Assignment X2 Solutions

Solution X2.1

Comment

This question is broadly based on the material in Chapter 12, Section 5 on Supervisory intervention levels, although it goes significantly beyond the level of detail provided in the Core Reading.

Issues raised

It sounds like the insurer has been in difficulty for a while, and the problem could have been reasonably foreseen. [½]

Therefore the regulator will be concerned to know:

- why the insurer has waited until the breach is imminent before raising the issue with the regulator [½]
- what measures the insurer has previously put in place to try to improve its results, and the effectiveness of these measures. [½]

So far, the breach has not occurred. The PRA will now have to consider initiating steps to ensure that the risk does not materialise. [½]

Under Solvency II, the insurer is not required to notify the regulator until after any non-compliance with the MCR or SCR has been observed. Therefore it is to the company's credit that it has notified the PRA already. [1]

However, it may have been in the company's interests to initiate discussions with the regulator even earlier, and confidence in the senior management is likely to be lower as a result. [1]

The PRA may feel that it should have been able to spot the problem earlier for itself, *eg* through the company's recent reports, or the IMAP. [½]

Therefore the regulator should investigate why the problem was not foreseen sooner. It should consider whether this was due to: [½]

- internal failures within its own monitoring process [½]
- a structural failing with the Solvency II requirements themselves, *eg* in the internal model requirements, or reporting requirements [½]
- inaccuracies in the returns submitted by the company [½]
- mismanagement on the part of the company – this may be quite possible, given the internal failings already experienced. [½]

The regulator will also need to place the insurer's problems in the context of the market's overall results: [½]

- in particular it will want to understand how much of the poor performance is due to poor underwriting and internal failures, and how much is due to market-wide factors, such as poor investment returns in a high inflation environment. [½]
- *ie* it may be that many other insurance companies are suffering similar poor results due to poor publicity of life insurance (*eg* arising from mis-selling scandals for a few dominant players in the insurance market) – if this is the case then the regulator will have to consider a broader response for the whole market

[1]

Company obligations

It is not entirely clear whether the insurer expects its solvency level to fall below the SCR or the MCR. The actions required by the company will depend on the degree of the failure. [½]

For example:

- if the SCR is breached, the company must submit a realistic recovery to the regulator within two months, to be approved by the PRA [1]
- if the MCR is breached, the company has one month to submit a short-term realistic finance scheme (and/or risk reduction scheme) to restore the MCR within three months. [1]

The ideas below could be generated by also thinking of a run-off plan of a closed fund.

The recovery plan and finance scheme will have to include:

- estimates of management expenses, including general expenses and commissions [½]
- estimates of income and expenditure in respect of direct business, inwards reinsurance business and outwards reinsurance [1]
- a forecast balance sheet [½]
- estimates of the financial resources intended to meet the technical provisions, SCR and MCR [½]
- details of the bases and methods used by the company to calculate its estimates – the estimates must be realistic, and include any planned remedial measures [1]
- the company's reinsurance policy, and any subsequent changes to its reinsurance arrangements as a result of the breach. [1]

Markers please award marks for alternative similar ideas.

The information above should be submitted for the current financial year and the subsequent financial year. [½]

The regulator will have to decide what level of granularity is appropriate for the recovery plan / finance scheme. [½]

The exact content of the recovery plan / finance scheme will depend on the urgency of the measures needed to re-establish compliance. [½]

The company should make sure it communicates with the Chief Actuary and With-Profits Actuary on any proposals as these will ultimately impact policyholders. [½]

Regulatory intervention

The regulator is permitted to take all proportionate measures necessary to safeguard the interests of policyholders. [1]

For example, if the MCR is not restored within three months, the PRA will be obliged to withdraw the insurer's authorisation. [1]

In addition, if the regulator feels it can't approve the company's recovery plan, it can dictate what remedial action is to be taken itself. [½]

Therefore, other examples of restrictions and actions that may be imposed include:

- restrict or prohibit the disposal of the company's assets [½]
- a requirement to analyse the reasons for the breach, and take corrective action in a timely manner [½]
- increased reporting requirements, and at more frequent intervals, and using specific templates [1]
- requesting an independent review of the position – this is likely to be onerous and costly [1]
- a requirement to restrict volumes of new business, or stop writing particular segments of business, *eg* stop writing with-profits business [1]
- a requirement for the company to change its investment strategy, *ie* to reduce market / credit risk [½]
- measures to limit the further reduction of financial resources, *eg* prohibiting dividends or the disposal of assets [1]
- requesting prior notification before implementing any significant decisions [½]
- reorganisation measures [½]
- a requirement to notify policyholders of the insurer's financial position. [½]

If the short-term finance scheme does not work, the regulator would withdraw the company's authorisation to selling any more business. [1]

Markers please give credit for other relevant examples.

