INSTITUTE AND FACULTY OF ACTUARIES

EXAMINERS' REPORT

April 2012 Examinations

Subject CA1 – Actuarial Risk Management

Paper Two

Purpose of Examiners' Reports

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 who are 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. Although Examiners have access to the Core Reading, which is designed to interpret the syllabus, the Examiners are not required to examine the content of Core Reading. Notwithstanding that, the questions set, and the following comments, will generally be based on Core Reading.

For numerical questions the Examiners' preferred approach to the solution is reproduced in this report. Other valid approaches are always given appropriate credit; where there is a commonly used alternative approach, this is also noted in the report. For essay-style questions, and particularly the open-ended questions in the later subjects, this report contains all the points for which the Examiners awarded marks. This is much more than a model solution – it would be impossible to write down all the points in the report in the time allowed for the question.

T J Birse
Chairman of the Board of Examiners

July 2012

General comments on Subject CA1

This subject examines applications in practical situation 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 – an attempt to understand the breadth of the answer required combined with a logical flow is a bid 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 April 2012 paper

The general performance was slightly better than in April and September 2011. Questions that required the application of principles or explanation, such as Q3 and Q7, were 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 VaR and Tail VaR are both measures of risk but are calculated differently.

VaR assesses the potential losses on a portfolio over a given future time period with a given confidence level.

Tail VaR is defined to be the expected loss in a portfolio's value given that the loss is occurring at or below the *pth*-quantile.

Tail VaR gives information on the severity of failure whereas VaR gives no information on the losses in the tail.

Both VaR and Tail VaR are calculated from the same distribution of possible capital outcomes.

However, creating a distribution of capital outcomes involves some subjectivity, and often involves compromises, particularly around the tail of the distribution.

To get an appropriate VaR it is possible to focus on the particular area of the distribution (percentile) so that the compromises can be minimised over this range.

To get an appropriate Tail VaR is more challenging because it is necessary to have an appropriate distribution from the percentile for the Tail VaR onward throughout the extreme of the distribution.

A tail VaR is therefore much more dependent on areas of the distribution where there can be more compromises and greater subjectivity.

If the potential outcomes in the tail are very extreme then small changes to the tail can have a significant impact on the Tail VaR.

So Tail VaR is more complex to calculate and can also be more difficult to explain.

Due to the limitations inherent in Tail VaR, many people prefer the VaR measure.

Disappointedly answered. A surprising number of candidates did not understand these two terms, and the difference between them. The Tail VaR metric is dependent on the tail of the distribution an area where there is greatest uncertainty. It is important for candidates to appreciate the limitations and implicit assumptions underlying metrics used in the insurance industry.

2 (i) The money markets are dominated by the clearing banks who use them to lend excess liquid funds and to borrow when they need short term funds.

These loans and deposits are usually very short term, often overnight. Interbank rates are usually taken as the benchmark for short term interest rates.

Central banks, as lenders of last resort, provide liquidity to the banking system when required and also use their operations in the money markets to establish the level of short term interest rates.

Other financial institutions and non-financial companies also lend and borrow short term funds in the money market.

(ii) The central bank controls the shortest rate, typically the overnight rate, they are prepared to lend to the money market when demanded.

Other short term interest rates are agreed through supply and demand between money market participants, however, they are related or set relative to the shortest rate the central bank is prepared to lend.

The longer the short term interest rates, for example the 1 year rate, will reflect money market expectations for future short term interest rates over that period.

The expectation of the future short term interest rates will be influenced by:

- expectations of economic growth, for example interest rates being reduced to stimulate economic growth.

- expectations of inflation, for example interest rates being increased to reduce inflationary pressures.

- expectations for the exchange rate, the exchange rate is important affecting the cost of imports and exports and therefore relative competitiveness. Interest rates can be changed to help manage relative competitiveness, for example lowering interest rates to lower demand for the currency, lowering the exchange rate making exports more competitive.

Where the liquidity of the market is constrained interest rates may be bid up.

Where interest rates are bid up due to liquidity constraints the central bank may intervene to lend to the market to increase liquidity and lower interest rates.

Reasonably well answered. A number of candidates did not appear to know money markets typically covers short dated instruments from overnight to 1 year and missed the point that interest rates are agreed through supply and demand. Many candidates overstated the role of central banks in influencing money market interest rates compared with the fundamentals of expectation of economic growth, inflation and changes to exchange rates

3 (i) An annuity is a single premium policy where the benefit is a stream of payments to the policyholder, often dependent on their survival.

