

# LIFE INSURANCE AND RETIREMENT VALUATION

MODULE 15: APPRAISAL VALUES





## Module 15

# APPRAISAL VALUES



---

## Table of contents

|   |           |
|---|-----------|
| <b>15.1. Introduction</b>   | <b>5</b>  |
| 15.1.1. Module overview   | 5         |
| 15.1.2. Economic value of an entity                               | 6         |
| <b>15.2. Components of an appraisal value</b>                     | <b>10</b> |
| <b>15.3. Adjusted net worth</b>                                   | <b>11</b> |
| <b>15.4. Value of existing business</b>                           | <b>12</b> |
| <b>15.5. Value of future new business</b>                         | <b>14</b> |
| 15.5.1. Distinguishing between new business and existing business | 15        |
| <b>15.6. AV actuarial basis</b>                                   | <b>16</b> |
| <b>15.7. Taxation and Australian imputation credits</b>           | <b>17</b> |
| <b>15.8. Balance sheet view of embedded value</b>                 | <b>18</b> |
| <b>15.9. Analysis of change in embedded value</b>                 | <b>22</b> |
| 15.9.1. Why analyse the change?                                   | 22        |
| 15.9.2. Items to consider   | 23        |
| <b>15.10. Detailed examples</b>                                   | <b>29</b> |
| 15.10.1. Yearly renewable term insurance                          | 29        |
| 15.10.2. Investment product example                               | 33        |
| 15.10.3. Change in AV exercise                                    | 37        |
| <b>15.11. Example of disclosure of embedded value</b>             | <b>41</b> |
| <b>15.12. Market consistent embedded values</b>                   | <b>42</b> |
| <b>15.13. Key learning points</b>                                 | <b>45</b> |
| <b>15.14. Answers to exercises</b>                                | <b>46</b> |



## 15. Appraisal values

By the end of this module students should be able to achieve the following key performance outcomes:

| Item | Unit/Key Performance Objective/Learning Objective                                       |
|------|---|
| 8.   | Evaluate economic valuations (appraisal values)   |
| 8.1. | Determine the reasons for obtaining an appraisal value                                  |
| 8.2. | Identify and determine the components of an appraisal value                             |
| 8.3. | Discuss the key issues involved in determining an appraisal value                       |
| 8.4. | Demonstrate the steps required to calculate an appraisal value                          |
| 8.5. | Compare and contrast the different methods available for arriving at an appraisal value |
| 8.6. | Prepare an analysis of the change in appraisal values and communicate the results       |
| 8.7. | Explain why an analysis may be undertaken   |
| 8.8. | Contrast the change in appraisal value with the reported profit                         |
| 8.9. | Identify and examine issues associated with the change in appraisal values              |



## 15.1. Introduction

### 15.1.1. Module overview

The appraisal value (AV) technique provides stakeholders with an estimate of the economic value of a life insurer. This module describes the components of an AV and the various methods, models and assumptions required to calculate the AV.

An AV is the sum of:

- the value of contracts in force as at the valuation date plus the adjusted value of net assets, collectively known as the embedded value (EV); and
- the value of future new business.

We focus on what is called the traditional EV. It is derived using a deterministic discounted cash flow model of distributable profits (being the cash flows that could be distributed to an owner). Assumptions are selected based on a combination of sound analysis of experience and the application of judgement. The final section of this module explains a market-consistent EV method, where some of the assumptions are derived from market prices, and explicit values are placed on guarantees and options.

An output of calculating the EV is the identification of profitable, or otherwise, business lines. Management may decide to replace loss-making products through repricing or redesigning contract terms.

The change in EV, when broken down into its constituent parts over a period, provides useful information on how the business is developing. A change in AV adds additional components which need to be interpreted with caution, as they depend largely on assumptions about expected future sales and profit margins on those sales, both of which can be very subjective.



Module 5 (Life valuation) described policy liability valuation methods and Module 12 (Analysis of surplus) showed how to perform an analysis of the change in surplus over a period. The reasoning and many of the techniques applied in analysis of changes in surplus are similar to those applied in the analysis of changes in EV. There are, however, significant differences, particularly in the choice of discount rates and allowance for the opportunity cost of capital. These differences are explained in section 15.6 (Actuarial Basis).

### 15.1.2. Economic value of an entity

Other than the EV method, a range of other possible methods exist that may be used to value companies, including:

- taking the book value, being the equity reported on the balance sheet (capital and retained profits); and
- deriving a value by applying a price/earnings ratio to a measure of profit.

These methods often do not adequately capture the value of life insurance companies.

#### Book value

Using the value of equity on the balance sheet as a measure of the value of a company is rarely done as it has the following shortcomings:

- it ignores the value of future profits expected to emerge from existing business;
- it ignores the value of future new business; and
- it does not deduct a *cost of capital* to reflect the fact that a portion of the net assets must be held to meet prudential capital requirements.

Prudential capital needs to be held until contracts end. The rate of return required by investors typically exceeds the expected investment return on invested assets and hence there is an economic cost associated with maintaining this capital. This issue is discussed in section 15.3.



### Price/earnings ratios

A method commonly used to perform simple valuations of companies is via a price/earnings (P/E) ratio. The latest year's profit (or next year's forecast profit) is multiplied by a P/E ratio. The P/E ratio is derived from a comparison of market values of similar listed companies (or other quoted sale prices of companies) to their reported profits. There is an obvious difficulty if there are no similar companies with quoted valuations. In this circumstance, a broader pool of reference companies could be used, for example, companies in similar industries or foreign companies.

Adjustments to the P/E ratio can be made to reflect company-specific issues, such as risk or growth rates. The reported profit may also be adjusted to remove any distortions such as one-off items. Some of the issues with life companies that can make them difficult to value using P/E ratios are:

- the accounting basis can lead to reported profit being a poor indicator of the performance of the business in a period (e.g. there can be significant conservatism in the balance sheet value of liabilities);
- the mix of business may change over time; and
- actual profit in a period can be significantly distorted by one-off experience profits or the impact of assumption changes (and determining whether experience variations are temporary or permanent is difficult and subjective).

The P/E method can, however, be used for life companies that have a simple product range and a reasonably stable rate of growth. An example would be an established life company whose business consisted entirely of single premium investment-linked business.



### Appraisal values

To overcome the shortcomings in other valuation methods, the **appraisal value technique** was developed. The value of an owner's interests in a life insurance company, termed the appraisal value, is calculated using a realistic, or best estimate, cash flow projection, discounted using a risk-adjusted discount rate. The calculation of appraisal values is an important task for actuaries in the life insurance and wealth management sectors of the financial services industry. The paper *The Determination of Life Office Appraisal Values*<sup>1</sup>, is one of the earliest describing the development of appraisal values. It provides a historical background to the development of traditional embedded value techniques and provides a method for calculating embedded values. Note that the ideas are traced back to a paper by James Anderson<sup>2</sup> written in 1959.

Many companies perform internal appraisal valuations of their businesses. These provide critical management information on the value of the business and how it is changing. Additionally, some life insurance companies publish appraisal values (or components thereof) as supplementary financial information for external market analysts.

Appraisal values also often form the basis for assessment of value in merger and acquisition activities, as well as business restructures.

When calculating an appraisal value, you should be clear about who you are preparing it for, who will use it and the purpose of the appraisal value, including from whose perspective you are assessing value, as there may be different values for different potential owners. You will also need to understand the business you are valuing. Based on these you should select appropriate methods, models and assumptions. If, for example, the business you are valuing is a small, immaterial part of a bigger economic valuation, your valuation of the 'smaller' entity may be approximate.

---

<sup>1</sup> Burrow et al 1987, 'The Determination of Life Office Appraisal Values', JIA 114, p.p 411-465

<sup>2</sup> Anderson, James C.H. 1959, 'Gross Premium Calculations and Profit Measurement for Non-Participating Insurance', TSA. 11, p. 357





If the appraisal value might be used for purposes other than those intended, you should disclose any qualifications or limitations on the usage of the appraisal value. For example, where the appraisal value could reasonably be construed to be an assessment of market value or fair value when this was not the intended purpose, you should include a statement to that effect in your report.

An appraisal value is very sensitive to the assumptions that are used. It is very different in this respect from policy liabilities, where a change in assumptions may have little immediate impact on results, provided there are profit margins to absorb any such changes. An appraisal value investigation should highlight the sensitivity of the results to changes in the key assumptions.

There are generally no prudential or accounting standards governing the calculation and disclosure of appraisal values. An exception may be for values calculated for accounting disclosures for assessment of the carrying value of a purchased subsidiary under international accounting standards.

The methodology for the calculation of appraisal values described in this module is commonly used by many life companies. However, some companies use alternative methods. In Europe, the CFO forum has published principles and guidance for Market Consistent Embedded Values (MCEVs). These principles have been widely adopted by European life companies. The MCEV principles are described in the last part of this module.

### Exercise 15.1

Write down situations where appraisal values are likely to be a useful tool.



### 15.2. Components of an appraisal value

The AV of a life insurance company is a realistic estimate of the value of the life insurance business to the owners of the company, with appropriate allowance for the inherent risks.

