Institute of Actuaries of Australia

2006 PART III EXAMINATIONS

Subject Title: **Course 1 Investments**

Date: **Monday 30 October 2006**

Time**: 9:15am to 12:30pm**

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	20
2	20
3	20
4	20
5	20
Total	**100**

Candidates are required to answer <u>ALL</u> questions.

This paper has 7 pages (excluding this page and the blank back page).

INSTITUTE OF ACTUARIES OF AUSTRALIA

COURSE 1 INVESTMENTS **NOVEMBER 2006 EXAMINATIONS**

Answer all 5 questions.

QUESTION 1 **(20 Marks)**

The stability of world financial markets in recent years is reflected in low interest rates relative to historical levels, coupled with strong GDP growth. In its 2006 *Financial Stability Review*, the Reserve Bank comments:

> "Notwithstanding these favourable outcomes, there continue to be a number of puzzles regarding the pricing of risk in the financial system. In global capital markets these include the persistence of low long-term bond yields and compressed credit risk premiums. Both these phenomena reflect, in part, the *ex ante* excess global supply of saving over investment and an associated 'search for yield'. They also reflect an apparent optimism by investors that inflation will remain low and economic conditions will remain generally stable."

(a) Discuss in what sense interest rates may be regarded as historically low. (1 mark)

(b) Suggest reasons why interest rates may be presently low. (2 marks)

(c) Suggest reasons why credit risk premiums may be presently low. (2 marks)

(d) Discuss in broad terms the effect that low interest rates may have on investment strategy. (2 marks)

(e) Are there any concerns that you would raise with the effects you identify in (c)? (2 marks)

At a particular time, the par yield curve and the spot curve for Commonwealth Government securities have the following shapes:

Yield p.a. convertible semi annually

maturity (years)	1	2	3	4	5	6	7	8	9	10
Par yield	3.27%	3.87%	4.32%	4.81%	5.26%	5.53%	5.70%	5.80%	5.85%	5.86%
spot	3.30%	3.93%	4.42%	4.95%	5.45%	5.76%	5.95%	6.06%	6.10%	6.10%

(f) Suggest possible reasons for the shape of the curves. (2 marks)

(g) Describe briefly the general relationship between the par yield and spot yield curves. (2 marks)

(h) Calculate the 1-year forward rates implied by the above for terms 1, 2…9 years and suggest possible reasons for the shape. (5 marks)

(i) *Assuming no short term movement in the yield curves*, suggest possible strategies you would consider to exploit your analysis in (h). (2 marks)

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QUESTION 2 **(20 Marks)**

You are establishing a company to purchase and operate a VHF television licence in a well developed economy. Your financial advisers have adopted a Discounted Cash Flow (DCF) model for valuing the licences, applying a discount rate representing the opportunity cost of capital. This compensates investors for the time preference of receiving income sooner rather than later. The cost of capital for a particular project is the minimum expected rate of return on an investment required by the providers of debt or equity for that particular project.

The weighted average return required by the providers of debt and equity is the Weighted Average Cost of Capital (WACC). The conventional specification of WACC is:

$$WACC = R_d(1 - T_c)\frac{D}{V} + R_e\frac{E}{V}$$

where:

R_d is the cost of debt, before taxes. For the purposes of our calculations, we have calculated the cost of debt, based upon a sound credit rating and a conservative 150 basis point spread over and above the yield on a 5 year bond.

T_c is the corporate tax rate.

D is the market value of (interest bearing) debt. We have reviewed the level of gearing D/V for our sample of international companies and historically. Our sample produced a mean market gearing figure of 41%.

V is the market value of the firm, $D+E$

R_e is the cost of equity.

E is the market value of equity.

Within this specification of WACC, the cost of equity is specified under the Capital Asset Pricing Model (CAPM) as:

$$R_e = R_f(1 - T_i) + \beta_e.PTERP$$

where:

R_f is the risk free rate of interest. The typical financial instrument to use for an assessment of the risk free rate is a long-dated government bond. Conceptually, the maturity of the selected government bond should match the maturity of the investment or calculation under consideration

T_i is the investor tax rate. A comprehensive analysis of the mix of investors in the market and their tax status has been made. From this, we have derived an average investor tax rate estimate of 28%.

β_e is the equity beta. Drivers of the equity beta are the asset beta and gearing. An equity beta is a measure of the relationship between movements in a company's share price and movements in a share market index. It is used as a measure of the relative degree of risk associated with investment in a particular company. Equity

betas encompass the effects of financial risk as well as operating risk, while asset betas only incorporate the effects of operating risk (i.e. the riskiness of the business itself). Asset betas β_a are independent of financing, and the relationship between equity and asset betas is $\beta_e = \beta_a\left(1+\frac{D}{E}\right)$.

$PTERP$ is the expected post tax equity risk premium. Our estimate for the ERP input is based on extensive research on government bond yields, investor tax rates, and equity market returns (comprising dividends, imputation credits and capital gains). The data set covers several decades extending back to 1926. Based on this data, the research has in recent years provided a point estimate for the ERP in the range of 7.5% to 8.0%.

