Marking Guide

Level of difficulty

Question	Units	Knowledge & Understanding	Straight-forward Judgement	Complex Judgement	Total Marks
1a	BM*	3			3
1b	BM*		3		3
1c	BM*			3	3
1d	BM*	2			2
1e	BM*		3		3
1f	BM*		3		3
1g	BM*, 1			3	3
2a	1		3		3
2b	1		4		4
2c	1	3			3
2d	1			10	10
3a	1		4		4
3b	1		2		2
3c	1			4	4
3d	1			4	4
3e	1		4		4
3f	1	2			2
4a	2	5			5
4b	2			3	3
4c	2		8		8
4d	2			4	4
5a	2	3			3
5b	2		2		2
5c	2			4	4
5d	2			4	4
5e	2		4		4
5f	2		3		3
TOTAL		**18**	**43**	**39**	**100**

*Background Material to the course

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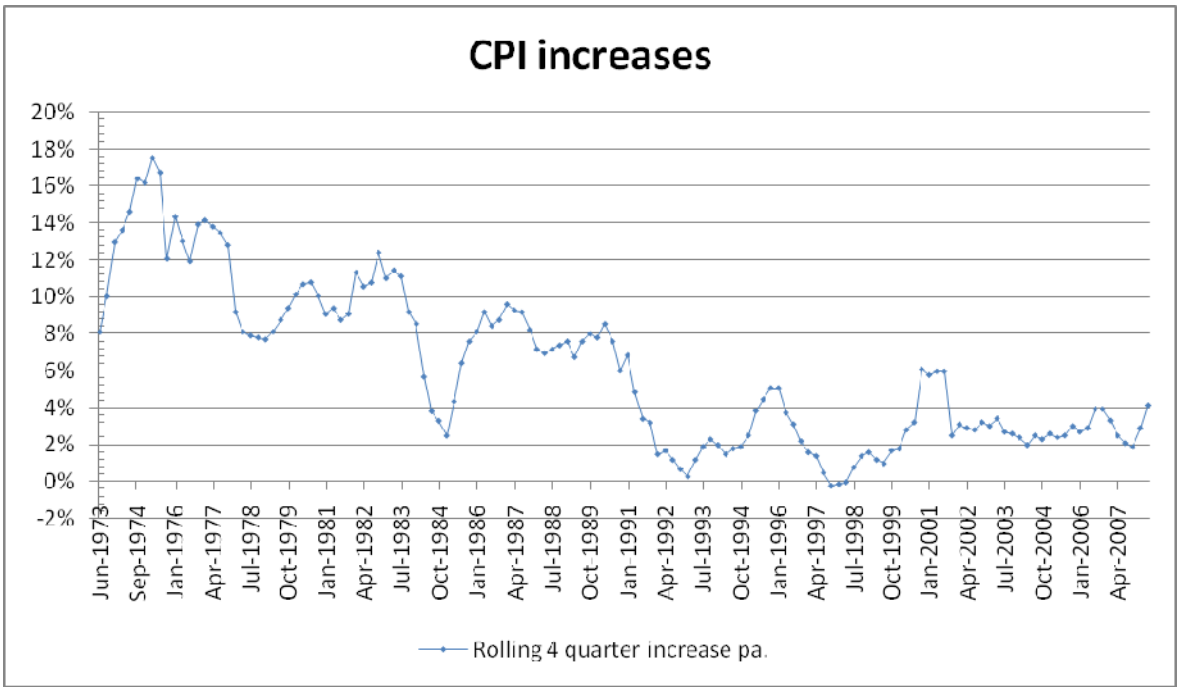
Answer all 5 questions.