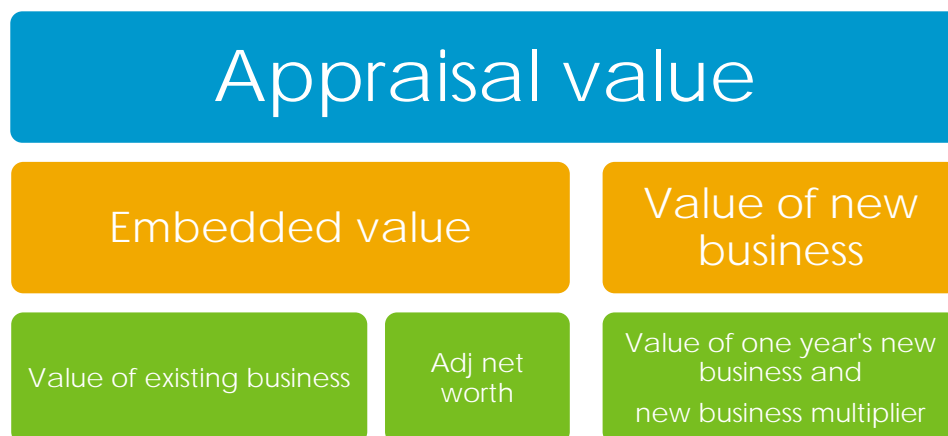
An AV is the sum of three components, as outlined in Table 15.1. Each component is discussed in the following three sections.

Table 15.1

| Adjusted net worth (ANW)  | Owners' assets in excess of required capital  |
|---|---|
| Value of existing business (VEB) <ul style="list-style-type: none"><li>also known as value of in-force business (VIF)</li></ul> | Present value, at the hurdle rate, of future net distributable profits (including releases of required capital) from existing business. |
| Value of future new business (VNB)  | Present value, at the hurdle rate, of future net distributable profits from sales of future new business.                               |

The sum of the ANW and the VEB is known as the **embedded value**. The components of the AV and EV are shown in figure 15.1.

Figure 15.1





It is common for listed life insurance companies to disclose an EV calculation and an analysis of the change in EV over a period. Information on the value of business sold over the preceding financial year is also typically disclosed as a component of the change in EV. This can also be used by stakeholders as an aid to determine the value of future new business. It is unusual for a company to publish an appraisal value.

Where a proprietary life insurance company has participating business, the AV is based on the shareholders' interest in the profits of the participating business. It does not include profits allocated to policyowners. There is a complicated issue of how to allow for run-off, in particular the timing of distributions of any excess participating retained profits beyond what may be considered to be directly attributable to existing policy owners. Typically, the valuation would assume that any such excess participating retained profit balance is run-off along with the in-force book. Issues related to the management of participating business are covered in the LI&R Product Development subject and Life Insurance Applications subject.

### Alternative presentations

An alternative presentation of EV results is sometimes used, in which the ANW includes the full face value of locked-in capital, and the value of in-force business is presented as the present value of profits less the difference between the face value and the present value of the ultimate release of that locked-in capital. Whichever method is used, it is important not to double count capital in the calculations.

### 15.3. Adjusted net worth

ANW refers to the 'excess assets' of the company. It is the economic value of assets in excess of liabilities and regulatory capital. In theory, it could be paid to owners immediately and thus it is valued at face value.



In most circumstances, the adjusted net worth will be approximately equal to the capital base excluding any additional Tier 1 and Tier 2 capital, less the prudential capital requirement (PCR). The prescribed capital amount (PCA) would be used instead of the PCR if the embedded value was to be disclosed to persons outside the company. (Any supervisory adjustments included in the PCR must remain confidential.) Where a *gross-gross* valuation approach is used (see Section 15.7 below), the value of existing franking account balances should be included in the ANW.

Sometimes target surplus is included with regulatory capital when determining required capital for economic valuation purposes. This recognises that life insurance companies must, in practice, hold surplus assets in excess of the PCR to provide a buffer against the risk of breach. This amount (or a component of it) may be deducted from net assets to reflect that surplus assets may not, in practice, be immediately distributable to shareholders. If surplus assets are included in the value of existing business, the overall embedded value will be reduced due to a cost of capital being applied to a larger quantum of required capital (see Exercise 15.2).

### 15.4. Value of existing business

The VEB is the present value, at the hurdle rate, or risk discount rate, of future distributable profits, being the sum of reported profits and net releases of required capital. It excludes excess capital that has already been included in the adjusted net worth. Typically, the VEB is projected by assuming that starting assets equal the amount needed to meet capital requirements, then the distributable profit in each period is simply the excess at the end of the period above the total quantum of assets needed to meet capital requirements. The distributable profit is assumed to be paid out each period in the model, so each period commences with assets equalling the amount needed to meet capital requirements.



The hurdle rate represents the average investment return required by the providers of capital. The hurdle rate normally exceeds the expected after-tax rate of investment return on the assets backing capital and this results in the present value of future distributions of capital being less than the current face value of capital. This difference between the current face value of capital and the present value of future distributions is referred to as a *cost of capital*.

### Exercise 15.2

Suppose a life assurance company holds \$100m of capital invested in cash, earning 3% per annum. If a projection showed that capital was depleted each year by \$10m, and shareholders required a 10% investment return, determine the cost of capital. State your assumptions.

The value of existing business is determined from a cash flow projection, not dissimilar to that used for the projection method for calculating the value of future profit margins for insurance contract policy liabilities. The key differences between the valuation of future profit margins and the valuation of existing business are:

- a valuation of existing business requires projections for all types of business;
  - contracts whose policy liabilities are determined using an accumulation method, such as investment contracts, will need to be valued using projection methods when calculating the value of existing business;
- the value of existing business is determined using a hurdle rate (or risk discount rate) representing the required rate of return, whereas insurance contract policy liabilities are calculated using a risk-free discount rate or, where appropriate, the expected earned rate on the assets backing the business;
- the value of existing business includes the release of required capital for the business as well as the best estimate profits emerging from the policy liabilities;
  - the amount of capital needed to meet the future PCR needs to be projected as well as the policy cash flows to determine the value of existing business;



- the value of existing business includes the investment earnings on the assets backing the policy liabilities and capital;
  - the discount rate differs from the investment earnings rate and, therefore, investment earnings have to be projected as an explicit cash flow item; and
- tax must be modelled as an explicit cash flow item and profits must be valued net of tax.

### 15.5. Value of future new business

To arrive at an AV, the VNB is added to the EV.

The VNB is the value of the distributable profits expected to emerge from future sales of new business. Typically, there is a negative distributable profit at point of sale, which is caused by the need to fund capital requirements as well as to cover any initial expenses that cannot be deferred.

The VNB may be calculated in a number of ways. These include:

- estimating sales into the future and building a projection model of the distributable profits from all such future sales; or
- calculating the value of one year's sales (VOYS) and multiplying by a *new business multiplier* (a capitalisation factor). While there are various rules of thumb to guide appropriate new business multipliers, one can be derived by considering the number of years of new business that are to be included in the appraisal value, the rate of growth in new business sales, margin squeeze (being an allowance for margins to be compressed over time), the base risk-adjusted discount rate used for the VEB valuation and potentially an additional discount rate margin to reflect the riskiness of achieving future new sales at the margins assumed.

The VNB is often the most subjective component of the AV, as there can be a lot of uncertainty around future sales volumes and future pricing. Depending upon the size of the company, the stage of development of the company, the relative profit margin on its recent new business and the potential for future growth in sales, the VNB can be the most materially significant part of the appraisal valuation.



The first step in estimating future sales volumes is to estimate the likely growth in the life insurance market. This will vary by product—for example, sales of retirement and risk products might be expected to grow strongly for a number of years, then stabilise at a lower growth rate as a greater proportion of the population enters retirement. The next step is to estimate growth rates for the company by allowing for future changes in the company's share of the total market.

For the purpose of providing supplementary information to market analysts, some life companies disclose the EV and the value of the new business sold in the latest reporting period. This information allows analysts to calculate the appraisal value using their own estimate of an appropriate new business multiplier.

### 15.5.1. Distinguishing between new business and existing business

There are complications in defining new business, as illustrated below.

- Are additional superannuation contributions arising from a member's increased salary new business?
- Is a single-premium top-up to a unit-linked contract new business?
- Are CPI increases on yearly renewal term insurance new business?
- Are new members to an ongoing group insurance scheme new business?
- Is renewal of a group insurance scheme following a tender process new business?

These distinctions are important. If a single-premium top-up is classified as existing business, then expected future top-ups may be included in EV calculations in the same way as expected future regular premium payments. They would not, however, be included in new business for AV calculations. It is important that any definition of new business is disclosed and applied consistently from year to year.



### 15.6. AV actuarial basis

Best estimate assumptions are generally used to determine an AV. Since the purpose of calculating an AV is not the same as calculating policy liabilities, an AV best estimate basis is not necessarily the same as a best estimate basis used for the determination of policy liabilities.

An AV is calculated on a going-concern basis and may incorporate growth scenarios according to the company's business plan. Policy liabilities are calculated ignoring future new business volumes. The implications on the bases are:

- for insurance contracts, the mortality, morbidity and lapse assumptions are usually the same as the assumptions used in determining policy liabilities;
- expense assumptions may differ as an EV/AV may allow for anticipated future expense savings;
- for investment-linked contracts, assumptions for lapse/withdrawal rates and servicing expenses are necessary, even though these may not be required to value the policy liabilities;
- changes to pricing may include increases or reductions to fees and/or premiums, depending on the outlook regarding competitive pressures;
  - fee reductions are referred to as *margin squeeze*; and
  - statutory valuations may be restricted to consider only pricing changes that are in the process of implementation.

