Institute of Actuaries of Australia

2011 PART III EXAMINATIONS

Subject Title: **C1**
Investments

Date: **Wednesday 27th April 2011**

Time**: 9:15 am – 12:30 pm**

Time allowed: Three (3) hours plus fifteen (15) minutes of reading time

Instructions: Each new question (but not each section of a question) must be commenced in a new answer book.

Number of Questions: **Five** (5)

Question	Marks
1	18
2	22
3	20
4	20
5	20
Total	**100**

Candidates are required to answer ALL questions.

This paper has 7 (seven) pages (excluding this page).

INSTITUTE OF ACTUARIES OF AUSTRALIA

COURSE 1 INVESTMENTS **APRIL 2011 EXAMINATIONS**

Answer all 5 questions.

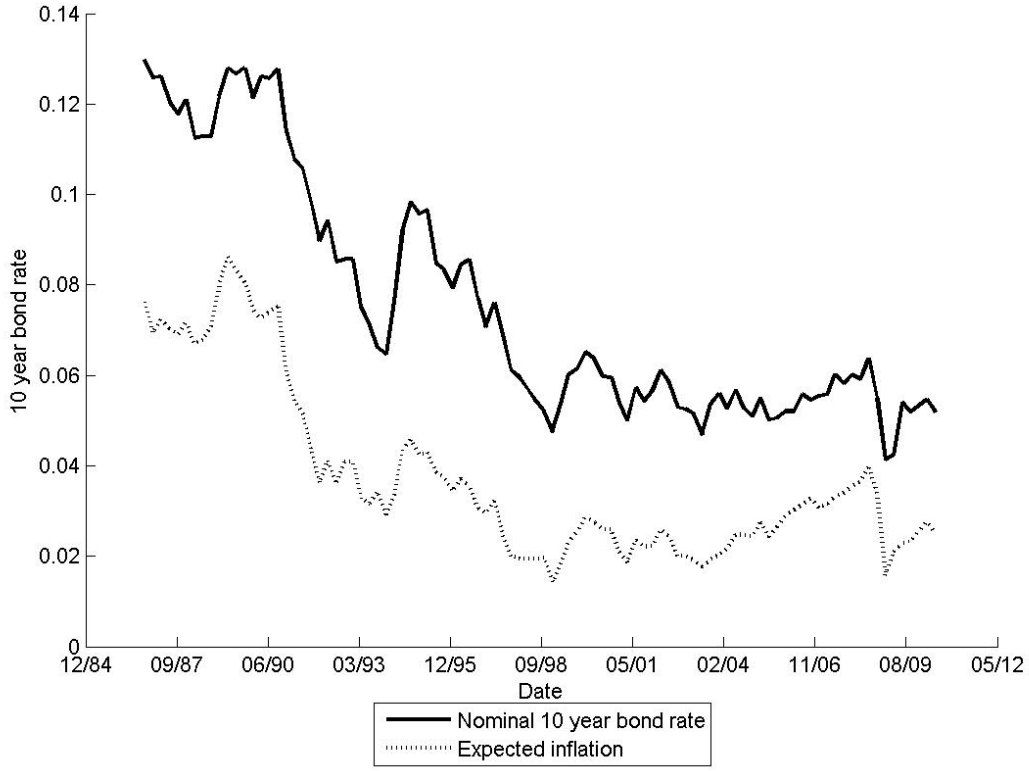
QUESTION 1 **(18 Marks)**

You are the actuary to an Australian superannuation fund providing salary-related benefits. Your work involves investment strategy and its relationship with the liabilities. In particular you are interested in asset classes that may provide a hedge for the liabilities.

Index-linked bonds (ILB) are bonds issued by the Australian government which are thought to provide a natural hedge for the liabilities. They pay a coupon expressed as a fixed percentage of their outstanding principal. The outstanding principal is indexed to CPI. The average yields on ILBs r_t at time t are related to yields on nominal bonds i_t by means of the relationship

$$i_t = r_t + \pi_t \qquad \text{equation (1)}$$

where π_t is the expected level of CPI increase over the term of the bond. The nominal ten year bond rate and expected inflation rate are shown in the graph below. Dates on the horizontal axis are given in the form MM/YY.



