

CMP Upgrade 2018/19

Subject SP1

CMP Upgrade

This CMP Upgrade lists the changes to the Syllabus objectives, Core Reading and the ActEd material since last year that might realistically affect your chance of success in the exam. It is produced so that you can manually amend your 2018 CMP to make it suitable for study for the 2019 exams. It includes replacement pages and additional pages where appropriate. Alternatively, you can buy a full set of up-to-date Course Notes / CMP at a significantly reduced price if you have previously bought the full-price Course Notes / CMP in this subject. Please see our 2019 *Student Brochure* for more details.

This CMP Upgrade contains:

- all significant changes to the Syllabus objectives and Core Reading.
- additional changes to the ActEd Course Notes and Series X Assignments that will make them suitable for study for the 2019 exams.

Note that the format of the Course Notes has changed for the 2019 exams. As well as presentational changes:

- the self-assessment questions now contain solutions within the chapters themselves
- there are no Q&A Banks; instead, each chapter contains a number of *Practice Questions* at the end.

1 Changes to the Syllabus objectives

General changes

The format of the Syllabus objectives has changed. They now include:

Weightings

Weightings that are indicative of the approximate balance of the assessment of this subject between the main syllabus topics, averaged over a number of examination sessions. For Subject SP1 these weightings are as follows:

1. Health and Care products and general business environment (15%)
2. Product design and specific features (25%)
3. Risks and risk management (30%)
4. Models and valuation (15%)
5. Monitoring experience and setting assumptions (15%)

Numbering

The numbering of the syllabus objectives has also changed.

Specific changes

Most of the Subject SP1 syllabus objectives have minor changes. In addition, a 'Solving problems' objective has been added. The syllabus objectives for Subject SP1 are copied in below:

Syllabus

The Syllabus for Subject SP1 is given here. To the right of each objective are the chapter numbers in which the objective is covered in the ActEd course.

Aim

The aim of the Health and Care Principles subject is to instil in successful candidates the ability to apply, in simple situations, the main principles of actuarial planning and control that are relevant to the provision of health and care benefits.

Competences

On successful completion of this subject, a student will be able to:

1. understand the main principles and techniques of actuarial management and control that are relevant to health and care insurance
2. apply these principles to simple situations within the context of health and care insurance
3. analyse hypothetical scenarios, including using judgement to assess the implications of possible actions and to develop appropriate proposals or recommendations relating to the management of health and care insurance business.

Syllabus topics

- | | | |
|----|---|-------|
| 1. | Health and Care products and general business environment | (15%) |
| 2. | Product design and specific features | (25%) |
| 3. | Risks and risk management | (30%) |
| 4. | Models and valuation | (15%) |
| 5. | Monitoring experience and setting assumptions | (15%) |

The weightings are indicative of the approximate balance of the assessment of this subject between the main syllabus topics, averaged over a number of examination sessions.

The weightings also have a correspondence with the amount of learning material underlying each syllabus topic. However, this will also reflect aspects such as:

- the relative complexity of each topic, and hence the amount of explanation and support required for it
- the need to provide thorough foundation understanding on which to build the other objectives
- the extent of prior knowledge which is expected
- the degree to which each topic area is more knowledge or application based.

Detailed syllabus objectives

0. Introduction
- 0.1 Define the principal terms used in health and care. (Chapter 31)
1. Health and Care products and general business environment (15%)
- 1.1 Describe the main types of Health and Care contract and their purpose for the customer: (Chapters 1 to 5)
- critical illness insurance
 - income protection insurance
 - long-term care insurance
 - health cash plans
 - major medical expenses
 - private medical insurance
 - group and individual covers.
- 1.2 Understand the operating environments in which health and care insurance products and services are traded: (Chapters 8 and 9)
- distribution channels
 - regulatory and taxation regimes
 - professional guidance
 - economic and political influences.
- 1.3 Explain the role of the State in the provision of alternative or complementary health and care protection: (Chapter 10)
- objectives of State healthcare provision
 - methods of State healthcare provision
 - funding approaches.
2. Product design and specific features (25%)
- 2.1 Demonstrate an understanding of health and care product design, including: (Chapters 6 and 7)
- 2.1.1 Describe the principles by which health and care insurance contracts are designed and the interest of the various stakeholders in the process.
- 2.1.2 Determine a suitable design for a product in a given situation.
- 2.1.3 Discuss the relative merits of different product designs.

3. Risks and risk management (30%)
- 3.1 Assess how the following can be a source of risk to a health and care insurance company: (Chapters 23 to 25)
- data
 - claim rates
 - claim amounts
 - investment performance
 - expenses and inflation
 - persistency
 - mix of new business
 - volume of new business
 - guarantees and options
 - competition
 - actions of management
 - actions of distributors
 - counterparties
 - legal, regulatory and tax developments
 - reputation
 - internal audit failures/fraud
 - physical risks
 - aggregation and concentration of risk
 - catastrophes
 - non-disclosure and anti-selection.
- 3.2 Demonstrate the application of reinsurance as a risk management technique. (Chapter 26)
- 3.2.1 Describe the purposes of reinsurance.
- 3.2.2 Describe the different types and structures of reinsurance.
- 3.2.3 Discuss the factors that should be considered in determining the level of retention.
- 3.3 Demonstrate the application of underwriting as a risk management technique. (Chapter 27)
- 3.3.1 Outline the purposes of underwriting.
- 3.3.2 Describe the different approaches by which underwriting is applied.
- 3.3.3 Discuss the factors that should be considered when determining the level of underwriting to use.

- 3.4 Propose further ways of managing the risks in 3.1, including: (Chapter 27)
- claims management
 - data checks
 - product design
 - managing the distribution process and customer relationship
 - managing other counterparties
 - other internal processes.
- 3.5 Demonstrate the application of asset-liability matching as a risk management technique. (Chapter 28)
- 3.5.1 State the principles of investment and how they apply to health and care insurance.
- 3.5.2 Analyse health and care insurance liabilities into different types for asset-liability matching purposes.
- 3.5.3 Propose an appropriate asset-liability matching strategy for different types of liability.
4. Models and valuation (15%)
- 4.1 Describe the main features of a health and care insurance model. (Chapters 11 and 17)
- 4.1.1 Outline the objectives and basic features of a health insurance model.
- 4.1.2 Compare the stochastic and deterministic approaches.
- 4.1.3 Compare a formula and cashflow approach.
- 4.1.4 Outline the basic features of multi-state models.
- 4.1.5 Explain the use of sensitivity analysis.
- 4.2 Understand and apply the techniques used in pricing health and care insurance products in terms of: (Chapters 11, 12 and 17 to 20)
- data availability
 - assumptions used
 - equation of value / formula approach
 - cashflow techniques
 - group risk assessments
 - options and guarantees
 - external influences.

- 4.3 Demonstrate the different uses of actuarial models for decision-making purposes in health and care insurance, including: (Chapter 11)
- pricing products
 - developing investment strategy
 - projecting solvency
 - calculating embedded value.
- 4.4 Discuss the determination of supervisory reserves and solvency capital requirements for a health and care insurance company. (Chapters 21 and 22)
- 4.4.1 Describe the purposes of reserves, solvency capital requirements and embedded values, and the methodologies by which they are calculated for a health and care insurer, including:
- role of statistical and individual case estimates
 - setting assumptions, including a comparison with those used in pricing
 - market-consistent valuation
 - Value at Risk (VaR) capital assessment.
- 4.4.2 Discuss the interplay between the strength of the supervisory reserves and the level of solvency capital required.
- 4.4.3 Compare passive and active valuation approaches.
5. Monitoring experience and setting assumptions (15%)
- 5.1 Describe the principles of setting assumptions for health and care insurance business. (Chapters 13 to 16 and 19)
- 5.1.1 Describe the principles of setting assumptions for pricing health and care insurance contracts.
- 5.1.2 Describe the principles of setting assumptions for determining liabilities.
- 5.1.3 Explain why the assumptions used for supervisory reserves may be different from those used in pricing.
- 5.1.4 Outline the principles of setting assumptions for determining embedded value.
- 5.2 Demonstrate the relevance of experience monitoring to a health insurance company. (Chapter 29)
- 5.2.1 Explain why it is important for a health insurance company to monitor its experience.
- 5.2.2 Describe how the actual mortality, morbidity, claims amounts, persistency, expense, new business and investment experience of a health insurance company should be monitored, including the data required.

- 5.3 Demonstrate the relevance of analysis of surplus or profit. (Chapter 29)
 - 5.3.1 Give reasons for undertaking an analysis of surplus and an analysis of embedded value profit.
 - 5.3.2 Suggest ways in which the results of such analyses can be used.
- 6. Solving problems
 - 6.1 Analyse hypothetical examples and scenarios in relation to the financial management of health and care insurance companies. (Chapter 30)
 - 6.1.1 Propose solutions and actions that are appropriate to the given context, with justification where required.
 - 6.1.2 Suggest possible reasons why certain actions have been chosen.
 - 6.1.3 Assess the implications of actions within a given scenario.
 - 6.1.4 Discuss the advantages and disadvantages of suggested actions, taking into account different perspectives.

2 Changes to the Core Reading and ActEd material

There are numerous minor changes throughout the Core Reading and ActEd material.

This section contains all the *non-trivial* changes to the Core Reading and ActEd text.

Chapter 17

Section 1

This section (on IP pricing) has been amended (and reduced) significantly. Replacement pages are attached.

Chapter 20

Section 2

This section has been amended significantly. Replacement pages are attached.

The Appendix has also been deleted.

Chapter 21

This chapter has been split into two new chapters:

- Reserves and embedded value
- Approaches to setting reserves and solvency capital requirements

and the following chapters have been renumbered accordingly.

A small amount of material on EV has been moved from Chapter 13 to the new *Reserves and embedded value* chapter.

The material in these chapters is largely unchanged.

Chapter 27

Section 3.4, page 15

The penultimate bullet point (which was ActEd text) has been replaced by the following Core Reading bullet point:

- **restrictions on the valuation method used**

Chapter 29

Some definitions required for Subject SA1 (previously marked '(UK)' and now marked '(SA1)') have been deleted and others added. Details are not given here as they are only examinable in Subject SA1.

The following definition has been added and is examinable in Subject SP1:

Wearable technology

Wearable technology is often in the form of devices worn by a health and care insurance company's policyholders, which allows the insurer to monitor the policyholder's physical activity. For example, some devices allow the tracking of the number of steps taken by an individual on a given day. Some health and care insurers offer incentives and premium discounts for consumers that wear this type of technology.

Chapter 30

A new chapter has been added on problem solving. A replacement chapter is attached.

3 Changes to the X Assignments

Overall

There have been minor changes throughout the handout, including changes to mark allocations.

More significant changes are listed below.

Assignment X1

The questions have been re-ordered, but the questions and solutions are largely unchanged. Replacement pages are included for the questions.

Assignment X2

Question X2.7 now refers to a generic developed country rather than Actuarial.

Question X2.8 is now split into two parts:

- (i) Describe the sensitivity tests you would perform before going ahead with the launch. [11]
- (ii) Suggest any amendments that you might have to make to the product as a result of your investigations. [4]

but the content of the solution is largely unchanged.

Assignment X3

Question X3.2 has been removed from this assignment and subsequent questions renumbered.

Question X3.3 has been expanded. Replacement pages are attached.

Assignment X4

Question X4.1 has been deleted and an alternative added in its place. Replacement pages are attached.

Question X4.3 has been reduced from [12] to [11] and the solution changed significantly. Replacement pages are attached.

Question X4.4(ii) has been reduced from [8] to [6] and a new part has been added at the end. Replacement pages are attached.

Question X4.5(ii) has been reduced from [6] to [5].

Question X4.6(i) has been reduced from [8] to [7].

Solution X4.7 has had its references to the conventional and North American methods removed.

Question X4.8(v) has been reduced from [3] to [2].

The questions have been re-ordered.

Assignment X5

Question X5.7 now refers to a local reinsurer rather than *NotonyourLife*.

Assignment X6

No significant changes.

4 Other tuition services

In addition to the CMP you might find the following services helpful with your study.

4.1 Study material

We also offer the following study material in Subject SP1:

- Flashcards
- Revision Notes
- ASET (ActEd Solutions with Exam Technique) and Mini-ASET
- Mock Exam.

For further details on ActEd's study materials, please refer to the *2019 Student Brochure*, which is available from the ActEd website at www.ActEd.co.uk.

