

INSTITUTE AND FACULTY OF ACTUARIES

EXAMINERS' REPORT

April 2021

Subject SA7 - Investment and Finance Specialist Advanced

Introduction

The Examiners' Report is written by the Chief 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.

Paul Nicholas
Chair of the Board of Examiners
July 2021

A. General comments on the *aims of this subject and how it is marked*

1. The aim of Investment and Finance Advanced (SA7) is for the candidate to develop a broad working understanding of financial and investment markets, across all major areas of investment expertise. The intent is to achieve expertise up to a level that allows for critical analysis of others, rather than up to the level of full specialist expertise in any particular area. This might be considered the level of expertise needed to be a Chief Investment Officer (CIO) of an investment management organisation or to hold a comparable role in a financial institution with significant involvement in financial markets.
2. Candidates should ensure that their answers are sufficiently detailed to demonstrate understanding, as there were instances where inadequate explanations led to candidates scoring less well on questions than they might have done. The model solutions are intended to reflect the level of detail that a high scoring candidate might be able to produce. For many questions there are more marks available than the question requires to achieve full marks. This reflects that the examiners will give credit for valid alternative solutions, particularly in questions focussed on higher level skills.
3. Candidates who make relevant and well-reasoned points, not in the marking schedule, are awarded marks for doing so.

B. Comments on *candidate performance in this session of the examination*

1. Overall the paper was well attempted by most candidates. Candidates tended to score equally well on application and higher order parts of questions. Suitably prepared candidates were able to score highly across the four questions demonstrating their ability to apply their SA7 knowledge and techniques to a range of familiar and unfamiliar scenarios.
2. Candidates are reminded to ensure that their answers are relevant to the scenario. Candidates are also reminded that to score well they will need to generate a broad range of points, particularly on the longer question parts.
3. With the online format candidates benefit from the ability to carry out calculations in Excel. It is important that assumptions are stated and intermediate steps shown for calculations so that maximum credit can be given.

C. Pass Mark

The pass mark for this exam was 60.

106 candidates presented themselves and 44 passed.

Solutions for Subject SA7 – April 2021

Q1

(i)

As the annuity fund's return target has been increased, the fund will need to increase its holdings of higher expected return assets than the current assets [1]
 These asset classes provide predictable fixed or floating rate cash flows [1]
 Where the asset cash flows are a close match for the liability cash flows [½]
 Solvency II requires capital to be held in respect of the credit risk of the cash flows [1]
 rather than the volatility of the asset values. [½]
 For an annuity fund looking to increase its expected return, [½]
 these asset classes are more attractive new investments than assets with uncertain income
 such as equities or property [½]
 where the capital requirements will be much higher. [½]
 The attractiveness of each of these assets will depend on its level of yield [½]
 [expected return also acceptable] and its level of credit risk [½]
 By using a blend of these assets with different maturities [½]
 an asset portfolio can be constructed that matches some or all of these liability cash [½]
 flows to benefit from the favourable capital treatment [½]

Credit given for other relevant comments

[Marks available 8, maximum 6]

(ii)

Whilst these assets do provide predictable cash flows, it may not be straightforward to construct such a portfolio [1]
 From a theoretical perspective, the asset and liability cash flows would need to be identical in all scenarios [1]
 Practically this is not possible given the nature of liabilities where it is not possible to know the exact timing of the liability outgo [1]
 In addition, there are elements of the assets cashflows which lead to uncertainty of timing and amount for cash flows [1]
 These factors include partial or full default for bonds, loans and leases [1]
 Uncertainty of timing for leases [1]
 Loan prepayments which may change asset income profile. [1]
 These issues will need to be factored into the expected capital requirement following the restructure of the asset portfolio [1]

[Marks available 8, maximum 5]

(iii)

The initial step would be to determine a liability benchmark, which in this case would be liability cashflows to match [1]
 Liability cashflows will need to be projected for the entire fund [1]
 This is key in determining the timing and size of the outflows [1]
 It will be important to use relevant mortality tables in order to determine the impact longevity will have on liability cashflows [1]
 Projections for inflation will be required to determine the size of cashflows in future where there are inflation linked payments [1]
 It is important that the projected inflation is related to that defined for liability cashflow escalation. [1]