The choice of measures will depend on:

- the cause of the breach [½]
- the extents of the initial breach and the deterioration [½]
- the relationship between the SCR and MCR [½]
- the nature of the business [½]
- how much of the recovery plan has already been implemented [½]
- the effect of any short-term measures on the company's long-term prospects. [½]

[Maximum 22]

Solution X2.2

Comment

Pillar 1 of the Solvency II regime is covered in Chapter 12.

As the product is unit-linked, the unit and non-unit components must be unbundled for the purposes of determining the technical provisions. [1]

It is possible for the best estimate liability (BEL) to be negative (there is no "floor" of zero) but this is unlikely as the single premium will ensure a large unit reserve component … [½]

… however negative non-unit reserves can be held. [½]

The BEL for the unit reserves can be set equal to the unit price multiplied by the number of units. [½]

The unit reserve should be derived from the unit prices on the valuation date. [½]

Care is needed to ensure that the impact of tax is allowed for consistently in the value of the assets and the BEL. [½]

So an adjustment is needed for BLAGAB business to allow for the impact of tax on unrealised gains and losses. [½]

The non-unit-related liabilities should be calculated by discounting the projected non-unit cashflows. These are given by: [½]

- expenses [½]
- plus death benefits paid in excess of unit fund, *ie* 1% of the value of units at the time of claim [½]
- plus the cost of the maturity guarantee, *ie* the excess of 101% of the premium over the value of units (subject to a minimum of zero) for policies reaching maturity [½]
- less the charges, *ie* 5% bid-offer spread, fixed annual management charge of 1.5% plus the guarantee charge. [1]

The cashflow projections should ideally be performed on a policy-by-policy basis. [½]

Approximations are permitted and grouped model points can be used provided certain conditions are met, including validation of accuracy. [½]

Policy-by-policy reserves might not be calculated for the unit component. Instead a global figure could be calculated separately for each fund. [½]

Policy-by-policy calculations would be more likely for the non-unit reserves as they more accurately allow for the interaction of charges and costs (particularly the cost of the maturity guarantee) … [½]

… and the modern design of the contract should mean that policy-by-policy reserves are relatively easy to calculate. [½]

Assumptions

Assumptions will be required to project the non-unit cashflows. [½]

Assumptions regarding the investment performance of each unit fund are required in order to calculate the charges and costs to be included in the non-unit cashflows. [1]

All assumptions should be best estimate, with no prudential margins. [1]

The non-unit fund projections should allow for all expected decrements and policyholder actions, *ie* they should allow for full surrenders, partial withdrawals and death. [1]

Insurance companies must take into account all relevant available data, both internal and external, when arriving at assumptions that best reflect the characteristics of the underlying insurance portfolio. [½]

The company should consider recent experience investigations of its own business regarding mortality and surrenders. However, the small size of the company means that this data is limited, so it should also consider external sources such as reinsurers' and industry data. [1]

The cost of financial guarantees and options must be determined in a market-consistent manner. [½]

In this case, the cost of the maturity guarantee must be calculated. The cost will vary for each policy depending on the current value of units, the premium, the choice of fund and the duration. [1]

Different assumptions will be required for each fund as the volatility of the assets will impact the probability that the guarantee bites and by how much. [½]

Correlations between the investment return on different asset types should be allowed for. [1]

Investment return will also be correlated to rates of surrender and expense inflation. [½]

Expected decrements and policyholder actions must also be allowed for. In particular, assumptions are needed for the number of policies that remain in force at maturity. [½]

The impact of any switching option is likely to increase the cost of the money back guarantee as policyholders may choose to switch into higher risk funds … [½]

… particularly if the guarantee is in the money (because the policyholder would benefit from the expected higher return but would be protected from further asset falls). [1]

When valuing financial guarantees and options, a market-consistent simulation or stochastic analysis is likely to be the most appropriate calculation approach, … [½]

… although a deterministic "closed form" solution could be acceptable depending on the risks involved and the materiality. [½]

