Estimate basis:
  - Planned profits emerge entirely at time t = 0. Liabilities are negative as expected future premiums and investment income exceed expected outgoings. Profits for Year 1 onwards are zero. That is, year-end liability values reflect exactly the amounts required to meet expected future costs, allowing for future income.
- Under the Conservative Bases 1 and 2:
  - The higher liabilities, while providing margins for adverse contingencies, also act as a mechanism to delay the release of profit.
  - Losses are incurred in Year 0, representing the cost of funding reserves with conservative margins. Profits are released in later years due to the release of conservative margins in reserves.
  - While initial liability margins are higher under Conservative Basis 2 than 1, the different pattern of release means the liability margins are released earlier under Conservative Basis 2 than 1.
  - Under Conservative Basis 1, profit in Years 1 to 10 are uniform as a percentage of premium, 15.6%. Liability margins under Conservative Basis 1 are based on mortality or claims rates. These margins change in line with premiums, which are also set as a multiple of claims rates. Under Conservative Basis 2, profit as a percentage of premium is more variable. You should consider the method of calculation of the liability margins and how this affects the timing of the release as the portfolio runs off.

**Exercise 6.4**

Why might management prefer to recognise all profits at the commencement of a policy? What might be the problems with this approach?

## 6.3.2. Profit release through explicit profit margins

The use of conservative margins in calculating liability values can be a mechanism for deferring the release of planned profit. Another method of deferring the release of planned profit is to incorporate deliberate profit margins in the liability basis to adjust liability values and thereby achieve a desired pattern of release of planned profit over time.

In the example in Table 6.5, the value of planned profit at the assumed discount rate, 3%, was $540. If liabilities were calculated using the best estimate valuation basis, the value of liabilities at policy inception (i.e. after the contract was written but before any cash flows occurred) would be -$540 and the profit emerging at that point would be $540. If a liability margin of $540 was added to the liability value calculated at inception, the total policy liability would be zero and the profit arising at issue would be zero. If the margin added was then reduced gradually over future years, profit could be recognised as a gradual release of planned margins. The reduction in the liability margin in each period is referred to as a release or 'unwind' of the margin.

Methodologies under Australian accounting standards provide for the smooth release of profit in this way. The margin added can be calculated as a percentage of a business driver, referred to as a 'profit carrier'. The profit carrier is typically an underlying cash flow or other variable whose pattern over time is considered to represent the pattern of the provision of services by the life company under the contract. A profit carrier smooths the release of profit in line with the provision of services of the life insurer.

In the example in Table 6.5, a margin of 10% of the value of future premiums would equal $540 and would result in no profit being recognised at policy inception.

In the example in Table 6.5, if the margin for liability adjustment was set at a constant 10% of expected future premiums, the value of the margin would reduce as the portfolio of policies ran off and expected future premium income reduced. If experience was exactly as expected, then 10% of premiums would be released from the liability margin each year. The planned profit emerging each year would therefore be 10% of the premium income in that year.

Another way to think of this is that adding a planned profit margin to policy liabilities treats planned profit as an item of planned outgo, in the same way as claims or expenses. As the liability unwinds, the planned profit margin, which is not required to meet costs, is released to profit.

Continuing the stepped premium term example from Section 6.3.1, Table 6.6 illustrates a methodology for adding an explicit liability margin, calculated as a percentage of premiums, to achieve a desired release of planned profit.

### Table 6.6: Adding explicit profit margins to the liability

| | Best Estimate Basis | | | | Best Estimate Basis | | | |
|---|---|---|---|---|---|---|---|---|
| Year | Premiums | Claims | Expenses | Net Cash Flow | Best Estimate Liability before profit margin | Value of future premiums | Value of expected future profit margins | Liability with profit margin |
| t=0 | | | | | -540 | 5419 | 540 | 0 |
| 1 | 667 | -428 | -203 | 35 | -507 | 4894 | 488 | -19 |
| 2 | 638 | -409 | -189 | 39 | -470 | 4385 | 437 | -33 |
| 3 | 614 | -394 | -178 | 42 | -429 | 3884 | 387 | -42 |
| 4 | 607 | -390 | -172 | 45 | -384 | 3376 | 337 | -47 |
| 5 | 605 | -388 | -167 | 49 | -333 | 2854 | 285 | -49 |
| 6 | 603 | -387 | -163 | 53 | -278 | 2319 | 231 | -46 |
| 7 | 603 | -387 | -160 | 56 | -216 | 1767 | 176 | -40 |
| 8 | 604 | -388 | -156 | 60 | -150 | 1198 | 119 | -30 |
| 9 | 607 | -390 | -154 | 63 | -78 | 609 | 61 | -17 |
| 10 | 609 | -391 | -152 | 66 | 0 | 0 | 0 | 0 |

**Product:** 10-year stepped premium term insurance
**Liability basis:** Realistic with explicit profit margins added
**Mortality:** 85% of IA95-97 ultimate rates for a male age 45 exact at policy commencement
**Lapses rates:** 12% in years 1 & 2 and 10% p.a. thereafter
**Initial expenses:** $70
**Renewal expenses:** $70 p.a. from Year 2 onwards with an expense inflation rate of 2% p.a.
**Initial commission:** 20% of the initial premium
**Renewal commission:** 20% of subsequent premiums
**Interest and discount rates:** 3% p.a.
**Profit margin:** 10% of premiums

The planned profit margin as a percentage of the value of premiums, calculated at the outset, is $540 / $5,419 = 10%. The best estimate liability is -$540. That is, the value of expected future income exceeds outgo by $540 at the outset. By adding the present value of expected future profits, the liability value increases to zero at the outset. Liability values are calculated each year as the liability before margins, being the best estimate liability, plus the present value of future profit margins. As the portfolio runs off, the values of future profit margins decrease and therefore the liability adjustment reduces.

Table 6.7 shows the impact of this liability adjustment on profit released each year. Liability values used to calculate profit in Table 6.7 comprise the best estimate liability plus the value of expected future margins.

Profit is assumed to be released at the end of the year, whereas premiums are received at the start. We have assumed (Section 6.1.3) that profit, expressed as a percentage of the premium, uses the profit for the year discounted to the start of the year at the assumed discount rate. By calculating the percentage in this way the value of profit emerging each year is the planned margin of 10%, if experience follows assumptions. If the undiscounted profit was used, the margin shown would be 10.3% as one year's interest is earned on the planned margin until its release.

**Table 6.7: Liabilities with and without an explicit profit margin**

| Year | Best Estimate Basis | | | Best Estimate Basis with Profit Margin | | | |
|---|---|---|---|---|---|---|---|
| | Liability | Interest | Profit | Liability | Interest | Profit | Profit % Prem |
| 1 | -507 | 14 | 557 | -19 | 14 | 69 | 10.0% |
| 2 | -470 | -2 | 0 | -33 | 13 | 65 | 10.0% |
| 3 | -429 | -1 | 0 | -42 | 12 | 63 | 10.0% |
| 4 | -384 | 0 | 0 | -47 | 12 | 62 | 10.0% |
| 5 | -333 | 2 | 0 | -49 | 12 | 62 | 10.0% |
| 6 | -278 | 3 | 0 | -46 | 12 | 62 | 10.0% |
| 7 | -216 | 5 | 0 | -40 | 12 | 62 | 10.0% |
| 8 | -150 | 7 | 0 | -30 | 12 | 62 | 10.0% |
| 9 | -78 | 9 | 0 | -17 | 13 | 62 | 10.0% |
| 10 | 0 | 11 | 0 | 0 | 13 | 63 | 10.0% |

**Product:** 10-year stepped premium term insurance
**Liability basis:** Realistic gross premium with and without explicit profit margins added
**Mortality:** 85% of IA95-97 ultimate rates for a male age 45 exact at policy commencement
**Lapses rates:** 12% in years 1 & 2 and 10% p.a. thereafter
**Initial expenses:** $70
**Renewal expenses:** $70 p.a. from Year 2 onwards with an expense inflation rate of 2% p.a.
**Initial commission:** 20% of the initial premium
**Renewal commission:** 20% of subsequent premiums
**Interest and discount rates:** 3% p.a.
**Profit margin:** 10% of premiums

In Table 6.7, planned profit released each year is exactly 10% of premiums received for that year. It is important to note that the use of premiums as a driver of planned profit or profit carrier is one possible approach. Other business drivers or carriers could also be used, such as expected claims or expenses.

In the above examples, the profit margin of 10% of premiums could instead be expressed as 15.5% of the present value of claims. The same methodology could be applied, but instead using claims as the planned carrier. Profit would therefore emerge or be recognised in line with claim payments. Use of different profit carriers will change the timing of planned releases of profit.

The selection of a suitable profit carrier can be subjective, as insurers provide a number of services to policy owners which all contribute to the earning of profits. There are differing views as to when profit should be recognised and methods for the orderly release of profits are a key focus of accounting standards internationally. The AASB and increasingly the International Accounting Standards Board have expressed the view that profit should be recognised at the time it is 'earned'. This raises the issue of when profit is deemed to be earned.

The services provided under a long-term contract include premium renewal, payment of claims and communications. Profit could be considered as earned as these services are provided. For an endowment insurance policy, a large part of the payments to customers are expected to occur at the end of the contract term. The services of receiving and investing premiums and providing insurance cover are provided throughout the contract term.

**Exercise 6.5**

1. How would you select an appropriate driver for the release of planned profit? Consider the different types of products that may be sold and their features.
2. Adjust the spreadsheet example for Table 6.6 and Table 6.7 to calculate profit where claims and then expenses are selected as drivers or 'carriers' of profit. Note the differences in the emergence of planned profits. Write a note to a CFO explaining the differences.

**Exercise 6.6**

1. The risk business manager says he understands that business is more profitable the longer it stays on the books. He has therefore asked you why planned profit margins do not increase in later years in your projections. Draft a response to the manager.
2. You should use and adapt the projection spreadsheet underlying Table 6.6 and Table 6.7 to develop other examples, varying product features and assumptions and explaining the effects on liability values and profit.

## 6.3.3. Planned profit and actual experience

The examples provided in this module so far have assumed that actual experience throughout the life of the policy or group of policies is exactly the same as that assumed at policy commencement. In practice, this never happens. Actual experience may sometimes be close to that originally assumed but will never be exactly the same!

