Actuarial Society of South Africa

Examination

Subject F202 — Life Insurance Specialist Applications

1 November 2011 (am)

EXAMINERS' REPORT

Question 1

i. Discuss how you would go about pricing the unit linked product.

Most students spent a lot of their time discussing how they would determine the pricing basis. Some spent the vast majority of their time on this. Also, a few students wanted to solve for the premium rather than the charges and others ignored the unit linked design altogether.

Need to build model that projects unit and non-unit cash flows separately. As you are pricing the product the model should allow for monthly cash flows (annual will not provide enough detail).

The model needs to allow for following cash flows:

Unit cash flows
- Premium,
- Allocation/Administration charge,
- Risk charges,
- Management fees, and,
- Unit fund Investment return (net of tax and external investment manager fees).

Non-unit cash flows
- Charges from above as income here,
- Expenses (initial and renewal),
- Commission (initial and renewal),
- Non-unit Death payment,
- Surrender charge,
- Non-unit surrender payments (if in excess of unit fund value)
- Non-unit Maturity payments,
- Non-unit fund investment return,
- Change in non-unit reserves, and,
- Shareholder tax.

As you will require a change in reserve element as well, will need to produce a similar set of cash flows to determine the reserve at each point in time, based on the reserving assumptions.

Will require an initial set of best estimate assumptions for the following:
- Mortality
- Withdrawal
- Investment returns (both unit and non-unit)
- Tax rate based on companies expected tax status.
- Inflation
- Expenses (both initial and renewal)
- Risk discount rate.
- Reserving assumptions (i.e. above plus compulsory margins).

Also require a set of assumptions regarding the average policyholder (or model point) that will purchase the product. These should include:

- Average age
- Average term of product
- Average premium/sum assured

Use the cashflow model to determine the monthly net non-unit cashflow. By discounting the net non-unit cashflows at the risk discount rate, the present value of profit is determined for a model point.

Additional allowance should be made for the cost of capital using an appropriate basis and taking into account the company's approach to capital and the statutory required minimum capital.

Establish the profit criteria. This could be:

- IRR
- NPV expressed as percentage of an appropriate measure (e.g. first year premium, present value of premium) [Also award mark for other sensible option]
- The payback period.

Once the profit criterion is established, the product charges can be varied until the appropriate profit margin is obtained.

Items that could be varied until appropriate profit is achieved are:

- Allocation charge
- Management fee
- Surrender charge
- Risk charges

The management fee will be disclosed and prospective policyholders will be able to directly compare the fee with competitors, so limited scope to vary. Select a level that is broadly in line with competitors (say, 0.75% to 1.5% p.a.)

Surrender charge can be varied, but also limited by competition and legislation.
Should be based on a sliding scale, with a high initial charge reducing down to zero (or close to zero) after a few years?

The surrender charge should be chosen such that it protects the company against selective withdrawals and/or making significant initial expense losses. As the recurring management fee and allocation charges are levied to cover recurring expenses, the surrender charge should be used to recover outstanding initial expenses and potentially some compensation for shareholders due to a loss of future profits.

Risk charges can only be changed after 5 years. As the base set of assumptions will be based on a best estimate assumption, the model should not allow for changes in the risk charges after 5 years.

However, the risk charges will need to vary by age, sex, socio-economic class, etc. (in line with the company's approach on other risk business, and consistent with the structure of the best estimate assumptions), and include an appropriate profit margin.

The allocation charge will be the main lever to change in order to achieve an appropriate profit margin. Again, should probably have a sliding scale reducing over time to a constant level (or zero) after a few policy years.

At the one extreme you can select a 100% allocation charge for a period and then a very low (or zero) allocation charge thereafter. At the other extreme you can select a level allocation charge throughout, but this will expose the company to significant withdrawal risk in the early years before the initial expenses and commission has been recovered.

However, any proposed bases will have to compare against the maximum charges allowed by Regulation 5.