Source: Reserve Bank of Australia

'Inflation' in this question refers to price inflation as measured by the CPI.

(a) Explain the relationship in equation (1) between yields on ILBs and nominal bonds given in the graph above. What does the difference between yields on nominal bonds and ILBs of equal duration represent? (2 Marks)

(b) Explain the difference between actual (i.e. realised) inflation, and the expected inflation implied by π_t above. Do these two measures of inflation have to be equal in the long term? (3 Marks)

(c) The Fisher hypothesis suggests that the real yield r_t in equation (1) is stationary (i.e. has a mean and other statistical properties that do not change over time), and statistically independent of π_t. If this were true, what would be the implications for:

- valuing and hedging liabilities?
- modelling ILBs as an asset class?

(7 Marks)

(d) The 'Golden Rule' of economic growth[1] suggests that real interest rates are governed by real GDP growth. Is this consistent with the Fisher Hypothesis?

(2 Marks)

(e) Discuss the factors that might prevent the Fisher Hypothesis from holding in practice. (4 Marks)

[1] http://www.treasury.govt.nz/publications/research-policy/wp/2002/02-04/05.htm

QUESTION 2 **(22 Marks)**

You are a financial strategist for a major diversified Australian mining company. The company is a producer of coal, iron ore, and other minerals for both domestic and export markets. You are considering ways of exploiting the derivative markets that are being developed for these commodities.

Your modelling framework is to regard the company's mineral reserves and current production as its assets, with each type of commodity as a separate asset class. Mineral reserves may be valued as a *real* option to exploit reserves, exercisable when the benefits of production exceed the costs of production.

Your aim is to optimise the value of the company, including its mineral reserves. This is to be achieved by appropriate levels of production for each commodity, and by managing exposures to each commodity with the help of derivatives. This process is thus similar to asset allocation.

Option pricing will therefore be an important aspect of building an asset model. Many option pricing models exist (apart from the conventional Black Scholes model), but they all require:

- Identifying a dynamic process for modelling the commodity prices; and
- Calibrating the parameters (e.g. volatility) of the model by reference to historical or current data.

Your approach is thus one of *tactical* asset allocation, taking into account all information at the company's disposal.

(a) Suggest appropriate objectives and constraints for your strategy. (4 Marks)

(b) Discuss what control variables are available to achieve your objectives. (3 Marks)

(c) Discuss what features of your model of commodity prices that you would regard as important. (6 Marks)

(d) Describe how you would use your commodity price model to assess and implement asset allocations, and any other information you would need. You should consider how financial option contracts as a tool in managing exposures may be integrated into your modelling. (7 Marks)

(e) What informational advantages might the company enjoy? (2 Marks)

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QUESTION 3 **(20 Marks)**

You are a member of an Australian superannuation fund's Investment Strategy Committee. The Committee acts as a committee of the Board of Trustees of the fund. Its role is to discuss investment issues for the purposes of making recommendations to the Board on the appropriateness of the fund's current strategy and changes to it. The fund's current strategic asset allocation is as follows:

	Australian	Ex-Australian
Listed shares	20%	20%
Listed REITs	5%	5%*
Direct property	5%	5%*
Direct infrastructure	5%	5%*
Government fixed interest**/***	10%	10%*
Non-Government credits**	5%	5%*
Total	50%	50%

*Fully hedged back to AUD.

**Are both open as to term, so may effectively include cash.

***Government may include sovereign or state exposures and exposures carrying their effective backing.

The committee has the following issues on the agenda for its next meeting:

- Reduce its Australian REIT exposure to nil and change its ex-Australian REIT exposure to global REIT and listed infrastructure to the level of 10%.
- Create a specific cash exposure of 5% and:
  - Reduce its Australian Government fixed interest exposure to 5%, or
  - Reduce its ex-Australian Government interest exposure to 5%, or
  - Merge both exposures to a global Government fixed interest exposure to 15%, or
  - Create a global Government fixed interest credit of 15% and a global non Government credits exposure of 10% by collapsing both the Australian and ex-Australian mandates into it.