The maturity guarantee acts in a similar way to a European put option on the unit fund with strike price equal to 101% of the premium. [1]

A closed form solution such as the Black-Scholes equation could be used to allow the cost of the guarantee to be calculated efficiently on a policy-by-policy basis. [½]

However, the money back guarantee poses a significant and material risk. Stochastic simulations could allow for the impact of policyholder actions in a much more sophisticated way than a closed form solution. [1]

So, performing stochastic simulation is likely to be considered preferable to the closed form approach. [½]

Stochastic simulation would require a large number (many thousands) of projections to be performed. [½]

The best estimate liability would be the average value of the simulated liabilities discounted at the risk-free rate. [½]

The model needs to be market-consistent, so the model parameters should be calibrated to observed market values. [½]

In particular, the expected return should be calibrated to the current risk-free rate … [½]

… irrespective of the underlying backing assets. [½]

The volatility of investment return could be implied from the price of traded derivatives on appropriate assets. [1]

The volatility assumptions will vary depending on the underlying assets and so will differ according to the fund chosen by the policyholder. [½]

Allowance needs to be made for the expected number of surrenders and partial withdrawals. [½]

These will vary by duration in force and will be highly correlated to investment performance. [½]

So the stochastic model should have dynamic withdrawal rates that vary according to the scenario. [½]

We would expect fewer surrenders in the period approaching maturity if the investment performance had been poor so that the money back guarantee was likely to be valuable. [½]

Allowance for future expenses needs to take into account both overheads and directly attributable expenses. [½]

The inflation of future expenses needs to be allowed for. [½]

Expense inflation could be modelled stochastically and correlated to the investment return assumptions used to value the money back guarantee. [½]

No reserve is required for the expenses of closure. [½]

Discount rate

The BEL is calculated by discounting the expected future cashflows using a risk-free yield curve. [½]

The risk-free yield curves are published by EIOPA on a monthly basis, published for each of the key currencies within the EU insurance market. [½]

The UK rates are based on swap rates as there is a sufficiently deep and liquid swap market. [½]

These rates are then adjusted (by EIOPA) to reflect the risk of default of the counterparty (*ie* credit risk adjustment). [½]

Where insurers have long-term predictable liabilities, and can hold matching assets to maturity, they are not exposed to the risk of changing spreads on these assets. In such cases, insurers are allowed to use a matching adjustment, *ie* insurers can adjust the risk-free discount rate in line with the spread movements of their assets. [1]

In this case the policyholder can choose to surrender at any time, so the liability cashflows are not predictable. [½]

So it is unlikely that it would be permissible to increase the risk-free discount rate to allow for a matching adjustment. [½]

If the liabilities are not eligible for use of the "matching adjustment", the insurer can alternatively add a "volatility adjustment" to the risk-free discount rate. The purpose of the volatility adjustment is to reduce the risk of forced sales of assets in the event of extreme bond spread movements. [1]

The volatility adjustment is based on the spreads on a representative portfolio of assets for each relevant currency. [½]

Risk-free discount curves including the addition of a volatility adjustment are also published by EIOPA for firms to use. [½]

[Maximum 24]

Solution X2.3

Comment

The SCR under the Solvency II regime is covered in Chapter 12.

(i) ***Standard formula***

The starting point of the standard formula is to determine the Basic SCR (BSCR). [½]

The BSCR is calculated by considering different risk modules:

- market [½]
- counterparty default [½]
- life insurance (as there are no other insurance types for this company) [½]
- intangible assets. [½]

A separate SCR is calculated in respect of each of these risk modules. [½]

Market and life insurance risk modules

For these risk modules, individual stresses in respect of individual risks are performed separately. [½]

The standard formula defines the individual risks and specifies the calibration and application of each stress. [½]

For some parts of the standard formula, insurance companies can apply to use "undertaking specific parameters" instead of the prescribed parameters. [½]

The market risk module consists of the following individual risks:

- equity
- property
- interest rate
- credit spread
- currency
- concentration. [2]

Deduct half a mark for each missing risk in the lists above and below (subject to a minimum of zero).

For life insurance business, the individual risks that apply to this company are:

- mortality
- longevity
- lapse
- expenses
- catastrophe (*eg* pandemic) risk. [2]

(Morbidity risk and revision risk do not apply given the make-up of the company's business.)

