

# INSTITUTE AND FACULTY OF ACTUARIES



## EXAMINATION

27 April 2015 (am)

### **Subject ST5 – Finance and Investment Specialist Technical A**

*Time allowed: Three hours*

#### ***INSTRUCTIONS TO THE CANDIDATE***

1. *Enter all the candidate and examination details as requested on the front of your answer booklet.*
2. *You have 15 minutes before the start of the examination in which to read the questions. You are strongly encouraged to use this time for reading only, but notes may be made. You then have three hours to complete the paper.*
3. *You must not start writing your answers in the booklet until instructed to do so by the supervisor.*
4. *Mark allocations are shown in brackets.*
5. *Attempt all eight questions, beginning your answer to each question on a new page.*
6. *Candidates should show calculations where this is appropriate.*

***Graph paper is required for this paper.***

#### ***AT THE END OF THE EXAMINATION***

*Hand in BOTH your answer booklet, with any additional sheets firmly attached, and this question paper.*

*In addition to this paper you should have available the 2002 edition of the Formulae and Tables and your own electronic calculator from the approved list.*

- 1** (i) Describe the role of credit rating agencies in the fixed income markets. [4]
- (ii) Assess the consequences of investors placing less reliance on credit ratings, following a period of stress in the fixed income markets. [4]
- [Total 8]

- 2** (i) Describe the main limitations of portfolio performance measurement. [4]
- (ii) Propose an action that could be taken to address each of the limitations described in part (i). [4]
- [Total 8]

- 3** (i) State why pension funds generally have investment restrictions. [3]
- (ii) Outline reasons why a pension scheme's investment restrictions might limit exposure to hedge funds. [4]
- (iii) Suggest other issues that pension fund trustees might have regarding hedge fund investment. [3]
- [Total 10]

- 4** A bond fund manager is considering an anomaly switch between two gilts. The data he has concerning current market values are:

	<i>Redemption Date</i>	<i>Clean price</i>	<i>Yield %</i>
4¾% Treasury Stock 2020	7 March 2020	113.84	2.33
3¾% Treasury Gilt 2020	7 September 2020	107.88	2.46

- (i) Demonstrate three methods to assess whether there is an opportunity here for an anomaly switch. [4]
- (ii) Outline additional factors that would need to be considered by an institutional investor considering a large anomaly switch. [5]
- (iii) Outline two methods by which an investor could take advantage of an anomaly whilst maintaining no overall market exposure (i.e. having a market neutral position) to the bond markets. [2]
- [Total 11]

- 5** The following total return data is provided for a fund and relevant indices:

	<i>Year 1</i>		<i>Year 2</i>		<i>Year 3</i>	
	<i>Index</i>	<i>Fund</i>	<i>Index</i>	<i>Fund</i>	<i>Index</i>	<i>Fund</i>
Index-linked bonds	−5%	−1%	+27%	+29%	+34%	+38%
Domestic equities	+14%	+11%	+4%	+5%	+17%	+16%
Overseas equities	+14%	+13%	+10%	+10%	+14%	+15%

The fund's strategic benchmark was set at the start of Year 1 as 40% index-linked bonds, 40% domestic equities and 20% overseas equities. It was not amended during the three year period.

The fund manager adopted a strategy of 50% index-linked bonds, 25% domestic equities and 25% overseas equities at the start of the period and did not rebalance.

Ignoring the fund's cash flows and stating any assumptions that you make:

- (i) Calculate the total returns on the fund and the strategic benchmark over the period and state the relative performance. [3]
  - (ii) (a) Calculate how much of the fund's relative performance is attributable to stock selection and how much is attributable to asset allocation.
  - (b) Calculate the relative contributions of stock selection and asset allocation at the asset class level.
  - (c) Assess the most important areas for attention in order to reduce underperformance.
- [9]  
[Total 12]

- 6** An experienced business person has a successful restaurant chain with five locations in two major cities. He believes that the economy is about to come out of a deep recession and has therefore decided to pursue an aggressive expansion plan with five new restaurants planned over the next 12 months.

- (i) List the sources of financing that the individual could use to aid the expansion. [4]

The restaurant owner decides to raise a bond issue to finance the expansion. The bond issue is currently being marketed to potential investors.

- (ii) Describe the analysis that an investor might undertake prior to investing in this bond issue. [12]  
[Total 16]

- 7** An investor is comparing two possible investment strategies:

**Strategy A**

Buy £100 of equity shares.  
Buy £100 notional of European calls at a strike price of 6,600.  
Sell £200 notional of European calls at a strike price of 7,800.  
Sell £100 notional of European puts at a strike price of 4,500.

It can be assumed that these options have zero premium.

**Strategy B**

Sell £100 notional of European calls at a strike of 5,400 (price £5 per £100 notional).  
Buy £100 notional of European calls at a strike of 5,100 (price £3 per £100 notional).  
Sell £100 notional of European calls at a strike of 6,600 (price £4 per £100 notional).  
Buy £100 notional of European calls at a strike of 6,900 (price £3 per £100 notional).

The options are all written with a one year term on the same equity index, the current value of which is 6,000. Dividends can be ignored.

- (i) Plot a chart for each of these strategies that shows the value of the portfolio after one year. [8]
- (ii) Suggest why an investor might choose to follow Strategy A over a one year time horizon. [2]
- (iii) (a) Comment on why Value at Risk is a poor measure of the risk of this strategy.
- (b) Suggest an alternative approach.

[4]

[Total 14]

- 8** A large global charity provides long term care to the elderly whilst at the same time seeking to have minimal impact on the environment.

- (i) Determine what should be the main investment objectives for the charity's assets. [8]

Following a review of the current investments, it has been decided that a small proportion of the assets should be invested in infrastructure. A specialist investment manager has therefore been appointed.

- (ii) Describe the main features of an infrastructure investment. [6]
- (iii) Assess whether infrastructure might be considered a suitable asset class for the charity. [4]
- (iv) State what should be included in the explicit written mandate between the trustees of the charity and the investment managers. [3]

[Total 21]

**END OF PAPER**

# **INSTITUTE AND FACULTY OF ACTUARIES**

## **EXAMINERS' REPORT**

April 2015 examinations

### **Subject ST5 – Finance and Investment Specialist Technical A**

#### **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 at the date the examination was set. Candidates should take into account the possibility that circumstances may have changed if using these reports for revision.

