INSTITUTE OF ACTUARIES OF AUSTRALIA

COURSE 1 INVESTMENTS MAY 2006 EXAMINATIONS

MARKING GUIDE

Level of Difficulty

Question	Units	Knowledge & Understanding	Straight-forward Judgement	Complex Judgement	Total Marks
1a	1,2	2			2
1b	1,2		3		3
1c	1,2		1	3	4
1d	1,2,3			3	3
2a	2	2	2		4
2b	2		2	1	3
2c	2		1	3	4
2d	2		2	3	5
3a	2	3	2	1	6
3b	2	1	2	2	5
3c	2		1	3	4
3d	2		2	1	3
4a	4	2	1		3
4b	4	2	3	3	8
4c	4, 2	2	1		3
4d	4, 2		2	3	5
4e	4			3	3
5a	5	2	3		5
5b	5		1	3	4
5c	5	2	2		4
5d	5		2	3	5
6a	5, 6		3		3
6b	5, 6, 3	2	1		3
6c	6		1	2	3
6d	6	1	2		3
6e	6	2			2
TOTAL		**23**	**40**	**37**	**100**

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COURSE 1 INVESTMENTS **MAY 2006 EXAMINATIONS**

Answer all 6 questions.

QUESTION 1 **(12 Marks)**

A notable phenomenon of the last decade has been the rise of emerging markets, especially China and India, in their share of world GDP. As the investment manager to a large multinational organisation, you are concerned with the effects of this emergence on investment strategy.

(a) Identify two defining characteristics of an emerging market. (2 Marks)

(b) Describe possible implications of this emergence for a resource-based economy such as Australia's. (3 marks)

(c) Discuss in broad terms the effect that you would expect of this emergence on both domestic and international investment strategy. (4 marks)

(d) Discuss how currency might affect your answer to (c). (3 marks)

Solution

(a) An emerging market is usually defined as a country with a low to medium income per head of population, and with underdeveloped financial markets. The former is as defined by the World Bank, and the latter is usually measured by the ratio of market capitalisation to GDP. (There are also other qualitative criteria for the latter.)

(b) Emerging markets have the potential to:

- Increase substantially (as in the case of China) the demand for natural resources such as minerals and energy, of which Australia is a major supplier.

- Provide manufactured goods (China) and services (India) at much lower labour costs than in developed countries.

Both these effects are beneficial for resource based countries, in that they increase exports and reduce import prices. The overall effect is to increase living standards for resource rich countries.

(c) In terms of investment strategy, there is clearly a stimulus for resource based industries arising from the demand from emerging markets. In fact there may be direct demand for foreign ownership of some resources (eg. coal and aluminium).

On the downside, there is obvious competition for domestic manufacturing industry, leading to pressure to move manufacturing offshore. This may result in loss of lower skilled jobs, and there will be a dislocation of wage structures as the domestic economy moves from manufacturing to higher value services (such as education and technology).

The overall effect is that there are increased prospects for investment in resource or service based industries, and in the emerging markets themselves. There are reduced prospects for domestic manufacturing.

(d) Currency is one factor which tends to restore the balance between the demand and supply for a country's output. In the longer term, an increased demand for an emerging market's goods or services should lead to appreciation of that country's currency, thus making its exports less competitive. This means that the currency effects of investment in emerging markets must be considered carefully. It also means that domestic manufacturing may one day become attractive again, as the domestic currency depreciates.

In practice emerging markets do not allow their currencies to float freely, and they may build up significant foreign exchange reserves. The existence of such reserves, especially in the US, can have distortionary effects on domestic interest rate policy.

QUESTION 2 **(16 Marks)**

You are an investment consultant discussing the merits of listed and direct property (i.e. real estate) investment with a property manager. He believes that your modelling of direct property as an asset class is too conservative, and does not reflect its true potential in delivering stable returns.

