

INSTITUTE AND FACULTY OF ACTUARIES

EXAMINERS' REPORT

April 2011 examinations

Subject CA1 — Actuarial Risk Management

Paper Two

Introduction

The attached subject report has been written by the Principal Examiner with the aim of helping candidates. The questions and comments are based around Core Reading as the interpretation of the syllabus to which the examiners are working. They have however given credit for any alternative approach or interpretation which they consider to be reasonable.

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Chairman of the Board of Examiners

July 2011

General comments

This subject examines applications in practical situations of the core actuarial techniques and concepts. To perform well in this subject requires good general business awareness and the ability to use common sense in the situations posed, as much as learning the content of the core reading.

The examiners therefore look for candidates to apply answers to the specific situation that the examiners asked, having read the question carefully. Too many candidates write around the subject matter of the question in more general fashion, and gain few marks. On the other hand, detailed specialist knowledge is not required nor is very detailed development of particular points.

Good candidates demonstrate that they have used the planning time well - an attempt to get a logical flow is a big advantage in making points clearly and without repetition. This also enables candidates to use the later parts of questions to generate ideas for answers to the earlier parts. Time management is important so that candidates give answers to all questions that are roughly proportionate to the number of marks available.

The notes that follow are not to be interpreted as model solutions. Although they contain the majority of the points that the examiners were looking for, they also contain more than even the best prepared candidate could be expected to write in the time allowed in the examination room

1 (i) The state uses tax policy to influence the behaviour of citizens.

A state may provide a minimum safety net for its citizens that is in effect means-tested.

It may use the tax system to incentivise citizens providing for themselves, and consequently reduce the demand for state benefits and the cost to tax-payers, for example retirement saving or health insurance. It may also use the tax system to provide an incentive to work.

More directly, the state may levy tax on state benefits or on people who receive them, and so discourage claims or reduce their net cost (especially if benefits are not means-tested).

(ii) Tax relief can be granted on pension contributions. This can be used to encourage citizens to save for retirement to avoid a future burden on the state.

The state can restrict when benefits can be taken on retirement.

By simply deferring the taxation it will be able to charge tax at the point benefits to other citizens need to be paid.

Lower tax rates could also be applied on benefits e.g. a tax free lump sum on retirement.

The state will also want to encourage individuals to make other savings and to continue to hold these savings. It can provide beneficial tax in roll-up rather than providing tax relief at outset.

Or seek to restrict circumstances when tax-advantaged savings can be drawn, or target tax relief on certain groups

There will usually be limits on the amounts that can be saved to control the cost versus the benefit to the state of granting the tax relief.

Most candidates picked up the basic bookwork but surprisingly few candidates scored well by setting out further ideas. Many did not explore the angle of controlling costs as a government objective.

- 2** (i) Will need to estimate the number of policies being taken on by:

Estimating the number of births expected in any year.

Estimating the number of mothers that will take up the offer, which will probably be dependent on how the offer is communicated.

Estimating the age of prospective mothers and using mortality tables to calculate likelihood of death (allowing for peri-natal mortality).

Consider the length of the promotional period.

- (ii) The main issue is that the company has taken on the risk but with no premium in which to offset it.

It will need to actively manage risks by monitoring the number of contracts issued and the numbers of deaths.

Consider diversifying the risk away as part of a broader portfolio.

Could use reinsurance to transfer some of the risk.

Ensure that the person is actually a new mother i.e. underwriting at point of application.

Consider restrictions on the offer, for example country of residence.

Ensure that the claims control procedures work, i.e. underwriting at point of claim.

Implement control systems to reduce operational risks such as financial fraud.

Must also monitor the expenses associated with these policies.

Will need to determine an appropriate amount of capital to hold against the risks accepted.

In determining the appropriate amount of capital will need to determine the expected cost. This will be based on cost estimates and use sensitivities to consider what the worst case scenarios could be. This could be expressed as a ruin probability over the year.

Sensitivities will be in relation to key parameters, for example number of births, take up rate or mortality.