QUESTION 1 **(20 Marks)**

The monetary policy of the Reserve Bank (RBA) is based on a target for price inflation of 2%-3% p.a. Whilst this target has been generally achieved since it was introduced in 1996, recent CPI increases have exceeded the target range, as shown below:



Source: ABS

(a) **Suggest reasons why an inflation target is a suitable objective for monetary policy.** **(3 marks)**

(b) **Suggest possible causes of inflation in Australia.** **(3 marks)**

(c) **Suggest reasons why the inflation target was *not* achieved at particular times since 1996.** **(3 marks)**

(d) **Explain how the RBA attempts to achieve its inflation target, and the role of interest rate management in this objective.** **(2 marks)**

(e) **Discuss the limitations of monetary policy in controlling inflation.** **(3 marks)**

(f) **Suggest other approaches to controlling inflation.** **(3 marks)**

(g) Discuss how actual price inflation affects expectations of *future* inflation. Do inflationary expectations matter when assessing the *value* of inflation-linked liabilities? (3 marks)

Solutions

(a) Price inflation is a suitable target for monetary policy because:

- One of the overarching objectives of the RBA is to contribute to "the economic prosperity and welfare of the people of Australia". Price inflation is detrimental to economic growth as it is a form of economic disequilibrium, making uncertain the terms of trade in goods and services and discouraging future investment and savings.
- Price inflation can be measured reliably, and it is generally accepted that very high inflation rates can occur only with uncontrolled increases in the money supply.
- The RBA has the ability to control the money supply by its short term lending to banks, i.e. by open market operations.

[1 mark per point, to a maximum of 3 marks]

(b) The most common causes of inflation are:

- An imbalance between the supply and demand for goods and services (e.g. capacity constraints in manufacturing, coupled with high wages.).
- Increases in input prices (e.g. imported oil)
- Perpetuation of price inflation by wage inflation.

[1 mark per point, to a maximum of 3 marks]

(c) In the period since 1996, price inflation has been affected by certain events outside the RBA's control:

- The introduction of GST in 2000, which saw a one-off 10% increase in the price of most goods and services (this was not necessarily economically detrimental, as it was offset by an increase in after-tax disposable income).
- A severe drought in the early 2000s, which affected food prices.
- Strong overseas demand for resources, the mining boom and consequent wage and price inflation in Queensland and WA
- Rising oil prices driven by demand in China, India and elsewhere

[1 mark per point, to a maximum of 3 marks]

(d) The RBA has the ability to control economic demand to some extent by open market operations, varying the extent to which it lends to the banking sector and therefore varying short terms cash rates:

- In turn, short term cash rates (and the resulting supply of credit) influence whether consumers purchase goods immediately or defer consumption (i.e. save). High cash rates discourage economic demand, dampen price inflation, and stimulate investment.
- In addition, high inflation and interest rates tend to raise exchange rates, and tend to favour imports over exports, again diminishing domestic prices.

[1 mark per point, to a maximum of 2 marks]

(e) Price inflation is not solely dependent on domestic economic demand. It may be that the *supply* of goods and services is affected by events outside the RBA's control [1 mark], such as:

- worldwide imbalance for certain goods (e.g. limited oil supply) [1 mark]
- natural limitations on supply (e.g. agriculture affected by drought or climate conditions) [1 mark]
- political events (war or civil unrest) [1 mark]

[maximum of 3 marks for this part of the question]

(f) Other ways of controlling price inflation are to:

- Maintain a contractionary fiscal policy (e.g. controlled government spending relative to tax revenue), so that demand arising from government spending is limited;
- Limit spending directly (e.g. by imposing savings, as occurred with the 3% productivity increase in the 1980s, that was directed to superannuation savings);
- control wage increases (e.g. prices and income accord).

[1 mark per point, to a maximum of 3 marks]

(g) Inflationary expectations are affected by current rates of inflation, to the extent that the factors that drive current inflation will persist into the future. [1 mark] One of these factors is future monetary policy, which may result in *real* interest rates[1] being relatively stable [1 mark]

Inflationary expectations are relevant for assessing future obligations that are linked to future prices or wages (e.g. defined benefit or general insurance claims, social security benefits). However the value of these obligations depend on real interest rates, and to the extent that such rates are independent of inflation, inflationary expectations do not matter. [1 mark]

[1 mark per point, to a maximum of 3 marks]

[1] The *Fisher Hypothesis* is that real interest rates are independent of inflation.

QUESTION 2 **(20 Marks)**

An asset is said to be *liquid* when it can be sold quickly and with minimal price impact. Several asset classes are regarded as generally illiquid, and most of them are *unlisted*. A *liquidity crisis* is a situation in which an investor has difficulty in liquidating assets.