Derivation of Discount Rates

The parameters underlying the WACC, as explained above, may be assessed at the present time as follows:

Component	
Government 5 year bond rate	6.3%
Post Tax Equity Risk Premium	8.0%
Debt Margin	1.5%
Investor Tax Rate	28%
Corporate Tax Rate	30%
Asset Beta	0.63
Debt / (Debt + Equity)	41%
Equity Beta	1.06
Cost of Debt	7.8%
Cost of Equity	13.0%
WACC estimate	9.9%

(a) Explain the rationale for the use of the WACC as a discount rate for valuing the television licence. (2 marks)

(b) Discuss the version of the CAPM that has been applied to assess the return on equity. (2 marks)

(c) Suggest reasons why two forms of beta (asset beta and equity beta) have been considered in the analysis, and explain the relationship between the two. (4 marks)

(d) Discuss the appropriateness of the derivation of the PTERP. (4 marks)

(e) Describe fully how you would expect the resulting WACC to be applied in assessing a value for a television licence on the basis of its projected cash flows, indicating any difficulties that you may encounter in practice. (4 marks)

(f) Suggest alternative approaches of valuation that circumvent the difficulties you identify in (e). (4 marks)

QUESTION 3 **(20 Marks)**

You are an adviser in the infrastructure development section of an investment bank, which has been approached by a developing country to provide financing for its water supply.

The financier must agree on a plan for suitable dams and infrastructure, and to meet the costs of its construction. In return the financier will be given the right to charge for water usage in perpetuity at an agreed maximum price, once storage levels have reached a particular level. However there are severe penalties for undersupply.

Preliminary studies have indicated that:

- There are several suitable sites for dams, each with a distinctive catchment area.
- For each possible site, the rates of water inflow and its distribution according to season have been assessed.
- Construction costs for each dam have also been assessed, as well as ongoing operational costs.
- The demand for water, according to season and to price, has also been modelled statistically.

The financier suggests that its task may be approached as an asset-liability model, where the dams are the 'asset classes', each with a distinctive distribution of water inflow that provides revenue. The 'liabilities' arise from the demand for water at a particular price.

(a) Explain how the financier's asset-liability modelling for the proposed development differs from conventional asset-liability modelling. (4 marks)

(b) From the viewpoint of the country's water regulator, explain why the price charged by the financier must be subject to a cap. (2 marks)

(c) Suggest possible investment objectives and constraints for the financier (either mathematically or in words). (6 marks)

(d) Describe broadly the process you would adopt to assess whether the investment objectives are met by a given configuration of dams and water price. (4 marks)

(e) Discuss how you would approach the pricing of water when the scheme is operational. (4 marks)

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QUESTION 4 **(20 Marks)**

You are the CFO of a trustee for a large retail superannuation fund which offers a range of investment options to its members. You have been asked by the Board to rationalise the fund's investment structure. Two structures are being canvassed:

(i) Retention of the existing structure, under which a particular investment manager is appointed to manage each investment option. Mandates are given to both balanced and specialist managers.

(ii) A new structure under which all investments are managed by an *implemented consultant* under a multi-manager, multi style arrangement. The consultant would be responsible for the selection of specialist managers and the allocation of funds to each manager.

(a) Describe how investment options might be designed under structure (ii). (2 marks)

(b) Discuss the relative strengths of the two structures. (7 marks)

(c) Discuss the relative weaknesses of the two structures and how they may be mitigated in practice. (7 marks)

(d) Discuss what performance benchmarks you would recommend, and how you would report the performance achieved under the two structures. (4 marks)

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QUESTION 5 **(20 Marks)**

You are the investment officer of a large superannuation fund that employs specialist active managers for most asset classes. One of your responsibilities is the reporting of managers' quarterly performance to the trustee Board. This is benchmarked against the appropriate indexes.

A member of the Board has suggested that tax should be taken into account in the quarterly performance reporting. Your research of the issue has provided two alternative approaches to assessing after tax performance:

Conventional approach

$$After\ tax\ return = \frac{1}{APV}\left[(UCG + RCG)\times\left(1-\frac{2}{3}t_s\right)+\left(OI+\frac{FD_A}{1-t_c}\right)\times(1-t_s)\right]$$

where:

- RCG is realised capital gains
- UCG is unrealised capital gains
- FD_A is franked dividends
- OI is income other than franked dividends
- t_c is the corporate tax rate applicable to franked dividends
- t_s is the superannuation tax rate of 15%
- APV is the average portfolio value (based on fund accounts, with provision for tax on UCG).

AIMR Approach

The performance standards of the *Association of Investment Management and Research* propose an alternative approach

$$After\ tax\ return = \frac{1}{\overline{APV}}\left[UCG + RCG\times\left(1-\frac{2}{3}t_s\right)+\left(OI+\frac{FD_A}{1-t_c}\right)\times(1-t_s)\right]$$

where

- $\overline{APV}$ is the average portfolio value (based on fund accounts, without provision for tax on UCG).

(a) Discuss the factors that would affect the Board's preference for reporting after-tax, as opposed to before-tax, returns. (3 marks)

(b) Explain the rationale of the conventional approach to after tax performance. (3 marks)

(c) Explain the rationale of the AIMR approach to after tax performance and in what circumstances it would be meaningful. (3 marks)

(d) Discuss the benefits and limitations of the two approaches in assessing overall fund performance or a manager's performance. (5 marks)

(e) Suggest how some limitations of the AIMR approach may be overcome in practice. (3 marks)

(f) Discuss how the profit/loss from derivatives should be accounted for under the two approaches, and whether derivative strategies should depend on the approach adopted. (3 marks)

END OF PAPER

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