An EV projection often uses unit costs to project expenses. However, when the VNB is included, the projected total expenses should be reviewed in order to test if the projected expense base looks reasonable. Allowance needs to be made for:

- fixed costs that will not increase with volume;
- semi-fixed costs which will increase in a stepped fashion (a good example of this is computer systems); and
- variable costs, particularly business processing costs.





Obviously, allowing for new business involves assumptions not needed in a statutory liability valuation.

Finally, cash flows in an AV are discounted using a risk discount rate, whereas policy liability cash flows may be discounted at a different rate, such as a risk-free rate. Module 8 (Assumptions) contained a detailed discussion on setting risk discount rates.

### 15.7. Taxation and Australian imputation credits

AV models need to reflect the relevant tax legislation, which varies widely from country to country. Where the tax status of an owner is not known, or there are multiple owners with different tax statuses, the AV will not be able to reflect the net of tax position of distributions to owners. The interpretation and application of tax rules often requires expert advice from taxation specialists. Tax may be affected, for example, by international tax treaties and how they apply to income repatriated to a parent or distributed to shareholders.

An example of a local tax rule that can have a significant impact is that of imputation tax credits. In Australia, corporations and individuals receive tax credits where income is derived from dividends paid from net of tax profits. These are termed *imputation credits* and the value of imputation credits is often included in EVs and AVs of life insurance and wealth-management businesses. The reasoning behind imputation tax credits in Australia is that the income would otherwise be taxed twice with the company paying tax on its profits and the shareholders paying tax again on their dividends. Not all shareholders can fully benefit from imputation credits. Foreign shareholders are generally only able to obtain partial value from imputation credits by using them as an offset to withholding tax that would otherwise be payable. A consequence is that some discounting is generally applied in valuing imputation credits in an AV calculation.

The modelling of tax and its impacts on AV are usually disclosed. This allows the users of the information to assess the impact and adjust for their own circumstances.



Including imputation credits essentially means that an EV or AV represents the value of the business in the hands of the shareholders before the shareholders are taxed on their dividend income. This means that a before tax or 'gross' risk discount rate is applied to net of tax profits, plus imputation credits. The resulting appraisal value is effectively before tax or 'gross' of tax for the shareholders. This is often referred to as a *gross-gross* valuation.

Sometimes a valuation may exclude tax offsets, such as imputation credits, and use a discount rate that is 'net' of tax. A net of tax discount rate applied to net of tax earnings (i.e. a *net-net* approach) should produce an equivalent result to the *gross-gross* method. However, it is less useful to the users of the information because they cannot adjust the results to reflect their own tax position (i.e. they cannot deduct the value of imputation credits if the credits are of no value to them).

## 15.8. Balance sheet view of embedded value

Figure 15.1 demonstrates how the embedded value of a company reconciles to items appearing on the company's reported balance sheet. The column on the left shows the liabilities on a reported balance sheet. The column on the right shows an EV balance sheet. The main take-away from this section is that the EV is a more 'economic' representation of items that exist on a reported balance sheet. Both columns are equal in size and, by definition, are equal to the value of the assets.

For ease of presentation, we have made some simplifications, such as assuming there are no participating contracts. You are not expected to be able to recreate the numbers in the figure.



Figure 15.2: EV balance sheet reconciliation

| Balance Sheet Liabilities                 |                          | Reconciliation to EV                   |                           |
|---|--------------------------|--|---------------------------|
| <b>Total = \$950</b>                      |                          | <b>Total = \$950</b>                   |                           |
| Surplus capital \$250                     | Capital base             | Adjusted net worth \$250               | Embedded value            |
| Prudential capital adequacy margins \$150 |                          | PV of capital releases \$140           |                           |
| Deductions from capital base \$50         |                          | Value of future profit margins \$250   |                           |
| Future profit margins \$350               | Total policy liabilities | Cost of capital \$60                   | Fair value of liabilities |
| Best estimate policy liabilities \$150    |                          | Cost of delayed profit release \$100   |                           |
|   |                          | Best estimate policy liabilities \$150 |                           |

The differences between the two columns are consequences of:

- capital held to support liabilities are at face value on the left-hand side (appearing as two separate buckets: deductions from the capital base and explicit regulatory capital margins) and discounted on the right-hand side (so the total face value is split between the value of the releases of capital over time and the balance, being the cost of capital);
- profit is discounted at a higher rate in the EV calculation; and
- excess capital that can be released immediately is at face value in both columns.

The total value of liabilities on both balance sheets is \$950, matching the value of assets.



On the reported balance sheet, the liabilities are the sum of the shareholder equity and policy liabilities. Shareholder equity of \$450 is the sum of surplus capital, solvency margins (recall PCR defined in Module 14 (Capital)) and deductions from the capital base. Total policy liabilities of \$500 is the sum of best estimate liabilities (\$150) plus the future profit margins (\$350). These topics were discussed in depth in Modules 5 (Life valuation), 6 (Profit) and 14 (Capital).

On the EV balance sheet, the liabilities are the sum of the components of value to the owner (the EV) and an amount representing an estimate of the fair value of liabilities.

The fair value of liabilities is the amount for which a liability could be settled between knowledgeable, willing parties in an arm's length transaction. If a liability is transferred between life companies, the company acquiring the liabilities will want to be rewarded for accepting the risks. The acquiring company will want to earn a hurdle rate, above expected investment returns, on the capital they must provide to acquire and support the liabilities. They can only earn the hurdle rate if the assets they receive exceed the best estimate of the liabilities. The excess of fair value over best estimate is a margin for risk which reduces the present value of shareholder profits on the EV balance sheet compared to the reported balance sheet.

Thus, the fair value of liabilities is the sum of the best estimate liabilities, the cost of capital and the cost of delayed profit release.

The EV of \$640 is comprised of \$250 ANW and a VEB totalling \$390. The components of the VEB are \$250 representing the present value of future profit margins plus \$140 representing the present value of capital release as the business runs off. The fair value of liabilities of \$310 is the sum of the best estimate liabilities (\$150) plus \$160 representing the effect of discounting net releases of profit and capital at the EV hurdle rate, which we have labelled as the cost of delayed profit release and cost of capital.



### Capital run-off

Required capital may be released as the liabilities reduce over time. It is held at face value on the reported balance sheet but discounted on the EV balance sheet.

The discounted value of required capital forms the PV of capital releases item. The difference between the face value and discounted value is the cost of capital item.

### Discounting profit

The EV calculation discounts distributable profit (being reported profits plus the net change in required capital) at a higher rate than the rate used in discounting profits in the company balance sheet.

The future profit margin of \$350 is reduced to \$250 (value of future profit margins) in the EV balance sheet. The difference is the cost of the delayed profit release item.

### Excess Capital

The ANW in the EV is just the amount shown as surplus capital in the reported balance sheet. These are held at face value in the EV as they could, in theory, be distributed immediately to owners.

### Reconciliation

A reconciliation between the two balance sheet liabilities is captured in Table 15.2.

**Table 15.2: Matching items**

| Left                                |              | Right                          |              |
|-------------------------------------|--------------|--------------------------------|--------------|
| Prudential capital adequacy margins | \$150        | PV of capital releases         | \$140        |
| Capital deductions                  | \$50         | Cost of capital                | \$60         |
| Future profit margins               | \$350        | Value of future profit margins | \$250        |
|                                     |              | Cost of delayed profit release | \$100        |
| <b>Total</b>                        | <b>\$550</b> | <b>Total</b>                   | <b>\$550</b> |



### Taxation

In Figure 15.2 tax has been ignored. The reconciliation would need to be adjusted for tax. Where tax is on reported profits, the PV of shareholder profits (*future profit margins*) would be valued gross of tax. It would represent both the shareholder and tax office interests in future profits. Tax would be payable as these profits are earned or released. In the diagram on the right, PV shareholder profits are valued net of tax and tax is treated as part of the best estimate liabilities.

## 15.9. Analysis of change in embedded value

### 15.9.1. Why analyse the change?

Internal management and external analysts need to understand the reasons for the change in EV. For example, it is of little value to report a large movement in EV without explaining why the movement occurred.

The analysis depends on the order in which the cash flows are analysed. There is no correct ordering, but it is important to take a consistent approach from year to year.

An analysis of change acts as a check on the accuracy of the calculations (unexplained items should be small) and provides a reconciliation between the opening and closing values.

The result will highlight areas where there has been a significant deviation between actual experience and the best estimate assumptions. These may be due to random fluctuations but may indicate a need to update best estimate assumptions. The effects of any change in assumptions that apply at the year-end valuation also form part of the analysis of change.

Individual items in the analysis of change, at a broad portfolio level, may highlight actions required to protect the company. For example, if losses arising through withdrawals are higher than expected, then management will want to understand what has caused the increase and take appropriate mitigating actions.



Management will be interested in the previous year's VOYS as this is a key component in the growth of the EV from year to year. The publication of last year's VOYS may be used by equity analysts to derive the VNB.

### 15.9.2. Items to consider

Conceptually, the approach and items that appear in an analysis of change in EV are similar to the analysis of surplus.

Suppose we label the start of the period as  $t = 0$  and the end period as  $t = 1$ .