Actual profit earned over the life of the policies will depend on the actual experience that emerges. The example in Table 6.8 is based on the simplified, 5-year level premium term example from Table 6.1, where planned margins are zero. If claims in each of years 2 and 3 are 20% higher than originally expected, the profit emerging or earned each year would be as follows:

**Table 6.8: Actual experience (claims) different to expected**

| Year | Premiums | Claims | Expenses | Net Cash Flow | Liability | Chane in Liability | Profit |
|---|---|---|---|---|---|---|---|
| 1 | 781 | -619 | 0 | 162 | 162 | -162 | 0 |
| 2 | 659 | -709.2 | 0 | -50.2 | 230 | -68 | -118.2 |
| 3 | 589 | -717.6 | 0 | -128.6 | 221 | 9 | -119.6 |
| 4 | 526 | -605 | 0 | -79 | 142 | 79 | 0 |
| 5 | 469 | -611 | 0 | -142 | 0 | 142 | 0 |

**Product:** 5-year level premium term insurance
**Liability basis:** n/a
**Sum insured:** $100,000
**Investment earnings:** 0%
**Discount rates:** 0%
**Profit margin:** $0
**Experience:** claims in years 2 and 3 20% higher than expected

The planned profit margin is still zero. However, the actual profit earned over the five years is equal to the experience profit of -118.2 in Year 2 and -119.6 in Year 3, a total loss of 237.8 over the five years. This will be the same irrespective of the approach used to calculate the value of policy liabilities.

Here, policy liabilities are assumed not to be affected by the adverse claims. In practice, adverse claims can impact future liability values in two ways:

- The actuary needs to assess whether higher claims are random variations or indicate a change in the underlying expected level of claims. The latter would typically require a change to assumptions used to calculate liability values.
- Higher claims costs due to higher claims rates are likely to result in a reduction in the number of policies in force and will result in faster run-off of the portfolio.

## 6.3.4. Accounting profit and distributable profit

It is important to understand the difference between accounting and distributable profit and how the valuation basis can impact each of these.

Accounting profit is the profit determined according to accounting standards. It is frequently defined as income less outgo, less the change in the value of policy liabilities over a period (Formula 6.1). Accounting standards are designed to create consistency in the measurement of profit over time, between insurers and, where appropriate, across industries. Consistency is an important theme in the development of standards.

Determining accounting profit requires the valuation of policy liabilities at the end of each period. In Australia, these are assessed on a best estimate basis with the addition of profit margins to achieve a release of profit in line with the provision of services. A best estimate basis has no deliberate over or under statement of assumed experience. If probability distributions are symmetrical, a best estimate will prove inadequate 50% of the time.

Regulators, however, require life companies to demonstrate that they could meet claim payments and other obligations in a range of adverse circumstances. To achieve this, life insurers are required to hold additional reserves or margins for adversity over the best estimate cost of their liabilities. The additional reserves are also referred to as 'risk capital' and are discussed in detail in Module 14 (Capital).

The required level of capital may be determined by assessing the likely financial impact of specific risks affecting the business and adding liability margins based on these assessments. Alternatively, the capital may be determined implicitly, using a conservative basis for the valuation of liabilities, resulting in higher liability values. An example is the deliberate use of mortality assumptions that are 20% higher than expected. In some jurisdictions, life insurers are required to value liabilities only on a conservative basis and report profit on this basis. Liabilities calculated in this way may be referred to as solvency liabilities, containing solvency margins to support the ongoing solvency of the company.

As life companies are required to hold solvency margins, the accounting profit earned in a period may not be distributable to shareholders (or participating policy owners). Distributable profit is the amount of profit that can be distributed in a period. It is calculated in a similar way to accounting profit: income less outgo, less the change in the value of liabilities over a period. The difference is that the liabilities are determined on a solvency basis. Alternatively, distributable profit can be determined as accounting profit plus the net release of solvency margins in excess of balance sheet policy liabilities.

Solvency margins may be funded by shareholder equity, that is, through funding provided by shareholders or by retaining accounting profits rather than distributing them as dividends. In practice, a company's capital will be funded from both shareholder equity and retained profits. The mutual life insurance model does not assume future access to shareholder capital markets; the main source of funding for solvency margins is therefore retained surplus.

This raises a question as to whether accounting or distributable profits are more appropriate for assessing the performance or progress of a company. The views of regulators have changed over time. This reflects changes in the types of products sold and significant increases in computing power, enabling more sophisticated modelling and reporting. In the past, liability values were more likely to contain deliberate, but not necessarily well quantified, margins for conservatism. Profit was measured using conservative bases and therefore included implicit capital margins. Participating business was sold extensively. Under this business model, risks and experience profits on portfolios of policies were shared between policy owners and shareholders. Australian regulation and the International Accounting Standards Board now favour realistic profit reporting and a clear distinction between profit and capital margins.

Table 6.9 illustrates the distinction between accounting and distributable profit for a level premium term policy.

The valuation bases used are as follows:

- **BE + PM Basis:** Realistic basis, plus a margin for the orderly release of profit. This basis is typical of accounting bases used in Australia and will be used to assess accounting profit.
- **Conservative Basis 1** with mortality assumed to be 25% higher than under the Best Estimate Basis and no explicit profit margin. This basis contains a margin for conservatism and will be used to assess distributable profit.

### Table 6.9: Accounting vs. distributable profit

| Year | BE + PM Basis | | | | Conservative Basis 1 | | | |
|---|---|---|---|---|---|---|---|---|
| | Interest | Liability | Profit | Profit % Prem | Interest | Liability | Profit | Profit % Prem |
| t=0 | | 0 | 0 | 0.0% | | 301 | -301 | -30.4% |
| 1 | 21 | 192 | 99 | 10.0% | 30 | 493 | 107 | 10.8% |
| 2 | 24 | 333 | 87 | 10.0% | 33 | 628 | 102 | 11.8% |
| 3 | 26 | 427 | 76 | 10.0% | 35 | 709 | 99 | 12.9% |
| 4 | 27 | 479 | 69 | 10.0% | 36 | 741 | 97 | 14.2% |
| 5 | 27 | 489 | 62 | 10.0% | 35 | 723 | 97 | 15.7% |
| 6 | 26 | 461 | 55 | 10.0% | 33 | 661 | 97 | 17.4% |
| 7 | 24 | 397 | 50 | 10.0% | 30 | 556 | 97 | 19.4% |
| 8 | 21 | 297 | 45 | 10.0% | 26 | 410 | 97 | 21.6% |
| 9 | 17 | 164 | 40 | 10.0% | 21 | 223 | 97 | 24.1% |
| 10 | 12 | 0 | 36 | 10.0% | 14 | 0 | 97 | 26.8% |

**Product:** 10-year level premium term insurance
**Liability basis:** BEB1: realistic with explicit profit margins, CB2: mortality + 25%, no explicit profit margins
**Interest**: 3% p.a.
**Profit margin:** 10% of premiums
**Experience:** as expected

The negative profit shown at inception under Conservative Basis 2 represents the initial cost of establishing conservative margins, which are released as the business runs off.

Liabilities under Conservative Basis 2 include margins for solvency or adversity due to the conservative assumption delaying the release of profit. Profit shown under Basis 1 can be considered accounting profit and under Basis 2 the profit can be considered to measure distributable profit, which includes accounting profit plus the net flow of capital margins above the accounting liability.

If the company was required to hold solvency liabilities under Conservative Basis 2, the accounting profit in Year 1 would be $99 but the amount that could be distributed in Year 1 would be -$203 (107 - 301). This means that, in respect of this business, the company would report profit of $99 in Year 1 but would require a capital injection of $203 to meet the cost of establishing reserves.

To illustrate the significance of the distinction between accounting and distributable profit, the values of the respective profit streams to a shareholder can be calculated, as shown in Table 6.10. The valuation of profit streams at a higher risk discount rate which allows for future uncertainty is common practice and is discussed in Module 15 (Appraisal values).

**Table 6.10: Present value of accounting and distributable profits**

| Basis | Value of profits |
|---|---|
| Best Estimate Basis 1 (with explicit profit margin): | $436 |
| Conservative Basis 2: | $365 |

**Product:** 10-year level premium term insurance
**Liability basis:** BEB: realistic with explicit profit margins, CB2: mortality + 25%, no explicit profit margins
**Interest:** 3% p.a.
**Discount rate:** 8.5% p.a.
**Profit margin:** 10% of premiums
**Experience:** as expected

In Table 6.10, the assumed investment earning rate (3%) is lower than the discount rate (8.5%). Profits that are distributable sooner therefore have a higher value. A higher value is attributed to the profit stream under Best Estimate Basis 1 due to the earlier pattern of release. The difference is described as the economic cost of holding capital.

## 6.4. Deferral of acquisition costs

Acquisition costs are those incurred in acquiring new business. For life insurers, acquisition costs include costs of selling new business and related administrative processes, such as underwriting. Acquisition costs may be incremental and apply only on the actual sale of a new policy. The most obvious example here is initial commissions, which, depending on the type of product, are typically paid as a percentage of the new annualised premium. Acquisition costs may also refer to costs that relate to the acquisition of new business but would be incurred whether or not new policies are actually sold. Examples are underwriting costs and advertising costs. Costs associated with the development of supporting new business administration or underwriting systems may also be classified as acquisition costs.

Often the costs of acquisition are considerably greater than initial premium or fee income and are expected to be recovered from future premium or fee income. If the full amount of acquisition costs were included in the calculation of profit, without adjustment, profitable new business would contribute losses in its first year and profits thereafter. Companies that are new or growing their business quickly would appear less profitable than companies with more mature portfolios of policies.

Many other industries also incur high costs of acquiring business and seek to recover these costs from future revenue or fee income. Examples include software, mining and telecommunications companies.

Accounting standards internationally tend to provide rules and methodologies for adjusting the impact of acquisition costs on reported profit by spreading them over a number of years. Approaches to achieve the spreading of acquisition costs are described in the following sections.

## 6.4.1. Creating a DAC asset

One approach to spreading acquisition costs is to create an asset equal to the acquisition costs paid, referred to as a Deferred Acquisition Cost asset (DAC). The DAC essentially recognises immediately the value of future margins in premiums or fees for the recovery of acquisition costs and the recognition of this asset offsets the cost. The DAC represents an investment in the policies issued that is, as yet, unrecovered. In accounting terminology, the DAC is capitalised as an intangible asset to match costs with related revenues.

Over time, the DAC is written down (reduced), which causes acquisition costs to be gradually recognised as an expense. The process of recognising the costs in the income statement by reducing the DAC asset is referred to as 'amortisation' and results in acquisition costs being spread over a number of years.

Ideally, the acquisition expense recovery margins earned should exactly offset the fall in value or amortisation of the DAC. In practice, rules for DAC assets and their amortisation vary. For instance, the DAC may reduce linearly over a number of years but future fees may increase with account balances. The timing of fees may therefore not exactly match the amortisation of the DAC.

