Marking Guide

Level of difficulty

Question	Units	Knowledge & Understanding	Straight-forward Judgement	Complex Judgement	Total Marks
1a	BM (*)	4			4
1b	BM	6			6
1c	BM			4	4
1d	BM		4		4
1e	BM			2	2
2a	1	3			3
2b	1		4		4
2c	1			2	2
2d	1		4		4
2e	1			4	4
2f	1			3	3
3a	1		4		4
3b	1	4			4
3c	1			5	5
3d	1		4		4
3e	1	3			3
4a	2		2		2
4b	2			4	4
4c	2		5		5
4d	2			6	6
4e	2		3		3
5a	2		2		2
5b	2			3	3
5c	2		3		3
5d	2			3	3
5e	2		5		5
5f	2			4	4
TOTAL		**20**	**40**	**40**	**100**

(*) BM means background material to the course

Answer all 5 questions.

QUESTION 1 **(20 Marks)**

Stock, commodity and futures exchanges (of which the ASX and SFE are examples) operate throughout the world to facilitate the operation of market economies. Trading on the exchanges is effected exclusively through brokers, who are members of the exchange.

In recent years, there has been a tendency for these exchanges to both amalgamate (e.g. Euronext/NYSE) and to demutualise (e.g. ASX/SFE). There has also been a strong trend to electronic trading.

You are the portfolio strategist for a global funds management organisation, responsible for implementation of all investment transactions. You are concerned with optimising how and where trading takes place.

(a) **List the main ways in which exchanges facilitate trading activity and contribute to the efficiency of the economy, compared to direct transactions between buyers and sellers in goods and securities. (4 marks)**

(b) **What are the main types of regulation that you would expect exchanges to impose? (6 marks)**

(c) **What do you regard as the advantages and disadvantages of the amalgamation and demutualisation of exchanges from the perspective of their users? (4 marks)**

(d) **List the main benefits of electronic trading compared to floor trading, and the safeguards that you would expect to be provided by exchanges in relation to electronic trading. (4 marks)**

(e) **In recent decades, it has been observed that economic activity (i.e. GDP growth) for major world economies – such as the US, Europe, China and Japan - has become less correlated. However, the stockmarket performance (i.e. returns) in these countries have become more strongly correlated. Discuss the reasons for this phenomenon. (2 marks)**

QUESTION 1 SOLUTIONS

(a) Trading on organised exchanges is more efficient than the alternative of transactions between individual buyers and sellers:

- It permits efficient transfer of ownership rights and facilitates change of ownership and management of assets and businesses from inefficient and ineffective management teams to more efficient and effective management teams.
- It provides information to the investing public that would otherwise be expensive and difficult to obtain. This contributes to economic efficiency.
- It promotes efficient allocation of capital.
- It provides more transparent price signals.
- It gives those seeking funds access to many investors and sources of capital.
- It more efficiently allows those who want to sell assets with an opportunity to do so.
- It facilitates access to investment opportunities for small investors.
- It provides standards for disclosure, trading and corporate governance.

Overall it is a more efficient, informative and less expensive way to conduct economic transactions on the capital markets.

[½ mark per point to a maximum of 4 marks]

(b) The types of regulation imposed should ensure equity, fairness, and appropriate disclosure:

- Timely disclosure of information to the market.
- Suspension of trading in some circumstances.
- Protocols for the behaviour of market participants in merger and takeover situations (in conjunction with ASIC under the Corporations Act)
- Listing rules.
- Prohibition of short selling in particular situations (e.g. short selling not allowed if the market is falling).
- Protection of the exchange from default by market participants (e.g. the system of margins and deposits used in derivative markets).
- Assurance as to the performance of brokers (e.g. capital requirements for brokers who trade on their own account).
- Supervision of the clearing and settlement of transactions.

