

# INSTITUTE AND FACULTY OF ACTUARIES

## EXAMINERS' REPORT

April 2014 examinations

### Subject SA5 – Finance Specialist Applications

#### Introduction

The Examiners' Report is written by the Principal Examiner with the aim of helping candidates, both those who are sitting the examination for the first time and using past papers as a revision aid and also those who have previously failed the subject.

The Examiners are charged by Council with examining the published syllabus. The Examiners have access to the Core Reading, which is designed to interpret the syllabus, and will generally base questions around it but are not required to examine the content of Core Reading specifically or exclusively.

For numerical questions the Examiners' preferred approach to the solution is reproduced in this report; other valid approaches are given appropriate credit. For essay-style questions, particularly the open-ended questions in the later subjects, the report may contain more points than the Examiners will expect from a solution that scores full marks.

The report is written based on the legislative and regulatory context pertaining to the date that the examination was set. Candidates should take into account the possibility that circumstances may have changed if using these reports for revision.

D C Bowie  
Chairman of the Board of Examiners

July 2014

## **General comments on Subject SA5**

The SA5 exam generally requires bullet point form or short form essay style answers that apply general principles to directly address specific circumstances. The answers given below are just one possible set of acceptable answers. Candidates are awarded marks for all reasonable answers including different but still reasonable numerical solutions. Marks are awarded for working in the case of numerical answers.

Candidates' answers are made up of a series of points. For example, a point can be stating a valid type of risk, describing the type of risk or (part of) a calculation. Some points are more fundamental to the correct answer but, in the main, candidates earn one-half mark per correct point up to the limit of marks available for the question.

## **Comments on the April 2014 paper**

Questions 1 and 3 were based on relatively common place circumstances. Question 1 concentrated on issues arising from a company's inventory. Question 2 required candidates to demonstrate their knowledge and understanding of shadow banks. Shadow banks have been around in one way or another for centuries. Their role in the world's financial markets has been under increased scrutiny since the 2007–09 credit crisis. Question 3 was based on a life insurer's investment strategy for its annuity business. The question focussed on the risks associated with investing in different types of securities. This is important as the insurer needs to try to increase returns to maintain and increase new business whilst recognising that the shareholders are taking most or all of the risk.

Most candidates attempted answers to every question. Overall, questions 1 and 2 were reasonably well-handled by many. In contrast, many candidates scored relatively poorly in question 3.

Candidates will benefit from practice with past papers and reading the financial press. The resulting improved depth of understanding of the application of finance in practical situations will make some questions much easier to answer.

The SA subjects are the last subjects in the sequence of formal actuarial exams. Candidates taking SA5 are expected to have at least a basic knowledge of how businesses such as banks, life insurance and general insurance companies function.

Well-prepared candidates scored acceptably well across the whole paper. The comments that follow the questions concentrate on areas where candidates could have improved their performance.

- 1 (i)
- Opportunity cost of holding inventory
  - Cost of realizing or acquiring inventory
  - Competition will likely provide a guide

*Many candidates scored full or near full marks for this question.*

- (ii)
- Land holding represents capital tied up which could be used for developing new properties or returned to shareholders
  - Unlikely to earn much return until developed
  - In event of not being developed, likely to suffer loss on sale unless another developer can be found to take over the land
  - If company has (high) borrowings, may be paying interest on loans therefore negative cost of carry of the land
  - Company may have “overstocked” if inventory very high
  - Shareholders wish to maximize future profits and having an inventory of land is important to maintain output, buy land at good prices and gives flexibility to future production but
  - It comes at a holding cost that could hold down share price growth
  - Land is hard to value and so it could mean that the asset on the balance sheet is materially under or over valued

*The question was handled well by most. As ever, marks were given for other reasonable answers including the possibility that planning permission might lapse reducing the value of the land.*

- (iii)
- Could value using original purchase price increased in line with house prices index for that region
  - But adjusting for the fact that vacant land prices differ from house prices
  - If this was some time ago, could adjust original purchase price for price of comparable land sold nearby more recently
  - If intending to develop according to predictable horizon (i.e. plans already submitted, marketing underway etc), could instead value from first principles as a portion of the discounted value of the expected homes to be built and sold
  - Could get a surveyor's valuation. Might value say one-third of the inventory on a three year rolling basis to save costs.