(a) It is often claimed that property as an asset class has the attributes of both equity and debt. Discuss the reasons why this may be so. (4 marks)

(b) Suggest with reasons a basis at the present time for modelling *listed* property returns in terms of both expected return and volatility, indicating the relevance of current interest rates. (3 marks)

(c) How would your answer to (b) differ for *direct* property? (4 marks)

(d) Describe the benefits and limitations of the various approaches to constructing a benchmark for direct property. (5 marks)

Solution

(a) Property provides income in the form of a regular rental stream, which for most property types is linked to CPI, reviewed infrequently and is reasonably stable. This gives property some of the income characteristics of debt. Property valuers therefore use a long term bond rate as the basis for a capitalisation rate, and it would follow that property values have some of the interest rate sensitivity of debt.

On the other hand, the growth of rental steams is subject to the following influences:

- Cyclical economic demand, which affects commercial and retail property particularly;
- Geographic proximity to other facilities and residential neighbourhoods, which determine local demand;
- The costs involved in maintaining property, which include maintenance, rates, insurance and other outgoings.

These effects give property the characteristics of equity, which are reflected in a valuer's assessment of future rental growth in establishing a capitalisation rate for a given property.

(b) A CAPM type analysis of listed property returns would produce a beta of between 40% to 50%. This indicates that an expected return for listed property could be taken at about halfway between expected returns for debt and equity, and a volatility of about half that for equity. The expected return for listed property could thus be taken also as halfway between expected returns for debt and equity.

Current cash rates are therefore relevant to the extent that they predict future cash rates, and the long term return on debt.

(c) There is little reliable data for assessment of direct property returns. The limited data available is distorted by the infrequency and subjectivity in valuers' appraisals. Therefore property is often modelled based on the historical performance of listed property. It can reasonably be expected that the returns for listed and direct property should in the long term be equal, on the basis that the underlying assets are the same. [Some argue that there is a long term liquidity premium for listed property above direct property. On the other hand, there is a scarcity of unlisted/direct property investments vs. significant demand from institutional investors such as super funds seeking to diversify away from listed investments, which drive up the prices of unlisted property.]

The volatility of direct property should be expected to be lower than that for listed property because of the appraisal process used for valuing the former. However it may be better to model this feature as direct property being a lagged variant of listed property. This will introduce some smoothness in direct property returns, relative to listed property, which probably reflects the property manager's convictions.

(d) There are essentially two ways of constructing a direct property index to be used as a benchmark in practice:

- Using appraisal values for a predetermined portfolio of properties (eg. the Mercer Unlisted Property Index)
- Using actual transactions on direct properties (eg. the Property Council of Australia indexes).

Benefits of the appraisal approach:

- Its application for benchmarking can be assessed by the relevance of the properties selected for the benchmark – for example CBD properties in the benchmark would be appropriate as a benchmark for a CBD portfolio, but not for a retail portfolio.

Limitations of the appraisal approach:

- May adjust only slowly, as appraisal values are remeasured
- Is subjective to the extent that appraisal values are subjective

Benefits of the transaction approach:

- It is objective, as actual transaction values are used
- Should be more responsive to changes in economic conditions

Limitations of the transaction approach:

- The class of possible transactions has to be wide, as transactions are infrequent. For example there may be only a few dozen transactions in major properties in any quarter, covering CBD, retail and industrial classes. The relevance of a broad based index is questionable for any specific property class

QUESTION 3 (18 Marks)

You work for an investment adviser that specialises in private equity investments. A major government authority has approached you with a view to advising on the selection of investments in private equity.

(a) Describe briefly the major *structural* differences between investing in public equity and private equity. List the benefits and limitations of these asset classes that flow as a result of these differences. (6 marks)

(b) Explain why agency risk is a significant aspect to be considered when investing in private equity, and how that risk could be managed. (5 marks)

(c) Suggest ways in which the performance of private equity investments can be measured and evaluated. (4 marks)

(d) **Private equity and hedge funds are often classified under the same 'alternative equity' umbrella. However, they are not substitutes for each other. Discuss the main differences between them. (3 marks)**

Solution

(a) The major *structural* differences between public and private equity are as follows:

- Trading of public equity is facilitated by exchanges, which promote:
  - information flows
  - liquidity
  - a regulated and orderly market.
- Information on private equity is scant, and hence specialist managers need to be used in practice.