[1 mark per point, up to a maximum of 6 marks]

(c) Amalgamation:

- Economies of scale and scope which may lead to lower prices or improved services being offered to users. (adv)
- Greater information flow and continuity of trading (adv)
- Diversification of services – more choices for customers (adv)
- Disadvantages: may lead to concentration of power and resources in the hands of a few brokers. This could create a monopoly / oligopoly of broker services which would disadvantage users / customers.

[½ mark per point, to a maximum of 2 marks for discussing amalgamation. Should include at least 1 advantage and 1 disadvantage.]

Demutualisation:

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- Access to capital for expansion by the exchange. This may lead to the exchange being able to offer better services to customers. (+)
- Economic efficiency for operating exchanges as a business – could make the service providers compete more for business and thus lower prices / improve services for customers. (+)
- Participation by greater base of investors - customers can buy shares in the exchange itself. (+)
- It will probably improve the exchange's responsiveness to market needs (+)
- Likely to result in the demise of smaller brokers and thus a reduction in the number of brokers. (-)
- Potential concentration of power – could lead to a more monopolistic market situation where the service providers can get away with charging higher prices for their services. (-)
- Profit motive for operating exchanges, not necessarily acting in the interests of users. (-)

[½ mark per point, to a maximum of 2 marks for discussing demutualisation. Should include at least 2 advantages and 2 disadvantages.]

(d) Benefits of electronic vs. floor trading:

- Speed, flexibility, low cost.
- Avoidance of trading abuses (front running and trade allocation by brokers).
- Potential for implementation of novel trading strategies by investors – e.g. algorithmic trading.
- Access to multiple markets.
- Greater scope for regulation and monitoring of trading and avoidance of market abuses.

Safeguards:

- Need to specify trading rules for users precisely.
- Over-reliance on systems – need to ensure backups and security.
- Privacy standards for investors and listed companies.

[½ mark per point, up to a maximum of 4 marks.]

(e) Lower correlation of economic activity is due to:

- Specialisation in particular industries varies by country: manufacturing (China); IT (India and US); resources (3rd world); technology (Japan and US).
- Economic development in emerging markets such as China, Russia and India, (growth in GDP has been very strong there but weaker elsewhere).

[½ mark per point or reasonable equivalent, with a maximum of 1 mark for this part.]

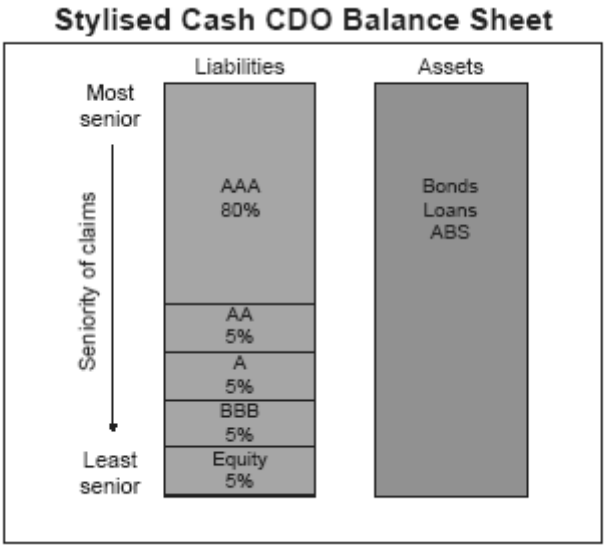
Greater correlation of stockmarket performance:

- Globalization has made it possible for capital to move to almost anywhere in the world with fewer restrictions than in the past. More corporations have global operations than in the past.
- Many companies are traded on multiple exchanges and there is a trend towards multiple listings.
- More efficient information flow to investors facilitates international investment.

[½ mark per point or reasonable equivalent, with a maximum of 1 mark for this part.]

QUESTION 2 **(20 Marks)**

Collateralised Debt Obligations (CDOs) are securities that have become popular with investors in recent years. They are a special type of credit-risky investment, in that they provide a vehicle for transforming and transferring the credit risks associated with the underlying assets. This is achieved by dividing the ownership of the assets into 'tranches', as illustrated below.