We have a value for:

- The opening embedded value:  $EV_0 = ANW_0 + VEB_0$ ; and
- The closing embedded value:  $EV_1 = ANW_1 + VEB_1$ .

The objective is to describe the reasons for the difference between the actual  $EV_1$  and the expectation at  $t = 0$  of  $EV_1$ . There is no single correct method and the order of calculations will affect the results.

A graphical representation of the change in EV is captured in the waterfall chart shown in Figure 15.3. The items in the chart are based on descriptions in the CFO Forum<sup>3</sup> publication discussing a standardised approach to embedded value reporting in Europe.

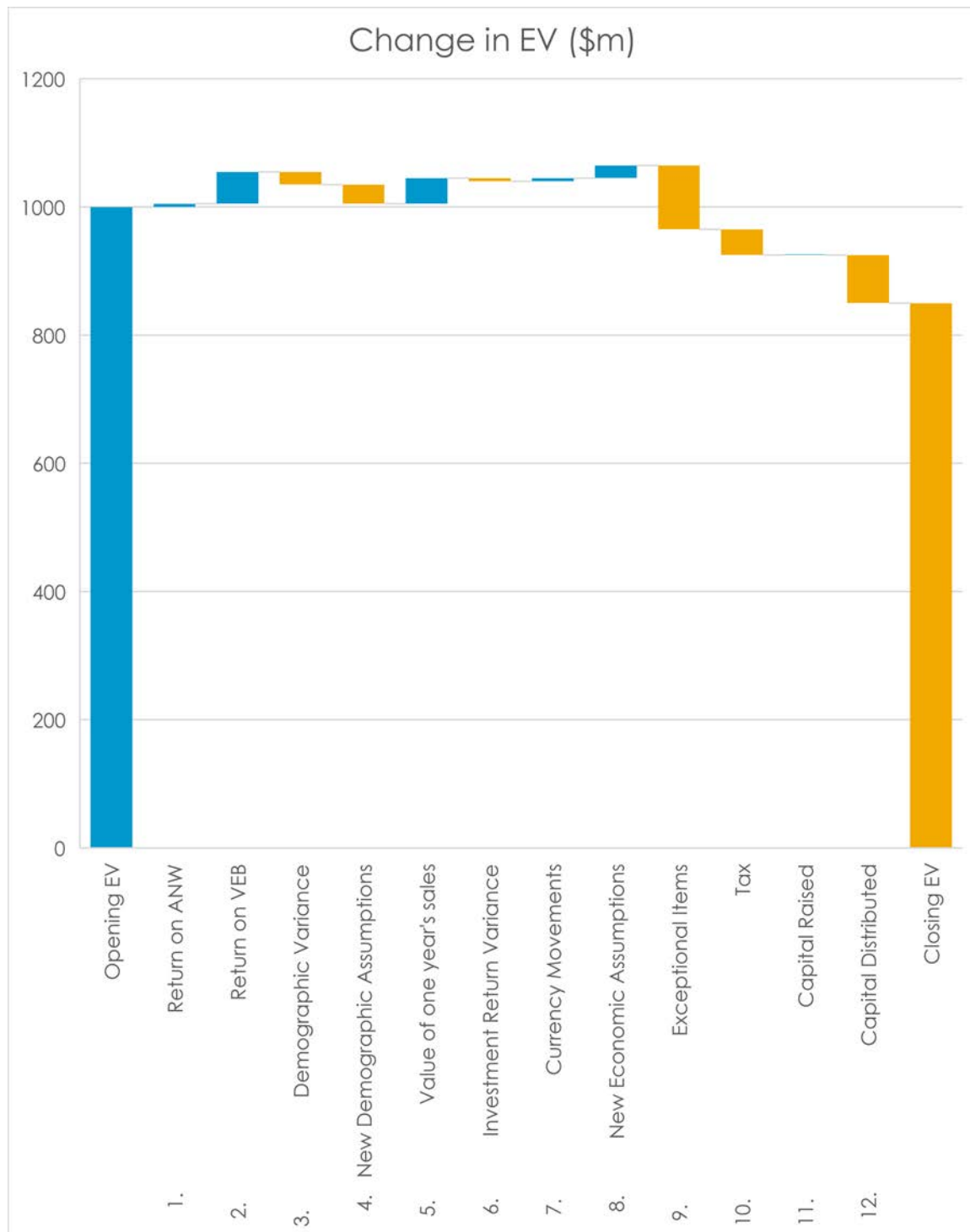
The chart separates effects from demographic assumptions (lapse, mortality, expenses, etc.) and effects from investment assumptions. Changes in actuarial bases (statutory valuation and embedded value) are separately identified. Note that new business is always classified as an item of experience variation in the analysis of embedded value, as the opening EV does not anticipate any future new business.

---

<sup>3</sup> [http://www.cfoforum.eu/embedded\\_value](http://www.cfoforum.eu/embedded_value)



Figure 15.3







### 1. Return on ANW

The  $ANW_0$  is expected to grow at the expected investment return for assets backing  $ANW_0$ .

### 2. Return on VEB

$VEB_0$  represents the present value, at the risk discount, of future profits distributed to shareholders. It is equal to:

- the present value at  $t = 0$  of profits in the period  $t = 0$  to  $t = 1$ ; and
- the present value at  $t = 0$  of profits in periods post  $t = 1$ .

Rolling the above forward by one year, the total simply increases by the risk discount rate (although part of the total, being the profits released at  $t = 1$ , are expected to transfer to ANW, with the balance forming  $VEB_1$ ). Thus, the expected return on  $VIF_0$  is the risk discount rate multiplied by  $VIF_0$ . This item is known as unwinding of the risk discount rate.

### 3. Demographic experience variations

Actual experience of operational items will be different than expected experience in two ways:

- profit emerging over the year will be different than expected (e.g. more deaths, lower lapses, higher actual office costs); and
- the number and types of contracts remaining at the end of the year will be different than originally anticipated.

Demographic experience variations will be split into components in a similar manner to that used to analyse policy liability profit over a period.

Typically, experience is analysed against opening assumptions (with changes in assumptions reflected at the end of the period). It is possible (but unusual) to reflect changes in assumptions on the opening EV, in which case demographic experience variations would be analysed against the new assumptions.



#### 4. **Demographic assumptions changes**

Changes in the valuation basis at the end of the period will have an effect on EV. Similarly, any change to the EV methodology should be disclosed. Assumption changes are typically applied to the closing EV (using the actual in-force data as at the end of the period).

#### 5. **New business**

New business sold in the year will typically cause a decrease in ANW through new business costs or strain, and an increase in VEB. If the ongoing margins for profit and initial expense recovery are negative, new business sales could reduce VEB. It is unlikely that business would be issued on loss-making terms, although isolated loss leading product series may be used for marketing purposes. Even for loss-making business, the release of capital supporting that business can result in positive distributable profits post sale.

As discussed in Section 15.6, it is important that definitions and measures of new versus existing business are applied consistently.

#### 6. **Investment experience variations, currency movements and economic assumption changes**

These are analysed analogously to the demographic experience variations and demographic assumption changes.

#### 7. **Capital raised** will increase ANW and **capital distributed** (i.e. shareholder dividends or capital returns) will decrease ANW. Analysis of this item simply requires careful identification of records as to the amount and timing of any capital transfers.

The above analysis is one way; a tabular approach is shown for an analysis of change in embedded value (for a savings portfolio) is shown in Table 15.3.



Table 15.3: Analysis of change in EV

| Analysis of Change in Embedded Value |                |
|--------------------------------------|----------------|
| Analysis Item                        | Embedded Value |
|                                      | \$m            |
| Value at start of year               | 1,000          |
| Expected change in value             | 110            |
| Expected value at end year           | 1,110          |
| Experience variations over period    |                |
| expenses                             | (20)           |
| sales                                | 24             |
| <i>redemptions</i>                   | (16)           |
| investment earnings                  | 20             |
|                                      | 8              |
| Assumption changes                   |                |
| redemptions                          | (85)           |
|                                      | (77)           |
| <b>Actual value at end year</b>      | <b>1,033</b>   |

The example illustrates the type of items which could appear in an analysis of change. Note that in this example, variations in investment earnings are part of the experience variations. In practice, the key variance items will depend upon the business being valued and what the variations are. For example, if the information above were based on a risk portfolio rather than a savings portfolio, then variance items relating to claims experience would be included.

Changes due to movements in the risk-free discount rate and risk discount rate are always likely to be significant, although they are not shown in this table. They are analysed by calculating the EV under old and new assumptions.



The construction of the steps in an analysis of change requires a considerable degree of judgement, particularly with regard to how related impacts are treated. Take, for example, CPI increases on sums insured for risk business. If opening assumptions include CPI of 3% and a CPI increase take-up rate of 80% (producing net CPI increases at 2.4%), and closing assumptions include CPI of 4% and a CPI increase take-up rate of 60%, there are two ways of analysing the change:

|                           | Approach A                        | Approach B   |
|---------------------------|-----------------------------------|--|
| Base                      | CPI = 3%<br>CPI Indexation = 2.4% | CPI = 3%<br>Take-up = 80%<br>CPI Indexation = 2.4% |
| Step 1: Change CPI        | CPI = 3%<br>CPI Indexation = 2.4% | CPI = 4%<br>Take-up = 80%<br>CPI Indexation = 3.2% |
| Step 2: Change Indexation | [No impact]                       | CPI = 4%<br>Take-up = 60%<br>CPI Indexation = 2.4% |

In practice, the analysis is likely to be further split so that it explains the movement in embedded value (often including a separate analysis of the movement in adjusted net worth and value of existing business) and, if considering appraisal values, the movement in the value of future new business. One of the most important items in the analysis of change for both of these items is the value of the new business sold during the reporting period. The value of new business sold will explain part of the increase in the embedded value. It will also directly affect the value of future new business if this is calculated using a new business multiplier applied to the value of one year's sales.