Another consideration would be an assumption on the proportion of funds taken as a lump sum which would impact the size of regular payments [1]
 Lump sums taken as well as the age profile of the scheme may impact the cashflows - and hence liquidity requirements through time [1]
 The liability cashflows would probably be bucketed into multi-year periods, e.g. 5 years in order to get sizeable cash flows which can be matched
 Projected Inflation would also be needed to determine relevant asset cashflows if there are any which increase with inflation [1]
 This inflation is likely to be different to that used to project liability cashflows as issued inflation-linked bonds are generally standardised [1]
 Default probabilities will need to be estimated for loans and bonds in order to determine payment patterns, and in this case when expected payments may not be received [1]
 The default probabilities will likely be estimated in a different way if some of the loans or bonds are for specific issuers (e.g. start-ups) [1]
 An estimate of recovery rate for corporate loans will be required [1]
 Rates of voids would need to be estimated for leases [1]
 The incidence of other events which may impact the timing and size of payments would need to be projected for the duration of the assets (e.g. redevelopment of properties resulting in loss of ground rents) [1]
 Once all of this information is available, it becomes possible to determine a portfolio with cashflows that closely align with the liability cashflows [1]
 This can only be done within a specified degree of confidence due to the assumptions impacting the timing and size of cashflows [1]

Credit given for other relevant comments
 [Marks available 17, maximum 9]

(iv)

The CRO is referring to the difficulty of estimating the factors that impact the projection of asset cash flows [1]
 There may also be difficulty in constructing a suitably diversified portfolio if allocations to these asset classes are large [1]
 As ground rents and loans are illiquid, there may be liquidity issues to consider [1]
 These assets may not be well suited to matching the liability cashflow profile by maturity [1]
 [Marks available 4, maximum 3]

[Total 23]

Question 1 was not as well answered as other questions on this paper.

In part (i) a number of candidates approached the question by explaining the Solvency II regulatory capital requirements, rather than discussing the portfolio manager's asset class recommendations. In part (iii) several candidates focused on the narrow question of ring-fencing, rather than considering wider questions such as how assets should be mapped to liabilities and a benchmark constructed. In part (iv) many candidates assumed that the Chief Risk Officer would have a narrow role in relation to regulatory capital rather than taking a holistic view of risk.

Q2

(i)

Pension Funds - they can use the fixed payments to hedge annuity payments while gaining exposure to assets that have a long duration and have coupons which can increase over time

[1]

Individual investors - they can use the fund to gain exposure to property assets

[1]

Credit given for other investors with similar needs

(ii)

There is a risk that at the time when coupon payments need to be made, the income generated will be insufficient

[1]

This could be due to an insufficient number of properties being purchased by the time coupon payments need to start

[1]

This can be mitigated by promising coupon amounts that are much lower than the expected income. Although the coupons cannot be too low otherwise the fund will not be attractive to investors

[1]

Another option would be to transfer the investment risk to investors by linking coupon payments to the proportion of the portfolio value

[1]

There is a risk of prolonged voids in a material proportion of the property assets which will impact the ability to pay the guaranteed coupons

[1]

This risk can be partly mitigated by investing in properties that are in key locations where finding tenants is not an issue (e.g. close proximity to transportation hubs, schools, etc).

WAL would also need to have a robust process to find and assess prospective tenants

[1]

WAL can also sign long-term contracts with certain institutions (e.g. hospitals) so that they can house their staff to reduce this risk

[1]

Given the homogeneity of the assets within the fund, there is a risk that specific events can significantly impact the fund's income

[1]

This includes tax and regulatory risks

[1]

This risk can be mitigated by the use of insurance or diversification which is achieved by purchasing properties in different regions/countries etc

[1]

There is a risk that the income stream to the fund can be disrupted if tenanted buildings need to go through significant refurbishments or renovations

[1]

This can be mitigated by building up a reserve fund which accumulates funds that can be used to pay coupons during renovation periods

[1]

There is a risk that increases in coupons can materially increase the income required from the assets over time

[1]

This risk can be mitigated by setting initial coupon amounts to a smaller proportion of expected income

[1]

or by managing the rate at which coupon levels are increased

[1]

Credit given for other relevant comments

[Marks available 15, maximum 10]

(iii)

The rental yield does not take into account the capital appreciation/depreciation component of the total return

[1]

The capital component may be significant if the property profiles of the fund vs direct investment are significantly different

[1]

Investing directly can have tax benefits (e.g. expenses to maintain property can be subtracted from taxable income) which improve the return that can be achieved [1]

Due to the high cost needed to purchase directly, individual investors will have less diversification. This increases the volatility of their return [1]

Purchasing directly can also make it difficult to exit the investment and that can reduce the returns that can be achieved in the long run if investors cannot easily crystallize gains [1]

It is difficult to reduce maintenance costs as an individual investor who purchases a low number of properties and this will impact the overall return which can be achieved [1]

There will be costs associated with managing rental properties and these will be a higher proportion of the return for individual investors who invest directly into property [1]

[Marks available 7, maximum 5]

(iv)

The mortgage durations will be long depending on the age of the homeowners [1]

