INSTITUTE OF ACTUARIES OF AUSTRALIA

COURSE 1 INVESTMENTS **OCTOBER 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	3	1	1	5
Q1(b)	1	1.1	2	2	2	6
Q1(c)	1	1.1	2	2	2	6
Q1(d)	1	1.1	5	3		8
Q2(a)	3	5.1, 5.2	2	2		4
Q2(b)	3	5.3	2	2	3	7
Q2(c)	3	5.4, 5.5			7	7
Q3(a)	2	4.3, 4.4		3		3
Q3(b)	1	2.1			5	5
Q3(c)	1	2.1		4		4
Q3(d)	1	2.1	1	2		3
Q3(e)	1	2.1		2		2
Q3(f)	1	2.1			3	3
Q4(a)	3	5.3	2	2	3	7
Q4(b)	2	4.6			2	2
Q4(c)	3	5.4		2		2
Q4(d)	3	5.4		4		4
Q4(e)	3	5.4			5	5
Q5(a)	1	1.1			2	2
Q5(b)	2	4.3		3		3
Q5(c)	1	3.1			3	3
Q5(d)	3	5.5		5		5
Q5(e)	3	5.5			4	4
Total			**19**	**39**	**42**	**100**

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Answer all 5 questions.

QUESTION 1 **(25 Marks)**

You have been retained by the Board of an Australian defined contribution superannuation fund to provide investment advice. The Board has relayed to you the contents of a recent presentation to them in which the presenter claimed that, as the standard deviation of the returns of directly held property was generally lower than that of listed shares, there were good risk management reasons for participating in this asset class. The Board has asked you for your opinion.

In addition the Board has contemplated investing in a particular property company. The company buys plots of land, builds residential developments on them and (generally) sells the completed homes to purchasers. The company retains and rents a small number of houses in its premium developments to create a pool of residential properties to supply recurrent income to assist in the funding of working capital.

(a) Briefly summarise the various types of directly held property the superannuation fund might contemplate. All things being equal, which of these types would generally be the most suitable for the fund to consider? (5 Marks)

(b) What general characteristics of directly held property make it an attractive asset class for this fund? (6 Marks)

(c) Comment on the risk management proposition claimed by the presenter of the above-mentioned presentation. Within your commentary indicate whether you agree with it, the extent to which standard deviation adequately summarises the risks associated with directly held property and other risk areas that need to be considered. (6 Marks)

(d) Briefly assess the residential property development company as a potential holding within the fund's direct property holdings. What issues would you need to account for in undertaking a discounted cashflow valuation of the company? (8 Marks)

SOLUTIONS: QUESTION 1

(a)
Briefly summarise the various types of directly held property the superannuation fund might contemplate. All things being equal, which of these types would generally be the most suitable for the fund to consider? (5 Marks)

Answer

Types of Property
Property can be held directly in the form of:
- Land only - held for land value appreciation, development purposes or for rent to a building owner, in which case the land owner receives a ground rent
- Building only – held for demolition and redevelopment, occupation or rental, and
- Land and building – held for a combination of the above purposes.

Property can also be held directly in the form of freehold (ownership) or leasehold with a right to re-let or sub-let.

Buildings held to rent are sometimes called "passive property".

(N.B. "Directly held" excludes unlisted funds.)

Property can also vary by the use to which the land or buildings on the land are put. These uses fall under the following headings:

Core Property
- Residential – Houses, apartments, town houses etc
- Retail – Shopping malls, "strip" shopping etc
- Office/commercial – Office buildings or premises etc, and
- Industrial - Factories, assembly centres, logistics management/ distribution buildings etc.

Specialist Property, of which examples (examples are not required but are given here for additional information) are:
- Agricultural
- Entertainment – Pubs, hotels, resorts, theatres etc
- Healthcare – Hospitals, doctors surgeries/treatment centres etc, and
- Communities – Retirement living, student accommodation etc

Superannuation Fund Suitability
In general:
- There would need to be tax or strategic reasons for a superannuation fund to hold property on a building or land only basis, other than as an intended redevelopment of land in the case of land only. In the absence of such motivation, the fund is more likely to achieve its objectives by concentrating on freehold ownership of land and buildings combined and land only held for redevelopment.

- Within the above, development property is riskier than passive property owing to the specialist skills required, the chance that market dynamics will have changed by the time the development is complete (unless financed pre-commitments are obtained) and the drain on returns caused by financing the development (unless offset by interim capital gains received by revaluation or onselling).
- The more specialised the use, the thinner the market and the less likely a superannuation fund would be to hold such property except as a smallish component within its portfolio for diversification or opportunity purposes.
- The lower the population density of the location of the property, the thinner the market, except for industrial property, where supply chain and transport proximity are more relevant criteria. The fund is likely to limit its allocation to suburban, regional or rural locations to a modest share of its overall property allocation.

Marking Guide: (3 KU, 1 SJ, 1 CJ)

- Types of property: land, buildings, both, influence of location, freehold vs leasehold, core vs specialist. (1 KU for land and buildings, 2 KU for others)
- Suitability: passive property vs development; liquidity issues; allow for other relevant factors (N.B. must make suggestions of some form – deduct 0.5 CJ for not doing so). (1st mark awarded SJ, 2nd mark awarded CJ)
- Note that more detail is given in the marking guide than is required. This is additional guidance for markers and future candidates reviewing this as a past paper.

To a maximum of 5 marks

(b)

What general characteristics of directly held property make it an attractive asset class for this fund? (6 Marks)

This answer is framed within the context of the types of property covered by the "suitability" heading above.

Depending on the type of property held and the structure of the leases held for it, the attributes of directly held property that might make it attractive to superannuation fund include:

- Land scarcity and the tying of a building to the land it occupies give property a demand profile that can produce good capital growth over the relevant holding period provided it is purchased at a suitable price, it is well located etc – this demand often reflects economic growth at some level and this assumes that demand feeds into property prices and, therefore, capital appreciation
- Property can produce healthy yields (though this attractiveness can depend on the interest rate regime applying from time to time), making it attractive from income and cashflow perspectives
- Moreover, leases are often subject to periodic reviews that cause face rents to move with inflation and, to this extent and the extent that growth (in the context noted above) and inflation are inter-related, property may provide a degree of hedging against inflation*

- The smaller universe of participants in some sectors and the higher costs of property may make parts of it less market efficient than other asset classes**
- Within the equity category, direct property returns are generally less volatile than those of traded assets as mentioned in the question and this can make it useful for portfolio optimisation (but note comments below),
- Property can be attractive from an after tax perspective – capital gains may be taxed at a concessional rate (2/3 of their value for a superannuation fund) and depreciation and investment allowances might result in tax deferral for a portion of income, and
- During financial crises with sudden property price drops, property investment funds can freeze member withdrawals. With direct property, this will not be an issue if the super fund wants to sell investments.