The SCR for each individual risk is determined as the difference between the net asset value (NAV) in the unstressed balance sheet and the NAV in the stressed balance sheet. [½]

In determining this individual SCR, the NAV can be taken as "assets – best estimate liabilities" rather than "assets – technical provisions", in order to avoid introducing circularity into the calculation. [½]

In determining the values of assets and best estimate liabilities in each stress scenario, adverse changes in policyholder option take-up rates should be allowed for. [½]

For example, if there are any guaranteed surrender values on the unit-linked business, policyholder surrender rates should be assumed to be higher in the event of the equity market crash stress within the market risk module. [½]

The beneficial effects of any risk mitigation techniques and any future management actions can also be taken into account provided they are objective and verifiable. [½]

For example, the benefits of any reinsurance arrangements the company has in place could be taken into account in the mortality or catastrophe stresses within the life insurance module. [½]

Any residual risks associated with risk mitigation techniques, *eg* counterparty default risk in relation to the reinsurer, should be allowed for. [½]

As the stresses are instantaneous, no management actions can be assumed to take place "during" the stress. [½]

Management actions, *eg* changes to variable charges on unit-linked policies, could however be assumed to be implemented at a reasonable point in the future. [½]

The SCR for each individual risk is subject to a minimum of zero. [½]

The individual risk capital amounts are then combined across the risks within each of the modules, using a specified correlation matrix and matrix multiplication. [½]

The specification of these is designed to reflect the potential dependencies and correlations between risks under the stress conditions (which may differ from those observed in normal conditions). [½]

Counterparty default risk

The company must first differentiate between:

- type 1 exposures – those that may not be diversified and where the counterparty is likely to be rated – *eg* bonds, derivatives, reinsurance arrangements [1]
- type 2 exposures – usually diversified and the counterparty is unlikely to be rated – *eg* receivables from intermediaries and policyholders. [1]

Different detailed approaches are specified for the determination of the SCR for each type of exposure, which are then combined using a given formula. [½]

The total SCR in respect of type 1 exposures and the total SCR in respect of type 2 exposures are then aggregated using a specified correlation matrix. [½]

Intangible assets risk

If the company includes any intangible assets in its asset valuation in its Solvency II balance sheet, then the SCR in respect of intangible asset reflects the risk that their value decreases (perhaps to zero). [½]

Combining the results

Having obtained the SCR for each risk module, matrix multiplication with a specified correlation matrix is used to combine them and determine the BSCR. [1]

In performing this aggregation, the intangibles risk module is taken to be completely separate from the other risk modules. [½]

To obtain the overall SCR, two adjustments may then be made to the BSCR:

- an allowance for operational risk [½]

  The allowance for operational risk is based on percentages of earned premiums and technical provisions. [½]

  100% of the resultant capital amount is added to the BSCR with no recognition of any partial correlation or diversification effects with other risks. [½]

- an allowance for the loss absorbing capacity of technical provisions and deferred taxes. [½]

  The loss absorbing capacity of technical provisions could include the ability to reduce discretionary benefits under the stressed conditions. However, as this company has no with-profits business, it will have very limited (possibly zero) ability to reduce discretionary benefits and so this adjustment will be small. [1]

  The loss absorbing capacity of deferred taxes could, for example, include a reduction in any base balance sheet deferred tax liability, as this would no longer be fully payable in a stressed scenario. [½]

In practice, the BSCR is calculated both with and without allowance for the loss absorbing effects and the "adjustment" is determined as the difference. [½]

[Maximum 15]

(ii) ***Deciding whether to use the standard formula or an internal model***

The company should have considered the fit of the standard formula with its own risk profile, *eg* if the company's business has a lower risk profile then using an internal model should free up capital. [1]

This may have involved a consideration of the appropriateness of the calibration of the standard model stresses and recognition of diversification benefits given the company's particular business and circumstances. [½]

For example, the company's unit funds may be invested in more or less volatile stocks than those underlying the standard formula or its mortality risk may be more or less diversified than the standard formula assumes. [1]

However it is calculated, the SCR should include all the risks specified in the standard formula and provide at least the equivalent protection to a 99.5% confidence level over one year. [½]

The company should have also considered how suitable any existing models it uses (*eg* for pricing or setting investment strategy or for determining the ICA under the previous UK solvency regime) would be as internal models for SCR purposes. [1]

The higher the quality of any existing models, the more practical it may be for the company to use them as the basis for an internal model. [½]

