EXAMINATION

September 2005

Subject CA1 — Core Applications Concepts

Paper 2
(Liabilities and Asset Liability Management)

EXAMINERS' REPORT

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.

M Flaherty
Chairman of the Board of Examiners

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The division of the syllabus and core reading for CA1into two parts for the 2005 and 2006 examinations in order to cope with the transition arrangements between the old and new examination strategies leads to an unbalanced split in the examination papers. The paper 2 syllabus and reading is considerably longer and less straightforward than that for paper 1. As expected the standard of candidates' solutions was less good in this paper than in paper 1.

As the title of the course suggests, this subject examines applications of the core techniques and considers broad actuarial concepts in practical situations. 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. These features are particularly tested in Paper 2.

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 Minimise set-up costs by using standard legal structures and documentation based on similar schemes run by other employers.

No member options:

- Reduces calculations required; and
- Simplifies member communications.

Require that benefits of small value be wholly commuted for cash:

- Reduces benefit payment costs; and
- Shortens period over which records have to be held.

Simple benefit structures:

- Less actuarial costs;
- Less management time.

If retirement benefits are provided offer a lump sum not a pension.

Require member contributions to be made by deduction from pay:

- Saves processing payments by other means.

Keep tight control on expenses of running the scheme:

- Prepare a budget;
- Monitor expenses against budget;
- Take action on overruns quickly;
- Adequate staff training;

- Purchase/design efficient and cost effective administration systems;
- Cost effective communication methods;
- Choice of professional advisers.

Consider outsourcing some functions to reduce the costs of administration, but remember only the function not the responsibility is outsourced:

- Investments;
- Paying pension benefits.

This was the least well answered question on the paper. Few candidates thought widely enough to gain many marks. Although many candidates mentioned simple benefit and contribution structures, few suggested why these would reduce costs. There were also a significant number of candidates who failed to read the question and indicated how the overall cost of the scheme, i.e. the contribution rates, could be minimised.

2 (i) Reasons for purchasing reinsurance:

To limit the effect of a catastrophe or aggregate loss
Commission paid by the reinsurer for the business/ financial assistance
Reduce exposure when new market or area
Stabilise results
Spread risks/ diversification
Reciprocity
Supervisory requirement
Technical assistance
Write large risks
Improve solvency position
Take advantage of low priced reinsurance
Investment freedom
Financial reinsurance to manage balance sheet
Not to be out of line with market practice
To write more business for same capital

(ii) Features of reinsurer that would be reviewed:

Reinsurer's solvency position.

Assets of reinsurer adequate to meet liabilities and suitable re term, marketability, admissibility, cash flow, liquidity etc.

Liabilities spread by class and geographically, technical reserve adequacy, exposure to catastrophes.

Spread of risk: to ensure random fluctuations covered.

Reinsurer's own reinsurance arrangements: no appreciable gaps and reinsurers' security.

Quality of management.

Ownership of reinsurer and quality/size of backing.

Market views on security and pricing adequacy.

Business being reinsured, i.e. will reinsurer still be around when claims come to be paid.

Credit rating.

Legislative regime of reinsurer/ where incorporated.

Size of reinsurer.

Reputation.

Part (i) was a straightforward piece of bookwork that has been asked regularly over recent years, in both subjects 302 and 303. As expected candidates performed well. Part (ii) was also generally well answered by most candidates.

3 (i) More information is required from the motor dealer on the loans:

Terms of loans: are these all, say, 5 year loans or of varied length? What are the interest rates on loans? What are the repayment conditions on early repayment of loans?

Is there just one lender involved or more than one with different arrangements?

Is the insurance on new cars, second-hand cars, or both?

What is the range of prices of cars sold with loans?

What are the loans expressed as a percentage of the price?

What is the likely volume of business (split by new/second-hand; term of loan; price of car; etc. if at all possible)?

Other information required would be:

Statistics on frequency of total losses of motor vehicles from own company's motor insurance experience.

Residual value decay information, i.e. what the value of a car would be for the purposes of insurance throughout the period of the loan from own company statistics or from the motor trade, e.g. motor pricing guide books.

It is presumed, although confirmation would be required, that cover under the policy would cease on resale of the car (or death of the car-owner).

The amount of cover depends on:

The loan repayment value: a value slowly decreasing to zero (starting at more than the amount borrowed depending on early repayment conditions) over the term of the loan; and

the residual value of the car, depending on whether it is second hand or new when purchased.