F Layton  
Chairman of the Board of Examiners

July 2015

## **General comments on Subject ST5**

Candidates are reminded of a bias in the paper towards recognising higher level skills and practical application – this is intentional and will continue. Likewise the examination system does properly allow for prior subject knowledge to be assumed. Investment is a necessarily practical subject and, at this level, the examiners expect candidates to demonstrate a breadth and depth of competency as would be expected from a senior student in a frequently evolving discipline. Hence simple regurgitation of bookwork will never be sufficient to ensure a Pass grade – and this was evident from the dispersion of candidates' responses in the more differentiating questions.

Whilst the examiners will tolerate bullet point style responses, handwriting that is too poor to assess will lose marks. Likewise "text speak" abbreviations will not be accepted.

## **Specific comments on the April 2015 paper**

Comments on individual questions are incorporated in the solutions below.

Many questions represented opportunities to demonstrate higher level skills in terms of non-standard or practical application of theory to current or unusual issues in investment. Most candidates seemed to identify and understand the key issues being examined and so appreciated the general content of solutions that the examiners were looking for – however those that were unsuccessful will find their solutions lacked sufficient (and often the most basic) detail or application of knowledge and scored lower accordingly. Thus, weaker candidates found difficulties with Question 1 and the first part of Question 7.

Whilst some candidates are too narrow in their responses, a greater number still deviate from the topic and include irrelevant material or over emphasise minor points. Although candidates will not be explicitly penalised for this, it gives an impression of a lack of understanding and, more importantly, wastes limited time. Time and priority management are key skills actuaries need to have.

Weaker candidates often fail to respond to the *specific* issues included in the question. Instead, they regurgitate a *generic* answer based on the syllabus topic. More care needs to be given to crafting answers that directly address the points raised in the question. Question 4 part (i) was an example of this.

Where candidates made relevant points in other parts of their solutions, the examiners have used their discretion as to whether to recognise these answers or not. Likewise the examiners share and agree alternative possible solutions to questions alongside the approach outlined below.

**1 (i) Ratings agencies apply a mix of qualitative and quantitative analysis to make an assessment of the credit quality of a bond or an issuer of bonds.**

Provided an investor has confidence in the process applied by a ratings agency, an investor can place a certain degree of reliance on bond and issuer ratings, rather than carry out their own credit analysis independently.

**The cost of independent credit analysis is a particular barrier to smaller investors placing funds in the fixed income markets.**

**Therefore, bond issuers have found that by employing ratings agencies to maintain a credit rating for them, they are more successfully able to raise funds.** Arguably secondary market liquidity for their bonds is also improved.

*Some candidates discussed the purpose and practice of credit rating, rather than the role of the rating agencies (as required by the question).*

**(ii) If investors had less confidence in credit ratings, then they would need to carry out their own credit analysis** to understand the credit quality of the bonds they purchase.

Alternatively they might demand a higher risk premium as compensation for credit uncertainty. There may be a 'flight to quality' with less demand for higher-risk bonds.

**This would lead to higher direct costs for credit investors,** particularly smaller investors.

Over time we might expect increased use of independent credit research.

Some investors may be comfortable to trade or own bonds on the basis of market price, without doing or purchasing detailed credit analysis.

**Legislation and regulations may also remove references to credit ratings,** if confidence reduces sufficiently.

Going forward this is likely to lead to falling revenues for credit rating agencies. Possibly fewer bonds will carry ratings and fewer bonds will be issued.

*Generally well answered, although not many candidates considered the references to credit ratings in legislation and regulation.*

**2 (i) Projection of past results – past performance is not necessarily a good guide to future performance,** but it is typically (erroneously) used as such a guide in an over-simplified manner. Measures may be unduly influenced by the impact of cashflows.

**Risk – past performance is likely to be impacted by the amount of risk taken** – which may not be comparable to the risk to be taken in the future.

Timescale – needs to balance assessing performance frequently enough to stop problems but not too frequently that it encourages short-termism.

Differing fund objectives – **funds with differing objectives may not be directly comparable.**

Impact on investment manager's behaviour – the frequency and method of performance measurement may negatively impact the behaviour of the investment manager – e.g. by encouraging short-termism.

Cost – there is always a cost / benefit trade off with performance measurement.

(ii) Projection of past results

Use of a caveat – stating that past performance is not a guide to future performance.

Avoid using performance measures that are influenced by cashflows (e.g. MWRR).

Risk

Using a risk-adjusted performance measure.

Timescale

Use a number of performance measure measures and/or manage the internal use and handling of short-term published performance measures to keep focus away from, and interests not aligned to, short-termism.

Differing fund objectives

Only measure against funds with similar objectives – or adjust comparison based on the differing objectives.

Impact on investment manager's behaviour

Have remuneration policies for the fund manager based on longer-term performance measures.

Cost

Avoiding overly short-term measurement and/or any subjective measures.



*Other sensible answers were also accepted. Generally, this question was well answered, although weaker candidates needed to 'describe' the limitations identified in part (i) more fully.*

- 3** (i) Pension fund investment managers are increasingly employed on a “specialist mandate” basis to invest in a single asset class, rather than on a traditional “balanced” or “multi-asset” mandate. This requires them to make operational decisions in relation to stock selection (unless a “passive” index-tracking approach is to be adopted). Managers will therefore need to be given instructions regarding any restrictions to be applied.

The purpose of such restrictions can be seen as threefold:

- **To limit the risk they are taking**
- **To comply with regulations/legislation**
- **To keep portfolio in line with strategic asset allocation**

- (ii) A pension scheme's investment restrictions might limit exposure to hedge funds because they:

- **restrict use of derivatives**
- **restrict short selling**
- **prohibit investment in non-regulated entities**
- **introduce an excessive level of risk**

- (iii) Specific issues that might concern the trustees regarding hedge funds are:

- **The fees charged are excessive when compared to other investments**
- **Trustees don't believe they have the necessary knowledge to make an investment on behalf of the Scheme**
- **Scheme might be de-risking and therefore will be invested primarily in bonds**
- **The scheme may have previously had a bad experience with hedge fund investments (e.g. Madoff) and is therefore very cautious about investing in Hedge Funds again**
- **Dealing cycles for investment / disinvestment of hedge fund are too infrequent for Defined Contribution schemes**

Lack of transparency regarding underlying assets may make valuation difficult.

*In marking, credit was given equally for issues raised in parts (ii) and (iii). Comments regarding hedge fund liquidity were also given credit.*

**4 (i) Yield differences**

A switch from the 4¾% stock to the 3¾% gilt would generate an additional redemption yield of 0.13%. However, a better approach would be to consider the *trend* in yield differences, over time, to determine whether the current differential is likely to be maintained.