The following example demonstrates an approach to the capitalisation and amortisation of acquisition costs. In this example, amortisation of the DAC and the earning of fees for the recovery of acquisition costs are perfectly matched.

**Example: Creating a DAC asset**

A software company sells complex software solutions. It spends a lot of time and resources working with potential clients to win contracts and tailor its solutions. The company expects to recover the costs of winning new contracts from annual licence fees on its software.

Acquisition and development costs are $750,000. The company receives licence fees of $275,000 p.a. and incurs ongoing costs of $50,000 p.a.. The company expects to recover its acquisition costs from these fees over 5 years while still making a profit each year.

The margin generated each year is $275,000 - $50,000 = $225,000. This margin can be split into two parts.

1. Acquisition expense recovery: $750,000 / 5 = $150,000; and
2. The residual margin: $225,000- $150,00 = $75,000

Instead of reporting a loss of $525,000 ($275,000-$50,000-$750,000) in Year 1 and profit of $225,000 ($275,000-$50,000) for the next 4 years, the company uses a capitalisation and amortisation approach and reports a profit of $75,000 in each of the 5 years, as described below.

Firstly, an asset of $750,000 is created. The acquisition expense is 'capitalised' or recognised as a DAC asset. The DAC asset is amortised (or depreciated), on a straight-line basis at $150,000 per year, to zero after 5 years.

Profit each year is defined as income less outgo. Income includes the value of the DAC asset in the year that it is 'acquired', Year 1. Outgo includes the amortisation of the DAC each year. Profit is calculated as follows:

Year 1: $275,000 (fee) - $50,000 (ongoing costs) - $750,000 (initial cost) + $750,000 (DAC asset) - $150,000 (first year's amortisation of the DAC) = $75,000

Years 2 to 5: $275,000 (fee) - $50,000 (ongoing costs) - $150,000 (amortised asset) = $75,000

Note that in Year 1, profit includes both the creation of the DAC asset and the first year's amortisation.

**Exercise 6.7**

Students should construct an example where fees and DAC asset amortisation do not match. What problems arise if the time period for amortisation of the DAC asset exceeds the period over which fees are recovered?

## 6.4.2. Deferral of acquisition costs through policy liabilities

For life insurers, policy acquisition costs may be spread over a number of years by adjusting the value of policy liabilities, rather than by creating an asset.

In Section 6.3.2, the use of margins to adjust the timing of release of planned profits was examined. Liability values were increased by adding margins to delay the release of profit. The increase to liability values was withdrawn gradually, creating an orderly release of profit over the life of the business.

The deferral of acquisition expenses by adjusting liability values operates in a similar way, except that a margin for acquisition expense recovery is subtracted from liability values. By subtracting a margin, liability values are decreased, not increased as per profit margins. Reducing liability values has the same impact on net assets as creating a DAC asset. The margin used to decrease liabilities for acquisition expenses is then gradually withdrawn in subsequent years, in the same way as a DAC asset is amortised. Future reductions in the liability margin result in acquisition expenses being spread over future years.

For example, assume that the best estimate liability calculated at policy issue, using the original pricing basis but assuming no initial expenses, is -$1,000. The details of the policy and its pricing basis are not important for this example. The negative best estimate liability represents the value of future planned profit margins, as the policy has been priced to make a profit. The total policy liability includes a margin for the orderly release of planned profit. Ignoring acquisition costs for the moment, a planned profit margin of $1,000 is added to the best estimate liability and this would be reduced gradually in future years. The total liability at the outset, made up of the best estimate liability plus the profit margin, is zero, before allowance for acquisition costs.

Now assume that acquisition costs under the policy are $300. The best estimate liability at the outset, before any cash flows have occurred, is now -$700 (-$1000 + $300). However, the best estimate liability one day after the policy has been issued and acquisition costs have been paid is -$1000. If the margin added for the orderly release of profit is $700, the policy liability would be zero at the outset, before any cash flows had occurred, and -$300 (-$1,000 + $700) on day 1, after acquisition costs had been paid.[2]

Looking at the impact on the company one day after the policy has been issued, the company would incur acquisition costs of $300 and report a change in the value of policy liabilities of -$300. If profit for a period is calculated as net cash flow plus change in liabilities over the period, the total profit impact on sale of the policy is therefore zero. The negative liability has offset the impact of acquisition costs. The negative liability of -$300 operates as a DAC asset. Acquisition costs are gradually recognised in future years as the business runs off and the negative adjustment diminishes.

In practice, liability adjustment margins for DAC may be incorporated into one overall adjustment margin for both planned profit and deferment of acquisition costs. Alternatively, separate acquisition expense adjustment margins may be used. Later in this module in Section 6.7, methodologies for the valuation of group risk are examined and an accumulation approach is presented where explicit liability margins are used to spread acquisition costs over future years.

[2] For this example, we will ignore the impact of the first premium being paid soon after policy issue.

The application of margin adjustments to spread acquisition costs is illustrated in Table 6.11 and Table 6.12, which are based on the same stepped premium term policy example from Sections 6.3.1 and 6.3.2. A difference is that for the example in Table 6.11, initial commissions of 100% of premium and lower (10%) renewal commission are assumed, rather than a level 20% commission. Renewal commission from Year 2 onwards is included in 'Ongoing Expenses' in Table 6.11.

**Table 6.11: Deferral of acquisition costs by adjusting policy liabilities — cash flows**

| | Cash flow projection | | | | |
|---|---|---|---|---|---|
| Year | Premiums | Claims | Acquisition Expenses | Ongoing Expenses | Net Cash Flow |
| | | | | | |
| 1 | 667 | -428 | -667 | -70 | -498 |
| 2 | 638 | -409 | 0 | -125 | 103 |
| 3 | 614 | -394 | 0 | -117 | 103 |
| 4 | 607 | -390 | 0 | -111 | 106 |
| 5 | 605 | -388 | 0 | -107 | 110 |
| 6 | 603 | -387 | 0 | -103 | 113 |
| 7 | 603 | -387 | 0 | -99 | 117 |
| 8 | 604 | -388 | 0 | -96 | 120 |
| 9 | 607 | -390 | 0 | -93 | 124 |
| 10 | 609 | -391 | 0 | -91 | 127 |

**Product:** 10-year stepped premium term insurance
**Liability basis:** n/a
**Mortality:** 85% of IA95-97 ultimate rates for a male age 45 exact at policy commencement
**Lapses rates:** 12% in years 1 & 2 and 10% p.a. thereafter
**Initial expenses:** $70
**Renewal expenses:** $70 p.a. from Year 2 onwards with an expense inflation rate of 2% p.a.
**Initial commission:** 100% of the initial premium
**Renewal commission:** 10% of subsequent premiums
**Interest and discount rates:** 3% p.a.
**Profit margin:** 10% of premiums

In Table 6.11, high initial commission causes net cash flow to be negative in Year 1. Net cash flow is positive thereafter.

Table 6.12 shows the adjustment made to liabilities each year to explicitly include margins for both gross profits and deferral of acquisition costs.

**Table 6.12: Deferral of acquisition costs by adjusting policy liabilities**

| Calculation of liabilities including DAC | | | | | | |
|---|---|---|---|---|---|---|
| Year | Liability before margins | Value of future premiums | Planned margin (% premiums) | | | Liability with all margins |
| | | | Gross 21.2% | AC recovery -12.3% | Net 8.9% | |
| 0 | -482 | 5419 | 1149 | -667 | 482 | 0 |
| 1 | -997 | 4894 | 1038 | -603 | 435 | -562 |
| 2 | -909 | 4385 | 930 | -540 | 390 | -519 |
| 3 | -818 | 3884 | 824 | -478 | 345 | -472 |
| 4 | -722 | 3376 | 716 | -416 | 300 | -421 |
| 5 | -619 | 2854 | 605 | -351 | 254 | -365 |
| 6 | -509 | 2319 | 492 | -285 | 206 | -303 |
| 7 | -393 | 1767 | 375 | -218 | 157 | -236 |
| 8 | -270 | 1198 | 254 | -147 | 107 | -163 |
| 9 | -138 | 609 | 129 | -75 | 54 | -84 |
| 10 | 0 | 0 | 0 | 0 | 0 | 0 |

**Product:** 10-year stepped premium term insurance
**Liability basis:** Realistic gross premium with explicit profit and DA recovery margins added
**Mortality:** 85% of IA95-97 ultimate rates for a male age 45 exact at policy commencement
**Lapses rates:** 12% in years 1 & 2 and 10% p.a. thereafter
**Initial expenses:** $70
**Renewal expenses:** $70 p.a. from Year 2 onwards with an expense inflation rate of 2% p.a.
**Initial commission:** 100% of the initial premium
**Renewal commission:** 10% of subsequent premiums
**Interest and discount rates:** 3% p.a.
**Profit margin:** 10% of premiums

From Table 6.12, the present value of premiums is $5,419 and the present value of profits is $482. The best estimate liability is -$482. That is, the present value of expected future income exceeds outgo by $482 at the outset.

The planned profit margin as a percentage of the value of premiums, calculated at the outset, is $482 / $5,419 = 8.9%. The 8.9% planned margin can be considered as being:

- a gross margin ignoring acquisition costs of 21.2%

  less

- a margin for acquisition cost recovery of 12.3% (calculated by dividing acquisition costs by the value of future premiums: $667 / $5,419).

In this example, acquisition commissions are the only initial costs considered. Most regulations, including Australian standards, allow commissions plus a range of other costs of acquisition to be deferred in certain circumstances.

When the net profit margin of 8.9% of premiums is added to the value of liabilities, acquisition costs are spread and planned profit once again emerges uniformly as a percentage of premiums each year. This is shown in Table 6.13 under the scenario '(i) With DAC'.

