

Institute of Actuaries of India

Subject SA1– Health and Care

November 2023 Examination

INDICATIVE SOLUTION

Introduction

The indicative solution has been written by the Examiners with the aim of helping candidates. The solutions given are only indicative. It is realized that there could be other points as valid answers and examiner have given credit for any alternative approach or interpretation which they consider to be reasonable

Solution 1:

- i) The CFO is correct to comment that the initial reserve will be unit fund value which is same as the premium income provided the word “reserve” is replaced by “non-unit reserve”.

Due to the requirement of non-unit reserve floored to surrender value independently, the policy reserve should be higher or equal to the premium income.

Additionally, the commission and initial expenses for such a new policy will be shown as outgo in the revenue A/C.

Although first month’s morbidity charges will be deducted from unit fund at inception, hereby reducing the unit fund and unit reserve, it should add the expected claim outgo in the first month to a similar extent without impacting the policy reserve requirement significantly.

In summary, the initial expenses and commission plus any non-unit reserve requirement will be reflected as the Revenue deficit or the New Business Strain.

In contrary to the comment of the CFO, such policies should have significant New Business Strain depending upon the level of commission and initial expenses. [5]

- ii) CFO is correct in relating the non-unit reserve to traditional long-term pure risk plan since both are covering the pure risk and expense portion of the respective contract.

The savings portion is captured under unit fund and non-unit fund captures the risk and expense portion separately under the unit liked product. Accordingly, the non-unit fund is very similar to a traditional pure risk product and the treatment should also be similar.

For both the non-unit fund and traditional pure risk product, the reserve is calculated by discounted cash flow method, means the expected net cash flows arising are discounted back to the reporting date.

However, there are few differences as well...

The basic income is the level premium for the traditional product and it is the charges for the non-unit fund which is likely to increase as fund size increases with further premium and investment income.

The risk generally increases with age and so, the expected claims and expenses outgoes are likely to increase over the future projection period.

So, the net cash flows is likely to be negative (outgoes exceeds income) towards the later part of the projection period for the traditional product.

However, it is not the same for the non-unit fund since the charges also increase (unlike premiums in traditional product) over the projection period.

Both are effectively for pure risk portion and should not have any positive surrender value. Accordingly, the reserve would be floored to zero for all future time to address surrender risk for both.

Since the negative cash flows are arising at the later period for the traditional product, the discounted values of outgoes less income would implicitly ensure the surrender value flooring over the projection period.

The non-unit reserve would have to be calculated at every point over the projection period and compliance to the surrender value flooring would be ensured explicitly.

The calculated reserve for non-unit fund as calculated above is expected to be higher than that would have been calculated as per the traditional approach.

[10]

- iii) Shareholder value profit is the change over a year in the shareholder value of the long-term insurance fund, plus this year's transfer to shareholders.

It would therefore be necessary to assess the value of future transfers during every future reporting periods.

This would be done as follows:

1. Estimates were made of each element of future experience that would affect the transfers to shareholders, such as investment returns, claim and withdrawal rates, and expenses.

2. Using these estimates, the future transfers to shareholders arising on the in-force business were projected. Since all surplus is distributed to shareholders, the profits valued were those that emerged in excess of the statutory reserves that were projected to be required.

3. The estimated future transfers were then discounted to the reporting date, to give the shareholder value. The discounting rates used is called the Risk Discounting Rate (RDR) which should reflect the risk inherent to the business.

Any shareholder value in respect of free assets in the long-term business fund would also be included in the total shareholder value figure.

The recognition of Shareholder value profit could be controlled by:

- including risk margins in each of the projection assumptions
- including a margin for risk in the discount rate used, or
- a combination of both.

The margins should have had regard to the uncertainty attaching to each element of future experience and the risks of the business.

[8]

- iv) The next financial statements will include the DAC assets as it has been allowed by the regulator now.

The revised approach attempts to give a realistic measure of profit by using a Deferred Acquisition Cost (DAC) asset to spread the effect of initial expenses.

This would reduce statutory capital strain when a contract is first written and so produce a more even emergence of profit over the term of a contract.

However, the method will not recognize the future profits on in-force business.

It may therefore still have undervalued the “true” worth of the business, especially if the business is expanding.

The EV places a value on all the expected transfers from a contract once the contract is written.

This avoids the problems of capital strain and, unlike the above revised approach, makes some allowance for any changes in future expected profits during the year, eg due to sales during that year.

The future profits are assessed prudently, however, to reflect the risks that they would not arise as expected, RDR is set at higher level.

The EV therefore still do not represent a fully best estimate view of profit when the business is written.

As risk margins unwound, further profit would be expected to emerge in the future.