In practice investment in private equity is conducted through limited partnerships or other close-ended vehicles. These vehicles tend to involve:

- Low liquidity (although some secondary markets exist)
- Slow entry/investment
- Little regulation of operation or reporting of performance

The benefits of private equity in relation to public equity are as follows:

- Diversification in a wide range of economic activities, countries and strategies. In fact investment in all human activity is possible in theory.
- Investment at all stages of economic development, including on the ground floor in new technologies and services.

- Scope for exploitation of private information, which may yield spectacular results.
- Scope for exploiting inefficiency of pricing of private markets.

The limitations are:

- Cumbersome investment structures, which suffer a 'J-curve' effect in delivering performance.
- Limited liquidity, and a need to plan exit mechanisms.
- High management fees, which are usually partly performance based.
- A lack of transparency in reporting.
- A lack of a comprehensive regulatory framework (even in the US).
- Lumpiness in terms of size of commitment.
- Greater management effort in monitoring and control.
- A lack of theory in modelling their performance characteristics.

(b) Private equity necessarily involves:

- A large universe of investible assets
- specialist managers who are responsible for creating deal flow,
- informational asymmetry between managers and investors.

In contrast for public equity, the universe of possible investments is limited and the informational asymmetry of much less impact. Thus in private equity the alignment of the manager's and investors' interests is more critical.

The manager as the agent of investors must be given incentives to act in their interests. This can be achieved in various ways:

- Co-investment by the manager
- Performance fees for the manager, on a cumulative ("carried interest") basis, with no floors or caps.
- The effectiveness of controls built into the investing vehicle, in terms of due diligence of investments and their monitoring and reporting.
- Extensive due diligence of the manager's operations before investing

- Direct representation of investors on the board of the investing vehicle (for significant investors).

- Delegation of control to another financial intermediary with specialist knowledge (eg. a fund of funds manager).

(c) Private equity investments are usually valued by the manager responsible for their selection. Naturally this leaves much to be desired in the way of the timeliness and reliability of performance reporting, but there are no alternatives. The only means of dealing with this problem are to:

- Use a long timeframe for assessing performance results (say by giving weight to the vintage year of an investment)

- Use money-weighted returns for particular vehicles (MWR or IRRs are more applicable because of the lumpiness of timing and size of cashflows)

- Smooth the effect of large revaluations

There is an equally difficult problem with selecting an appropriate benchmark, given the diversity of private equity investments. The alternatives are to adopt:

- A public equity index as a long term benchmark.

- One of the few published benchmarks (Venture Economics)

- An absolute return benchmark, based say on the performance targets on the underlying investment vehicles.

(d) Private equity and hedge funds are classified under the 'alternative equity' umbrella because they are not listed on public exchanges. The main differences are as follows

- Hedge funds involve investing in traditional asset classes using new or different investment strategies not available or used by traditional managers, e.g. relaxing the long-only constraint to allow shorting of stocks, arbitraging between convertible and regular issues, arbitrage between stocks involved in mergers.

- Liquidity - Private equity is much more illiquid than hedge funds because of the timeframe required to invest committed funds into underlying projects. (cf. the J curve). In contrast hedge funds often provide limited liquidity within 1-3 months (especially fund of fund vehicles).

- Risk/return – depending on the type of hedge funds, these can offer lower risk and correlations to listed equity investments (while alpha is lower, the aggregate information ratio may be improved due to diversification). Private equity can have similar or higher risk/return profiles to listed equity.

QUESTION 4 **(22 Marks)**

You are the asset consultant to a general insurance company that issues policies covering malpractice by medical practitioners. You are working with the actuary who advises the insurer on the assessment of liabilities for outstanding claims. The liabilities are measured as a discounted value of expected claim payments, with the discount rate based on current bond yields.

The management of the insurer have asked you and its actuary to advise jointly on the investment strategy that is most appropriate for the liabilities. The insurer's actuary adopts a stochastic approach to model liabilities and you adopt a similar approach to model assets.

The insurer is particularly interested in the possibility of immunising the liabilities by means of Commonwealth government securities, but other asset classes available are listed equity and property.

