

# EXAMINATION

April 2006

## Subject CA1 — Core Applications Concepts

### Paper 1 (Assets)

## EXAMINERS' REPORT

### Introduction

The attached subject report has been written by the Principal Examiner with the aim of helping candidates. The questions and comments are based around Core Reading as the interpretation of the syllabus to which the examiners are working. They have however given credit for any alternative approach or interpretation which they consider to be reasonable.

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Chairman of the Board of Examiners

June 2006

### Comments

Individual comments are shown after each question and after each part question where relevant.

### General comments

*As the title of the course suggests, this subject examines applications of the core techniques and considers broad actuarial concepts in practical situations. To perform well in this subject requires good general business awareness and the ability to use common sense in the situations posed, as much as learning the content of the core reading.*

*The notes that follow are not to be interpreted as model solutions. Although they contain the majority of the points that the examiners were looking for, they also contain more than even the best prepared candidate could be expected to write in the time allowed in the examination room.*

- 1** (a) A lifetime mortgage with interest added to capital.

The mortgage amount (less any associated costs) will be received immediately and no capital or interest payments will be made.

On death, the estate will have the proceeds from the sale of the property, but will need to pay the capital cost of the mortgage along with all accrued interest.

- (b) A lifetime mortgage with repayments each year (or other regular times).

The mortgage amount (less any associated costs) will be received immediately. Repayments, which may be fixed or variable, will be payable at regular times.

On death, the estate will have the proceeds from the sale of the property, but will need to pay the capital cost of the mortgage only.

- (c) The home (or a proportion of it) could be sold to a company in return for a lump sum and the right to live in the property until he died.

The value less associated costs will be received immediately. The value received would be less than the open market value in view of the right of residence.

On death, nothing will be received if the entire home was sold. If a proportion were sold, then the estate would receive the value of the remaining proportion.

- (d) The owner could sell the home and move to a cheaper property or rent.

The difference between the two property values after costs have been paid would be received on sale. Alternatively the net sale price is received, and regular rent (certain or uncertain) is paid out.

On death, there will be no monies due and the value of the new home (if there is one) would form part of the estate. If not, the new residence is not part of the estate.

***Comments on question 1:***

*Marks were given for any two sets of answers under (a) to (d) above. Equity release or home reversion plans generally address the need for additional income, and were not appropriate answers, unless the description of the cash flows clearly involved the homeowner receiving capital. Other methods that involved the homeowner gaining capital were also given credit.*

*The question was generally well answered. The better candidates included mention of the costs associated with the options they chose, and concentrated on describing the cash flows, rather than the plan in general.*

- 2 (i) The general formula is:

$$V = \sum_{t=1}^{\infty} D_t v(t)$$

where:

$V$  is the value of the share

$D_t$  is the amount of the  $t$ th dividend payment

$v(t)$  is the discount factor applied between time 0 and the time of the  $t$ th dividend payment

The simplified formula is:

$$V = \frac{D_0(1+g)}{(i-g)}$$

where:

$D_0$  is the most recent dividend received.

$i$  is the required rate of return

$g$  is dividend growth rate

*Credit was also given for defining  $D_0$  as the next dividend due provided that the  $(1 + g)$  term was omitted.*

- (ii) Dividends are paid annually, and the next dividend is payable in one year's time.

Dividends grow at constant rate  $g$ .

The required rate of return is independent of the time at which payments are received.

Shares are held in perpetuity or are sold at a price consistent with the formula.

**Comments on question 2:** *Many candidates attempts at general formulae were not actually general; for example they assumed a constant discount rate  $i$ . Otherwise the question was generally well answered.*

- 3 The key features of indices that are suitable to be used with index tracking fund are:

The index should be representative of the equity market.

- It needs to be practical to be used as an index tracker, for example avoiding frequent changes in constituents or being calculated with reasonable frequency (real time pricing is best).

- Firms for inclusion should have sufficient liquidity so that full index replication is possible without causing prices for individual equities to be too volatile.
- All firms within the index should be subject to the same financial reporting/accounting and other standards as far as possible e.g. same market regulation standards, this is particularly important for investors from overseas where lack of information, language and poorer market regulation represent barriers to investment.