*Markers Note: Whether the co-movement of property and returns and inflation rates satisfies statistical tests for same is less certain.
**Markers Note: While being conscious that the market window offered by listed property is an offsetting argument.

Marking Guide: (2 KU, 2 SJ, 2 CJ)

- Potential for capital growth (1 KU)
- Yield properties (1 KU)
- Inflation hedge (1 SJ)
- Efficiency arguments (1 SJ)
- Lower volatility, portfolio optimization (1 SJ)
- Financial crises and member withdrawals (1 SJ)
- Taxation (detail need not match that of the solution) (1 SJ) (to a max of 2 SJ)

To a maximum of 6 marks

(c)

Comment on the risk management proposition claimed by the presenter in the above-mentioned presentation. Within your commentary indicate whether you agree with it, the extent to which standard deviation adequately summarises the risks associated with directly held property and other risk areas that need to be considered.

(6 Marks)

Direct property returns reflect a mixture of income through rents (and perhaps money held on deposit awaiting redeployment), net capital appreciation for continuing holdings and net capital gains for disposals. Interest (holding cost) on development capital may sometimes be capitalised rather than channelled through income.

Net capital appreciation reflects net valuation gains. Valuations are either undertaken internally or externally. Best practice requires arms'-length, external valuation at a reasonable frequency to meet independence and objectivity standards. Valuation principles are generally made within the willing buyer, willing seller principle and may adjust to new regimes with a lag when transactions volumes decline or accelerate rapidly. Valuations do not also routinely capture the cost of a potential transaction in the asset. While external data is sourced in terms of sales of comparable properties and inputs into valuation model assumptions, the process lends itself to a degree of smoothing of outcomes.

In addition valuations are conducted with a much lower frequency than for traded assets.

Though $\sqrt{(n_1/n_2)}$-type multipliers can be used to adjust for different valuation frequencies (n being frequency), these multipliers assume independence and arguably do not capture the full extent of the impact of the differences in market dynamics.

For this reason this element of returns may exhibit a valuation-process induced reduction in volatility at times, and reflect lagged step movements in values when regimes begin to be reflected in transaction prices. Return volatility is measured by standard deviation.

Standard deviation is a two-sided measure that is indifferent to whether returns are greater or less than the mean, whereas drawdowns are arguably more important than volatility per se. Standard deviation is also unrelated to fund liabilities.

In any event there are other risks associated with property that are not embodied by standard deviation. These risks include:

- The concentration risk associated with the lumpiness of larger holdings
- The liquidity risk posed by the above, property's unlisted nature (when held in this form) and economic regime effects
- Development project risks, where relevant, as noted above – timing relies on forecast demand, the need to stay on time and expense budgets, financing etc
- Liability-related risks (noting that the mean is not a liability reference point), and
- Asymmetric or fat-tailed return distribution features not captured by standard deviation (to the extent they exist).

For these reasons standard deviation is a useful but incomplete risk measure and insufficient on its own as a basis for investing in property.

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

- Valuation regime effects on returns (1 KU)
- Limitations of sd – symmetric between upside and downside, reliance on normal distribution for effectiveness as risk measure, lack of liability linkage (2 SJ)
- Giving an opinion with intelligent argument as required for the question (1 KU)
- Other risks – concentration/liquidity, development risks, statement re agreement (2 CJ)

To a maximum of 6 marks

(d)

Briefly assess the residential property development company as a potential holding within the fund's direct property holdings. What issues would you need to account for in undertaking a discounted cashflow valuation of the company? (8 Marks)

Arguments for:

- The attraction of the company as an investment will depend greatly on management's ability and record in timing its buying and selling activities and development project management; and on the fund's views on the outlook for residential property market pricing over the projected holding period. The latter will take in issues such as regional variations, population growth, supply constraints, Government policy, the interest rate regime etc.
- Results will gestate over a property cycle and perhaps several property cycles. This may be attractive from a liability term matching perspective for the fund.

Arguments against/constraints:

- The company is privately-owned and may exhibit limited liquidity. This is not necessarily a great limitation in the context of property's generally illiquidity, but the market for such companies will not be the same as for its underlying properties.
- The company's business is a mix of residential development and residential ownership. Given the latter is used to "assist in the funding of working capital", it is likely the former will provide the bulk of the profit. This will be achieved by sales of lots within the developments or developments as a whole. The company would require a continuous inventory of land banks, properties under development and properties ready for sale to provide profit continuity. This would be difficult to achieve and there is, therefore, likely to be some accentuation of the natural seasonality and economic growth dependence in the company's results. Note also the risks associated with development noted above. In addition, residential property is often regarded as being low yielding; this may be offset somewhat in this case by the company's focus on its premium developments and the possibility of corporate rentals.
- Dividends & gearing – Rentals only "assist" in funding working capital. The company is, therefore, likely to retain some element of profit and to borrow to buy land and fund development. The former will affect dividends and the latter makes sense while ever development IRRs exceed the cost of debt. Property valuations and, therefore, LVRs vary over time and gearing levels will need to be monitored.
- The fact that this investment would be in company form rather than trust form means that there will not always be an automatic pass-through of the results of the company's property nor of changes in its property assets.

Conclusion

In general, if the fund were to invest in this company, it should only do so at a modest (say less than 5%) exposure level within its overall property portfolio.

DCF Valuation

Cashflow projections

- A valuation in parts with each business line modelled separately may be required, depending on the contribution rents make to revenue stability. There will also be some inter-dependence between business lines given that rented dwellings are sourced from the firm's completed developments.
- Cashflow projections should run for at least one development cycle.

Discount rate

- Where each business line is modelled separately, separate discount rates will also be required to reflect the different risk profiles of the business lines.
- Some allowance should be made for illiquidity.

Terminal value estimation

- Terminal values should reflect equilibrium conditions given that, to do otherwise, would capitalise imbalances.
- A reversion path may need to be plotted from the end of the cashflow projection period to the terminal estimation point if equilibrium conditions do not apply at the end of the projection period.

Other

- Given the likely regime-switching nature and cyclicality of the development business, it will probably require modelling over multiple scenarios before a best estimate revenue model is settled.
- In any event the strength and breadth of the confidence interval within which the best estimate sits should receive some attention.
- Market testing - Given this is a private company, it may be difficult to find market comparables against which to test assumptions. Given the prevalence of the residential sector to the economy there should, however, a ready source of data for it, even if not for the business. Listed companies might be a useful starting point.