Allocation charges will vary by term of the policy and also by premium size. Theoretically you can establish an allocation charge for each combination of premium level and term. However, practically this will be set for premium bands and term bands.

A distinction will also be needed based on the frequency of premium payments.

Use the model to determine minimum premium/sum assured levels and minimum term. These may be selected based on the scenario where the company makes no profits or only a small loss on the best estimate set of assumptions.

Compare results against competitor products and any market research that was performed.

Sensitivity tests should be carried out to assess the robustness of the pricing basis.

If the company reinsures mortality risk, the effect of reinsurance should be allowed for in the pricing (if material).

ii. During the presentation of the results to the director she mentioned that a friend of hers (an actuarial student) has suggested that you can ignore withdrawals when pricing new products. The reasons she gave is that the surrender value will not exceed the statutory reserve; hence a profit will emerge on withdrawal. Discuss the suggestion.

This question was relatively well answered, with most candidates identifying the importance of the asset share.

The suggestion is confusing the asset share (or accumulated fund) of the policy with the statutory reserve.

The statutory reserve will be equal to the unit reserve plus the non-unit reserve. With a profitable product the non-unit reserve is expected to be negative. Assuming that the surrender values were set to recover all (or most) of the initial expenses, the inclusion of compulsory margins in the reserves should mean that the surrender value is below the statutory reserves.

However, the surrender value may well exceed the asset share in the early years of the product. Although a valuation profit will emerge, the surrender will result in a real loss for the company.

If the argument is that the company always makes profits, so why bother with withdrawals, this is also wrong.
Due to compulsory margins the initial valuation reserve usually requires an injection of funds from sources external to the policy. This is particularly true for recurring premium policies.

Since surrenders affect the amount and timing of profits, and the company wants to manage its capital efficiently, it is important to take the surrenders into account.

iii. Explain how the reserves and the embedded value of the company will be affected following the change in the economic circumstances.

This question was disappointingly answered. Many candidates failed to identify the links between interest rates, valuation discount rates, risk discount rates, and bond prices. Most candidates were better able to explain changes to the reserves than to the EV.

Impact on reserve

The reduction in interest rates will have a direct impact on the valuation basis used for the company. Assumptions for returns per asset class are usually set relative to bonds.

As a result the valuation interest rate for the risk products will reduce resulting in an increase in the prospectively valued statutory reserves.

The company is likely to have established retrospective reserves (e.g. IBNRs) for the risk business. These reserves will not be affected by the reduction in interest rates.

For the unit linked products the reserve will be made-up in two parts. The unit reserve and the non-unit reserve.

The move in the unit reserves will largely depend on the underlying unit fund investments. The fixed interest investments in the unit fund will increase due to the lower interest rates.

It is not obvious what will happen to the equity component of the unit fund. If the market expects the low interest rates to continue for the foreseeable future, equity values are likely to increase in value to reduce yields.

Overall, it is likely that the unit reserves will increase as a result of the lower interest rates on fixed income investments.

The non-unit reserve impact is less clear-cut. Given that the company will only have written business for a couple of years, there will still be significant negative non-unit reserves assuming that the premium rates are profitable.

Looking at the valuation discount rate in isolation, a reduction in the interest rates will therefore increase the overall size of the negative, resulting in an overall reduction in non-unit reserves for unit linked business.

However, the unit return assumption will most probably be adjusted downwards to reflect the changed economic environment. As a result the projected management fees will be lower, hence less expense coverage and profits. This will lead to a smaller negative non-unit reserve.

Impact on Embedded Value

The embedded value basis will be updated to reflect the lower interest rates available in the market. Hence both the valuation interest rate and the risk discount rate will be reduced. The company may also want to consider if the risk premiums assumed for different asset classes need to be reviewed.

The change in the economic circumstances may also have implications for other elements of the basis. For example the withdrawal rate may increase as certain policyholders select against the company if the surrender charge was not set appropriately. Also salary growth will be expected to slow resulting in affordability issues and higher lapses.

The expense inflation rate will also need to be reviewed, which is likely to result in a reduction of the inflation assumption.