For all the above reasons the smallest firms and those firms with a low proportion of free-float shares are likely to need to be excluded.

A small number of firms may be very large. It may be necessary to restrict the weighting of these firms because their performance could dominate the whole index. The country is unlikely to achieve the implicit aim of encouraging investment in a wide range of firms.

Similarly it may be necessary to restrict weightings where there are large proportions of closely held holdings that are not traded as they could cause distortions to the index.

Restricting the representation of the largest firms and non-free float shares will increase the diversity within the index and therefore reduce the level of specific equity risk.

Having identified firms and the extent to which they are suitable for inclusion then the country needs to consider how many indices/sub-indices should be created. Initially the country is likely to restrict the number of indices to a few as it will be easier to create a domestic and international profile for the indices and therefore assist the encouraging domestic equity investment.

There may be a variety of tax bases applying to potential users of the index. The country may want to calculate indices that allow for these differences (e.g. withholding tax for overseas investors).

The index should try to reflect the actual accrual of dividend income in the market.

*Comments on question 3: This question was not well answered. The main problem was that many candidates gave a good list of what needed to be considered when constructing indices in general (coverage, weightings, calculation frequency, updating constituents, etc.), but then did not relate their answers to the specific circumstances of a developing economy. In the type of question that requires a general concept to be considered in specific circumstances it is necessary to give equal attention to the specific circumstances and to the general concept.*

- 4 Corporate bonds may have enjoyed very good performance relative to all other asset classes. This may have encouraged new investors.

There may be a general trend towards more secure assets, as there may be uncertainty in the political or economic climate. For example, it may be felt that the economy is moving towards recession and future returns on equities will be poor, or that investors are taking profits from other classes and reinvesting in corporate bonds.

There may have been an overall change in investors' liabilities, or recognition of such a change. For example, pension schemes may have come to realise that a greater proportion of their liabilities are guaranteed than they have thought guaranteed in the past, and may have moved into bonds.

There may have been an improvement in investor education so that bonds have been purchased as a better match for particular liabilities.

In the opinion of investors, the difference between returns on corporate bonds and government bonds may more than allow for the additional risks. This may have caused investors to accept the additional risks in exchange for the extra return. One reason for such a market distortion could be supply related (either oversupply of corporate or undersupply of government bonds)

There may have been a change in the regulatory regime. For example, the government may have forced benefit schemes to match their liabilities more closely by investing in bonds.

There may have been a change in the tax regime so that bonds are now treated more favourably relative to other assets.

It may be part of investor fashion. If bonds are seen to be popular, more and more investors may move into them. Being out of step with everyone else is a risk.

If this is not an industry trend, the fund may have had good past performance relative to competitors, which has attracted new investors. The fund may be managed by a highly rated fund manager.

There may have been improved marketing and publicity of this fund, for example an advertising campaign, new literature or a special offer.

**Comments on question 4:** Performance on this question was very variable. Many candidates seemed to find several different ways of saying "bonds looked cheap". The better candidates considered matching issues; looked at the yield differentials with other asset classes and argued risk versus return; and then picked up some of the softer points such as quality of manager.

- 5** The price of an equity that is regularly traded is a figure that equates the expectations of a willing buyer and a willing seller.

The key drivers of price are the current level of income, the growth in that level of income and the uncertainty over that growth. There are elements of subjectivity in assessing these items, and the further the amounts are in the future the greater the uncertainty.

There are also elements of sentiment that drive the precise price level, such as the market's view of the ability of the board and management team.

The price of shares will reflect the latest information including:

- announced post balance sheet events
- trading conditions affecting the market sector
- market speculation about unannounced events, such as mergers and takeovers

The company's earnings is a retrospective accounting measure. The level of retrospective earnings may not be representative of the future, for example they may include the effect of historical events such as exceptional items, or particularly good or poor past results. Different accounting policies may make comparison of quoted earnings tricky.