4.2 Tutorials

We offer the following tutorials in Subject SP1:

- a set of Regular Tutorials (lasting three full days)
- a Block Tutorial (lasting three full days).

For further details on ActEd's tutorials, please refer to our latest *Tuition Bulletin*, which is available from the ActEd website at www.ActEd.co.uk.

4.3 Marking

You can have your attempts at any of our assignments or mock exams marked by ActEd. When marking your scripts, we aim to provide specific advice to improve your chances of success in the exam and to return your scripts as quickly as possible.

For further details on ActEd's marking services, please refer to the *2019 Student Brochure*, which is available from the ActEd website at www.ActEd.co.uk.

4.4 Feedback on the study material

ActEd is always pleased to get feedback from students about any aspect of our study programmes. Please let us know if you have any specific comments (*eg* about certain sections of the notes or particular questions) or general suggestions about how we can improve the study material. We will incorporate as many of your suggestions as we can when we update the course material each year.

If you have any comments on this course please send them by email to SP1@bpp.com.

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1 Income protection insurance

1.1 Inception / disabled life annuity approach

The inception / disabled life annuity approach provides a method of determining the *expected cost of benefits from claims incepting in a particular year*.

The inception / disabled life annuity approach is a simplified model that considers two functions, namely:

- the claim inception rate
- the disabled life annuity.

It ignores recoveries (or alternatively makes no distinction between recoveries and death) and subsequent future sickness.

Claim inception rate

The claim inception rate, i_x^d , is the probability that a claim will become payable to an individual in the year of age x to $x+1$. The individual will have become sick d weeks or months (or years) earlier and remained so to benefit commencement.

Note that *claim* inception rates are different from *sickness* inception rates:

- *Sickness inception rates* relate to when individuals fall sick. In an IP insurance context, this corresponds to the point in time when the individual is first deemed unable to work.
- *Claim inception rates* relate to the point in time at which benefit payments commence. In an IP insurance context, this corresponds to the end of the deferred period.



Question

When would the sickness and claim inception rates be equal?

Solution

The sickness and claim inception rates would be equal when there is no deferred period, so that the benefit payments commence immediately as the policyholder falls sick.

'Claim inception rates' are derived from 'sickness inception rates' by multiplying the probability of sickness inception by the probability of remaining sick throughout the deferred period.

Disabled life annuity

The disabled life annuity is the present value at the date of claim inception of expected claim payments to individuals disabled after the deferred period until policy expiry.

Allowance is made for any escalation of the claim amount, interest and the probabilities of death and recovery between the end of the deferred period and expiry date.

Expected claims outgo

Within the cashflow program, the claims outgo in any period is taken as the lump sum value of the benefit (annual amount \times disabled life annuity) multiplied by the probability of becoming eligible for claim (claim inception rate).

The final steps would be to allow for the probability of being *alive and not currently claiming* at the point of making a claim and to discount the value of this claims outgo back to the date of policy inception.

So, in summary, the expected present value of claims incepting in a particular year can be derived as the product of the following five components:

- (1) the probability that the policyholder is eligible to claim in the year under consideration (for example, policyholders who are already claiming and policyholders who have died before that year would not be eligible to claim) – this is sometimes referred to as a *survival* probability
- (2) the claim inception rate corresponding to the year under consideration
- (3) the value of the annuity then payable for the duration of the claim
- (4) a discount factor – this is needed to discount the annuity value from the point of claim back to the policy inception
- (5) the annual benefit amount.

Note that these components are not uniquely defined and that there are different types of eligibility probability, claim inception rate and disability annuity.

1.2 Multi-state modelling

Multi-state modelling was introduced in Chapter 11.

The inception / disabled life annuity approach is a simplification of a more complex methodology, multi-state modelling. With multi-state modelling, policyholders are separately tracked through the various stages of ‘healthy’ and ‘claiming’:

- **healthy premium payers**
- **lives falling sick within deferred period**
- **lives becoming claimants following deferred period**
- **lives recovering, reverting to premium payers**
- **lives dying.**

Each subclass will have its own set of transition probabilities: sickness inception, lapse, mortality, recovery, policy expiry.

Depending on the sophistication of the model, probabilities may vary according to the number of previous times that the cohort has been ill and all transition rates may be a function of the duration within that stage.

The actuary needs to recognise that the available data may not permit this degree of sophistication of the method in practice.

Recall from Chapter 11 that:

- in theory, the model could be very complex, with hundreds of sub-cohorts open at any time
- in practice, the lack of detailed, credible data is likely to necessitate the combination of various sub-cohorts and/or a reduction in the number of transition intensities required.

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2 Valuing a mortality / morbidity option

2.1 Method

Mortality / morbidity options are normally valued using cashflow projections.

These cashflows would include the additional benefits expected to be payable under the option and the additional premiums expected to be received in relation to these benefits, to the extent to which the option is assumed to be taken up. The additional premiums would be based on the expected premium rates that would be charged to standard lives for the additional benefit, as at the option exercise date.

So, when policyholders exercise the option, they will pay exactly the same premium as a new policyholder that has just passed underwriting on that day, *ie* they will be charged a premium based on the select tables in use at that time.

The projections should also allow for any additional expenses incurred in the administration of the option.

For example, expenses would be incurred if the insurer writes to each policyholder to remind them of the option before the exercise date. Expenses will then be incurred in processing the policyholder's request to exercise the option.

If the purpose of the valuation is pricing the option, then allowance should also be made for the additional reserves that should be held, both before and after exercise.



Question

Explain why a policy that contains a morbidity option is likely to need much higher reserves than the equivalent policy without an option.

Solution

The existence of the morbidity option increases the morbidity risk. For example, an option to extend the term increases the *time* for which the insurer is exposed to risk. Similarly, an option to increase the sum insured increases the *amount* that is exposed to risk. The reserves need to be increased for the expected cost of the increased claims.

However, reserves will also need to increase to reflect the uncertainty in this expected cost. Alternatively, additional solvency capital will be required to cover these risks.

Before the option is exercised, the insurer is exposed to the risk that policyholders will selectively choose to exercise the option if their health is worse than for a select life.

Even after the option has been exercised, the insurer is still exposed to considerable uncertainty. As there is no further underwriting, it has no way of knowing the health of the lives that exercised the option. Reserves will need to be calculated on the assumption that a level of anti-selection has taken place.

2.2 Assumptions needed

Valuing a mortality option therefore requires extra assumptions as part of the basis:

- the probability that the option will be exercised, at each possible exercise date
- the additional benefit level that will be chosen, if this is at the discretion of the policyholder
- the expected mortality / morbidity of the lives who choose to exercise the option
- the expected mortality / morbidity of the lives who choose not to exercise the option
- any additional expenses relating to the option.

Option take-up rates

The model may assume that all eligible policyholders will take up the option, and that the maximum additional benefit will always be taken.

You may see this approach (*ie* using the assumption that everyone exercises the option) described as the 'conventional method' in past exam questions.

The assumption that *everyone* will exercise the option is unlikely to be borne out in practice, but the method does have the advantage of simplicity.

If there are many possible dates on which an option may be exercised, or there is a choice from several alternative options, the model may assume that the worst option from the financial point of view of the company is chosen with probability one.

Alternatively, the model may use more sophisticated take-up rate assumptions which vary by exercise date or by alternative option. These would ideally be based on past experience.

You may see this approach (*ie* making an assumption about the proportion of policyholders that exercise the option) described as the 'North American method' in past exam questions.

This method uses a more realistic assumption for the option take-up rate than the first approach suggested above. However, it may be difficult to obtain the data to make suitable assumptions (historically this data was only available in North America, hence the name).

Mortality / morbidity rates

Typically, due to anti-selection, the expected mortality / morbidity of lives who take up the option will be heavier than that of those who do not.

For example, the mortality of those who exercise the option may be assumed to be a higher percentage of the base mortality table, eg those that exercise the option might be assumed to experience mortality of 150% of the base mortality table.

Alternatively, an age loading may be applied (eg a policyholder of age x may be assumed to experience mortality of age $x + 5$ years).

It may instead be assumed that the mortality experience of those who take up the option will be the Ultimate experience which corresponds to the Select experience that would have been used as a basis if underwriting had been completed as normal when the option was exercised. This would be consistent with an assumption that all eligible policyholders take up the option.

So, this would be the approach to use under the ‘conventional method’ described above.

As noted earlier, there should be a link between the assumed option take-up rates and the assumed mortality rates.

It may be assumed that the lives who do not take up the option will continue to experience the same level of mortality as would have been assumed without the existence of the option. However, this would mean that the average mortality for all lives has been assumed to be in excess of the base mortality assumption, since those taking up the option are assumed to experience higher mortality than this level.

For example, if lives that take up the option are assumed to be ‘ultimate plus ten years’ and the lives that do not take up the option are assumed to be ‘ultimate’, then the average of their mortality must be heavier than ultimate.

However, the average mortality of all lives (both those that take and do not take the option) would be expected to be ultimate. To address this, the following alternative approach could be used.

An alternative assumption would therefore be that the mortality of those who do not take up the option is such that average mortality for all lives remains at the base expected level. The assumed mortality of those who do not take up the option would then be lower than this base level.

For example, under this alternative approach, the lives that take up the option could be assumed to be ‘ultimate plus ten years’ and the average mortality would be assumed to be ultimate. If the proportion that take up the option is 25% (say), then a mortality assumption could be determined for the lives that *do not* take up the option, q' , as follows:

$$q_x = 0.25q_{x+10} + 0.75q'$$

The assumed mortality of those who do not take up the option, q' , will be *lower* than ultimate, for example, it might turn out that $q' = q_{x-3}$.

Whilst the example outlined above discuss a mortality example, similar comments would apply for morbidity.

2.3 Stochastic modelling

The core cost of options can be established through stochastic modelling. The future experience is projected and the numbers taking up the various options and their subsequent claim propensities are investigated. A large number of simulations will be tested and the cost of the option will be calculated with a particular statistical degree of adequacy.

The model would have to subdivide the population of policyholders into different risk categories, such as groups (1) and (2) as defined in the previous section, and quite possibly including additional subgroups within these. The proportions ending up in each risk group and also the average claim experience of each risk group at the option date could be modelled as stochastic variables. We would therefore need appropriate probability distributions for these.



Question

Suggest briefly how we could model the effects of the kinds of large changes to option costs described in Section 0.1, *eg* as a result of a significant increase in the prevalence of a particular disease.

Solution

It is very difficult to include this degree of uncertainty in a stochastic model with any confidence about the probability distributions that would need to be assumed. Instead the stochastic model would probably be run several times incorporating major ‘what-if’ shifts to the underlying parameters of the assumed probability distributions.

So, for example, our assumption shifts could imply significant changes to the expected proportions in each risk group, and to the expected morbidity of each group, and the model would be rerun to see the effect this might have on the simulated distribution of option costs and hence on the required option premium.

This is an example of sensitivity testing in a stochastic modelling context.

30

Problem solving

Syllabus objectives

- 6.1 Analyse hypothetical examples and scenarios in relation to the financial management of health and care insurance companies.
 - 6.1.1 Propose solutions and actions that are appropriate to the given context, with justification where required.
 - 6.1.2 Suggest possible reasons why certain actions have been chosen.
 - 6.1.3 Assess the implications of actions within a given scenario.
 - 6.1.4 Discuss the advantages and disadvantages of suggested actions, taking into account different perspectives.

0 Introduction

The examiners will expect candidates to be able to apply the knowledge and understanding they have developed through the study of the Subject SP1 Core Reading to produce coherent solutions and actions in relation to the financial management of a health and care insurance company.

Students are expected to be able to combine ideas across the chapters in the course, and apply them to scenarios proposed by the examiners.

From your studies of the earlier chapters you should now have a firm grasp of all of the issues central to the financial management of a health and care insurance company. However, the course has had to introduce these in a relatively isolated fashion. But, as the Core Reading above makes clear, you may be asked in the exam to combine these issues together to solve various problems that health and care actuaries may face.

This chapter takes a look at the financial mechanics of the health and care insurance company, considering how the different parts of the course come together. The material should not be new, but it should represent some new perspectives. Thinking through the ideas in this chapter will help to generate ideas in the exam, particularly for questions that cover a wide range of topics.

In particular, it covers:

- a health and care insurance company income statement and balance sheet
- the lifetime of a policy
- the interested parties in the health and care insurance world
- the control cycle.

The chapter then finishes with some longer practice questions to help you develop your problem solving skills.