It also relies on estimates about the future and so was subject to a degree of judgment.

It gives a realistic view of profit, though, bearing in mind the risks still to be faced. It was regarded as being a more realistic measure of profit recognition than the revised reported profit considering DAC.

[8]

v) The risk margin is determined using the “cost of capital” method, ...

ie based on the cost of holding capital to support those risks that cannot be hedged.

These include all insurance risk, reinsurance credit risk, operational risk and “residual market risk”. For this contract the insurance risks are:

- expenses are higher than expected (without a compensating increase in income from charges)
- mortality / morbidity rates are higher than in the corresponding charge
- adverse surrender and partial withdrawal experience.

There is also the potential for operational risk, eg a failure to price the units correctly leading to bad publicity and the need to compensate policyholders.

If the sum-at-risk is reinsured then reinsurance credit risk should also be considered.

Residual market risk does not arise here as the unit reserves are perfectly matched by the assets in the unit fund.

The cost of capital method First of all, the risk margin calculation requires a projection of the future capital that the company is required to hold at the end of each projection period (eg year) during the run-off of the existing business.

The projected capital requirement is a subset of the SCR, consisting of those risks that cannot be hedged in financial markets,

ie the insurance, operational and reinsurance credit risks in this case.

These projected capital amounts are then multiplied by a cost of capital rate.

For Solvency II the cost of capital rate is a fixed rate of 6% per annum.

The product of the cost of capital rate and the capital requirement at each future projection point is then discounted, using risk-free discount rates, to give the overall risk margin.

Approximations Since the projection of the SCR is potentially complex, various simplified approaches can be used.

For example, this could involve selecting a driver which has an approximately linear relationship with the required capital or its components.

Possible drivers might be:

- policy count for expense risk
- sum-at-risk for mortality / morbidity risk
- total reserves or unit fund for operational risk
- unit fund for surrender risk.

The initial capital requirement can be expressed as a percentage of that driver,

and the projected capital is then approximated as the same percentage of the projected values of the driver.

In practice, more sophisticated methods using a combination of drivers and correlations may have to be used.

Diversification The risk margin can be reduced to take into account any diversification benefits.

[12]

vi) The following aspects need to be reviewed before taking any decision:

Nature of the business:

If the approach used in the standard model is a good fit to the company's business then it makes sense to use it as this will save using considerable resources in developing an internal model.

However, an internal model might be appropriate if the risk profile of the business differs materially from that covered by the standard formula.

In this case, the internal model will provide a more accurate picture of the capital actually required to run the business.

Indeed, insurance companies are expected to be able to justify that the standard formula is appropriate

and the supervisor can compel a company to develop an internal model if it feels that the standard formula is not appropriate to the risk profile of the company.

An internal model could allow for special features of the business that are not covered by the more general approach used by the standard formula.

Existing models An internal model might be appropriate if the company already uses such a model for risk management or other decision-making purposes.

Adjusting existing models and processes to be suitable for Solvency II could be much less resource intensive than building a model from scratch.

If these models do not already exist, then developing an internal model may have wider benefits for the company and give it a competitive advantage over competitors that use simpler models.

For example, the company will have a better understanding of its risks and will be able to make better risk management decisions.

Capital requirements:

The use of an internal model can lead to less onerous overall capital requirements than if the standard formula was used. For example, the internal model may be able to demonstrate higher benefits of diversification within the business.

A lower capital requirement has many benefits for the company. Firstly, the shareholders need to invest less capital to support the business and this leads to a higher return on capital.

Secondly, capital that would otherwise be tied up backing the SCR is now released for other purposes, eg to grow the business through developing new products or new distribution channels.

Complexity:

The standard formula calculates the SCR using standard prescribed stress tests or factors, which are then aggregated using prescribed correlation matrices.

To use an internal model, the company must determine its own stress tests and method of aggregation (which may be through correlation matrices or alternative approaches, such as directly by simulation).

So, the internal model is a more complex approach that requires more decisions to be made and a greater amount of analysis to be performed. A small company may not possess the necessary expertise.

A more complex approach also makes it harder to explain the calculation to the senior management who must use the results in their decision-making processes.

Internal Model Application Process (IMAP):

An internal model must be approved by the regulator before it can be used to calculate the SCR.

The company will need to put considerable effort into passing the tests required by the regulator to gain approval. There is the possibility that the company will fail some of these tests so that it is required to perform further work or to abandon the internal model.

The “use test” is seen as one of the most challenging aspects of gaining internal model approval.

As well as embedding the model throughout the company and developing an effective risk culture, companies will need to be able to provide evidence that this is the case.

However, much of this work must be done anyway as Pillar 2 of Solvency II requires the company to produce evidence to the supervisor showing that the ORSA is used by senior management and that the impact on the ORSA is considered in strategic decisions.