The most junior tranche, the equity holders, must bear any losses in asset value of the CDO, up to 5% of the nominal asset value. The next tranche (rated BBB) must bear losses up to the next 5% of the nominal asset value, and so on. [The credit rating associated with a debt investment is a broad indication of the probability that the debt will be repaid.] The most senior tranche (rated AAA) suffers losses only if they exceed 20% of the nominal asset value.

The underlying assets may be equity or debt in the form of corporate bonds or asset-backed securities (ABS, eg mortgages). They may include investments in other CDOs.

As an investment consultant advising on credit exposures within a debt portfolio, you are concerned with modelling this new asset type, which promises to provide higher returns (and risks) for investors than traditional debt.

(a) Describe briefly how a credit-risky investment in general, such as a senior corporate bond, can be regarded as default-free debt, coupled with the grant of a put option on some underlying assets by the lender to the borrower. Explain how this applies (with modifications) to the tranches within a CDO structure. (3 marks)

(b) What information would you seek to assess the pricing of a credit-risky investment in general? (4 marks)

(c) **Sub-prime mortgage lending, as practised in the US, is the lending at attractive interest rates to borrowers with poor credit histories. This has had unfortunate experience in the US. How can this experience be avoided in Australia? (2 marks)**

(d) **In the light of your answers to (a) and (b), suggest a general method for modelling credit-risky debt as an asset class, in relation to other asset classes. (4 marks)**

(e) **Discuss whether CDOs could be modelled under the method you propose in (d). (4 marks)**

(f) **What type of restrictions would you recommend for a client wishing to invest in CDOs? (3 marks)**

QUESTION 2 SOLUTIONS

(a) A senior loan to a corporate borrower is secure only while the borrower's assets are sufficient to repay the loan. Once the borrower's assets fall to a point that does not cover the loan (and prior ranking loans), the debt behaves like a form of equity (and in practice a bank that has lent to a defaulting borrower assumes ownership of the assets). This can be thought of (from the lender's perspective) as a combination of a default free bond and a put option (over the firm's assets) granted by the lender to the borrower (the equity holders) for an exercise price equal to the amount of the loan.
[1 mark]

In the case of CDOs, this situation applies directly to the most senior tranche.

The next most senior debt tranche can be thought of (from the lender's perspective) as a combination of a long position in a default free bond combined with a short position in a put option on the firm's assets and a long position in another put option on the firms assets. The long and the short puts have different exercise prices.

The situation may be described more formally as follows. Consider 2 loans with face values X_1 and X_2, with X_1 senior to X_2. Suppose the firm's assets are A and the bonds mature at time T.

The payoff to the bondholders in the senior debt can be written as
$$payoff_1 = X_1 - \max(X_1 - A, 0)$$

which is the payoff from being long a zero coupon bond with face value X_1 and short a put option over the asset A with exercise price X_1.

The payoff to the debtholders in the junior debt can be written as
$$payoff_2 = X_2 - \max(X_1 + X_2 - A, 0) + \max(X_1 - A, 0).$$

This is a combination of a default free bond with face value X_2, a short position in a put option over the asset A with exercise price $X_1 + X_2$ and a long position in a put option over the asset A with exercise price X_1.

A similar expression applies to all other debt junior to this debt. Students should show some understanding of these combinations of default free bonds and options, but detailed formulae are not necessary.

[2 marks]

[Total of 3 marks for part (a)]

(b) General information to be sought for pricing of credit:

- Type / nature of asset/s securing the debt
- The rating awarded by a credit rating agency (if available).
- The full distribution of asset returns (which depends on the type of asset, e.g. its industry, and any embedded options).

- The nature (i.e. yield, duration) and priority of the debt, and its relationship to the assets.
- Credit risk premiums applied by the market, in addition to the default risks.