Note that, as this chapter discusses exam technique rather than adds new technical material, it does not have a summary section.

1 Health and care insurance company accounts

One approach that can be useful to generate ideas is to consider each element of the accounts in turn.

To ensure you understand fully where health and care insurance company profits come from, it makes sense to consider what a health and care insurance company income statement and balance sheet normally look like. The exact form that they take will depend on local statute and practice. For example, it is common for the policyholder cashflows to be dealt with in a revenue account, and for profit from that account to then pass through to the income statement (or 'profit and loss' account), which adds in the impact of shareholders' assets to give a final result for the company. Here, everything is assumed to 'happen' in the revenue account.

1.1 The revenue account

A health and care insurance company revenue account might look something like:

Premiums	<i>positive</i>
Investment income	<i>positive</i>
Increase in reserves	<i>negative</i>
Benefit payments	<i>negative</i>
Expenses	<i>negative</i>
Commission	<i>negative</i>
<hr/>	
Profit / loss (pre-tax)	
Tax payable	<i>negative</i>
<hr/> <hr/>	
Profit / loss (post-tax)	
<u>Dividends to shareholders</u>	<i>negative</i>
Transfer to balance sheet 'shareholders' retained profit'	

This should be intuitively very familiar. One useful application is as a way of generating ideas about the financial impact of any action, both in terms of the individual elements that might be affected and the 'bottom line' effect on profit.



Question

How will the sale of a new policy affect the above items?

Solution

Writing a new policy will have the following impact:

Premiums increase to the extent of the premium concerned (or slightly less, if we are considering a policy sold during the year with premiums payable *eg* monthly).

Investment income will not change significantly: on average there will be a half-year's interest on the premium less expenses and benefit outgo.

The reserves will increase in proportion to the premium. If the statutory valuation basis is stronger than the realistic assumption basis used in pricing (and/or if there is a solvency capital requirement), the company will suffer valuation strain and the proportion 'increase in reserves and solvency capital as a percentage of premium' will generally be higher.

Expenses will increase, due to the underwriting, marketing and administration costs involved. Note that this question is about the *marginal* effect of selling one policy: thus the expenses from overheads which need to be attributed to policies in other contexts (*eg* pricing) are not relevant here.

Commission will increase if the policy was sold through commission-rewarded brokers / agents.

Benefit payments are likely to increase, but not significantly (unless the policy is a contract of duration one year or less).

The net effect is likely to be a loss (unless there is some financial reinsurance arrangement).

In this case, it is almost certain that no tax will be incurred in respect of this (considering the two common tax bases, profits and 'investment income less expenses').

Total shareholder profits will therefore be reduced by the sale of the policy. (This means reduced from what they otherwise would have been; it does not necessarily mean reduced compared with the previous year.)

The account shown here gives the basic idea. Many variations are possible:

- There might be separate entries for 'increase in reserves' and 'increase in required solvency capital', or the required solvency capital may be excluded from the accounts (depending on the purpose).
- Instead of 'increase in reserves', there could be two entries: 'reserves brought forward at start of year' and 'reserves carried forward at end of year'. A similar split could then be made for required solvency capital as well.
- Commission might be included in expenses (or there may be no commission at all).
- Benefit payments might be split into their components.



Question

What are the components of the benefit payment entry?

Solution

The components of benefit payments will be:

- claims (lump sums)
- claims (annuity instalments)
- surrenders.

‘Waivers of premium’ might also fall into this category.

-
- Investment income might or might not include unrealised capital gains.
 - Reinsurance might be implicit in the items (so ‘premiums’ is really ‘gross premiums’ less ‘premiums ceded under reinsurance’) or it might be split out.
 - Surrenders and lapses might be implicit in the items (so ‘commission’ is really ‘commission less commission recovered from early discontinuance’) or they might be split out.

One consequence of these possible variations is that, if an exam question presents any form of revenue account, or talks about some revenue account item such as ‘benefit payments’, you need to be aware of what each item really means. If not made clear, and it is important, you need to specify your assumption (for instance, whether ‘profit’ is post-tax or pre-tax), or to consider both cases. Areas to watch out for are:

- Is the figure net or gross of reinsurance?
- Is the figure net or gross of discontinuances?
- Does the figure relate to the particular line of business only, or the whole company?
- What about tax?



Question

How will the cashflow of the company differ from the revenue account?

Solution

At its simplest, the cashflow will be the total of all of the items *excluding* the increase (or decrease) in reserves (and required solvency capital). This is because the increase in reserves is really just a reallocation of monies inside the company, while all of the other items involve real cash being paid to or by the company.

If accounts are prepared with assets valued at market value, then the revenue account may include unrealised capital appreciation / depreciation but the corresponding amounts will not feature in the cashflow.

It is also possible for the expense figure in the revenue account to include an allowance for depreciation, while there will be no corresponding cash movement in that year (there will in fact have been a cash payment in respect of that amount in some previous year).

So the cashflow is:

- premiums
 - + investment income (excluding unrealised gains / losses)
 - benefits
 - actual expenses (*ie* excluding depreciation / amortisation)
 - commission
 - tax
-

1.2 The balance sheet

The presentation of health and care insurance company balance sheets seems to vary even more than that of revenue accounts. In essence, they are extremely simple, with total assets equal to total liabilities (including shareholders' capital and retained profits).

Consider the relationship between the revenue account and balance sheet.

Example

The balance sheet for Abingdon Health and Care insurance company as at 31 Dec 2015 is:

£ millions

<u>Assets</u>		<u>Liabilities</u>	
		Share capital / retained profit	45
		Reserves	114
Total assets	159	Total liabilities	159

The revenue account for the year 2016 is as follows:

Premiums written	46
Investment income	18
Increase in reserves	(41)
Benefit payments	(8)
Expenses	(3)
Commission	(6)
<hr/>	
Profit / loss (pre-tax)	6
Tax payable	(2)
<hr/> <hr/>	
Profit / loss (post-tax)	4
Dividends to shareholders	(1)
<hr/>	
Transfer to balance sheet 'shareholders' retained profit'	3



Question

Calculate the 31 Dec 2016 balance sheet, and the company's free assets at that date.

Solution

The balance sheet will be:

£ millions

<u>Assets</u>		<u>Liabilities</u>	
		Share capital / retained profit	48
		Reserves	155
Total assets	203	Total liabilities	203

The mechanics are as follows:

- Share capital increases by the retained profit transferred to balance sheet of 3.
- Reserves increase by the increase in reserves.
- Total assets will have varied in accordance with the cashflow:

$$159 + 46 + 18 - 8 - 3 - 6 - 2 - 1 = 203$$
- Free assets = total assets less non-shareholder liabilities = $203 - 155 = 48$
- Alternatively, free assets = shareholders' capital = 48
- Check that the two sides balance: $203 = 48 + 155$

1.3 Solvency capital requirement

In all of the above, how would any solvency capital requirement (SCR) come into play?

The company might build up the SCR via the revenue account in the same way as it builds up reserves. This is the approach that you would need to take in profit testing / model office work. However, it is often the case that the SCR is not seen in any way in the revenue account.

Even in the balance sheet, where you might reasonably expect to see the SCR, it is common for it not to be shown explicitly in the published accounts. However, the company will need to demonstrate to the supervisory authority that, given the balance sheet as at a certain date, the SCR as prescribed by statute can be covered by shareholders' capital and retained profit (so you would expect to see the SCR in the supervisory balance sheet).

For instance, in the example of Abingdon Health and Care as at 31 December 2015, the company might have needed to show that the figure of £45m for shareholders' capital and retained profit exceeded the SCR at that date of £6m (say).

So you may or may not see the SCR in either the revenue account or the balance sheet. The approach used will depend on the purpose of the calculation (*eg* reporting profit to shareholders or demonstrating solvency to the supervisory authorities) and the regulations that apply in that country.



Question

How will the sale of a new critical illness insurance policy affect the balance sheet at the end of the year?

Solution

Writing a new policy will have the following impact:

The assets will be:

- increased by the premium coming in – since CI insurance policies have relatively small premiums (as the insured event isn't certain to occur and also, most CI insurance policies are regular premium), the assets will be increased by only a small amount
- reduced by the initial expenses and any commission paid – underwriting expenses could be very significant as the policy has a large sum at risk; initial expenses of writing the contract will also be large compared to the relatively small regular premium.

Overall, the expenses and commission will outweigh the premiums and the assets will fall.

Any claims that occur before the end of the year will reduce assets further. The contract will have provided no assets to contribute any investment return at this stage (in fact the asset share is negative, so any interest attributed to the contract would be negative).

If reserves are calculated on a prudent basis, then reserves are likely to increase following the sale of the contract. Alternatively, the insurer may be required to hold more solvency capital to cover the increased risk from selling this contract. So the total of reserves and required solvency capital will rise.

Therefore overall, the balance sheet will show a fall in assets and a rise in reserves / solvency capital. Hence the shareholder capital will fall (as the assets must equal the liabilities, *ie* the balance sheet must balance).

This is consistent with the question at the start of this section that showed that writing new business could result in a loss on the revenue account.

The first and last questions in this section indicate that considering the elements of the accounts in turn can generate a good description of the impact, in this case of writing new business, on the insurance company.

2 The life and times of a policy

A useful way for thinking about how a health and care insurance company functions is to consider all of the stages involved in the lifetime of a policy. This can also be a good way to generate ideas in the exam, particularly for questions where a change is being considered by the insurer.

It can be broken down as follows:

- the idea
- the sale
- the first day
- a typical year
- the last day
- even later days.

2.1 The idea

You can argue that the lifetime of a policy starts with the product itself being created. This will reflect:

- some perceived market need for the product
- a regulatory and taxation environment that makes the product both possible and practical
- the company wanting to write such a product.

Once the company decides that it wants to write the product, the next stage will be product design.



Question

What will be the main steps in product design and pricing?

Solution

The main steps in product design and pricing will be:

- formulate the structure of the product (with marketing)
 - decide on the assumptions for expenses, interest, mortality, persistency
 - profit test to give premiums to meet a set profitability target
 - given these premiums, sensitivity test and decide whether to adjust premiums or design
 - compare with competition and adjust premiums (especially for expense loadings/charges)
 - run model office with expected tranche of new business – determine if there are any capital, tax or expense problems, and whether it is worthwhile in terms of impact on EV.
-

2.2 The sale

The policy now needs to be written. Or, as a marketing manager might say, 'the policy needs to be sold'.

The sale process will depend greatly on whether the sale involves members of the public being approached, or whether the initiative is taken by the public – *eg* they decide to go and ask a broker about a CI insurance policy.

Looking at the agent / broker sales process:

The first thing will be when some innocent member of the public, Mr X, thinks that he might need a policy of a particular type. This might be pre-empted by advertising by this insurance company, or (more likely) by any other health and care insurance company, about such a contract. The other main avenue would be if the prospective policyholder is doing something that entails getting insurance – *eg* much CI assurance will be written as a result of people taking out mortgages on a house purchase, for example.

Mr X then decides to do something about his idea. He visits a high street broker, or the insurance adviser at his bank or building society.

Suppose the high street broker works with a number of health and care insurance companies (*ie* it is 'independent' rather than 'tied'). In that case, the broker will ask Mr X about his finances and requirements, decide on which insurance companies' products are most suitable, and show Mr X the relevant marketing literature from those companies. The broker might indicate just one contract, which he judges to be the most suitable for Mr X. Any commission that the broker might receive on sale of the contract should not be an influence on the contract recommended.

The broker could also produce a 'quote' – *ie* the premiums and benefits to which Mr X would be entitled – given Mr X's age and gender, and intended premium (or required benefit). The quote could be done on the broker's PC using software supplied by the companies. Alternatively, there might be a web-based quotation system. In some markets, rate tables are still used, *ie* the broker would calculate the premium by hand using a printed copy of the insurer's rates.



Question

How would the above procedure differ if Mr X had approached his bank's insurance adviser, and his bank has its own insurance subsidiary?

Solution

The advisor would recommend one of the bank's products (unless there was absolutely nothing of the right type). The quote would come from the bank's computer system, or from a PC.

Assume that sensible Mr X decides to take out our company's CI insurance product.

First, he will need to fill in a proposal form.



Question

State the information required on the proposal form.

Solution

- personal information, such as name, address
 - policy information, such as premium and benefit proposed, and any options
 - medical information, such as own and family medical history, current or recent illnesses, height and weight
 - lifestyle information, such as smoking and drinking habits, occupation, dangerous hobbies
 - financial information, such as income, and whether the applicant has any other CI policies
 - bank details if payment is to be by automatic deduction from account
-

Next, the proposal form goes to the health and care insurance company.