*The question was handled well by most. Almost all candidates made three or four of the above points but many made no further points.*

- (iv)
- Scheme would reduce credit risk of mortgage borrowers because the government would absorb the first 5% loss in the event of a borrower defaulting
  - Doing this should make mortgage customers more attractive to banks

- This should encourage lending to mortgage customers who are eligible for the scheme
- Overall, mortgage lending should grow and there should be a boost in demand for new houses
- However the level of increase may be modest as the government is only guaranteeing 5% of the loan
- The extent of the growth will depend on the eligibility criteria not being too restrictive.
- The plan certainly wont reduce demand.
- It could allow banks to lend to people or to areas/types of houses that it otherwise wouldn’t lend to, increasing the number of sales and hence increasing satisfied demand
- It could increase the maximum loan to value that a bank will lend at or reduce other bank caps leading to more bank lending

*There were a wide range of relatively poor answers. Many candidates would have likely benefited from thinking about the circumstances of the question for a little longer before attempting to answer it. Both assumptions that the government was covering 5% of the loss or 5% of the mortgage were accepted.*

(v)

- Level of first-loss guarantee could be increased
- Government lend some of the mortgage itself
- Government could provide low-cost loans to banks or to the developer directly for the purpose of providing loans to similar applicants

*The question was handled well by many.*

(vi)

- Sell the land and purchase a call option from the buyer, allowing the company to repurchase the land at a later date at a prearranged price
- Buy a “development option” from the buyer granting the company the right to develop the land in future, possibly with a profit-share with the buyer
- Enter into a sale-and-leaseback style transaction where the company sells the land but effectively rents it back from the buyer with the ability to develop it if desired
- Securitise the land and remain in control of its use and development

*Many candidates made approximately one-half of the number of points needed to score full marks. The question asked for more than one approach.*

(vii)

- The buyer may want full rights to use the land
- The reduced price that the buyer pays for restricted ownership may not be attractive compared with alternative purchases that the buyer might make
- The buyer may wish to develop the land himself
- The buyer may want to sell it to someone else at a profit (which could be complicated by the existence of any options or rights to third parties)

- The price paid for the option may be unattractive or the amount of lease rent payment may be unattractive as the case may be

*Many candidates failed to make the straight forward point that the buyer may want full rights to use the land.*

- 2** (i) Shadow banks are subject to much less regulation than banks. This enables them to offer similar products more cost effectively and to bring new products to market faster.

Shadow banks can operate with relatively much lower reporting requirements and hence much less transparency. This enables them to take advantage of technical expertise (proprietary strategies) for longer. It also enables them to pretend that their superior abilities are down to expertise and not the result of undisclosed risk taking.

*The question was handled well by most. As ever, marks were given for other reasonable answers including the possibility that shadow banks could get preferential tax treatment.*

- (ii) A vast array of investment funds using many products to increase returns, lower correlations and reduce relative risk. The products can include debt leverage, derivatives, swaps, commodities, specialist investment products.

Services including matching lenders and borrowers and providing investment advice. The matching of lenders and borrowers can be both direct and indirect through fund structures.

*Many candidates scored near full marks for this question.*

- (iii) Securitization – to create safe assets  
Collateral intermediation – to help reduce counterparty risks and facilitate secured transactions

Diversification of risks – to help to reduce a customer's aggregate risk for an expected aggregate return

*Many candidates scored near full marks for this question.*

- (iv) Leverage. Don't have to keep the levels of capital relative to financial exposure. This means that shadow banks do tend to leverage and are more exposed to booms and busts. The relative out-performance in boom times is advertised to clients as being superior rather than the result of leverage. This leads to more money moving to shadow banks and exacerbates any future financial crisis.