**Price ratios**

The ratio between the prices of the bonds ( $113.84/107.88 = 1.05525$ ) should again be compared to historic values.

**Price models**

The theoretical price of each bond could be calculated using an “approved” model. This might be the discounted value of the cash flows determined at some pre-specified discount rate. The theoretical price is then compared to the actual price to determine whether an anomaly exists.

*Most candidates failed to ‘demonstrate’ the approaches identified by making explicit reference to the data provided. Weaker candidates did not consider the need to consider trends in the values.*

(ii)

- **Authority and advice to switch – are approvals in place/required**
- **Are there portfolio/mandate constraints on the changes that can be made?**
- **Problems of switching a large portfolio of assets**
- **Tax treatment of coupons (and capital gains)**
- **Costs incurred in exercising the switch**
- Costs of reversing the switch at some later date if the switch resulted in a move away from the neutral portfolio allocations or if a change in market conditions eliminates the anomaly.

(iii) The investor could:

- buy the asset which is believed to be under priced and short sell a similar asset which is correctly priced or overpriced, or
- buy the asset which is believed to be under priced and sell a derivative linked to the benchmark bond for the market.

Examples might also involve the use of Total Return Swaps.

*Credit was given for other suitable methods proposed, provided that it was shown that these were ‘market neutral’.*

**5** The table below shows the results:

	<i>Fund Wt</i>	<i>Index Wt</i>	<i>Fund Return</i>	<i>Index Return</i>	<i>Asset Alloc</i>	<i>Stock selection</i>	<i>Total</i>
Index Linked	50.00%	40.00%	76.24%	61.67%	<b>1.29%</b>	<b>7.28%</b>	8.58%
Domestic Equity	25.00%	40.00%	35.20%	38.72%	<b>1.50%</b>	<b>−0.88%</b>	0.63%
Overseas Equity	25.00%	20.00%	42.95%	42.96%	<b>−0.29%</b>	<b>0.00%</b>	−0.29%
Total	100.00%	100.00%	57.66%	48.75%	2.51%	6.40%	8.91%

Assumptions: No rebalancing. Ignores taxes, transaction costs and cashflows. Fund and index are consistent in respect of treatment of dividends received and currency hedging.

*Not all candidates stated the underlying assumptions (as required by the question).*

- (i) **The fund has outperformed its benchmark by 9%, having returned 58% against the benchmark's 49%.**

*Some candidates failed to reflect that 'the fund manager did not rebalance over the three year period'. As a consequence, their results were incorrect.*

- (ii) (a) **Stock selection made a positive contribution of 6.4% whilst asset allocation gave a positive contribution of 2.5%.**
- (b) See table above.
- (c) The main area of underperformance was the decision to overweight overseas equity. **It would be appropriate to reconsider the weighting given to overseas equity.** Domestic equity stock selection also contributed some underperformance, so **the quality of analysis in this area might be reassessed. Alternatively, it might be more suitable to adopt a passive approach to equity investment.**

*Credit was given for appropriate attempts to calculate the required measures, although full marks were only awarded when the correct results were produced. Credit was given for comments in part (c) that reflected the candidate's results in parts (a) and (b). Few candidates identified the possible adoption of a passive approach.*

- 6** (i) Issue a bond to investors  
Bank loan  
Term loan  
Evergreen credit  
Revolving credit  
Bridging loan  
Commercial paper  
Private loan (private debt financing)

Use cash on balance sheet  
Share sale / dilute ownership  
Venture Capital

*Generally well answered.*

(ii) **Why does the company need to borrow?**

Growth – is the growth realistic, have the costs been correctly accounted for.

Acquisition

Capital Expenditure - how much of the raised finance is required to set-up the restaurants and how much for initial operating expenses

**What is the expected source of repayment?**

Cash flow of company – has the owner done a cashflow projection to ensure can payback as restaurants are cashflow intensive in opening months

Possible sale of assets – what are the tangible assets to back the loan i.e. freehold of restaurants

Refinancing – is this a one off tap for liquidity or will the owner be refinancing

**What are the risks?**

Economic – what is the wider view of an economic recovery

Are the restaurant sites identified suitable for the type of restaurant, what is the likely footfall?

**What is the structure of the bond and the payment profile?**

How does it compare to similar issues?

Is the coupon payment sufficient for the risk being taken compared to similar investments?

Does it meet the requirements for the investor?

