

# **INSTITUTE AND FACULTY OF ACTUARIES**

## **EXAMINERS' REPORT**

September 2014 examinations

### **Subject CA1 – Actuarial Risk Management**

#### **Paper Two**

##### **Introduction**

The Examiners' Report is written by the Principal Examiner with the aim of helping candidates, both those who are sitting the examination for the first time and using past papers as a revision aid and also those who have previously failed the subject.

The Examiners are charged by Council with examining the published syllabus. The Examiners have access to the Core Reading, which is designed to interpret the syllabus, and will generally base questions around it but are not required to examine the content of Core Reading specifically or exclusively.

For numerical questions the Examiners' preferred approach to the solution is reproduced in this report; other valid approaches are given appropriate credit. For essay-style questions, particularly the open-ended questions in the later subjects, the report may contain more points than the Examiners will expect from a solution that scores full marks.

The report is written based on the legislative and regulatory context at the date the examination was set. Candidates should take into account the possibility that circumstances may have changed if using these reports for revision.

F Layton  
Chairman of the Board of Examiners

December 2014

## **General comments on Subject CA1**

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 candidates who perform best learn, understand and apply the principles rather than memorising the core reading.

The examiners set questions that look for candidates to apply the principles specific to the situation set out in the questions, having read the question carefully. Many candidates gain few marks by writing around the subject matter of the question in a more general fashion. Detailed specialist knowledge is not required and nor is very detailed development of particular points.

Good candidates demonstrate that they have used the planning time well to understand the breadth of the question and to structure their answer – this 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.

## **Comments on the September 2014 paper**

The general performance was slightly higher than in April. Questions 1 and 7 on paper 1 and question 7 on paper 2 were on average less well answered.

The comments that follow the questions concentrate on areas where candidates could have improved their performance. Candidates approaching the subject for the first time are advised to use these points to aid their revision.

- 1** (i) Credit risk is the risk of failure by third parties to repay debts [1]
- (ii) *Character of borrower (and/or its principals)*  
Who introduced them? Can references be obtained?  
Track record? E.g. if borrower is found to have lied (or intentionally misled) do not lend.  
Do key personnel have the required depth and spread of skills and experience?
- Purpose — to what use will the monies be put?*  
Is the project acceptable on ethical and moral grounds? Is the borrower in a sector where there are concerns?  
Will the lending be subject to country, currency, environmental, resource, technological, or other inherent risk?  
Are there controls to ensure that the monies are correctly applied?
- Amount — is the amount to be borrowed reasonable?*  
Does it fit with the stated purpose?  
Any contribution by the borrower? Who stands to lose if the project fails?  
Is the loan an acceptable risk to me, given my risk tolerance, other exposure, etc.?
- Are repayment terms acceptable?*  
Can the borrower service and service the debt when due?  
How certain is the source of repayment? Security and ability to repay  
What margin of safety has been built into the projections and assumptions?
- [5]  
[Total 6]

*Candidates generally scored well on this question, although many didn’t give sufficient detail on part (ii) for the marks available.*

- 2** (i) Inexperience dealing with trucks and the transport industry will add to uncertainty and risk
- As the current portfolio is for conventional motor insurance a repair / recovery contract will be outside the current expertise of the company
- This will introduce operational risks
- There will be little or no data on which to price insurance (e.g. identifying rating factors), either on the volume of breakdowns/accidents or the cost of repairs or recovery
- This risk is higher because the industry is currently developing; and therefore past data held by third parties may no longer be valid
- Particular routes may have increased or specialist hazards which would need to be understood

Maybe relatively high likelihood of breakdown because of the heavy machinery

There may also be an increased concentration risk if there are a limited number of truck operators

There will be a reputational risk if the terms of the policy are not understood. E.g. delays in recovery, claims being refused

There may be exposure to moral hazard from the truck operators, as incentive to get maintenance paid for by the insurer. Also moral hazard for companies carrying out the repairs or recovery, which if insured could lead to inflated costs and therefore inflated claims

Risk of Competitors introducing similar breakdown packages

There may be a political risk as a policy change could reduce journeys back to former levels

