

Actuarial Society of India

Examinations

November 2005

CA11 – Assets

Indicative Solutions

Q.1)

The report should consider:

- ? Whether the company can make sufficient financial return on this project out of the 0.25% pa management charge. [0.5]
- ? The payback period, in particular the time taken to recoup the start-up and appraisal costs. [0.5]
- ? How to maximize the funds under management – via sales, investment performance of the fund, or minimising the numbers leaving – as both the overall return and the payback period will depend on the size of the funds. [1]
- ? The risks, e.g. of start-up or ongoing expenses being higher than expected, of failing to achieve performance within the specified tracking error, of not raising Rs.10 crore. [1]
- ? Any available risk mitigation options. [0.5]
- ? the sensitivity of the results to the assumptions made such as expenses, sales volumes, withdrawal rates and investment returns. [1]
- ? the upside potential of the project. The upside potential appears to be limited given the fixed management charge. However, as many of the costs are fixed, the returns may be very good if the fund achieves a certain critical size. [1]
- ? any non-financial benefits of the project such as extending the range of funds marketed and so to be able to meet more of customers' needs. [1]
- ? whether there may be other available opportunities that would make better use of the company's scarce resources. [0.5]

Total [6]

Generally poorly answered by most candidates who failed to generate enough ideas. Those candidates who produced good answers tended to do well in the rest of the paper.

Q.2) Positive issues arising from investing in emerging markets

With the prospects of high growth rates, and possible market inefficiencies, opportunities exist for profitable investment, but with a correspondingly higher level of risk than for investment in Japan. [0.5]

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 a good mean of diversification. [0.5]

Negative issues arising from investing in emerging markets

The fund will then tend to underperform, both in absolute terms and relative to the indices, when Japan does well. [0.5]

If the money is transferred from Japanese equities after “recent returns” that have disappointed it may be that we will be selling Japanese equities at a low point in the

market. (We also need to consider current valuation and future outlook of the markets that we are investing in). [0.5]

Markets in small economics can be highly affected by the enormous flows of money generated by changes in sentiment of international investors. This mean that returns may be more volatile. [0.5]

Emerging markets tend to have less stable currencies. [0.5]

If one of the reasons for investing in Japanese equities was to match yen-denominated liabilities, emerging markets will not match. [0.5]

Practical issues arising from implementing the proposal. [0.5]

The term “emerging markets” needs to be defined. An exact definition can be difficult (it might be based on the constituents of a particular emerging markets index). [0.5]

Marketability may be poorer in emerging markets. This means the process for making investments needs to be considered carefully and the issue of whether or not it is acceptable for part of the fund to be unmarketable needs to be considered. [0.5]

Whether the existing fund managers are the best people to invest in emerging markets is an important issue. It is possible that the mandate should be given to other managers with greater expertise and or a better track record in these specialist markets. [0.5]

Settlement and administration of emerging market deals is more complex. This leads to the issue of whether or not indirect investment would be better for these markets. [0.5]

[Any 10 (10 X 0.5 =5)]

A key issue will be which counties to invest in. this will depend upon:

- ? Current market valuation
- ? Possibility of high economic growth
- ? Currency stability and strength
- ? Level of marketability
- ? Degree of political stability
- ? Market regulation
- ? Restrictions on foreign investment
- ? Range of companies available
- ? Tax
- ? Information problems (eg availability and quality of information)

[0.5 mark each, maximum2]

Total [7]

Most candidates answered this question well.

Q.3) Method of construction

Probably a weighted average arithmetic index should be used in order to make it appropriate as a performance measurement benchmark.

The number of individual constituents needs to be considered in terms of the trade-off between accuracy (large number) versus cost (few constituents).

Should the rules be fully codified, or should discretion be allowed in order to make on going improvements and more pragmatic decisions when unforeseen events occur?

[2]

Coverage

Institutions portfolios will vary in terms of:

- ? Direct versus indirect holdings **[0.5]**
- ? Type of property (office, shop, industrial) **[0.5]**
- ? Prime and non-prime property **[0.5]**
- ? Geographical location (including UK versus overseas) **[0.5]**
- ? Size of building **[0.5]**
- ? Tenure (freehold or leasehold). **[0.5]**

The desire for accuracy would suggest that several sub-indices should be published, covering the above factors. However, this must be traded-off against the need for simplicity in calculation, and availability of data. A lot of grouping will probably be used, despite the problem of heterogeneity. **[0.5]**

Where the above factors are grouped together, consideration needs to be given to the weighting that each type of property should have. Presumably the aim should be to reflect the institutions' holding. **[0.5]**

Probably some factors (eg overseas, leasehold, non-prime, department stores) will be left out altogether in order to increase homogeneity.