(a) Suggest specific investment objectives that might be adopted in relation to claim liabilities. (3 marks)

(b) Outline the framework you would adopt for assessing how well a given investment strategy meets the objectives in (a). You should give particular attention to:

(i) The type of asset model you would adopt
(ii) The inputs needed for your model
(iii)The link between the assets and liabilities (8 marks)

(c) Define immunisation and describe how it may be implemented as an investment strategy by the insurer. (3 marks)

(d) Discuss how immunisation can be treated as a particular form of investment strategy that can be assessed like other strategies in (b). What aspects of your asset model are critical for this assessment? (5 marks)

(e) Discuss how your modelling can assess the benefits and limitations of immunisation as part of an investment strategy. (3 marks)

Solution

(a) The investment objectives would have to involve solvency and might comprise:

- Maximisation of the level of solvency, defined as coverage of assessed liabilities by assets over a specified period. [Alternatively profit maximisation may be the objective];
- Subject to an upper bound on the probability of insolvency at any time during a specified period; and
- A liquidity constraint on certain asset classes (eg direct property).

(b) The asset model must be suited to the task of realistically modelling the investment objectives adopted, centering on solvency. Thus the incidence of asset returns across years is just as important as their distribution in any given year. The asset model would thus need to address the following types of behaviour:

- The asset return distribution for each relevant asset class, with attention given to fat tails of equity classes;
- The possibility of serial correlation or mean reversion for some asset classes (property and debt)
- The possibility of volatility clustering, associated with market booms and crashes (equity)

The inputs required to calibrate the model would include:

- Expectations of asset returns, derived from theory and consistent with current economic conditions;
- The dynamics of asset returns, found from fitting the appropriate model to historical data.
- Consistent modelling of other economic variables which are relevant to the liabilities. This obviously includes bond yields but, depending on the sophistication of the liability model, may also cover CPI and claim escalation rates. In order to model immunisation, the whole yield curve also needs to be modelled consistently with debt returns.

The overall asset model can obviously be used to generate simulations of asset returns and other economic variables. This can be combined with a stochastic liability model in the following way:

- The actuary's liability model can be used to generate simulations of claim payments, assuming no variation in the economic conditions (CPI) which are modelled under the asset model.
- Each liability simulation could then be paired with an asset simulation to give a total simulation of escalated claims, assets and discounted claim liabilities, for any given asset allocation or investment strategy. This assumes that the asset model and liability model can be decoupled for this purpose.
- The solvency and other objectives can then be determined for each combined asset/liability simulation.
- Lastly, several thousands of simulations can be analysed to assess how well the investment objectives are met.

(c) As an investment strategy, immunisation is about structuring a debt portfolio (of equal present value to the liabilities) so that the duration of the debt components is

equal to that of the claim payments or, for the case in question, the expected claim payments. This should make the funding position of the liabilities less volatile.

In practice an immunisation strategy can be implemented by assigning weights to each CGS on issue. The weights can be chosen to minimise the convexity of the differences between debt and claim cash flows, subject to the weights being positive and subject to the durations of the debt and liability cash flows being equal. This should allow for the limits on CGS maturities that hold in practice.

(d) It is not possible to model an immunisation strategy directly without modelling asset cash flows. However an indirect approach is possible provided that the duration of expected claim payments can be simulated at future points of time. The return on the debt portfolio should then be modelled as one with a duration equal to that of the expected claims.

The critical ingredients for such an approach are therefore:

- The modelling of a full yield curve.
- The ability to assess the duration of expected claim payments at future times (and preferably the ability to have these 'evolve' in a given simulation according to past claims experience)

(e) The clear benefit of an immunisation strategy is the reduction in volatility of funding ratios, as debt is a natural hedge for liabilities denominated in absolute terms. However it is unlikely that the claims payments satisfy this description perfectly – they would escalate at least with inflation, and they are stochastic with respect to the parameters used in the liability modelling of the insurer's actuary. However the modelling of the immunisation strategy should be able to quantify the benefits.

In addition, hedging of liabilities in this way also removes the upside potential associated with asset classes of higher return than debt – namely equity. The whole asset/liability framework is directed to quantifying the trade off between upside capture and volatility reduction.