Marking Guide: (5 KU, 3 SJ)

- Assessment as investment: quality of management, residential outlook, matching, liquidity, seasonality of results, balance sheet/gearing, company form, other issues, conclusion: desirable but not necessary (5 KU – 1 per mention and intelligent comment)
- DCF Valuation: identify key issues of cashflow projections, discount rate and terminal value estimation. (3 marks SJ)

To a maximum of 8 marks

QUESTION 2 **(18 Marks)**

(a) What do you understand by the terms "relative return investor" and "absolute return investor"? Give an example of a risk-return measure for an active investor of each type. (4 Marks)

(b) What are the arguments for and against performance-based fees in funds management? What elements are important in the design of performance-based fees? (7 Marks)

(c) A fund manager offers an Australian equities-themed hedge fund based on fundamental analysis. The fund can take both bought and sold positions in stocks in the agreed universes, and cash, so long as the fund's effective exposure is 100% in shares and cash. The fund can also increase funds invested by borrowing up to 25% of money raised from its investors from time to time. The fund charges both a management fee of 1% of net funds under management and a performance fee.

(i) Why would the fund's manager seek to borrow?
(ii) Why would an investor allow an active manager to short-sell?
(iii) Leaving aside generally equity market risk and the other information an investor would require in order to assess this fund, what "special" risk/s would an investor need to bear in mind with the fund?

(7 Marks)

SOLUTIONS: QUESTION 2

(a)
What do you understand by the terms "relative return investor" and "absolute return investor"? Give an example of a risk-return measure for an active investor of each type. (4 Marks)

Answer

A relative return investor sets his/her objectives around market indices (which may rise or fall in value and for which falls in value produce negative returns). A risk-return measure for an active relative investor would be the information ratio (= excess return above the index ÷ tracking error [TE], where TE is the standard deviation of excess returns).

An absolute return investor sets his/her objectives around real economy measures such as inflation or significant measures such as the cash rate. For such investors a market index has no real economic significance and can't be spent. A risk-return measure for an absolute return investor would be the Sharpe ratio (= excess return above risk free rate ÷ standard deviation, where the "risk free rate" could be short term treasury yield or real economy measure or budget measure, depending on the circumstances).

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

- Relative return: definition – index referencing (1 KU)
- Risk-return – Information ratio or other relevant measure (which must capture active return and risk in some way) (1 KU)
- Absolute return: definition – referencing to real economy or related measure (1 SJ)
- Risk-return: Sharpe ratio or other relevant measure (which must capture active return and risk in some way) (1 SJ)

To a maximum of 4 Marks

(b)
What are the arguments for and against performance-based fees in funds management? What elements are important in the design of performance-based fees? (7 Marks)

Arguments for:

- Performance fees reward managers as performance increases. This better aligns manager incentives with investor interests than systems that are independent of or only indirectly related to performance (such as FuM related fees). Fixed fees do not reward skill which should be the basis for hiring active managers.
- Brinson argues that, since active management is a zero sum game, market-aggregate active manager fees should be no greater than passive manager fees, yet they are clearly a multiple of these. (In fact aggregate alpha should probably be negative after transaction fees are taken into account.) Performance fees may be one way to redress this structural imbalance.
- The game theory style argument that performance fees (as a rule of the game) may be more likely to attract managers (players) who will outperform (win).

Arguments against:

- Assuming return and risk are correlated at least in the short term, performance fees may induce greater than desired risk taking by managers in search of extra reward.
- A purely performance fee system makes no allowance for the funding of the research or infrastructure necessary to sustain performance over the longer term. This may cause managers to under-spend on these. A mix of fixed and performance fees would better protect against this risk.
- Performance fees will generally cost the investor more for a successful manager. (Arnott has suggested that performance fees reflect an investor's lack of belief in his or her ability pick good managers – if you could, you might well keep all the upside for yourself.)
- May have a negative effect of cash flow to manager causing problems with loss of staff and viability

Setting performance fees

- The threshold beyond which performance fees are payable should be cognisant of the active fee spread (the additional fees paid for active management) and the performance value proposition presented by the manager – why reward disproportionately expected or promised outperformance that underlie a manager's appointment?
- The choice of reward horizon should be consistent with the horizon appropriate to the manager's investment process, style and position within the overall portfolio. (While the portfolio investment horizon should reflect liability term or duration, this may not be required of each portfolio component.)
- The design needs to consider the extent to which losses are carried forward. Intra-horizon losses should clearly be taken into account but there can be different views on inter-period losses or "high water marks". The arguments for carrying forward inter-period losses and having high water marks relate to previous under-delivery for the former and not rewarding capital losses for the latter. The arguments against them relate to the building-in of structural disincentives that may mitigate against future outperformance.
- The performance participation level (share of outperformance) should not be so great as to compromise the extent of outperformance enjoyed by the client.
- As noted above a mix of fixed and performance fees will provide some incentive for the manager to spend adequately on research and other infrastructure.

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

- Arguments for: investment alignment and Other (1 mark each KU) to a maximum of 2 marks
- Arguments against: induces risk taking, infrastructure disincentive, Other (1 mark each SJ) to a maximum of 2 marks
- Design: performance threshold, performance horizon, share of outperformance, loss carry-forward and high water marks (3 CJ)

To a maximum of 7 Marks

(c)

A fund manager offers an Australian equities-themed hedge fund based on fundamental analysis. The fund can take both bought and sold positions in stocks in the agreed universes, and cash, so long as the fund's effective exposure is 100% in shares and cash. The fund can also increase funds invested by borrowing up to 25% of money raised from its investors from time to time. The fund charges both a management fee of 1% of net funds under management and a performance fee.

(i) Why would the fund's manager seek to borrow?
(ii) Why would an investor allow an active manager to short-sell?
(iii) Leaving aside generally equity market risk and the other information an investor would require in order to assess this fund, what "special" risk/s would an investor need to bear in mind with the fund?

(7 Marks)

Borrowing

The manager may seek to borrow to increase the amount of funds deployed into the sharemarket either as bought or sold positions. (Note that, however, only long positions can be held as security against borrowings.) Ignoring risk, this would make sense while ever prospective returns exceed the cost of borrowing (cost of debt lower than cost of equity). Note that cash holdings are likely to yield less than borrowing costs unless term, credit or other risks underlie cash holdings. In addition, borrowing costs should be tax deductible, while dividends may attract franking credits and capital gains may be concessionally taxed, leading to improved after-tax returns.

Borrowing also increases the funds available and therefore the fees to the fund manager, however this is best done by having the investors gear rather than the fund.

Short selling

The alternative to allowing short-selling would be to limit a manager to long positions only. If the manager did not like a stock, it would be limited to holding a zero position in it. This would result in an asymmetric exposure range for shorts relative to the manager's long preferences – the manager could go more overweight a stock than it could go underweight. Yet, if an investor had sufficient confidence in a manager's stock picking skills and provided the manager's risk management processes were adequate, returns could be enhanced by allowing the manager to short. The overall portfolio should also be more efficient as the information advantages uncovered by the manager would be given full expression. (The risks of doing so are discussed below.)