**Management issues**

Quality of management running the company

Future business plans and prospect of further borrowing

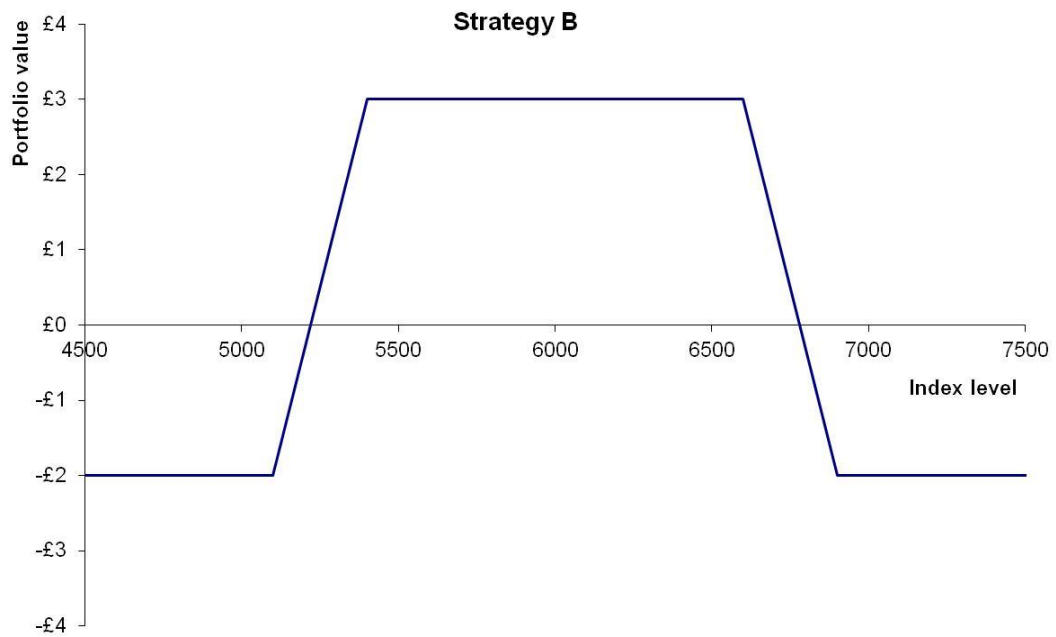
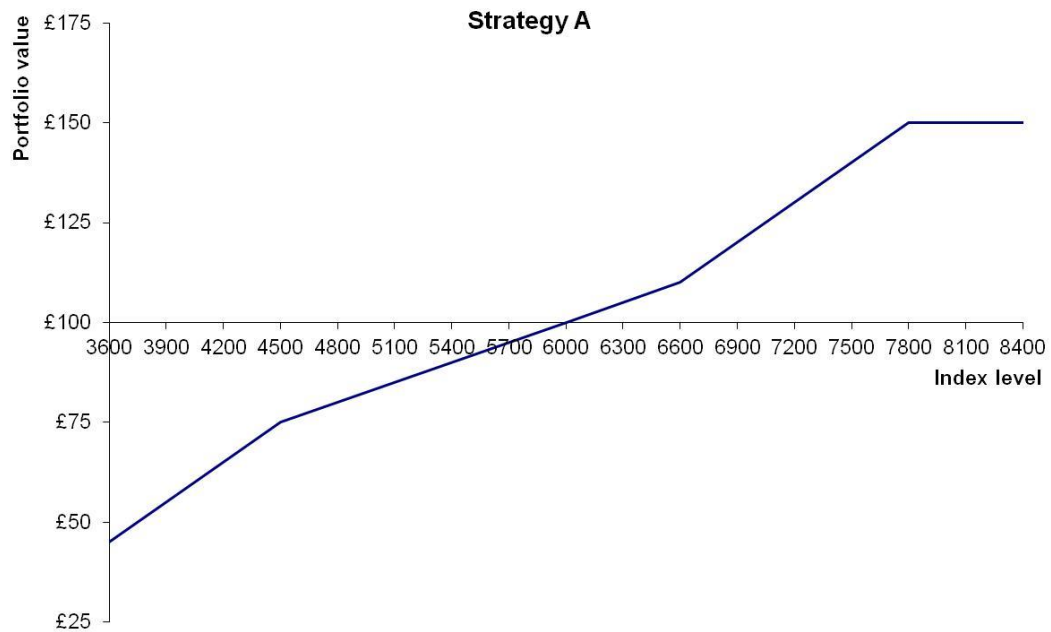
**Ability to service debt**

Current and future promised debt obligations

Financial health of company – review accounts

*Other sensible points regarding the risks of the business and the potential for default on a bond issue were given credit. Candidates were expected to 'describe' the analysis with suitable references to the scenario set out in the case study*

7 (i)



*Credit was given for correct identification of appropriate elements of the portfolios, even if the aggregate diagram was incorrect. Thus credit was given for identifying ranges over which portfolio values increased / decreased / held steady and for points of inflection. However, some candidates struggled to translate the information provided into relevant charts.*

- (ii) **The investor may feel that the options markets are underestimating scope for positive equity returns and overestimating scope for negative returns over the next year.**

*Not all candidates registered that they were only required to comment on Strategy A. Few realised that the rationale for adopting the strategy involved comparing the market premium with the investor's assessment of likely outcomes.*

- (iii) **Because value at risk focuses on outcomes at or around the chosen threshold level (e.g. 1 in 20 confidence level), it ignores the impact of events in less likely scenarios which may increase losses in a nonlinear manner. It is frequently calculated assuming a normal distribution of returns, and so may be misleading if the actual distribution is 'fat-tailed' or skewed.**

**Other measures of risk such as conditional VaR (also known as tail VaR) are better able to capture the losses in tail scenarios. Alternatively, investigation of the entire distribution of gains and losses would reveal the risk characteristics of the strategy.**

**8**

- (i) Investment objectives should:
  - (a) **seek to maximise returns subject to the trustee's best judgement of what is necessary to meet the liabilities**
  - (b) **take account of their attitude to risk**
  - (c) **consider a "socially responsible overlay" to address the environmental objective**

It is likely, therefore, that this fund will need to meet liabilities that are **increasing due to inflation** (not just underlying price inflation but the higher rates due to additional demand for care from an ageing population and the need for medical coverage). The liabilities are therefore "super-real" in nature. **They are (relatively) short-term compared to a typical long-term investor** as care needs will generally only persist for 8 to 10 years. They are likely to be **denominated in domestic currency** for each group of beneficiaries (although the global nature of the charity's operations suggests that some degree of exchange rate risk can be withstood). **Alternatively, it is possible that the liabilities are denominated in many currencies if the charity provides care in many counties.** This would need a global investment objective covering the appropriate countries (or currency hedging) to minimise currency risk. The tax status of the charity should also be considered within the objectives.

**The trustees are otherwise likely to be highly risk-averse,** since the charity will need to be able to continue care provision irrespective of market conditions.

Additionally, **their wish to have “minimal impact on the environment” will impose additional restrictions on the investment activities**, the extent of which will be driven by the charity's commitment to environmental issues. The charity may have other social and ethical restrictions on what can be invested in.

All of these considerations should feature in the investment objectives.

*Generally well answered. Alternative suggestions were given credit provided that they aligned to the scenario set out in the case study.*

- (ii) Infrastructure assets are generally characterised by high development costs (high barriers to entry) and long lives. They are generally managed and financed on a long-term basis.

Infrastructure assets tend to be single purpose in nature (such as gas pipeline, toll road or hospital). The private investor's participation in the asset is often for a finite period although the assets themselves are characterised by their long lives.

One of the key characteristics of infrastructure assets is that they tend to be, or **exhibit the characteristics of, natural monopolies**. Firms operating in a natural monopoly, protected from new competitors by the high barriers to entry, may be **able to earn abnormal profits by charging higher prices**. Infrastructure assets therefore tend to be subject to varying degrees of government regulation. This is not necessarily to the detriment of investors in infrastructure, as it provides a level of certainty regarding the income streams that will flow from the asset. There may also be liquidity and/or diversification features to the investment that can be attractive to investors.

Although infrastructure assets vary in terms of the level of regulation they face, this regulation generally results in **income streams that exhibit low growth**. To compensate investors for this, infrastructure investments tend to be **higher yielding than equity investments**. In terms of capital values, this stable, high yield results in infrastructure assets displaying a lower level of price volatility than equity investments over the longer term. It also acts as a support to the price of infrastructure assets in periods of poor returns in the broader equity market. As such, infrastructure is often referred to as a “defensive” asset.