Earnings may result from a period where the company was fundamentally different, due, for example, to corporate restructuring.

The companies may be in completely different industries or market sectors, which traditionally trade at different P/E ratios. Some companies (e.g. property companies) are not valued on an earnings basis and P/E ratios are largely irrelevant to them.

The way in which earnings are distributed may distort P/E ratios.

P/E ratios of two firms may also differ due to a combination of all the factors outlined above.

*Comments on question 5: Although "price earnings ratio" is not a defined term in the core reading, the concepts of market price and corporate earnings are both well covered. Sadly a number of candidates based their answers on dividend yield issues (i.e. price/dividend ratios) and scored few marks. Potential distorting effects were not well covered, but most candidates pointed out the effects of different industries or market sectors.*

- 6** (i) Stock markets in developing countries are more risky markets. They offer higher returns than developed markets to reflect the additional risk.

Due to rapid industrialisation the rate of economic growth is also expected to be high. In addition, possible market inefficiencies also generate opportunities for profitable investment.

The economies and markets of many smaller countries are less interdependent than those of the major economic powers. Therefore investment in emerging markets may provide diversification.

Competitor funds may be similarly invested, and this fund wants to be “in the pack”.

- (ii) Emerging markets will differ from each other in practice but points to consider will generally include the following:
- current market valuation
  - possibility of high or volatile economic growth rate
  - currency stability and strength
  - level of marketability
  - degree of political stability
  - market regulation
  - restrictions on foreign investment such as exchange controls
  - range of companies available
  - communication problems such as language or time delays
  - availability and quality of information and accounting standards.
  - withholding taxes could be more of an issue
  - expertise in these markets
  - extra costs such as custody fees
  - the extent of additional diversity generated.
- (iii) Markets in small economies can be affected by the enormous flows of money generated by changes in sentiment of international investors. For example, domestic factors in the US that cause investors to repatriate funds, can completely swamp economic fundamentals in determining the level of local markets.

*Marks were given for any sensible example that specifically related to small economies.*

**Comments on question 6:** *In part (i) many candidates spent too much time talking about overseas markets in general rather than concentrating on developing economies. Part (ii) was largely bookwork and was well answered. In part (iii) most candidates made the point about lack of liquidity, but often it was described in the context of a given investor moving the market or not being able to sell. The bigger issue of other investors moving the market a lot due to large cash flows was missed.*

- 7
- (i)
    - (a) Arbitrage — The simultaneous buying and selling of two economically equivalent but differently priced portfolios so as to make a risk free profit.
    - (b) Spot interest rate — The n year spot interest rate is the geometric average of the interest rates that are expected to apply over the next n years. It is the redemption yield on an n year zero coupon bond.
  - (ii)
    - (a) Expectations theory — Expectations theory describes the shape of the yield curve as determined by economic factors which drive the market's expectations for future short-term interest rates.
    - (b) Liquidity preference theory — Investors require a greater return to encourage them to commit funds for a longer period so yields should be higher for long-dated stocks.
    - (c) Market segmentation theory— Yields at each term are determined by supply and demand from investors with liabilities of that term so yields on short and long bonds may therefore move somewhat independently.
  - (iii) To cost the guarantee, it is necessary to estimate future 1 year yields (using the above theories and the yield curve) and compare these rates to the possible guaranteed rate.

The yield curve is upward sloping so based on the expectations theory the market expectations for future short-term (1-year) interest rates is that the one-year rates will progressively increase.

Part of the upward slope of the yield curve relates to liquidity rather than the expectation of increases to short-term rates. Thus based on the liquidity preference theory using the yield curve to estimate future short-term rates risks overestimating future rates therefore understating the cost of the investment guarantee.

Market segmentation theory says that the yields on long and short bonds may move somewhat independently, so the yield curve does not necessarily predict the future short-rates so care should be exercised in using the yield curve to anticipate the future cost of investment guarantees.

Using the initial yield curve to anticipate the cost of investment guarantees risks mis-stating the anticipated cost, however, there may be no better objective information available.