On the other, a *credit crisis* is a situation in which credit is difficult, or expensive, to obtain for financing a firm's operations. The 2007 subprime mortgage crisis is an example of such a crisis for banks worldwide.

(a) Describe the differences between a liquidity crisis and a credit crisis for an institutional investor. Do the crises result from the type of assets held by the investor or from the type of the investor's liabilities? (3 marks)

(b) Discuss how liquidity and credit risks could be modelled in an asset/liability study. (4 marks)

(c) Give examples of asset classes that are typically regarded as illiquid, including at least one *listed* asset class, and describe the features that inhibit liquidity. (3 marks)

(d) Illiquid asset classes are difficult to model, because their asset values are often subjectively assessed, on an 'appraisal' basis, by a professional valuer. Various approaches have been suggested for modelling illiquid asset classes:

- **Use a listed and liquid proxy;**
- **Use a very long data period for analysing returns for an illiquid asset class;**
- **Use only transaction values of illiquid assets in assessing performance;**
- **Attempt to 'desmooth' appraisal-based performance by assuming that actual transaction values are a known function of appraisal values.**

Discuss the merits and limitations of each approach for constructing an asset model. (10 marks)

Solutions

(a) A liquidity crisis, from its definition, depends on the individual investor's cash flow position, and thus on the liabilities of the investor. Given a need to liquidate a high level of assets, a liquidity crisis can occur without any stress on investment markets. [1 mark].
For an institutional investor, a liquidity crisis can be exacerbated if the types of assets they hold are illiquid. For example unlisted shares and direct real estate assets may be difficult to sell quickly. [1 mark]

A credit crisis is a result of external events, and should be expected to affect the assets of all investors to some extent. As credit risks would be harshly priced, the value of debt investments, and even highly leveraged equity investments, would suffer in these circumstances. [1 mark]

Nonetheless, a credit crisis may provoke or aggravate a liquidity crisis, for example where client investors panic in response to downgrades in credit ratings. [1 mark] For this reason the two concepts are sometimes confused.

[1 mark per point, to a maximum of 3 marks]

(b) A credit crisis could be modelled in terms of credit-risky debt having equity-like characteristics. This is because credit risky debt contains effectively a short put option on the assets of the debtor. The greater the extent of the option, and the higher the volatility of equity returns, the more likely that credit crises would arise.

Alternatively, a credit crisis could be modelled in terms of transitions in credit ratings, with the probability of transition based upon historical experience as well as on the occurrence of global credit events (e.g. business confidence).

Liquidity crises depend on the liabilities of the investor, and the possibility of having to liquidate assets in unfavourable situations. Hence the sensitivity of the investor's cash flows to particular factors has to be modelled.

These may include inflation, GDP growth, business confidence, or asset performance such as in credit risky investment.

In addition, the liquidity of individual assets has to be taken into account, for example as set out in (c).

[1 mark per point, up to a maximum of 4 marks]

(c) Examples of illiquid asset classes are:

- Direct property: liquidity depends on location, type and usage. CBD office accommodation should be expected to be more liquid than outback warehousing.

- Private equity: usually regarded as illiquid due to a fixed commitment period and the nature of the underlying assets. However some secondary markets exist, and may provide a limited form of liquidity.

- Hedge funds: liquidity depends on the underlying assets and strategies. If their strategies involve long term commitments, then liquidity depends on the relative numbers of buyers and sellers.

- High yield bonds, repackaged as CDOs, may be regarded as an illiquid asset class. Though often listed, demand for these assets can suffer greatly during credit crises. The same is true of other thinly traded securities such as low cap equity.

[1 mark per point, up to a maximum of 3 marks. To get full marks there must be at least one point related to a listed asset class.]