The annuity premium is usually invested in a mixture of government and corporate bonds. The investments are usually invested to produce cashflows that match the timing and amount of the benefit outgo.

Provided the assumptions made in calculating the liabilities hold over the lifetime of the benefit payments then there is no requirement to sell assets or alter the portfolio over the lifetime of the contract.

The financial risk can be divided into those inherent in the contract and those that arise as a result of the reserving basis.

Inherent in design of contract:

- The assumptions such as future longevity or expenses may be wrong resulting in additional benefit outgo, with no additional income from the assets.

- The assets may not perform as expected, for example the amount and timing of defaults on either corporate or government bonds different from expected.

Inherent in the reserving basis:

- Assets are valued at market values, whereas the liabilities are valued based only on the yield on government bonds. As the yields on corporate bonds and government bonds change relative to each other the market value of assets will change, however, only changes to the government bond yields will affect the value of liabilities resulting in a balance sheet mis-match between the assets and liabilities.

- This mis-match occurs despite the asset cashflows and benefits payments being cash flow matched.

- There is a financial risk that additional assets are required so that based on the reserving basis there are sufficient assets to meet the liabilities.

(ii) The capital requirements are likely to involve a solvency capital requirement. This will be a target level of capital below which the sponsors of the scheme may need to discuss remedies with their regulators.

The solvency capital requirement may be calculated using a prescribed model or an internal model. It is likely that any internal model would need approval.

This would initially appear to be a benefit for the members of a defined benefit scheme as it should increase the protection available. However, need to consider if the requirements are likely to lead to additional capital being needed and where will come from.

If from sponsor, this capital will no longer be available for the business and so this will have a negative effect on the company. This may lead to redundancies which will not be good for the employees.

May lead to a reduction in benefits from the scheme or to closure of the scheme – to new members or future accrual.

These capital requirements may not be needed as the relationship between an insurer and its policyholders is very different from the relationship between the sponsor of a benefit scheme and its members.

The DB scheme will have additional security due to the support of the sponsor.

There may already be a pension protection fund which will provide some protection for scheme members.

There could be a large impact on the market if these schemes are required to increase their allocations of risk free assets. There would be disinvestment from equities and corporate bonds to invest in more secure government bonds. This could lead to the schemes being forced to sell equities at reduced prices and to buy government bond at higher prices.

A defined benefit scheme will have liabilities linked to salary inflation and so equities may be more appropriate to match these liabilities.

This was the least well answered question on the paper. Many candidates did not appear to know that corporate bonds could be used to match annuities as well as government bonds. Many candidates therefore did not pick up the marks available from appreciating that the market value of corporate bonds will tend to be more volatile than corporate bonds that are exposed to changes in credit spreads and changes in credit rating.

4 (i) Initial cost of car this may be a capital sum or a monthly payment or a combination of both.
Car insurance
Car servicing costs
Car repair costs
Car licensing cost
Petrol costs
Car cleaning costs
Cost of any breakdown cover
Tolls, fines, insurance excesses

(ii) All the initial costs (capital sum, licensing, breakdown costs and possibly insurance) will need to be covered in full.

These can be split evenly between all the members of the group or they could be split by planned usage (may be fair if some members are expected to use the car considerably more than others) or by household size.

Any fixed monthly costs (payment for car or insurance) could be split in a similar fashion. Tolls, fines and insurance excesses could be paid by the individual who incurs them. The other costs are likely to relate to car usage.

These costs will need to be estimated and can then be split between the members of the group. This can be split according to mileage and/or the time the car is being used by a member (e.g. per hour). It will be necessary to have an initial estimate of mileage and time to calculate a suitable amount.

All members will need to have money available to cover higher than expected costs and/or shortfalls in the amounts raised by the above methods and this will be allocated between members in a similar way.

(iii) Under this arrangement, there will be similar items of expense, which will be covered in the annual fee and hire charges.

Car Club may be able to negotiate discounts on many of these items and so the relative costs may be lower. They will have a large number of cars and so will be likely to have more predictable costs. The cars may be in use more frequently and so the costs will be shared by a larger number of members. All of the above should lead to lower costs.

There may be additional costs of administration and profits to the provider which may affect this.

For a member of Car Club, all charges will be known in advance and their liability will be limited to this amount.

There will be no initial set up costs and no additional sums will be called for.

There may be more chance of a car being available at the time needed with Car Club. There may be more choice of vehicles with Car Club so useful if needs are not always the same e.g. may want occasional use of a very large car. The cars may, however, not be as conveniently located.

Members will not need to be concerned about where to keep the car when not in use.