### Table 6.13: Profits with and without deferral of acquisition costs

| Year | With DAC | | | | Without DAC | | | |
|---|---|---|---|---|---|---|---|---|
| | Liability | Interest | Profit | Profit % Prem | Liability | Interest | Profit | Profit % Prem |
| 1 | -562 | -2 | 61 | 8.9% | 41 | -2 | -541 | -78.8% |
| 2 | -519 | -1 | 58 | 8.9% | 21 | 17 | 139 | 21.2% |
| 3 | -472 | -1 | 56 | 8.9% | 6 | 16 | 134 | 21.2% |
| 4 | -421 | 1 | 56 | 8.9% | -6 | 15 | 133 | 21.2% |
| 5 | -365 | 2 | 55 | 8.9% | -14 | 15 | 132 | 21.2% |
| 6 | -303 | 4 | 55 | 8.9% | -18 | 15 | 132 | 21.2% |
| 7 | -236 | 6 | 55 | 8.9% | -18 | 15 | 132 | 21.2% |
| 8 | -163 | 8 | 55 | 8.9% | -16 | 15 | 132 | 21.2% |
| 9 | -84 | 11 | 56 | 8.9% | -9 | 15 | 133 | 21.2% |
| 10 | 0 | 13 | 56 | 8.9% | 0 | 15 | 133 | 21.2% |

**Product:** 10-year stepped premium term insurance
**Liability basis:** Realistic gross premium with explicit profit margins, with and without DAC margins
**Mortality:** 85% of IA95-97 ultimate rates for a male age 45 exact at policy commencement
**Lapses rates:** 12% in years 1 & 2 and 10% p.a. thereafter
**Initial expenses:** $70
**Renewal expenses:** $70 p.a. from Year 2 onwards with an expense inflation rate of 2% p.a.
**Initial commission:** 100% of the initial premium
**Renewal commission:** 10% of subsequent premiums
**Interest and discount rates:** 3% p.a.
**Profit margin:** 10% of premiums

If acquisition costs were not spread, as is shown under the '(ii) Without DAC' scenario, losses would emerge in Year 1 and a higher profit, equal to the gross margin, would emerge in Year 2 onwards.

**Exercise 6.8**

1. Assume you are investigating the impact of changes to rules allowing deferment of acquisition costs. You are moving from a 'Without DAC' model to a 'With DAC' model. Write an explanation to the CFO as to why policy liabilities will become negative and how this will impact calculated shareholder equity.
2. Students should construct examples of deferring acquisition costs for a range of other products including Level Term and Endowment using the spreadsheet provided for the example in Table 6.11, Table 6.12 and Table 6.13.

# 6.5. Unit linked policy example

## 6.5.1. Projection approach for unit linked

As discussed in Module 5 (Life valuation), the valuation of unit linked business is often performed by determining the value of unit balances (i.e. an accumulation approach). A gross premium projected cash flow may also be required to determine the value of any reserves required for expected temporary future mismatches. Mismatches occur where projected costs exceed fee income in a year, despite a contract being profitable overall.

The value of liabilities for unit linked policies can also be determined entirely using projection methods. A gross premium projection with realistic assumptions can be used to calculate a best estimate liability, or a more conservative basis may be adopted. Where expected future fees exceed expenses, an amount lower than the value of unit balances could theoretically be reserved and invested to meet the cost of future obligations.

To illustrate this simplistically, assume a policy where a single investment premium of $10,000 is invested for 10 years. There is no insurance rider cover and 100% of the amount invested is allocated to units at the end of the 10 years. The policy owner will receive the $10,000 accumulated with investment earnings. Expected investment earnings are 6% p.a. and the company charges a 1% fee, such that the balance each year increases by 5%. For simplicity, expenses are ignored in this example.

The benefit at maturity will be $16,289 (10,000 x $[(1 + 5\%)^{10}$). The company could reserve $9,096 (16,289 / 1.06^10) at the outset and would expect to earn 6% on this amount. The reserve would grow with earnings to equal the benefit amount after 10 years. The amount of $9,096 can be viewed as a best estimate liability. A company setting liabilities under this approach would show a profit of $904 in Year 1 (10,000-9,096).

Since there are no expenses in this simple example, the profit is the present value of future fees, discounted at 6% p.a..

The issue of the timing of the release of planned margins was discussed earlier in this module. It may not be appropriate for all profit to be recognised immediately on sale.

The use of liability margins to deliberately target a particular pattern of release of planned profit, as discussed in Section 6.3.2, can also be applied to the valuation of unit linked liabilities.

## 6.5.2. Profit release for unit linked

The example presented in this section relates to a 10 year, $10,000 single premium unit linked policy. Table 6.14 shows projected cash flows for this policy. Initial commissions are used in the examples in this section, although significant initial commissions are losing acceptance in the industry for these types of products. As discussed in 6.1.3, pricing bases and assumptions for examples are used to illustrate valuation techniques and are not necessarily indicative of those used in practice.

**Table 6.14: Unit linked policy cash flows**

| Year | Account (unit) balance | Premiums | Commissions | Expenses | Policy payments on termination | Net Cash Flow |
|---|---|---|---|---|---|---|
| 1 | 10,185 | 10,000 | -300 | -50 | 0 | 9,650 |
| 2 | 10,694 | 0 | 0 | -50 | 0 | -50 |
| 3 | 11,229 | 0 | 0 | -51 | 0 | -51 |
| 4 | 11,790 | 0 | 0 | -52 | 0 | -52 |
| 5 | 12,380 | 0 | 0 | -53 | 0 | -53 |
| 6 | 12,999 | 0 | 0 | -54 | 0 | -54 |
| 7 | 13,649 | 0 | 0 | -55 | 0 | -55 |
| 8 | 14,331 | 0 | 0 | -56 | 0 | -56 |
| 9 | 15,048 | 0 | 0 | -57 | 0 | -57 |
| 10 | 0 | 0 | 0 | -59 | -15,800 | -15,859 |

**Product:** $10,000 single premium unit linked policy. No attaching riders.
**Liability basis:** n/a
**Entry fee:** 3% of the single premium
**Ongoing fee**: 1% p.a. of the accumulated value of units
**Lapse rates:** No lapses assumed
**Surrender penalty:** None
**Initial commission:** 3% of the single premium
**Initial expenses:** $50
**Renewal expenses:** $50 p.a.
**Expense inflation:** 2% p.a.
**Investment earnings:** 6% p.a.
**Discount rate:** 6% p.a.

The net cash flows shown in Table 6.14 are before investment earnings. Two large cash flows occurring are the premium income of $10,000 at the start of Year 1 and the maturity proceeds of $15,800 paid to the policy owner at the end of Year 10.

The value of liabilities under four alternative bases and the projected planned profit arising using reserves based on these values are shown in Table 6.15.

The bases used are as follows:

- **Basis 1:** best estimate (BE) or realistic basis (consistent with the pricing basis used in Table 6.14) with no margins for adversity and no margins for the orderly release of planned profit;
- **Basis 2:** BE basis with a margin for the orderly release of planned profits. The profit carrier is expected future fees. There are no margins for adversity;
- **Basis 3:** policy owner unit balances at year end; and
- **Basis 4:** policy owner unit balances at year end plus a margin for adverse contingencies of 1% of the value of policy owner unit balances at year end.

## Table 6.15: Unit linked profit under four liability bases

### Basis 1: BE without margins

| Year | Policy liability | Interest | Inrease in liability | Profit |
|---|---|---|---|---|
| 1 | 9,740 | 579 | 9,740 | 489 |
| 2 | 10,271 | 581 | 531 | -0 |
| 3 | 10,833 | 613 | 562 | -0 |
| 4 | 11,428 | 647 | 595 | 0 |
| 5 | 12,058 | 683 | 629 | 0 |
| 6 | 12,724 | 720 | 666 | 0 |
| 7 | 13,429 | 760 | 705 | 0 |
| 8 | 14,175 | 802 | 746 | -0 |
| 9 | 14,965 | 847 | 790 | 0 |
| 10 | 0 | 894 | -14,965 | 0 |

### Basis 2: BE with profit margin

| Year | Policy liability | Interest | Inrease in liability | Profit |
|---|---|---|---|---|
| 1 | 10,178 | 579 | 10,178 | 51 |
| 2 | 10,682 | 608 | 504 | 54 |
| 3 | 11,213 | 638 | 531 | 56 |
| 4 | 11,771 | 670 | 559 | 59 |
| 5 | 12,359 | 703 | 588 | 62 |
| 6 | 12,978 | 738 | 619 | 65 |
| 7 | 13,630 | 775 | 652 | 68 |
| 8 | 14,316 | 814 | 686 | 72 |
| 9 | 15,039 | 856 | 723 | 75 |
| 10 | 0 | 899 | -15,039 | 79 |

### Basis 3: Account balance

| Year | Policy liability | Interest | Inrease in liability | Profit |
|---|---|---|---|---|
| 1 | 10,185 | 579 | 10,185 | 44 |
| 2 | 10,694 | 608 | 509 | 49 |
| 3 | 11,229 | 639 | 535 | 53 |
| 4 | 11,790 | 671 | 561 | 57 |
| 5 | 12,380 | 704 | 590 | 62 |
| 6 | 12,999 | 740 | 619 | 66 |
| 7 | 13,649 | 777 | 650 | 71 |
| 8 | 14,331 | 816 | 682 | 77 |
| 9 | 15,048 | 856 | 717 | 82 |
| 10 | 0 | 899 | -15,048 | 88 |

### Basis 4: Account balance+1%

| Year | Policy liability | Interest | Inrease in liability | Profit |
|---|---|---|---|---|
| 1 | 10,287 | 579 | 10,287 | -58 |
| 2 | 10,801 | 614 | 514 | 50 |
| 3 | 11,341 | 645 | 540 | 54 |
| 4 | 11,908 | 677 | 567 | 58 |
| 5 | 12,504 | 711 | 595 | 63 |
| 6 | 13,129 | 747 | 625 | 68 |
| 7 | 13,785 | 784 | 656 | 73 |
| 8 | 14,475 | 824 | 689 | 78 |
| 9 | 15,198 | 865 | 724 | 84 |
| 10 | 0 | 908 | -15,198 | 248 |

**Product:** $10,000 single premium unit linked policy. No attaching riders.
**Liability bases:** i) Realistic, ii) Realistic with profit margins, iii) Account balance, iv) Account balance +1%
**Entry fee:** 3% of the single premium
**Ongoing fee**: 1% p.a. of the accumulated value of units
**Lapse rates:** No lapses assumed
**Surrender penalty:** None
**Initial commission:** 3% of the single premium
**Initial expenses:** $50
**Renewal expenses:** $50 p.a.
**Expense inflation:** 2% p.a.
**Investment earnings:** 6% p.a.
**Discount rate:** 6% p.a.

The company would hold balance sheet reserves equal to the value of policy liabilities under each basis. The same cash flows, as shown in Table 6.14, are used in determining profit under each basis. Differences in profit are driven only by differences in the liability basis and method used, and investment income earned on the different reserves.