There is also a risk of political intervention if this new product becomes subject to any additional regulatory attention

Given uncertainty over business there may be financial strain due to the capital requirement both setting up, and financing this new business line

[6]

- (ii) It may not be possible to diversify/reduce the political risks as any business relating to this industry will be subject to those risks

Risks introduced by lack of data will also be difficult to diversify

The main source of diversification will be the current portfolio, which is large and therefore should mean the risk from this new product is less significant for insurance as a whole

For this policy it is possible to diversify by placing business across a number of different operators/drivers, which may reduce the impact of specialist hazards on particular routes

Policy terms could reduce claim volume and uncertainty and moral hazard risk.

- E.g. only covering cost if an approved mechanic is used
- Or only paying out if vehicles are properly maintained (e.g. no payment of repair is due to poor maintenance). Adequate driver training and adhering to health and safety regulations
- Or setting maximum pay outs for particular repairs, or maximum pay outs per policy
- Or use of policy excess, or pricing with no claim discount

But need to balance stringency versus marketability

This product will require a different type of claims underwriting to the current portfolio

Another way of diversifying risk may be to consider use of reinsurance, for example quota share, although this would come at a price and reduce overall profitability

[5]

[Total 11]

*Some candidates appeared intimidated by the unfamiliar setting and so missed out on key points such as this being outside the insurance company’s experience. In part (ii) many candidates didn’t focus on the issues raised in the question, in particular saying little about diversification.*

- 3** (i) Valid
- Rigorous enough for the purpose
  - Adequately documented
  - Capable of reflecting the risk profile of the business
  - Parameterised to show sensitivity to key features – including failure to renew, low business volumes – and may need to be stochastic
  - Input values appropriate to target’s business – particularly the discount rate reflecting the business risk
  - Outputs communicable to the owners
  - Outputs verifiable
  - Not unnecessarily complex to interpret,
  - Not unnecessarily expensive or time-consuming to build/operate
  - Allows for all cashflows to/from the business, and for effect of reserving requirements
  - Takes into account interactions between assets/liabilities, and interactions with the company’s existing business
  - Capable of being reused for the next target?

[7]

- (ii) The model is likely to suggest a range rather than a single price.

The company may offer relatively high price if there are large synergies

- more efficient operations
- cross-selling opportunities
- Intangibles such as brand names, patents, unique staff knowledge (expertise)

High price may be cheaper than growing organically into desired business areas

But may offer a relatively low price

- if the target’s market value is lower

- e.g. if target is experiencing management/operational difficulties so value is depressed
- or if market sentiment is currently adverse

Will offer a lower price than what company expects to finally pay, this will depend on negotiating strengths and/or bidding wars

[3]

- (iii) It has a more diversified portfolio and so capital usage is less intense
- diversification coming either from different uncorrelated business lines
  - or within the existing line but wider spread geographically/etc.

It has access to more policy/claims data so can build better models for pricing/valuation

It has economies of scale, for example in administration and marketing, systems

It may have a competitive edge if seen as more secure by consumers/brokers

[2]

[Total 12]

*Part (i) was generally well answered, good candidates scored highly by making comments specific to the scenario. Part (ii) was not well answered, many candidates focussed too much on problems with the model rather than commercial issues. Part (iii) was reasonably well answered although only a few candidates considered the impact on capital requirements.*

#### 4 What are the objectives, profits, market share, competitive position?

Need to understand fully the product’s benefits

Then build a model of the product’s expected cashflows to calculate expected risk cost per policy, and add loadings for expenses, commission, profit and tax, and allow for reserving requirements and cost of capital and for reinsurance premiums/claims if applicable

*T&Cs*

Need to understand what will be the policy terms/conditions

- Excess levels?
- Exclusions for hazardous pursuits/self harm/etc.?
- How much choice will customers have?

