INSTITUTE OF ACTUARIES OF AUSTRALIA

COURSE 1 INVESTMENTS **APRIL 2011 EXAMINATIONS**

Marking Guide

Level of difficulty

Question	Units	Learning Objectives	Knowledge & Understanding	Straight-forward Judgement	Complex Judgement	Total Marks
Q1(a)	1	1.1	2			2
Q1(b)	1	1.1, 2.1		3		3
Q1(c)	1, 2	1.1, 4.6			7	7
Q1(d)	1	2.1		2		2
Q1(e)	1	2.1			4	4
Q2(a)	2	4.1		4		4
Q2(b)	2	4.2	3			3
Q2(c)	2	4.3, 4.4			6	6
Q2(d)	2	4.6			7	7
Q2(e)	1	2.1		2		2
Q3(a)	2,3	4.7, 5.1	3	3	2	8
Q3(b)	3	5.1 to 5.5	3	5	4	12
Q4(a)	1	3.1	2	1		3
Q4(b)	3	5.5	3	2	4	9
Q4(c)	3	5.5	2	2		4
Q4(d)	1	1.1	1	2	1	4
Q5(a)	1	1.1	2.5	1.5		4
Q5(b)	3	5.5		4	2	6
Q5(c)	3	5.3 to 5.5			5	5
Q5(d)	3	5.1 to 5.5		1	4	5
Total			**21.5**	**32.5**	**46**	**100**

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Answer all 5 questions.

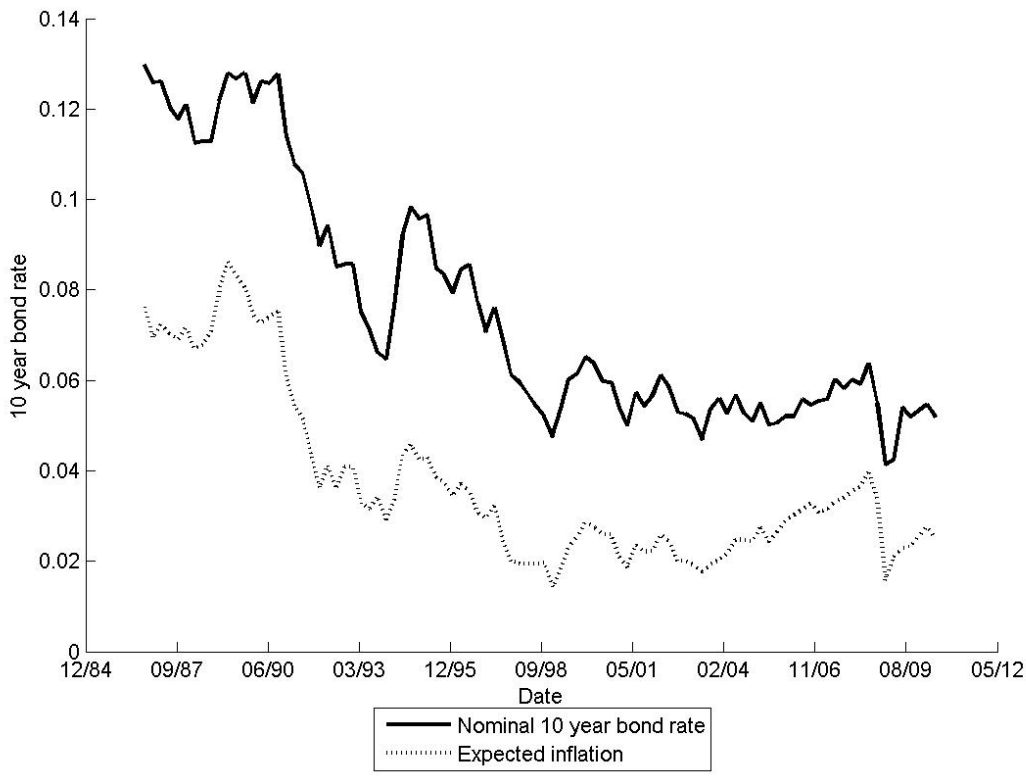
QUESTION 1 **(18 Marks)**

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 1 Solutions (18 marks - 2KU, 5SJ, 11CJ)

(a) Explain the relationship (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?