(d) Each approach has both merits (+) as well as limitations (-):

Using a proxy:

(+) Financial studies show that listed and unlisted indexes of assets of the similar type have similar long term behaviour in terms of return. [1 mark]

(-) However in the short term their behaviour may vary significantly. [1 mark]

(-) However allowance has to be made for differences in characteristics such as leverage and composition of assets. [1 mark]

(-) Further, individual unlisted assets may have idiosyncratic features (such as location) that may make them more susceptible to forced sales. [1 mark]

(-) This approach cannot always be applied because there may not be a listed market (e.g. private equity). [1 mark]

A long data period for return analysis:

(+) This approach is based on the fact that appraisal values of illiquid assets must converge to their true market values over the long term. [1 mark]

(-) Whilst this is undoubtedly correct, appraisal values are backward looking and do not capture the short term volatility of listed markets. This may become apparent when one tries to sell an illiquid asset. [1 mark]

(-) Thus this approach must be supplemented by volatility of asset values under adverse market conditions. [1 mark]

Using only transaction values:

(+) This would be the ideal approach, as transaction values are what would be achieved if illiquid assets were to be sold. For some large asset classes (e.g. commercial property), indexes of transaction value exist. [1 mark]

(-) However by their nature, transactions on illiquid assets are infrequent, and hence it is unlikely this approach would be often available. Even if one were to look at transactions for a very large asset class, those transactions may be very heterogeneous in nature. [1 mark]

Desmoothing appraisal values

(+) This approach has been attempted for unlisted property. In theory one is trying to reconstruct transaction values from appraisal values, based on a knowledge or assumption of what the smoothing process is. If there is some justification for the assumption, then the approach should be valid. [1 mark]

(-) However appraisal values alone are not sufficient to provide such justification. Either a listed proxy for the assets, or transaction values for them, would also be needed, so that this approach is very similar to those discussed above. [1 mark]

Award 1 mark per point. Students should have at least one disadvantage and one advantage for each of the 4 approaches plus two additional points (from any of the sections) to get the full 10 marks.

QUESTION 3 **(20 marks)**

You are an investment consultant advising retail superannuation funds on asset allocation. However you are considering whether an alternative approach to asset modelling is justified, in the light of increasing globalisation of investment markets.

Your alternative approach is to abandon the conventional model of asset markets, classified into broad equity, debt, real estate and alternative markets, with each assumed to be operating more or less efficiently. You favour a model where business activity plays the central role. You propose to model the major business sectors as 'asset classes' in their own right:

- **Energy**
- **Materials**
- **Capital Goods**
- **Commercial Services & Supplies**
- **Transportation**
- **Automobiles & Components**
- **Consumer Durables & Apparel**
- **Hotels, Restaurants & Leisure**
- **Media**
- **Retailing**
- **Food & Staples Retailing**
- **Food, Beverage & Tobacco**
- **Household & Personal Products**
- **Health Care Equipment & Services**
- **Pharmaceuticals & Biotechnology**
- **Banks**
- **Diversified Financials**
- **Insurance**
- **Real Estate**
- **Software & Services**
- **Technology Hardware & Equipment**
- **Semiconductors & Semiconductor Equipment**
- **Telecommunication Services**
- **Utilities**
- **Government**

Both equity and debt securities would be modelled according to the business sector from which they are issued.

(a) Suggest a justification for your proposed approach based on economic or financial theory. **(4 marks)**

(b) The Capital Asset Pricing Model (CAPM) assumes that securities (and business sectors) are always appropriately priced relative to each other, on the basis of their known risk and return characteristics. Explain how using the CAPM for implementing your alternative approach will work. **(2 marks)**

(c) Critique the CAPM and suggest, with reasons, what technical modification(s) you would make to CAPM for modelling both equity and debt according to business sector under your alternative approach. **(4 marks)**

(d) Discuss possible economic or financial factors that you would consider in deriving return expectations for the model you construct in (c). (4 marks)

(e) Outline how you would apply your alternative asset model in assessing asset allocations for a superannuation fund with an inflation-linked investment objective. (4 marks)

(f) Suggest ways in which your recommended asset allocations could be implemented in practice. (2 marks)

Solutions

(a) The Efficient Market Hypothesis (EMH) suggests that individual securities are correctly priced in relation to the information about their risk and return at all times. [1 mark]

This means that only the indexes of the major asset classes need to be considered for asset allocation.
[1 mark]

Thus under conventional asset allocation approaches, the implicit assumption is that the only deviation from the EMH is for broad asset classes like equity and debt.
[1 mark]

Under the alternative approach proposed, it is conceded that the EMH may fail even at the level of business activity.
[1 mark]

The informational demands for efficiency may be much greater in times of economic instability:

- the increasing complexity and cross-interaction of business activities,
- in the way that new technologies can affect different activities differently, and
- the uncertain effects of trends such as carbon emissions trading.