Will need to consider length of the promotional period or how it will be financed in the long term. For example if it will be financed by the profits the life insurer might generate from selling longer terms/higher sum assureds to mothers, or from sales of other products.

If product is being used to generate sales elsewhere will need to monitor the level of sales generated. Will also need to ensure risks from these sales are actively managed, to ensure these lead to profits.

Care as to terms and conditions, especially in relation to maternal death around the time of the birth

This was a question where better candidates differentiated themselves, in particular picking up the points from the question that this is a marketing exercise with no payment of premium, and discussing issues beyond mortality such as business volumes and cross-selling.

- 3** (a) They will need to fund their current living expenses with any additional income likely to be used to save for the holiday, and will also need to allow for longer-term financial commitments (pensions/etc).

The amount needed is likely to be a fixed cash sum.

Probably short term and known e.g. need the funds in 3 to 5 years say.

Will need liquidity, certainly once trip starts i.e. possibly lots of small outgoings for duration of holiday.

Could be some uncertainty over cost or duration if not pre-booked yet.

May be some in foreign currency. Could be significant if a lot of things not pre-booked.

Main impact could be a need to avoid risk i.e. they have a definite objective they want to meet.

May need funds as a reserve e.g. to cover property or pension contributions whilst away.

- (b) Most liabilities will be short term and real in nature.

May have debts to clear e.g. loans or credit cards.

Probably want to spend some as a treat e.g. presents for children or a holiday. So again part of cash win is spent quickly.

May have immediate capital spending needs (car/housing/etc.).

May wish to use win to help with current or future income potential so could be longer term and more real.

For example could use towards training or childcare costs enabling part-time work say.

Alternatively could invest for the longer term with a need for real growth.

Will be concerned over the security of assets so low risk investments are likely to be suitable.

Perhaps make provision for education costs, trust fund for children or for personal savings against unexpected outgo.

Would have to consider tax position e.g. on the win and impact on other income e.g. benefits paid from the state.

- (c) Unlikely to have any specific liabilities as such either in terms of current outgo or a specific need to save for the future.

Hence consumption on luxuries e.g. boats, planes etc. may be the objective.

Alternatively, could engage in high risk, speculative investment projects e.g. venture capital, sports clubs or property development. Looking for significant returns (or utility).

Will wish to make any investments as tax efficient as possible.

Maybe could use funds to secure future income so look at long term real growth. Enabling the individual to retire early and follow a different (less financially rewarding) career e.g. farming.

Altruistic or charitable donations (or supporting family e.g. parents) could be a factor.

- (d) The liabilities are determined by the investment mandate i.e. to invest in commodities.

This mandate could be narrow e.g. a specific range say certain agricultural products or very wide covering everything that could be defined as a commodity e.g. currencies.

Given the target market, there should be no limits imposed by fund size (some commodities may be traded in large units) or by a need for simple products or approaches.

There is a desire for high returns. This implies a high-risk strategy. Hence speculation by using gearing may be appropriate.

However, some liquidity or capping/monitoring of exposure will be needed to ensure that the guarantee can be met.

The period over which the guarantee will apply and/or any indication of the term returns are to be measured against (e.g. a strategic take a position fund or a trading fund) will be a factor.

Some candidates made introductory comments on investment principles, which was helpful to avoid repetition. But to score well we looked for candidates to make comments on the

specific circumstances in each part. Weaker candidates did not do so – for example in (a) not focussing on the holiday (although some marks were available for comments on other potential commitments). Some candidates wasted time by commenting in detail on specific investment classes, particularly in (c), despite the question stating that this was not necessary.

4 (i)

Scenario analysis

For each group of risks a representative plausible scenario is developed.

For each scenario the consequences of the event occurring are calculated.

A number of different scenarios may be considered.

Stress testing

Modelling of extreme changes and scenarios.

Will be looking at correlations and volatilities which are observed to simultaneously increase during extreme events.

Aim to identify weak areas by looking at effect of different combinations of correlations and volatilities.