The quality of data and assumptions required to use an internal model can be problematic.

The historic data available to calibrate extreme events is limited.

Setting correlation factors that apply under extreme conditions is also challenging.

These assumptions must all be adapted to allow for the specific features of the company.

Resource issues:

Developing the internal model, checking it, getting it approved by the regulator, and subsequently using and maintaining the model all introduce costs for the company.

The major cost is the staff time (and that of any consultants employed) in developing, documenting and running the model.

There will also be costs of purchasing the computer software (and possibly hardware too) required by the internal model.

These costs may be a substantial part of the expenses of a small insurance company.

There is an opportunity cost, as the staff and management time invested in the internal model may be better applied to other projects, eg developing new business lines.

The company must balance the benefits from using an internal model with its cost. It may conclude that using a partial internal model would be the best compromise.

[12]

vii) Technical provisions are based on a market-consistent approach

and should represent the amount that the insurance company would have to pay in order to transfer its obligations immediately to another insurance company.

Such liability values are rarely directly observable in the market, so they will need to be modelled using market-consistent assumptions.

The technical provisions consist of a best estimate liability and a risk margin.

The best estimate liability is the present value of expected future cashflows (benefits and expenses less premiums) based on best estimate demographic assumptions.

Future premiums can be considered up to the “contract boundary”.

For long term health insurance business this normally means the maturity or expiry date of the contract.

For short-term health insurance business that is annually renewable, it means to the end of the policy year.

Allowance for future expenses needs to consider both overheads and directly attributable expenses. No closure reserve is required.

The assumptions should allow for all expected decrements and policyholder actions, including lapses, and should consider expected future changes in health status.

Insurance companies must consider all relevant available data, both internal and external, when arriving at assumptions that best reflect the characteristics of the underlying insurance portfolio.

These calculations should ideally be performed on a policy-by-policy basis. However, approximations are permitted and grouped model points can be used.

For some liabilities, including financial guarantees and options, a market-consistent simulation or stochastic analysis may be the most appropriate calculation approach.

Discounting takes place using the relevant risk-free interest rate term structure.

The correct reference rate to use will depend on the currency and timing of the cash flow to be discounted.

The same reference rate will be used by all insurance companies, ie published G-Sec rates or as agreed for all currencies.

For long-term predictable liabilities, where the insurer can hold matching assets to maturity and so not be exposed to the risk of changing spreads, a “matching adjustment” can be applied to the risk-free discount rate.

The matching adjustment applies to annuity business and its addition, which must be approved by the regulator is subject to strict requirements in relation to the eligibility of the assets and liabilities.

The matching adjustment is derived by taking the spread on the portfolio of matching assets and deducting the “fundamental spread”, an allowance for the credit risks retained by the insurer. Regulator may publish or indicate the fundamental spreads that insurers must use.

Alternatively, a volatility adjustment can be added to the risk-free discount rate if the liabilities are not eligible for the use of the matching adjustment.

The purpose of the volatility adjustment is to reduce the risk of forced sales of assets in the event of extreme bond spread movements.

Risk-free discount curves including the addition of a volatility adjustment might be prescribed by regulator.

The use of the volatility adjustment should be subject to prior supervisory approval and is subject to certain risk management requirements (such as a liquidity plan and sensitivity analysis).

The risk margin is intended to increase the technical provision to the amount that would have to be paid to another insurance company in order for them to take on the best estimate liability.

The risk margin therefore represents the theoretical compensation for the risk of future experience being worse than the best estimate assumptions, and for the cost of holding regulatory capital against this.

It is determined using the “cost of capital” method, ie based on the cost of holding capital to support those risks that cannot be hedged. These include all insurance risk, reinsurance credit risk, operational risk and “residual market risk”.

The cost of capital rate charged for these projected capital amounts is 6% pa currently.

Alternatively, the cost of capital element of the technical provisions can be calculated using a simplified approach, eg by selecting a driver which has an approximately linear relationship with the required capital.

[10]

[65 Marks]

Solution 2:

- i) The most important reason is physiological differences – that male and female policyholders simply have different bodies.

There are certain illnesses and diseases that only one sex can physically suffer from, such as gynecological diseases or testicular cancer.

Moreover, there are many illnesses that are far more prevalent in one sex or the other, such as breast cancer.