[1 mark for each point to a maximum of 4 points]

(c) The issues with the US sub-prime market are of mispricing credit risks, exacerbated by their securitisation, which tends to disguise the true extent of the risks from investors. The issues can be mitigated by:

- Policies that promote fair pricing [both of the underlying loans and the securitisations].
- Regulation of lending and securitisation practices (e.g. restrictions on lending to poor credit risks or on honeymoon interest rates on mortgage loans).
- Increased disclosure of securitised assets.

[1 mark for each point to a maximum of 2 marks for this part.]

(d) An approach to modelling of credit-risky debt could be structured as follows:

- Define the credit-risky asset class in terms of the maximum (or minimum) credit ratings that are to be permitted.
- By virtue of credit-risky assets having the features of both equity and debt as per (a), model credit-risky debt as leveraged equity, with a beta found empirically from the performance of the asset class.
- The expected return is based on the pricing of credit risk and rating as in (b).
- The correlation of the asset class with others is the result of the correlations with the (appropriately weighted) equity and debt components.

[1 mark for each point to a maximum of 4 points for this part.]

(e) CDOs are superficially similar to other credit-risky debt in some ways, but fundamentally different in others, making it difficult to model using the approach above:

- If investors hold all tranches in a CDO, then it is equivalent to holding the underlying assets.
- However individual tranches have a different risk profile from the underlying assets – they risk total loss even if the underlying assets suffer a partial loss - hence tranches may be rated very differently from assets.
- **Though CDOs may be rated similarly to corporate debt , the pricing of CDOs may be very different, reflecting different and possibly inefficient markets. (This is due partly to complex interactions between borrowers, a lack of complete information on the underlying assets, and the non-linear effect of asset losses on the various tranches of a CDO.) Note that "rated similarly" means a similar credit rating for the same underlying assets.**
- Underlying assets themselves may not be traditional (other CDOs, subprime mortgages, which are non-exchange traded).
- Some components of the assets may suffer contagion during times of stress (eg subprime mortgages).
- There may be management options with respect to the nature of the assets.

[2 marks for bolded point, 1 mark for others, up to a maximum of 4 marks.]

(f) Possible restrictions on CDOs for investment purposes:

- Degree of leverage.
- Minimum credit rating for tranches.
- Credit rating of underlying assets.
- Variation in and correlation of underlying assets.

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

QUESTION 3 **(20 marks)**

You are an investment consultant advising superannuation funds about communicating potential future investment outcomes to their members. Such outcomes are typically illustrated by projecting a range of benefit levels at various ages for a given investment choice by defined contribution members. The investment choices may include static asset allocations, and also dynamic strategies where the asset allocation becomes progressively more defensive as the member approaches retirement.

These projections are based on certain individual data specified by the member, such as contribution patterns and retirement ages, as well as on an asset model for investment returns. They are often provided as a decision-making tool on fund websites, and thus the financial basis for the assumptions must be precise and generally appropriate in a variety of circumstances.

You have been requested to advise on the asset model to be adopted.

(a) Discuss the key characteristics of asset classes that you would incorporate into an appropriate asset model. (4 marks)

(b) For each of the main types of asset, namely equity, debt and direct (i.e. unlisted) property, discuss how you would derive return expectations applicable to long term projections. (4 marks)

(c) Outline how you would calibrate (i.e. estimate) the risk aspects of your asset model to give effect to the key characteristics you have identified in (a). (5 marks)

(d) Outline, with formulas if appropriate, how you would apply your asset model in producing annual benefit projections, in either real or nominal terms, if no serial correlation of returns is assumed. (Note that benefit projections require both the mean and the standard deviation of benefit outcomes to be projected. You may assume that all cash flows occur at the start of a year.) What difference would it make to your modelling approach if serial correlation is a critical aspect of the model? (4 marks)

(e) Discuss what aspects of your asset model should be disclosed to members, and what qualifications you would include. (3 marks)

QUESTION 3 SOLUTIONS

(a) Key characteristics:

- Volatility as a function of return expectation – i.e. the risk / return tradeoff.
- Serial correlation and/or mean reversion – i.e. how returns behave in the short and long term.
- Long term interrelationships – e.g. whether particular asset classes may be expected to provide the same performance in the long term such as listed and unlisted property.
- Consistent relationships with economic variables, eg inflation (real interest rates have to be positive in the long term).