QUESTION 5 (18 Marks)

You are the investment consultant to a large funds management operation that uses other managers who are specialists in their field. Your expertise is in the appointment of managers in international equity with different styles under a multi-manager framework.

A client, who is expert in merger and acquisition (M&A) activity, has observed to you that equity investment, like M&A, is about the gathering of information on particular stocks. The better the information, then hopefully the better the performance, but the more costly the management fees.

(a) List the differences in investment process between active 'quant' managers and fundamental managers. (5 marks)

(b) Discuss the benefits and limitations of quant managers in relation to fundamental managers. (4 marks)

(c) List the particular aspects you would consider in recommending a quant manager, assuming one is to be chosen. (4 marks)

(d) Compare the basis of the quant style with those of the passive or fundamental styles, and discuss whether you agree with your client's observation. (5 marks)

Solution

(a) Active quant managers:

- Rely on systematic monitoring of factors to detect inefficient pricing. These factors can measure the value, price or earnings momentum of a company, or just about any aspect of its operations or financing. The key to successful quant management is the identification of relevant factors.

- Amass substantial amounts of information about a large range of target stocks. These support the factors that identify pricing opportunities. The sources of information are published information and sometimes brokers. Quant managers do not usually engage in original research, but rely on being better able to use existing research.

- Employ quantitative pricing models to process the information collated, to a much greater degree than fundamental managers. These models can measure the contributions of the various factors to past pricing, as well as their riskiness. Factors are given forward expectations for the purpose of building portfolios, with risk and reward being the usual parameters.

- Use quant models to optimise portfolio, taking into account stock inputs, risk contributions from each stock and portfolio parameters/constraints. The models recommend portfolios that maximise returns given the risk constraints required by client (e.g. tracking error, maximum stock/sector positions relative to index)

In contrast to active quant managers, fundamental managers:

- Rely on superior information to detect inefficient pricing. This information is usually costly to gain, and hence only a small number of stocks may be researched.

- The information may be used in a variety of ways, ranging from developing broad economic themes (eg. population ageing) to individual stock valuation.

- Portfolio construction is usually not quantitative or disciplined, relying instead on broad filtering and ranking criteria.

(b) Quant managers provide the following benefits:

- Display discipline in their processes, and hence can be expected to provide more consistency in performance.

- Address risk directly as an attribute of a portfolio.

- Are reliant on large scale information processing, and hence should be expected to be more cost effective.

On the other hand, they also suffer the following limitations:

- May show little transparency in the reliance placed on factors or their return expectations (a form of intellectual capital), thereby requiring a leap of faith of the investor. The process may appear as a 'black box' to investors.

- Have risk models which are tied to history, and are therefore unresponsive to changing market conditions

- apply a judgemental overlay for hard-to-include factors, e.g. IPOs where there is less publicly available information.

(c) In recommending a particular quant manager, the following are critical discriminators

- Modelling sophistication and analytical skills (the identification of factors in quant model, and the analysis of exposures of stocks to those factors)
- Personnel (remuneration and retention policies)
- Data sources (the quality of broker and other data)
- Systems (appropriate software and access to on-line trading)
- Organisation (allocation of responsibilities; effective management)

(d) Passive management is based on market efficiency, whereas management styles that are based on intensive research of a few stocks are clearly based on the

existence of significant pricing inefficiencies. The quant style is clearly an active style but falls between these two extremes for the following reasons:

- It does not seek to limit the universe of stocks that are researched.
- Rather, it seeks to reduce the number of risk factors that drive performance to a manageable number that can be monitored.
- The information that underpins the factors is usually not generated in house, but are in the public domain or purchased.
- Diversification across the risk factors is practised, as the risk factors cannot alone explain performance perfectly.
- Quant models are easier to customise – they can dial up or down the level of active risk required by client (so, quant can allow for middle ground between passive and active, e.g. enhanced passive)
- The application of quant models follow closely the 'fundamental law of active management' – alpha is a function of breadth of information x level of management skills.

