THE INSTITUTE OF ACTUARIES OF AUSTRALIA

INVESTMENT MANAGEMENT **1998 EXAMINATIONS**

PAPER ONE **MODEL SOLUTIONS**

QUESTION 1 **(14 Marks)**

a)(i)

- Has a negative duration, since the value increases with an increase in interest rates, so need "short" exposure to fixed interest (2 marks)
- Hold cash and sell bill & bond futures to match expected $/pt sensitivity to floating and fixed mortgage rates. (1 mark)
- The portfolio is likely to have some "optionality" (skewed impact of interest rates), so either options or dynamic hedging may be appropriate (1 mark)

(To a maximum of 3 marks)

a)(ii)

- As the liability equates to the value of the assets, any asset portfolio is matched by the liabilities (½mark)
- Assets should reflect policyholder expectations (½ mark)

b)(i)

Portfolio

- A portfolio of CPI indexed bonds and annuities (1 mark)
- Expected cash flow best matches the expected liability cash flow at each year of the future – cash flows should be fairly predictable for a large portfolio (1 mark)
- Possibility of some property and/or equities, but only in respect of liabilities longer than available indexed securities (i.e. very long term liabilities) (½ mark)

Problems

- Availability of suitable bonds (depth of market, length of maturities, credit) (½ mark for each point)
- Possible mis-match in the indexation process between assets & liabilities (especially for indexed bonds) (½ mark)
- Updating portfolio when actual experience ≠ expected, liquidity problems (1 mark)
- Mismatch risks when including property and equities (½ mark)

(To a maximum of 5 marks)

Question 1 (continued)

b)(ii)

Portfolio

- Equities plus put-option protection (OR cash plus call option) with a strike equal to the guaranteed floor from time to time.
  (1 mark) (if identify both, additional 1/2 mark)
- The put option protection could be achieved via the purchase of a put with strikes equal to the guaranteed floor from time to time, (1 mark)
  or :
- By dynamic hedging to replicate the option payoff, or by an approach such as constant proportion portfolio insurance (1 mark)

Problems

- Cost of option protection, cost of rolling options (1 mark)
- Choice of option expiry date, recognising that frequent rolling of short-maturity options can be expensive (½ mark)
- Risk of mismatch from dynamic hedging (e.g. as result of large market movements) (1 mark)

(To a maximum of 5 marks)

QUESTION 2 **(17 Marks)**

a)

- AR(4) model with drift on the change in yields (1 mark)
  OR
- ARIMA(4,1,0) model on yields (1 mark)
- ARIMA model (½ mark)

(To a maximum of 1 mark)

b)

- Buy as yields near the top of the range, Sell as yields near the bottom of the range (1 mark)

Question 2 (continued)

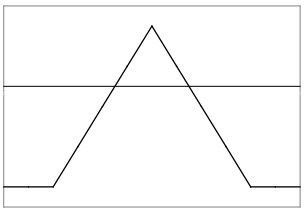
c)

- Short straddle + OTM Put and + OTM call (+OTM Put - ATM Put - ATM Call + OTM Call), aka "sold (short) butterfly" (2 marks)
  OR
- Short strangle + OTM Put and + OTM Call (with OTM strikes wider than the strangle strikes) aka "sold (short) condor" or "sold (short) iron butterfly" (2 marks)
- Short strangle or straddle (without the extra OTM options) (1 mark)
- No marks for a call spread or other inappropriate strategy
- Students can adequately describe the strategy either by giving its name or by identifying the calls/puts that make up the strategy.

d)

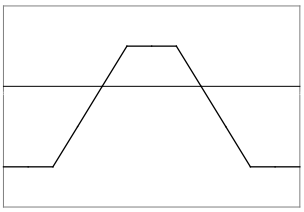
- 1 point for any correct diagram, even if it is an inappropriate strategy
- Examples :

Short butterfly



OR

Short condor



e)