The profits emerging from the risk products will be largely driven by margins on the risk loadings contained in the premium rates. This profit stream should therefore be unaffected by the change in economic circumstances. By discounting the profit stream at a lower rate, the EV for the risk products is expected to increase.

This increase will be off-set, but to a very limited extent by the lower profit release on the lower expected interest rates.

The profit drivers for the unit linked product will be:
- Differences between allocation charge and actual expenses (including commission).
- The management fees.
- Release of profit margins contained in the risk charges.

Other than a small impact due to a reduction in the expense inflation, the first item should remain broadly similar. Hence, with a lower risk discount rate the present value of this stream should increase.

The second item will have two off-setting elements. The initial increase in unit reserves will result in higher expected management charges and hence greater profits. However, as the long term outlook for interest rates will have been reviewed downwards, the projected increase in management charges will be smaller.

As this will still be a relatively small unit fund (only a couple of years of business), it is likely that the second element will outweigh the first one, hence a reduction in the profit stream.

However, this lower profit stream will be discounted at a lower risk discount rate resulting in a higher present value. Overall it will be difficult to say whether this element of the EV will increase or decrease.

With the higher unit funds the sum at risk will be smaller and hence smaller risk charges and profits. However, the profit stream from this source will be very small and hence any change in the economic circumstances should not have a major impact on this profit element.

Overall the EV for unit linked business will be expected to increase.

The changes in asset values will also affect the assets backing the net worth.

Question 2

i. Discuss this suggestion, including the merits of a full internal model compared to a standard model approach.

This question was generally well answered, with candidates showing practical insight into the issues.

A full internal model will allow insurers to include their own risk profile in the capital calculations. Assuming they are well aware of all the risks they face, a full internal model will theoretically provide a better reflection of the capital requirements of an individual insurer.

This will be particularly true for niche insurers who face very specific (and often peculiar) risks and can be allowed for more appropriately via an internal model.

With a standard model (like the CAR model discussed above), the model will not fully reflect the individual risk profile of the insurer, which may vary significantly from company to company. As a result some companies may be over capitalised or, more concerning, even under capitalised.

Requiring a full internal model, insurers will be forced to consider all the risks faced by the company which will assist with a better understanding of the underlying risks. This should in turn feed into better overall management of risks.

By applying the internal model at a product level, it will assist the company in better understanding the capital requirements of product classes. This should lead to more appropriate pricing of products and assist with better overall capital management of the insurer.

However, an internal model will require significant time and effort to build and embed in the business. For the smaller firms the benefit of a full internal model may be outweighed by the effort and cost of building a full internal model.

The additional cost may eventually be passed on to policyholders via product charges.

As long as a standard model is appropriately calibrated to the industry (and sufficiently prudent), then a standard model may well be a better solution for smaller insurers. Hence a combination of internal model, partial internal model and standard models may provide a more appropriate regulatory regime.
It is unlikely that a fully fledged internal model would immediately be accepted by the FSB. Over time, some companies may get there, but until then it would be a mix between a standard model and some components that are on an internal model approach.

Due to the cost and effort involved with internal model development and use, there may be a few small insurers who either close to new business or consolidate with larger insurers. This will lead to less competition in the insurance market and ultimately less choice for the policyholders. In the extreme this could also lead to higher premiums due to reduced competition in the insurance market.

The proposal would also place a significant burden on the regulator, which would need to review internal model applications prior to approving them. The regulator would have to recruit and train more staff.

If introduced for all companies at the same date, there may be considerable delay between submission of applications and approval of internal models.

The additional costs incurred by the regulator could be passed onto consumers in the form of increased taxes. More likely in the form of higher levies on insurance companies and thus directly onto those who purchase insurance.

(ii) IOCAR components and risks not covered in CAR

The bookwork element (the IOCAR components) was well answered, but most struggled to identify risks not covered.