The yield on an ILB at a particular time is calculated on its projected cash flows without allowance for future CPI increases, using the fixed coupon rate expressed as a percentage of the principal outstanding. It is therefore a real yield. If allowance for future inflation were made, then the nominal yield would be the real yield plus the future rate of inflation expected.

The difference between yields on nominal bonds and ILBs of equal duration would thus represent the allowance for future inflation that is priced by the market.

Marking Guide: (2 marks KU)

- Explain real yield (1 KU)
- Difference between nominal and real yield (1 KU)

(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?

Actual inflation is that which affects, from time to time, the cash flows actually paid on ILBs, or as benefits. Expected inflation is relevant for valuing or pricing those cash flows or benefits at a particular time, and is ultimately an assumption.

The assumption implied in market pricing can be derived from (a) above, and this is an efficient estimate to the extent that the bond market is efficient. [An alternative way of measuring expected inflation is by taking surveys (e.g. of economists), but this is a subjective approach.]

There is no compelling reason why inflationary expectations must be correct, even in the long term. This is a similar situation to current bond yields being predictors of future cash rates: under the pure expectations theory of the yield curve, they are the best (i.e. efficient) estimates of future cash rates based on available information. But they need not be correct in the long term.

Marking Guide: (3 marks SJ)

- Explain actual and expected inflation (1 SJ)
- Measurement of expected inflation (1 SJ)
- Efficient estimates of expected inflation (1 SJ)

(c) The Fisher hypothesis suggests that the real yield r_t is stationary 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?**

The real yield curve serves as the key for valuing ILBs, and by extension all CPI related benefits on a market-consistent basis.

If it were stationary, then it may be expected that ILB prices and benefit valuations cannot, in real terms, drift systematically away from their long term levels as a result of changing market conditions.

If in addition the real yield has a short period for reverting to its long term level, then hedging CPI related benefits would be unnecessary in the long term.

This should be reflected in modelling ILBs as asset class. The nominal yield on ILBs would be long term expected CPI increases plus the real yield.

Therefore the long term return on ILBs should be the expected long term increase in CPI plus the stationary expected real yield.

The volatility of ILB returns would be governed by the volatility of CPI and real yields only, and of course by the duration of ILBs as a whole. ILBs as an asset class would therefore be quite unlike equities, or even nominal bonds.

<u>Marking Guide: (7 marks CJ)</u>

- Real yield as market-related discount rate (1 CJ)
- Implications of stationarity of real yield (1 CJ)
- Implications for hedging if fast reversion of real yields (1 CJ)
- Expected yield on ILBs (1 CJ)
- Expected return on ILBs (1 CJ)
- Implications for volatility of ILB returns vs. other asset classes (2 CJ)

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

Yes. The Fisher Hypothesis suggests that the real interest rate, or real yields, are independent of monetary effects like inflation and depend only on real effects, like real GDP growth.

<u>Marking Guide: (2 marks SJ)</u>

- Relationship to monetary effects (1 SJ)
- GDP growth as real effect (1 SJ)

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

Real yields on ILBs are observed on a before-tax basis. It is not clear whether the Fisher Hypothesis should be tested on an after-tax basis and, if so, at what level of taxation.

For real interest rates to be independent of inflation, this must require monetary policy (i.e. nominal interest rates) to respond solely to inflation. This is violated when monetary policy is directed to affecting the real interest rate as well (e.g. when monetary policy is intended to have effects on real GDP or on the exchange rate).

Finally, not only must monetary policy be directed solely to control inflation, which is a short term aim, but the market must be prepared to believe and price this feature over the long term. That is, it must be credible that monetary policy should be persistent.

Marking Guide: (4 marks CJ)

- Tax as complication (1 CJ)
- Monetary policy and its real effects (2 CJ)
- Permanence of monetary policy for expectation formations (1 CJ)

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)

Solutions Question 2

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

The broad aims are to 'optimise the value of the company, including its mineral reserves'. This may suggest the market value of the company, which may depend on many factors, some of which may be beyond the company's control (such as discount rates for valuing mining projects). A reasonable objective might be to maximise the net assets of the company at current commodity prices and under current financial conditions.