(iv) May have an absolute minimum or maximum age limit.

There may other (higher) minimum age limits where drivers may be subject to additional restrictions e.g. at least two years since passing test.

Drivers may need to have a clean driving licence and to have had no (or only a small number) of accidents in the last five years and no criminal record.

Could charge a large excess to reduce liability and to encourage safe driving.

Cars may need to be stored in specific locations.

Cars must be locked when not in use.

All parts of this question were generally answered well with many candidates scoring close to the maximum available marks.

5 (i) The primary motivation will be to keep costs down.

If an employee was absent extra costs would be incurred in covering for them e.g. pay overtime or temps to do their job.

There would also be management time and costs involved in coping with problems caused by absences. Loss of production/revenue could also be an issue. Not providing sick pay would mitigate these extra costs.

It is possible that some employees regularly take time off when they are not really sick. This may be hard to prove and legislation may make it hard to discipline offenders. Not providing sick pay may cut down on such abuses. However, given the nature of the work (manufacturing) there may be many genuine sickness cases.

A discretionary arrangement will enable such genuine cases (e.g. people who generally have good sickness records or are injured at work) to be fairly dealt with.

Having flexibility over payments avoids long-term commitments, which could be abused and allows changing circumstances to be accommodated.

Immediate mangers may be best placed to make such decisions, as they will know the individuals and circumstances better than senior management.

(ii) Past, even recent, experience may not be a guide to the future. That is, will the data they have be typical and so a credible starting point. Over the recent past, there could have been abnormal experience. For example flu type epidemics or serious work related events – accidents or food poisoning say.

The company is not large and so there could be significant random fluctuations in experience. If economic times were hard, sick people may come to work due to fears over no pay or being dismissed – this will distort experience.

It is possible that general sickness experience is gradually changing. This could go either way e.g. better preventative care or worse diet, sedentary lifestyles. Changes within the company could be an issue. For example processes could have changed so altering experience. The nature of the company may have changed (or change in the future) e.g. is either manufacturing or distribution fairly new.

This highlights issues over a changing workforce e.g. by age, sex or other significant characteristic.

The company may not have adequate data to analyse and project experience e.g. just broad summary numbers of days off. It may not have data relating to sickness absence where no payments were actually made. However, the new policy will in itself alter future experience compared to past experience. This will be most significant for short-term sickness.

In the past, people with minor ailments may have come to work. Under the new policy, they are much more likely to take a few days off as they will be paid, no questions asked. Hence the use of past experience may seriously understate future sickness payments.

With longer-term complaints, under the old arrangements, employees would probably have gone sick. Hence the new policy may not distort such experience too much.

In addition, longer-term more clear-cut cases are where discretion may have been used to make payments under the old arrangements. So reducing the need to work when sick. But, depending on the level of discretionary benefits, there could be some distortion. For example, low levels relative to the new benefits may mean employees came back earlier than they would do under the new system.

Relatively generous treatment under the old system (long periods on full pay) may mean that employees were off sick longer than they would have been under the new policy. For example, the drops after 3 months under the new policy may lead to employees returning to work.

Under the new policy, certification is needed. Previously the whims of a manager mattered. So this subjective v objective difference will alter experience.

Different managers will have taken different approaches. Hence it will be difficult to say how experience under that regime will compare to a uniform approach.

It is possible that the distortions will vary by types of employees. For example, highly paid or motivated employees may not take dubious sick days even if paid – whereas lower paid employees in more physical jobs would. This pattern is also likely to vary a lot with age.

(iii) Other sources may be:

- Other employers
- Insurance companies offering sickness policies
- Industry wide data
- National statistics
- Overseas data

All these sources may not reflect the particular features of this employer.

This employer has a specific mix of employees. It is unlikely that other sources will match this – especially when lots of data is included e.g. hard to define an industry type.

Many sources may cover non or self-employed individuals. That is individual policyholders may have different experience to a group of employees.

This employer may be concentrated in a specific geographical location and sickness will vary by location.

Other sources may define sickness differently e.g. could be looking at critical injury or sickness satisfying statutory requirements.

Data from other sources may be out of date e.g. if statistics take a long time to compile or not detailed enough/in the right format. Even if sickness is defined in the same way, the nature of the benefits will affect sickness experience. Other sources may cover arrangements with different levels and/or forms of benefit e.g. in relation to the number of days before certification is required

Parts (i) and (iii) were answered well. Part (ii) was less well answered and required candidates to think about practical aspects, for example that changing the benefits available to employees will change their behaviour. The future experience may therefore be very different compared with past experience.