*Generally well answered, although some candidates wrongly characterised the asset class as risky and volatile. Not all candidates recognised that a secondary market for infrastructure assets is now developed.*

- (iii) The general characteristics of infrastructure investment suggest that this could be a **suitable asset class for the charity**. Forecast returns from individual infrastructure investments vary depending on the characteristics of the underlying asset, its maturity, risk and taxation treatment in the context of the

prevailing macro environment. Over the longer term, as industry structures and regulatory regimes mature, the listed infrastructure sector will most likely behave like a hybrid between an equity and a bond. **Returns will therefore be real in nature** which will meet the charity's needs. Assets of a suitable term should be available. The focussed nature of the investment should preclude exchange rate risk.

Clearly, it will be necessary to **assess the likely environmental impact of each investment project to determine whether it will be suitable for the charity**, particularly due to the assets typically being large capital projects. Even here, though, there is scope for debate: for example, traditional environmental thinking tended to avoid involvement in nuclear projects, but with the increased focus on climate change and reduction in carbon emission, such projects are seen as more environmentally friendly. This might be less acceptable in the case of highway development, though.

*Alternative arguments were given credit if appropriately justified.*

- (iv) Trustees should agree an explicit written mandate covering agreement between trustees and managers on:
- **an objective, benchmark(s) and risk parameters that, together with all the other mandates, are coherent with the fund's aggregate objective and risk tolerances**
  - **the manager's approach in attempting to achieve the objective**
  - **management fees to be charged**
  - **clear time scales of measurement and evaluation**

The mandate should not exclude the use of any set of financial instruments without clear justification in the light of the specific circumstances of the fund (noting the specific environmental aspects relevant to the charity).

## **END OF EXAMINERS' REPORT**



# INSTITUTE AND FACULTY OF ACTUARIES



## EXAMINATION

9 October 2015 (pm)

### **Subject ST5 – Finance and Investment Specialist Technical A**

*Time allowed: Three hours*

#### **INSTRUCTIONS TO THE CANDIDATE**

1. *Enter all the candidate and examination details as requested on the front of your answer booklet.*
2. *You have 15 minutes before the start of the examination in which to read the questions. You are strongly encouraged to use this time for reading only, but notes may be made. You then have three hours to complete the paper.*
3. *You must not start writing your answers in the booklet until instructed to do so by the supervisor.*
4. *Mark allocations are shown in brackets.*
5. *Attempt all seven questions, beginning your answer to each question on a new page.*
6. *Candidates should show calculations where this is appropriate.*

#### **AT THE END OF THE EXAMINATION**

*Hand in BOTH your answer booklet, with any additional sheets firmly attached, and this question paper.*

*In addition to this paper you should have available the 2002 edition of the Formulae and Tables and your own electronic calculator from the approved list.*

- 1** (i) Define the following terms:
- (a) trade cycle
  - (b) price earnings ratio
  - (c) defensive company
  - (d) cyclical company
- [4]
- (ii) Describe how the price earnings ratios of defensive and cyclical companies might evolve over the trade cycle.
- [4]  
[Total 8]
- 2** A European call option is being written for a 9-month option on a 10-year bond with a face value of £1,000. The bond pays a semi-annual coupon of 8% p.a. and coupon payments are due in 2 months and 8 months. The current “dirty” bond price is £960, the strike price is £1,000, the risk-free force of interest is 5% p.a. for all durations up to one year and the volatility of the lognormal distribution of forward bond prices in nine months is 10% p.a.
- Calculate the price of the call option, where the strike price is the “dirty” cash price that will be paid for the bond on exercise.
- [8]
- 3** (i) Describe the different corporation tax systems which a country may adopt. [6]
- An investment consultant has recently been offered a job in a country which does not levy income tax. Holders of the job will be required to move to the country and be registered as a resident there. The consultant is independently wealthy and married with two small children. The consultant’s family will not be relocating.
- (ii) Discuss potential reasons why accepting the job might not be advantageous for the consultant from a net of tax perspective.
- [6]  
[Total 12]

- 4 (i) State the main uses of investment indices that track equity markets. [4]
- (ii) Describe the main features of two Japanese equity indices. [4]

You have been given the following information in relation to an index that tracks Japanese equities:

<i>Time <math>t</math></i>	<i>Capital index value <math>I(t)</math></i>	<i>Accumulated XD adjustment at time <math>t</math></i>
1 January 2010	670	26
1 January 2011	684	40
1 January 2012	676	48

- (iii) Calculate the total return on this index over 2011. [2]
- (iv) Comment on the result from part (iii). [2]
- (v) Describe an alternative method and formula that could be used to calculate the total return if the ex-dividend adjustment is not available. [2]
- (vi) Comment on a possible limitation of each of the approaches in parts (iii) and (v). [2]

[Total 16]

- 5** The financial regulator who oversees retail investments has received a number of complaints regarding an investment manager who manages money on behalf of private investors. As a result, the regulator has carried out an inspection visit to the investment manager's offices. Some of the findings from the report were:
- (a) Boxes of documents containing client addresses and personal details left in hallways, under desks and in the staff canteen.
  - (b) Empty files in the Know Your Customer directory on the computer's main server.
  - (c) Only one registered bank account. The bank account was in the name of the investment manager.
  - (d) An employee incentive scheme which invested in the investment manager's best stock ideas one day prior to client monies being invested in the stocks.
  - (e) Marketing materials which gave information on only 70% of the asset classes that the investment manager actually invested in.
  - (f) A \$1m loan from a local bank which was due for payment in 30 days. The company had no provisions set aside to meet this payment.
  - (g) No written procedure documents.

Explain, for each issue, the potential breaches in the principles which financial services legislation seeks to address. [16]

- 6** An established life insurance company primarily writes annuity business but has been struggling to maintain adequate capital reserves. A competitor insurance company is performing due diligence on the insurance company with a view to making a take-over offer. The risk of future insolvency is to be analysed using asset-liability modelling techniques.

- (i) State the steps that would be taken to construct the model. [3]

The results of the asset-liability modelling suggest that there is insufficient interest rate hedging at the longer durations.

- (ii) Assess the advantages and disadvantages of TWO methods that could be used to hedge this risk. [15]

[Total 18]

- 7 (i) Describe the characteristics of Exchange Traded Funds. [4]

A retail investor is planning to make modest regular cash contributions in order to create investment portfolios to provide infant grandchildren with finance for university fees and house purchase.