- The modelling period is probably too small (1 mark)
- Too many variables (especially given the modelling period) (1 mark)
- Some variables have negligible impact – model is close to random walk (1 mark)
- Model simply suggests (on average) a continuation of previous rally. (1 mark)
- The model is probably too simplistic as a forecast tool, as it ignores substantial fundamental information – may be better to use a model incorporating other financial and economic variables. (2 marks)
- A constant variance model is likely to be too simplistic (½ mark)
- Time series models are unlikely to be useful for short term trading, as they imply very simplistic market inefficiency, and are likely to drowned out by market "noise" in the short term. (1 mark)
- Use of differencing to achieve a stationary series increases the variance (while the relevance of this could be challenged, it is part of the course notes). (½ mark)

(To a maximum of 7 marks)

Question 2 (continued)

f)

- As the model has some short-comings (identified above), its use is unsound. (1 mark)
- Model only suggests direction (which, being close to a random walk, is largely sideways) - you need to model the residual to understand likely variance. (2 marks)
- As model is similar to random walk, standard deviation is roughly $\propto \sqrt{time}$, so the model itself will probably not suggest range-bound behaviour. (1 mark)
- Given the sample period & the order of the model, it is unreasonable to make strong conclusions over 4 weeks (1 mark)

QUESTION 3 (18 Marks)

a) *The intention of the question is that "unlisted property assets" should include property assets both within unlisted trusts and owned directly. It is reasonable for students to take this as referring only to "unlisted trusts" - which limits the marks available. If students take this path, then exam markers may compensate them by allocating more marks to each point, up to an additional 3 marks..*

Main points

- The direct property and listed property trusts may be concentrated in different sectors (e.g. commercial, retail, industrial, residential). (1½ marks)
- The direct property may have return differences due to specific factors affecting the direct property investment. (1½ marks)
- Property trusts may have leveraged positions or cash holdings, which will alter return characteristics, especially as interest rates change. (1½ marks)
- Over long term returns of listed property trusts and underlying property should be similar. (1½ marks)
- If equity market is trading on "sentiment", then listed property may be dragged along. (1½ marks)
- Property trusts are often bought as yield proxies (instead of direct property, which is illiquid). (1½ marks)

Other points

- Direct property is re-valued less frequently than listed property trusts, for which intra-day market valuations can be made (1 mark)
- There may be a premium paid for the liquidity of listed property trusts (½ mark)
- There will be fess payable to a listed property trust manager - although these may be less than for direct property due to economies of scale (½ mark)
- Listed property trusts may have limits on redemptions (½ mark)

(To a maximum of 10 marks)

Question 3 (continued)

b)

- Difficulty in identifying historical "benchmark" direct property returns (1 mark)
  - use listed property (½ mark)
- Individual direct properties may be effected by specific factors, causing increased uncertainty (1 mark)
  - increase volatility assumption (½ mark)
- Lack of historical data for an unusual property investment (1 mark)
  - use "benchmark' direct property, if available (½ mark)
- Infrequent historical valuations of direct property can hide the true underlying volatility of the asset class (1 mark)
  - select a volatility that is consistent with the relativities of returns and volatilities assumed for other asset classes (e.g. more than bonds, less than equity - Stein estimation) (1 mark)
- Insufficient history for listed property (1 mark)
- Historical return information for listed and unlisted property may suggest unusual differences that may not be expected over the long term (½ mark)
  - use Stein estimation (½ mark)

(To a maximum of 8 marks)

QUESTION 4 **(23 Marks)**

a)

- Equities rise due to privatisations (1½ marks)
- Fixed interest falls as surplus means retiring Govt debt (1 mark)
- Relativities will depend on how other sources of fixed interest issuance fills the gap (½ mark)
- The impact may also be lessened by the Govt being unwilling to fully retire debt, so as to maintain a liquid bond market, and may hold other securities against its liability portfolio (½ mark)

(To a maximum of 3 marks)

b)(i)

- There is no single correct answer to this, however students should be able to argue their case. Allocate marks for soundness of argument and clarity of explanation – use judgement (0, ½ or 1 mark)
- Possibility of shortage of fixed interest may be positive for fixed interest in the short term (1 mark)
- This suggests an allocation towards fixed interest until shortly after the budget details are known by the market (1 mark)

- The medium term outlook for equities might worsen, due to possibility that increased privatisations may "flood" the equity market – the impact will depend on how effectively the Govt manages the process (1 mark)

Question 4 (continued)