The major constraint is the level of volatility in the company's net assets which might be acceptable to shareholders. Other constraints facing the company are mainly in the means of financing its operations and an acceptable level of indebtedness. It may also face political and physical constraints on production imposed by the infrastructure available.

Marking Guide: (4 marks SJ)

- Objective as net market value or net asset value (2 SJ)
- Volatility as constraint (1 SJ)
- Physical constrains (1 SJ)

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

The obvious control variables are the level of production and the financial management of exposures through derivatives.

Less obvious control variables are the terms of sale of production, and investment in exploration as a means of acquiring future resources.

Marking Guide: (3 marks KU)

- Production as control (1 KU)
- Derivatives as control (1 KU)
- Either pricing or exploration as control (1 KU)

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

The pricing of commodities worldwide is clearly subject to a variety of factors reflecting global demand and supply. These include economic growth (especially in the developing world), the political arena, and climate.

As the model is to be used for tactical purposes, it must be conditioned on a range of observable financial or economic variables that can reflect these changing conditions. The following features should be shown by the model:

- Interactions between commodity prices should be linked to observable financial variables. This is because commodities may be substitutes (aluminium/copper) or complements (coal/iron ore) in world demand.

- Prices also depend on the relative demand and supply, which drives volatility. The pricing model must be able to accommodate situations in which volatility moves drastically, such as predicted in futures markets or by exercise of monopoly power of suppliers. As a major producer, the levels of supply from this company will have significant impact on prices so price elasticity is very important.

- Unanticipated discontinuities in prices should be admissible in the model, as a result of, say, political instability limiting supply.

- Currency needs to part of the model, as the company's operations are multinational, and currency and commodity prices may interact (especially for the AUD).

Marking Guide: (6 marks CJ)

- Drivers of demand/supply (1 CJ)
- Conditioning of modeling variables (1 CJ)
- Interactions between commodities (1 CJ)
- Non-stationary volatility (1 CJ)
- Jump processes for prices (1 CJ)
- Currency (1 CJ)

(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 options may be integrated into your modelling.

It should be noted that the mineral reserves of the company represent themselves a real option for exploitation (i.e. production) and should be valued as such. The value of the option depends on current commodity prices, their volatilities, extraction costs and financing terms.

The commodity pricing model, calibrated to current conditions, should be able to generate distributions of prices in the short term.

A tactical asset allocation strategy is then a rule which stipulates how exposures to different commodities should changes as prices change. This can be derived on a risk/return basis for the company's net assets.

There are however many constraints facing the company in implementing these ideal exposures to commodity classes. The value of mineral reserves held by the company will react in a non-linear fashion to commodity price movements.

This non-linearity may be partly managed by implementing financial options (on a

put basis), but that itself may introduce exposure to interest rate risk. The size of the assets likely to be involved (major producer) means that any put strategy over and above managing non-linearity would have a negative impact on price (i.e. akin to physical sales). These constraints should be allowed for in assessing the asset allocation strategy.

The additional information required is the precise nature of the optionality involved in mineral reserves, and the interest rate exposures tolerated by the company. Note that, unlike some investors, companies may tolerate negative exposures to interest rates.

In integrating options into the model, we don't want to unwittingly allow for arbitrage between the derivative security and the physical security underlying that derivative security. That is, unless there is evidence of persistent arbitrage (extremely unlikely) ensure the derivative model is efficient.

Marking Guide: (7 marks CJ)

- Need for option valuation (2 CJ)
- Price simulation (1 CJ)
- Define asset strategy (1 CJ)
- Optionality behaviour of mineral reserves (1 CJ)
- Use of financial options for managing option like exposure (1 CJ)
- Implications for leverage (1 CJ)

(e) **What informational advantages might the company enjoy?**

As a major producer, the company may:

- Be a price maker, rather than a price taker
- Have access to information on a sizeable part of global mineral reserves.