The value of a second hand car may only decline slowly and the "gap" may be extinguished within two or three years. A new car may lose a large part of its value immediately on purchase (because it is no longer new), so the "gap" will be bigger and persist for longer.

In view of the cash flow characteristics of the exposure, it is probably necessary to perform a stochastic exercise when testing premium rates allowing, for example, for various changes in the assumptions for residual value decay, total loss rates and for early loan repayment.

Premium might be expressed as a fixed percentage of the loan with different rates for different loan percentages/terms of loans, or a fixed amount within bands of loan amount varying by loan percentages/terms of loans, in each case possibly varying by whether new or old car.

Loading for expenses and profit.

(ii) The risks for the insurer are that the assumptions made in assessing rates were not realised in practice.

The cover is dependent on the amount recovered from the policyholder's motor insurance policy as a result of the total loss. As the policyholder will be fully covered in any event, there is no incentive for him to query the amount recovered. The amounts could be lower than assumed and hence the amounts recoverable under the residual value insurance could be correspondingly higher than assumed. Also moral hazard from underinsurance of car.

A condition of the cover could be that the policyholder passes some responsibility to the company to negotiate the amount recoverable from the other insurer although this would increase administration expenses.

The volume of business could be much higher or lower than expected.

Higher could entail more risk than desired and could be mitigated by imposing a predetermined limit in the agreement with the car dealer.

There could be a requirement for additional solvency capital (but unlikely).

Too little volume might not cover the expenses incurred in writing a new line of business: part of the agreement might be early cessation of the contract if volumes do not exceed a certain amount to cut losses early.

Assumptions about the rate of residual value decay, frequencies for write offs and resale volumes pre loan expiry could be incorrect. These should be monitored and changes to rates sought if warranted.

Reinsurance (e.g. stop loss) may overcome some problems.

Most candidates found this question difficult. The concept of "gap insurance" is not specifically covered in the core reading, but the risk that the cover was trying to protect against was fully explained in the question. This question tested the ability of the candidate to apply basic concepts, and a lot of common sense, to a possibly unfamiliar situation. Very few candidates tried to analyse the shape of the risk that was covered, but those who did quickly realised that the rate of depreciation was the key factor, and hence that a main rating factor was whether the car was new or second-hand.

In part (ii) most candidates mentioned that the main risk was the company getting the rates wrong, and many also commented on the effect of over- or under-estimating sales volumes. The other points above were generally missed.

4 (i) *For any of following affected parties, any other reasonable reason why affected gained the marks.*

Shareholders of pension scheme sponsors whose funds will pay the levies.

The management of pension scheme sponsors whose performance indicators may be affected.

Distinguishing between current schemes and those who will still be around in a few years, who will pay more/less if initial levies turn out too low/high.

Employees of pension scheme sponsors who may want low levies that do not discourage sponsors from offering pensions.

Pension scheme trustees whose funding and investment decisions may be affected by a desire to reduce levies.

Pension scheme members and dependants who will want the FPP to be as secure as possible.

Government who won't want levies higher than predicted when introducing the legislation.

Taxpayers who might have to support the FPP if levies are too low and FPP is unable to meet benefit promises.

(ii) Conflicts could arise if the actuary, as well as being an adviser has one or more of the following roles:

As advisor to existing pension scheme clients;
As manager of a firm that may sponsor a DB scheme;
As member of DB scheme;
As taxpayer;
As shareholder in firms that may sponsor DB schemes.

It will be very difficult for FPP to find an actuary who has no such conflicts. The FPP could look for advice outside the country, or appoint an actuary who has fewer conflicts. If the job was big enough, then the actuary could cease advising other clients or be full-time employee of FPP.

Any potential conflict must be disclosed to all relevant parties. Procedures should be established to prevent information being used in other areas (Chinese walls).

(iii) Fundamental principles are to invest appropriately to the nature/term/currency of liabilities, and to aim to maximise returns subject to an acceptable level of risk.

Benefits are largely determined, but may not be able to be afforded.

Start with an assessment of the expected cashflows — promised benefits, expenses and investment return. These will be uncertain, particularly due to inflation and longevity, and so it will be necessary to assess the impact of these and other risks.

What options does the FPP have to mitigate these risks?

Ideally, there would be assets that would guarantee payments to match the benefit/expense outgo in term and nature (inflation-linked/fixed).

High quality bonds give the best match. Swaps may be available to smooth out the redemption terms if a suitable range of durations is not available. Sufficient liquid assets are necessary to meet cash flow requirements.