Because the value of one year's sales is such an important item in determining the appraisal value, it is important to analyse the reasons why it changes from one year to the next. Changes in the value of one year's sales will be driven by changes in volume and mix, best estimate assumptions, acquisition costs and product pricing.



### 15.10. Detailed examples

Two examples are presented in the next two sections and students are expected to work through the detail in the accompanying spreadsheet, *LI&R Val S1 2020 M15 Examples.xlsx*.

#### 15.10.1. Yearly renewable term insurance

This example is provided to assist in understanding the fundamental concepts and calculations of an appraisal value. There is more explanatory material on the LMS explaining the reserve calculations as the calculations obey a set of rules.

The example is for a single yearly-renewable term insurance policy. In practice, this calculation would be done across a portfolio of policies. It is shown for illustration only under simplified assumptions. The best estimate rate of investment return is assumed to be the same as the risk-free discount rate.

This example relates to new business and does not consider existing business.

You are given the following data, assumptions and information relating to the starting position.



Table 15.4

|                    |                  |  |
|--------------------|------------------|--|
| Entry              | 56               | Next   |
| Sex                | Male             |  |
| Smoker             | Non smoker       |  |
| Policy term        | 10               | Years  |
| Premium term       | 10               | Years  |
| Sum insured        | 250,000          | increases with CPI annually                                    |
| Premium payable    | annually         |  |
|                    |                  |  |
| Risk-free rate     | 3%               |  |
| Tax rate           | 30%              |  |
| Inflation          | 2%               |  |
| Expenses           |                  |  |
|                    | Fixed initial    | \$350.00 point of sale   |
|                    | Fixed renewal    | \$75.00 indexed and starts from beginning year 2               |
| Commission         |                  |  |
|                    | Variable initial | 70% of annual premium  |
|                    | Variable renewal | 5% of annual premium, indexed and starts from beginning year 2 |
| Mortality          | 100%             |  |
| Mortality table    | IA90-92          |  |
| Lapse rate         | 15%              |  |
| Reserves as % AP   | 20%              | Policy liabilities and capital requirements                    |
|                    |                  |  |
| Assets at start    | 1,500.00         |  |
| Risk discount rate | 8%               |  |



Table 15.5

| Term premium rates |                              | Decrement Rates |         |
|--------------------|------------------------------|-----------------|---------|
| Male non-smoker    |                              |                 |         |
| Age next           | Rate per \$1,000 sum insured | Age next        | qx      |
| 56                 | 0.00553                      | 56              | 0.0043  |
| 57                 | 0.00622                      | 57              | 0.0047  |
| 58                 | 0.00703                      | 58              | 0.00529 |
| 59                 | 0.00797                      | 59              | 0.00591 |
| 60                 | 0.00900                      | 60              | 0.00662 |
| 61                 | 0.01027                      | 61              | 0.00743 |
| 62                 | 0.01168                      | 62              | 0.00836 |
| 63                 | 0.01324                      | 63              | 0.00940 |
| 64                 | 0.01507                      | 64              | 0.01058 |
| 65                 | 0.01704                      | 65              | 0.01192 |

The resulting projection of cash flows (excluding interest earnings on net worth) is shown in Table 15.6.

Table 15.6

| Embedded/Appraisal value        |         |                   |             |           |            |         |            |                      |                              |     |                            |
|---------------------------------|---------|-------------------|-------------|-----------|------------|---------|------------|----------------------|------------------------------|-----|----------------------------|
| Year                            | Premium | Investment Income | Death outgo | Mat outgo | Surr outgo | Expense | Commission | Increase in reserves | Distributable Profit (gross) | Tax | Distributable Profit (net) |
| 1                               | 1,383   | 2                 | 1,065       | 0         | 0          | 350     | 968        | 277                  | -1,275                       | 39  | -1,313                     |
| 2                               | 1,342   | 45                | 1,023       | 0         | 0          | 65      | 68         | -8                   | 239                          | 50  | 189                        |
| 3                               | 1,309   | 44                | 985         | 0         | 0          | 56      | 68         | -7                   | 250                          | 48  | 202                        |
| 4                               | 1,280   | 43                | 949         | 0         | 0          | 48      | 68         | -6                   | 263                          | 47  | 216                        |
| 5                               | 1,246   | 42                | 916         | 0         | 0          | 42      | 67         | -7                   | 269                          | 45  | 224                        |
| 6                               | 1,224   | 41                | 886         | 0         | 0          | 36      | 68         | -4                   | 281                          | 43  | 237                        |
| 7                               | 1,198   | 40                | 858         | 0         | 0          | 31      | 67         | -5                   | 288                          | 41  | 247                        |
| 8                               | 1,168   | 39                | 829         | 0         | 0          | 26      | 67         | -6                   | 291                          | 39  | 252                        |
| 9                               | 1,142   | 39                | 802         | 0         | 0          | 23      | 67         | -5                   | 294                          | 37  | 257                        |
| 10                              | 1,107   | 38                | 775         | 0         | 0          | 19      | 66         | -228                 | 513                          | 34  | 478                        |
| Distributable Profit (lifetime) |         |                   |             |           |            |         |            |                      |                              |     | 989                        |
| Distributable Profit (NPV 8%)   |         |                   |             |           |            |         |            |                      |                              |     | 197                        |

Note: Investment income for VEB/VNB calculations is that the earnings on those assets backing capital reserves. This is because the 'Excess Assets' component of the EV/AV implicitly includes the future earnings on these assets in the face/market value given to them.



The initial excess assets held are assumed to be \$1,500, which is sufficient to support the initial strain of the business. The ongoing policy liabilities plus capital requirements are assumed, for simplicity, as being 20% of annual premiums in force on business written. This results in the following reserves and excess assets, which are used in the derivation of the distributable profits.

Additionally, in order to determine the tax amount, it is necessary to determine the policy liabilities. To assist, the policy liabilities are shown below.

**Table 15.7 Reserves and excess assets**

| Year | Reserve (boy) | Excess assets (boy) | Policy liabilities (boy) |
|------|---------------|---------------------|--------------------------|
| 1    | 0             | 1,500               | 0                        |
| 2    | 277           | 218                 | -1127                    |
| 3    | 268           | 411                 | -1063                    |
| 4    | 262           | 622                 | -981                     |
| 5    | 256           | 852                 | -879                     |
| 6    | 249           | 1,094               | -767                     |
| 7    | 245           | 1,354               | -635                     |
| 8    | 240           | 1,629               | -490                     |
| 9    | 234           | 1,915               | -336                     |
| 10   | 228           | 2,212               | -170                     |

The appraisal value also includes a value for imputation credits. These are assumed to be worth 70% of the value of future tax payable. (Perform the calculation yourself based on the above tax cash flows!)





Using the results above and calculating imputation credits, the appraisal value can be expressed as in Table 15.8.

**Table 15.8**

| Item                        | Value<br>\$ |                              |
|-----------------------------|-------------|------------------------------|
| Adjusted Net Worth          | 1,500       |                              |
| Value of Existing Business  | -           | As assumed only new business |
| Value of New Business       | 197         | Only one policy considered   |
| Value of Imputation Credits | 202         |                              |
| Appraisal Value             | 1,900       |                              |

### 15.10.2. Investment product example

This example is intended to show the fundamental concepts of an appraisal value as well as an analysis of change for an investment product.

In the example, tax rules based on Australian rules for superannuation are used to illustrate possible approaches to the modelling of tax. Tax is payable on policy owner investment earnings and policy owner fees receive a tax deduction, both at a rate of 15%. The net policy owner tax payable is deducted from policy owner unit balances and therefore benefits payable.

Tax is also payable at the corporate tax rate, 30%, on shareholder income less expenses, including investment income on the PCR. The impact of this tax in the EV is partially offset by the assumed value of imputation credits, being 70% of the net tax payable.

The example relates to 1,000 retirement bonds that all mature in 10 years' time, when all of the clients turn 65.