The present value of profit is the same under each basis. However, the following differences relating to the timing of profit and size of reserves can be observed:

- **Basis 1:**
  - all profit is recognised on day1; and
  - reserves are less than account balances. Since account balances are payable to the policy owner on voluntary surrender, a reserve less than the account balance is not adequate for solvency purposes.
- **Basis 2:**
  - shows how a profit margin can be added to the BE liability to achieve an orderly release of profit. Here, the profit carrier is the value of expected future fees, which move in line with account balances. The timing of profit release based on expected future fees may be considered to align with the level of investment and administrative services provided by the company in the management of these policies.
- **Basis 3:**
  - liabilities based on the account balance are larger, in every year, than those calculated on a best estimate basis without a profit margin (Basis (i));
  - liabilities are very similar to those calculated on a best estimate basis with a margin (Basis (ii)); and
  - the timing of profit arising is also very similar to that under Basis (ii).
- **Basis 4:**
  - liabilities are higher than those under the other three bases; and
  - the negative profit in Year 1 is due to the cost of the contingency margin, which is released as the business runs off.

As introduced in Exercise 6.3, a profit signature is a graph showing profit emerging each year. It provides a useful visual summary of the relative size and direction of profit (in this case planned profit) emerging from year to year.

**Figure 6.1: Unit linked profit signatures**

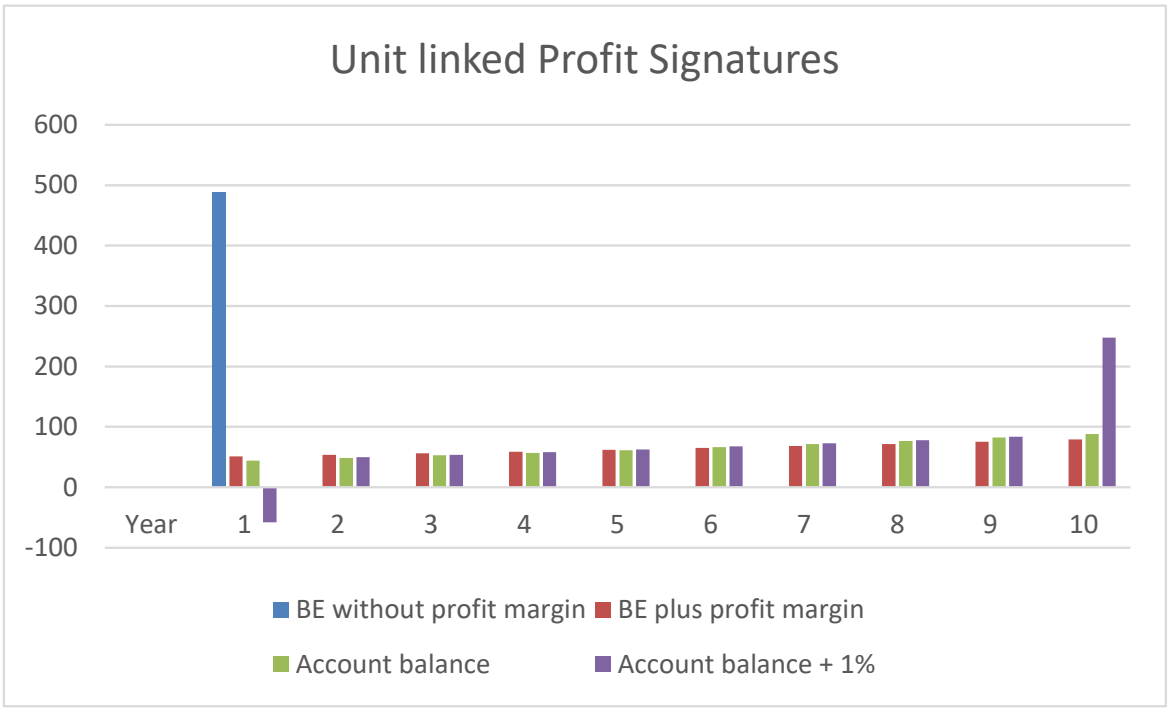



Figure 6.1 shows that:

- the timing of profit is similar under bases 2 (BE plus profit margin) and 3 (Account balance);
- all profit is recognised immediately under Basis 1 (BE without profit margin); and
- under Basis 4 (Account balance + 1%), there is a cost of creating a 1% contingency margin in Year 1 and this cost is largely released in Year 10.

## 6.5.3. Deferral of acquisition costs for unit linked

In Section 6.4.2, techniques for deferring acquisition expenses by subtracting a margin from the policy liability were discussed. The example below demonstrates the deferral of acquisition costs for unit linked business.

In the example in Section 6.5.2, initial commissions (3%) were matched by entry fees (3%) and therefore did not result in losses arising in Year 1. In the example in this section, initial commission is still 3% but a lower entry fee (1%) applies. A higher ongoing fee of 1.5% is assumed. Initial expenses ($100) are also higher than under the example in Section 6.5.2.

Table 6.16 shows the cash flows (before investment earnings) under this revised unit linked policy.

**Table 6.16: Unit linked policy cash flows — revised assumptions**

| Year | Account (unit) balance | Premiums | Commissions | Expenses | Policy payments on termination | Net Cash Flow |
|---|---|---|---|---|---|---|
| 1 | 8,276 | 10,000 | -300 | -100 | -2,069 | 7,531 |
| 2 | 7,784 | 0 | 0 | -40 | -865 | -905 |
| 3 | 7,321 | 0 | 0 | -37 | -813 | -850 |
| 4 | 6,885 | 0 | 0 | -34 | -765 | -799 |
| 5 | 6,476 | 0 | 0 | -31 | -720 | -750 |
| 6 | 6,090 | 0 | 0 | -28 | -677 | -705 |
| 7 | 5,728 | 0 | 0 | -26 | -636 | -663 |
| 8 | 5,387 | 0 | 0 | -24 | -599 | -623 |
| 9 | 5,067 | 0 | 0 | -22 | -563 | -585 |
| 10 | 0 | 0 | 0 | -20 | -5,295 | -5,315 |

**Product:** $10,000 single premium unit linked policy. No attaching riders.
**Liability bases:** n/a
**Entry fee:** 1% of the single premium
**Ongoing fee**: 1.5% p.a. of the accumulated value of units
**Lapse rates:** 20% in Year 1, 10% p.a. thereafter
**Surrender penalty:** None
**Initial commission:** 3% of the single premium
**Initial expenses:** $100
**Renewal expenses:** $50 p.a.
**Expense inflation:** 2% p.a.
**Investment earnings:** 6% p.a.
**Discount rate:** 6% p.a.

The value of liabilities under four alternative bases and the projected planned profit arising using reserves based on these values are shown in Table 6.17.

The bases used are as follows:

- **Basis 1:** best estimate (BE) or realistic basis (consistent with the pricing basis used in Table 6.16). The basis includes no margins for adversity and no margins for the orderly release of planned profit;
- **Basis 2:** BE basis with a margin for the orderly release of planned profits. The margin is calculated using the pricing basis in Table 6.16, which includes an allowance for initial costs;
- **Basis 3:** policy owner unit balances at year end without adjustment for acquisition costs ; and
- **Basis 4:** policy owner unit balances at year end less an explicit margin to spread initial costs. The amount of initial costs spread is $200. This is 2% of the single premium (3% commission less 1% initial fee). The Year 1 expense of $100 is not spread under this basis.

## Table 6.17: (Revised) Unit linked profit under four liability bases

### Basis 1: BE without margins

| Year | Policy liability | Interest | Inrease in liability | Profit |
|---|---|---|---|---|
| 1 | 7,808 | 576 | 7,808 | 299 |
| 2 | 7,370 | 466 | -439 | -0 |
| 3 | 6,959 | 440 | -410 | 0 |
| 4 | 6,576 | 416 | -383 | -0 |
| 5 | 6,218 | 393 | -358 | -0 |
| 6 | 5,885 | 371 | -334 | -0 |
| 7 | 5,574 | 352 | -311 | -0 |
| 8 | 5,284 | 333 | -290 | 0 |
| 9 | 5,015 | 316 | -269 | -0 |
| 10 | 0 | 300 | -5,015 | 0 |

### Basis 2: BE with profit margin

| Year | Policy liability | Interest | Inrease in liability | Profit |
|---|---|---|---|---|
| 1 | 8,054 | 576 | 8,054 | 53 |
| 2 | 7,585 | 481 | -469 | 44 |
| 3 | 7,146 | 453 | -439 | 42 |
| 4 | 6,735 | 427 | -411 | 39 |
| 5 | 6,350 | 402 | -385 | 37 |
| 6 | 5,989 | 379 | -361 | 35 |
| 7 | 5,651 | 358 | -337 | 33 |
| 8 | 5,336 | 338 | -316 | 31 |
| 9 | 5,041 | 319 | -295 | 29 |
| 10 | 0 | 301 | -5,041 | 27 |

### Basis 3: Account balance

| Year | Policy liability | Interest | Inrease in liability | Profit |
|---|---|---|---|---|
| 1 | 8,276 | 576 | 8,276 | -170 |
| 2 | 7,784 | 494 | -492 | 82 |
| 3 | 7,321 | 465 | -463 | 78 |
| 4 | 6,885 | 437 | -436 | 74 |
| 5 | 6,476 | 411 | -410 | 70 |
| 6 | 6,090 | 387 | -385 | 67 |
| 7 | 5,728 | 364 | -362 | 64 |
| 8 | 5,387 | 342 | -341 | 61 |
| 9 | 5,067 | 322 | -321 | 58 |
| 10 | 0 | 303 | -5,067 | 55 |

### Basis 4: Account balance with DAC adj.

| Year | Policy liability | Interest | Inrease in liability | Profit |
|---|---|---|---|---|
| 1 | 8,102 | 576 | 8,102 | 5 |
| 2 | 7,631 | 484 | -471 | 50 |
| 3 | 7,188 | 456 | -443 | 48 |
| 4 | 6,773 | 429 | -416 | 46 |
| 5 | 6,382 | 405 | -390 | 44 |
| 6 | 6,016 | 381 | -366 | 42 |
| 7 | 5,673 | 359 | -344 | 40 |
| 8 | 5,350 | 339 | -322 | 39 |
| 9 | 5,048 | 320 | -302 | 37 |
| 10 | 0 | 302 | -5,048 | 35 |

**Product:** $10,000 single premium unit linked policy. No attaching riders.

**Liability bases:** i) Realistic, ii) Realistic with profit margin, iii) Account balance, iv) Account balance with DAC adjustment