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

(b) Approach to setting expectations

Equity

- ERP based on long term history (e.g. 6.5% pa relative to cash).
- Expected earnings or dividend growth.
- Adjust for current pricing levels (PE) – which may be volatile.

Debt

- Expected return in line with long term interest rate expectations (i.e. with CPI and GDP growth, used for assessing liabilities).
- Consistency with current long term yields.

Direct Property

- Consistency with equity and debt returns (as property displays characteristics of both).
- As beta based version of equity, with serial correlation of returns as a result of the appraisal process. Listed property has a beta of approximately 0.40 to 0.50. Direct property is usually regarded as a lagged, serially correlated version of listed property, with the same long term expectation.

[2 marks for equity issues; 1 mark for debt and 1 mark for property]

(c) Estimation of an asset model:

- Specify return dynamics (eg as a vector autoregressive model).
- Use OLS or some other estimation procedure to fit the model.
- Test the errors resulting from the estimation for stationarity and randomness.
- Consider the implications of structural breaks, discontinuities and outliers (e.g. October 1987).
- If necessary respecify the model and repeat.

[1 mark per point to a maximum of 5 points for this part]

(d) Let A_t be the accumulated value of the portfolio at time t, just before payment of the cash flow at that time of C_t (measured in either real or nominal terms), the accumulated value one period later is clearly:

$$A_{t+1} = (1+i_t)(A_t + C_t) \qquad (*) \qquad \text{[1 mark]}$$

where i_t denotes the (stochastic) return – *in either real or nominal terms* - for the period starting at time t, with mean μ_t and volatility σ_t.

Because i_t is assumed to be independent of returns in previous periods, it is also independent of A_t. [½ mark]

Hence taking expectations:

$$E(A_{t+1}) = [1+E(i_t)][E(A_t)+C_t] = (1+\mu_t)[E(A_t)+C_t] \qquad \text{[½ mark]}$$

$$E\left(A_{t+1}^2\right) = \left[1+E\left(i_t^2\right)+2E\left(i_t\right)\right]\left[E\left(A_t^2\right)+2E\left(A_t\right)C_t+C_t^2\right]$$

$$= \left(1+\mu_t^2+\sigma_t^2+2\mu_t\right)\left[E\left(A_t^2\right)+2E\left(A_t\right)C_t+C_t^2\right] \qquad \text{[½ mark]}$$

Variance and standard deviation can be computed from $E\left(A_{t+1}\right)$ and $E\left(A_{t+1}^2\right)$ [½ mark]

If returns from year to year are *not* independent, then there are no simple closed form relations, and (*) must be simulated for both the mean and standard deviation. [1 mark]

(e) Disclosures:

- Expectations and volatilities for asset classes and inflation.
- Treatment of tax and expenses, switching costs.

[1 mark per point]

Qualifications:

- Dependence of expectations on current conditions (yields, inflation).
- Assumptions are long term and may not be realised in practice.

[½ mark per point]

[Total of 3 marks for this part]

QUESTION 4 **(20 marks)**

With the ratification of the Kyoto Protocol by the Australian Government, it is likely that an Emissions Trading Scheme (ETS) will be established in some form to limit the production of greenhouse gases.

The ETS will assign certain permits for the production of emissions up to specified limits, and those permits can be traded on markets. The ETS may also assign additional permits to companies that operate carbon sinks (e.g. tree plantations that offset carbon emissions). As producers must procure permits sufficient to cover their emissions, an indirect cost on emissions will result.