Table 15.9

|  |            |   |
|--|------------|---|
| Adjusted net worth   | 2,000,000  |   |
| Opening FUM  | 20,000,000 |   |
| All funds returned at end of 10 years as all members turn 65 |            |   |
| Premium p.a.   | -          | received at start of year                         |
| No. of members   | 1,000      |   |
| Fees:  |            |   |
| Member fee p.a.  | 90         | net of policy owner tax and paid at start of year |
| % fee  | 1.20%      | net of policy owner tax and paid over the year    |
| Risk discount rate   | 12%        |   |
| Expenses:  |            |   |
| \$ per member exp  | 75         | paid at start of year                             |
| % per member exp   | 1.10%      | paid over the year                                |
| Policy owner tax rate  | 15%        |   |
| Shareholder tax rate   | 30%        |   |
| Investment return on unit liabilities                        | 8%         |   |
| Investment return on shareholder equity                      | 4%         |   |
| Lapse rate   | 12%        | leaving midway through the year                   |
| PCR (% of FUM)   | 1%         |   |
| Assumes there are no deferred acquisition costs running off  |            |   |
| Distributable profits paid at end of year                    |            |   |



Table 15.10

| Time | Number of members boy | P/H FUM at boy | Premiums | P/H interest | P/H tax on interest | P/H fees gross of tax | P/H tax on fees | Lapses     | Maturity   | P/H FUM at eoy |
|------|-----------------------|----------------|----------|--------------|---------------------|-----------------------|-----------------|------------|------------|----------------|
| 1    | 1,000                 | 20,000,000     | 0        | 1,504,000    | -225,600            | -380,318              | 57,048          | -2,467,200 | 0          | 18,487,930     |
| 2    | 880                   | 18,487,930     | 0        | 1,390,292    | -208,544            | -346,864              | 52,030          | -2,280,671 | 0          | 17,094,173     |
| 3    | 774                   | 17,094,173     | 0        | 1,285,482    | -192,822            | -316,558              | 47,484          | -2,108,737 | 0          | 15,809,021     |
| 4    | 681                   | 15,809,021     | 0        | 1,188,838    | -178,326            | -289,084              | 43,363          | -1,950,201 | 0          | 14,623,611     |
| 5    | 600                   | 14,623,611     | 0        | 1,099,696    | -164,954            | -264,159              | 39,624          | -1,803,969 | 0          | 13,529,849     |
| 6    | 528                   | 13,529,849     | 0        | 1,017,445    | -152,617            | -241,531              | 36,230          | -1,669,042 | 0          | 12,520,333     |
| 7    | 464                   | 12,520,333     | 0        | 941,529      | -141,229            | -220,974              | 33,146          | -1,544,508 | 0          | 11,588,297     |
| 8    | 409                   | 11,588,297     | 0        | 871,440      | -130,716            | -202,284              | 30,343          | -1,429,532 | 0          | 10,727,547     |
| 9    | 360                   | 10,727,547     | 0        | 806,712      | -121,007            | -185,280              | 27,792          | -1,323,350 | 0          | 9,932,414      |
| 10   | 316                   | 9,932,414      | 0        | 746,918      | -112,038            | -169,800              | 25,470          | -1,225,263 | -9,197,701 | 0              |

Table 15.11

| Time | PCR at boy | PCR at eoy | Int on PCR | S/H fees | S/H expenses | S/H tax on int on PCR | S/H tax on fees | S/H tax on expenses | Distributable profits | Imputation credits |
|------|------------|------------|------------|----------|--------------|-----------------------|-----------------|---------------------|-----------------------|--------------------|
| 1    | 200,000    | 184,879    | 16,000     | 380,318  | -286,684     | -4,800                | -114,095        | 86,005              | 91,865                | 23,023             |
| 2    | 184,879    | 170,942    | 7,395      | 346,864  | -261,702     | -2,219                | -104,059        | 78,510              | 78,728                | 19,437             |
| 3    | 170,942    | 158,090    | 6,838      | 316,558  | -239,048     | -2,051                | -94,967         | 71,714              | 71,895                | 17,713             |
| 4    | 158,090    | 146,236    | 6,324      | 289,084  | -218,490     | -1,897                | -86,725         | 65,547              | 65,696                | 16,153             |
| 5    | 146,236    | 135,298    | 5,849      | 264,159  | -199,821     | -1,755                | -79,248         | 59,946              | 60,069                | 14,739             |
| 6    | 135,298    | 125,203    | 5,412      | 241,531  | -182,856     | -1,624                | -72,459         | 54,857              | 54,956                | 13,458             |
| 7    | 125,203    | 115,883    | 5,008      | 220,974  | -167,428     | -1,502                | -66,292         | 50,228              | 50,308                | 12,296             |
| 8    | 115,883    | 107,275    | 4,635      | 202,284  | -153,388     | -1,391                | -60,685         | 46,016              | 46,079                | 11,242             |
| 9    | 107,275    | 99,324     | 4,291      | 185,280  | -140,602     | -1,287                | -55,584         | 42,181              | 42,229                | 10,283             |
| 10   | 99,324     | 0          | 3,973      | 169,800  | -78,364      | -1,192                | -50,940         | 23,509              | 166,110               | 20,036             |

Table 15.12 shows the value represented by the example at time 0 as well as the expected value in one year's time (which equals the actual value if all goes as expected).



Table 15.12

|   | Net Worth   | Value of Inforce | Embedded Value | Value of New Business | Total       |
|---|-------------|------------------|----------------|-----------------------|-------------|
| Value at time 0                         | \$2,000,000 | \$497,583        | \$2,497,583    | \$0                   | \$2,497,583 |
| Expected change in value                | \$80,000    | \$59,710         | \$139,710      | \$0                   | \$139,710   |
| Move distributable profits to Net Worth | \$107,608   | -\$107,608       | \$0            |                       | \$0         |
| Expected value at end of period         | \$2,187,608 | \$449,685        | \$2,637,293    | \$0                   | \$2,637,293 |
| Actual value at time 1                  | \$2,187,608 | \$449,685        | \$2,637,293    | \$0                   | \$2,637,293 |

Expected gross expenses in Year 1 total \$286,684. Assume that expenses turned out to be different from expected in Year 1 with the effect of reducing profits by \$10,000, after allowing for tax and imputation credits. This suggests that the actual gross expense in Year 1 was \$297,673. Assume this leads to a basis change and the per member expense assumption for future years will be increased to \$80 per member from \$75, then the following two tables represent the impact on cash flows and value.

Table 15.13

| Time | PCR at boy | PCR at eoy | Int on PCR | S/H fees | S/H expenses | S/H tax on int on margin | S/H tax on fees | S/H tax on expenses | Distributable profits | Imputation credits |
|------|------------|------------|------------|----------|--------------|--------------------------|-----------------|---------------------|-----------------------|--------------------|
| 1    | 184,879    | 170,942    | 7,395      | 346,864  | -266,102     | -2,219                   | -104,059        | 79,830              | 75,648                | 18,513             |
| 2    | 170,942    | 158,090    | 6,838      | 316,558  | -242,920     | -2,051                   | -94,967         | 72,876              | 69,185                | 16,900             |
| 3    | 158,090    | 146,236    | 6,324      | 289,084  | -221,897     | -1,897                   | -86,725         | 66,569              | 63,311                | 15,437             |
| 4    | 146,236    | 135,298    | 5,849      | 264,159  | -202,820     | -1,755                   | -79,248         | 60,846              | 57,970                | 14,110             |
| 5    | 135,298    | 125,203    | 5,412      | 241,531  | -185,495     | -1,624                   | -72,459         | 55,648              | 53,109                | 12,904             |
| 6    | 125,203    | 115,883    | 5,008      | 220,974  | -169,750     | -1,502                   | -66,292         | 50,925              | 48,683                | 11,809             |
| 7    | 115,883    | 107,275    | 4,635      | 202,284  | -155,431     | -1,391                   | -60,685         | 46,629              | 44,649                | 10,812             |
| 8    | 107,275    | 99,324     | 4,291      | 185,280  | -142,401     | -1,287                   | -55,584         | 42,720              | 40,971                | 9,906              |
| 9    | 99,324     | 0          | 3,973      | 169,800  | -79,947      | -1,192                   | -50,940         | 23,984              | 165,003               | 19,704             |



Table 15.14

|   | Net Worth   | Value of Inforce | Embedded Value | Value of New Business | Total       |
|---|-------------|------------------|----------------|-----------------------|-------------|
| Values at time 0                        | \$2,000,000 | \$497,583        | \$2,497,583    | \$0                   | \$2,497,583 |
| Expected change in value                | \$80,000    | \$59,710         | \$139,710      | \$0                   | \$139,710   |
| Move distributable profits to Net Worth | \$107,608   | -\$107,608       | \$0            | \$0                   | \$0         |
| Expected value at end of period         | \$2,187,608 | \$449,685        | \$2,637,293    | \$0                   | \$2,637,293 |
| Expenses higher than expected in period | -\$10,000   | \$0              | -\$10,000      | \$0                   | -\$10,000   |
| Change in expense assumption            | \$0         | -\$14,779        | -\$14,779      | \$0                   | -\$14,779   |
| Unexplained                             | \$0         | \$0              | \$0            | \$0                   | \$0         |
| Actual value at time 1                  | \$2,177,608 | \$434,906        | \$2,612,514    | \$0                   | \$2,612,514 |

### 15.10.3. Change in AV exercise

This exercise is a much more complicated exercise than typical exercises embedded in this textbook. It follows the exam format where a scenario is presented and you need to demonstrate your knowledge in the context of the scenario.

**Question:**

*Your company reports to its parent on an annual basis. The method in use is to calculate an appraisal value at the end of each financial year.*

*The appraisal value report provided to your parent includes the following information:*

- *the actual appraisal value at the end of the current financial year; and*
- *the expected change in that appraisal value over the following year.*

*The actual appraisal value at the end of the current financial year is considerably different to the expected appraisal value provided in last year's reporting.*



The company is a niche marketer that sells a range of yearly-renewable term insurance products with TPD and trauma riders available. The company has been selling these products for 25 years.

The following information is provided with respect to this business.