If there is other market information indicating that future short-term yields will be different from those predicted from the initial yield curve then this suggests an arbitrage opportunity exists.

Initial market yield information should therefore be used carefully and with judgement when estimating the cost of investment guarantees.

The yield curve will vary over time. Uncertainty over predicting future yield curves will increase the further in the future the prediction is required — there is an expanding funnel of doubt. Therefore the actual cost of the investment guarantee may be considerably different from that anticipated at outset.

*Comments on question 7: This was the least well done question on the paper. Considering that part (i) was bookwork definitions, very few did well. Part (ii) was much better; definitions tended to be both tight and relevant. Very few candidates did well on part (iii). Many started by not understanding how the contract works — overestimating future zero-coupon yields results in underestimating the cost of the guarantee; inadequate reserves will be established and the company will be financially exposed. The question was designed to explore the effects of the three theories together on the overall approach, not each theory separately.*

- 8** (i) The main factors that will influence a long term investment strategy are:
- The nature of the existing liabilities — fixed in monetary terms, fixed in real terms, or varying in some other way.
  - The currency of the existing liabilities.
  - The term of the existing liabilities.
  - The level of uncertainty of the existing liabilities both in amount and timing.
  - The tax treatment of different investments and the tax position of the investor.
  - Statutory, legal or voluntary restrictions on how the fund may invest.
  - The size of the assets, both in relation to the liabilities and in absolute terms.
  - The expected long term return from various asset classes allowing for expenses.
  - Statutory valuation and solvency requirements.
  - Future accrual of liabilities.
  - The existing portfolio.
  - The strategy followed by other funds.
  - The amount of risk that the investor is prepared to take.
  - The investor's objectives.
  - Liquidity requirements.
  - Features of the available assets.
  - The risks associated with those assets either absolutely or relative to the liabilities.

- (ii) (a) The investor's need for income or capital (allowing for existing assets). In particular, a low risk investor may wish to repay any debt including mortgage and invest for retirement. A high risk investor will wish to choose investments with the highest expected return.

The inheritance could be viewed as a windfall so just spend it for fun.

Some assets may be precluded due to the amount of capital available to invest. A desire for a diversified portfolio may suggest collective investments.

Individuals will need to consider their tax position and will wish to invest in tax efficient products.

- (b) The investment objective is to create as large a fund or pension as possible on retirement, although as retirement approaches some defence against the possibility of falling interest rates is also desirable.

The likely strategy would involve investment in equities and possibly bonds as well for diversification, transferring more into bonds as retirement approaches.

The key issues should centre around finding the optimum time to begin transferring which, may be linked to the contributor's age, and how regularly to transfer and in what proportions of the fund.

- (c) The first priority must be to ensure all liabilities can be met.

The amount of risk that can be taken depends on the financial strength and on the uncertainty over liabilities. Funds with low financial strength will need to be invested in high quality bonds of appropriate terms. If a slightly higher risk can be taken with part of the fund then equities and property could be considered.

The position of the fund would need to be monitored carefully and investments changed as it matures.

Unit-linked funds would be invested in accordance with the fund descriptions issued to policyholders.

- (d) The first priority must be to ensure that all liabilities can be met, allowing for the length of time it might take to achieve settlement and uncertainty over amounts and timings of payments.

Competitive premiums may require the highest investment return using asset types permitted by regulations.

It may be important to stabilise profits.

Investment policy depends on size of free reserves, and reinsurance arrangements.

- (e) Investment policy may impact on the reputation of the charity, which will have broad objectives and constraints. The attitude to risk of trustees/management and contributors should be considered.

It will also be necessary to consider the specific purpose of charity, its operating considerations, need for investment income and capital.

Impact of the tax status on expected returns.

The amount and timing of contribution income will be relevant.

*Comments on question 8: This question was answered well by most candidates. In part (i) the command verb is "outline", indicating that a bit more than a list is required, but not much more, given the number of marks available. Most candidates tied the answer to part (i) to the different scenarios on part (ii) fairly well.*

- 9** (i) The main purpose of any initial appraisal is to ascertain whether the project is likely to satisfy the minimum criteria that have been established by the company for projects to proceed. A major consideration could be opportunity costs e.g. better use of resources might be possible in other projects.