[1 mark]

[award marks as above, up to a total of 4 marks]
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(b) CAPM provides a model of pricing based on a security's or sector's covariance with the market portfolio. It suggests that the return r_i of each sector i may be modelled as:

$$r_i = r_f + \beta_i (r_m - r_f) + \varepsilon_i \qquad (*)$$

where r_m, r_f represent the market and risk-free returns respectively. The betas β_i reflect the sector's covariance with the market and may be estimated from past performance. For investment in government debt, $\beta_i = 0$. Betas for corporate debt may be found empirically as for equity. [1 mark]

The errors ε_i are assumed to be random, independent over time, and have a covariance matrix across sectors which can also be estimated from past performance. In this way CAPM provides a mean-variance asset model of returns for all business sectors, by making assumptions only for r_m, r_f. [1 mark]

[to a maximum of 2 marks]

(c) Apart from the usual assumptions required for CAPM to hold, the conventional approach assumes that the betas β_i are stationary over time and may be estimated reliably from past performance. This means that CAPM provides a stable

relationship between expected sector return, market returns and risk free returns [1 mark]

This is unlikely to be consistent with the philosophy of the approach, which allows for inefficiency in the pricing of business sectors. Hence more flexibility is required in assessing return expectations for each business activity. [1 mark]

One of the most dubious assumptions made in applying CAPM is that of (log) normality and stationarity of the error terms ε_i, and their independence over time. It seems clear that these assumptions must be relaxed in order to reflect the complexities in the behaviour of returns on business activities over time. [1 mark]

One possible modification to CAPM is to extend it to be a multi-factor model. CAPM is a single factor model, the single factor being the return on the market portfolio. Returns on business sectors may be more accurately modelled using other factors such as proposed below. [1 mark]

[1 mark per point, to a maximum of 4 marks]

(d) In order for the proposed approach to offer advantages over the conventional one, it must be possible to assess return expectations of the business sectors that differ from those predicted by the relationship $r_i = r_f + \beta_i(r_m - r_f) + \varepsilon_i$

Factors that might be considered in this assessment might include:

- An ageing population, that favours investment in healthcare, pharmaceuticals, financials and discretionary consumer spending;
- An export-based resources boom;
- Carbon emission costs under an emissions trading scheme, which would tend to impact energy producers and transport more heavily than other activities.
- Technological progress (IT, biotech, and telecommunications).
- Factors relating to environment, social responsibility and corporate governance.

[1 mark per point, up to a maximum of 4 marks]

Markers should use their discretion in awarding marks for this part of the question. Award 1 mark per factor for a set of valid factors, up to a maximum of 4 points.

(e) The model of business sectors would need to be coupled with a model of price inflation, so that *real* asset returns can be modelled. Then depending on the complexity of the dynamics of the model:

- the accumulation of a typical series of investor cash flows can be simulated;
- the mean and variance of terminal wealth can be assessed for various asset allocations;
- an efficient frontier for terminal wealth can be constructed;

- the point on the efficient frontier meeting the trustee's investment objectives can be assessed.

This process is likely to be specific to the cash flow profile of the investor, and hence compromises may have to be made for a single overall asset allocation.

[1 mark per point, to a maximum of 4 marks]

(f) The alternative asset allocation would in general result in asset allocations that differ from the indexes for equity as well as debt investment. These allocations can be implemented by:

- Index management, coupled with active tilts in business sectors. Management costs would be limited, but there would be no weight given to individual stock selection.

- Specialist active management, constrained by the allocations to business sectors. Stock selection in business sectors would be enabled, but would attract active management fees.

[1 mark per point, to a maximum of 2 marks]

QUESTION 4 **(20 marks)**

Equity managers are often classified by style with a view to achieving diversification across different styles of managers. The style relates to the process by which a manager selects stocks in the light of current conditions.

You are the Chief Investment Officer of a large trustee organisation, responsible for management of equity investments and the appointment of equity managers. You are sceptical about whether a manager's true style can be readily ascertained from the available information on managers, and are interested in objective methods for identifying style. One such method is cluster analysis, which has been applied for classifying US mutual fund managers.