Risks

- Borrowing - Assuming borrowing costs would be floating rate in nature, borrowing would become expensive when short term interest rates rose. At such times the sharemarket usually falls in value. Hence the loan-to-value ratio (LVR) would increase and the capital available to repay the loan would have reduced. LVRs and borrowing costs need to be carefully monitored and exit plans put in place in case the risk or cost of borrowing becomes unacceptable.

- Short selling - Short selling requires borrowing stock and then selling it. The transaction is closed by buying stock on the market to return it to the stock lender once the sale is complete. In theory losses are unbounded because, if the stock appreciates rather than falls in price, it can continue to do so without limit; whereas price cannot fall below zero. For this reason an investor would need to be confident in the manager's ability to short stocks successfully and in its risk management processes in terms of monitoring such risks. Presumably an investor would want to see stop losses or like mechanisms within these processes, or a limit on the shorting that might be undertaken.
- Interaction - To the extent that borrowed funds have been used to pay margin calls or stock loan fees on a short stock, shorting losses could be accentuated by interest payable on the funds borrowed. This would result in a form of double leverage. If the manager chose to repay the loans in this event, either cash or long positions would need to be sold to fund the repayment.

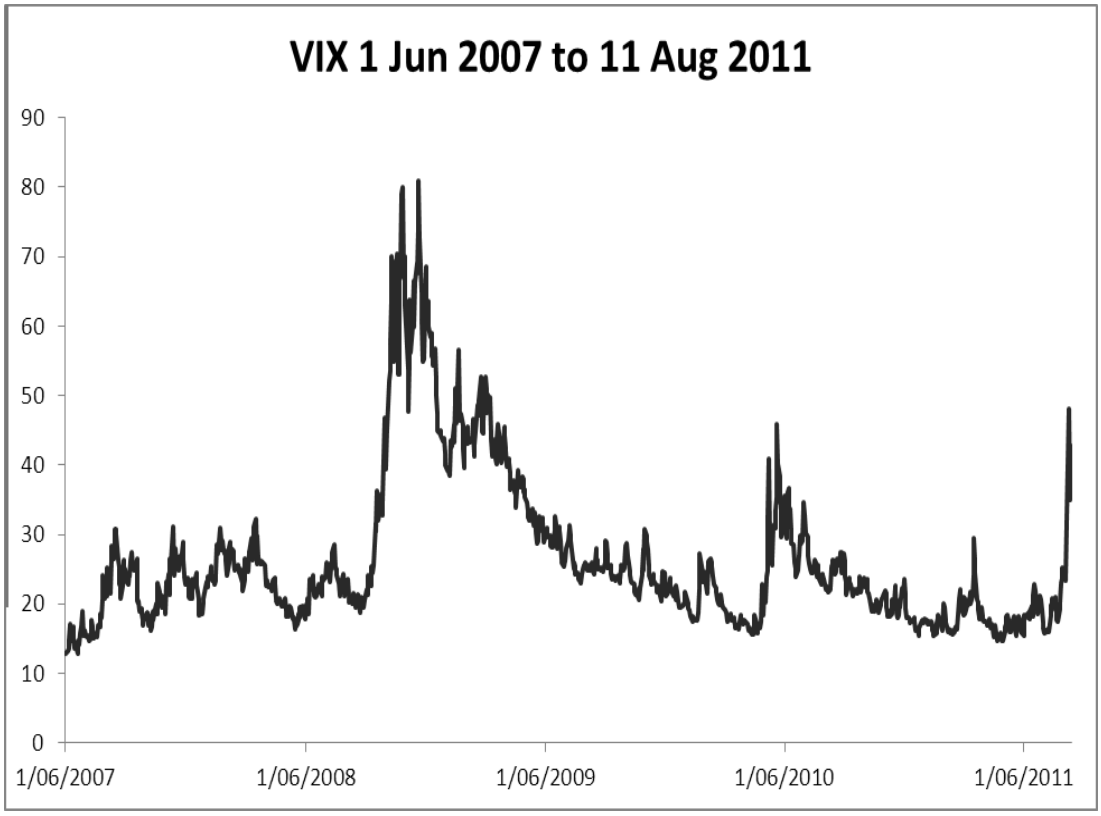
Marking Guide: (7 CJ)

- Cost of borrowing relative to expected returns (1 CJ)
- Tax efficiency (1 CJ)
- Risk: increasing ST interest rate regime risk for gearing (1 CJ)
- Infinite short side risk (1 CJ)
- Potential for double leverage (1 CJ)
- Overall quality of answer (2 CJ)

To a maximum of 7 Marks

QUESTION 3 **(20 Marks)**

(a) The graph below shows the Chicago Board Options Exchange (CBOE) VIX volatility index movements for the past 4 years. The VIX is sometimes referred to as 'the fear index' and represents option market estimates of the annualised volatility (standard deviation) of the S&P500 index for the next 30 days. The VIX index is closely correlated with the actual realised sample path of S&P500 volatility.



Stochastic Volatility (SV) models such as the Heston and GARCH models are called Diffusion models and assume that SV is a stochastic process (random function) that has continuous sample paths without jumps. Another class of SV models called Jump-Diffusion models (e.g. Jorion) assumes the presence of discontinuities or 'jumps' in the SV sample path.

With reference to the VIX graph above, which of these types of model do you think would most accurately describe the stochastic volatility process of the S&P500? Give reasons for your answer. What recent financial market events may be associated with increases in volatility? (3 Marks)

(b) The following stochastic differential equation (SDE) is a continuous stochastic process commonly used to describe the return process r_t of assets traded on financial markets:

$$dr_t = \mu_t dt + \sigma_t dW_t$$

where W_t is a standard Brownian motion and μ_t and σ_t denote drift and volatility respectively.

Suppose the volatility σ_t is constant (as assumed in the Black-Scholes framework).

(i) Show that this implies the marginal distribution of the financial market return process is normally distributed.

(ii) Is it reasonable to use a model that assumes normality of the return process? Give reasons.

(iii) Would it be more reasonable to use a suitable leptokurtic ('fat-tailed') distribution to model the probability of large return movements on the S&P500 than to assume normality of returns? Why?