- (ii) Assess which asset classes might be most suitable for investment of these contributions. Consideration of tax issues is not required. [10]

- (iii) Discuss appropriate ways in which investment in the chosen investment classes might be achieved. [8]

[Total 22]

**END OF PAPER**

# INSTITUTE AND FACULTY OF ACTUARIES

## EXAMINERS' REPORT

September 2015

### **Subject ST5 – Finance and Investment Specialist Technical A**

#### **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.

F Layton  
Chairman of the Board of Examiners  
December 2015

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

1. The aim of this Finance and Investment Technical A subject is to instil in successful candidates the ability to apply, in simple situations, the principles of actuarial planning and control to the appraisal of investments, and to the selection and management of investments appropriate to the needs of investors.
2. A mix of questions styles is used, covering *knowledge* of the material set out in Core Reading, *application* of this in calculations and case studies and *higher order skills* such as synthesis and collation of recommendations. Marks are awarded for the constituent elements of calculations, not just for the final answer generated. Scenario appraisal will similarly provide credit for evidence of the issues considered, not solely for the conclusions reached.

**B. General comments on *student performance in this diet of the examination***

As in past diets, there was a broad span of performance. Well-prepared candidates clearly demonstrated their familiarity with the course material and the ability to use this knowledge in constructing answers. Weaker candidates, however, lacked such skills and ability. These candidates were generally less able to address the 'discursive' nature of the later questions in the paper.

**C. Comparative pass rates for the past 3 years for this diet of examination**

Year	%
September 2015	44
April 2015	49
September 2014	45
April 2014	45
September 2013	59
April 2013	45

**Reasons for any significant change in pass rates in current diet to those in the past:**

The pass rate for this examination diet is broadly in line with previous diets (with the exception of the particularly good pass rate in September 2013). Some variation in the pass rate between sessions is expected as different cohorts of students sit the examination.

## Solutions

- Q1** (i) Trade cycle – The periodic fluctuations of national output around its long-term trend.

Price-earnings ratio (PER) – The ratio of a share's price to its net earnings.

$$\text{PER} = \frac{\text{ordinary share price}}{\text{earnings per share}}$$

The earnings per share used can be historic or prospective.

Defensive company – A company whose fortunes are reasonably immune to the state of the economy.

Any security that exhibits less volatility than the market as a whole (i.e. its beta is less than 1.0), providing lower, but more stable, returns.

Cyclical company – A company whose fortunes are very closely linked to the state of the economy.

The share price, relative to the rest of the market, will therefore depend on the current state of the economy and any (discounted) expected future changes in the economy.

- (ii) If the economy is moderately buoyant and profits are fairly stable, both defensive and cyclical companies might be similarly rated.

As the economy starts to move into recession PERs for cyclical companies are likely to fall while those of defensive companies will remain stable or may even rise slightly.

At the bottom of the cycle PERs of cyclical companies will probably have risen from their low point as earnings have fallen, but defensive stocks will still be more highly rated.

As the economy starts to recover, the PER of cyclical companies will rise as the price increases in anticipation of future earnings growth.

PERs of defensive companies may be below those of cyclical companies.

As growth continues, the earnings of cyclical companies will catch up with the share price and PERs will fall back.

Answers to part (i) displayed a lack of familiarity with the Glossary of Terms set out in Unit 17 of Core Reading. Part (ii) was generally well answered, although not all candidates compared the PERs of the two types of companies.



$$\begin{aligned}\text{Q2 Present value of coupon payments} &= 40 \left( e^{-0.167 \times 0.05} + e^{-0.667 \times 0.05} \right) \\ &= 78.355\end{aligned}$$

$$\begin{aligned}\text{Forward price of bond} &= (960 - 78.355)e^{0.05 \times 0.75} \\ &= 915.334\end{aligned}$$

$$\text{Price of the option} = P(0,T) [F_0 \Phi(d_1) - X \Phi(d_2)]$$

$$\text{Where } P(0,T) = e^{-(0.05 \times 0.75)} = .96319$$

$$F_0 = 915.334$$

$$X = 1000$$

$$S = 0.10$$

$$T = \frac{9}{12}$$

$$\begin{aligned}d_1 &= \frac{\ln\left(\frac{F_0}{X}\right) + \sigma^2 \frac{T}{2}}{\sigma \sqrt{T}} \\ &= \frac{\ln \frac{915.334}{1000} + \frac{0.10^2 \times \frac{9}{12}}{2}}{0.10 \sqrt{\frac{9}{12}}} \\ &= \frac{(-0.088466 + 0.00375)}{0.086603} \\ &= -0.9782 \\ d_2 &= d_1 - \sigma \sqrt{T} \\ &= -0.9782 - 0.086603 \\ &= -1.0648\end{aligned}$$

$$\begin{aligned}\text{So price of call option} &= 0.96319 [915.334 \Phi(-0.9782) - 1000\Phi(-1.0648)] \\ &= 0.96319[150.1056 - 143.49] \\ &= £6.372\end{aligned}$$

Weaker candidates showed a lack of familiarity with the material set out in Section 4.1 of Unit 6 of Core Reading and its application.

- Q3** (i) There are three main systems of corporation tax.

**Classical**

In the classical system of corporation tax, company profits are taxed twice: once in the hands of the company and once in the hands of the investor. The investor may be subject to income tax on distributions and capital gains tax arising from increases in the share price.

**Split-rate**

The split rate system is similar to the classical system but different rates are levied on distributed profits and retained profits. This system is often used when income and capital gains are taxed at different rates. Thus, a higher level of income tax than capital gains tax would be coupled with a higher tax rate on retained profits than on distributed profits.

**Imputation**

In the imputation system the company has to deduct some of the tax payable by investors on distributions and pay it directly to the government. This amount can then be set off against the total corporation tax bill of the company. The tax deducted by the company is “imputed” to the shareholder who may be able to reclaim it if they are not liable to tax. If the rate at which they are liable to tax is greater than the rate imputed they may have to pay some more tax on their dividend.

- (ii) If the country they currently live in is also free of income tax, they will be no better off.  
The overall tax system in the new country might have higher tax rates on investments than in current country.  
Tax allowances such as thresholds before Capital Gains Tax become payable may be lower in the new country  
Consultant might get a lot of income from investments as independently wealthy which means his overall net of tax income is lower than currently.  
The consultant's assets might enjoy some tax benefits which would be lost if registered in another country, or additional taxes (such as non-dom tax) would be payable as result of being registered in another country.