Key area is constructing appropriate stress test scenarios.

Stochastic modelling

Variables are modelled using probability distributions.

Dynamic interaction between variables.

The result will be a distribution of outcomes.

(ii)

Large quantity of data will help with parameterising, making it easier to set up models (particularly for stochastic) although a 10 year period may not be long enough in this case.

Different data items in territories may lead to some parameters being easier to analyse than others – consider the common factors recorded in all territories.

Different territories displaying different trends may lead to complications for the modelling, which may lend itself more towards scenario analysis as an appropriate method.

Scenario analysis

Scenario analysis is useful when a full mathematical model is inappropriate.

Given uncertainty and therefore difficulty in projecting climate change this is likely to be the case.

For the risks being modelled it will be possible to pull together plausible scenarios (including particularly adverse scenarios).

The consequences of scenarios occurring may be more difficult than constructing the scenario.

Scenario analysis removes the risk of using many subjective parameters and may be easier to communicate than other approaches.

While scenario analysis can help in showing the impact of different scenarios, it does not assist with the relative likelihood of different scenarios.

This means that the likelihood of different outcomes is not apparent.

The choice of scenarios requires external input, this in turn is critical.

Stress testing

Identifying the key climate risks to be tested will enable stress testing to show weak areas in the portfolio.

Must be able to consider interaction with other parameters (e.g. financial) to check for weaknesses in portfolio.

Considering extreme potential scenarios for climate change stress testing would appear to be appropriate, particularly given the wide range of scenarios predicted by experts.

Difficulty in identifying appropriate correlations for other parameters may make stress testing less suitable.

Need to consider sensitivity of portfolio to extreme movements in parameters, which may be difficult to model.

Stochastic modelling

Shows a distribution of possible outcomes, which provides a more complete picture than other approaches.

By only allowing some parameters to vary stochastically it may be possible to focus on the particular risks which are of interest.

Stochastic models require a probability distribution to be applied to parameters which may be difficult to derive, and will require expert judgement.

Also requires correlation and interaction between parameters to be set up which may present further difficulties.

Computationally intensive approach which increases costs.

Generally answered well. The main problem on (i) related to confusing scenario analysis and stress testing, not emphasising extremes in stress testing. Good candidates related the bookwork in (i) to the situation in (ii).

- 5** (i) Any six of:
Financial Reinsurance (FinRe)
Securitisation
Subordinated debt
Banking products
Derivatives
Equity
Internal

(ii) **Financial Reinsurance**

This aims to exploit some form of regulatory arbitrage in order to manage the capital, solvency or tax position of a provider more efficiently.

It frequently relies on the regulatory, solvency or tax position of a reinsurer, which may be based in an overseas state, being different from that of the provider.

This can be used to provide a capital benefit to an insurance company although there will still be some risk transfer involved.

This will be in the form of a reinsurance contract between the reinsured and the reinsurer e.g. discounted covers.

Securitisation

Securitisation involves converting an illiquid asset into tradable instruments.

The primary motivations are often to achieve regulatory or accounting off balance sheet treatment.

Typical transactions will be structured with an element of transfer of the risk associated with the value of the asset. This will result in any potential loss in value of the asset being capped.

The securities will be backed by assets and their cash flows eg mortgages, student loans or other loans.

Subordinated debt

Capital can be raised through issuing subordinated debt in the capital markets. The main aim will be to generate additional capital that improves the free capital position of a company.

An insurance company could issue debt through a stand-alone subsidiary, which would be guaranteed on a subordinated basis by the company, i.e. the repayment of the debt is guaranteed only after the policyholders' reasonable expectations have been met.

The debt can be dated or undated, though this will impact the amount available as an admissible asset and may impact the tax implications.

An example is where the debt repayment comes after all reasonable expectations of policyholders have been met, including non-guaranteed bonuses, if any. The liability for repayment will not need to be included in the assessment of solvency.

Banking products

The banking sector can provide direct capital management solutions for an insurance company.