Internal models require approval from the PRA (in the UK). The criteria for approval, *eg* the use test, demonstrating wide use of the model throughout the company, are demanding. The company should have conducted a "gap analysis" to identify steps it would have needed to take to make any existing models fit for internal model approval. [1]

However, the ORSA also requires significant documentation of processes and evidencing of use, so the company would have needed to put these into place anyway. [½]

The company would only have been able to use the standard formula if it could have justified to the PRA that this was appropriate. [½]

So if the company had some features that meant that the standard formula would materially understate or overstate the capital required, then it should use an internal model to more accurately reflect these features. [½]

Other practical issues that the company should have considered include the resources involved in each method of determining the SCR, especially given competing priorities (*eg* other aspects of the Solvency II regime and its impact on wider business activities including capital allocation and pricing). [½]

It should have considered the timescales for going through the PRA internal model pre-application and approval processes. [½]

The company should also have considered other alternatives, in particular an option in between the two extremes of the standard formula or a full internal model. [½]

A partial internal model or the standard formula with undertaking specific parameters (USPs) may have been appropriate choices. [½]

Either of these may have been appropriate if they addressed a particular shortcoming of the standard formula in relation to this company. [½]

[Maximum 5]

(iii) ***Calculation of the SCR for the life insurance risk module***

The life insurance risk module SCR is calculated as:

$$SCR_{Life} = \sqrt{\sum_i \sum_j Corr_{ij} \times SCR_i \times SCR_j} \qquad [2]$$

where:

SCR_i = capital requirement for individual risk i

$Corr_{ij}$ = correlation between risks i and j.

$$SCR_{Life} = \sqrt{\begin{matrix} 80^2 + 300^2 + 40^2 + 50^2 \\ +2 \times (-0.2) \times 80 \times 300 + 2 \times 0.2 \times 80 \times 40 \\ +2 \times 0.1 \times 80 \times 50 + 2 \times 0.4 \times 40 \times 50 \end{matrix}}$$

$$= \sqrt{94,580.0} \qquad [2]$$

$$= £307.54m$$

[Total 4]

(iv) ***Points in reply to Board member***

A strategy that might help to generate marks in this part is to try to give specific examples of some of the technical ideas in the answer. In particular, there are marks available for giving examples of pairs of correlated and uncorrelated risks and of non-linearity.

The requirement is to base the SCR on a 99.5% one-year survival probability. This is from all the stresses combined. [½]

The chances of each individual risk's "99.5% survival event" stress happening *together* is not a 99.5% one-year survival event. [½]

The chances of them all happening together is less than 0.5%, so considering them all together is more prudent than the Solvency II requirement and is likely to lead to an unnecessarily high capital requirement. [½]

The sum of the individual risks represents the risk of everything bad happening at once, *ie* the following 1 in 200 year events all happen in the same year: [½]

- death claims increase [½]
- annuitants live longer [½]
- lapses increase [½]
- expenses increase. [½]

Summing them in this way assumes that they are all perfectly correlated. [½]

In reality, although the occurrence of some of these different events may be related … [½]

… *eg* increased mortality and increased lapses might occur together (due to selective lapsing) … [½]

… this isn't the case for all risks. [½]

The correlation matrix allows for this by combining the capital requirements for the separate risks in a way which allows for diversification … [½]

… *eg* only partial or no correlation between risks. [½]

Uncorrelated risks include, for example, improvements in annuitant longevity and increases in lapses … [½]

… as there is no link between these two that makes them likely to occur at the same time. [½]

However, it should be recognised that a combination of a certain subset of events happening at the same time, with an overall probability level of 0.5%, may produce a higher capital requirement than combining all of the individual capital requirements for separate 0.5% events using a correlation matrix … [1]

… due to the "non-linearity" … [½]

…and "non-separability" of individual risks. [½]

The mortality shock may be non-linear: if an increase in mortality rate of 10% results in a capital requirement of £30*m*, it may well be the case that a 20% increase in mortality rates results in a capital requirement greater than £60*m* … [½]

… for example, there might be a sharp increase in the number of policyholders exercising their option to renew a renewable term assurance policy. [½]

Similarly, although we might believe that mortality and lapses normally have low correlation … [½]

… an extreme event, such as a pandemic, might cause mortality and lapses to change significantly at the same time (*eg* if the global economy went into a deep recession and unit-linked policies became unaffordable). This is an example of the non-separability of mortality and lapses. [½]

[Maximum 7]

(v) ***Correlations between assumptions***

(a) *Longevity and mortality*

The longevity risk relates to any annuity business the company has sold … [½]

… and possibly also to guaranteed annuity options attaching to unit-linked pension products. [½]

The mortality risk relates to any contracts with death benefits such as without-profits term assurances … [½]

… and unit-linked policies with a guaranteed death benefit. [½]

The table shows that the assumed correlation between improved annuitant longevity and the increase in non-annuitant mortality rates is –20%.