Increased systemic risk and hence increases the risk of future financial crises being worse than they would otherwise have been. This is because the shadow banks operate with similar levels of excess leverage and are exposed to similar external risks.

Liquidity risk – No access to central banks as lender of last resort.

Information – Shadow banks provide outside stakeholders with relatively little information. The lack of information means that outsiders cannot assess the risks that shadow banks are running to produce their returns.

Two money market funds failed to pay par back to investors during the 2008 financial crisis as a result of being forced to sell US treasuries at below par to meet cash flow requirements.

Ponzi funds including the Bernie Madoff fund was the result of opaque reporting (and fraud).

Long Term Capital Management was a highly leveraged and unregulated hedge fund that supposedly had proprietary trading systems to produce superior returns. It failed because it was borrowing moneys and investing them in long term illiquid assets.

*The question was handled well by many. As ever, marks were given for other reasonable answers including that shadow banks’ deposits will not be subject to government guarantees or deposit guarantee schemes.*

- (v) Yes governments should allow shadow banks to establish and operate in their country.

If they don’t they will go elsewhere costing jobs, tax receipts and prosperity.

Shadow banks increase liquidity in the economy.

If they are not allowed to operate legally in the country then:

- The financial system will lose at least some entrepreneurs and innovators.
- People will still find ways to use them overseas but at much increased risk.
- The government will be unable to impose any level of scrutiny or operating standards on them.
- The country may experience capital outflows.

*The question was handled well by many. As ever, marks were given for other reasonable answers including the “no” case. For example, a reasonable “no” case would include the protection of consumers and the potential for increased systemic risks to the regulated financial markets.*

- (vi) The government could legislate that it could regulate all institutions of systemic importance (Dodd-Frank Act in the USA).

It could require all investment advisers advising clients to invest in shadow banks to register with the government and evidence that they are fit and proper.

It could require the regulators regulating the securities exchanges to increase reporting levels for those shadow banks wishing to list securities.

It could help the industry to introduce a voluntary standards office which could suggest operational standards, reporting standards and the like and award compliant firms with certificates.

*The question was answered poorly. Many candidates were only able to answer one or two points.*

- 3** (i) The exposure to interest rate risk will be measured using the maturity gap approach or using a duration analysis.

Under a maturity gap approach the liabilities and assets are classified into those that will be repriced within a period and those that will be repriced later

A reprice occurs when the asset or liability has to be reissued at a competitive market price

The maturity gap is the net amount of assets and liabilities are mismatched.

The PV01 is a measure of the change in a set of cashflows to a change in interest rates

The company's equity is at risk to the size of PV01.

However, the interest risk may be diversified against other risks in practice. The PV01 measure is gross of diversification.

The change in the value of the equity can be measured in relation to the duration of both the assets and liabilities

Hence, in relation to interest rate risk, the duration of the equity can be defined.

This can be a useful metric to illustrate the change in company value to interest rate changes and can helpful when considering how to hedge the position.

*The question was handled well by most. As ever, marks were given for other reasonable answers including the possibility that shadow banks could get preferential tax treatment.*

- (ii) The Solvency 2 Standard Formula groups risks into pre-defined categories.

Under market risk, the interest rate risk the life office bears if its liability and asset position are mis-matched will be captured.

Because the life office has chosen to invest in government bonds, the spread risk should be small.

There is no currency risk as the life office is a UK annuity provider and there is no non-life risk component as per the standard formula.

There should not be any illiquidity risk.

It is possible that bonds of sufficient duration will not be available to match the longest liabilities.

This will leave exposure to interest rate risk and /or reinvestment risk.

This could be the case where a country gets into economic difficulty.

The other area where there will be risk for the company is in the Life Risk.

Annuities carry longevity risk.

In addition, revision risk will need to be considered, where changes in legislation may require the level of the annuities in payment to be revised.

Finally, the company will be exposed to expense risk.

Expenses would be expected to grow in line with inflation and there is a risk that the company's internal inflation outpaces its assumption.

Using fixed income bonds to match its liabilities means that this exposure is not matched.