If the answers to the medical questions raise any doubts, or the sum insured is over a certain level, some form of extra medical evidence might be required.



Question

What extra medical evidence might be asked for?

Solution

The extra medical evidence could be:

- a report from Mr X's regular doctor
 - a general medical examination
 - specific medical tests such as an ECG (electrocardiogram).
-

The company would also consider the financial condition of Mr X to ensure that the policy is appropriate given his probable needs and lifestyle.

If the sum insured is particularly high the health and care insurance company might need to contact its reinsurer to ensure that it is appropriately covered.

If there are no problems, and the proposal is accepted by the company, the proposal data will be fed into the health and care insurance company's policy administration computer system and the system should print out the policy. Mr X will then be sent the policy (a health and care insurance policy is in reality a legal contract printed on paper, signed by the policyholder and the insurance company) and cover will commence on the agreed date, probably subject to satisfactory payment of premium.

(The premium might be paid to the broker, rather than direct to the health and care insurance company.)



Question

Summarise the main differences to the above description if Mr X had taken out the policy via a direct marketing telesales channel.

Solution

Mr X sees an advertisement in the paper and rings the number.

He is given a brief description of the product on the phone, and then needs to give his address so that the company can send an information pack.

This would include information about the product, about the insurance company and might include quotes for X's age / gender / premium if that was sorted out in the telephone call.

The pack might also include a proposal form for Mr X to fill in and send off. This might include some underwriting questions.

On receipt of this, and possibly conditional on appropriate payment and responses to underwriting questions, the insurance company would produce the policy and send it to Mr X.

2.3 The first day

On cover commencing, the policy becomes a liability of the health and care insurance company. The insurance company therefore needs to establish suitable reserves (and if there is a solvency capital requirement, then this will also need to be considered). The reserves may be calculated on a more prudent basis than the premium basis (and/or the requirement to set aside solvency capital will build in a level of prudence). If this is the case, then the company incurs some *capital strain* at inception – ie the cost of reserving for the policy is greater than that assuming the (realistic) premium basis.

The company must also pay the acquisition costs of the policy. In the example of the broker, this would probably entail the company's account department crediting the broker's account with the commission amount (alternatively the broker may receive a fee directly from the policyholder) which would depend on the market, the insurance company, the product and the broker. The broker will then receive actual cash when the account is settled, which might be done, say, monthly.

In addition, the policy will have cost a certain amount to set up on the insurance company's administration system, to administer the proposal / policy and to cash and invest the premium.

These expenses (including commission) are the initial marginal expenses of the company in respect of the policy, and it is vital that the expense loadings or charges in the contract cover these.

However, it is normal to expect every policy to contribute something to cover the other expenses of the company – for example, the overheads of the company, or the development costs of the contract. This contribution would normally be expressed per policy, or possibly in relation to premium size. This will go into the ‘initial expenses per policy for contract Y = £270’ figure which came out of the expense investigation – the product should be priced on the basis of these suggested loadings. *But the contract’s loadings might not be equal to these suggested expenses*, perhaps because the contract was priced two years ago and the expense experience of the company has changed since then, or because the balance between ‘fixed per-policy expenses’ and ‘percentage of premium’ expenses has been adjusted for competitive reasons.

So, the insurance company might make an expense profit or loss if the required contribution to current expenses is lower or greater than that assumed in the premium basis.

Moving on from considering the expenses in isolation, what is the overall impact on the company’s financial results?

Considering the income statement earlier, for an annual premium contract, the insurance company might see on the first day an effect along the lines of:

Premium	P
Increase in reserves	$0.95 \times P$
Expenses	$0.6 \times P$
Commission	$0.8 \times P$
Profit / loss	$-1.35 \times P$

So, writing that policy will have required the insurance company to find capital of $1.35 \times P$. That money will have been provided by the free assets of the company.

Lucky Mr X. The company has been prepared to suffer an income loss of 1.35 times his premium so that he could have his favourite insurance policy. (Remember, this has assumed a full expense figure, including a contribution to overheads, rather than the marginal expense involved.)

In fact, the insurance company would need to find even more capital than this if there is some solvency capital requirement (any weakness in the reserving basis is likely to be offset by stronger capital requirements). For example, if there is a requirement of $0.05P$ in respect of the policy then the insurance company has to find capital of $1.4P$ to write that business.

So the revenue account impact is: a loss. This will often be the case for a regular premium policy. A single premium policy might give some loss, primarily due to capital strain, but the size of loss (in relation to the premium) would be much lower than that seen with a regular premium contract.



Question

What is the embedded value impact of writing the policy?

Solution

If the policy is profitable on the embedded value basis, the embedded value will increase. This will normally come from a large increase in the present value of future profits and a small decrease in free assets.

2.4 A typical year

Several years have passed since that exciting first day. What might happen in a typical uneventful year?

Consider the financial impact of the policy on the revenue account of the company. At the start of the year the policy will be 'visible' in the balance sheet, via its associated investments on the assets side and reserves and shareholders' retained profit on the liabilities side.

During the year Mr X faithfully pays his premium. At each policy anniversary, or perhaps at 31 December, the insurance company may determine the surplus arising. That surplus will be the result of experience having been better than that assumed in the valuation basis.



Question

The premiums coming in every year are calculated on the premium basis, so why isn't the surplus the result of experience being better than the premium basis?

Solution

As soon as the insurance company receives a premium, it has to set up the necessary reserves for the policy concerned (and be able to cover any solvency capital required). For simplicity, assume that the valuation basis contains margins for prudence and there is no requirement to hold solvency capital.

As the valuation basis is more prudent than the premium basis (usually) the insurance company will record an immediate loss. This is the capitalisation of all the future losses the company is now expecting to make, from a policy whose premiums are inadequate to meet its liabilities according to the reserving basis assumptions of the future experience. The basis underlying that premium becomes irrelevant from this point: having set up these reserves, the insurance company will not make any (more) loss, or profit, if its experience is exactly that of the reserving basis. Hence, if the actual experience is *better* than its *reserving* basis, then a profit will be recorded in the insurance company's accounts.

Assuming that the policy is a regular premium policy, how would its passage through the year be reflected in the revenue account?

At the end of the year, the revenue account might look something like:

Premium	P
Investment income	$0.01 \times P$
Increase in reserves	$(0.1 \times P)$
Benefits	$(0.55 \times P)$
Expenses	$(0.1 \times P)$
Renewal commission	$(0.06 \times P)$
Surplus (profit)	$0.2 \times P$

Assuming that tax is paid on profits at 40%, the revenue account would continue:

Surplus (profit)	$0.2 \times P$
Tax	$(0.08 \times P)$
Profit net of tax	$0.12 \times P$

So the shareholders make a small profit. In fact, the original pricing of the contract should have been such as to ensure that the profits that emerge in subsequent years are sufficient to repay the initial new business strain, valuing at the risk discount rate.

What is the effect on embedded value?



Question

If experience is worse than that in the embedded value basis, how will the embedded value move over the year?

Solution

If experience is worse than expected then there will be two effects:

The free assets will not increase by as much as expected. (This could equally appear as the free assets decreasing by more than expected, or the free assets decreasing when an increase was expected.) This corresponds to the immediate profit consequences of this experience (*ie* less profit – or more loss – than expected).

The PVFP might be decreased. In the case of decrements (claims and withdrawals) their PVFP will no longer contain the future profits of those 'extra' policies which have gone off the books.

Both of these will lead to a reduction in embedded value. The effect on free assets will normally be much greater than the effect on PVFP. However, there might be instances where the opposite is true (*eg* if the bad experience in question is a high lapse rate for CI policies).

Furthermore, if the experience then moves you to change the embedded value assumption set, then the PVFP could be significantly affected.

2.5 The last day

Sadly, Mr X is diagnosed with a CI. After obtaining the required medical evidence, the health and care insurance company sends him a cheque for the sum insured.

Settling the claim will involve some expenses.

If the policy comes under any reinsurance arrangement then the insurance company will get some money back from the reinsurer. This will not happen there and then – the insurance company will receive the money when the reinsurer settles the relevant quarter's account (if the reinsurance accounts are quarterly – which is common practice).



Question

What is the impact of the claim on the insurance company's financial results?

Solution

There will be a loss equal to the difference between the amount paid and the policy reserve.



Question

What is the impact of the claim on the company's embedded value?

Solution

The net asset value will take a loss as per the revenue account result in the previous question – but note that it would be net of tax.

The present value of future profits component will suffer a small loss due to the fact that that policy will no longer be contributing profits to the company. However, if the experience for the portfolio as a whole is as per the embedded value basis, then the present value of future profits for the portfolio will not decrease in this way.

2.6 Subsequent to the last day



Question

How might the policy affect the health and care insurance company after that last day?

Solution

Possibilities here are:

- the insurance company retrospectively contests the claim and gets the money back in the event of fraud (*eg* faked medical evidence)
 - the insurance company contests the claim and gets some money back (*eg* extra premiums) in the event of false information on the policy proposal form coming to light
 - the insurance company tries to cross sell health and care insurance products to Mr X and/or his family, trying to sell a policy appropriate to the recent receipt of the claim payment (*eg* an annuity to give regular income, or a simple single premium savings policy)
 - Mr X's claim will appear in the insurance company's claims investigation, and will eventually feed into the assumption sets used for future modelling work.
-

3 Different parties in the insurance world

One way to create ideas when thinking about certain health and care insurance issues is to consider the various different stakeholders who may be affected, or in any way interested, and what their standpoints are.

The following parties may be relevant in a health and care context:

- policyholders
- future policyholders
- dependants / relatives of policyholders
- employers
- the health and care insurance company:
 - shareholders
 - management
 - underwriters and claims managers
 - actuaries
 - marketing department
 - administrators
- other health and care insurance companies
- sales channels
- reinsurers
- providers of health and care services / facilities
- the State (government)
- the regulator
- taxation authorities
- others.

3.1 The policyholders

Policyholders will ideally want:

- products that meet their requirements (*eg* appropriate deferred period / level of cover)
- products that are easy to understand
- a smooth and simple process (*eg* guaranteed premiums, fast and simple claims management)
- products that allow them to take advantage of any tax breaks
- affordable premiums and value for money
- benefits that keep up with inflation
- high security of benefits (*eg* financially strong companies).

Note that many of these desires may conflict.

3.2 Future policyholders



Question

In what way will the desires of members of the public who see themselves as potential future policyholders, differ from the views outlined above?

Solution

Members of the public will also want:

- a smooth sales process (*eg* easily accessible sales agents, simple underwriting)
 - a large choice of health and care insurance companies.
-

3.3 Dependants / relatives of policyholders



Question

What additional needs might dependants / relatives of policyholders have?

Solution

Dependants and relatives might also want:

- provision of advice (*eg* on suitable care facilities for long-term care policyholders)
 - flexibility and choice (*eg* over hospitals / care facilities used).
-

3.4 Employers

Employers are essentially policyholders and so will have similar wants and needs to those outlined above. However, they might also be concerned about:

- having the flexibility to change benefits each year (as employee needs / the environment change)
- straightforward and simple means of communication between employees and the insurer
- premium guarantees from year to year.

3.5 The health and care insurance company

There are many stakeholders *within* an insurance company. Here are a few key ones:

Shareholders

Shareholders will want:

- a return on their investment of at least the risk discount rate, and ideally as high as possible
- low risk (so a low probability of the value of their shares plummeting)
- smooth supply of dividends (so low volatility of financial results)
- in theory, useful financial information (*eg* embedded value results as well as traditional revenue account and balance sheet).

Management

Health and care insurance company management should want to:

- maximise long-term profits
- ensure that the company operates legally (*ie* demonstrates supervisory solvency, complies with regulations *etc*).

However, in order to be seen to be doing something, they may want to:

- maximise short-term profits, and/or
- maximise new business levels (probably short-term).

Underwriters and claims managers

Underwriters will want to ensure that:

- the process is not too onerous (and off-putting) to applicants
- policies are underwritten quickly and efficiently
- the risks taken on meet the company's objectives
- relevant, accurate data is obtained (for use in reserving, claims management *etc*).

Claims managers will want to ensure that:

- the claims paid are both genuine ...
... and reasonable (*ie* not excessive)
- claims are paid in a timely manner
- the company's reputation is not damaged.