**Entry fee:** 1% of the single premium

**Ongoing fee**: 1.5% p.a. of the accumulated value of units

**Lapse rates:** 20% in Year 1, 10% p.a. thereafter

**Surrender penalty:** None

**Initial commission:** 3% of the single premium

**Initial expenses:** $100

**Renewal expenses:** $50 p.a.

**Expense inflation:** 2% p.a.

**Investment earnings:** 6% p.a.

**Discount rate:** 6% p.a.

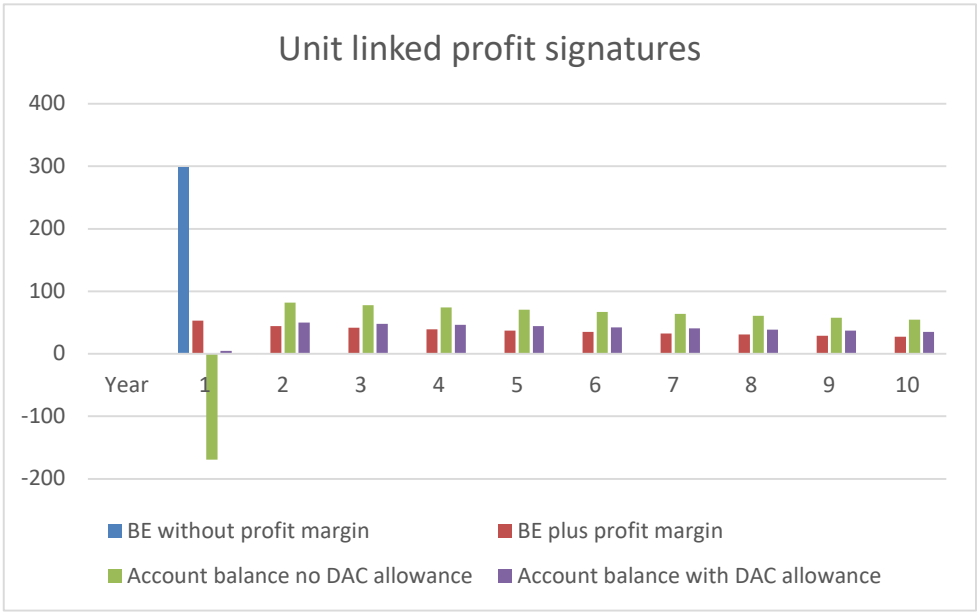
Profit is determined assuming the company would hold balance sheet reserves equal to the value of policy liabilities under each basis. The same cash flows, as shown in Table 6.16, are used in determining profit under each basis.

Once again, the present value of profit at the assumed discount rate, 6%, is the same under each basis, with the following differences related to the timing of release of profit:

- **Basis 1:** All future fees and costs are recognised at issue.
- **Basis 2:** The margin for adjusting liabilities for the orderly release of profit is determined net of initial costs, so initial costs are spread throughout the policy term.
- **Basis 3:** With no adjustment to the account balance to spread initial costs over time, initial costs cause losses in Year 1.
- **Basis 4:** The adjustment to the account balance to spread the impact of initial costs eliminates losses in Year 1 seen under Basis 3. The adjustment is amortised in line with the value of expected future fees. Profit is still lower in Year 1 than in later years. This is due to the higher administrative costs in Year 1 ($100) that are not spread. Accounting standards sometimes limit the initial costs that can be spread to those costs that strictly vary with sales volumes, such as commission.

A comparison of the profit signatures from Table 6.17 is shown in Figure 6.2.

**Figure 6.2: (Revised) Unit linked profit signatures**



**Exercise 6.9**

Comment on the different profit signatures shown in Figure 6.2.

# 6.6. Disability income policy example

## 6.6.1. Disability income liability for active lives

The example presented in this section is for a 10-year disability income policy, priced for a planned margin of 4.3% of premiums. The example demonstrates the application of a liability margin to spread acquisition costs and achieve a uniform emergence of planned profits for a disability income policy. The profit carrier used is expected premium income. The 'incidence and annuity' model for claims costs, introduced in Module 5 (Life valuation), is used here.

Table 6.18 shows the projected cash flows for this policy in respect of active lives (i.e. policy owners who have not yet claimed for disability cover under the policy as at the projection or valuation date). In this example, the pool of active lives includes all policy owners as our perspective is the commencement of the policy, before any policy owners have been able to claim.

### Table 6.18: Disability income policy (active lives) cash flows

| Year End | Premium | Comm | Expenses | Disability | Total |
|---|---|---|---|---|---|
| 0 | | | | | |
| 1 | 480 | -480 | -380 | -307 | -687 |
| 2 | 427 | -43 | -44 | -288 | 53 |
| 3 | 418 | -42 | -40 | -284 | 52 |
| 4 | 438 | -44 | -39 | -301 | 54 |
| 5 | 464 | -46 | -38 | -318 | 62 |
| 6 | 496 | -50 | -37 | -339 | 70 |
| 7 | 555 | -55 | -36 | -363 | 100 |
| 8 | 630 | -63 | -35 | -386 | 146 |
| 9 | 714 | -71 | -34 | -409 | 200 |
| 10 | 826 | -83 | -33 | -431 | 279 |

**Product:** Disability income insurance
**Liability basis:** n/a
**Claims incidence rates:** per spreadsheet based on a 1-month waiting period
**Claims continuance rates:** per spreadsheet based on a 1-month waiting period
**Occupation:** Clerical
**Lapse rates:** 15% in Year 1, 10% Year 2 and 5% p.a. thereafter
**Initial expenses:** $380
**Renewal expenses:** $50 p.a. from Year 2 onwards with expense inflation rate of 3% p.a.
**Claims expenses:** 3% of the cost of claims
**Initial commission:** 100% of initial premium
**Renewal commission:** 10% p.a. of renewal premiums
**Inflation rate**: 3% p.a., applied to expenses and the monthly benefit sum insured (the monthly income benefit payable on disablement is not indexed)
**Investment earnings:** 5% p.a.
**Discount rate:** 5% p.a.
**Profit margin:** 4.3% of premiums

Table 6.19 shows the profit emerging under this policy using a realistic liability basis with explicit profit margins added which include allowance for the deferral of acquisition expenses.

### Table 6.19: Disability income policy liability (active lives) with DAC

| Year End | Liability before profit margin | Value of future premiums | Value of expected profit | Liability with profit margin | Change in liability | Interest | Profit | Profit % Prem |
|---|---|---|---|---|---|---|---|---|
| 0 | -186 | 4292 | 186 | 0 | | | | |
| 1 | -902 | 4003 | 174 | -728 | 728 | -19 | 22 | 4.3% |
| 2 | -877 | 3755 | 163 | -714 | -14 | -19 | 19 | 4.3% |
| 3 | -852 | 3504 | 152 | -700 | -14 | -19 | 19 | 4.3% |
| 4 | -823 | 3219 | 140 | -683 | -17 | -17 | 20 | 4.3% |
| 5 | -783 | 2892 | 125 | -657 | -26 | -15 | 21 | 4.3% |
| 6 | -731 | 2516 | 109 | -622 | -35 | -12 | 23 | 4.3% |
| 7 | -645 | 2059 | 89 | -555 | -67 | -8 | 25 | 4.3% |
| 8 | -505 | 1501 | 65 | -439 | -116 | -1 | 29 | 4.3% |
| 9 | -299 | 826 | 36 | -264 | -176 | 8 | 33 | 4.3% |
| 10 | 0 | 0 | 0 | 0 | -264 | 22 | 38 | 4.3% |

**Product:** Disability income insurance
**Liability basis:** Realistic with explicit profit margin
**Claims incidence rates:** per spreadsheet based on a 1-month waiting period
**Claims continuance rates:** per spreadsheet based on a 1-month waiting period
**Occupation:** Clerical
**Lapse rates:** 15% in Year 1, 10% Year 2 and 5% p.a. thereafter
**Initial expenses:** $380
**Renewal expenses:** $50 p.a. from Year 2 onwards with expense inflation rate of 3% p.a.
**Claims expenses:** 3% of the cost of claims
**Initial commission:** 100% of initial premium
**Renewal commission:** 10% p.a. of renewal premiums
**Inflation rate**: 3% p.a., applied to expenses and the monthly benefit sum insured (the monthly income benefit payable on disablement is not indexed)
**Investment earnings:** 5% p.a.
**Discount rate:** 5% p.a.
**Profit margin:** 4.3% of premiums

In this example, a single planned profit margin of 4.3% is used. By calculating the profit margin at commencement, including an allowance for initial expenses, the liability with profit margin in Table 6.19 results in a uniform emergence of planned margins as a percentage of premiums.

If the profit margin was instead calculated as at day 2 (after initial costs of $860 had been paid), the planned margin would be higher, 24%. In this case, the planned profit in Year 2 onwards would still be expected to emerge in an orderly manner (at a considerably higher level) but a loss would arise in Year 1, with initial costs recognised up front rather than being spread over the policy term.

## 6.6.2. Disabled lives

Liabilities for policy owners who are currently disabled (i.e. existing claims) may be grouped, modelled and valued separately to those for active lives. Liability valuation methods for disabled lives were discussed in Module 5 (Life valuation). Liabilities for disabled lives are also termed liabilities for open claims or claims in the course of payment (CICP). These are generally calculated as the monthly benefit payable, multiplied by an annuity factor, plus an allowance for claim management expenses.

The valuation of disabled lives will produce a positive liability, being the costs of expected claims with no offsetting expected premium income as disabled lives do not pay premiums while in the state of claim.

An issue that arises with disability income insurance is whether liability values for disabled lives should include a share of any profit margin for the disability policies as a whole. By including a margin for future profit, some profit is deferred or held back, and released as claim payments are made. There are differing views on the validity of this approach. One view is that claim payments for disabled lives are an important part of the service provided under disability income policies, so profit margins should be included. Another view is that profit is generated from active, not disabled, lives who do not pay premiums while disabled.

**Exercise 6.10**

The example in Table 6.19 includes a valuation margin for the orderly release of profit. The profit carrier is expected premium income. What could be the issues with using premiums as a profit carrier? What other drivers might be considered and what would be the impact? (Hint: consider reserves for active lives and for disabled lives.)

## 6.7. Group risk policy example

The accumulation method is commonly used for valuing policy liabilities for group risk business. It is also sometimes used for valuing individual risk business. Group risk business is typically short-term with low acquisition costs, in contrast to individual risk business, which is typically long-term with high acquisition costs.

Group risk business policy liabilities determined under an accumulation method generally have the following components:

- **Unearned Premium Reserve (UPR):** This is a proportion of the last premium received, representing payment for insurance risk occurring after the liability calculation date. For example, if a monthly premium is received a few days before the valuation date, then most of this payment is for risks that occur after the valuation date; plus
- **Claim reserves:** These include incurred but not reported (IBNR) claims, reported but not admitted (RBNA) claims and disability claims in the course of payment (CICP); less
- **DAC:** Any deferred acquisition cost recovery adjustments.