As an investment consultant, you are concerned about the impact of an ETS on the performance of Australian equities, either through direct emissions costs on companies or through the higher costs of inputs.

(a) **It has been suggested that, in the long term, an ETS should have no financial impact, as emission costs would eventually be reflected in companies' earnings, whether or not an ETS is established. State whether or not you agree with this suggestion, giving brief reasons for your answer.** **(2 marks)**

(b) **Suggest the factors that would have an impact on the cost of emission permits.** **(4 marks)**

(c) **Describe what information you would ideally seek of individual Australian companies to gauge the impact of an ETS on their financial performance.** **(5 marks)**

(d) **Discuss which of the following investment approaches would better exploit inefficiencies in pricing emissions:**

- **By treating emissions as a technological 'theme' that impacts particular industries more than others;**
- **By treating emission costs as a selection criterion in an active quantitative process.** **(6 marks)**

(e) **Would you expect value or growth managers to benefit more from an ETS? Why?** **(3 marks)**

QUESTION 4 SOLUTIONS

(a) An ETS may have a financial impact for the following reasons:

- Emission costs may be reduced if they are recognised sooner (i.e. prevention is cheaper than cure).
- As they are of a very long term nature, there is no reason why the market should price emissions correctly, unless governments intervene.
- With an allocation of permits to emitters (and negligible transaction costs), trading of permits should ensure a socially beneficial outcome (cf. the Coase theorem for externalities).
- The permits may not be allocated to emitters for free. The permits may be auctioned. There could be a cost involved. Accordingly it may have a financial impact.
- Without an ETS or a similar measure, corporations can damage the environment at no cost to themselves, at least in the short term. The aim of an ETS is to shift these types of cost to corporations.
- An ETS puts one country at a disadvantage relative to those that do not have an ETS (which argues for an ETS to be universal if it is to have any chance for success).

[1 mark per point, with a maximum of 2 marks for this part].

(b) Relevant factors in pricing permits include:

- National ceilings on emissions.
- Propensity for producers to emit.
- Availability of alternatives to emissions (alternative energy sources, cleaner technologies).
- The cost of direct abatement of emissions (afforestation, waste treatment).
- The ability of producers to move emissions offshore.

[1 mark per point or reasonable equivalent to a maximum of 4 marks for this part]

(c) Company specific information that should ideally be sought:

- Current production methods and processes.
- Nature and level of direct emissions in outputs.
- Alternative technologies that can be used in production and the costs and benefits associated with these.
- Level of indirect emissions associated with inputs (e.g. fuel costs).
- Management response to controlling costs of an ETS – on-market purchase of permits; emission control.

[1 mark per point or reasonable equivalent to a maximum of 5 marks for this part].

(d) For exploiting inefficiencies in emissions pricing the quant basis is more comprehensive but it has more extensive information requirements.

Thematic basis:

- Industries vary widely in direct emission intensity (e.g. mining, metals), much more so than individual companies within the same industry.
- The response to emission costs is likely to be on an industry basis, as it is a technological issue – it is hard to predict an individual company response.
- It is much easier to deal with indirect emission costs on an industry basis (that is, provide a macro analysis of supply chain costs across industries).

Quant basis:

- Emission costs may be a key indicator of the sustainable free cash flow of an individual company, which is part of a value approach to stock selection.

However:

- It is difficult to identify or assess individual company emissions without mandatory disclosure standards.
- It is hard to assess how an individual company will respond to emissions, unless it is especially significant in its industry.
- It is hard to identify the source of an individual company's indirect emissions without looking at it in the context of its industry.

[1 mark per point, up to a maximum of 6 marks for this part].

(e) Growth managers are more likely to benefit from an ETS:

- Value stocks more likely to operate in traditional industries that rely on established technologies (manufacturing).

- Growth stocks are more prominent in new industries that are better equipped to deal with emission costs.

- Growth stocks are more likely to afford or invest in emission abating technologies.