(a) Set out arguments for and against the REIT proposal. Include considerations of the current structure of REIT and infrastructure markets. What other decisions, if any, might such a move entail? (8 Marks)

(b) Comment on the extent of any cash exposure that might arise under the current SAA. Under what circumstances might a specific cash exposure make sense for the fund? Set out arguments for and against the various fixed interest proposals (this does not include cash). Include considerations of the current structure of bond markets. What other decisions, if any, might such a move entail?

(12 Marks)

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QUESTION 4 **(20 Marks)**

A conglomerate has a small subsidiary operating in the branded goods sector. The conglomerate is contemplating a corporate transaction that might involve the sale of the subsidiary in 12 months time and wants to investigate ways of locking in the return it currently expects to receive on the subsidiary at the time of sale.

The conglomerate's Treasury analysts have deduced the following relationship for modelling the long term performance of the listed branded goods sector:

r(bgs) = 0.2 x r(c) + 0.2 x i + 0.5 x r(m)

where

r(bgs) = return on branded goods sector

r(c) = return on cash

i = rate of consumer inflation, and

r(m) = return on the S&P/ASX 200 Price Index.

The analysts are considering using share price index futures for the purpose of ensuring the sale price as envisaged above.

(a) How could share price index futures be used for this purpose? Ensure your answer refers to the formula above and specifies the amount of the transaction as well as whether futures are bought or sold. (3 Marks)

(b) What assumptions and shortcomings would this be subject to and what risks would it expose the conglomerate to? (9 Marks)

(c) How might the overall hedging process be improved? What risks in (b) would your suggestion address? (4 Marks)

(d) Assuming the transaction were completed successfully, what courses of action would be available to the conglomerate to deal with the sale proceeds? How might an investor in the conglomerate react to these suggestions? (4 Marks)

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QUESTION 5 **(20 Marks)**

On 15th December 2010, Origin Energy announced they had successfully bid for and acquired Integral Energy and Country Energy from the NSW State Government, along with GenTrader Rights from Eraring Power Station. The transaction was worth $3.25 billion, and was financed using $3.3 billion of debt facilities. The Board and Senior Management have announced they will raise equity capital in relation to this transaction.

By purchasing Integral Energy and Country Energy, Origin Energy has increased its retail customer base by over 50% to 4.6 million. The acquisition of GenTrader Rights means Origin Energy will receive revenues on power output from a number of NSW power generators. In return, Origin Energy will be responsible for the fixed and variable operations and maintenance expenditures. The power plants remain the government's property. The power plants involved under the current arrangement are predominantly black coal and gas, with one wind farm.

You have been hired in the capacity of an external financial consultant to provide advice on their upcoming equity raising. The potential equity raising will be in the form of a pro-rata rights issue. Under the pro-rata rights issue arrangement, existing shareholders may purchase additional stocks in proportion to their existing holdings.

(a) What are three key factors you would advise the Origin Energy Board to consider in deciding the size of the equity rights issue? (4 Marks)

(b) The three key risk groups faced by Origin Energy in purchasing Integral Energy, Country Energy and the Eraring GenTrader Rights are Operational Risks, Business and Market Risks and Legislative Risks. For each key risk group, specify its nature in the context of the power generation asset management, operation and general market environment. (6 Marks)

(c) Discuss, with reference to (a) and (b), how you would allocate the new equity capital into the individual components of the power assets acquired in this transaction. (5 Marks)

(d) The Board has asked you to review their long-term equity based remuneration policy for their senior executives in light of the significant purchase of these power assets. State why performance measurement for managing power assets differs from managing a normal investment portfolio. Hence, explain two performance measures you will include in the performance hurdles which the executives will need to exceed to qualify for the rewards. Do not include measures such as annual returns or volatility. (5 Marks)

END OF PAPER

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