Actuaries

Depending on the context, it might be possible to split this category of stakeholders even further, for example, the pricing actuary, the reserving actuary *etc.*



Question

What will be the actuary's aims?

Solution

The actuary will want:

- to conform to statute and regulations
 - to conform to professional guidance
 - generally to work to a highly professional level (*eg* concern about policyholder fairness)
 - to work for the company to increase its profits, subject to not going against policyholders' expectations.
-

Marketing department

The health and care insurance company marketing manager will normally want to:

- maximise new business levels.

3.6 Other health and care insurance companies

Taking the perspective of any one health and care insurance company, other health and care insurance companies will want to maximise *their* profits and (probably) new business levels. There are a number of possible ways in which they might try to outperform their competitors:

- lower premiums from a lower profit margin
- lower premiums from lower expenses (perhaps from economies of scale)
- better investment performance (historic and expected)
- better administrative service
- quicker and simpler underwriting
- greater brand awareness
- appeal to different target markets
- specialist (niche) products
- product designs that are easier to understand
- greater security of policy benefits (*eg* guarantees on future benefits and/or premiums)
- greater security of insurance company (by demonstrating higher free assets)
- greater incentivisation of sales channels (often, higher commissions)
- more incentives for policyholders (free gifts, enhanced benefits, loyalty bonus).

3.7 Sales channels

Sales channels (*ie* brokers, agents and direct sales forces) will want to:

- maximise their remuneration
- provide a good service
- provide suitable products
- build up a portfolio of happy customers.



Question

What are the implications of sales channels wanting to maximise their remuneration?

Solution

Sales people will often want to sell those products that give them the highest remuneration, rather than sell the product that is best for the customer. From a strictly financial and quantitative point of view, their only interest in the suitability of the product for the customer is the fact that a well-matched product should show good retention and so bring in future renewal commissions.

In reality, sales people may not be completely influenced by commission, because:

- they want to offer a good service to attract business in the long term
 - they may have a sincere interest in the suitability of the product for the customer.
-

3.8 Reinsurers

The aim of reinsurers is to maximise their long-term profit, subject to operating legally (*eg* demonstrating solvency). They will do this by:

- charging premiums that cover the cost of the inherent risk, plus their expenses and some profit margin
- helping insurance companies to reduce the cost of claims by providing underwriting advice and assistance
- attracting business by:
 - offering high commission on business ceded by insurers
 - offering advice on pricing, underwriting and other areas
 - by demonstrating financial strength
- charging premiums that are competitive compared with other reinsurers (and competitive with respect to the alternatives to reinsurance that health and care insurance companies might consider)
- offering reinsurance and expertise for new risks (perhaps using their research and experience from other markets).

In addition, in the interests of short-term profit stability, they may reinsure some of the business that they have taken from direct writers.

3.9 Providers of health and care services / facilities

This includes the staff that run the facilities (surgeries, hospitals, specialist facilities, care homes *etc*) and the individuals who provide the care (doctors, nurses, surgeons, consultants *etc*).

Their objectives may be profit-related:

- charging prices that are adequate to cover the marginal and overhead costs of the facilities
- attracting enough customers to make sufficient contribution to overheads and/or to achieve economies of scale
- negotiating deals with suppliers
- being efficient

or service-related:

- providing treatments / care with certain target success rates
- providing treatments / care that meet the expectations of patients
- providing treatments within specified time frames.

3.10 The State (government)

The specific objectives of the government in relation to health and care were covered in Chapter 10.

For each of the four main objectives, there are likely to be specific targets / goals, for example:

- protecting the nation's health:
 - target waiting times for various treatments
 - a target number of research projects conducted each year for various illnesses
- subsidising the poor:
 - targets to narrow the level of inequality between the rich and the poor
 - targets to reduce the number of people living in poverty / without access to basic facilities
- balancing the budget:
 - overall targets, *eg* ensuring that tax revenues cover overall government expenditure over the course of the economic cycle
 - specific targets on healthcare spending, *eg* to keep increases in real spending below 2%*pa*
- following social culture and/or political promises.
 - a target to keep the population (especially the voters) happy and to get re-elected.

More generally, the government is likely to have the following additional aims that relate to health and care insurance companies:

- to ensure that the legal framework maximises policyholder security
- to incentivise products that are considered socially desirable (*eg* PMI where no State healthcare exists)
- possibly to assist policyholders of insurance companies that go insolvent
- to encourage a fair and competitive marketplace.

The Government may also act in its own interests, for example:

- by forcing health and care insurance companies to invest in large amounts of government bonds
- by protecting the monopoly (and profitability) of any State insurer.



Question

How might the Government encourage a fair and competitive marketplace?

Solution

- through restrictions on monopolies within the health and care insurance sector
 - by ensuring that companies present their products in a consistent way (eg all benefit projections done on the same assumed investment return, regulation on advertising and sales processes)
 - by ensuring that different sectors – eg banks vs health and care insurers vs personal investment providers – all enjoy equivalent regulation and tax treatment (both from the point of view of the companies and the ‘consumers’)
 - by encouraging cross-border freedom between countries as far as the provision of insurance policies is concerned
-

3.11 The regulator

The regulator will want to:

- ensure health and care insurance companies act in compliance with the law and regulations
- ensure health and care insurance companies remain solvent in the future
- ensure that policyholders are not mistreated
- ensure that potential policyholders (*ie* customers) are not misled.

3.12 Taxation authorities

The taxation authorities will want to

- maximise tax income (subject to what the tax laws allow).

3.13 Others

The list could continue. Here are a few examples.

- other employees of health and care insurance companies, who will have a considerable personal interest in the financial prosperity of the company
- investment analysts, who will be interested in the financial prospects for the insurance company’s shares, if it is proprietary
- Non-health and care insurance companies, banks, building societies *etc*, whose businesses in some way compete with the health and care insurance market.

4 The control cycle revisited

It's a useful exercise to look again at the control cycle (introduced in Subject CP1), but this time applying all of the knowledge built up in Subject SP1.

In essence, the control cycle can be thought of as the best way for a health and care insurance company to operate. In any situation, the company will have some *aims* shaped by the business environment. What are the *risks* that might impinge on these aims? Given those risks, what is *the best approach*? Eventually, in the light of *experience*, was the perception of risks correct, and was the selected approach the best or can it be improved?

The following example is presented as a possible exam question and solution. It is laid out without marks so that you can concentrate on the *ideas* involved rather than on exam technique.

Question

In the country of Ruritania, health and care insurance premiums are paid out of net income and benefits above certain levels are subject to special rates of tax.

For political reasons, the Government of Ruritania has just passed legislation allowing house-owners to buy accelerated critical illness policies up to the value of their house tax-free (*ie* premiums will be payable from pre-tax income and the benefit will be tax free).

The health and care insurance company of which you are the product-design actuary wants to take advantage of this to launch a new range of accelerated critical illness products.

Describe:

- (a) the risks faced by the company
- (b) possible solutions to these risks
- (c) how the company might then modify its chosen approach in the light of experience.

You should now spend 5-10 minutes on writing down an outline solution, just putting down the keywords (rather than details about expense investigation mechanics etc).

Having done that, now read through the Syllabus in the Study Guide and check that you have not missed out any areas which might affect your solution. Then read on.

Solution

Note that this is written in 'ActEd course note' style rather than 'standard exam solution' style.

- (a) **Risks**

The company's aims will be to stay solvent, and subject to that, almost certainly to maximise profits. What are the risks that might affect these aims? The risks here are the various areas covered in part 3.1 of the Syllabus. The main risks (and the ones covered below) are mortality and morbidity, expenses and persistency.

Mortality and morbidity

Fundamentally, the risk is that of actual mortality / morbidity exceeding that priced for. This risk can be broken down into the three components of model risk, parameter risk and random fluctuation.

There is the model risk that the expectations of mortality / morbidity are not correctly modelled – for example, they might be modelled as constants when they will in fact vary over time. Furthermore, the model might omit certain claim types, for example, new types of cancer that are not currently known about, but would be covered under the policies.

There is the parameter risk that the estimates of mortality / morbidity, and hence the parameters that define the modelled versions of mortality / morbidity, will not be correct.

To estimate mortality and morbidity, the insurance company will need to look at its experience with its current accelerated CI contracts (assuming it has some), and possibly also related contracts, *eg* stand-alone CI insurance. However, the policyholders eligible for this new product may be significantly different from those in the insurance company's existing portfolio, or those underlying any other statistics that the insurance company may look at (industry data, reinsurers).

Mortality and morbidity rates are likely to change over time. This might be a gradual change, *eg* standard mortality improvements, or a one-off change, *eg* a change in critical illness incidence rates following advances in diagnosis. There is a risk that such trends / changes are not correctly allowed for.

If mortality and/or morbidity is overestimated, then the product will be over-priced and there will be a risk of not selling the product. If mortality and/or morbidity is underestimated, then the product will be under-priced and there will be a risk of making a loss, or eventually facing solvency problems if the new product becomes a major part of the portfolio. Of the two, underestimating will be more problematic than overestimating.

Associated with the parameter risk is the risk of anti-selection if the insurance company does not price by splitting policyholders into reasonably homogeneous groups with respect to mortality and morbidity.

There is also the risk of random fluctuations – even if the estimates of mortality / morbidity are spot on, claims would be expected to fluctuate around the expected level. The extent to which claims vary from expected will depend on the size of the portfolio.

Expenses

There is the risk that the contracts sold will not cover the associated expenses. This could come about in various different ways.

First, the insurance company will not know the expenses involved with this contract. They should be very similar to those for similar contracts – for example, the current range of critical illness insurance contracts. But there will be some differences, for example, it will be necessary to incorporate some checks that the potential policyholders are house-owners, so the underwriting might be slightly more involved.

Secondly, future expense inflation might be underestimated.

Thirdly, there is a risk of selling insufficient levels of the contract to recover the development costs, or to make a sufficient contribution to the insurance company's overheads.

Finally, the price structure might involve cross-subsidy of (say) small policies by large policies, otherwise small policies could prove uncompetitive. In this case, there is the risk that the insurance company sells a greater than expected proportion of small policies, and that overall the contribution to overheads is insufficient.

Persistency

There are two completely different risks here.

First, if most of these policyholders will have mortgages, then in the event of economic recession they may be especially hard hit, and may be even more likely than other critical illness insurance policyholders to lapse their policies (if legislation does not oblige them to have such policies in respect of their mortgage).

The extent to which this is true will depend on the average wealth of house owners with mortgages, compared with the wealth of the remaining population of critical illness insurance policyholders.

Secondly, there is the risk that a large number of existing accelerated critical illness insurance policyholders who are house owners will be better off lapsing their current policies and taking out new policies under this tax-efficient format.

(b) Possible solutions to the risks

Mortality and morbidity

To minimise the risk of modelling or parameterising mortality and morbidity risks incorrectly, the insurance company will need to study the experience of its related contracts. Existing accelerated critical illness and stand-alone critical illness insurance should be a good starting point.

Reinsurers' and industry statistics will also be a useful point of reference, especially for unusual illnesses and more extreme ages.

The risk of pricing on the wrong mortality / morbidity basis could be reduced by offering the contract as a reviewable premium product, rather than a guaranteed premium product.

The insurance company should use (at least) all of the rating factors that most of the competition use (eg age, gender, smoker/non-smoker, medical).

The insurance company will need to ensure that the policyholders undergo underwriting at least as strict as that used for the policyholders underlying the mortality / morbidity data above. Alternatively the mortality / morbidity 'advantage' of belonging to the socio-economic group 'house-owners' might be deemed sufficient to compensate for a weakening of the underwriting procedures, eg a raising of the sums insured at which detailed medical evidence is required.

Quota share reinsurance could be taken out to reduce the financial impact of parameter error.

To deal with the risk of random fluctuations, the insurance company could use individual surplus or aggregate excess of loss reinsurance. The extent of reinsurance required will depend on the insurance company's total portfolio of similar policies, its free assets and the extent to which smooth financial results are desirable (*eg* more important for a proprietary than for a mutual company).

An alternative to this would be to set up a claim fluctuations reserve, but this would require a certain amount of capital.

Persistency

The insurance company could tackle the risk of low persistency on this product by setting premiums assuming a high withdrawal basis, although the extent to which the insurance company can do this is constrained by competition.

A commission structure to sales agents that shifts remuneration from initial to renewal commission may make it less likely that the agents sell the product to people for whom it is not very suitable.

The second problem, of lapse and re-entry on current products, could be tackled in various ways.