Indirect holdings might already be assessed by reference to an appropriate property companies sub-index, and therefore we will probably leave them out of the index.

[Any 6 (6 X 0.5 =3)]

Answers were very mixed and few candidates described how to construct and index well.

Q.4) The discounted cashflow value of the benchmark GOI bonds is:

$$12a_{20@8\%}^{(2)} + 100v^{20@8\%} = 141.58 \quad [1]$$

Assuming that the next dividend is due in a year's time, then the discounted cashflow value of the equity is $P + \frac{D}{i - g}$, which leads to $i = g + d$ where d is the prospective dividend yield. So the prospective dividend yield implied by the valuation assumptions is $8\% - 4\% = 4\%$ [1]

Also as the dividend yield is historic – ie based on dividends that were paid on average half a year ago, but d is prospective, we need to adjust the S& P yield for $1\frac{1}{2}$ dividend growth in order to ensure that the dividend yield figures are consistent. [1]

Thus, the notional value of the equities is :

$$0.75 \times 10 \times \frac{0.039 \times 1.04^{1.5}}{0.04} = 7.7556 \quad [1.5]$$

Whilst the notional value of the bond is:

$$0.25 \times 10 \times \frac{141.58}{153.39} = 2.3075 \quad [1.5]$$

Working these out and adding them together gives the total notional value of the assets of approximately Rs.10.0631 crore. [1]

Total [7]

A straight forward value of assets question that was well answered by most candidates.

Q.5)

(a) Reasons why the investor may not make a return of 7.1%

- ? reinvestment of coupons may not occur at 7.1% [0.5]
- ? default by issuer [0.5]
- ? sterling return on overseas bond affected by currency movements [0.5]
- ? inflation means that real return is not 7.1% [0.5]
- ? dealing costs [0.5]
- ? issuer exercises a call option against the investor [0.5]

Note also that tax may sometimes even be payable by a tax-exempt investor (eg on an overseas bond, where the withholding tax cannot be reclaimed or due to a change in tax rules) [1]

(b) Three reasons why a government may sometimes issue index-linked securities rather than fixed interest securities:

- ? to offer a range of different types of securities so as to attract a range of different investors and thus be able to issue at the lowest possible cost. [2]
- ? it believes that inflation will fall so that index linked issues will turn out to be a cheaper sources to finance than fixed interest debt. [1]
- ? It wants to convince the private sector that it will reduce inflation – issuing index- linked government bonds shows a commitment to this (because debt financed by selling index linked government bonds is more expensive to service than fixed interest debt if inflation is high). [1]
- ? Funding costs in early years will be easier to manage on an annual basis. [1]

Total [6]

G. Total [10]

This question was generally well answered.

Q.6) (a) Risk discount rate

The risk discount rate can be estimated using the security market relationship:

$$E_i = r + \beta_{i,m} (E_m - r) \quad [1]$$

Where:

E_m = expected return on existing portfolio of risky projects

E_i = expected return on project i - ie the risk discount rate

r = risk free of return (=3%)

$\beta_{i,m}$ = beta

Putting in the relevant numbers yields:

$$E_i = 3 + 1.4(8-3) = 10\% \quad [1]$$

(b) The actual NPV of the project is given by:

$$NPV = -100 + Xa_3 \quad @ 10\%$$

Where :

$$X = 50 \text{ if the project is very successful, and } 40 \text{ otherwise.} \quad [1]$$

Thus, the actual NPV is equal to 24.34 if the project is very successful, otherwise it equals – 0.526. As the probability of each outcome is assessed to be 50%, the expected NPV equals approximately Rs. 11.9 crore. [1]

As this is positive it suggests that it will be profitable to go ahead with the project. [1]

(c) Mean IRR

The mean IRR is usually determined as the yield such that the NPV based upon upon the expected cashflows is equal to zero. Thus, in this case, the appropriate equation of value to solve is:

$$\text{NPV} = -100 + 45 @ i\% \quad [1.5]$$

Solving for i by interpolation leads to a value of 17% (to the nearest 1%). This value is well in excess of the expected return of 10% suggested by the project's beta of 1.4, again suggesting that the project should go ahead. [1.5]

(d) Expected NPV if insurance is taken out

Purchasing insurance increases the initial outgo to 105. The revenues if the project is very successful are unaffected. If the project is not very successful, however, revenues will be increased to Rs.43.5 crore per annum [0.5]

The actual NPV in the former case is therefore:

$$\text{NPV} = -105 + 50a_3 @ 10\% = 19.34 \quad [1]$$

And in the latter case:

$$\text{NPV} = -105 + 43.5a_3 @ 10\% = 3.18 \quad [1]$$

Thus the expected NPV is in this case equal to about Rs.11.25crore. [0.5]

The effect of insurance is therefore to eliminate the possibility of a significant loss, whilst at the same time reducing slightly the expected NPV of the project. [1]

Total [12]

A straight forward project evaluation question that many candidates scored full marks on. However a significant number of candidates failed to notice that the insurance eliminated the risk of a significant loss.