(5 Marks)

(c) The Single Index Model (SIM) is a model of stock returns where returns can be decomposed into stock specific returns due to firm-specific economic events and external economic events that are fully captured in market returns:

$$r_i - r_f = \alpha_i + \beta_i \left(r_m - r_f \right) + \varepsilon_i$$

where

r_i **is the return of stock *i***

r_f **is the risk free rate**

r_m **is the market return**

α_i **is the expected (constant) return of stock i if market excess return is zero,** $r_m - r_f = 0$

β_i **is the beta of stock *i*,** ε_i **is the stock *i* specific return random variable with a mean of zero and is uncorrelated with the stock specific returns of other stocks or market returns.**

(i) Suppose we construct a portfolio of *n* equally weighted stocks. For simplicity, assume that the volatility (standard deviation) of the stock specific returns of all stocks in the portfolio are the same $\sigma\left[\varepsilon_i\right] = \sigma\left[\varepsilon_j\right] = \sigma_{ss}$. Assuming the SIM model of stock returns, give an expression (and briefly justify it) for the <u>stock specific</u> volatility (standard deviation) of the portfolio as a function of the number *n* of stocks in the equal weighted portfolio? (2 Marks)

(ii) Assume the SIM model of stock returns is correct. What is the covariance of returns between any two stocks? Explicitly derive your answer. (2 Marks)

(d) The Sharpe-Lintner CAPM model assumes the market portfolio is highly diversified (a large number of stocks) and that the market portfolio risk due to stock specific returns is zero. The Security Market Line (SML) in the CAPM model relates expected excess stock/portfolio returns to expected market returns.

$$E[r_i] - r_f = \beta_i \left(E(r_m) - r_f \right)$$

(i) What is the additional assumption we require to formulate the SML from the Single index Model? (1 Mark)

(ii) The ex-ante Treynor ratio *T* is a measure of the non-diversifiable risk adjusted expected excess return of a stock or portfolio: $T = \dfrac{E[r_i] - r_f}{\beta_i}$.

Suppose we estimate the Treynor ratio of a stock and find that it is higher than the CAPM market portfolio. What implications does this have for the CAPM model and the SIM model? (2 Marks)

(e) The beta β_i **of a stock/portfolio can be formulated as** $\beta_i = \dfrac{\sigma_i \sigma_m}{\sigma_m^2} \rho_{i,m}$, **where** σ_i **is the standard deviation of stock/portfolio returns** σ_m **is the standard deviation of market returns** $\rho_{i,m}$ **is correlation of stock and market returns. Suppose we hold a well-diversified portfolio with a beta = 1. What is the volatility (standard deviation) of the portfolio? (2 Marks)**

(f) The Markowitz mean-variance model is the foundation of modern portfolio theory. The Markowitz mean-variance utility function is formulated as follows (in vector notation):

$$U(\lambda, h) = \mathrm{h}^{\mathrm{T}}\mathrm{r} - \lambda \mathrm{h}^{\mathrm{T}}\mathrm{V}\mathrm{h}.$$

Give a proof that portfolios generated by Markowitz mean-variance optimisation lie on the efficient frontier.

(3 Marks)

Solutions Question 3

(a) With reference to the VIX graph above, which of these types of model do you think would most accurately describe the stochastic volatility process of the S&P500? Give reasons for your answer. What recent financial market events may be associated with increases in volatility?

(3 marks)

Answer

The discontinuities in the VIX sample path appear to correspond to the Lehman Brothers collapse (Sep 2008), the emergence of the European sovereign debt crisis (May 2010) and the Standard & Poors downgrade of U.S. sovereign debt (Aug 2011). The existence of these discontinuities suggests that the S&P500 stochastic volatility is best modelled by a Jump-Diffusion process.

<u>Marking Guide: (3 SJ)</u>

- Identifying recent financial events connected to the increases in volatility. 1 mark only for a general GFC related answer without any specifics. (2 SJ)
- Identifying the jump-diffusion process (1 SJ)

(b) Suppose the volatility σ_t is constant (as assumed in the Black-Scholes framework).

(i) Show that this implies the marginal distribution of the financial market return process is normally distributed.
(ii) Is it reasonable to use a model that assumes normality of the return process? Give reasons.
(iii) Would it be more reasonable to use a suitable leptokurtic ('fat-tailed') distribution to model the probability of large return movements on the S&P500 than to assume normality of returns? Why?

(5 marks)

Answer

(i) If the increments are independent and identically distributed (iid) as implied by the model $dr_t = \mu_t dt + \sigma dW_t$ then the return process will have a normal distribution.

(ii) The graph of the VIX index suggests that the volatility is non constant and also that the return increments are not iid. Hence the assumption of the Central Limit Theorem (CLT) of independent identically distributed innovations is violated and the return distribution is not normally distributed and is instead a leptokurtic ('fat-tailed') distribution .

(iii) The S&P 500 equity returns are strongly leptokurtic because of the S&P500 stochastic volatility exemplified in the VIX graph above. Therefore a

suitable leptokurtic (`fat-tailed') distribution must be used to model the large equity return movements otherwise the risk (probability) of large (adverse) return movements will be grossly underestimated.

Marking Guide: (5 CJ)

- Part (i) (1 CJ)
- Part (ii) (2 CJ)
- Part (iii) (2 CJ)

(c) The Single Index Model (SIM) is a model of stock returns where returns can be decomposed into stock specific returns due to firm-specific economic events and external economic events that are fully captured in market returns:

$$r_i - r_f = \alpha_i + \beta_i \left(r_m - r_f \right) + \varepsilon_i$$

where

r_i **is the return of stock *i***

r_f **is the risk free rate**

r_m **is the market return**

α_i **is the expected (constant) return of stock i if market excess return is zero,**

$r_m - r_f = 0$

β_i **is the beta of stock *i*,** ε_i **is the stock *i* specific return random variable with a mean of zero and is uncorrelated with the stock specific returns of other stocks or market returns.**

(i) Suppose we construct a portfolio of *n* equally weighted stocks. For simplicity, assume that the volatility (standard deviation) of the stock specific returns of all stocks in the portfolio are the same $\sigma\left[\varepsilon_i\right] = \sigma\left[\varepsilon_j\right] = \sigma_{ss}$. **Assuming the SIM model of stock returns, give an expression (and briefly justify it) for the <u>stock specific</u> volatility (standard deviation) of the portfolio as a function of the number *n* of stocks in the equal weighted portfolio?**

(2 marks)

(ii) Assume the SIM model of stock returns is correct. What is the covariance of returns between any two stocks? Explicitly derive your answer.

(2 marks)

(c) (i) Answer

Stocks are equally weighted in the portfolio and the stock specific returns have equal volatilities. Since we assume the SIM model of returns, then the stock specific returns are not correlated and the stock specific risk of the equal weighted portfolio with n stocks can be formulated as: $\sigma_{ss}(n) = \sqrt{\sum_{i=1}^{n} \frac{\sigma_{ss}^2}{n^2}} = \frac{\sigma_{ss}}{\sqrt{n}}$.