One way would be to offer to reclassify eligible policies, charging an appropriate administration fee. However, a realistic fee might be so high that it still leaves lapse and re-entry as the preferable option to most policyholders.

Another possibility would be to quantify what addition to benefit (or reduction in premiums) would equate to the expected cost of administering a large number of lapses and re-entries, and offering some portion of such an increase as an incentive to continue with the policy in the existing format.

Expenses

The risk of underestimating expenses could be reduced by making it a reviewable premium contract.

The risk of insufficient sales could be reduced by aggressive marketing, and a competitive pricing basis.

The aim is to maximise the total expense contribution plus profit, which will be equal to:

$$\{\text{number of sales}\} \times \{\text{expense contribution and profit per sale}\}.$$

This will be almost zero for very high and low premiums, and maximised for some middle-of-the-range premium – depending on elasticity of demand.

The risk that a cross-subsidy of small policies by large policies combined with a low proportion of high-premium sales gives rise to an insufficient contribution to the insurance company's overheads could be countered by:

- setting the cross-subsidy such that all policies at least pay their own marginal expenses
- profit testing the new business portfolio on a variety of new business mix assumptions
- market research to ascertain the likely new business mix.

(c) ***Modification with experience***

The insurance company will need to monitor the experience of the contract. Such monitoring will include looking at:

- the composition of new business by age, gender, premium level
- mortality / morbidity experience from mortality / morbidity investigations
- persistency experience from persistency investigations
- expense experience for the product
- embedded value analysis of movement
- analysis of valuation surplus.

In the light of this experience, the actuary will then check that the pricing assumptions for the contract are adequate. If they are not (or if they were too conservative) then the contract will be repriced.

This could include altering, if necessary, the balance between fixed and 'percentage of premium' expenses in the price structure, depending on the actual composition of new business.

If persistency experience is particularly poor for any group of policyholders (*eg* all in one area, or from one seller) then some further investigation would be warranted to determine the real reason.

The insurance company should also be monitoring the persistency experience of related contracts to guard against the lapse and re-entry issue. If this looks like it is becoming a problem, then the insurance company might adopt one of the measures outlined above.

4.1 Conclusion

The solution above has:

- used the actuarial control cycle to structure the answer
- considered the context of the problem (the *general business environment*)
- used the *specify the problem* stage to identify potential *risks* to the insurance company's aims, and how they might arise in the particular situation
- used the *develop the solution* stage of the cycle to identify *possible solutions*, and how they would apply in this situation
- used the last stage of the cycle to think about how to *monitor experience*
- looked at the risks and solutions earlier to see how that experience will allow the approach to be *modified*.

Note how useful the control cycle is as a way of generating the various aspects to consider.



Chapter 30 Practice Questions

30.1

Exam style

An insurance company has a large and established portfolio of immediate needs long-term care annuities currently in payment. In return for a single premium based on the expected mortality experience of the policyholder at the date the annuity payments start, these policies pay an index-linked benefit.

To be eligible to take out a policy, applicants must have a medically certified need for long-term care, based on criteria of activities of daily living (ADLs). Two levels of need are identified: 'Level 1' is where the policyholder requires only non-nursing, residential home care, and 'Level 2' is where full nursing residential home care is required.

Policyholders who satisfy the criteria for nursing home care at outset receive 175% of the benefit level received by those who only meet the lower care level criteria. However, benefit levels cannot be changed once payouts have commenced, except for the automatic index-linked increases promised under the policy.

The insurance company now proposes launching a third variant of the policy. This will provide the lower benefit level initially to applicants who satisfy the less stringent ADL criteria, but will also give the policyholder the right to apply for the enhanced benefit level at any subsequent time, subject to then meeting the additional ADL criteria required but for no extra cost at the time of benefit increase.

- (i) Explain how, if at all, the mortality assumptions that will be used for pricing the existing product types may alter if the proposal goes ahead. [2]
- (ii) Discuss how the mortality assumptions for pricing the new variant of the product are likely to compare with those used for the existing products. [3]
- (iii) Discuss how the premiums charged for the three types of policy in the future are likely to compare with each other, and with those charged for the existing policy types before the new product launch. [5]
- (iv) Describe the investigations that the insurance company might undertake in order to help determine appropriate mortality assumptions for pricing the new variant of policy, and explain how the assumptions would be determined. [10]

[Total 20]

30.2 An insurance company issues a wide range of conventional and unit-linked long-term health and care insurance policies.

Exam style

- (i) Explain how each of model error, parameter error and random fluctuations can lead to losses from morbidity experience, in each case giving a simple example of how this can arise. [3]
- (ii) (a) Suggest how the actuarial control cycle can help the company to monitor and so manage any problem that it may have with its morbidity experience.
- (b) Suggest and briefly describe the various steps that the insurance company could take to manage any problem that it may have with regard to its morbidity experience. [10]

[Total 13]



Chapter 30 Solutions

30.1 For convenience, the level 1 policy that has the option to increase to level 2 will be referred to as the “enhanced level 1 policy”, and the level 1 policy without the option will be called the “normal level 1 policy”.

(i) **Effect on mortality assumptions for normal level 1 and level 2 policies**

The mortality assumption for level 2 policies should be unchanged from before. [½]

Applicants for normal level 1 policies will now be more selective than before, ... [½]

... *ie* those who don’t expect to remain at level 1 for a significant time will be more likely to purchase the enhanced level 1 policy instead. [½]

Assuming that level 1 annuitants generally experience lighter mortality than those at level 2, then it is likely that lower mortality rates will need to be assumed for the normal level 1 applicants than previously. [½]

[Total 2]

(ii) **Mortality assumptions for the new enhanced level 1 policies**

For these policies, two different mortality assumptions will be needed: one to apply to policyholders while (and only while) they qualify for level 1 benefits, the other to apply from when they first qualify for level 2 benefits. [1]

Under normal level 1 policies, the mortality assumption represents an average of these two mortality bases, ... [½]

... weighted by the expected proportions of policyholders in the two health classes in each future policy year. [½]

So the mortality that should be assumed here for policyholders while receiving level 1 benefits will be lighter than previously assumed for this benefit level (all else being equal). [½]

Once policyholders have transferred to level 2, it should be reasonable to assume that they would have the same mortality as annuitants who originally take out their annuities *at* level 2, for the same risk classification group. [½]

On the other hand, it might be argued that enhanced level 1 annuitants would apply as quickly as possible for transfer to level 2, to maximise benefit payments, ... [½]

... which might mean that slightly lower mortality assumptions might be appropriate at level 2 compared with normal level 2 entrants. [½]

[Maximum 3]

(iii) Effect on premium rates*How the premiums for the different levels compare with each other*

The single premium for the enhanced level 1 policies will be higher than for normal level 1, because in each future policy year an assumed proportion of policyholders will transfer to higher benefit levels, whereas under normal level 1 policies they receive the lower level of benefit at all times. [1]

However, this product will also tend to attract more people who think they are likely to require full nursing care in the future. [½]

This will tend to increase further the premium charged for the enhanced level 1 policies. [½]

There remains the issue of how the level 2 policy premiums compare with those of the others. [½]

It is not clear whether these should be higher or lower than the level 1 premiums, because although someone buying in at level 2 will receive higher average annual payments, the benefits will be received for a shorter period. This is again assuming that level 2 mortality is higher than level 1. [½]

So it will depend on how much worse level 2 mortality is than level 1 mortality. [½]

How the new premiums compare with the existing ones

The single premium for normal level 1 policies is likely to be higher than before, on average, because of the generally lower mortality assumptions. [½]

The single premium for level 2 policies is expected to be unchanged (except for any beneficial effect from expense assumptions – see below). [½]

As well as the above changes to mortality, there should be some reduction in the expense assumptions from previously. [½]

This is because the insurance company will be expecting to sell significantly higher volumes of business overall as a result of the change, spreading the overhead costs over more policies. [½]

This will reduce all the single premiums compared with the above. [½]

The above will also be affected by the competition in the market. The new enhanced level 1 policy will need to be seen as significantly attractive in the market, to offset the increase in price compared with the normal level 1 benefit type. [½]

[Maximum 5]

(iv) Obtaining the new pricing assumptions*Level 2 annuity rate mortality*

The insurance company would investigate the mortality experience under its existing level 2 policyholders. [½]

The most recent experience would be chosen, with a long enough investigation period to produce a credible volume of data in each cell. [½]

Cells would be created by subdividing the data into homogeneous groups, by age, gender, policy duration, and by smoker status. [½]

Other health-related factors such as medical history, family history, and results of the ADL assessments should be considered, ... [½]

... as this information will also be used by the company when assessing the risk of each individual applicant. [½]

Other factors, *eg* territory, sales channel and location might also be investigated. [½]

The actual deaths occurring in each cell would be compared with those expected according to some standard mortality basis. [½]

This might be the mortality assumptions in the original pricing basis, or a relevant standard mortality table (which may be appropriately broken down by the major risk classification factors). [½]

This will enable the insurance company to estimate its recent experience rates. The future mortality experience will be projected, allowing for: [½]

- any possible improvement in mortality in future [½]
- the effect of any future changes to underwriting and risk classification procedures. [½]

The mortality projection will incorporate the extrapolation of any recent trends in the experience that are expected to continue in the future. [½]

The insurance company will try to identify these trends, both by looking at its own experience over a longer time period, ... [½]

... and also by looking at any relevant industry and population mortality data. [½]

Finally a margin may be included in the basis (assume lower mortality than best estimate) to take account of the uncertainty involved in setting the assumption. [½]

Level 1 annuity rate mortality

The existing level 1 policyholder data could be analysed in the same way as level 2. [½]

However, the experience data could not be used without significant adjustment, because now the insurance company must only include policyholders in the exposed to risk while they do not qualify for the enhanced benefit level. [½]

This will be difficult to assess. The insurance company could group its data according to the *actual* level of care to which each level 1 policyholder would have been entitled. [½]

This may be possible if the insurance company has kept historical address records of all its policyholders, so that a change in status could be apparent from the date the address changes, *eg* from a residential home to a nursing home. [½]

This could be a very laborious process, and would be fraught with errors. [½]

A possible alternative might be to group the data by policy duration, recognising that the proportion of policyholders eligible for level 2 benefits should increase steadily with increasing duration of the annuity. The mortality assumption might then be based only on the experience of policyholders within the first few years of entry, although this would be an approximation.

[1 for any sensible suggestion]

In practice it might be possible to make use of standard industry mortality tables that are suitably split (*eg* according to ADL levels). [½]

Because of this uncertainty, the company would probably be quite prudent in the first instance, assuming lighter mortality than it might have done otherwise. [½]

It will be imperative to monitor closely the emerging experience under the enhanced level 1 policyholders, ... [½]

... and to update the pricing basis as the new experience emerges. [½]

[Maximum 10]

30.2 (i) **Model, parameter and random fluctuations risk**

Model error

This occurs when the insurance company incurs losses due to error in the specification (structure) of the model of the sickness process that has been used. [½]

For example, the insurance company might have priced its IP insurance contracts using the claim inception and annuity method, which is not a fully realistic approach. The approximations involved may have led to the premiums being too low. [½]

The use of a more realistic model (*eg* multiple-state model) could have led to fewer losses, even where the same data were used to estimate the models' parameters. [½]

Parameter error

This is where the insurance company incurs losses as a result of incorrect parameter values being used in its morbidity model. [½]

For example, when pricing a critical illness contract, the insurance company may have assumed critical illness incidence rates at each age that were lower than the actual probabilities of claiming in the insured population. [½]

Random fluctuations error

This is where the insurance company incurs losses due to random fluctuations, even though it might have used an appropriate morbidity model and correct parameter values. [½]

For example, a portfolio of critical illness contracts, whose expected critical illness rates were equal to the pricing model's parameters, could still by chance have more critical illness claims than expected over a particular time period. [½]

[Maximum 3]

(ii)(a) **Use of the actuarial control cycle**

The extent of any problem can be identified by monitoring the experience. [½]

The actual experience rates should be compared with those expected according to the relevant premium and/or reserving basis. [½]

An analysis of surplus will be performed. [½]

This will quantify the amount of loss actually incurred as a result of the morbidity experience, separately from other sources of profit or loss. [½]

This will put the morbidity losses into context and will help establish whether the losses are of a sufficient magnitude to justify taking further action. [½]

For this purpose it is important to ascertain whether or not the losses have been consistent over time, for example by looking at past trends. [½]

Revised assumptions can be fed back into the insurance company's decision-making procedures, for example: [½]

- into the pricing basis, ... [½]
 - ... leading to a revision of prices and/or charges to reduce the risk of losses on future new business (and on existing business, if the charges and/or premiums under existing contracts are reviewable) [½]
- into the reserving basis, ... [½]
 - ... which will prevent the over-distribution of profit to the providers of capital, and hence help to protect the solvency of the existing business [½]
- into the insurance company's risk management and decision-making models, ... [½]
 - ... for example in calculating the probability of ruin when determining reinsurance policy, which will then help to ensure that appropriate levels of risk control (reinsurance) are bought. [½]

(ii)(b) **Other methods of managing the morbidity risk**

The underwriting strategy could be changed. [½]

An inconsistency between the morbidity rates implied by the underwriting strategy and those used in the insurance company's standard rates of premium could be a significant contributor to risk. [½]

Claims control procedures could be improved, ... [½]

... *eg* the sickness status of claimants could be reassessed and recertified more frequently, or perhaps more objectively or independently, in order to stay within the expected experience. [½]

Rehabilitation and counselling services could be introduced if this was cost effective (*ie* the cost of providing the services was less than the cost of claims saved). [½]

In the longer term, could change the product design. For example: [½]

- change policy wording (definition of claim) [½]
- introduce partial return to work benefit [½]
- reduce guarantees and options [½]
- introduce price / charges review facility [½]
- shorten the contractual linked-claims period [½]
- change from without-profits to unit-linked designs. [½]

More focused selling on the basis of financial need could improve morbidity rates, by reducing the levels of lapse rates and so reducing the impact of selective withdrawal against the insurance company. [½]

The reinsurance strategy could be revised. A surplus reinsurance treaty on an original terms or risk premium basis may be appropriate. [½]

[Maximum 10]

End of Part 6

What next?