Marking Guide: (2 SJ)

- Monopoly power (1 SJ)
- Inside information as producer (1 SJ)

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)

Solutions Question Three

(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?

REIT proposal

There are two changes embodied within the REIT proposal:

- Ignoring global infrastructure for the moment, the split between Australian and ex-Australian exposures from 50/50 to an index level of something like 15-20/80-85, and
- The basis change of only REITs to REITs and listed global infrastructure.

On the change in country split the current AA exhibits a home country bias. This might be appropriate on the grounds of the Australian domicile of the fund's liabilities (though overseas assets are fully hedged), which might include tax advantages (tax deferred income), greater familiarity with the nature and structure of the Australian market and lower consequential investment costs. On the other hand, it provides for lower diversification within the REIT sector (generally and gives the exposure of members to the Australian economy).

Also, the Australian REIT sector is heavily concentrated – Westfield stocks account for about 40% of the index, with Stockland, GPT and Mirvac also having substantial market capitalisation. A shift to purely global exposure will (at least in index terms) provide an ability to counter this concentration and improve diversification as well countering the issues identified in the above paragraph.

To the extent that global infrastructure makes its way into this section of the portfolio, it will change its performance and risk profile and improve diversification. At one level listed property and infrastructure are complementary in the sense both derive their economic value from asset usage and their appeal can be somewhat sector- and location–related. While a passive REIT is an earnings pass-through vehicle, subject to distribution policy, infrastructure may be structured as a company or a trust or trust-equivalent. In the former case the earnings/distribution flow-through may be more discretionary. Where a REIT encompasses more than passive rent collection, it may be more like a company.

Other Decisions

Other decisions required include:

- Whether the shift to global REITS and the inclusion of global infrastructure (at the level envisaged) maintain the overall risk-return profile of the previous split REIT exposure within an acceptable tolerance; otherwise the SAA may need to be remodelled
- Whether there will be a sub-allocation between REITS and infrastructure

- The nature of the new mandate/s – active vs passive, insourced vs outsourced, number of managers if outsourced etc
- The extent of any overlap between the global REIT and infrastructure mandate and international equities – there will be a current policy for the ex-Australian REITS but exposures will increase
- Whether the policy governing overlap between A-REITSs and Australian shares needs review, and
- Whether to apply the current full hedging policy for ex-Australian REITs to the new mandates (a fully hedged approach would maintain the current AUD/non-AUD split (85/15)).

Marking Guide: (8 marks, 3 KU, 3 SJ, 2 CJ)

- Diversification impact: Australian vs global, concentrated nature of ARIETs, inclusion of global infrastructure (3 KU)
- Basis change due to inclusion of global infrastructure (1 SJ)
- Four (first 2 marks award as SJ, last 2 marks award as CJ) of: consistency of risk-return profile, allocation between global REITs and infrastructure, nature of mandates, mandate overlaps, currency. (2 SJ, 2 CJ)

(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?

Cash

The extent of any current cash is likely to be episodic (cash inflow is presumably held until invested or pending a cash outflow) and discretionary (for duration management purposes and to the extent of floating rate exposures).

The shift to a dedicated cash exposure would generally be for liability management reasons (recurrent outflows for the period in question, with a possible consequent shortening of liability duration) or a result of the fund wanting to bias its AA – either via an overall shorter duration in its FI portfolio, rather than leaving it as a discretionary decision within the FI portfolio, or a slightly more defensive overall posture. Whether this is the case for this fund is open to question because the increase in cash is being funded out of FI; the fund may, however, be more worried about FI markets more than equity markets for the reasons set out below.

Another reason for having a dedicated cash allocation is to recognise the inevitability of having to hold some cash and therefore making the benchmark more realistic.

FI Proposals

The 4 FI options are:

	Current	Option			
		1	2	3	4
Cash		5%	5%	5%	5%
Aust Govt FI	10%	5%	10%		
Aust Credits	5%	5%	5%	5%	
Ex Aust FI	10%	10%	5%		
Ex Aust Credits	5%	5%	5%	5%	
Global Govt FI				15%	15%
Global Credits					10%

All options reduce no-cash FI exposure. Possible reasons for this are covered under the "Cash" heading.