(c) (ii) Answer

Using the translation invariance property of covariance; $Cov(y+c, x+d) = Cov(y, x)$ for any c, d non-random constants. Since β, α and r_f are non-random constants and using the SIM index model given above:

$$Cov(r_i, r_j) = Cov(r_i - r_f, r_j - r_f) = Cov(\beta_i r_m + \varepsilon_i, \beta_j r_m + \varepsilon_j)$$

Expanding the right covariance term:

$$Cov(\beta_i r_m + \varepsilon_i, \beta_j r_m + \varepsilon_j)$$

$$= \beta_i \beta_j Var(r_m) + \beta_i Cov(r_m, \varepsilon_j) + \beta_j Cov(r_m, \varepsilon_i) + Cov(\varepsilon_j, \varepsilon_i)$$

By the assumptions of the SIM model, stock specific risk is uncorrelated with market risk and the stock specific risk of different stocks is uncorrelated. Therefore the covariance between two stocks can be formulated as: $Cov(r_i, r_j) = \beta_i \beta_j Var(r_m)$.

<u>Marking Guide: (4 SJ)</u>

- Part (i) Expression (1 SJ), Justification (1 SJ)
- Part (ii) Use of translation invariance property and result (1 SJ), Final covariance expression (1 SJ)

(d) The Sharpe-Lintner CAPM model assumes the market portfolio is highly diversified (a large number of stocks) and that the market portfolio risk due to stock specific returns is zero. The Security Market Line (SML) in the CAPM model relates expected excess stock/portfolio returns to expected market returns.

$$E[r_i] - r_f = \beta_i (E(r_m) - r_f)$$

(i) What is the additional assumption we require to formulate the SML from the Single index Model?

(1 mark)

(ii) The ex-ante Treynor ratio *T* is a measure of the non-diversifiable risk adjusted expected excess return of a stock or portfolio: $T = \dfrac{E[r_i] - r_f}{\beta_i}$. Suppose we estimate the Treynor ratio of a stock and find that it is higher than the CAPM market portfolio. What implications does this have for the CAPM model and the SIM model?

(2 marks)

(i) Answer

The additional assumption is that Jensen's Alpha α_i in the SIM model is zero , $\alpha_i = 0$..

(ii)
If the Treynor ratio of a stock is above that of the market then Jensen's Alpha α_i in the SIM model is positive, $\alpha_i > 0$. . This invalidates the additional assumption of the CAPM model: $\frac{E[r_i] - r_f}{\beta_i} > E[r_m] - r_f$

Marking Guide: (1 KU, 2 SJ)

- Part (i) Additional assumption specified (1 KU)
- Part (ii) Link between Treynor ratio and Jensen's Alpha (1 SJ), Invalidates CAPM assumption (1 SJ)

(e) The beta β_i of a stock/portfolio can be formulated as $\beta_i = \frac{\sigma_i \sigma_m}{\sigma_m^2} \rho_{i,m}$, where σ_i is the standard deviation of stock/portfolio returns σ_m is the standard deviation of market returns $\rho_{i,m}$ is correlation of stock and market returns. Suppose we hold a well-diversified portfolio with a beta = 1. What is the volatility (standard deviation) of the portfolio?

(2 marks)

(e) Answer:

With a portfolio beta of 1 we can rewrite the beta formula above as: $\sigma_i = \frac{\sigma_m}{\rho_{i,m}}$

Since the portfolio is well diversified it has little or no stock specific risk and portfolio returns will be highly correlated with market returns, $\rho_{i,m} \approx 1$. Therefore the volatility of the portfolio will be close to the market portfolio volatility. $\sigma_i \approx \sigma_m$.

Marking Guide (2 SJ):

- (1 SJ) per point above

(f) The Markowitz mean-variance model is the foundation of modern portfolio theory. The Markowitz mean-variance utility function is formulated as follows (in vector notation):

$$U(\lambda, h) = \mathrm{h}^{\mathrm{T}}\mathrm{r} - \lambda \mathrm{h}^{\mathrm{T}}\mathrm{V}\mathrm{h}.$$

Give a proof that portfolios generated by Markowitz mean-variance optimisation lie on the efficient frontier.

(3 marks)

Answer

Proof by contradiction.
Suppose the Markowitz optimal portfolio 'A' lies below the efficient frontier. (1 mark)

Then there exists another portfolio 'B' with the same risk but greater expected return that does lie on the efficient frontier. (1 mark)

This portfolio 'B' will also have a higher value for the Markowitz utility function because of its higher return. (1 mark)

This contradicts the assumption that portfolio 'A' is Markowitz optimal. (1 mark) Thus portfolio 'A' must lie on the efficient frontier.

Marking Guide: (3 CJ)

- 1 mark per point in the argument to a maximum of 3 marks (3 CJ)

QUESTION 4 (20 Marks)

You are an investment analyst working for a firm of Asset Consultants.

You have been asked to critically examine the fee and active management structure of a $5 billion Australian Equity Fund. This fund is currently managed externally with a single active manager. The Management Expense Ratio (MER) of this manager is 0.85% of the equity fund asset value managed and the manager has a 10 year record with an average information ratio of 0.25 before fees against the ASX200 benchmark. The ex-ante information ratio of this manager is expected to continue at 0.25. The current target active risk of the equity fund is 3%.

A new structure for the equity fund is proposed where the ASX200 index market return of the equity fund is generated by an external wholesale index fund manager with an MER of 0.15% and active returns are to be generated by 2 specialist 'pure alpha' active managers proportionally overlaid over the index fund. These managers implement 'pure alpha' long-short portfolios where they are short the ASX200 benchmark and are long an active equity portfolio with no net investment.

Active 'pure alpha' manager 'A' is an active investor who cycles between the Value and Growth investment style. The ex-ante information ratio of manager 'A' is expected to be 0.50. The management expense ratio (MER) of manager 'A' is 0.90% of the proportion $0 \le \delta \le 1$ of the value of the underlying equity fund managed.

Active 'pure alpha' manager 'B' is an active investor who cycles between the Large and Small capitalisation investment style. The ex-ante information ratio of manager 'B' is expected to be 0.40. The MER of manager 'B' is 0.70% of the proportion $1 - \delta$ of the value of the underlying equity fund managed.

The active investment styles of the two 'pure alpha' managers are not independent and their active returns have a correlation of 0.3. The combined active return strategy should introduce an active risk of 3% to the underlying equity portfolio.