Appraisal information at the end of the prior financial year:

|                 |                  |
|-----------------|------------------|
| VEB             | \$88.91m         |
| VNB             | \$72.05m         |
| ANW             | \$8.54m          |
| <b>Total AV</b> | <b>\$169.50m</b> |

In last year's appraisal value report, the expected change in the appraisal value over one year was \$19.31m.

The capital requirements above the policy liabilities are estimated to be 20% of the value of existing business calculated on appraisal value assumptions.

Capital strain for appraisal value reporting purposes expected for the coming financial year is \$8m. This represents shareholder capital required to fund costs and statutory capital requirements for new business.

Typical new business multipliers for AV purposes lie in the range 7 – 9.

Assume a risk discount rate of 10% is in use.

1. Identify and roughly quantify the impact of new business being 20% greater than expected for the current year on the experience on the parts (i.e. ANW, VEB and VNB) and the whole of the appraisal value as given.
2. Identify the impact of expenses (acquisition and maintenance combined) being \$2m higher than expected.  
(Hints: assume the expense variation occurs in the same year as the increase in new business in (1). Assume new business strain is 80% of premiums and initial expenses are 20% of the premium.)
3. Identify the changes you would expect in the ANW, VEB and VNB and the appraisal value overall if actual lapses were 30% higher than expected at all durations in force.



**Answer:**

### Part 1

$$\text{VEB on NB} = \text{VNB(at inception)} * (1 + \text{RDR})^{0.5} + \text{NB strain(@ year end)}$$

The question supplied information on new business multipliers and we can take 8 as an average.

Thus, we can deduce the rough value of 1 year's new business as  $\text{VNB}/8 = 72.05/8 = 9.01\text{m}$ . Therefore, VEB for 1 year of new business =  $9.01 * 1.1^{0.5} + 8 = 17.45$ .

If new business is 20% higher than expected, then VEB after this 1 year of new business is added would be expected to increase by  $20\% * 17.45 = 3.49\text{m}$ .

If new business is 20% higher than expected the VNB would be expected to increase by somewhere between 1 and 1.2 times, depending on the expected sustainability of the increase. In the absence of information around this, a conservative approach would be to allow a 10% increase, leading to a new VNB of 79.30 (increase of  $79.30 - 72.05 = 7.25$ ).

Additional reserves for capital are 20% of VEB, currently  $88.91 * 0.2 = 17.78\text{m}$ . The VEB will increase as indicated above; presumably, the capital will increase in line with this due to the additional liabilities and the additional assets backing them, and these being invested in a manner similar to the current arrangement. Thus, the capital will increase by  $3.49 * 0.2 = 0.7\text{m}$ .

VNW will also be reduced by the 1 year of strain now included in the VEB for this year's NB. Overall change to VNW =  $-0.7 - 8 * 0.2 = -2.30\text{m}$ .

This gives the following new end of year values:

**Table 15.15: New end of year values**

|                                |               |
|--------------------------------|---------------|
| Change in VEB from NB increase | 3.49          |
| Change in VNB from NB increase | 7.25          |
| Change in ANW from NB increase | -2.30         |
| Plus beginning year AV         | 169.50        |
| Plus change in AV              | 19.31         |
| <b>Total</b>                   | <b>197.25</b> |



### Part 2: Expenses \$2m higher than expected

Generally, initial expenses would be around 20% of premium.

New business strain would be around 70% to 90% of premium—let's say 80%.

Thus, an increase in new business of 20% above expected would generally result in a corresponding increase in initial expenses of  $20\% \times 20\% \times \$8\text{m} / 80\% = \$400,000$ .

Thus, \$400,000 has been allowed for in a). The remaining \$1.6m is an expense overrun that will affect the ANW.

### Part 3: Lapses 30% higher

There will be a lower end-of-year in force than expected, which will result in a proportionate reduction in the PVFP, thus VEB will reduce.

VNB will not be affected as the NB strain affects the net worth.

There will be a lower capital requirement at the end of the year due to the reduced end-of-year volume of business in force.

ANW is affected by the reduction in capital, which increases the net worth.

The reduction in VEB would be expected to be greater than the increase in ANW due to the capitalised effect of loss of all future profits from a lower volume of business in force at year-end.

Therefore, overall AV will be lower.

Any subsequent increase in the lapse assumption (given experience) will further decrease the VEB and also reduce the VNB due to the reduction in renewal premium volumes to recover the new business strain.





### 15.11. Example of disclosure of embedded value

This section shows an extract from the publicly-available investor report of an Australian listed life insurance company, showing a part of the disclosure of an EV calculation. The disclosure includes sensitivities of EVs to different discount rates and an analysis of changes in EV since the previous year end. Students should review this and other disclosures of embedded value calculations to gain an appreciation for the styles of presentation of results, disclosure of methods and assumptions, and some of the key business issues raised for the companies concerned.

Figure 15.4: AMP investor report 2013 EV and attribution of change

#### Embedded value (EV) and value of new business (VNB)

| <b>AFS embedded value (A\$m)<sup>1</sup></b>                 | <b>3% dm</b>  | <b>4% dm</b>  | <b>5% dm</b>  |
|--|---------------|---------------|---------------|
| Embedded value as at FY 12                                   | 11,695        | 10,962        | 10,318        |
| Expected return  | 725           | 780           | 828           |
| Investment markets, bond yields and currency                 | 418           | 432           | 443           |
| Claim and persistency assumptions, product and other         | (528)         | (482)         | (443)         |
| VNB  | 348           | 306           | 270           |
| Net transfers out  | (799)         | (799)         | (799)         |
| <b>Embedded value as at FY 13</b>                            | <b>11,859</b> | <b>11,199</b> | <b>10,617</b> |
| <b>Return on embedded value before transfers as at FY 13</b> | <b>8.2%</b>   | <b>9.4%</b>   | <b>10.6%</b>  |
| <b>Embedded value comprises</b>                              |               |               |               |
| Adjusted net assets <sup>2</sup>                             | 1,142         | 1,142         | 1,142         |
| Value of in-force business <sup>3,4</sup>                    | 10,717        | 10,057        | 9,475         |

#### Exercise 15.3

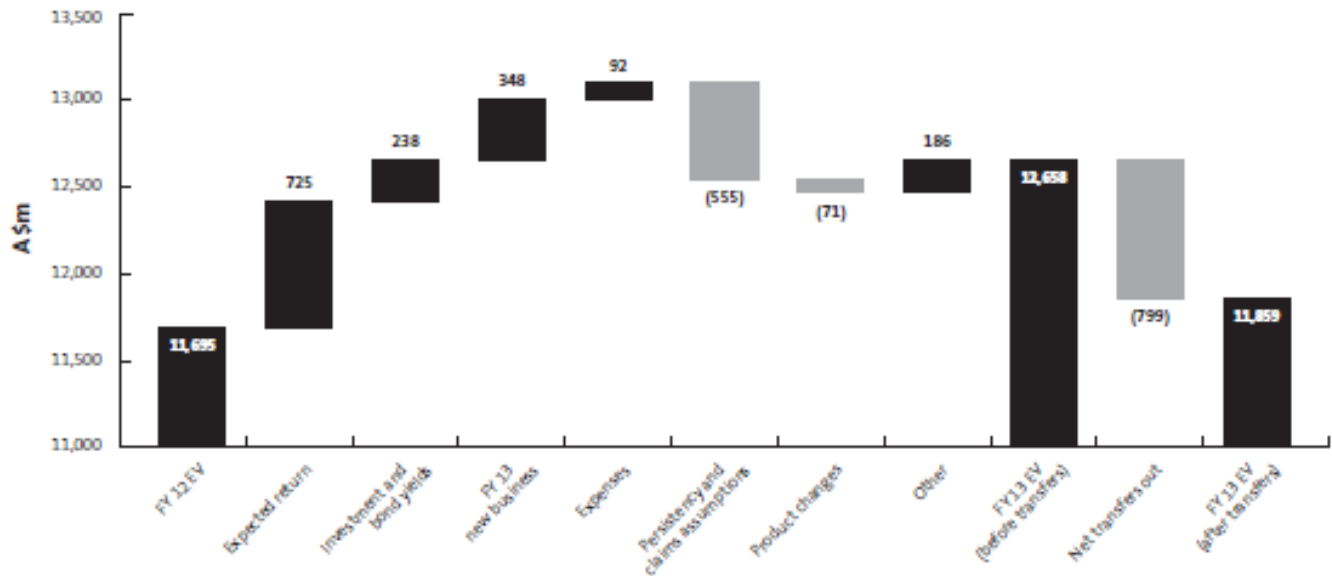
- (i) Why is the EV shown at three different discount rates?
- (ii) The table above includes VNB (\$306m at 4%dm). Is the row labelled 'Embedded value as at FY13' actually an appraisal value or an embedded value or something else?



Figure 15.5: Change in EV

### Change in AFS embedded value FY 13 (A\$m)

(at a discount rate of 3% above the bond yield)



#### Exercise 15.4

In the waterfall in Figure 15.5, explain which items of change the company would have known about at the end of 2012 and which would have come as a surprise. What may have happened to the business to cause those surprises?

## 15.12. Market consistent embedded values

This section introduces market consistent embedded values.

An MCEV consists of:

- free surplus;
- required capital; and
- value of existing business.



The required capital consists of shareholder assets whose distribution is restricted (e.g. required to meet regulatory requirements but may include target surplus). Free surplus consists of the remaining shareholder equity. The value of existing business is the risk-adjusted value of future distributable profits expected to emerge from the policy liabilities, allowing for the costs of holding capital to support the business.