Liquidity will be low which would tie up funds thus inhibiting the chance to take advantage of other assets in the medium term [1]

The terms of the loans may lead to the guarantee biting which would limit the overall return to investors [1]

If proportion of loan is high compared to property value this increases the chances of the amount owed to be higher than property price due to loan interest [1]

If loan interest rate is materially higher than property price growth this increases the chances of the amount owed to be higher than property price [1]

Some properties may be in regions where the growth rate is low or negative and this increases the chances of amount owed being above property price [1]

The amount owed will be greater than the property price if property markets suffer a shock [1]

In the case where property growth increases and is materially higher than the loan interest rate, the investor would only receive the interest rate (minus expenses and defaults) [1]

The holding period may be significantly shorter than expected if the loan is suddenly repaid due to various reasons [1]

Due to the complexity of the product, it is difficult to estimate the ultimate rate of return [1]

The fees associated with this investment are likely to be high due to the broker and originator fees. [1]

Some properties may become significantly dilapidated which would reduce their value at time of repaying the mortgage, increasing investor losses [1]

[Marks available 12, maximum 10]

[Total 27]

Question 2 was generally well answered by most candidates.

In part (ii) some candidates assumed that the guaranteed return was being underwritten by the asset manager, rather than the fund needing to manage its risk of having an obligation in excess of its resources. Similarly some responses to part (iv) assumed that the asset manager was providing guaranteed liquidity to investors, which would be unusual given the underlying assets. A few responses to part (iv) did not appreciate that there is no obligation for a mortgagee to ensure that their property is higher in value than the sum outstanding under the loan.

Q3

(i)

- For dealing and execution, it can potentially minimise market impact [1]
- especially for large trades [1]
- to help achieve an execution price closest to the market price [1]
- For trading and active management, it opens up a new potential source of outperformance [1]
- assuming that the manager has a competitive advantage and can translate this into its algorithms [1]
- Having more sources of alpha can in theory increase the investment outperformance of the manager [1]
- Algorithms can help protect the investment manager from market makers pushing the market against the investment manager, by helping disguise their trades [1]
- Information is power in markets and algorithms can help investment managers to tip this power more in their favour [1]
- Introducing an algorithmic trading capability can help the manager's reputation [1]
- and can help them retain and attract talent [1]

Credit given for other relevant comments
[Marks available 10, maximum 7]

(ii)

- Algorithmic trading means that market participants with the best algorithmic systems and the best information [1]
- can get their orders executed before those who do not have those advantages [1]
- This acts as a performance drag on those who cannot compete [1]
- The performance drag may not be obvious and may be hard to detect [1]
- but it will likely show up over long periods of time, in a cumulative manner [1]
- This can cause theoretical issues with market models that assume you can transact at the market price [1]
- and likely mean an additional implicit transaction cost should be included in the models [1]
- The potential problems arising from algorithmic trading are exacerbated when there are a small number of dominant firms and that act as agents in a market [1]
- in other words when the main players in a market are closer to monopolistic or oligopolistic competition rather than perfect competition. [1]

Credit given for other relevant comments
[Marks available 9, maximum 5]

(iii)

Implementation shortfall is a methodology for assessing the efficiency of execution only algorithm trading models [1]
 It involves assessing the size of the implementation shortfall [1]
 which is defined as the difference between the value of a notional portfolio with trades conducted at the observed market prices at the time of the trades and the value of the actual portfolio after the actual trades are executed. [1]
 The algorithmic process with the lowest implementation shortfall is considered the best [1]
 It can be difficult to exactly measure the market price when the trade happens when there are very large volumes of trades [1]
 The methodology is limited by the assumptions it uses [1]

Credit given for other relevant comments, e.g. latency

[Marks available 6, maximum 5]

(iv)

In theory, and in practice, those involved in design and implementation need to be able to apply patience and open-mindedness over a long period of time to develop their plan for the system [1]
 be disciplined and logical in carrying out their testing and implementation [1]
 and have a significant drive [1]
 As this will be taking a competitive perspective, the narrative needs to be that of the designers [1]
 and needs to be continually recalibrated to reflect market conditions and pricing achieved [1]
 Their narrative also needs to be one that is aiming at an actively critical understanding [1]
 rather than one merely looking to improve a passive understanding [1]
 Problems will likely arise if there are issues arising from unhealthy Ego [1]
 or tiredness issues [1]
 and/or not fully recognizing what is required to do create a system that can compete well in the market [1]
 This arises when those involved are being ruled by emotion (Pyr) [1]
 rather than thought (Nous) [1]
 and reason (Logos) [1]
 And when their narratives are narrow or shallow [1]
 whereby they try to 'solve' complex events in an overly simplistic way [1]
 without adequate thought or using a sufficient degree of disciplined logical and rational analyses of their ideas [1]
 From a technical perspective, the speed of the algorithm system is a key factor [1]
 it needs to be at least as fast as those of the average competitor [1]
 or there will likely be a performance drag from other systems submitting orders faster than this system [1]
 A key driver of speed is location of the servers [1]
 the proximity to the exchange. [1]
 Again, the proximity needs to be closer than the average proximity of competing systems or there will likely be a performance drag [1]
 The system needs to be soundly tested for glitches and other potential issues [1]
 The algorithms need to be appropriately back-tested [1]