Market risks will be aggregated using a correlation matrix. The life risks will be separately aggregated as well using the same method.

An overall correlation matrix will then be applied to aggregate the risk modules.

The life office will then also need to perform an assessment of its operational risk.

This is the risk that losses occur from inadequate or failed processes, people or systems.

The operational risk module is based on a percentage of the annuity premiums and the technical provisions held in respect of them.

*Candidates either found this question straightforward or very difficult. Some candidates were not familiar with the Solvency II standard formula.*

- (iii) Corporate bonds bring additional counterparty risk to the organisation.

There a range of different ratings of bonds and the company will need to consider its risk appetite when determining the mix of bonds it is targeting.

The transition of bonds between credit ratings could lead to the company needing to trade bonds to remain within its target mix.

This means that it is not able to definitely hold assets to maturity as part of its matching policy.

On turning assets over there will be reinvestment risk.

Corporate bonds have some features that may make matching the liability outflows more difficult.

Some bonds contain options that allow them to be repaid at the option of the borrower.

This can make them less suitable for matching as it introduces an element of uncertainty into the timing of the receipt of cashflows and in this case also carry a reinvestment risk.

In these cases the security may not qualify for a matching premium under Solvency II although the rules are still uncertain, so the company is taking a regulatory risk.

They will not be as liquid as government bonds so in a shock may need to be sold at a distressed value.

This can make them less suitable for matching as it introduces an element of uncertainty into the timing of the receipt of cashflows and in this case also carry a reinvestment risk.

There will be additional operational risk that the company carries in entering into a new asset class

It may elect to use a third party adviser or manager to take the investment decisions given a broad remit though the company will then need to manage the risk that the investment mandate is not managed appropriately.

A different type of asset will provide some diversification for the organisation though this would not be expected to be very much given that corporate bonds and government bonds share many of the same risk exposures.

*The question was handled well by most. Almost all candidates made four or five of the above points but many made no further points. There is a reasonably standard list of investment risks. Candidates could have scored full marks for the question by cycling through the list of risks and noting the before and after position.*

- (iv) Zero-coupon bonds (or strips) could be used to match the annuity liabilities.

These have the advantage that the assets can be used to precisely match the liabilities as the cash flows are uniform across the term

This removes reinvestment risk and so the assets can be held to maturity assuming that strips of a sufficiently long duration can be acquired.

Not all bonds can be stripped so there may be limited availability in the market leading to mis-match risk.

Whilst zero coupon bonds can provide a precise match they would not be expected to provide a yield uplift as they arise predominantly from Government Securities and so would be close to risk-free.

Collateralised mortgage obligations provide a stream of income payments from a book of mortgages.

These types of securities can be purchased with different probabilities that the payments will be met.

The life office will be able to weigh up the level of return it can get against its risk appetite and hence the default probability it is prepared to accept against the additional return it can earn.

The quality of the underlying mortgages on which the securities are based may not be well understood, leading the life office to misunderstand the risk that it is bearing by investing in these securities.

The behaviour of the original borrowers will be affected by other underlying economic factors such as interest rates (e.g. people remortgage if they can get better rates, high interest rates lead to defaults).

*The question was handled well by most. A wide range of different but reasonable points were given marks.*

- (v) Swaps can be used to change the nature or timing of cash flow receipts by agreeing to enter a contract with a counterparty

This company is seeking to receive income payments matching its liability outgo which is broadly fixed. Therefore it could use swaps to:

- Change the timing of the payments on its fixed income portfolio so that they precisely match the predicted liability outgo.

This may be helpful if the life office cannot construct a portfolio from physical assets as it can eliminate exposure to interest rates by offering precise matching

- Manage interest rate risk, were the company to have a portfolio of assets paying a floating rate of interest. It can then swap these for fixed rate, though that would not apply to the company in this example.

The life office does have an element of inflation-linked exposure due to its expense risk which it may wish to hedge and for which a swap would be suitable.

In considering whether to employ a swap the life office will need to consider the expenses associated with entering into the swap arrangement against the costs of buying the assets directly and any capital costs associated with the residual exposure.