Also, certain life experiences only occur for one sex, such as pregnancy, and this can give rise to differing morbidity experience

Women live longer than men so durations of claims likely to be longer for women

Lifestyle factors are also very important in differing morbidity experience, e.g.:

Different occupational distributions with more male policyholders holding “blue collar” manual jobs

Different alcohol intake patterns

Different smoking patterns

Different health choices such as diet and exercise

Different propensities to take up hazardous pastimes

Different social factors also play a part, e.g.:

Propensity to visit doctors – male policyholders may be more likely to wait for a longer time before they visit the doctor

Differing understanding of health and lifestyle choices

Potential stigma attached to health and healthy choices

[7]

- ii) The key reason is likely to be to avoid anti-selection.

The morbidity difference described above means that the “theoretically correct” premium rate will differ between males and females.

If only one combined rate is charged, an average rate needs to be set.

The insurer is more exposed to the risk of the gender mix differing from that expected or loaded into the combined rate.

Individuals will “shop around” for the best rate. If a competitor offers different rates, it may be able to offer cheaper rates to females than males (or vice versa, depending on product). Females will tend

to go to the competitor with cheaper rates, but men will come to the combined rate, which is cheaper for them.

This will lead to poorer experience than assumed in the pricing basis, and losses will be made.

The company might alternatively decide to charge the higher of the two rates as its “combined” rate, which would have adverse implications for the amount of business sold if competitors charged differing rates.

[5]

- iii) In the group market, simplicity of pricing basis may be paramount especially as business can be very high volume.

Some of the differences may not apply for a group (e.g. occupation).

A blended rate can be charged which takes account of the overall mix of males and females in the group in question.

This mix may be fairly stable overall and at least it is unlikely that actions will be deliberately taken to create a selection effect.

The blend in the rate can be reviewed at the annual review of the group rate.

Group business is often subject to profit sharing which further reduces the risk of adverse selection.

[3]

- iv) Advertise in places in which different sexes will see the adverts, such as magazines clearly targeted at a specific gender and/or television adverts placed in the breaks of targeted programs (e.g. football match v. lifestyle programs).

Consider billboard advertising at shopping malls v football stadium.

Offer discounts for services with a gender bias or market to affinity groups.

Use different language and styles to appeal to different groups and/or different colours (e.g. pink/blue) and/or different branding, names etc.

Highlight specific illnesses covered.

Have different sales teams, with different manners of talking and listening.

Use worksite marketing that targets specific occupations which have a particular male or female bias.

[4]

- v) In theory it should reduce anti-selection risk.

May be able to charge a more appropriate combined premium since should be able to predict better the gender mix e.g. if engaging via a women’s magazine, should be able to predict a high proportion of female take up).

Hence may also allow a lower margin in the combined premium than would otherwise be required, since lower gender mix risk.

May be able to capture attention more effectively as males and females absorb information in different ways (e.g. colours vs shapes).

Hence may even increase sales volumes.

May be able to use the approach to target sectors of the population with expected low morbidity, such as higher socio-economic groups, or gym go-ers.

However, this may add to cost and may still be subject to anti-selection, especially if consumers wise up to it.

May be seen as unfair if premiums differ according to the specific marketing channel.

It is also possible that this may be deemed to be an indirect breach of the new legislation, which will depend on the precise wording of the legislation; therefore, the insurer may be exposed to potential reputational risk.

Risk of business mix (and hence pricing) not being as expected if the strategy is not as successful as anticipated.

Need to consider treating customers fairly.

[6]

vi) When the company sets its new price under the new basis, it will have an assumed mix by gender.

If it can collect gender data then it will know what it is actually writing; if the actual mix is very different, the company will know almost immediately and can review the price.

If it cannot collect gender data then it will be many years before it will find out that the rates are (potentially) loss making.

The data is also important as the company will need to set appropriate gender specific reserves.

If it cannot collect gender data the company will need higher margins in pricing and reserving.

If reinsurance is not covered by the proposed legislation, then collection of gender data may help the insurer to get better reinsurance prices.

[4]

vii) Add margins to premiums against risk of mis-pricing particularly the risk of gender mix differing from that expected.

Monitor experience frequently.

Review rates frequently/write reviewable premium business.

Increase underwriting to address underlying risks contributing to the gender gap.

If possible, price based on proxy rating factors such as occupation.

Check competitor rates to guard against risk of under-pricing.

Reduce exposures, e.g. by reducing maximum benefit levels.

Stop writing business with significant gender morbidity risk or write other business with less gender risk, such as group business, to dilute the risk.

Write business with the opposite gender risk e.g. if currently write a lot of critical illness business, start also to write long term care insurance (to mitigate the risk that for some reason your brand appeals more to one sex than the other).

Increase proportional reinsurance.

Get reinsurance for the technical assistance, as reinsurers may have ideas on how to tackle the issue.

If the company has a significant lapse and re-entry experience, could set up a retention team
Write business in countries that do not have this restriction.

[6]

[35 Marks]