This certainly implies that the costs involved in active quant are higher than those for passive management, but probably lower than for fundamental styles (and certainly for identifying M&A targets).

Thus to the extent that the cost of gathering information reflects its usefulness, then active quant should be a compromise between passive and fundamental styles. However the value of information relies also in the skill in which it is exploited, so that in practice human factors can play a large part in the relative performance of active quant managers.

QUESTION 6 (14 Marks)

You are an investment consultant advising on the implementation of an Australian equity mandate as an individual portfolio for a client, a large charitable trust. Because of its nature, the trust is precluded from investing in some activities, including alcohol, tobacco and gambling. Though your client is attracted to the growth prospects of equity investment, the trust's obligations are unpredictable and liquidity of investments is a key concern.

(a) List the main features of the Investment Management Agreement you would consider *specifically* for the mandate in question. (3 marks)

(b) Explain the role that derivatives can play in the operation of the mandate, the circumstances in which they can be useful, and their limitations. (3 marks)

(c) Describe the concept of tracking error, what is meant by ex-ante and ex-post tracking error, and how they can be determined in practice for the mandate in question. (3 marks)

(d) Describe with reasons the risk controls you would recommend to be included as part of the investment mandate. (3 marks)

(e) Discuss what information you would recommend in order to monitor the operation of the mandate. (2 marks)

Solution

(a) The features in the IMA that need *specific* consideration are:

- The range of authorised investments. As some of the restricted activities (eg. gambling) are only part of the activities of some significant stocks (eg PBL), a decision has to made to either completely exclude those stocks or limit their weighting.

- The investment objectives of the mandate.

- The investment controls of the mandate, because the benchmark must also be consistent with the restrictions, and large holdings of illiquid stocks must be avoided.

(b) SPI derivatives can be used to adjust the exposure under the mandate to Australian equity, cheaply and quickly. They can be useful in the following situations:

- When new funds are to be invested under the mandate, long positions in either SPI futures or options can be used to increase equity exposure, as an alternative to physical purchase of equity.

- When funds are to be realised under the mandate, short positions in either SPI futures or options can be used to reduce equity exposure, as a prelude to physical sale.

- SPI options can be used to set a floor to performance if that is needed as a result of the client's obligations.

The limitations of derivatives are:

- Their timeframe – they can be used to manage current exposures for up to only 24 months.

- They are based on the ASX/S&P 200 index, and hence provide only approximate adjustment of exposure if the benchmark under the mandate is significantly different. This is particularly important in the light of the client's investment restrictions.

- The pricing of options may be expensive.

(c) Tracking error is defined as the volatility of performance relative to the benchmark. Two versions are possible:

- Ex-post tracking error is that which the manager achieves in practice. This is the product of the manager's divergence from benchmark weights, as well as the actual performance of each stock relative to benchmark.

- Ex-ante tracking error is a theoretical concept, which measures the volatility that can be *expected* from a given portfolio of stocks.

Ex post tracking error is easily measured as the volatility of the outperformance that the manager achieves. Ex-ante tracking error requires a volatility of each stock's relative performance to be assessed, usually with a CAPM model (such as that found under tools such as BARRA) The difficulty with the mandate in question is that the benchmark is likely to be non-standard, with the result that stock volatilities against the benchmark need to be specially assessed.

(d) In view of the nature of the mandate, appropriate risk controls would be as follows:

- A benchmark consistent with the mandate's restrictions.

- Limits on both ex-post tracking error, assessed say on rolling three year periods, and limits on ex-ante tracking error at any time.

- Limitations of derivative usage. A common limitation is that the effective exposure to equity cannot be negative, but more stringent limitations based on the total face value of derivatives can be imposed.

- A limit on the divergence of any stock from its benchmark weighting, according to the stock's liquidity

(e) To monitor the operation of the mandate, the following reporting information is recommended:

- Portfolio allocations
- Derivative holdings
- Transaction and cash flow listing
- Monthly returns, before tax and fees, and benchmark performance
- Compliance with mandate and risk management statement
- Commentary on major deviations from benchmark
- Exercise of voting rights
- Reconciliation with custodial information

END OF PAPER