- Budget surplus may have mixed impact on equity markets - may be seen as fiscally responsible, or may be seen as contradictory to growth and money is diverted from spending and new investment to fund the privatisation (1 mark)

(To a maximum of 4 marks)

b)(ii)

- Again, there is no single correct answer to this, however students should be able to argue their case. There is a wide range of points that students could put down. Allocate marks for soundness of argument and clarity of explanation – use judgement (0, ½ or 1 mark)
- Long term shortage of domestic fixed interest may mean that VERY big balanced funds are forced to have lower domestic fixed interest exposure (1 mark)
- One can argue that the neutral benchmark of funds other than VERY big may not need to change, as the benchmark should reflect liabilities (1 mark)
- As the fund competes against other balanced funds, the allocations of those funds will have an impact on its asset allocation – notwithstanding the link between the benchmark and liabilities (½ mark)
- If the supply reduction is severe, then - in the long term - CGS may appear more illiquid to overseas investors (½ mark)
- The supply reduction may cause Australian fixed interest to fall out of international indices (½ mark)
- There should be justification for some reduction in the neutral benchmark exposure to domestic fixed interest, which may be done in stages over time (½ mark)
- Perhaps replace by increased exposure to cash and/or overseas fixed interest (fully hedged) (½ mark)

(To a maximum of 4 marks)

Question 4 (continued)

c)

- The Duration constraint is too wide for passive management (1½ marks)
  - suggest between +/- 0.02 years and +/- 0.15 years (1½ marks)
  - no marks is suggest a wider or narrower range.
- No restriction on curve exposure – should set limits (1 mark)
- Allowable physical investments too restrictive (given benchmark, and need for passive) (1 mark)
  and given expected reductions in CGS (1 mark)
  - allow lower credit investments, floating rate notes, mortgage-backed securities (1 mark)
- Consider altering benchmark to allow a wider range of investments (½ mark)
- Restrictions on use of derivatives is appropriate for a passive fund (1 mark)
- Remuneration encourages risk taking (1½ marks)
  - suggest flat fee (1 mark)
- Additional marks for clarity of explanation - up to (1 mark)

QUESTION 5 **(28 Marks)**

a)

- Investment earnings on shareholders funds for the domestic life business should be "normalised" as neither 20% (company A) or 1% (company B) is sustainable (1½ marks)
- Investment earnings on offshore life business is lower than "normalised levels (1 mark)
- Profit from asset sales is a one-off and should be excluded (1½ marks)
- Currency translation loss should be added back (or normalised to hedge cost) (1 mark)
- Goodwill depreciation in the bank should be added back, as it is a non-cash item (1 mark)
- Banking operation has an effective tax rate of 10% (on pre-goodwill profit) which should be normalised to 36% (1 mark)
- Capitalising the dividends received from investments at less than 20 times may understate the value of investments (1 mark)
- Adjust profit and number of shares for conversion of preference shares (1 mark)

Question 5 (continued)

b)

- Composition of life insurance business operating margins (1 mark)
- Comparable expense ratios (1 mark)
- Level of present value of planned profit margins (1 mark)
- Tax rates paid on business not disclosed (1 mark)
- Level of provisioning charge (general / specific) to P&L in period for the bank (1 mark)
- Level of provisioning (ability to smooth earnings) (1 mark)

(To a maximum of 5 marks)

c)

- Apply the PE ratio to maintainable earnings per share (1½ marks)
- Use different PE multiples to value the various business operations based on the maintainable earnings of each business (1½ marks)
- Adjust valuation of Company A for the converting preference shares (1 mark)
- Use domestic / global comparisons to determine which PE ratio should be used (1 mark)
- Adjust PE for expected levels of earnings per share growth (strong growth = higher PE) (1½ marks)
- Adjust PE for assessed level of risk (1½ marks)

d)

- Multiple of NTA (or book) for the Banking operations (1½ marks)
- Multiple of funds under management for the Funds Management Business (1½ marks)
- Market value of investments in accounts (1½ marks)
- Shareholders funds valued at face value or at a discount (1 mark)
- Pre-tax (or EBIT) approach to avoid distortions by tax and/or debt (1 mark)

(To a maximum of 6 marks)

END SOLUTIONS PAPER ONE