In terms of interest rate cycles, Australia and Asia (ex Japan) have moved upwards since the GFC and have a normalisation or tightening bias, whereas the rest of the world (except perhaps Canada) are at historic lows, and are borrowing heavily and pursuing loose monetary policies. The medium term path for these countries is likely to increase interest rates.

At a Government level, market capitalisation indices reflect issuance (as well as price) – the biggest issuers take up the largest index shares, all things being equal. Hence increasing ex Australian Govt exposure is likely to increase exposure to the heaviest borrowers (and potentially weaker credits).

Options 1, 2, 3 and 4 carry the consequence or potential of weighting away from Australian Govt issuance and look difficult to justify over the medium term tactical view on interest rate and creditworthiness grounds. On the other hand, they all reduce Govt exposure by 5 percentage points and take account of increased global Govt indebtedness relative to corporate indebtedness.

Options 3 and 4 entail globalising Govt exposures in 3 and Govt and credit exposures in 4. Reasons for doing so include a desire to improve diversification within these sectors or to exploit a richer opportunity set. There has been a general reduction in issuance by Australian Govts, with concerns about market depth. Non-Govt credit markets in Australia are thin by international standards, are generally issued for shorter terms and tend to have greater representation of asset-backed instruments than many other markets. The fund may believe these structural biases are sufficient cause for lowering its weighting to Australian markets.

Other Decisions

Other decisions required include:

- Depending on the option chosen, whether the current FI mandates will be maintained as are and the nature of the new mandate/s – active vs passive, insourced vs outsourced, number of managers if outsourced etc, and
- Depending on the option chosen, whether to continue to apply the current full hedging policy for ex-Australian exposures and whether to apply it to the new global exposures. One perspective of hedged overseas government bonds is that you are effectively just creating a synthetic version of an Australian Government Bond plus some counterparty risk. Unless you are seeking longer durations (possible) or arbitrage (unlikely) why bother?

Marking Guide: (12 marks, 3 KU, 5 SJ, 4 CJ)

- Current cash – episodic, discretionary (1 KU)
- Increase in cash – liability management, risk management (2 KU)
- To a total of 3 marks

Relevant issues (award SJ for first 5 marks awarded, 2 CJ for last 2 points awarded marks (quality of discussion point is 2 CJ))

- Interest rate cycle (1)
- Increases in issuance (1)
- Lesser depth of Australian government market (1)
- Structural features of Australian credit markets (1)
- Diversification vs opportunity set (1)
- Ensure each option is mentioned somewhere (1)
- Quality of discussion (1)
- Add 1 if a student has 6 points above
- Add 2 if a student has 7 points above
- To a total of 9 marks

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)

Question 4 Solutions

(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.

Let V_0 be the current value of the subsidiary
Then, according to the formula, the expected value in a year's time will be
$E(V_1) = V_0\{1 + E[r(bgs)]\} = V_0\{1 + 0.2E[r(c)] + 0.2E[i] + 0.5E[r(m)]\}$
$= V_0\{1 + 0.5E[r(m)]\} + V_0\{0.2E[r(c)] + 0.2E[i]\}$.

The r(c) and (i) components can be likened to a risk free factor, being nominal and real rate variants. The r(bgs) component can be likened to an equity risk premium factor.

Share prices index futures can be used to hedge the component of the expected value of the subsidiary subject to equity market risk, $V_0\{1 + 0.5E[r(m)]\}$, specifically the risk that r(m) is negative.

The conglomerate could sell 12 month index futures to the value of V_0 (no. of contracts = V_0/index level x dollar value of index point) and close them out in a year's time by an offsetting transaction.