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

QUESTION 5 **(20 marks)**

You are the performance analyst for an international funds manager. Besides investing actively in regional equity and debt, the manager takes active positions in countries and currencies.

The performance benchmarks used by the manager are based on a static country allocation and assume currency positions are being hedged. You are considering the appropriateness of this basis.

(a) **Show that the forward exchange rate F for a forward contract to buy foreign currency at time t, given the current spot rate is S, may be determined as:**

$$F = \left(\frac{1+r_d}{1+r_f}\right)^t S$$

where r_d, r_f denote the annualised risk free rates in the domestic and foreign currency respectively. Hence show that the annualised rate of currency appreciation on a hedged holding of foreign exchange is approximately $r_d - r_f$, the difference between the domestic and foreign interest rates. (This is called the principle of "covered interest rate parity".) **(2 marks)**

(b) **Suggest reasons why the actual rate of currency appreciation on an unhedged holding of foreign exchange may not be equal to the difference between the domestic and foreign interest rates, $r_d - r_f$.** **(3 marks)**

(c) **On the basis of (a) and (b), or on any other basis, suggest why performance benchmarks for international debt portfolios are generally hedged.** **(3 marks)**

(d) **Discuss whether performance benchmarks for international equity should also be hedged.** **(3 marks)**

(e) **Design a general method of attributing overall portfolio performance within a single period to: regional stock selection; country allocation; and currency. How would you apply this method to attribution of performance over multiple periods?** **(5 marks)**

(f) **For the specific case of an international debt portfolio, discuss broadly how you would attribute portfolio performance to duration and convexity decisions taken within a given region. State all assumptions.** **(4 marks)**

QUESTION 5 SOLUTIONS

(a) To replicate a forward exchange rate contract to buy 1 unit of the foreign currency at time t in the future we can do the following transactions:

- We borrow S units of the domestic currency at rate r_d for term t. We thus incur at time t liability in the domestic currency of amount $(1+r_d)^t S$. Exchange this S units for 1 unit of the foreign currency immediately, and invest (lend) this 1 unit at the foreign interest rate for term t. At time t this accumulates to $1\times(1+r_f)^t$ units of the foreign currency. This generates a situation where there is no net cashflow at time 0, an inflow of $1\times(1+r_f)^t$ units of the foreign currency at time t and an outflow of $(1+r_d)^t S$ units of the domestic currency at time t. This is a forward contract to buy the foreign currency at time t. The rate of exchange implicit in this contract is $F = S\dfrac{(1+r_d)^t}{(1+r_f)^t}$.

- Alternatively, the combination of investing S units of the domestic currency in 1 unit of foreign currency, lending that foreign currency at the foreign rate to time t and hedging the foreign asset (cash) with a forward contract (with forward price F) will provide a time t cashflow (in domestic currency) of amount $F(1+r_f)^t$. That S units of domestic currency could instead be invested in the domestic economy at rate r_d for term t and would accumulate to amount $(1+r_d)^t S$ at time t. To avoid arbitrage, the hedged return on foreign cash must be the same as that on domestic cash, so that $(1+r_d)^t S = F(1+r_f)^t$.

- The capital appreciation of foreign currency is therefore approximately $\dfrac{F}{S}-1=\dfrac{(1+r_f)^t}{(1+r_d)^t}\approx(r_f-r_d)t$

[1 mark for justifying the formula for F and 1 mark for the expression for the interest rate differential]

(b) Uncovered interest rate parity need not apply because:

- The forward rate on currency may not be an unbiased expectation of the future exchange rate.

- Market conditions change, so the expected return based on forward prices today may be different from the actual return experienced over the holding period.

- Investors may allow for risk in pricing particular currencies (i.e. there could be a risk premium or discount).
- These risks may arise because of a perceived association of particular currencies with particular assets, e.g. the AUD with world commodity prices.