Group risk policies often provide for a share of underwriting profit to be returned to the policy owner. A reserve for accrued profit share for policies with profit-sharing arrangements would therefore also be required. This could be valued using stochastic modelling techniques.

Deferred acquisition costs (DAC) may be deducted from the policy liability to spread the cost and recognise it as margins are earned. This avoids reporting of losses or lower profitability at policy commencement.

It is important to note that under an accumulation method, a projection may still be required to test that:

- reserves are sufficient to meet future outgo less income; and
- any DAC is recoverable.

A simplified projection approach is used where current margins are clearly adequate to cover future net cash flows and are likely to continue to be clearly adequate. More detailed modelling is required where this is not the case. Any projected future shortfalls in being able to meet negative net cash flows need to be added to liability values.

The example below shows a comparison of the projection and accumulation methods for a group policy with a term of 3 years and premiums paid yearly in advance. The policy liability and profit emergence have been calculated at the end of each 6 months in order to show the impact of yearly premiums. There is assumed to be no profit sharing. Claims reserves for IBNR, RBNA and CICP are ignored in this example.

Table 6.20 shows expected 6-monthly profits using a projection method to calculate liabilities.

### Table 6.20: Group risk policy liability using a projection method

| Month | Premiums | Claims | Expenses | Net Cash Flow | PV Driver | BEL | PV Profit Margin | Policy liability | Profit |
|---|---|---|---|---|---|---|---|---|---|
| 0 | | | | | 2,520.00 | -322.50 | 322.50 | 0.00 | |
| 6 | 1,000.00 | 400.00 | 175.00 | 425.00 | 2,120.00 | 102.50 | 271.31 | 373.81 | 51.19 |
| 12 | 0.00 | 400.00 | 25.00 | -425.00 | 1,720.00 | -322.50 | 220.12 | -102.38 | 51.19 |
| 18 | 1,050.00 | 420.00 | 26.25 | 603.75 | 1,300.00 | 281.25 | 166.37 | 447.62 | 53.75 |
| 24 | 0.00 | 420.00 | 26.25 | -446.25 | 880.00 | -165.00 | 112.62 | -52.38 | 53.75 |
| 30 | 1,100.00 | 440.00 | 27.50 | 632.50 | 440.00 | 467.50 | 56.31 | 523.81 | 56.31 |
| 36 | 0.00 | 440.00 | 27.50 | -467.50 | 0.00 | 0.00 | 0.00 | 0.00 | 56.31 |

**Product:** Group risk
**Liability basis:** Realistic projection method with explicit profit margin
**Acquisition expenses:** $150
**Maintenance expenses:** $50 p.a.
**Expense inflation:** 5% p.a.
**Discount rate:** 0% p.a.
**Profit margin:** 12.8% of claims

The present value of future profits at commencement is 322.50. The value of the profit carrier (expected claims) is 2,520.00, so the profit margin is 12.8%.

Table 6.21 shows expected 6-monthly profits using an accumulation method to calculate liabilities.

### Table 6.21: Group risk policy liability using an accumulation method

| Month | Premiums | Claims | Expenses | Net Cash Flow | UPR | PV AER Driver | DAC | Policy liability | Profit |
|---|---|---|---|---|---|---|---|---|---|
| 0 | | | | | 0.00 | 3,150.00 | 150.00 | -150.00 | |
| 6 | 1,000.00 | 400.00 | 175.00 | 425.00 | 500.00 | 2,650.00 | 126.19 | 373.81 | 51.19 |
| 12 | 0.00 | 400.00 | 25.00 | -425.00 | 0.00 | 2,150.00 | 102.38 | -102.38 | 51.19 |
| 18 | 1,050.00 | 420.00 | 26.25 | 603.75 | 525.00 | 1,625.00 | 77.38 | 447.62 | 53.75 |
| 24 | 0.00 | 420.00 | 26.25 | -446.25 | 0.00 | 1,100.00 | 52.38 | -52.38 | 53.75 |
| 30 | 1,100.00 | 440.00 | 27.50 | 632.50 | 550.00 | 550.00 | 26.19 | 523.81 | 56.31 |
| 36 | 0.00 | 440.00 | 27.50 | -467.50 | 0.00 | 0.00 | 0.00 | 0.00 | 56.31 |

**Product:** Group risk
**Liability basis:** Projection method
**Acquisition expenses:** $150
**Maintenance expenses:** $50 p.a.
**Expense inflation:** 5% p.a.
**Discount rate:** 0% p.a.
**DAC recovery:** 4.8% of claims

Under an accumulation method, no explicit projection of future expected cash flows is made. In theory, the cash flows shown in Table 6.21 would emerge only as experience unfolds. For this reason, it is harder to determine an appropriate acquisition cost recovery margin, as the present value of the profit carrier may not be known if projected future cash flows are not available.

In the example in Table 6.21, the driver used to spread acquisition costs is premiums, which are reasonably certain over a 3-year period for a group risk policy. The value of the acquisition expense recovery driver (premiums) is 3,150. The acquisition expense recovery component is 4.8% (150/3,150).

Note that under an accumulation method, an unearned premium reserve is required. This is because premiums have been received, for which future obligations (i.e. claims payments) exist. An unearned premium reserve is not required as part of a projection method, because future obligations are explicitly included in the liability calculation.

In the example shown in Table 6.20 and Table 6.21, the accumulation method gives exactly the same profit signature as the projection method. This is only the case in this example as the acquisition cost recovery carrier (premiums) has the same run-off pattern as the profit carrier (claims). In this example, the loss ratio is 80% so expected 6-monthly claims are exactly 40% of the expected annual premium. For a group risk policy, expected claims are likely to be a fairly constant proportion of earned premiums due to the relatively short term of the contract, the absence of any significant selection effects, and because new lives insured are continuously replacing those who cease to be covered by the policy.

## 6.8. Key learning points

- Actual profit for a life insurance portfolio is not known until all long-term obligations under its policies have been discharged. The calculation of profit in any period is therefore only an estimate.
- Profit can be measured as income less outgo, less the change in the value of policy liabilities over a period.
- The valuation methodology and basis influence how much profit is recognised in a given period. Ultimately, however, actual profit earned will be driven by the experience of the business (claims, expenses and income) over the life of a portfolio.
- Profits arising each year are a result of both expected profits (from profit margins included in the price of the product) and unexpected profits, such as those arising when actual experience turns out to be better than expected.
- Without further valuation adjustments, a realistic valuation basis generates negative liability values on issue of profitable policies. The negative liability represents the value of planned profit margins.
- The release of planned profit over time can be smoothed through the use of profit margins added to the policy liability. The value of future profit is expressed as a percentage of a chosen profit carrier.

- Accounting profit is the amount of profit reported in a period. Distributable profit is the amount of profit that can be distributed in a period after allowing for any capital requirements.
- Policy acquisition costs can be large and expected to be recovered from future income. The inclusion of acquisition costs in estimated profits can be deferred and recognised in line with income being earned over time. This can be achieved through acquisition expense recovery margins subtracted from liability values.
- An issue that arises with disability income insurance is whether liability values for disabled lives should include a share of the profit margin, thereby deferring part of the profit until claims payments are actually made.
- Group risk business liabilities determined under an accumulation method generally have the following components: unearned premium reserves, claim reserves and DAC.

# 6.9. Answers to exercises

## Exercise 6.1:

What is the total amount of profit earned under each of Table 6.1 and Table 6.2? Why is this the same for both examples?

Answer:

The total profit is zero in both scenarios.

It is the same because the assumed experience is the same. Profit depends on actual experience and, other than investment earnings on reserves, the total profit over the lifetime of a policy is not affected by the reserving basis. In examples 6.1 and 6.2 the assumed investment earning rate is zero.

## Exercise 6.2:

Why doesn't the modelling simplification impact Conservative Basis 2?

Answer:

This is not an issue for CB2 because under this basis, expenses are assumed to be higher, but there is no change to the assumed number of policies in-force.

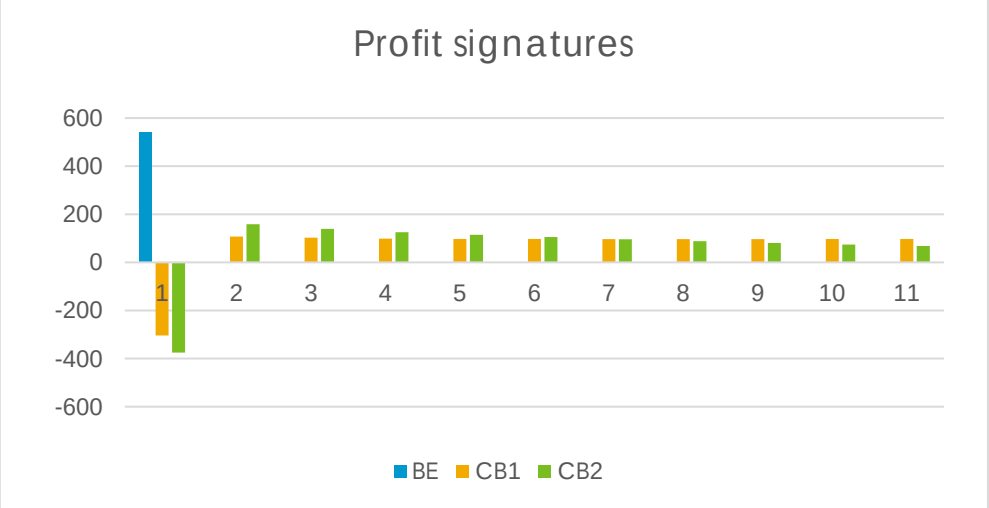
## Exercise 6.3:

A profit signature is a column graph showing profit emerging each year. Graph the profit signatures under each of the three bases shown in Table 6.5. How might senior management react differently to each of these profit signatures?

Answer:

The profit BE signature may be considered more favourably by senior management as planned profit is recognised immediately on a sale. In this way, higher sales would be immediately reflected in higher planned profits. CB1 and CB2 appear to generate losses on sale, recoverable from profits in future years.

Note that under the BE basis, adverse future experience would be reflected in losses, as there would be no future planned margins to absorb additional costs.




## Exercise 6.4:

Why might management prefer to recognise all profits at the commencement of a policy? What might be the problems with this approach?

Answer:

Management generally have a range of performance targets and reported profit is often a key metric. The earlier that profit is reported then that appears to increase the profit and loss account.