Lapse risk
Surrender risk
Mortality, morbidity and medical fluctuation risk
Annuitant mortality fluctuation risk
Mortality, morbidity and medical assumption risk
Expense fluctuation risk
Investment risk
Credit risk
Operational risk and others

Risks not covered:

Liquidity
Currency
Model
Legal

Reputational
Strategic
Catastrophe
Embedded guarantees (e.g. investment guarantees)

(iii) List the falls in the fair value of assets backing the liabilities prescribed by PGN104.

Simple bookwork that was well answered, although quite a few students forgot that the fixed interest test should be in both directions.

Equities
FTSE/JSE All Share dividend yield below 4%: 30% fall in value
FTSE/JSE All Share dividend yield 5% or above: 20% fall in value
FTSE/JSE All Share dividend yield at 4% or above, but below 5%: Interpolate between 20% and 30%

Fixed property: 15% fall in value
Fixed interest: Impact of 25% relative increase/decrease in yield to maturity
Inflation linked bonds: Impact of increase/decrease in real yield to maturity by factor of 25% of real yield to maturity
Cash and similar floating interest rate assets: No change in value
Other assets: 35% fall in value
Foreign currency denominated assets: Same as for domestic assets subject to a minimum of 20% fall in value

Question 3

(i) **Discuss the possible financial implications to the company of each of the compensation packages, describing investigations.**

Option A

Option A was handled better than the other options, but few considered the effect of withdrawals in any depth.

This approach introduces a maturity guarantee into the contract.

The cost is represented by the excess of the continuation amount over the maturity proceeds from the policy.

It will depend principally on future investment returns.

And also on other items of experience, especially the surrender rates under the policies concerned.

In addition, the comparison between the past returns earned on the balanced fund and the return required from outset to repay the continuation amount is important. The further past returns are behind the target return, the more likely shortfalls are to arise.

The range of possible costs is likely to be large.

A stochastic model should be used to estimate the cost. This model should be market-consistent, and could be a real-world or risk-neutral model.

This involves projecting the policies concerned to maturity under a large number of randomly-generated scenarios and comparing the maturity proceeds with the continuation amount.

Where the continuation amount exceeds the maturity value, the excess is discounted back to the current date and totalled across all policies. For a risk-neutral or real-world model, the risk-free rate or deflators would be used respectively.

The expected cost is then given by the average total cost.

The results will also give an indication of the variability of the cost, including its level under some of the more extreme investment conditions (if a real world stochastic model was used.)

Surrenders are likely to be included in the model on a deterministic basis. But it may be possible to model path dependent surrenders. It is likely that there will be less surrenders if policyholders realise the increasing worth of the guarantee should rates reduce.

The impact on the surrender rates of introducing the guarantee should be considered.

The sensitivity of the cost to changes in the surrender rates should be examined (if deterministic approach is followed in modelling surrenders).

The projection will need to allow for tax and policy charges. It must also incorporate the sale of units to pay the monthly income.

Tax on the assets backing the guarantee reserve would have to be appropriately allowed for.

The projection may be performed using all policies, or by constructing appropriate model points.

As well as incurring an actual cost from lifting maturity values up to the continuation amount, the company will have to set aside capital to meet the additional guarantee.

The amount of capital required will be derived using a stochastic method with a suitably low probability of ruin. This would be compared to the impact on CAR caused by introducing the guarantee (as described in PGN110).

Whilst the projected cost of the guarantee may be low, the capital required to support it could be much higher.

The company will incur the cost of having to set the capital aside.

This will depend not only on the level of the guarantee, but also on the outstanding term of the policies. The longer the term to maturity, the longer the period during which the additional capital will be required.

The likely amount of capital required, both now and in the future, should be ascertained, before it is agreed to proceed. The impact on the insurer's solvency position should be considered.

The insurer may investigate using dynamic hedging to meet the guarantee.

The insurer should also consider the cost of software, hardware and staff needed to run stochastic models.

Option B

Few candidates identified the upper bound to the costs. Answers therefore tended to be quite similar to those for Option A.

Again, this will be net of tax and expenses.