The fact that this assumption is negative means that the company is assuming that these events are related and are *unlikely* to occur at the same time. [½]

This seems reasonable as it would be surprising if one group of policyholders was experiencing improving mortality experience and another was experiencing worsening mortality experience. [½]

For example, some causes of increased mortality rates, *eg* a pandemic, will affect the experience of all groups of lives in the same direction. [½]

The fact that the correlation is less than 100% indicates that they are not fully related. [½]

This is reasonable, especially if the two groups are predominantly of independent groups of policyholders. [½]
In particular, the annuitant group are likely to be older and may be benefiting from longevity improvements … [½]

… whereas the unit-linked policyholders may be predominantly (but not exclusively) younger. [½]

The causes of death, and so possible "mortality shocks", may be very different for policyholders of different ages. [½]

For example, it is quite possible for mortality rates to increase for young people due to accidents at the same time that mortality rates to decrease for older people due to improvements in cancer treatment. [½]

The two groups of policyholders may also differ for other reasons that influence their mortality, for example:

- gender mix [½]
- location [½]
- socio-economic group. [½]

(b) *Lapse and mortality*

The table shows that the assumed correlation between an increase in lapses and an increase in mortality rates is 20%.

The fact that this assumption is positive means that the company is assuming that these events are related and are *likely* to occur at the same time. [½]

This seems reasonable if there is a significant amount of term assurance business … [½]

… as withdrawals may be selective and lead to worse mortality experience. [½]

There may also be selective withdrawals associated with unit-linked contracts if they have a significant guaranteed death benefit … [½]

… particularly early in the policy term when the value of units is low. [½]

However, we wouldn't expect the effect to be particularly large for unit-linked contracts as they are usually primarily savings contracts. [½]

So the size of the correlation will reflect the balance between term assurance and unit-linked business in the company, *ie* the correlation would be lower if the unit-linked business is a relatively larger proportion of total business. [½]

(c) *Expenses and mortality*

The table shows that the assumed correlation between an increase in expenses and an increase in mortality rates is 10%.

The fact that this assumption is positive means that the company is assuming that these events are related and are *likely* to occur at the same time. [½]

This seems reasonable as an increase in mortality rates will lead to an increase in expenses associated with checking the validity of claims. [½]

An increase in mortality rates will also reduce the number of policies over which the overheads can be spread … [½]

… and so will increase per policy expenses. [½]

An increase in expenses may lead to increased charges for unit-linked contracts … [½]

… and this may trigger selective withdrawals (*ie* the healthy policyholder who are unhappy with the higher charges will surrender). [½]

However, the above effects are relatively small, so we would not expect to see a large correlation between these two risks … [½]

… *eg* the claims expenses are a relatively small part of the overall expenses for a unit-linked contract. [½]

[Maximum 10]

(vi) ***Correlation between equity market risk and lapse risk***

Reason for positive correlation in you company

The company sells without-profits and unit-linked business, so it may need to consider lapses from term assurances as well as surrenders from unit-linked contracts. [½]

You have estimated that the correlation between the equity shock (of a fall in equity values) and the lapse shock (of an increase in withdrawal rates) is 30%.

The fact that this correlation is positive means that you are assuming that these events are related and likely to occur at around the same time, *ie* equity market falls are likely to be associated with an increase in surrender rates. [½]

But the fact that the correlation is less than 100% indicates that they are not fully correlated, *ie* there are lots of other influences on withdrawal rates in addition to the level of equity markets. [½]

It is reasonable to assume these two are related, *ie* to assume that when equity values fall, and so unit-linked policy fund values fall, there will be an increase in the number of surrendered unit-linked policies. [½]

For example, more policyholders may decide that their policies offer poor returns / poor value for money and so surrender them. [½]

The two assumptions may also be related because equity market falls may be occurring at times of poor economic conditions and poor or uncertain economic outlook. [½]