*Premiums*

How will customers pay premiums

How and to whom will product be sold

What sales volumes are expected/targeted: are these realistic, bearing in mind alternative products in the market, will these still be realistic if competitors react to this product launch

What is the commission structure

### *Claims*

Nature of claims, for example fixed or real amounts: will claim amounts be fixed or will they depend on other factors, for example medical or legal costs (and inflation)

Frequency of claims

Expected average claim amount

When will claims be paid, soon after event and within policy term, or after a lengthier claims underwriting process

Will there be additional legal costs or significant claims underwriting and processing costs

### *Data*

Will be essential for estimating claim frequencies and amounts

But as this is new product the insurance company won't have any

May be able to get data from other insurers or from data on other products, more likely from reinsurers or from published industry data or government statistics for the general population

Important to check any data for validity and relevance to the product; and adjust as necessary; and be aware of likely problems/limitations, for example if data is old and population trends mean it is unlikely to remain relevant

### *Analysis*

Analyse data over suitable period (depending on volume of data)

Split into major risk groups e.g. gender, location

Aim for balance of credible/homogeneous risk groups

Use data to calculate exposed to risk and number of incidents for each group

Adjust for influences from data source, especially different underwriting standards (or none)

Judgement needed if credible data not available, or insufficient data for reliable estimates

*Assumptions*

Claim amounts linked to medical costs, so need assumption for inflation

Expense/profit loadings consistent with general company policy, and competitive position of the market

Overall prudence in assumptions will depend on company’s risk appetite  
Tailored to perceived riskiness of this product

Loading required for fixed expenses such as initial expenses of developing and launching the product

After launch, will monitor experience (sales, claims, etc.) and adjust premiums appropriately.

[13]

*A wide range of marks on this question. Good candidates structured their answers well so as to avoid repetition and cover a good range of issues such as policy terms.*

- 5** (i) Scenario analysis is a method of evaluating risk where a full mathematical model is not appropriate. It is the process of measuring the impact of the risk as a result of changes for combinations of variables under plausible scenarios.

Stress testing measures losses under extreme values of individual variables, to identify weak areas or the impact of a stress

Stochastic Modelling is an extension of stress testing where some variables are stressed, so deriving a distribution of outputs

[3]

- (ii) Stress testing. The extreme value of the FTSE after a fall could be applied in the valuation interest rate calculation for example

An individual company capital assessment review would look at plausible adverse scenarios and quantify the impact of them. For example a key member of staff gets run over by a bus: this is not quantifiable by mathematical model and so scenario analysis is used in this situation

Stochastic Modelling is applicable here. We are looking at the entire portfolio and also the modelling of guarantees requires that some variables are modelled simultaneously.

[3]

- (iii) A standard model for SCR is a single standard model used by all insurers other than those with an approved internal model.

A standard model has to be able to be used in a cost effective way for a wide range of insurers; with different risk profiles and of different sizes.

The standard model is therefore required to be less complex; and less time-consuming

However, the standard model has the disadvantage that it aims to capture the risk profile of an average company; and approximations are made in modelling risks; which mean that it is not necessarily appropriate to the actual companies that need to use it; and the regulator might need to build in appropriate prudence accordingly.

An alternative to the standard model is the internal model designed by an individual insurer to calculate the solvency capital requirements reflecting the specific risk profile of the insurer; within parameters set by the regulator. Selection issues, could choose the model that allows the company to adopt lower capital requirements

An internal model being designed by the insurer can be more complex and sophisticated tailored to the risk profile. It can also be closely aligned with the insurer’s economic capital model; allowing a higher degree of consistency between the SCR and the economic capital. Being tailored to the company it can avoid unnecessary prudence (i.e. lower SCR).

There will be considerable cost involved in developing/maintaining an internal model; and gaining approval for its use.

For a regulator a standard model provides a comparable basis for comparing a wide range of companies. So the use of a single standard model makes it easier for the regulator to decide which companies need most regulatory attention.

The regulator needs to define the standard model; and ensure that it is appropriate for the range of insurers being regulated

An internal model requires the approval of the regulator before it can be used.

There will also be considerable time and effort involved on the part of the regulator in reviewing and approving an internal model. The cost of an insurer developing an internal model will act to limit the number of insurers where it is economical to develop an internal model. For the regulator this will act to limit the number of internal models applied for and so the resources the regulator needs to approve and then to continue to supervise approved internal models.