6 (i) Information asymmetry is the situation where at least one party to a transaction has relevant information which the other party or parties do not have.

(ii) There is a difference in expertise and negotiating strength between the two parties. This is made more significant by the fact that financial transactions related to insurance can have a significant impact on the future economic welfare of individuals.

Furthermore in most countries the majority of the population is not well educated in financial matters and find the range of solutions on offer complex and confusing.

There can also be information asymmetry when the prospective policyholder has more information than the insurer, for example information on their health.

(iii) Regulating the insurance market would reduce the information asymmetry which advantages the insurance company in (a), (b) and (c).

Consumer education could be provided which should help consumers to make informed financial decisions.

The insurance company could be required to disclose full information about its products or itself in an understandable form. This should give an indication of bonus policy which will be of use for (a) and also the terms of payment of benefits which will be of use for (b).

The weakness of an individual in negotiating a deal with a large institution may be addressed by price controls or the regulation of selling practices.

The customer's position can be strengthened by devices such as giving them the right to terminate the sales process at any time, or by providing a "cooling off" period, during which a consumer can cancel contract with no penalty.

(a) An endowment assurance provides a benefit on the death of the life insured within the term of the policy or on survival to the end of the term.

The earlier the benefit is paid out the more it will cost the insurer. This will depend on the mortality of the life insured over the term of the policy. The prospective policyholder will have more information than the insurer on this.

Mortality will be affected by the state of health of the applicant as well as family medical history, occupation, leisure activities undertaken, country of residence and possibly countries travelled to.

There will be additional information asymmetry if the endowment policies are with profits as the insurer will decide on the level of any bonuses payable. The policyholder cannot influence this. To reduce the information asymmetry from the endowment assurance the insurance company will underwrite the policy.

It will obtain evidence about the health of the applicant so as to assess whether he or she attains the company's required standard of health and if not what their state of health is relative to that standard. The level of evidence may depend on the sum assured and/or term of the policy.

It will also ask for details of the occupation of the applicant as well as any potentially dangerous leisure activities undertaken – in the recent past and planned for the future. It may also require details on the financial health of the applicant to counter the risk of over insurance.

(b) A long term care contract will start to pay out when an elderly person needs nursing-home or nursing care. It may provide a cash lump sum, an annuity to contribute towards the cost of care or pay all the costs of care throughout the remainder of life. The cost to the insurer will depend on when the benefit starts to be paid and how long it is paid for.

This will be affected by the state of health of the policyholder relating to the events under which the benefit will become payable as well as their mortality. The prospective policyholder will have more information than the insurer on this.

The insurer will be able to influence when the contract will start to pay out.

To reduce information asymmetry from the long term care contract the insurance company will need to underwrite the contract.

Health evidence will be needed but in this case it will be necessary to focus on aspects likely to give rise to the need for long term care. Family medical history may also be useful here.

Once the policy has been taken out, the policyholder may be more willing to receive nursing care or go into a care home so it is very important that the terms under which the benefit becomes payable are very clearly set out. There may be a minimum period before claims could be made. Claims control systems at the time of the claim will also be useful.

(c) This insurance indemnifies the insured against legal liability for the death or bodily injury to a third party or for damage to property belonging to a third party, which results from a product fault.

Here the perils depend greatly on the nature of the product being produced, but include faulty design, faulty manufacture, faulty packaging and incorrect or misleading instructions.

The company seeking insurance will know the full details and background of the product but the insurer will not. However, if the insurer specialises in product liability insurance, they may have much more expertise than their policyholders in this market.

The insurer will need to learn more about the product concerned. It will need information about how and where it is produced and the quality controls in place. It will also want details of any previous problems with this product or any others produced by the same company.

It will be very important that the company taking out the insurance still has an incentive to produce quality products. There may be exclusions on the policy if quality standards are not maintained. For the same reason, excesses are also likely to be useful.

Disappointedly answered. Most candidates correctly defined what an information asymmetry is, i.e. that an insurance company and policyholders will have different knowledge. However, in parts (ii) and (iii) many candidates failed to demonstrate that they actually understood in a practical sense what an information asymmetry is and how it can be managed. In part (iii) few candidates scored well and this appeared to be due to a failure of candidates to identify the different parties involved, their different knowledge and how this would influence their behaviour.

7 (i) A precise match will mean having a flow of asset proceeds that correspond perfectly to liability outgoings. In particular, it will be necessary to take into account the term and currency of the liability payments.