Though there are several analytical techniques available, the broad aim of cluster analysis is to identify managers whose performance is similar across time – these managers are classified as a single 'cluster'. Similarity of performance could be measured in terms of a performance distance metric such as:

$$d(A,B)=\sqrt{\sum_t \left(r_t^A - r_t^B\right)^2}$$

where r_t^A, r_t^B **are the returns in period** t **for managers** A, B **respectively.**

Thus where the metric $d(A,B)$ **is small, the managers perform in a consistent way across time.**

(a) **Outline the theory underlying value and growth management styles, and explain how managers may be classified by style under conventional methods.** **(5 marks)**

(b) **Discuss whether the metric proposed would be a suitable measure of performance differentiation for the purpose of style classification.** **(3 marks)**

(c) **Discuss the merits and limitations of cluster analysis, relative to conventional methods of style classification. Your answer should address:**

- **Data requirements**
- **Stability of classification**
- **Interpretation of clusters as styles.**

(8 marks)

(d) **Discuss the extent to which cluster analysis might be applied for manager selection, reservations you have regarding its use for this purpose and any additional information you might need in making a decision about selecting managers.** **(4 marks)**

Solutions

(a) A manager's style is usually ascertained by the types of stocks they tend to select. [1 mark] This may be evident from the factors that are used in assessing stocks:

- Where value factors, such as Price/Earnings, Price/Book or other information relating a stock's price to accounting fundamentals are used, the manager is said to be value oriented. [1 mark] The theory is that stocks that are cheaply priced against fundamentals tend to perform better than others, the so-called value anomaly.[1 mark]

- Where indicators of prospective growth, such as price momentum, projected earnings, or rating revisions are used, the manager is said to be growth oriented. [1 mark] The theory is that stock fundamentals do not capture the opportunities offered by start-up companies or new technologies, and these must be assessed for their future prospects rather than from past performance. [1 mark]

[1 mark per point, to a maximum of 5 marks]

(b) The metric has both shortcomings and strengths:

- Two managers with otherwise identical returns, except for a difference in alpha, may be treated as being in different clusters. Thus the metric would identify a manager's long term ability to select stocks, as well as their performance capability under different financial conditions.[1 mark]

- In a time period with high return volatility, deviations between managers' returns can be expected to be higher than in periods with low return volatility. This would affect even managers with the same style. The metric, however, weights returns from different periods equally. [1 mark]

- Nonetheless, managers of the same style should be expected to perform in similar ways only under certain economic conditions. For example, value stocks tend to do well before an economic recovery, whilst growth stocks do well during a bull market. The metric proposed assumes styles always perform in similar ways. [1 mark]

- Overall the metric proposed does not provide enough information by itself to be suitable for the purpose of style classification [1 mark]

[1 mark per point, to a maximum of 3 marks]

(c) Cluster analysis uses only past performance as a guide to style. The justification for looking only at performance is that, over time, different styles may be expected to perform differently under different conditions. The merits of this approach are:

- Data requirements are modest, compared to conventional classifications, where manager processes need to be identified and evaluated. The approach is indeed completely objective, because it relies on data that is well defined and readily validated.

- The approach does not rely on a manager having a stable management process, and the manager's staff and systems for delivering a style may change over time. However a consistent philosophy is assumed.

- The approach does not presume a given range of styles, nor the characteristics of any style. It simply identifies managers who are similar to each other in performance. New styles may be discoverable under this approach.

- The approach does not assume what attributes are required for outperformance, nor how this is achieved.

However:

- The assumption of consistent investment philosophy may invalidate cluster analysis completely, especially if conducted over a very long time period. Managers may change direction, lose focus or become extinct.

- Clustering depends greatly on the performance metric used, particularly the relevance of the risk measure (essentially tracking error), and the time period used for analysis.

- There is some subjectivity involved in mapping clusters to styles. Some manager clusters may be small ('orphans') with eclectic styles.

- Some managers may belong to some extent to several clusters (or styles) from time to time, which may not be reliably revealed by cluster analysis (but may be revealed under conventional methods – e.g. growth at a reasonable price).

  [1 mark per point, to a maximum of 8 marks. To get the full 8 marks, there must be at least one comment on each of data, stability of classification and interpretation of clusters as styles.]