An internal model is tailored to the risk profile of an individual insurer, however, the risk profile will change over time; so the regulator will require that the internal model is kept up to date and developed further so that it continues to fit the risk profile of the firm.

The regulator has the responsibility for maintaining confidence in the financial system and protecting consumers.

The regulator in approving either a standard or internal models needs to make sure the model will be effective at maintaining confidence in the financial system and protecting the consumers of the insurer; not just at the point of initial approval, but also that it is resilient over time.

[10]

[Total 16]

*Parts (i) and (ii) were generally well answered. In (ii) we gave credit for appropriately argued alternatives; but some candidates did not give plausible reasons for their choices. Part (iii) was less well answered; many candidates didn’t relate their answers to the purpose (determining SCR) and didn’t really consider the regulator perspective.*

**6** (i) Investment trusts are a form of closed-ended fund.

They are companies whose function is to manage shares and other investments.

They have a capital structure exactly like other public companies, and can raise both loan and equity capital.

Investment trust shares are usually listed on a stock exchange; and their shares are bought and sold in a similar way to other quoted shares, price is determined by the market.

Their share price may be either at a premium or a discount to the trust’s underlying asset value

Investment trusts have boards of directors who are responsible for the direction of the company; but day-to-day investment decisions are usually undertaken by investment managers such as merchant banks or specialised investment trust managers.

A number of investment trusts may be managed by the same group of managers but have different directors and objectives.

Investment trusts have a stated investment objective, and new investment trusts usually have this written into their prospectus or offer for sale documents.

[4]

- (ii) This investment trust can be used to invest in unquoted investments that may not be available to individual investors.

Specialist professional expertise will be obtained.

The investor will be able to invest in a diversified range of unquoted assets. This is likely to give diversification from their existing investments.

The costs could be much lower than for direct investment.

Any holdings are divisible so part of a holding of the trust can be sold.

They can take advantage of any gearing, potential for higher returns by changing equity to debt ratio

They may be able to purchase the investment trust at a discount to net asset value. Discount exists but need to be able to identify it and then also to take advantage i.e. by selling at the right time.

The investment trust is closed ended so it will not be a forced seller of its investments.

There may be potentially high returns.

There may be marketability issues with unquoted investments but these will not be an issue for the trust so it can take advantage of any marketability premium.

[3]

- (iii) **Bonds**

Will need to know:

time until the next cashflow is due

coupon – frequency of payment, if increasing relevant index and indexation lag redemption date and amount

any options will need to be allowed for

will need to discount at rates consistent with the market spot yield curve; for the relevant default risk, with appropriate adjustments for lower marketability

[7]

### **Equities**

Will need to know how much the next interim and final dividends are expected to be; and when they are due

Will also need to estimate expected future dividends. Can use dividends based on profit forecasts for the first few years; and then apply a long term average

growth rate. (Alternatively, could assume that the dividends grow at a constant rate. This may, however, not be a realistic assumption.)

Will need to ensure that the growth rate assumed is appropriate for the company being valued.

The dividends will need to be discounted at an appropriate rate: can use the yield on long term government bonds plus an appropriate addition for the risk of the income stream and lack of marketability, or could use index-linked government bond yield and estimate the real, rather, than nominal rate of dividend growth.

There is difficulty in setting the discount rate, so consider how material the rate is and sensitivity of answers

- (iv) The main stock market index is unlikely to be an appropriate comparator. It is likely to consist of equities in large companies and will not hold bonds.

The investments in this investment trust are different to the index components

The trust contains bonds as well as equities and bonds may have underperformed equities

The companies may be in different sectors, or may be smaller, or may be in different countries/geographies. These sectors/etc. may have underperformed relative to the stock market.

Also the trust’s managers may have underperformed by poor stock selection; or by poor allocation to sectors bond/equities/etc.

The method of valuing the unquoted assets may have changed. The assumptions made when calculating the values of the unquoted equities and bonds may have changed.