Q.7) (a) The 10 methods are:

1. book value
2. adjusted (written up/ down) book value
3. market value
4. smoothed market value
5. discounted cashflow (including market value to calculated value ratio)

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- 6. stochastic models
 - 7. expected utility
 - 8. arbitrage value
 - 9. fair value
 - 10. economic value (as proxy to market value) [2]

The two that are probably the most important – and certainly the most widely used in practice – are:

- ? Market value
- ? Discounted cashflow – of which there are several variations. [1]

(b) An investor may not obtain the “market value” because:

- ? “market value” may mean mid-market value rather than bid value
- ? “market value” may mean yesterday’s market value
- ? net proceeds from a sale will be reduced by dealing costs and possible tax
- ? if you sell a large holding of an asset you may depress the price of the asset
- ? if you own a strategic block of share, you might receive more than the market value from a predator who wished to gain control of the company.

[Any 4(4 x 0.5 =2)]

A standard bookwork question that was poorly answered.

Q.8) (a)

- ? Representativeness – the model should mimic the most important characteristics of real world financial assets. This is clearly necessary if the model is to help us predict the future possible behaviour of those financial assets and the cashflows that they produce. Here we might wish to consider both the behaviour of variables individually and also their joint behaviour.
- ? Economic interpretation – The behaviour of assets within the model should be consistent with generally accepted economic principles. In particular, the generated results should be arbitrage-free. The model should also exhibit sensible joint behaviour of model variables.
- ? Parsimony – models should be as simple as possible, while retaining the most important features of the problem. Good models are models that are easy to develop and use. Introducing more complexity may simply add spurious accuracy to results and makes the results harder to interpret and communicate.
- ? It is important to avoid the impression that everything can be modeled. This is because we usually cannot!
- ? Transparency – The workings of the model should be easy to appreciate and communicate. The results should be displayed clearly. Graphic formats are often

used. Pictures can be particularly useful for conveying complex ideas to non-experts.

- ? Evolution – The model should be capable of development and refinement - nothing complex can be successfully designed and built in a single attempt. Therefore, it is important that designers and builders of a model maintain good documentation and clear audit trails for inputs and calculations. This makes it easier for subsequent designers and builders to refine the model.
- ? Implementation tools: A range of methods of implementation should be available to facilitate testing, parameterization and focus of results. A typical hierarchy of implementation methods, in order of increasing complexity.

[3]

- (b) An Arch model or autoregressive conditional heteroscedastic model allows directly for heteroscedasticity - ie variation in the volatility or standard deviation of the random innovation term through time.

Wilkie considered an ARCH model for the force of inflation $I(t)$, in which QSD , the standard deviation of the innovation term, was allowed to vary with t as follows:

$$I(t) = QMU + QA.(I(t-1)-QMU) + QSD.QZ(t)$$

$$QSD(t)^2 = QSA^2 + QSB.(I(t-1) - QMU)^2$$

ie this period volatility depends upon last period's force of inflation. [2]

- (c) The different approaches that may be used to facilitate testing and parameterization of an asset model include:
- ? analytical models – which describe the main features of the assets using mathematical functions. However, analytical models that are capable of being solved can usually be used to describe very simple situations.
 - ? historical back-tests using past data – if the model results are consistent with past data, then they may help us predict future outcomes. However, the past may not be a very accurate indicator of the future
 - ? scenario analysis, ie deterministic simulation and sensitivity analysis – here the modeler maps out a series of scenarios of interest. This will usually allow considerations of only a small number of different scenarios.
 - ? tree-building techniques can be used to build scenarios in the form of a tree. Again this is likely to be useful for modeling only where there is a small

number of stochastic factors involved and hence a limited number of possible scenarios.

- ? Monte Carlo stochastic simulation using a stochastic asset model – which can be used to generate very large numbers of plausible scenarios. These can be particularly useful where the financial outcomes are path dependent.

[5]

Total [10]

Part (a) was generally well answered. In part (b) most candidates did not know what is an ARCH model. Part (c) despite being bookwork was poorly answered.