(a)

(i) What is the after fees information ratio of the current external active manager? (2 Marks)

(ii) Suppose now that active manager 'A' manages 50% ($\delta = 0.5$) of the value of the underlying equity fund and active manager 'B' manages the other 50%. Assuming that both managers also have equal active risk, what is the resultant information ratio of the combined active strategies before MER fees? (3 Marks)

(iii) What is the resultant information ratio of the combined active strategies after all MER fees? (2 Marks)

(b) The optimal allocation of active risk between active managers in an investment portfolio to maximise expected active return (information ratio) is known as 'risk budgeting'. Outline briefly in words how you would formally calculate the optimal proportion of active risk allocated to active manager 'A' and active manager 'B'. (2 Marks)

(c) The formula for a t-statistic to test a sample mean against the null hypothesis (the probability that the population mean is zero) is as follows: $\frac{\bar{S}}{\bar{\sigma}}\sqrt{n}$, where *t* is the *t*-statistic, $\bar{S}$ is the sample mean, $\bar{\sigma}$ is the sample standard deviation and *n* is the sample size. How would we use this statistic to assess if active manager ex-post returns are due to skill rather than luck ? (2 Marks)

(d) You calculate the annualised monthly performance of an equity portfolio where retail investors can buy and sell investment units that are priced daily using the Net Asset Value (NAV) of portfolio. Assume that the unit price was U_0 at the beginning of the month and U_{31} at the end of the month. Give reasons for the choice of portfolio performance calculation methodology you use and formulate in detail how you would calculate the annualised monthly portfolio return to a retail investor assuming that the buy price is the same as sell price on any day. (4 Marks)

(e) You have been asked to analyse the performance of an investment portfolio that is invested in two sectors: 50% cash and 50% domestic equities. It trades only at the end of each month and has no deposits or redemptions. It has a benchmark of 100% domestic equities. Cash returned 0.5% for the month, the portfolio's equity sector increased in value by 2.0% for the month. The benchmark return was -1.0% for the month.

(i) Describe and quantify the performance effect of sector allocation for the month. (2 Marks)

(ii) Describe and quantify the performance effect of stock selection for the month. (1 Mark)

(iii) Describe how your calculation process would change if there was a large cash deposit made to the fund during through the month. (2 Marks)

QUESTION 4: SOLUTIONS

(a) (i) What is the after fees information ratio of the current external active manager?

(2 marks)

(ii) Suppose now that active manager 'A' manages 50% ($\delta = 0.5$) of the value of the underlying equity fund and active manager 'B' manages the other 50%. Assuming that both managers also have equal active risk, what is the resultant information ratio of the combined active strategies before MER fees?

(3 marks)

(iii)What is the resultant information ratio of the combined active strategies after all MER fees?

(2 marks)

(i)
The current active manager has a before fees ex-post and ex-ante information ratio of 0.25. Thus with an active risk of 3% we expect the manager to generate an active return of 0.75%. However the MER is 0.80% so the after fees the expected fund active return is: 0.75%-0.80%=-0.05%.

Therefore the information ratio after fees is: $IR = \frac{-0.05}{3} \approx -0.02$

(ii)
Assume we have a% active risk for each strategy then the resultant combined active risk will be:

$$\omega = a\% \sqrt{0.5^2 + 0.5^2 + 2(0.5)(0.5)(0.3)} = a\% \sqrt{0.65} = 3\%$$

Therefore the active risk for each manager is: $a\% = \frac{3\%}{\sqrt{0.65}}$.

Using the pre-MER fee information ratio, the combined expected active return will be:

$$\alpha_{pre} = a\% \left(0.5 \times 0.5 + 0.5 \times 0.4\right) = a\% 0.45$$

Therefore the pre-MER fee combined information ratio will be:

$$IR_{pre} = \frac{\alpha_{pre}}{\omega} = \frac{a\% 0.45}{a\% \sqrt{0.65}} \approx 0.56$$

(iii)
The post-MER fee active return is the active return without fees less the MER fees of the two active managers weighted by 0.5 and less the MER of the index manager.

$$\alpha_{post} = a\% \left(0.5 \times 0.5 + 0.5 \times 0.4\right) - \left(0.90\% + 0.70\%\right) \times 0.5 - 0.15\%$$

$$= a\$0.45 - 0.95\% \approx 0.72\%.$$

Therefore the post-MER fee information ratio is: $IR_{post} = \frac{\alpha_{post}}{\omega} \approx \frac{0.72\%}{3\%} \approx 0.24.$

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

- Part (i) (2 KU)
- Part (ii) Combined expected active return (2 CJ), pre-MER combined information ratio (1 CJ)
- Post-MER fee information ratio (2 SJ)

(b) The optimal allocation of active risk between active managers in an investment portfolio to maximise expected active return (information ratio) is known as 'risk budgeting'. Outline briefly in words how you would formally calculate the optimal proportion of active risk allocated to active manager 'A' and active manager 'B'.

(2 marks)

The optimal allocation of active risk between active managers is a Markowitz mean-variance optimization problem where the returns vector is expected active manager returns and the covariance matrix is calculated from the correlation between active investment styles and uses the expected information ratio of each active return strategy to relate active returns to active variance.

Marking Guide: (2 CJ)

- Identifying mean-variance optimisation (1 CJ)
- Brief explanation (1 CJ)

(c) The formula for a t-statistic to test a sample mean against the null hypothesis (the probability that the population mean is zero) is as follows: $\frac{\bar{S}}{\bar{\sigma}}\sqrt{n}$, where *t* is the *t*-statistic, $\bar{S}$ is the sample mean, $\bar{\sigma}$ is the sample standard deviation and *n* is the sample size. How would we use this statistic to assess if active manager ex-post returns are due to skill rather than luck ?

(2 marks)

The sample mean over the sample standard deviation is simply the manager information ratio. So if we observe *n* independent information ratio outcomes from an active manager then we can generate a t-statistic and calculate the probability that the positive information ratio over *n* periods was due to chance or skill.

Marking Guide: (1 SJ)

- Identifying the correct use of the t-statistic (2 SJ)

(d) You calculate the annualised monthly performance of an equity portfolio where retail investors can buy and sell investment units that are priced daily using the Net Asset Value (NAV) of portfolio. Assume that the unit price was U_0 at the beginning of the month and U_{31} at the end of the month. Give reasons for the choice of portfolio performance calculation methodology you use and formulate in detail how you would calculate the annualised monthly portfolio return to a retail investor assuming that the buy price is the same as sell price on any day.

(4 marks)

Since retail investors can buy or redeem investment units without restriction, the investment manager does not control cash flows in and out of the equity portfolio. Therefore the Association for Investment Management and Research Global Investment Performance Standards (AIMR-GIPS) specify that Time Weighted Rates of Return (TWRR) should be used to calculate investment portfolio returns to remove cash flow effects from the portfolio returns (TWRR to remove cash flow effects is sufficient for the mark).

To calculate the TWRR we first calculate the 31 daily arithmetic returns (implies that all portfolio cash flows occur at the end of the day) and compound them as a monthly geometric return r_M . (Note that some software performance analytics such as *HiPortfolio* actually model daily portfolio cash flows as occurring at midday. Any answer that includes this refinement is acceptable.)

$$r_M = \left(\left(\frac{U_1 - U_0}{U_0} + 1 \right) \times \cdots \times \left(\frac{U_{31} - U_{30}}{U_{30}} + 1 \right) \right) - 1 = \left(\frac{U_1}{U_0} \times \cdots \times \frac{U_{31}}{U_{30}} \right) - 1$$

The annualized geometric r_A return is then calculated as: $r_A = (r_M + 1)^n - 1$ where either n = 12 or n = 365/31 is acceptable. Note that if the student specifies the Modified Dietz formula then ½ marks should be given since this is generally accepted to be an approximation to a Money Weighted Rate of Return (MWRR) and the AIMR-GIPS standards explicitly specify TWRR should use a geometric return calculation.