<u>Marking Guide: (3 marks 2 KU, 1 SJ)</u>

- Recognise formula covers different (implied) factors (1 KU)
- Identity aspect of transaction that might be hedged by SPI futures (1 KU)
- Nature of transaction (1 SJ)

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

This approach is based on the assumptions that:

- The current value of the subsidiary to the conglomerate and its shareholders is equivalent to the value were the subsidiary listed in its own right – there may be strategic value to the conglomerate or synergies within the conglomerate (e.g. shared services) that would not be captured by an independent listing and shareholders might apply a discount rate in their segment valuations different to that which would apply on a standalone valuation, and
- The price likely to be paid by a buyer of the subsidiary has a similar dependence.

The shortcomings of this approach include:

- Selling a futures contract is equivalent to selling the underlying asset and depositing the proceeds in fixed income for the period. So the best you can hope for if the contract was a perfect match for the security is a fixed income type return for the year, not what the security would have returned. This is because you have deprived yourself of one of the significant contributors to return and that is market fluctuation. From this point of view, the futures strategy is incorrect.
- The formula has been devised as a long term estimate and may not fit the short term for which the hedge is required, and
- The conglomerate will not participate in any market rise – this could be particularly telling if the conglomerate changes its mind about selling the subsidiary.

The risks inherent in this approach include:

- Any basis risk between the stockmarket and the futures market, and
- Any basis risk between the individual company and the branded goods sector.

To ignore such basis risks implies an assumption of efficiency within and between markets.

<u>Marking Guide: (9 marks, 3 KU, 2 SJ, 4 CJ)</u>

Assumptions/shortcomings/risks include:

- Alignment between independently listed valuation and conglomerate's/shareholders'/ buyers' valuations (2 KU)
- Partial hedge only (1 KU)
- Applicability of "long term" formula to 12 month period (1 CJ)
- No participation in market gains (1 SJ)
- Basis risk between stockmarket and futures market and between individual company and sector – converse assumes market efficiency (1 CJ)
- Risks of deciding not to sell (1 SJ)
- Quality of discussion (2 CJ)

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

The domicile of the conglomerate is not mentioned but, to the extent that monetary policy in the domicile seeks to act against inflationary expectations, interest rates could be expected to move in line with expected inflation. Hence short term interest rate derivatives could be used to hedge both the cash and inflation components of the Treasury formula. In both cases the firm would sell futures.

In Australia 30 and 90 day exchange-traded derivatives are available. Positions would need to be rolled over at contract expiry or, in the event, that risks in these areas abate, the firm could exercise some discretion in this regard and thus reduce costs.

On the other hand, the conglomerate may regard the risk involved in their interest rate and inflation exposures as minor and ones they are prepared to accept. In this case it would not seek to hedge these risks.

Some market exposure could be retained overall by using an options approach could be used instead of futures. In the event that prices appreciated, the firm could choose not to exercise its option and so retain the excess of that appreciation over the initial and later margins. For equity market risk, the firm would buy puts on the index; for cash and inflation, the firm would buy puts on futures.

<u>Marking Guide: (4 marks 2KU, 2 SJ)</u>

- Use of short term interest rate derivatives to address cash and inflation elements of formula (1 KU)
- Explaining why STIR derivatives might cover inflation (1 KU)
- Need for position rollover or why the firm might not choose to hedge (1 SJ)
- Use options instead of futures to reduce impact of appreciation loss (1 SJ)

(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?

The sale proceeds could be reinvested, returned to unitholders as a special dividend, used to fund a share buy-back or retained with the conglomerate.

A decision other than to retain the proceeds would assume the proceeds are of sufficient quantum to justify the course of action.

Investors would examine the expected return from each course of action, their own preferences for cash-in-hand vs ongoing investment, the current share price (as guide to the conglomerate's cost of equity, the tax treatment of any distribution/buy-back and the company's plans and need for capital.