(d) How to use the information from cluster analysis.

Given an appropriate performance metric, cluster analysis may be applied to measure how managers with similar styles perform in given economic conditions.
[1 mark]

Cluster analysis can also be used empirically to identify new styles (but they must be confirmed by other means as described below).
[1/2 mark]

One way of combining cluster analysis with given style definitions is to identify style indexes[2] for the major recognised styles, and to formulate a performance metric for a manager with reference to these style indexes (rather than against another's manager's performance). [In this way, a single manager may belong to several clusters, a technique known as 'soft' or 'fuzzy' clustering.]
[1/2 mark]

Applicability to manager selection:

Given an assessment of how managers with different styles may perform under different economic circumstances (via cluster analysis), a view of likely future economic conditions may suggest that a particular management style is likely to perform better than another.
[1 mark]

It may also suggest the benefits of "style diversification" instead of choosing a particular style as being appropriate in all circumstances.
[1 mark]

Qualifications regarding its use

- In view of the difficulties in interpreting what clusters mean in practice, the technique has to be viewed as confirming manager classifications, but not as defining them. It is only when a manager cluster can be demonstrated by other means to have the characteristics of a style, that any reliable conclusions can be drawn from clustering [1 mark]

- There is still a need to drill down into your data if for example one manager has only been there for a short while, in favourable market conditions

[2] e.g. http://www.russell.com/Indexes/characteristics_fact_sheets/US/Russell_1000_Value_Index.asp

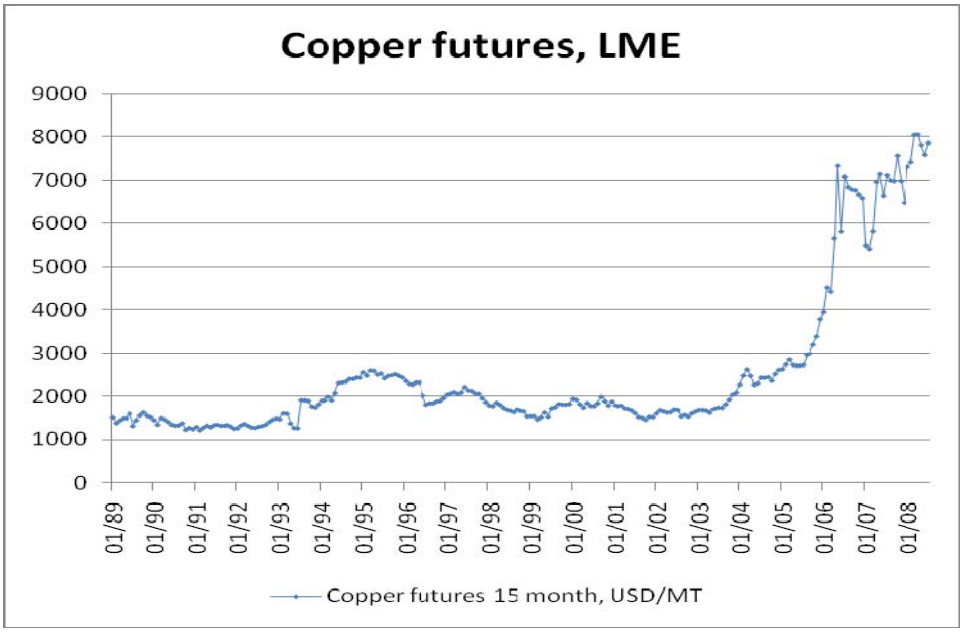
Additional Information

- Qualitative information about the manager such as:
  - Staff-well known, highly respected?
  - Stability of staff
- Level of fees
- Historic performance

[1 mark per point, to a maximum of 4 marks. To get full marks there must be a point covering each of the extent of use, qualifications and additional information]

QUESTION 5 **(20 marks)**

You are the Chief Financial Officer of an Australian manufacturer of electronic devices and integrated circuit boards. The metal copper is a significant input in your production. Unfortunately the worldwide demand for copper has increased dramatically in recent years, leading to large increases in price, as shown below.



Source: Datastream

You are responsible for managing the effect of the copper price on your firm's profitability. Though Australia is a significant producer of copper ore, there are no exchanges for trading copper or its derivatives in this country.