It may be impossible to find assets that match demographic risks because the term of the assets may not be long enough and the large size of the fund may be a constraint. So derive a portfolio that best matches the liabilities and build in additional reserves to cover the mismatching.

Investigate whether insurance policies are available that could cover some/all of the liabilities — the premium may be cheaper than the reserves it would be necessary to hold.

Almost inevitably, the market value of the target matched portfolio will not equal the value of the assets available. The rules of the FPP should address these situations.

If there are excess funds, then consider additional benefits.

If there are insufficient funds, then benefits will need to be reduced. Some categories of benefit may have higher priority.

Having adjusted the benefits, derive a target portfolio that is best suited to meet the (adjusted) benefit. Test the robustness of this by sensitivity analysis or stochastic modelling. Consider moving away from this portfolio in search of higher returns and risks of doing this need to be analysed.

Need to consider equity between members, because those who would gain from positive additional returns are different from those who would lose if the returns are negative.

Consider the transaction costs of moving from the existing portfolio to the target one, and the timing of the transition, bearing in mind any potential market impact.

There may be restrictions on what the FPP can invest in.

Tax regulations applying: could be different regime.

Establish suitable procedures for ongoing monitoring and review.

Part (i) was well answered, with many candidates giving a good list of affected parties and good reasons for their interest. Answers to part (ii) were mixed, with most candidates mentioning the actuary's role as advisor to benefit schemes as well as the FPP, but only the better candidates thinking about other possible conflicts. In part (iii) most candidates stated the basic principles of investment matching, but only the better candidates took the discussion much further. Again, only a few candidates considered what to due if the value of the assets does not equal the value of the liabilities (as will certainly be the case).

5 (i) Models will need to satisfy the following requirements:

The model being used must be valid, rigorous enough for its purpose and adequately documented.

The model chosen should be capable of reflecting the risk profile of the products being modelled adequately.

The parameters used must allow for all those features of the business being modelled that could significantly affect the advice being given.

The inputs to the parameter values should be appropriate to the business being modelled and take into account any special features of the company and the economic and business environment in which it is operating.

The outputs from the model should be capable of independent verification for reasonableness and should be communicable to those to whom advice will be given.

The model, however, must not be overly complex so that either the results become difficult to interpret and communicate or the model becomes too long or expensive to run, unless this is required by the purpose of the model.

When using a model for product pricing:

The model needs to allow for all the cash flows that may arise. These will depend on the nature of the products being modelled and any discretionary benefits involved.

It also needs to allow for the cash flows arising from any supervisory or commercial requirement to hold reserves and to maintain an adequate margin of solvency.

The cash flows need to allow for any interactions, particularly where the assets and the liabilities are being modelled together.

Where the business being modelled includes options, the potential cash flows from such options and the take-up rate need to be allowed for.

The ability to use stochastic models and simulation needs to be allowed for, where appropriate.

The time period for calculating the cash flows in the projection needs to be chosen bearing in mind that:

- The more frequently the cash flows are calculated the more reliable the output from the model, although there is a danger of spurious accuracy.

- The less frequently the cash flows are calculated the faster the model can be run and results obtained.

(ii) (a) **Without profits term insurance**

The investment return assumption is the least important as only small reserves accumulate for term insurances.

The withdrawal assumption will be more important. Withdrawals in later years will be less significant, as no surrender value is likely to be paid, and on withdrawal the small reserve is released as profit.

Because of the high initial expenses, withdrawals at early durations will give rise to losses as expenses will not have been recovered. If there are selective withdrawals the mortality of the remaining lives may be worse than expected.

Mortality rates are more important. The rates are low (in terms of deaths per 1000 lives), but the sums insured are high, thus a small underestimation in death rates could lead to large losses.

The expense assumption will be the most important, because expense allowances will be a relatively large part of the premium. Underwriting and claims handling costs will be particularly important.

As premiums are fixed at outset, expense inflation will be important.

Marks were given for a clear statement of order: investment, withdrawal, mortality, expense; or investment, withdrawal, expense, mortality.

To gain the marks in for order it was not necessary to list the order of importance specifically. The marks were awarded if the candidate demonstrated adequate knowledge of the relative importance in the answer.

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(b) **Without profit immediate annuity**

Withdrawals are unlikely to be allowed, so the assumption is unimportant.

The initial expense assumption is not particularly important, as expenses form a relatively small part of the single premium paid.

The importance of payment expenses and expense inflation depends on their size compared with the amount of annuity — they become more important for smaller policies. This is because the expense of making payments is generally independent of the size of the payment.