Supply and demand factors. There may be a demand for stock market index resulting in an increase in the value. The increased supply of the unquoted investment has resulted in the decrease in the value of the investment

There could have been a large outflow of charges so had to sell assets from the trust. Trading expenses are incurred by the trust but not the index

[3]

[Total 17]

*Part (i) was reasonably well answered, but not as well as might be expected for a straightforward question. Most candidates scored highly on part (ii). Part (iii) was not well answered – we were looking for a simple discussion of what the cashflows would be and how to appropriately discount them. Part (iv) was generally well answered.*

7 (i) *Choices – what to do on wind-up?*

The Scheme Rules will say how benefits can be secured on wind-up – the following options may exist:

- Although unlikely, given the sponsor’s position, transfer the liabilities to another scheme with the same sponsor
- The scheme could transfer the funds directly to the beneficiary to extinguish the liability; but legislation may not allow the individual to receive the capital value of their benefits.
- Allow the individual members to place the funds into a personal pension or insurance policy or in the scheme of any new employer via a transfer value payment ( because the scheme is in surplus it could decide to increase the normal transfer value to extinguish the liability in that way). Or transfer the benefits to a central discontinuance fund, if available
- The scheme could transfer all of the funds to an insurance company to invest and provide the benefits by annuity policies – however the insurance company would charge for taking on the risks inherent in the scheme

*Choices – what benefits?*

The trustees will need to decide on the final benefits that the members should get

The benefits that will be paid will be affected by the following factors:

- The rights of the beneficiaries which will depend on the terms under which the scheme operates; and any overriding legislation
- The expectations of the beneficiaries; which are likely to be the benefits that would have been available had the scheme not discontinued; there may have been established discretionary practices which the trustees would like to continue
- In this case the scheme is in surplus and as such would be able to meet the expectations of the beneficiaries and a higher benefit will be paid. However the trustees could decide to increase members’ benefits with the surplus; this will be particularly difficult as the majority of the members have not retired yet.

If the benefits are to be increased this is likely to be at the discretion of the trustees; but will need to consider legislation and the scheme rules; as these might dictate how these are to be paid and in what form (e.g. increase directly to the pension or changing the increases that apply every year)

The trustees could consider whether any individuals are more entitled to share in the surplus than others

The surplus may pass back to the sponsor (or its creditors in insolvency) ; and they may have power to refuse any benefit improvements

If the scheme is being wound up then the expenses of the wind up and securing appropriate provision for the liabilities will also need to be considered before using the surplus to increase members’ benefits

*More issues*

The scheme may have been in surplus but not on a wind-up basis (insurance cost etc.), this will depend on the basis used; and depends on what will happen to the benefits on wind up; then the trustees need to source additional funds or reduce benefits

The funding position may have changed since it was assessed and may change over the period before the trustees could secure benefits.

The trustees should consider what can be done to reduce the risk of the funding level falling; in particular matching the investment strategy to wind-up basis; although this may not be investible e.g. annuity prices influenced also by competition/mortality/etc.

Also the trustees should consider what can be done to get firm annuity quotes (or transfer cost, etc.) as soon as possible

The trustees will need to assess the scheme’s membership data. Is this complete and accurate for the purposes of securing benefits? If not, what can be done to fill the holes? Note that sorting this out adds to expense and takes time.

Communication issues. The scheme needs to effectively communicate the wind up process and the impact on members. It also needs to give members a way to voice their questions and concerns

[11]

(ii) *Longevity*

A key risk for the insurance company will be the members living longer than the assumptions that were used for pricing

This is a particular issue for this scheme because the high proportion of members that are deferred members with a long time to retirement – this will mean the pricing assumption around possible improvements to life expectancy will be critical; and therefore the insurance company will want to consider possible medical advancements in future years. Deaths in deferment may be lower, thus more members live to receive pension

Even the members that have retired recently will be relatively young and hence this issue will still apply

### *Investment*

The insurance company will need to invest the premium in a way that it will be confident that it can pay the benefits to the members as they fall due.