- Liquidity facilities can be used to provide short term financing. This may be very useful for a company facing rapid business growth.
- Contingent capital can be a cost-effective method of protecting the capital base of an insurance company.

For example, an arrangement may provide capital as it was required following a deterioration of experience (i.e. it is provided when it is needed). Although these arrangements clearly improve the financial strength of an insurer and can be given credit for by a rating agency, they lack visibility.

- Senior unsecured financing directly for an insurance company would not have capital benefits as the loan would be treated as a liability on the company's balance sheet.

Financing at the group level can, however, be used within a group structure to provide capital to insurance subsidiaries, for example a loan could be made. It can be more cost effective than other forms of capital but clearly has financial strength implications at the group level.

Derivatives

A derivative strategy can assist in the efficient management of a business and serve to reduce risk.

Prudent management requires that any provider entering into derivative contracts must exercise caution.

For example, a derivative contract could be used when a fund manager is concerned about the impact of a fall in equity values. It could enter into a contract to protect its equity portfolio falling below a certain level. Potentially, the cost of this downside protection could be partially met by the sale of some upside potential via a second derivative contract.

Equity

Increasing equity can be used as a source of capital. A proprietary company can raise funds through the issue of shares although this option is not available to a mutual. This will increase assets without increasing regulatory liabilities.

For example, equity may come from a parent company, from existing shareholders, by a rights issue or directly from the market by a new placement of shares.

Internal

The existing financial structure of an organisation could be reorganised in a more efficient way. This could result in lower cost of capital or lower expenses.

For an insurance company any of the following could be suitable:

- funds could be merged
- assets could be changed, for example to improve statutory funding if admissibility/matching are constraints
- the valuation basis could be weakened
- the distribution of surplus could be deferred
- capital could be retained in the organisation possibly by not paying dividends to any shareholders

This was answered well by candidates who knew the bookwork, but many others scored very poorly. We gave credit to candidates who made valid comments in (ii) even if they missed the bookwork.

6 (i) (a) Mortgage loans are typically long term up to 25 years.

Hence, in theory, interest rates on mortgages should be linked to yields on medium to long-term government bonds.

In general, such drastic cuts in short rates will also bring long rates down e.g. due to recession and low growth prospects.

However, the fall probably won't be as large due to the uncertainty over the long term (risk margins), inflationary worries or concerns over government funding issues.

But in practice, in many countries mortgage rates are linked to short-term interest rates.

This may be because:

- Short-term rates are more visible and easier to understand for consumers.
- Many mortgages are repaid early or otherwise altered or renegotiated so terms are in fact shorter than they might appear.
- Many providers fund mortgages from short term finance – customer deposits or money markets.

Mortgage rates are unlikely to fall by as much as short-term interest rates due to the default risk. They will also be dependent on the savings rate.

The circumstances leading to drastic cuts in short rates are likely to be severe. Hence risk margins on all non-AAA rated government loans should rise.

But mortgages will be secured on property so there is less risk. But this factor will be tempered by the likely depressed housing market and the problems of being a forced seller to recoup the loan.

Any patterns may be distorted by tracker mortgages where rates charged are explicitly linked to a given market rate e.g. the rate referred to in the question.

Likewise, many mortgage rates may be fixed for a set term and so they won't change – unless they are repaid (probably incurring a big penalty).

Competition could lead to a reduction in rates. It is possible that these circumstances will mean that there is a reduction in the competition and so this may not be the case.

- (b) Credit card balances represent variable rate unsecured short-term loans.

Hence, in theory, interest rates charged on them should be influenced by short-term money market rates.

The credit card company will borrow in the market and lend to its customers making its profit from the difference between borrowing and lending rates.

All things being equal, a large fall in market rates may be expected to lead to falls in credit card rates.

However, things are not equal. Credit card loans are unsecured and so the lender is exposed to significant bad debt/default risks.

As above, it is likely that the fall in market rates is linked to difficult economic circumstances. This will significantly increase the risks lenders face.