not just to see if they have a performance advantage [1]
 but to give a greater understanding of the likely different elements contributing or detracting
 from the performance advantage [1]
 The system needs to be monitored over time [1]
 in line with the actuarial control cycle [1]
 where poor outcomes can be analysed and appropriate remedial actions can be taken [1]
 Whether a cut-off / circuit breaker for the system needs to be added should be discussed [1]
 Lessons from the Quant crash of 2007 should be learnt [1]
 and some override mechanism [1]
 should be considered that would manage any damage and losses that could arise during
 extreme market moves [1]

[Marks available 33, maximum 14]

[Total 31]

Question 3 was well answered by most candidates. Where candidates scored less well, this was often due to insufficient detail in their answers, perhaps due to this being a relatively new area within the syllabus.

Q4

(i)

A zero coupon yield curve is constructed from the prices of the fixed interest bonds [½]
 When a bond cashflow of a given maturity is discounted at the zero coupon yield its value
 will be equal to the market price [1]
 Coupon bearing bonds will need to be decomposed into their component cashflows each of
 which is valued independently [1]
 An iterative process will need to be employed to construct the zero coupon curve starting
 with the shortest maturity bonds [1]
 Similarly, a zero coupon real yield curve is constructed from the prices of the index-linked
 bonds [½]
 The breakeven inflation curve is constructed from the geometric difference [½]
 between nominal and real yields at each maturity date [½]
 Smoothing of the raw curve may be required [½]
 and additional consideration given to dealing with the “last liquid point” [1]

[Marks available 6½, maximum 5]

(ii)

Hedging

Pros

The new bond will provide more flexibility and allow NewCPI liabilities to be hedged
 directly [½]
 rather than using OldCPI linked assets as a proxy hedge [½]
 Over time it is expected that multiple NewCPI linked bonds will be issued across the curve,
 [1]
 allowing NewCPI liabilities of different maturities to be hedged [½]
 The new bond will also allow banks to issue NewCPI linked derivatives in greater size [1]
 As the issue size grows it will create increased liquidity in NewCPI assets generally [½]

and improve price discovery [½]

Cons

By creating a NewCPI linked bond, liquidity in inflation linked assets will be fragmented [1]
 This could lead to increased dealing costs, both for OldCPI and NewCPI linked assets [1]
 There may also be increased market volatility, particularly for the basis between OldCPI and NewCPI, until the NewCPI market is well-established [1]
 Over time liquidity will shift from OldCPI linked assets to NewCPI linked assets [1]
 Existing hedges constructed using OldCPI linked assets will need to be restructured [1]
 particularly if the NewCPI curve behaves differently to models previously used to establish proxy hedges [1]
 These issues will persist until OldCPI assets and liabilities are migrated to NewCPI [1]

Liability valuation

Over time the NewCPI linked bonds will enable a NewCPI curve based on liquid assets to be constructed for liability valuation purposes [1]
 Currently NewCPI liabilities are valued using other approaches [1]
 There will be transitional issues associated with re-measuring the NewCPI liabilities based on prices of NewCPI bonds [1]

[Marks available 14½, maximum 10]

(iii)

5 year zero coupon interest rate = $(1.0075)^2 - 1 = 1.506\%$ pa [1]
 5 year zero coupon real interest rate = $(0.9975)^2 - 1 = -0.4994\%$ pa [1]
 5 year breakeven inflation rate = $(1.0075 / 0.99775)^2 - 1 = 2.015\%$ pa [1]
 Due to the 3 month lag, the 5 year breakeven rate is in fact a 4.75 year rate. [1]
 Since this is the only Government NewCPI bond, so the breakeven rate would be the same at all maturities [1]

[Marks available 14½, maximum 4]

[Total 19]

Question 4 was less well answered than other questions on this paper.

In part (i) a number of candidates failed to provide sufficient detail on the method for constructing a breakeven inflation curve. In part (ii) a common mistake was to assume that there would be a legal requirement to convert assets or liabilities from OldCPI to NewCPI, which led to them not considering mismatch risks in sufficient detail.

[Paper Total 100]

END OF EXAMINERS' REPORT