In the absence of double taxation agreements, some elements of income may be taxed twice

Higher taxes might be payable in respect of monies sent abroad

The consultant might get tax benefits/incentives for being married with children. He might lose these when moving country which could affect overall net of tax income.

There might be pension contribution tax incentives in current country which mean contributions are paid gross of tax. The new country might tax pension contributions.

Some non-salaried benefits such as universal health care may not be available in the new country

Other sensible suggestions based on the list in Unit 2 Section 1 of Core Reading were also given credit. The question related to the impact of taxation, so non-tax points were not given credit.

**Q4** (i) The uses to which indices can be put include:

- a measure of short-term market movements.
- providing a history of market movements and levels.
- as a tool for estimating future movements in the market, based on past trends.
- as a benchmark against which to assess the investment performance of portfolios.
- valuing a notional portfolio.
- analysing sub-sectors of the market.
- as a basis for index funds which track the particular market.
- to provide the basis for the creation of derivative instruments relating to the market or a sub-section of the market.

(ii) Two popular indices are the Nikkei Stock Average 225 and the Tokyo Stock Exchange First Section Index, commonly known as Topix.

The Nikkei Stock Average 225, commonly known as the Nikkei or Nikkei Index, is a price weighted arithmetic index of the shares of 225 Japanese companies.

It is listed on the Tokyo Stock Exchange and measured in Yen.

The constituents are reviewed annually and the index is designed to reflect the overall market in Japan .

It is the most widely used indicator of short term movements in the Japanese market.

The Tokyo Stock Exchange First Section Index, commonly known as Topix, comprises approximately 1,700 shares.

It is a market capitalisation weighted arithmetic index reflecting “free float” from June 2006 (i.e. a weighting based on the number of shares available for trading).

The constituents represent the leading companies in the market, so the index is much more comprehensive than the Nikkei index, and is more suitable for use in performance measurement.

- (iii) The formula to obtain a total return index at time  $t$  is:

$$TRI(t) = TRI(t-1) * \frac{I(t)}{I(t-1) - [XD(t) - XD(t-1)]}$$

where  $TRI(t)$  is the total return index,  $I(t)$  is the capital index and  $XD(t)$  is the value of the accumulated  $XD$  adjustment at time  $t$ .

The total return over 2011 is therefore:

$$\frac{676}{684 - [48 - 40]} - 1 = 0\%, \text{ i.e. a return of zero}$$

if the  $XD$  adjustment is not reset to zero at the end of the year. If it is reset (as suggested in Core Reading), the total return is  $676 / (684 - 48) - 1 = 6.29\%$ .

- (iv) The total return index has remained flat over the year despite the capital index suffering a fall of 1.2%. The total return index includes income received and dividends were received, which are assumed to be reinvested in the index.

This has offset the reduction in the capital index.

- (v) An alternative method is to use a yield adjustment. The income received over the 12 months prior to time  $t$  is  $I(t) * y_t$  where  $y_t$  is the dividend yield at time  $t$ . The total return is obtained by adding the yield adjustment to the capital only index.
- (vi) A limitation of the  $XD$  dividend adjustment method is that there is an assumption that reinvestment takes place on the ex dividend date. It is important to ensure that tax and re-investment assumptions are understood. A limitation of the yield adjustment approach is that over shorter time periods, the income is estimated on a proportionate basis.

This only provides an approximation as dividend income is not generally received uniformly over the year.

Part (ii) Discussion of the recent performance of the indices was also given credit.

Description of other Japanese equity indices were given equivalent credit.

Weaker candidates were not able to reproduce these points (as set out in Section 3.1.3 of Unit 3 of Core Reading).

Part (iii) Credit was also given if the XD adjustment was added to the numerator rather than deducted from the denominator.

Part (iv) Equivalent comments based on the alternative results in part (iii) were also given credit.

Part (v) Weaker candidates struggled to make much of this question.

**Q5** *Boxes of documents containing client addresses and personal details left in hallways, under desks and in the staff canteen*

**Information about customers**

– the firm should have proper policies and procedures to keep information secure

**Internal organisation**

– the business should be run in a proper manner and information stored appropriately

*Empty files in the Know Your Customer directory on the computer's main server*

**Information about customers**

– firm should have information on its customers so can understand risk appetite and act appropriately depending on customers' needs.

*Only one registered bank account. The bank account was in the name of the investment manager*

**Customer assets**

– need to maintain segregated assets for safeguarding client assets in case of bankruptcy etc.

*An employee incentive scheme which invested in the investment managers best stock ideas one day prior to client monies being invested in the stocks*

**Market Practice**

- this is front running and is outlawed in most markets

**Integrity**

- not acting in best interests of clients and putting employees first

*Marketing materials which gave information on only 70% of the asset classes that the investment manager actually invested in*

**Information for clients**

- need to provide adequate information on the investment products due to asymmetry of information and knowledge

**Integrity**

- provide full disclosure to clients to show what they will be investing in and acting with integrity

*A \$1m loan from a local bank which was due for payment in 30 days. The company had no provisions set aside to meet the payment*

**Financial resources**

- they need the financial resources to continue as a going concern, if no provision to pay for loan how will they continue to survive?

*No written procedure documents*

**Internal organisation**

- firm should be managed in a professional way and have appropriate documentation so individuals know their roles and duties

Other relevant issues raised were also given credit. Weaker candidates found difficulty in identifying the relevant issues contained in the described scenario.

**Q6** (i) The main stages in an ALM exercise are usually as follows:

1. The key objectives that investment should aim to achieve need to be clarified. These involve objectives such as:
  - a. future solvency levels
  - b. ruin probabilities of insolvency
  - c. the level of risk between assets and liabilities
2. Suitable assumptions to use in the study need to be agreed.
3. Data on the liabilities needs to be collected to carry out the projections.

4. The overall nature of the liabilities is considered — an analysis of cash flow projections under different scenarios is considered
  5. An analysis would be carried out to identify how the fund might progress in the future if different investment strategies were adopted.
  6. Different asset mixes would then be analysed in more detail to assess the risks (relative to the liabilities) and the rewards of each alternative under consideration.
  7. The results would be summarised and presented.
- (ii) The insurer could hold a portfolio of government bonds (in the appropriate currency) until maturity to meet the future payments from the annuities. This approach is often described as 'immunisation'.

This has the advantage of being a relatively simple strategy to adopt if there are sufficient bonds available in the market to match the liability payments.

Difficulties with this approach arise for the following reasons:

Such an approach requires a bond asset to be held that is equal in present value to the future payments discounted at bond yields (using the full yield curve). Therefore, only a partial hedge is only possible if asset cover is less than 100%.