Risks will vary depending on the customer (eg amount owed) and on individual company's lending practices. So rates charged will vary anyway.

The impact of events may exacerbate such variations. "Good" risks may see falls in rates whereas "bad" risks may incur increases in rates charged.

Financial companies may be in difficulties and so increasing rates on credit cards maybe a way to boost profit margins.

Legislative or administrative factors may come into play. Legislation may require a period of notice to be given before a change or there may be restrictions (e.g. on absolute or relative rates chargeable). Also, the desire not to change rates too often may mean reaction to falling market rates is deferred.

Many customers may be on fixed term low interest arrangements eg in conjunction with new accounts or balance transfers. These will dampen the impact of changes.

Competitive pressure may reduce rates but as in (a), it is possible that these circumstances may reduce this pressure.

- (ii) The first step would be to set profit criteria.

This could be set in relation to the company as a whole or in respect of the credit card business alone. It may differ from existing targets.

For example, the aim could be to increase expected profits from this business to offset losses elsewhere. Alternatively, the company may have to accept lower profits if charges needed to boost profits were commercially unacceptable.

The methodology would be to run a profit model based on cashflows using different proposed charging structures.

The optimum charging structure would be the one that comes closest to meeting the profit criteria both in terms of expected profit and variability of profit e.g. a lower but more stable projected profit maybe better.

The company will need to set a time period for the model. That is it will assess expected cashflows over a given period and project earnings arising.

One year might be a suitable period. It is unlikely that the company will want to change charges too often. However, given that it is likely to be able to do so relatively easily a long projection period would be pointless.

Because different customers pay different charges,

the model will need to cover a representative sample of customers. That is suitable model points will be needed.

The charges themselves will affect experience and so must be part of the modelling process. For example higher charges may lead to more bad debt.

The company may be able to model some of the key variables stochastically e.g. interest rates or economic growth. This will in itself give an idea of the possible variations in profit from a given charging structure.

However, it may prove impractical to treat all the key parameters as stochastic variables. Hence sensitivity analysis should be adopted

The model could be re-run with different core parameter values. This would give greater insight into the possible variations in profit.

There will need to be a market comparison of the rates.

- (iii) In order to assess the effect of variable experience, the company needs to identify the key influences on cashflows and model how changes in these parameters will affect its net revenues.

Significant factors to model will include:

Borrowing costs. It is likely that short to medium term borrowing is used to finance credit card balances. Hence the company will need to look at possible variations in the costs it faces.

Bad debt experience. Many customers may be unable to make repayments and so provisions i.e. deductions from profits will need to be factored in. The company may need to look at both numbers of defaults and average amounts of write-offs.

To assess the proportion of defaults, the company could model the impact of varying say unemployment rates, economic growth or interest rates.

Bad debts would vary by customer – hence the need for comprehensive model points. For example the level of debt customers have (related to income or assets) may matter.

Average balances over the year would need to be modelled. These could vary due to people repaying more, less spending by existing cardholders, new accounts being set up or customers transferring to other providers.

Again economic conditions will be a significant influence here. However, charges made by competitors will also be relevant and so the impact of how they react will need modelling.

Expenses may vary a lot e.g. more bad debt implies more work and hence a greater drain on profits.

It will be necessary to correctly allow for correlations and interactions between these parameters. For example the level of economic growth will be a major factor and so the assessment of its impact must be consistent.

This question was generally not answered well. In (i) we were looking for comments specific to the question rather than generic discussion of economic principles. Good candidates did make these points relevant, for example by commenting on default risks and the difference between long/short interest rates.

- 7** (i) Ideal data may not be available if data was not captured at a sufficiently detailed level when the policies were initially issued. If the premiums were collected at the door by an agent, only limited data may have been captured on the insurer's database. Also some of the data may be old and may contain errors.

There may be insufficient data to provide a credible result. There is no new business being written and so the number of policyholders will be reducing each year as policyholders die or lapse their policies.

- (ii) The company may need to use summarised data. It should, however, be recognised that the reliability of the values will be reduced, as full validation of the data will be impossible.