Reported profit results will appear more favourable in the short term under the BE Basis. The key problem is that adverse experience will hit the P&L more harshly than would occur with a deferral of profit recognition.

Note that for an entire portfolio of various durations, the total reported profit may be similar under all three bases. Also note that reported profit may not be immediately distributable, as discussed in section 6.3.4 ‘Accounting profit and distributable profit’.

## Exercise 6.5:

How would you select an appropriate driver for the release of planned profit for lump sum term insurance and for lifetime annuities? Consider different product features.

Answer:

There are technicalities hidden in this question that we do address until the Life Insurance Applications subject.

The intention is to release profit in line with a service provided. That may be the collection of premiums, payment of benefits or the asset management of the contract.

Lump sum insurance is typically paid by regular premiums and a death benefit is paid on a valid claim. We may choose expected premiums or expected claims as the carriers. Either metric should provide similar results for stepped premium term insurance.

Clearly, the pattern will differ for level premium term insurance as premiums are too high in the early years and too low in later years relative to a stepped premium term insurance. Ask yourself, which metric will produce higher profits initially and lower profits as the duration progresses.

With lifetime annuities, the obvious choice is in line with the claim amounts.

## Exercise 6.6:

The risk business manager says he understands that business is more profitable the longer it stays on the books. He has therefore asked you why planned profit margins do not increase in later years in your projections. Draft a response to the manager.

Notes:

Draft questions will have a couple of marks for style, appropriate language. Don't waste time in an exam thinking about how to begin and end.

I have included a few italicized teaching comments in brackets.

Answer:

Dear Risk Business Manager,

Thank you for your query on why planned profit margins do not increase in later years in our projections even though business is more profitable the longer it stays on the books. *(I've just rearranged the question stating what I can see.)*

In general, it is true that business is more profitable the longer it stays on the books. (State what you see – there is likely to be a mark here). This is because each premium contains a loading for profit and the more premiums are collected then it is generally true that profitability increases. *(This is stating the obvious – we know premium = benefits + expense + profit on an expectations basis. Hence there is a loading in each premium.)*

When we calculate planned profit margins at outset, we are looking at how we expect a portfolio of policies to change in future years. We expect a proportion to leave each year. Thus, our projection includes policies that leave relatively early as well as ones that stay on the books for a long time. The present value of the profits at outset for all the contracts are converted into a profit margin by using a suitable metric – typically premiums or claims or investment fees. *(Again, fairly obvious – our assumptions allow for fractional policies to leave each year.)*

Since our projection uses the same assumptions to derive the present value of profits then it is merely a mathematical fact that the profit margin percentage remains constant throughout the projection. *(We'll call this the unwind in the embedded value module.)*

Of course, the assumptions underlying our projections will not be the same as actual experience. Perhaps we can discuss at some point on how we cope with experience not being the same as that assumed. *(A quick sentence on a related issue that may be worth discussing but no discussion necessary yet.)*

Kind regards,

Actuary.

## Exercise 6.7:

Students should construct an example where fees and DAC asset amortisation do not match. What problems arise if the time period for amortisation of the DAC asset exceeds the period over which fees are recovered?

Notes:

To demonstrate that you understand the question then it would be useful to define DAC and show the consequences of writing off the DAC over a longer period than the fee recovery period.

Answer:

The DAC is an intangible asset representing the acquisition costs. The DAC represents the value of future margins in fees for the recovery of acquisition costs.

If the DAC is deliberately written off more slowly than the fee collection period, then that would increase profit in early years relative to later years. Profits in the years when fees are not paid but the DAC is being written off will be lower by the write-down of DAC. This appears to contradict the definition of the DAC as, after the fee-paying period, there are no more future margins and accounting rules would force all the remaining DAC to be written off at that point, which may cause a potentially large reporting loss.

For any individual life insurance contract there will be a random element as the number of premiums collected is not known at contract outset. Hence, it is unlikely that the DAC amortization period matches that for an individual contract. One should conclude that the DAC should be set up in respect of groups of contracts rather than individual contracts in an analogous manner to the setting up of premiums.

In practice, an aggregate DAC amount may be tracked against groups of similar policies, written at different times. The averaging effect is likely to create a profit pattern similar to a more matched DAC run-off for the portfolio as a whole. At some point in the future, if new policies in the series are no longer written, the issue discussed above of DAC amounts with no fees for their recovery would arise.

## Exercise 6.8:

Assume you are investigating the impact of changes to rules allowing deferment of acquisition costs. You are moving from a 'Without DAC' model to a 'With DAC' model. Write an explanation to the CFO as to why policy liabilities will become negative and how this will impact calculated shareholder equity.

Notes:

The intention of the question appears to be asking a straightforward question relating to recognizing acquisition expenses and how this impacts on liabilities and shareholder equity. The question should have said 'may' rather than 'will'.

The question assumes that you understand the term policy liabilities in the context of adding planned profit margins. This was a mistake and we will alter the question in future.

If this question was in the exam and you spotted that the policy liability was not defined then full marks would have to be given for a simpler explanation than that below.

Assume that the policy liability is the BEL + planned profit margins

The memo needs to be 'topped and tailed' (introduction, conclusion) and avoid unexplained jargon.

Answer:

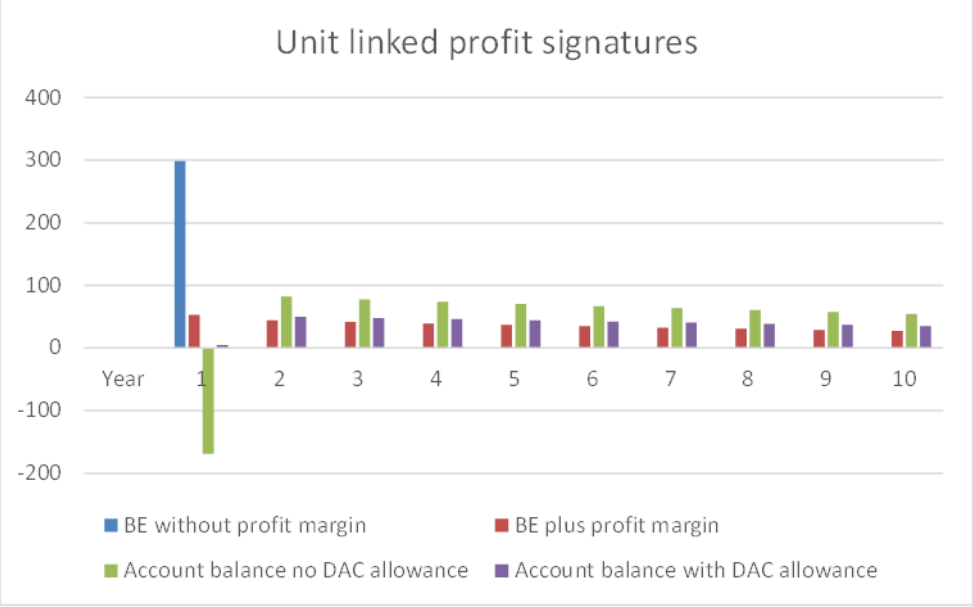
The points to consider are:

1. Explain what a 'without DAC model' means i.e. the opening liability is set immediately after the policy is issued and does not recognise those costs.
2. Explain what the 'with DAC model' represents.
3. Old method typically generates a loss in year one, if there are large acquisition expenses relative to first year premium income. Profits in future years are increased as the margins for the acquisition costs 'boost' future profitability.

4. The new method spreads the initial costs over future years by deducting an amount from the policy liability. This method should allow for a smoother profit across all years. Initial costs are spread by deducting an amount from the initial policy liability and then withdrawing the deduction over time. In practice withdrawing the deduction over time may be hidden because of new cohorts of business and averaging over portfolios
5. Whether the policy liabilities in aggregate will become negative depends on the duration of the portfolio.
6. If company pays tax on profit arising each year, the new method results in higher tax in year 1 (or loses a deduction), as the deductibility of acquisition costs is deferred.

## Exercise 6.9:

Comment on the different profit signatures shown in Figure 6.2.




Answer:

PV profits will be the same.

BE without margin – all profit released on day one and zero thereafter. Whilst none of the bases contain margins against adverse experience, this method accounts for all profits up-front and negative future experiences will show as a loss. The same fall in profits occur in any basis but are offset against some profits so the actual reported profits position following a period of bad experience may not show a loss using the other three methods.

BE plus margin. Zero profit at outset and stable profit, as percentage of profit carrier, each year. Profit is released when it is 'earned'.

Account balance with no DAC. Large new business strain followed by sequence of positive profits. The method produces negative profits in the early years for a business that is experiencing large growth in profitable products.

Account balance with DAC offsets initial costs and produces a more even stream of profits.

## Exercise 6.10:

The example in Table 6.19 includes a valuation margin for the orderly release of profit. The profit carrier is expected premium income. What could be the issues with using premiums as a profit carrier? What other drivers might be considered and what would be the impact? (Hint: consider reserves for active lives and for disabled lives.)

Answer:

The release of the profit margin is achieved through the selection of an appropriate business metric, Metrics that might be considered include the value of expected future premiums or claims. A suitable metric would measure the value of cover provided in a period, as a ratio of the cover provided in all future periods.

Premiums may provide a suitable measure where the timing of expected premiums is aligned with the timing of expected claim payments. The timing of premiums may not align, such as for limited premium or single premium contracts. In such cases, recognising profit in line with premiums would result in profit being recognised too early. Where premiums do not align with the cover provided, other measures would need to be considered.

Expected claims can provide an alternative metric, providing the revenue in respect of those claims has been received.

For disability income, claims can be considered as a profit carrier. Claims are settled over much longer periods than under lump sum policies such as term life. While claims may be considered as a metric for disability income policies, the claims amounts payable within a period would not represent the full value of expected claims arising in that period. For income protection, future payments are contingent upon the ongoing health of the insured. The costs of claims arising in a period would include the value of future benefit payments for claims that arise in that period.

If claims are used as a profit carrier for income protection insurance, the expected cost of claims in a period should include also the expected value of future amounts payable for those claims. Where the total costs of expected claims is used as a profit carrier, profit would be released in line with claims for policies on "active" lives. In this situation, experience under disabled lives' policies would not affect the release of planned margins.

Total profit is the sum of planned profit and experience variations, so experience under both active and disabled lives' policies would impact total profit arising.

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## Institute of Actuaries of Australia

ABN 69 000 423 656
Level 2, 50 Carrington Street,
Sydney NSW 2000, Australia
t +61 (0) 2 9239 6100
f +61 (0) 2 9239 6170
actuaries@actuaries.asn.au
www.actuaries.asn.au