In practice, even for guaranteed or fixed liability outgoings, it will be impossible to find assets that give such a perfect match. This is because there will usually be some uncertainty over the probability of some payments being made (e.g. due to mortality fluctuations). Also, the terms of some liabilities may exceed the terms of the available assets required to match them. Techniques such as immunisation or liability hedging may be used to select assets that perform in the same way as the liabilities.

In the case of assets that are real in nature, matching is only likely to be possible at a very broad by nature level. For example, few, if any, assets provide proceeds linked to salary growth and proceeds on real assets are often very volatile.

The closest match may well be to have assets, that over the long term, are expected to provide proceeds (income or capital) that grow in a broadly similar way to liability outgoings.

(ii) The priority for many investors will be to meet their liabilities as and when they fall due. Having matched assets and liabilities will remove the risk of failing to meet this objective. In particular, it will remove risks relating to having to sell assets at unknown prices or reinvest proceeds on unknown terms.

Matching will be important for investors if the consequences of a mismatch are severe for example in terms of solvency of an institution.

Many investors will have low appetites for risk (or manage money on behalf of such investors). They will put an ability to meet liabilities above a desire for potentially high returns.

In many cases, regulations may implicitly or explicitly require matching. There may be penalties e.g. in terms of higher reserving requirements if assets are mismatched. Investors with low free reserves or other sources of income or capital are likely to view matching as more important.

(iii) In general, investors would mismatch assets and liabilities in order to generate higher returns relative to a matched portfolio. So there will be a trade off between the chances of higher returns and additional risks by having an unmatched position.

Much will depend on the level of surplus in the scheme. A high surplus will enable a more aggressive investment strategy i.e. less matching. However, given that the scheme is closed, it is unlikely that there will be significant surplus.

Worries about the cost of continuing the scheme may be behind the decision to close. So there may be little surplus to start with. Some of the surplus may have been used as part of the closure arrangements – to benefit the sponsor or members.

Given that a decision has been made to close the scheme, it is unlikely that the sponsor will want the risk of having to find additional contributions should a mismatched asset policy lead to losses.

There may be scope for some mismatching if some benefits are discretionary or can be altered. That is if any guarantees can be adjusted. There may be practical difficulties in altering benefits in this way depending on the terms of the Trust Deed and Rules and on member expectations.

If the scheme still has a high proportion of members who have not yet retired, there may be some time before many of the liabilities come into payment.

It is possible that the volatility associated with mismatching may not be too significant. However, as the scheme matures, it will be more important to reduce volatility and have a tighter match. As the scheme matures, it will decrease in size and so the opportunities to mismatch may reduce. Expenses associated with active mismatching may become more significant.

Regulations associated with a closed scheme may be more onerous and effectively prohibit mismatching. For example if benefits were reduced (to discontinuance terms) or if the scheme wants to qualify for help from protection funds etc, it may be a condition that a matching policy has to be followed.

(iv) The couple have been investing to match an inflation linked liability due to start payment in two (probably) years and to continue for at least nine years from this time.

The nature, term and currency of the liabilities are unchanged so the existing assets may still be held to meet one third of the new fees for each child.

The amount has however changed significantly and so the existing investments will no longer provide all the required capital.

The couple will need to consider whether it is possible for them to meet this new cost. Even if they cannot meet it fully they may still wish to increase the amount held for each child. They only have two years to save for the first child and so they may prioritise this in the short term.

They will need to consider any other existing savings or assets they hold and whether these can be made available. These may be suitable as they are or they may need to be changed. They will want low risk investments that will be available when needed to meet these liabilities. They may need to move any existing assets gradually.

If they currently make any other regular savings from their income, these could be redirected. They may be tempted to reduce pension contributions although this is very unlikely to be a sensible long term solution.

They can also take into account their future income. Is it possible to increase any savings they make from their income?

Expenditure could also be reduced to increase amount available for savings.

If they own a property this could be mortgaged to provide any shortfall in capital. This will need to be repaid, probably before retirement, and so may not be a realistic option.

They may also investigate alternatives. They may consider overseas universities either because of lower fees or increased chances of scholarships. It would then be necessary to consider currency in any investment strategy, although the currency needed may not be known in advance.

It may be possible for students to obtain a loan. If this was the case the parents could make the repayments on behalf of their children. This would be a much longer term commitment.

Parts (i) and (ii) were reasonably well answered. Part (iii) was less well answered, in part because answers were not specific on the scheme being closed to new members, and why the scheme may be closed to new members. Part (iv) the magnitude of the increase in fees was not taken into account in the answers.

END OF EXAMINERS' REPORT