The London Metal Exchange (LME) provides trading on the futures and options associated with copper, with almost 95% of all futures trading conducted there. Though copper itself may be delivered on these contracts, the LME maintains only a few warehouses for such purposes. Trading is based on the USD price of copper and, generally, on cash settlement.

(a) Explain conceptually how copper futures and options can help to manage the effect of volatility in the copper price. (3 marks)

(b) Apart from simply holding copper futures or options, what other ways are there to hedge the effect of the copper price, and what are their limitations? (2 marks)

(c) Explain the advantages to the LME in having an options contract on copper futures, rather than an options contract on copper metal. (4 marks)

(d) **Explain how you would define your firm's exposure to the copper price, and outline the factors that determine it. (4 marks)**

(e) **Discuss how you could deal with the currency risks introduced in USD denominated trading in copper futures or options. (4 marks)**

(f) **Discuss the factors that would lead you to use copper options, in preference to copper futures. (3 marks)**

Solutions

(a) A futures contract on copper allows in effect for copper to be delivered at a future time for a price fixed today. [1 mark] An options contract allows in effect for an upper price to be fixed, dependent on payment of a known premium.[1 mark]

Both these types of contract provide greater certainty in the price to be paid for copper, when otherwise it would be subject to supply and demand in the world market for copper. It is, however, assumed that the firm's short term demand for copper can be estimated. [1 mark]

[1 mark per point, to a maximum of 3 marks].

(b) It is also possible to:

- Stockpile physical copper. However this would require financing (as well as incur a financing and storage cost).
- Proxy the copper price by that of some other related commodity, such as aluminium or oil. However the relationship is imperfect, and basis risk would result.
- In theory, synthesise copper options using a replication strategy with futures. However trading costs may be significant, and replication is never perfect.

[1 mark per point up to a maximum of 2 marks]

(c) The advantage of an option on a futures contract is that:

- The spot (i.e. physical) price of copper does not have to be monitored by the LME (futures trading is of much greater volume and depth than physical trading, so that futures prices are more reliable than physical prices).
- Trading and pricing of the options against the futures contract can be aligned perfectly (and arbitrage eliminated between these two contracts).
- Pricing of the option on futures contract does not suffer the complication of early exercise (because early exercise does not result in immediate delivery of physical copper);
- Trading and delivery of physical copper is minimised.

[1 mark per point, to a maximum of 4 marks for this part]

(d) The firm's exposure to the copper price may be defined as the equivalent amount of copper, which would give the same response to a small change in copper price, as the firm's yearly profit. The meaning of 'profit' for this purpose (whether it is accounting profit or a broader measure taking account of future activities), depends on the firm's purpose in hedging[1 mark]

Copper related factors that may impact its profit (however defined) might be:

- The amount of copper used in production
- Its existing inventory of copper
- Increases in copper costs that cannot be passed on to consumers (because of fixed price contracts or consumer resistance)
- Other inputs to production that are correlated to copper (such as oil)
- Its derivative exposure

[1 mark per point, up to a maximum of 4 marks]

(e) Trading in LME derivatives would inevitably introduce foreign exchange risk as the contracts are denominated in USD. Whether this risk is acceptable depends on the firm's overall FX position, for example its output may be priced in USD as well. [1 mark]

To the extent that FX exposure needs to be hedged:

- It may be undertaken with forward currency contracts, which would effectively convert LME contracts to an AUD basis: [1 mark] or

- To the extent that LME options are used, it may more cost effective to have a combined copper/AUD options contract, where an effective ceiling on the AUD copper price is imposed [1 mark].

- Though no such contract exists, it might be synthesised with copper futures and forward currency contracts. [1 mark]

[1 mark per point, up to a maximum of 4 marks]

(f) An options strategy may be preferred to a futures strategy if:

- Some upside with respect to the copper price is desired;

- Options are attractively priced (in relation to current volatility and the current futures price)

- The firm has views of future (upward) movements of the copper price; or

- The firm's stock price varies in a non-linear fashion with the copper price (and maximizing the stock price is the main objective of management).

[1 mark per point, to a maximum of 3 marks]

END OF PAPER

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