In these conditions, unit-linked policyholders may be more likely to surrender their policies because of affordability issues and a need for the surrender value cash. [½]

Term assurance policyholders may also lapse their term assurance policies for affordability reasons, *eg* they may become unemployed during an economic downturn. [½]

As the choice of a figure of less then 100% indicates, not all policyholders will behave in this way. [½]

Not every policyholder will choose to crystallise a loss in equity values, some may retain their policies in-force and hope that equity values will recover. [½]

Also, if some of the unit-linked policies have guarantees associated with them, then policyholders may be less likely to surrender them when equity markets fall. [½]

Similarly, most term assurance policyholders will not lapse during an economic downturn. [½]

We would expect that the persistency of unit-linked policies would be the most sensitive to changes in equity markets. [½]

So the size of the correlation will reflect the balance between term assurance and unit-linked business in this company, *ie* the correlation would be higher if the unit-linked business is a relatively larger proportion of total business. [½]

Reason for negative correlation in the Board member's previous company

Note that the Board member's previous company sold unitised with-profits (UWP) policies, but his current company has never sold with-profits. So a different logic applies. [½]

A possible explanation for the negative correlation for unitised with-profits (UWP) policies is due to MVRs that are a feature of UWP business. [½]

In the event of a severe fall in equity market values, it is very likely that a company with UWP policies would apply MVRs. [½]

The purpose of these MVRs would be to bring policy payouts on surrender down to something closer to the policy's reduced asset share (to protect the interests of the other policyholders in the with-profits fund). [½]

Policyholders may be keen to avoid an MVR being applied to their policy proceeds and so may be less likely to surrender when MVRs are in operation. [½]

The UWP policies will have guarantees on maturity (and possibly at other times, *eg* a "no MVR" guarantee after ten years), whereas unit-linked policies are much less likely to have such guarantees. [½]

When stock markets fall, the guarantees become more valuable… [½]

… and so UWP surrenders may actually be quite low following a 1 in 200 year stock market fall as policyholders will want to hold on to these guarantees. [½]

This might explain why the *absolute* size of the correlation is larger for the UWP company … [½]

… as most policyholders are likely to behave in the same for UWP contracts (*ie* most will hold on to their guarantees) … [½]

… while policyholder behaviour is quite mixed for unit-linked (*ie* some surrender while others hold on for the recovery). [½]

The absolute size may also be large as his previous company primarily sold UWP business … [½]

… so the correlation is not diluted as much by the term assurance business. [½]

[Maximum 8]

(vii) ***Reducing exposure to risk of surrenders of UL bonds following equity market falls***

Product design

The company could remove the guarantee for future new business (presumably the guarantee cannot be changed for policies that are already in force). [½]

Less extreme approaches would be to *reduce* the guarantee in some way, for example:

- make the guarantee apply only at one or more discrete points in time (rather than continuously over ten years) [½]
- reduce the period for which it applies to fewer than ten years [½]
- reduce the amount guaranteed to a smaller amount, *eg* 90% rather than 100% of the single premium. [½]

A further way to limit exposure to the risk, at a per-policy level, would be to limit the maximum amount of investment, *ie* maximum single premium, into the policy to which the guarantee applies. [½]

In addition to doing this for future new business, the company may be able to do this for any additional single premiums paid by existing customers. [½]

At an aggregate level, the company could limit its exposure by having a maximum amount of funds under management or maximum total amount in single premiums, *ie* limiting the volume of business it sells. [½]

A further option to reduce the risk would be to reduce the probability of the guarantee biting by restricting customer choice of unit-linked funds, in particular allowing the guarantee to apply only if specified, less volatile funds are chosen. [1]

Risk management of in-force policies

The company could use derivatives to hedge the guarantee. [½]

In particular it could use equity put options with the strike price set equivalent to the amount of single premium (*ie* the guaranteed amount). [½]

If equity values fall below the guaranteed amount, the profit on these options would compensate for the shortfall in the value of the equity unit funds. [½]

Purchase of such options may be complicated by the uncertainty over the term of the option required (given the uncertainty over when policyholders will choose to withdraw) … [½]

… and may necessitate the use of OTC options. [½]

The company could undertake a program of "customer retention" activity … [½]

… *eg* promoting reasons to continue with policies by explaining that they should be seen as long-term investments, having suitably qualified staff speak to any customers enquiring about withdrawals in order to discuss their other options with them. [½]

[Maximum 5]