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

(c) Performance benchmarks for international debt are generally hedged:

- From (a), hedged return on foreign asset = local return + Interest rate differential = local excess return + domestic cash rate [here 'local' means in the currency that the investment is made]
- From (b), unhedged return = local return + actual currency return = local excess return + (actual – forward currency return) + domestic cash rate
- Thus hedged international debt return captures the regional yield characteristics of overseas markets only, without currency effects – this is the diversification benefit of investing in different monetary systems.

[1 mark per point up to 3 marks]

(d) Performance benchmarks for international equity need not be hedged:

- There may be diversification benefits in having currency exposure (if currencies and economies and/or sharemarkets are negatively correlated).
- There may be benefits in exploiting the timeframes in which currencies revert to purchasing power parity (i.e. the real cost of consumer goods is the same worldwide) in the longer term.
- For some economies, growth may be realised, not so much through local returns but by long term currency appreciation, e.g. emerging markets.
- Hedging has a smaller impact on the volatility of equity returns than on debt returns (as the former is much higher).

[1 mark per point, up to 3 marks]

(e) For country i, let w_i denote the weight given to the country; r_i denote 1 + the return in local currency; and e_i denote 1 + the currency return for that country. Let $\Delta w_i = w_i^A - w_i^B$, $\Delta r_i = r_i^A - r_i^B$ and $\Delta e_i = e_i^A - e_i^B$ be the variation from the benchmark versions of respectively actual weights; local returns (in local currency); and currency returns. Thus if the benchmark is fully currency-hedged, e_i^B is 1+ forward currency return.

For simplicity drop the superscript on benchmark variables. Then $\sum_i w_i r_i e_i - 1$ is the benchmark return, and similarly for the actual return. The usual one period attribution is to decompose as follows:

$$\begin{aligned}
&\sum_i \left[(w_i + \Delta w_i)(r_i + \Delta r_i)(e_i + \Delta e_i) - e_i w_i r_i \right] \\
&= \underbrace{\sum_i e_i w_i \Delta r_i}_{\text{stock selection}} + \underbrace{\sum_i e_i r_i \Delta w_i}_{\text{country allocation}} + \underbrace{\sum_i w_i r_i \Delta e_i}_{\text{currency}} \\
&+ \underbrace{\sum_i e_i \Delta w_i \Delta r_i + \sum_i r_i \Delta e_i \Delta w_i + \sum_i w_i \Delta e_i \Delta r_i + \sum_i \Delta w_i \Delta e_i \Delta r_i}_{\text{interaction}}
\end{aligned}$$

[3 marks]

For compounding over multiple periods, a variety of methods can be used. The dollar attribution weights the attribution for the current period by the benchmark return factor $\Pi\left(1 + \sum_i e_i w_i r_i\right)$ for other periods.

[2 marks]

A simpler method is to consider instantaneous log-returns over short periods. Thus the attribution scheme above, applied to log-returns, can be summed over multiple periods.
[1 mark]

[marks as above to a total of 5 marks for this part]

(f) For international debt , it is possible to attribute the local return r_i^A in (e) to local duration and convexity decisions as follows:

$$\begin{aligned}
r_i^A &\approx \textit{income yield} + \textit{relative price change} \\
&= \textit{income yield} - MD_i^A \Delta y_i + \frac{C_i^A}{2} \Delta y_i^2
\end{aligned}$$

where Δy_i is the change in portfolio yield for country i for the period, and MD_i^A, C_i^A are respectively the actual modified duration and convexity of the portfolio. The same can be done for the benchmark portfolio.

[2 marks]

Then: $$\Delta r_i \approx \underbrace{-\left(MD_i^A - MD_i^B\right)\Delta y}_{duration} + \underbrace{\frac{C_i^A - C_i^B}{2}\Delta y_i^2}_{convexity}$$

This assumes that the income yields and redemption yields on the actual and benchmark portfolios are approximately equal.

[2 marks]

END OF PAPER