

INSTITUTE AND FACULTY OF ACTUARIES



EXAMINATION

26 September 2016 (pm)

Subject SA6 – Investment Specialist Applications

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 must not start writing your answers in the booklet until instructed to do so by the supervisor.*
3. *You have 15 minutes of planning and reading time before the start of this examination. You may make separate notes or write on the exam paper but not in your answer booklet. Calculators are not to be used during the reading time. You will then have three hours to complete the paper.*
4. *Mark allocations are shown in brackets.*
5. *Attempt all four 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) Describe what is meant by Quantitative Easing (QE). [5]
 - (ii) Explain how QE might affect inequality of wealth within an economy. [4]
 - (iii) Explain the likely impact of QE on underfunded pension schemes in the context of part (ii). [3]
- [Total 12]

2 A derivatives trader in a hedge fund has judged that the stock market, having reached all-time high levels several times in recent months, has become very over-valued. He considers that:

- the stock market is unlikely to reach a new all-time high.
- the correction that he expects will result in the market reaching the low levels of seven years ago, and
- he wants to go short in the market by selling futures.

- (i) Describe the THREE different types of order that he could give to his derivatives broker in order to implement a futures trade consistent with his view. [6]

A recently qualified actuary working at the hedge fund has suggested using volatility derivatives as an alternative to selling futures.

- (ii) Explain how volatility futures might be used to gain exposure to a downside movement in the stock market. [7]
 - (iii) Discuss why TWO other volatility derivatives might be used instead. [4]
 - (iv) Propose, with reasons, TWO other types of derivative strategies that could be used instead of selling futures. [6]
- [Total 23]

- 3 An Investment Consultant is reviewing the investment policy of a £1bn UK defined benefit pension scheme with a FTSE 100 sponsor and which is closed to future accrual.

The Investment Consultant has been asked to comment on the Trustees' risk appetite as well as carry out an asset liability modelling (ALM) exercise.

- (i) Outline the factors that will influence the Trustees' risk appetite. [9]
- (ii) Describe the difficulties in using historic data to set assumptions for future asset returns for the ALM exercise. [7]

Following completion of the review, the Trustees of the pension scheme decide to increase the interest rate and inflation hedge ratio significantly by constructing a gilt matching portfolio using repo.

- (iii) Describe a gilts plus repo approach to liability hedging. [8]
- (iv) Describe the collateral requirements over the life of the gilt repo hedge, assuming repos are traded under Global Master Repurchase Agreements ("GMRAs"). [6]

Soon after the hedge ratio increase has been completed, the sponsor covenant weakens and the Trustees decide to protect themselves against falling interest rates by buying receiver swaptions to cover any remaining interest rate risk.

The premium for a European receiver swaption of term T on a swap with maturity N can be calculated using Black's model:

$$P(T)L A_{\overline{N}}[X\Phi(-d_2) - F\Phi(-d_1)]$$

- (v) Define all terms used in the formula given above for Black's model. (As definitions for $\Phi(x)$, d_1 and d_2 are provided below there is no need to define these.) [2]

$\Phi(x)$ is the standard cumulative Normal distribution and:

$$d_1 = (\ln(F / X) + (\sigma^2 T / 2)) / \sigma\sqrt{T}$$

$$d_2 = (\ln(F / X) - (\sigma^2 T / 2)) / \sigma\sqrt{T}$$

- (vi) Calculate the premium payable at outset for a receiver swaption that satisfies the following parameters:
- notional value £200m
 - one year option on a 30 year par interest rate swap (with annual coupon)
 - one year spot interest rate is 1%

- current at-the-money forward (ATMF) rate 3%
- receiver strike 2.5%
- lognormal implied volatility of one year forward rates 30% (assume no skew)

[4]

(vii) Draw a pay-off chart for the value of this European receiver swaption:

- (a) immediately after the purchase date.
- (b) at maturity.

[4]

(viii) Describe the impact on the swaption based strategy of interest rates:

- (a) rising by 1% the day after the trade.
- (b) falling by 1% the day after the trade.

[4]

(ix) Discuss what actions the Trustees may take under a scenario where interest rates have changed significantly.

[6]

[Total 50]

4 Discuss the advantages and disadvantages for UK pension funds and insurers of investing in a portfolio of emerging market inflation-linked sovereign bonds.

You should assume that the allocation is funded from UK inflation-linked bonds that are being held both as low volatility and liability matching assets.

[15]

END OF PAPER