This approach is similar in nature to the first approach, but provides an upper bound to the cost.

The maximum cost is limited to the shortfall that would arise if the company earned a future net return on the balanced fund of 8% p.a.

This avoids the high costs under the more extreme investment scenarios and hence results in a much narrower range of costs.

There may be no possibility of a cost arising under a significant number of policies – those that require a future investment return below 8% p.a. to repay the continuation amount.

The maximum cost can be estimated deterministically by projecting the policies concerned to maturity assuming a net investment return of 8% p.a.

Where the continuation amount exceeds the maturity value, the excess is discounted back to the current date and totalled across all policies.

The only uncertainty surrounds items of experience such as future surrender rates.

If the maximum cost is sufficiently high, it may be desirable to calculate the best-estimate cost using a stochastic method, as for the first approach.

It may be necessary to set capital aside to meet this conditional guarantee.

However, this is likely to be considerably lower than for the first approach, because of the absence of the more extreme costs. Again, this should be investigated.

Option C

Few candidates considered the effect on EV (i.e. the longer term effect on shareholder profits). Some insisted on performing further stochastic calculations.

This approach crystallises the cost immediately, removing any future uncertainty.

The cost appears to be the enhancement made to the surrender value of the policy.

However, a better comparison would be to compare the effect on the company of a policy continuing unchanged, versus the effect of surrender at the enhanced terms.
The former would be the value of the policy, calculated consistently with the company's EV methodology.
The latter would be the reserve held for the policy less the enhanced surrender value.

The cost therefore depends on the surrender charges applicable. However, these tend to be small for single premium policies.

The comparison will likely be worse for policies at short durations. In such a case, the company would forfeit greater future charges.

This will be particularly significant if a large number of policies have been continued recently.

Where the enhanced surrender value exceeds the reserves held in respect of the policy, the company's free assets will be depleted.
Where the enhanced surrender value is less than the reserves held in respect of the policy, the company's free assets will increase.

Large numbers of surrenders would leave a lower residual in force portfolio, reducing the extent to which overheads are spread.

The comparisons described above would be performed at an individual policy level.
The financial impact on the company will depend on the profile of this product and on the proportion of policies at different durations that are surrendered.

The company should test various scenarios to consider the effects of different take up rates of the offer at different durations.

(ii) **Describe the relative advantages and disadvantages to the company and the policyholders of each of the compensation packages.**

This question was relatively well answered, with most candidates being able to identify many of the practical implications of each option.

Option A

Advantages

Eliminates risk of shortfall, while retaining full upside potential.

Will be popular with policyholders?

Gives them what they may have believed they were buying.

Positive PR likely.

Easy to implement and operate administratively.

Disadvantages

Cost uncertain.

Could be very high in the more extreme investment scenarios.

Large amount of capital could be required to support guarantee.

Stochastic model will have to be built to calculate statutory reserves.

Option B

Advantages

Reduces the return required to repay continuation amount down to more reasonable level.

Avoids clients having a shortfall at projection rates above 8%.

Avoids risk to company of large losses.

And hence reduces the capital support required.

Disadvantages

Policyholders still exposed to potentially large shortfalls.

More difficult to understand.

Hence, may lead to arguments if there is a shortfall at maturity.

Complicated to operate at maturity if returns have been below 8% p.a.

Option C

Advantages

Removes risk of shortfall for policyholders.

Cost to company incurred immediately, so avoids future uncertainty.

Given the low interest rate environment, the potential deficit of the maturity value against the continuation amount would be expected to become worse over time.

Hence, cost is unlikely to be excessive compared to Option A.

Simple and hence inexpensive to implement.

Disadvantages

Policyholders lose any upside potential.

Surrendering the policy may not be appropriate.

Hence, the company may wish to offer advice, which increases costs.

Depletes the company's free assets.

Reduces the in force portfolio and hence the ability to spread overheads.

Still problem of policyholders who retain their policies.

Though company has a defence having made the offer.

Will break relationship with some clients.