Ideally the data to be analysed should be split into homogeneous groups, for example, by age and sex. Any heterogeneity in data groups can distort the results.

However, where data is scarce, which may be the case at some ages for this company; this may result in data groups that are too small to enable any credible analysis to be carried out.

Data may need to be combined into groups which are large enough to be credible. There will need to be a balance between splitting the data into

homogeneous groups and having sufficient data in each group to enable a credible analysis to be carried out.

There is also a need to carry out sensitivity testing to check that if the data are grouped in a different way the same results are obtained.

The data can then be used to compare actual deaths to expected deaths over the period of investigation.

- (iii) This will be necessary because of the complexity of financial products, their long duration, and the financial impact that unfair treatment could have on customers.

These conflicts are exacerbated by the fact that many benefits or charges can be varied at the discretion of the product provider. It is generally accepted that discretionary benefits and charges should not be too dissimilar from those customers were led to believe that they would receive when they entered into the contract or transaction.

There is no precise method of defining what customers were led to believe at the inception of a contract, but it is generally accepted that the main influences on policyholder expectations are:

- statements made by the provider, especially those made to the client in marketing literature and other communications
- the past practice of the provider
- the general practices of other providers in the market

The management of the closed fund and the fair distribution of the surplus will be of vital importance. There will, however, be no need to consider any issues relating to new business as there would be for insurance companies still open to new business.

The company will, however, need to ensure that policyholders, particularly those in good health, do not lapse their policies.

The commitment may be needed to increase the confidence of other stakeholders.

The commitment may have been made in response to previous problems which led to the company being closed to new business.

Regulation may require this commitment to be made.

- (iv) There are many possible reasons for the reduced bonuses and the company will bring out the relevant points in its reply. Some will be related to being in a closed fund but others will be more general.

The company will need to explain that although policyholders taking out with profits policies will expect to receive bonuses on their policies, these are not guaranteed..

Any bonuses will be from the surplus of the company and the extent of the entitlement is usually at the discretion of the company.

Bonuses will be lower than expected if the surplus is lower than expected. This could be for many reasons and the company will need to explain all that apply in this case.

The investment return could be lower than expected. This may be due to a fall in investment returns due to the collapse of the market or due to investment choices which turned out to be poor or inappropriate. It may also be because different assets now need to be held appropriate for a closed fund and these may give lower returns. The regulator may restrict the types of assets available for investment again possibly giving a lower return.

Expenses could be higher than expected. Although there are no new business expenses, the renewal and claim expenses will be expected to increase due to diseconomies of scale. Expenses may also increase if inflation is higher than expected. There may also be additional closed fund expenses.

Mortality may be higher than expected. This may be because some healthy lives are lapsing their policies. It may be because the mortality assumptions used were not appropriate or the underwriting not rigorous enough.

Lapses may be higher than expected. This may affect mortality as discussed above. It should not affect surplus if surrender values are calculated to ensure there is no loss to the company. If, however, there is a guarantee then this may reduce the surplus.

The bonuses could also be lower than expected if the amount of surplus available for distribution has changed for other reasons. The company may need to set aside some of the surplus as margin for any future adverse experience.

The company may need more capital and deferring the distribution of profit may have been used as a source of working capital.

With profit premium rates will contain margins designed to generate profit for distribution. There will be years where the amount distributed is lower than the amount generated due to the smoothing process.

The policyholders are likely to have expectations as regards to the form of the profit distribution and the level of bonuses.

They may have been led to expect much higher bonuses. The agents may have been guilty of mis-selling these policies.

Refer to bonus falls that have occurred in other WP funds (if this is the case).

The company could also provide details of what to do next if not satisfied with the response e.g. involve regulator or ombudsman.

There was a wide range of scores on the question. Better candidates picked up on the specifics of the question, for example in (i) that the data would have been collected through the agents, and in (iv) that bonuses have fallen and that the company is closed to new business.

END OF EXAMINERS' REPORT