<u>Marking Guide: (4 SJ)</u>

- Paragraph 1 (1 SJ)
- Paragraph 2 (2 SJ)
- Paragraph 3 (1 SJ)

(e) You are the analyst for an investment portfolio that is invested in two sectors: 50% cash and 50% domestic equities. It trades only at the end of each month and has no deposits or redemptions. It has a benchmark of 100% domestic equities. Cash returned 0.5% for the month, the portfolio's equity sector increased in value by 2.0% for the month. The benchmark return was -1.0% for the month.

(i) Describe and quantify the performance effect of sector allocation for the month.

(2 marks)

(ii) Describe and quantify the performance effect of stock selection for the

month.

(1 mark)

(iii) Describe how your calculation process would change if there was a large cash deposit made to the fund during through the month.

(2 marks)

(i) Sector Allocation effect arises from the manager decision to have different exposure to the investment sectors compared with that specified in the benchmark. In this case the effect is caused by a 50% exposure to cash compared with zero in the benchmark + 50% exposure to equities compared with 100% in the benchmark. The return level used is commonly that of the benchmark (assume actual cash return is the same as benchmark cash return) so= (.5 – 0) x (.5%) + (1 - .5) x -1.0%

(ii) The Stock Selection effect is that caused by choosing stocks that were different from those in the benchmark for that sector. When weighting the sectors the benchmark weight is commonly used. So

= 0 x 0 + 1 x (2% - -1%)

= 3%

(iii) If there was a large cashflow during the month, the principles are the same except they only apply whilst there has been no cashflows, so the month needs to be split into two : pre and post cashflow. The calculations are then done separately for each sub period and aggregated. The method for aggregation varies across different models and can be geometric, additive or additive with adjustments.

<u>Marking Guide: (5 CJ)</u>

- Part (i) (2 CJ)
- Part 2 (1 CJ)
- Part 3 (2 CJ)

QUESTION 5 **(17 Marks)**

You are a financial consultant to a developing republic which was formerly a member of the Soviet Union. This country is reviewing its retirement incomes policy. Previously, a prescribed level of state pension, equal to 50% of income at retirement, was available to all workers on retirement at age 65. The government is concerned with the cost of maintaining this policy, and is interested in adopting a market based policy for retirement incomes.

You are asked to consider the effectiveness of offering tax concessions to workers for contributions to retirement accounts, to be established under regulation. The tax concessions operate in conjunction with reductions in the state pension. The proposal is similar to the retirement income policy in Australia. The proposal is as follows:

- **The state pension will be subject to an income test, as well as an assets test;**
- **Workers' income that is diverted to retirement accounts is taxed concessionally;**
- **Investment income on retirement accounts is taxed concessionally;**
- **Restrictions on the investment of retirement accounts will be imposed, to ensure diversification;**
- **Only on retirement after age 65 are the funds in retirement accounts accessible to workers. The income drawn from these accounts is subject to minimum and maximum limits, similar to the allocated pension rules operating in Australia;**
- **The income drawn from retirement accounts is not taxed, but is included in the income test.**

The government has engaged you to provide advice on the review. Draft your advice on the following issues:

(a) Discuss briefly how and why the proposed policy could promote economic growth. **(2 Marks)**

(b) What type of asset model would be suitable for assessing the impact of the policy? **(3 Marks)**

(c) How would you assess the financial objectives of the policy, in terms of the trade off between short term tax concessions and long term savings in state pensions? **(3 Marks)**

(d) What controls are available to the government in implementing the policy? **(5 Marks)**

(e) What risks are inherent in the policy? **(4 Marks)**

Question 5 Solutions

(a) Discuss briefly how and why the proposed policy could promote economic growth.

(2 marks)

The proposal can be seen as a form of government expenditure (in the form of tax concessions) that is invested in productive assets. This would be an investment in the local economy, directed by the market rather than by government. To the extent that the policy generates earnings higher than the government's borrowing cost, this would be a long term benefit to the economy.

Marking Guide: (2 CJ)

- Point as above (2 CJ)

(b) What type of asset model would be suitable for assessing the impact of the policy?

(3 marks)

From the point of view that the policy is for the long term, stochastic volatility in asset returns is not a major focus. In this case, serial correlation in returns with depressed markets could impact on budget surpluses. This feature should have a central role in the costing of the policy, along with the enhanced asset returns that the policy might bring.

However, the government may live or die by effects generated in the short term (eg workers now being exposed to market returns on their savings) so must get some idea what these are likely to be. In this case a stochastic model would be useful to get an insight into the range of possible outcomes in say the first 3 to 5 years of the policy.

Asset Mix

Marking Guide: (3 SJ)

- Stochastic volatility not a significant consideration (1 SJ)
- Serial correlation (1 SJ)
- Enhanced asset returns (1 SJ)
- Discussion of short term vs long term (1 SJ)
- Asset mix (1 SJ)

To a maximum of 3 marks

(c) How would you assess the financial objectives of the policy, in terms of the trade off between short term tax concessions and long term savings in state pensions?

(3 marks)

The policy may be modelled as an ALM with the following characteristics:

- The objective of the policy is to optimise the long term effect on GDP. As the policy could be funded by government borrowing, the discount rate used for assessing the present value of the policy should be the government's borrowing rate.
- The asset model should provide an indication of the range of outcomes possible.
- The constraints should be related to the budgetary impact of the policy, in terms of both extent and duration.

Marking Guide: (3 CJ)

- 1 per point above (3 CJ)

(d) What controls are available to the government in implementing the policy?

(5 marks)

The controls are many and various:

- The parameters of the incomes and asset tests
- The restrictions on asset allocations, especially to foreign investment
- The limits on drawing income from retirement accounts:
- Minimum limits to offset the state pension
- Maximum limits to stabilise the effect on budgets
- Limits on contributions to retirement accounts.
- Taxation of excessive accounts or incomes.

Marking Guide: (5 SJ)

- 1 per point above to a maximum of 5 marks (5 SJ)

(e) What risks are inherent in the policy?

(4 marks)

Several risks are relevant:

- The impact of increased savings and investment on economic growth and local asset returns.
- The interactions with global investment markets, and with global enterprises
- Non-diversification of asset allocations and volatility in asset returns
- The extent of natural resources and the adaptability of the population.

Marking Guide: (4 CJ)

- 1 per point above to a maximum of 4 marks with allowance for other risks not mentioned above (4 CJ).

END OF PAPER