In particular, as the life office is open to new business there will be need to review the matched position on an ongoing basis and that will lead to any swap needing to be reset or rebalanced. The expense could therefore be material.

Swaps and the way that they work can be complex which brings additional operational risk into the organisation in managing them.

The mitigation may be to purchase expertise, though this gives additional exposure to expense risk.

*The question was reasonably well handled by many. A wide range of different but reasonable points were given marks. Many candidates failed to make a sufficient number of different points and so scored poorly.*

- (vi) The credit rating gives an indication of how likely it is that the borrower will be able to repay the debt.

Ratings give a subjective measure as well as an objective measure of this likelihood.

They consider a company's future prospects as well as their current position.

The future prospects will be a particular issue for the lender and will interact with the required duration of the loan, which is likely to be for a significant term.

The rating will be established after interviewing the company and will use information that is otherwise not in the public domain to reach its conclusion.

The life office will need to consider any other loans the borrower has, the credit ratings of those and where its lending will sit in terms of repayment priority to those.

The life office may be constrained by regulation to being able to account for loans to entities that are below a certain credit rating so this will be an important check.

The rating is a measure of both probability of default and loss given default. It can be used to:

- Assess the probability of default
- Assess the likely loss given default
- Determine the interest to charge on the loan
- Determine the maximum loan amount
- Determine the security package of the loan
- Determine the term of the loan
- Other loan covenants and terms and conditions

*The question was handled well by most.*

- (vii) The company does not have any experience of issuing loans itself. Therefore, by choosing to enter the market the company is taking on significant operational risk.

To mitigate this risk the company will need to hire experts in offering these types of mortgages, either on a permanent or consultancy basis.

Alternatively, the company could employ a fund manager that will act as an intermediary to the commercial mortgage market.

This leaves the risk that the intermediary selected does not perform as expected. The Life Office will need to employ someone to manage the relationship.

There is a risk that the company cannot source loans of the right nature to match the liabilities. In particular:

- The term of the loan may be inappropriate for matching purposes;
- The company may not be able to source enough loans to match the liabilities;
- The loans may be too large to provide an optimal matching portfolio;
- To mitigate these risks the company will need to have clear criteria that it needs to monitor to ensure the mix of loans is appropriate as it moves to offer new loans.

The terms that the loans are written on will be very important. In particular:

- There is the risk that the loans are repaid early. This will add uncertainty to the matched position the company is seeking to maintain in which case a make whole clause could be added to ensure the early redemption carries a penalty for the borrower.
- Most importantly, the rate of interest charged will need to commensurate with the risk that the company is taking in making the loan

The life insurer is taking regulatory risk, as the asset issued will be required to have a structure that means it will qualify for a matching premium.

As the rules are not yet finalised there is a risk that the life insurer will be left with assets where it cannot take credit for the extra return when evaluating its solvency.

The loans will be illiquid.

The company will need to consider whether it has access to sufficient liquidity through other sources for example, other assets in its portfolio, access to lines of credit with banks etc.

The company will need to retain liquidity to be able to offer loans. This will give rise to an opportunity cost.

The company may find the size of the loans it needs to offer are too large for its appetite, or too small, which may cause problems with achieving its desired matched position.

By maintaining a mix of asset classes it will be able to circumvent this risk.

Dealing with these assets may be more expensive.

The insurer will want to avoid concentration risk by lending to parties in the same industry or in the same geographic location

The life insurer will need to have procedures in place in case the borrowers default.

If a default occurs then terms will need to be sought with the borrower.

The cost of dealing with this will be higher than if the company invested in corporate bonds, though as compensation the life company will have more influence in the outcome of the negotiations.

Other risk mitigants include:

- Stronger covenants
- Credit derivatives
- Sale of the loans in the secondary markets
- Using intermediaries and experts to reduce operational risks

*The question challenged most candidates. As ever, marks were given for other reasonable answers. Questions involving investments, their associated risks and how those risks can be mitigated are included in the exam on a regular basis.*

## **END OF EXAMINERS' REPORT**