This may be an issue if the insurer is struggling to maintain adequate capital reserves.

However, a leveraged exposure can be created using repo contracts

If the latter payments are payable after the principal payment of the longest available government bond then it will not be possible to hedge these payments at present (until longer maturity bonds become available, i.e. creating reinvestment risk).

Due to "gaps" between bond maturities (particularly at longer durations), there may be a need to reinvest or disinvest bonds prior to maturity, and the hedge may therefore be imperfect.

The use of government bonds gives rise to a (small) degree of credit risk that may not necessarily be reflected in the liability.

If the tax treatment of government bonds worsens, this may mean the assets are insufficient to meet the liability payments.

Due to the above factors, there may be some mark to market risks between the asset value of the bond portfolio and the present value of the liability payments discounted using the bond yield curve.

In some cases this may be a material risk factor, but in other cases this will be much smaller than uncertainties in the liability payments themselves or other portfolio risks.

This approach can be extended to annuity payments that are subject to indexation, provided there are bonds of the appropriate maturity available with the appropriate indexation built into their payment.

In markets where liquid and deep interest rate derivative markets have developed, additional flexibility in hedging fixed payments is available through the use of interest rate swaps.

Inflation-linked payments can similarly be hedged using inflation swaps in combination with an interest rate swap.

The use of swaps rather than bonds has the following advantages:

Interest rate and inflation swap markets may have longer maturities available than bond markets.

Swap markets may have greater liquidity and lower transaction costs than bond markets.

Swaps permit hedging to be achieved without full asset cover being required, as they are a contract for difference rather than a funded asset.

Swaps are in most cases bespoke contracts that are agreed with a single counterparty, rather than a standardised listed security (like a bond). Therefore greater flexibility is possible within the schedule of payments.

The use of swaps does create the following complications and disadvantages:

If the investor wishes to enter into a swap contract directly then they will need to have ISDA documentation in place with one or more market counterparties (typically investment banks), which is a legal document that is negotiated and can be expensive and time consuming to set up.

If the swaps are subject to collateralisation (to mitigate credit risk), then this will require the movement and investment of collateral on a daily or weekly basis.

The bespoke nature of a swap means that closing out a swap position is more complex than selling a bond.

However, in a liquid market closing out a swap may in fact have lower transaction costs than selling a government bond.

Swaps are subject to counterparty risk,



if the counterparty bank defaults. Whilst collateralisation will limit losses, if this happens a new swap will need to be put in place at potentially higher cost (replacement risk) or the hedge lost.

Under an interest rate swap, the receiver of the fixed interest rate will need to pay a floating interest rate to the counterparty. To the extent that there is investment risk in the assets that are used to generate the floating rate (e.g. cash or other assets), the swap will not mitigate these risks, whereas a government bond portfolio is intrinsically low risk from a credit standpoint.

If the swap interest rate curve moves differently to the government bond interest rate curve, this can create a basis risk, which could lead to a mark to market loss.

The mandate may prohibit the use of derivatives

Other valid methods of hedging interest-rate risk were also given credit. Credit was given where an advantage listed for one method was instead described as a disadvantage of the other (and vice versa).

- Q7** (i) Exchange Traded Funds (ETFs) are the “closed-ended” investment trust equivalents of (mutual) Index Funds.

An ETF represents shares of ownership of a unit investment trust which holds portfolios of stocks, bonds, currencies or commodities.

The investor purchases the shares on a stock exchange in a process identical to the purchase or sale of any other listed stock.

The ETF's performance tracks an underlying index, which it is designed to replicate.

Although the first ETFs tended to track broad market indices, more recent ETFs have been developed to track sectors, investment styles, fixed income, global investments, commodities and currencies.

ETFs will not exactly replicate index performance due to tracking error. This is due to differences in composition, management fees, expenses and handling of dividends. However, in practice ETFs track markets closely.

In general, management fees levied are low.

The ETF price should remain close to Net Asset Value. If not, arbitrage opportunities will exist.

- (ii) The portfolios are aimed at long-term accumulation of contributions and reinvested income with no fixed target value to achieve.

As the proceeds will not be drawn on for many years, volatility of portfolio value in the accumulation period is not a particular concern (and “pound / cost averaging” of regular contributions means that periods of depressed asset values can be beneficial)

Given the planned use of the accumulated funds, investment in ‘real’ assets would seem appropriate.

Based on historical returns, longer-term investment in cash or fixed interest assets would appear to be inappropriate for these portfolios during their accumulation period. However, as the beneficiaries approach maturity, it may be appropriate to transfer the accumulated funds into such asset classes in order to safeguard their value against market fluctuations.

So, during the accumulation period equity or property investment (including infrastructure) would seem most appropriate. However, given the “modest” size of the planned contributions it will be important to consider how diversification of holdings can be achieved. It is also important to consider the costs of investment and any minimum investment considerations that may be encountered.

There are no indications that a restriction to domestic assets is necessary, particularly if passive collective investment is to be used, but again the issues of cost and diversification need to be considered.

However, it would also be appropriate to consider the risk appetite of the beneficiaries, to ensure that the assets chosen met their needs

- (iii) Given the focus on equities and property, suitable vehicles would be unit trusts and investment trusts (including REITs for property investment).

However, while these will generally offer a suitable degree of diversification of the underlying holdings, they can incur significant management costs and, possibly, minimum investment levels that would be too high for the modest contributions planned. Using insurance vehicles to access these collective investments will add to the cost burden and may limit the flexibility of contributions in size and frequency.

For all these reasons, it is likely that “passive” investment will be most appropriate. The fact that this is a “retail” investor with, presumably, little investment expertise supports this view.

Since diversification and cost are the key considerations, use of Exchange Traded Funds to access the chosen asset classes would seem appropriate. For many “passive” index-tracking ETFs, annual management charges of 0.1% or

less are levied, although there will usually be additional charges for the “platform” that provides the trading and hosting of the funds.

While there are no specific taxation issues identified in the question it would clearly be appropriate to consider any local tax-favoured instruments and the impact of income and capital gains taxes on beneficiaries and donors. In some jurisdictions, there may also be tax issues in respect of the transfer of funds between parties, so that the use of vehicles such as trusts may be appropriate.

Relevant points raised under parts (ii) and (iii) were given credit irrespective of which part of the answer they appeared in. Credit was given for consideration of relevant issues rather than the precise conclusions reached.
---

## **END OF EXAMINERS' REPORT**