1. Briefly **review** the key areas of Part 6 and/or re-read the **summaries** at the end of Chapters 28 to 30.
2. Ensure you have attempted some of the **Practice Questions** at the end of each chapter in Part 6. If you don't have time to do them all, you could save the remainder for use as part of your revision.
3. Attempt **Assignment X6**.

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X1.1 Define the following terms that may apply to critical illness insurance:

- (a) assessment period
- (b) permanent
- (c) irreversible
- (d) total permanent disablement
- (e) terminal illness. [5]

X1.2 Discuss the following two ways in which a private medical insurance provider might seek to control the costs of claims:

- (a) pre-authorisation
- (b) preferred provider agreements. [5]

X1.3 A health and care insurer currently sells stand-alone critical illness insurance policies with terms varying from ten to twenty five years. The policies have premiums that are reviewable every five years. All other terms in the contract are guaranteed for the term of the contract.

It is considering selling a new policy that will allow both of the following to be reviewed every five years:

- the insured events
 - the level of the premiums.
- (i) Explain the problems with the existing design to the insurer. [2]
 - (ii) Discuss whether policyholders are likely to welcome this change and suggest how the insurer can ensure the changes *are* viewed well. [3]

[Total 5]

X1.4 The following events might lead to personal financial loss or hardship:

- A Payment of expenses for medical care where a person's home country has poor public health facilities.
 - B The occurrence of sickness or disability after retirement age.
- (i) Describe the ways in which each event can lead to hardship and indicate the range of persons who may be directly, or indirectly, affected. [3]
 - (ii) Describe, with reasons, a suitable health insurance product that may be purchased in order to alleviate or prevent the hardship arising from each event and state whether the product is likely to be traditional non-profit, unit-linked and/or inflation proofed. [4]

[Total 7]

X1.5 Janet and John, who are both in their 20's, were recently married and are meeting an insurance broker to discuss their financial plans. John is self-employed so has no employee benefits. He earns £30,000 *pa*. Janet works for a financial institution which has an employee benefit package that includes a short-term sick pay scheme and a group income protection plan. She earns £24,000 *pa*.

John is considering the following income protection policy:

Type: Individual income protection policy
 Deferred period: Three months
 Definition of disability: Unable to follow own occupation
 Benefit amount: £1,000 per month
 Benefit term: Benefit is paid from the end of the deferred period for a maximum of 5 years
 Expiry age: 60th birthday

Janet is currently a member of her employer's benefit package. The benefits are:

Type: Short-term sick pay plan
 Deferred period: None
 Definition of disability: Unable to follow own occupation
 Benefit amount: 100% of salary for 2 months, 75% of salary for the next 4 months
 Expiry age: 65th birthday

Type: Group income protection policy
 Deferred period: Six months
 Definition of disability: Unable to follow own occupation
 Benefit amount: 60% of pre-disability salary
 Benefit increase: 3% on the anniversary of the income protection benefit becoming payable
 Expiry age: 65th birthday

Calculate what employee and insurance benefits would be payable if Janet and John were both injured in a road traffic accident and were unable to work for six years. You should ignore the effect of any income tax that might be payable. You should set out your answer showing the benefits paid in each of the years. [7]

X1.6 A long-term health insurer sells both group and individual health insurance contracts.

- (i) Explain the differences between the group contracts and the individual contracts provided by this insurer. [5]
- (ii) Describe the advantages and disadvantages to an individual of joining a group insurance scheme rather than buying an individual policy. [2]

[Total 7]

X1.7 You are part of a team which is designing a pre-funded long-term care insurance plan which is to compete with a number of existing market products. You have been asked to produce a comparison of the benefit structure of the existing plans in the market.

List the features that you would need to consider and suggest appropriate values for these, where relevant. [8]

X1.8 You are a product actuary within a health and care insurer, which is reviewing its income protection business.

(i) Describe how a policyholder's occupation may be relevant in an individual income protection contract. [5]

(ii) Describe the types of guarantee that might be provided on individual income protection contracts. [5]

[Total 10]

X1.9 (i) Describe the employer's interests as a stakeholder in the design of a group income protection insurance product. [5]

(ii) Explain why employers have a stakeholder interest in the design of a group private medical insurance product, but rarely in the design of group critical illness insurance products. [4]

(iii) Suggest reasons why group long-term care insurance is unlikely to exist. [1]

[Total 10]

X1.10 An insurer is proposing to launch a physiotherapy cash plan for sportspeople on an individual basis.

Describe and explain a possible design for the policy including:

- the benefits that might be provided
- the policy conditions for claiming
- the underwriting procedures that might be used
- the premium rating structure
- the use of incentives to encourage the renewal of policies.

You are not required to suggest a pricing basis or discuss how premiums might be calculated. [16]

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- X3.2** (i) Explain why it is important to incorporate persistency into product pricing. [4]
- (ii) Describe how a change of distribution channel might affect persistency rates. [3]

It has been suggested that, rather than analysing its own experience, a health and care insurer should use industry statistics to estimate persistency appropriately for pricing future product launches.

A particular health and care insurer is considering using industry-average sickness rates for pricing a new IP insurance contract.

The data set was collected over a period of three years, ending two years ago.

- (iii) Discuss the issues it would face in using this source of data. [5]
- [Total 12]

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Solution X3.2

The material for this question is covered in Chapter 13, Assumptions (1) – General considerations.

(i) **Why persistency is an important component of product pricing**

Long-term contracts

If a health and care insurance company pays a benefit upon surrender that is higher than asset share, the company will make a loss on that individual policy. [½]

The same will happen on policies that pay no surrender benefit where asset shares are negative ... [½]

... which will normally be true at early policy durations when lapse rates also tend to be highest. [½]

Similarly, paying a benefit which is less than asset share will give rise to a profit. [½]

Persistency is also important for projecting future in-force volumes. For example, lower persistency rates would mean that less profit would be expected from the portfolio later in the policy term, as fewer policies would still be in force. [½]

Short-term contracts

Renewal rates are needed in order to assess the extent to which initial expenses can be spread over subsequent renewals. [½]

The lower the renewal rate, the fewer renewals are expected from each policy sold, and so the higher the premium loading for initial expenses needs to be. [½]

All types

The impact on volume will affect the spreading of overhead expenses, and also of any fixed one-off expenses such as those for product development. [½]

Poor rates of persistency may also lead to reduced profits as a result of excessive levels of commission being paid, eg if indemnity commission is used. [½]

This will be less of an issue if appropriate commission clawback arrangements are in place. [½]

Withdrawals can be selective, taking out the healthy individuals from the portfolio and leaving the remaining policies subject to higher claim experience than was originally expected. [½]

The pricing morbidity assumptions must take account of the expected effect of these selective withdrawals. [½]

If persistency is incorrectly allowed for in the company's pricing models, this would give a misleading indication of the profitability of the contract. [½]

This could also affect competitiveness and hence sales volumes. [½]

[Maximum 4]

(ii) The effect of changing distribution channel on persistency

A change in who initiates the sale can affect persistency rates. [½]

Persistency rates are likely to be higher if the client initiates the sale. [½]

The sales practice may be different, for example: [½]

- where clients have been put under more sales pressure to buy a policy or to take a larger policy, then lapse rates are likely to be higher than where sales have been more strictly based on need [1]

- sales of policies made without proper information being gathered about the client's needs, can lead to inappropriate policies being sold through ignorance. [½]

Poor sales practices might particularly be the case where the intermediary's rewards are largely based on initial commissions, rather than renewal or level commissions. [½]

Different levels of financial sophistication of the client base can lead to different perceptions of the value of a contract, and could lead to different persistency rates. [½]

Different target markets may encompass different levels of affluence and economic prosperity. There may then be differences in withdrawals that arise through economic hardship. [½]

[Maximum 3]

(iii) Issues faced in using industry data

The insurer would seek to adjust the data in forming its assumptions, but there will be many factors that it will not be able to allow for with certainty. [½]

There could be differences in the expected experience due to differences in:

- lapse rates:
 - distribution channel [½]
 - levels of commission paid / commission clawback arrangements [½]
 - quality of after-sales service [½]

- sickness rates:
 - initial underwriting or claims control [½]
 - definition of sickness [½]

- both lapse and sickness rates:
 - target market [½]
 - products or product features, eg the maximum proportion of pre-sickness income payable for sickness rates. [½]

Industry data will be a heterogeneous mix of the above factors, and the great variation in experience between the different companies will make the industry average a very poor indicator of the expected experience for any individual company. [½]

Other reasons why the industry data may not be appropriate for use by a given insurer:

- the data may be inaccurate, ... [½]
... incomplete ... [½]
... or otherwise unrepresentative of the market as a whole [½]
- there may not be sufficient data for credibility, although this is much less likely with industry data than it is for a single insurer [½]
- the data may not be in the correct format [½]
- the data may be unavailable [½]
- industry experience may have changed in the period since the data were collected, ... [½]
... or be expected to change in future, *eg* the data may have been collected during a recession when persistency was low. [½]

The effect of heterogeneity in the industry data can also give rise to spurious trends in experience observed over time, through changes in the mix of companies that comprise the industry statistics. [½]

Additionally, as this is a new product, the insurer will not have any data of its own with which to check the above points. [½]

[Maximum 5]

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X4.1 A health and care insurer has been using the inception / disabled life annuity approach for modelling and pricing its income protection business since it was launched many years ago.

(i) Describe the inception / disabled life annuity approach. [3]

In the health insurer's most recent board meeting, one of the board members questioned the ongoing appropriateness of the current modelling approach arguing that it is too simplistic. He believes that given the maturity of the income protection business, the multi-state modelling approach should enable more granular and accurate analyses to be produced.

(ii) Describe the main differences between the multi-state modelling approach and the inception / disabled life annuity approach. [5]

[Total 8]

X4.6 A health insurance company sells a conventional regular premium pre-funded long-term care product where the benefits are regular payments that are dependent on the severity of the impairment.

(i) Describe the different types of reserve that might be held for this product. [4]

(ii) Describe the approaches that this insurer can take to calculate claims reserves and suggest the circumstances in which it would use each. [6]

The health insurer has recently calculated its embedded value, but has now decided that its future new business volumes are likely to be lower than expected following changes just announced by the State regarding long-term care.

(iii) Explain how the lower than expected future new business volumes might impact the current and future embedded value of the insurer. [3]

[Maximum 13]

Solution X4.1

The method of pricing income protection insurance is covered in Chapter 17, Pricing (1) – Individual business. Chapter 11, Modelling, contains more general information on multiple-state modelling, which is also useful for part (ii).

This question is taken from Subject ST1, September 2017, Question 2(i)(ii).