The value of existing business consists of:

- present value of future shareholder profits (after tax); less
- the time value of financial options and guarantees; less
- frictional costs of required capital; less
- the cost of residual non-hedgeable risks.

The VEB should be valued on a market consistent basis (i.e. valued using discount rates consistent with those that would be used to value such cash flows in the capital markets). Different discount rates might be used for different types of cash flows. For example, if shareholder assets were invested in equities, a higher discount rate would be used to value the best estimate investment returns than if the assets were invested in fixed interest. Alternatively, a simplifying method sometimes used for calculating the VEB on a market consistent basis is to assume that both future investment return and the discount rate are at the risk-free rate.

The present value of future shareholder profits is determined using best estimate assumptions but excludes the time value of financial options and guarantees.

The time value of financial options and guarantees must be calculated using stochastic techniques. This is a key difference between an MCEV and the 'traditional' method discussed earlier in this module. Under the traditional method, the value of financial options and guarantees would be allowed for by adjusting the risk discount rate. If the guarantees were closer to being 'in the money', a higher risk discount would be used. However, this adjustment is fairly crude. Financial options and guarantees are asymmetric in nature (i.e. in many scenarios, often including the best estimate scenario, the options and guarantees will not come 'into the money' and will have zero cost, but in some adverse scenarios they will). A stochastic model is a far more accurate method of measuring the cost of financial options and guarantees.



Frictional costs are defined to be the tax and investment expenses relating to required capital. By investing capital in a life company, shareholders lock in their capital and become liable for additional tax and investment expenses, compared to the alternative of investing directly in assets similar to those held by the life company. The life company is taxed on its investment income and shareholders are taxed again on their dividends from the life company. Note that, in Australia, some shareholders can use imputation credits to offset their tax liabilities, therefore double taxation is largely avoided and frictional costs are limited to investment expenses.

Residual non-hedgeable risks are those risks not already allowed for in the value of future shareholder profits or in the time value of financial options and guarantees. Non-hedgeable means that the risks cannot be readily transferred to another party, such as a reinsurer, or through matching the assets to the liabilities. These risks include operational risk, strategic risk and reputational risk. This tends to be the most subjective part of the valuation. The cost of residual non-hedgeable risks might, for example, be allowed for by adding a margin to the discount rate used to determine the present value of future shareholder profits.

An MCEV (in total) should not necessarily be materially different from a traditional embedded value. Both methods have the same objective of determining the economic value of the owners' interest in a life company. However, the presentation of the components of the embedded value differs and an MCEV uses a more complex method of allowing for risk. It can be useful to use both methods in order to gain greater insights into the value of the business. For this reason, some companies publish both traditional and market consistent embedded values in their market disclosures. The MCEV methodology is particularly useful for valuing life companies with complex or asymmetric risks, such as those found in participating business. It tends to be less useful for simpler types of business, such as risk insurance business and investment-linked business, which do not have financial options or guarantees.

The reasons for moving from traditional embedded value reporting to market consistent techniques are considered in the paper by O'Keefe et al.<sup>4</sup>. The CFO Forum website ([www.cfoforum.eu](http://www.cfoforum.eu)) contains a set of MCEV principles used by European life insurance firms. The reasons for the move to MCEV and the CFO Forum MCEV principles are outside the syllabus.

---

<sup>4</sup> O'Keefe, P., Desai, A., Foroughi, K., Hibbett, G., Maxwell, A., Sharp, A., Taverner, N., Ward, M., Willis, F. (2005). Current Developments in Embedded Value Reporting. *British Actuarial Journal*, 11(3), 407-479.



### 15.13. Key learning points

- An appraisal value is the sum of three items: the value of existing business (VEB), the adjusted net worth (ANW) and the value of future new business (VNB).
- The embedded value (EV) is the sum of two items: the value of existing business and the adjusted net worth.
- The VEB is the present value, at the hurdle rate, or risk discount rate, of future distributable profits, being the sum of reported profits and net releases of required capital.
- ANW refers to the 'excess assets' of the company. It is the economic value of assets in excess of liabilities and regulatory capital.
- An alternative presentation of EV results is sometimes used, where ANW includes the full face value of locked-in capital, and the VEB is the present value of profits less the cost of capital.
- The VNB is the value of the distributable profits expected to emerge from future sales of new business. There can be a lot of uncertainty around future sales volumes and future pricing.
- Any definition of new business should be disclosed and applied consistently.
- The EV can be presented as a more 'economic' representation of the items on a life company's balance sheet. Key differences are that the EV reflects a cost of capital, since capital supporting liabilities are discounted and profit is discounted at a higher rate.
- Management needs to understand the reasons for changes in EV. An analysis of change also acts as a check on the accuracy of the calculations.
- An EV is very sensitive to the assumptions that are used and EV reports often highlight the sensitivity of the results to changes in the key assumptions.
- In Europe, market consistent embedded values (MCEVs) are widely adopted rather than the traditional deterministic approach to EV.



### 15.14. Answers to exercises

#### Exercise 15.1:

Write down situations where appraisal values are likely to be a useful tool.

Notes:

These answers are extracted from the paper 'The Determination of Life Office Appraisal Values' by Burros. R.P. and Whitehead, G.H.. JIA 114 (1987) 41 – 465.

Answer:

Appraisal values have been used as follows:

- as a basis for valuing life assurance companies which have been offered for sale;
- in the defence of a takeover bid for a quoted life assurance company;
- in assessing the financial implications of a potential merger of a life office with another financial institution;
- as input to the offer documentation for the listing of a financial group including a life assurance operation;
- in order to account for a life operation on a realistic basis;
- in order to place a more realistic value on the majority holding on an unquoted life insurance company by an investment trust;
- as a contribution to management information systems designed to disclose the effective progress of a proprietary life assurance operation; and
- to value shares under share incentive schemes.

#### Exercise 15.2:

Suppose a life assurance company holds \$100m of capital invested in cash, earning 3% per annum. If a projection showed that capital was depleted each year by \$10m, and shareholders required a 10% investment return, determine the cost of capital. State your assumptions.

Answer:

Assume the capital is depleted at the end of the year.



The face value of \$100m is received over the next 13 years at \$10m in years 1 – 12 plus a small residual at the end of year 13. The present value is \$68.33 and thus the cost of capital is \$31.77.

| Year                           | Capital SOY | Capital EOY | Outflow | Balance  | PV @ 10% |
|--------------------------------|-------------|-------------|---------|----------|----------|
| 1                              | 100         | 103         | -10     | 93       | 9.09091  |
| 2                              | 93          | 95.79       | -10     | 85.79    | 8.26446  |
| 3                              | 85.79       | 88.3637     | -10     | 78.3637  | 7.51315  |
| 4                              | 78.3637     | 80.71461    | -10     | 70.71461 | 6.83013  |
| 5                              | 70.71461    | 72.83605    | -10     | 62.83605 | 6.20921  |
| 6                              | 62.83605    | 64.72113    | -10     | 54.72113 | 5.64474  |
| 7                              | 54.72113    | 56.36276    | -10     | 46.36276 | 5.13158  |
| 8                              | 46.36276    | 47.75365    | -10     | 37.75365 | 4.66507  |
| 9                              | 37.75365    | 38.88626    | -10     | 28.88626 | 4.24098  |
| 10                             | 28.88626    | 29.75284    | -10     | 19.75284 | 3.85543  |
| 11                             | 19.75284    | 20.34543    | -10     | 10.34543 | 3.50494  |
| 12                             | 10.34543    | 10.65579    | -10     | 0.655793 | 3.18631  |
| 13                             | 0.655793    | 0.675467    | 0.67547 | 0        | 0.19566  |
| Total present value of outflow |             |             |         |          | 68.3326  |



### Exercise 15.3:

- (i) Why is the EV is shown at three different discount rates?
- (ii) The table above includes VNB (\$306m at 4%dm). Is the row labelled 'Embedded value as at FY13' actually an appraisal value or an embedded value or something else?

Answer:

- (i) This is to provide an indication of the sensitivity of the results to different discount rates.
- (ii) It is an EV calculation. The 'VNB' is the value of business written in 2013. It is a useful proxy for the value of future VNB.

### Exercise 15.4:

In the waterfall in Figure 15.5, explain which items of change the company would have known about at the end of 2012 and which would have come as a surprise. What may have happened to the business to cause those surprises?

Answer:

The expected return would have been known but all the other items are 'surprises'.

Try to think of distinct examples for each category.





## About the Actuaries Institute

The Actuaries Institute is the sole professional body for actuaries in Australia. The Institute provides expert comment on public policy issues where there is uncertainty of future financial outcomes. Actuaries have a reputation for a high level of technical financial skills and integrity. They apply their risk management expertise to allocate capital efficiently, identify and mitigate emerging risks and to help maintain system integrity across multiple segments of the financial and other sectors. This expertise enables the profession to comment on a wide range of issues including life insurance, health insurance, general insurance, climate change, retirement income policy, enterprise risk and prudential regulation, finance and investment and health financing.

Published December 2019  
© Institute of Actuaries of Australia 2019  
All rights reserved

## 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](mailto:actuaries@actuaries.asn.au)  
[www.actuaries.asn.au](http://www.actuaries.asn.au)