The investment return will be crucial, as the investment return on the single premium is a large part of the outgo on annuity payments and expenses. The guaranteed nature of the return increases the importance of the assumption.

If it is not possible to match income and outgo well there will need to be an assumption about reinvestment rates of return.

The mortality/longevity assumption is also crucial as it determines the average length of time the annuity will be paid. In the past improvements in longevity has been underestimated, and large losses have been generated.

Mark for order: withdrawal, expense, investment, mortality; or withdrawal, expense, mortality, investment.

(iii) (a) **Term insurance**

The main uncertainties arise from future events that cannot be estimated well at outset. These are expense inflation, withdrawal rates and mortality.

Expense inflation is not closely linked with the other assumptions, so would normally be tested by sensitivity testing with some deterministic assumptions.

Mortality and particularly mortality improvements could be tested through a stochastic model, as this is an important assumption. Although as it is known which direction generates the downside is this may not be done.

If it is assumed that withdrawals are selective, it will be necessary to link the mortality assumption to the withdrawal assumption.

(b) **Annuity**

The main uncertainty is future longevity. Other relevant factors are future investment conditions, especially where reinvestment is necessary, and expense inflation.

Because of the risk involved, longevity could be modelled stochastically. However it is clear that it is improved longevity that will be the issue, so it would be possible to stress test a range of deterministic scenarios.

A stochastic investment model could be used because of the importance of the assumption. This would generate future expense inflation rates automatically.

The decision is whether to model both investment and mortality stochastically, and if not, which to choose. The run time and development cost of a model with two independent stochastic variables would have to be considered.

There are well developed and well document stochastic investment models available in the market. This is not the case with stochastic mortality models, so there will be a significant development cost

If only one stochastic variable is chosen the above considerations a likely to mean that a stochastic investment model will be chosen, and longevity tested by deterministic scenarios.

(iv) The company might choose to sell the product at a cheaper or more expensive price than indicated by the pricing process.

A more expensive price could be used if there was no real competitive market in the product. Greater profit margins could be incorporated and the product still be competitive.

There may be a cartel keeping prices high.

The immediate implication is bigger profits. However customers may turn to a similar product from another provider that, although not fulfilling their needs completely, provides much better value for money.

Thus the total market size for the product would shrink. New business would decline even if market share were maintained. It might be possible to restore sales volumes quickly by a price cut to the price generated by the pricing process, and still remain profitable.

Regulators may take action against cartels. Adverse publicity may affect sales not only of the particular product, but of other business lines of the company.

A cheaper price might be as a result of taking a lower contribution to expense overheads and profit. As the total profit is the product of the number of units sold and the profit per unit, selling more units at a reduced profit margin may increase total profits.

Increased volumes may put capital pressure on the company through increased new business strain.

The cheap product may attract customers to other, more profitable products of the company. The company may expect greater profits across its whole product range. The risk is that in a developed market this may not work. Customers may find your "more profitable" products cheaper from other providers. The expected sales volumes may not materialise.

If the product is sold at a real loss, i.e. marginal expenses are not covered in the price, then the company is very exposed to the risk of more sales than expected and very high capital strains. As this could not be allowed to continue for long, the company could also be exposed to adverse publicity from steep price increases.

Tariff rates fixed by government could apply in some territories: the modelling is then done solely to determine profit.

The length of this question, and the fact that it accounted for one third of the marks on the whole paper clearly worried some candidates who mis-allocated their time. However it should have been clear that, although linked by a theme, parts (i), (ii) and (iii) together, and (iv) stood on their own as three separate questions, and might have been asked independently.

Part (i) was two bits of bookwork, from different parts of the core reading. Surprisingly, very many candidates identified the first and were able to repeat it verbatim, but were not able to identify or reproduce the second.

In part (ii) a surprisingly large number of candidates did not know that withdrawal from term assurances does not normally involve any payment, and that withdrawal from an annuity is not normally permitted. Consequently too much weight was given to withdrawal experience for both contracts. The examiners were hoping that candidates would come off the fence and conclude their answers with an ordered list, sadly few did. Part (iii) was poorly answered with many candidates suggesting that almost everything could be modelled stochastically, notwithstanding the cost and run time implications that they had correctly identified in part (i).

In part (iv) many candidates correctly identified reasons why the product might be sold at a lower price than identified in the pricing process, but only the better candidates discussed reasons why it might be sold at a higher price.

END OF EXAMINERS' REPORT