(i) **Inception / disabled life annuity approach**

An inception / disabled life annuity approach considers two functions, namely the claim inception rate and the disabled life annuity. [½]

It ignores recoveries and future sickness. [½]

The 'claim inception rate' is the probability that a claim will become payable to an individual in the year of age x to $x + 1$, for a given deferred period. [½]

The individual will have become sick and remained so until the end of the given deferred period for the benefit payment to commence. [½]

'Claim inception rates' are derived from 'sickness inception rates' by multiplying the probability of sickness inception by the probability of remaining sick throughout the deferred period. [½]

The 'disabled life annuity' is the present value at the date of claim inception of expected claim payments to individuals disabled after the deferred period until policy expiry. [½]

Allowance is made for any escalation of the claim amount, interest and the probabilities of death and recovery between the end of the deferred period and expiry date. [½]

Within the cashflow program, the claims outgo in any period is taken as the lump sum value of the benefit (annual benefit amount \times disabled life annuity) multiplied by the probability of becoming eligible for claim (claim inception rate). [½]

Cashflows should be discounted back to the policy inception date and the calculation needs to be carried out for all possible years of cover. [½]

[Maximum 3]

(ii) **Difference with the multi-state approach**

General modelling

Under the multi-state modelling approach, policyholders are separately tracked through the various stages of 'healthy' and 'claiming': [½]

- healthy premium payers [¼]
- lives falling sick within deferred period [¼]
- lives becoming claimants following deferred period [¼]
- lives recovering, reverting to premium payers [¼]
- lives dying. [¼]

Each subclass will have its own set of transition probabilities: [½]

- sickness inception [¼]
- lapse [¼]
- mortality [¼]
- recovery [¼]
- policy expiry. [¼]

Depending on the sophistication of the model, probabilities may vary according to the number of previous times that the cohort has been ill and all transition rates may be a function of the duration within that stage. [½]

The multi-state approach therefore requires a more granular level of data to be available for setting the various assumptions than the inception / disability annuity approach. [½]

The actuary needs to recognise that the available data may not permit this degree of sophistication of the method in practice. [½]

Pricing

Pricing using a multiple-state modelling approach requires determination of the proportion of lives in each state, using the relevant duration-based intensities. [½]

The specific rates required for the multi-state model are unlikely to be tabulated. [½]

Whereas for the claim inception / disability annuity approach these rates may be readily available. [½]

The value of claims outgo will thus depend on the number of lives within (one of) the benefit-receiving sub-cohorts, in a given month, multiplied by the relevant average sum insured. [½]

Against the claims outgo will be balanced: the premium coming from those in a premium-paying state, plus the investment income, less all relevant expenses and other outgoings in the appropriate month. [½]

Transition intensities will be applied to each status to determine the numbers appropriate to various cells for the next month. [½]

In theory, the model could be very complex, with hundreds of sub-cohorts open at any time. [½]

In practice, the lack of detailed statistics to estimate all of the transition intensities and the avoidance of spurious accuracy will necessitate a more straightforward and meaningful approach, ... [½]

... such as the combination of various sub-cohorts and reduction of number of transition intensities required. [½]

Even with these approximations, the multi-state model will provide more insight into the robustness of any rating and reserving structure ... [½]

... and allow sensitivity testing to be performed. [½]

The latter is more difficult with the inception / disabled life annuity approach. [½]

A multi-state approach can also allow more complex features to be modelled, such as linked or proportionate claims. [½]

[Maximum 5]

Solution X4.3

Options are covered in Chapter 20, Pricing (4) – Options and guarantees, and setting reserves is covered in Chapter 22, Approaches to setting reserves and solvency capital requirements.

General considerations

The method and assumptions depend on the purpose of the reserving exercise. [½]

For example, for statutory or solvency purposes a prudent approach is likely to be taken (by calculating prudent reserves and/or by holding solvency capital), ... [½]

... whereas for internal purposes a best estimate approach may be more appropriate. [½]

Details about the premium rates of the policies taken up under the option are needed. [½]

Insurability will usually be guaranteed at the company's standard premium rates at the time of extension. [½]

If the extension premiums are on *guaranteed* terms rather than the standard rates then in force, this poses an extra risk to the insurer since it is bound by these rates for the extended term. [½]

The extent of the option should be considered, *eg* whether the policies taken up under the option have options to extend again at the end of the new term. If so, the risks are compounded and further assumptions are needed for the second extension. [1]

Considerations when setting assumptions

Mortality / morbidity options are normally valued using cashflow projections. [½]

The total expected additional costs of an option depend on the health status of those that choose to exercise the option, and the proportion of lives that choose to exercise the option. [½]

More specifically, valuing a mortality / morbidity option requires the following extra assumptions:

- the probability that the option will be exercised, at each possible exercise date [½]
- the additional benefit level that will be chosen, if this is at the discretion of the policyholder [½]
- the expected mortality / morbidity of the lives who choose to exercise the option [½]
- the expected mortality / morbidity of the lives who choose not to exercise the option [½]
- any additional expenses relating to the option. [½]

Probability that the option will be exercised and the additional benefit level that will be chosen

The choice as to whether to exercise the option depends heavily on the self-perceived health of the policyholder. [½]

A policyholder who perceives himself/herself to be in poor health or more susceptible to illness is more likely to exercise the option, thus selecting against the insurer. [½]

The desirability of the option also depends on the financial needs of the policyholder at the option date, ... [½]

... eg the policyholder may no longer have a desire for cover in the event of diagnosis of a critical illness, and so opts not to extend it despite it being 'a good deal'. [½]

If prudence is required, the proportion choosing to extend would be overstated. [½]

Therefore the model may assume that all eligible policyholders will take up the option, ... [½]

... and that the maximum additional benefit will always be taken. [½]

If there are many possible dates on which an option may be exercised, or there is a choice from several alternative options, the model may assume that the worst option from the financial point of view of the company is chosen with probability one. [½]

Alternatively, the model may use more sophisticated take-up rate assumptions which vary by exercise date or by alternative option. These would ideally be based on past experience. [½]

Expected mortality / morbidity of the lives who choose to exercise / not exercise the option

Assumptions will also be needed for the morbidity and mortality experience during the original term, ... [½]

... and of those policyholders who choose to extend cover thereafter. [½]

The experience, split by age, gender *etc*, would be analysed ... [½]

... and allowance made for any trends and margins when projecting future morbidity / mortality. [½]

To reflect the anti-selection opportunity, a much higher claim incidence rate assumption would be made for post-option experience. [½]

For example, the mortality / morbidity of those who exercise the option may be:

- assumed to be a higher percentage of the base mortality / morbidity table, eg 120% of standard rates [½]
- age loaded, eg a policyholder of age x may be assumed to experience mortality of age $x+5$ years. [½]

Alternatively, it may be assumed that the mortality / morbidity experience of those who take up the option will be the ultimate experience which corresponds to the select experience that would have been used as a basis if underwriting had been completed as normal when the option was exercised. [½]

Assumptions would ideally be based on post-option past data, if available. [½]

Note that there should be a link between the assumed option take-up rates and the assumed mortality / morbidity rates. [½]

For example:

- In general, the smaller the proportion that exercises the option, the worse will be the subsequent mortality / morbidity experience of those exercising the option. If a substantial proportion exercises the option, then their subsequent mortality / morbidity experience will on average be less extreme. [½]
- An assumption that option-takers experience Ultimate mortality / morbidity would be consistent with an assumption that all eligible policyholders take up the option. [½]
- It may be assumed that the lives who *do not* take up the option will continue to experience the same level of mortality as would have been assumed without the existence of the option. However, this would mean that the average mortality for all lives has been assumed to be in excess of the base mortality / morbidity assumption. [½]
- It may be assumed that the mortality / morbidity of those who do not take up the option is such that average mortality / morbidity for all lives remains at the base expected level. The assumed mortality of those who do not take up the option would then be lower than this base level. [½]

The assumptions used in the valuation of the option should be consistent with those used to value the guaranteed benefits and the assets. [½]

The experience on similar options on similar contracts may be useful. [½]

Reinsurers may be able to offer some assistance in setting assumptions. [½]

[Maximum 11]

Solution X4.6

Types of reserves and embedded value are discussed in Chapter 21. Setting reserves is discussed in Chapter 22, Approaches to setting reserves and solvency capital requirements..

(i) **Types of reserve**

For each in-force policy the insurer should hold the expected present value of future claim inceptions ... [½]

... allowing for different benefits provided in different states of impairment... [½]

... plus the expected present value of future expenses (both regular and claim) ... [½]

... less the expected present value of the future premiums ... [½]

... plus the expected cost of any options. [½]

For each claiming policy, the insurer should hold the current claim annuity value of the benefits in payment, ... [½]

... again allowing for different benefit levels ... [½]

... and for the claimant's current state of health ... [½]

... plus the expected present value of the associated future claim expenses. [½]

Additional reserves may be needed to cover the expected cost of future payments that may be made for existing policyholders:

- who have reported the need for care but for whom payments have not commenced ... [½]
 - ... this may be because they are still within the deferred period of their policy as at the valuation date ... [½]
 - ... or because their severity level is still being ascertained [½]
- who are in need of care, but have not yet reported it to the insurer (*ie* IBNR). [½]

An investment mismatch reserve might also be held, to allow for the extent to which assets do not match liabilities. [½]

[Maximum 4]

(ii) **Approaches to setting reserves**

The two approaches that can be taken to calculating the claims reserves are statistical estimates and case estimates. [½]

Statistical estimates

Claims are assessed altogether in relatively homogenous cohorts, based on historical trends and patterns ... [½]

... adjusted for any known or anticipated future changes, *eg* an increase in medical inflation. [½]

The portfolio might be split by contract type, distribution channel or geographical location. [½]

A statistical distribution is fitted to the past experience, which allows the insurer to estimate the level of claims incurred given the earned premium in a certain period. [½]

The current claims reserves are calculated applying the relevant earned premium and adjusting this for any trends in claim incidence or cost. [½]

The calculation of the IBNR reserve can be included in the statistical estimation method if these claims are included separately in the data. [½]

This may be significant if long-term care claims take time to be reported. [½]

Statistical estimation is often appropriate:

- for homogenous claims [½]
- if the insurer has a large portfolio and it considers the claims experience to be stable [½]
- if the insurer has insufficient data on individual cases to carry out case estimates, or if it is concerned about the quality of such data [½]
- where benefits are paid as an income (as they are in this case). [½]

Case estimates

For case estimates, an experienced claims manager inspects the claims details and estimates the ultimate amount of claims for each case individually. [½]

The following factors are likely to be taken into account:

- age and gender of claimant [½]
- residence of claimant, *eg* own home, residential home [½]
- type of impairment, *eg* inability to dress oneself or mental impairment [½]
- current duration of claim [½]
- whether the level of impairment is increasing gradually or quickly [½]
- severity of impairment [½]
- recent medical examinations or doctors' reports on the claimant. [½]

Case estimation is more likely to be used:

- for a small volume of claims [½]
- for unusual claims, *eg* for very large benefit levels or for unusual types of impairment [½]
- if the information available will allow the insurer to produce a significantly better estimate of the ultimate claim cost ... [½]
 ... for example, in this case, where the claims manager is able to make a reasonable estimate of the duration of each claim. [½]

However, case estimation can be time consuming and costly, so the benefits that can be gained in terms of accuracy of claims reserves would need to be justified. [½]

[Maximum 6]

(iii) ***Impact of lower NB volumes on current and future EV***

Embedded value (EV) is the present value of future shareholder profits in respect of the existing business of a company, including the release of shareholder-owned net assets. [½]

Current embedded value

Since EV is the value of shareholder profits arising from existing business only, no credit is taken in respect of profits on future new business. [½]

Hence there is no direct impact on the current embedded value due to lower expected future new business volumes. [½]

However, lower expected new business volumes are also likely to mean higher per policy expenses due to the need to spread overheads and fixed expenses over a smaller portfolio. [½]

This could reduce the present value of shareholder profits and hence the current embedded value (due to the existing business needing to support a greater proportion of these overheads). [½]

Future embedded value

In future, lower new business volumes will lead to lower levels of in-force business and hence lower present value of future profits. [½]

However, if the product generates new business strain (which is likely), lower new business volumes would reduce the overall new business strain, ... [½]

... increasing the insurer's net assets. [½]

Overall the likely outcome is that the embedded value will increase more slowly under lower new business volumes than it would otherwise, assuming that new business is written on profitable terms. [½]

[Maximum 3]

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