The benefit cashflows are likely to be very long term. Even the 30% of members who have retired recently may have life expectancies of over 20 years; and an expected period of over 40 years until they have all died; and an even longer period if pensions continue to spouses after members’ death. And the 70% deferred members may retire on average in 20 years’ time; but the youngest may retire much later.

Ideally they can invest in bonds that match the liability cashflows; but there may not be sufficiently long bonds giving reinvestment risk; and there is risk that the bonds default in the future. So actual investment returns may not be as expected

Government or AAA bonds will be most secure; but this may mean the company is either uncompetitive or expensive such that benefits may need to be scaled at outset such the scheme decides not to go with that option

They could decide to invest in assets where there is a good chance of long term capital growth (e.g. equity); but this would give rise to disinvestment risk when an income from the assets will be required

These assets may be riskier than other assets and this may mean the capital might be lost

### *Expenses*

The ongoing expenses may be higher than anticipated in the pricing of the scheme

There is also a risk that expense inflation is higher than expected

### *Data Risks*

The company will be taking on all the benefits outlined in the scheme rules and this might be difficult for the insurance company to understand or price (or the assumptions for them might be incorrect) – for example the spouses benefit may apply at the time of the members death and not at outset (i.e. the member could marry someone between retirement and death).

Equally the company may not have all the correct individual member data for the scheme.

*Inflation Risk*

The member’s benefits may increase with inflation and this rate may be higher than the company had considered at the onset of the contract

*Legislation/Legal Risk*

Legislation may change in the future such that benefits could be increased and this could lead to the insurance company making losses. There is also the risk that members contact the insurance company and challenge the benefits being offered and that the insurance company had misunderstood the schemes rules

If the company is using reinsurance then there is a risk the reinsurance company defaults on its obligations

The deferred members may also be able to transfer the benefits out which may lead to a liquidity risk if the assets that the company are invested in are not freely disinvestible

There may be optionality in the benefits that presents risk to the insurer, e.g. retirement date/options

[8]

- (iii) The main tools that can be used to aid the management of risk are:

Diversification

Underwriting at the proposal stage

Claims control systems

Management control systems

The risk can also be passed on, for example longevity swaps and bonds, interest rate or inflation swaps

*Diversification*

The insurance company may already be using this deal to diversify its risks e.g. by class, or within class e.g. by geography, annuity type; but it also needs to consider diversifying its investments (i.e. not hold all in one bond, spread over a number of assets within the asset class)

If the contract is large and they are going to use reinsurers then they will need to consider diversifying across a number of providers of the reinsurance

*Underwriting at the proposal stage*

The particular risk here is that people are going to live longer than expected – given that the benefits are defined it might be difficult to underwrite the actual individuals

However the company can investigate the mortality experience of the scheme, general location of the main members (and how this relates to the general population) and also the type of jobs the members of the schemes had

In terms of understanding the data (e.g. to get the best assumptions for spouses benefits) to ensure the correct benefits were being taken on the insurance company could insist on going through the schemes records and using other sources of data to get the best information possible

#### *Claims Control Systems*

The insurance company will need to guard against fraudulent claims (spouses not existing)

*Management Control Systems:* good management control systems can reduce a provider’s exposure to risk

E.g.

- Data Recording: The company will want to ensure that it holds good data on all the risks it insures – it will want to ensure that it knows about all the deaths and have them recorded correctly and include whether a spouse benefit is liable
- Accounting and auditing – enables proper provisions to be established
- Monitoring of liabilities – protects against aggregation of risks, also need to consider inflation assumptions and how these may move as the market changes
- Reinsurance – the insurance company could consider using longevity reinsurance to reduce this risk OR full quota share type reinsurance to remove some of the investment risk.

[6]

[Total 25]

*Overall this was the least well answered question on this paper. Many candidates simply didn’t write enough in part (i), perhaps put off by lack of familiarity with defined benefit pensions, but missed the general points about investment risk and reliance on data. Most candidates scored slightly better on parts (ii) and (iii), but generally didn’t answer in sufficient depth for the marks available (in some cases this seemed to be because of time pressure).*

## **END OF EXAMINERS’ REPORT**