Marking Guide: (4 marks 1 KU, 2 SJ, 1 CJ)

- Reinvestment/distribution (1 KU)
- Buy-back/retention (1 SJ)
- Each consideration given above (first SJ, second CJ)

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)

Question 5 Solutions (20 marks)

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

The factors worth considering in terms of the size of the equity rights issue include the following :

- Origin Energy will need to balance the level of equity and debt capital to ensure they are funding their assets in an efficient and cost-effective manner. Idle equity capital is expensive whilst too much debt will bring unnecessary distress to the company.
- Dilution of shareholder capital. If Origin Energy wishes to raise substantial equity capital, they must raise this at a significant discount to the current price. Consequently, this leads to a substantially diluted shareholding with many more units of stocks and hence slower stock price growth.
- Number of other projects requiring financing. The equity raising should ensure the current projects are suitably financed so they can continue to operate in an orderly manner.

Marking Guide (4 marks – 2.5 KU, 1.5 SJ)

- Balance the level of equity and debt capital (1.5 KU)
- Dilution of shareholder capital (1.5 SJ)
- Suitable financing (1 KU)

(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.

The following key risk factors are associated with the acquisition of the three key power assets (in order of importance) :

- Operational risks associated with running the power generators include breakdowns, injuries and outages leading to cost blowouts beyond what is budgeted. Further, these power plants emit significant pollution, leading to potential loss of life and significant risks to the community. (2 marks – SJ)
- Business and market risks associated with competition to gain more customers, obtaining suitable finances to support operations and market volatility of resource and electricity prices may adversely impact on future revenue streams and profit. (2 marks – SJ)
- Legislative risks. These include changes in government legislation such as the introduction of the Emissions Trading Schemes or adverse changes in the GenTrader arrangements with the State Government. As most of the generators are from non-renewable energy, the introduction of ETS will lead to Origin Energy incurring substantial expenses in running these power generators and selling the power output to its customers. (2 marks – CJ)

Marking Guide (6 marks – 4 SJ, 2 CJ)

Note to Markers: Each risk group needs to contain explanation of the general nature as well as a more concrete example relating directly to the power generators or running the GenTrader scheme of selling energy output.

- Operational risks (2 SJ)
- Business and market risks and adverse impact on future revenue streams and profits (2 SJ)
- Legislative risks (2 CJ)

(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.

The allocation of equity capital to be invested into the individual components of the new power assets may be decided using these steps :

- Quantify the approximate risks associated with each component requiring additional financing by considering the extent to which the risks in b.) apply.
- Project the approximate future returns of each component in terms of its potential revenue and profit growth, fixed and variable expenses profile and provisions for unforeseen circumstances.
- Estimate the future cost of debt capital and equity capital by considering economic outlook as well as the health of the capital markets.
- Allocate a greater amount of equity capital into the more risky projects as they are more expensive to finance. Explain use of first two points above in informing this decision.
- Periodically monitor the level of returns generated by each component as well as the efficiency of the initial allocation. Adjust this if necessary.

Marking Guide (5 marks – 5 CJ)

Award 4 marks depending on the extent to which the response corresponds to the above steps.
Award 1 mark for the general logic and flow. (1 CJ)

(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.

Suitable performance measures may include the following (4 CJ) :

- Carbon emission reduction targets. The power generators may need to be upgraded

or periodically maintained so to reduce carbon emissions. This brings additional benefits to the company in terms of showing a "green streak". If ETS goes ahead, reducing carbon emissions may lead to lower costs.

- Power outage targets. As power generators form an essential part of the economy, power outages are generally unacceptable. As power outages occur due to poor maintenance and technical skills, executives should be incentivised to devote time to avoid power outages.
- Customer base growth targets. Origin Energy has purchased Integral Energy and Country Energy which come with a retail, commercial and industrial customer base. Growth of this customer base is encouraged and should be incorporated into the performance incentives scheme.
- Operational expenditure targets. As Origin Energy maintains the power generators and these can lead to substantial capital and maintenance expenditures, a target on such expenditures may motivate executives to wisely deploy funds.
- Injury and lost time targets. Executives should be motivated to uphold work safety targets given staff working in the power generating industry face significant risks in the workplace and off-site.

Marking Guide (5 marks – 1 SJ, 4 CJ)

Award 0.5 marks for each suitable performance measure which is specific to managing power assets.

Award 1.5 marks for each detailed and relevant explanation of why this performance measure enhances executives to delivering shareholder value and environmental benefits.

END OF PAPER