Other possible criteria include achieving synergy or compatibility with other projects undertaken by the company, or satisfying political constraints, both within and exterior to the company.

The return on the project could be determined as the net present value (NPV) or the Internal Rate of Return (IRR) or the payback period for the project. As the IRR can give multiple solutions it is less popular than NPV. Alternatively, the project could be viewed in terms of an option, and option pricing techniques could be used

The NPV method would yield a satisfactory result if the answer were positive when an appropriate discount rate was used. The result of the IRR and the payback period would be regarded as satisfactory if they exceeded the pre-set requirement of the company.

Following this analysis a sensitivity analysis should be conducted in order to ascertain how sensitive the result is to varying the parameters around their most likely levels.

If the results proved very unsatisfactory then the new range should not be launched. If the results show a satisfactory outcome then a detailed risk analysis should be conducted.

- (ii) The capital cost of the project could be underestimated. All areas of the project should be well planned and researched and costed at each stage.

The time to be operational could be underestimated. Each part of the project should be planned in advance to ensure the project is completed on time. Action should be taken at the first sign of overrun.

Sales are overestimated. Market research should be carried out to determine demand for organic foods and sensitivity of sales to price.

Costs are underestimated. Thorough research will be needed for realistic estimate of costs. Could try to set up fixed price deals with suppliers so that they are bearing some of the risk.

Market issues could be a problem. For example there could be difficulties in quality and quantity of supplies or you may have to replace otherwise profitable lines with the organic range. The market should be researched initially and continue to be monitored for any potential problem areas.

Regulations relating to organic produce change. This may be very costly. Be aware of all regulations and ensure that company produces its range to the required standards at all times. Also research any likely changes and ensure company can meet these as soon as possible if required.

- (iii) The starting point is the current cost of raising incremental capital for the company in order to carry out the project. This is the rate of return that needs to be earned on the capital if the existing shareholders are to be no better off and no worse off.

This should be the company's normal cost of raising capital, taking this as a weighted average where the weights are based on the optimum capital structure for the company as between equity and debt. (If the company's capital structure is not currently optimum, it could be made optimum through a separate decision).

The cost of debt capital should be taken as the cost in real terms of new borrowing for the company, by taking an appropriate margin over the current expected total real return on index-linked bonds, having regard to the company's credit rating, and multiplying by  $(1 - t)$ , where  $t$  is the assumed rate of corporation tax.

The cost of equity capital should be taken as the current expected total real return on index-linked bonds plus a suitable margin to allow for the additional return that equity investors seek to compensate them for the risks they run.

This would generate a real discount rate, to be applied to cash flows expressed in present-day monetary values, or adjusted by the assumed future inflation rate and used with cash flows in nominal terms.

The project might be considered a slightly higher risk as this is a new area for the retailer. The project should be appraised on a slightly higher discount rate

than would be considered for projects exhibiting normal degrees of risk for the company.

A guide may be the discount rate used by other organic food businesses. In practice these rates may be hard to obtain and therefore an arbitrary addition to the discount rate the company normally uses may be the only solution.

Care should be taken to avoid spurious accuracy and to avoid the rate being too high and so distorting relative weights of short and long term values.

*Comments on question 9: In part (i), the better candidates grasped the scope of the initial appraisal and so kept their answers focused on relevant points. The weaker ones went overboard on risk or went into too great depth on the methods, in some cases writing down everything they could think of, relevant or not. In part (ii), most people said many sensible things and gave examples and justifications of mitigating options. Answers were generally well structured and easy to follow, without too much padding. Part (iii) was one of the best answered sections. The good answers fleshed out WACC and explained all terms, the rationale, and how it needs to be tweaked for this project. There were some good discussions on why it was riskier (but not hugely different/riskier). Candidates who did not hang their answer around WACC ended up rambling in circles.*

## **END OF EXAMINERS' REPORT**