Q.9)

(a) Why financing arrangement (ii) more suitable

Property development is relatively high risk, therefore need to seek high expected returns.

Unlike the alternative, arrangement (ii) offers the potential for high upside returns if the development is successful.

The equity arrangement specified gives the developer an incentive to:

- maximize the value of the development (ie the rents achieved)
- minimize costs
- finish the project as soon as possible

Arrangement (ii) has a longer discounted mean term, and produces a real asset. It may therefore be better suited to matching the liabilities of the investor.

The 3% over short-term interest rates offered by arrangement (i) may be inadequate compensation for the risk, particularly give the lack of upside potential.

However, even a 3% margin may make servicing the debt burden too onerous for the developer to support.

Assuming rents and costs are in line expectations, the rental yield is 10% (which may be eaten into by on-going expenses). Initially this will be insufficient to service the debt if short term interest rates exceed 7%.

Or if the rents achieved do not quite match expectations and/or costs are higher than expected then additional funding is needed.

Since the shopping centre has not yet been built, there would be little in the way of capital security for the investor.

[5]

(b) Required modifications

The split of rent and the notional rate of interest suggested by the developer are presumably negotiating position, so I would seek better terms on these. (The split of rent is the most important aspect.)

If cost and rent turn out as forecast then the initial split of rents would be Rs.284,848 to the investor and Rs.115,152 to the developer (assuming all costs are incurred up front). This is calculated from:

$$\begin{aligned} &4,000,000 \times 0.06 \times 1.04^{1.5} \\ &+ 0.50 \times (400,000 - (4,000,000 \times (0.06 + 0.02) \times 1.04^{1.5})) \\ &= 284,848 \end{aligned}$$

Since the investor is providing all of the finance for the venture, this looks over-generous to the developer. See final point below, however.

If the actual rolled-up cost goes above Rs. 40 lacs, then the initial split based on gross cost cannot be supported from expected rents. Some specified arrangement by which developer would not then receive the full stated proportion of the cost as his share of rent is needed. (A similar point applies if rents are lower than expected.) **[1]**

The developer's option to convert the developer's share of rents into a capital value at a pre-agreed factor has some value. To minimize the value of what is, in effect, a put option given to the developer the factor should be kept low. **[1]**

Despite the second point above, it may be sensible to give the developer a large share of rents achieved in excess of the Rs. 4 lacs expected at current levels. This gives an extra incentive to maximise the appeal of the centre and hence rents achieved. **[1]**

Total [5]

(c) Further information and other factors

What is the developer's track record on such developments? Has he built such centres before? Has he delivered on time and budget? Have I dealt with him before?

Are the sub-contractors he plans to use financially sound and reliable.

Where is the development to be located? Presumably out-of town, but needs to be close to major centres of population and with good communication links and adequate car parking.

Details of the plan (eg how many shop units are planned within the centre? What is the total floor area? What specification will be building be?)

What planning permission has been sought/ granted so far?

Is such a specialist centre viable? Will manufacturers be keen to set up outlets of this sort in the proposed location? Have any manufacturers (especially “big” names) already signed up, at least provisionally?

Evidence to the seen that the expected cost is based on sound estimates and that the levels of rent should be achievable. What rents are being earned on similar centres?

What are the views on the state of the economy and consumer spending in particular? Such a centre could be particularly vulnerable to a downturn in the economy.

Does such a development fit well with my portfolio? Aspects include whether I want more development exposure and/or retail exposure. Will it leave me with adequate diversification?

Do I have the necessary cash available? If not, might the developer be able to find a joint backer?

If I do have the cash, are there alternative investments that I would prefer?

[6]

Total [16]

This question had poor answers with candidates failing to consider all the issues.

Q.10)

- (i) A tight monetary policy means that short-term interest rates are kept high, and that long-term inflation is expected to be low. This suggests a downward sloping yield curve.
- (ii) Life offices tend to buy medium and long dated government bonds, so extra demand pushes prices up and yields down at the longer terms.
- (iii) If investors are risk averse with respect to future reinvestment rates then they want to “lock-in” to current interest rates, and so buy long dated stocks (pushing prices up and yields down), giving a downward sloping yield curve. Note that this is the converse of liquidity preference.
- (iv) Fixing the exchange rate above its free market level may require high short-term interest rates. Expectations of low future inflation should lead to lower yields for long dated stocks. These two factors will create a downward sloping yield curve.
- (v) The prices (and hence yields) of domestic stocks will be positively related to the prices (and hence yields) of overseas stocks.

[5 X 2 = 10]

A well answered question. Unfortunately there was a typo in part (c) but candidates were given full credit if they explained their answer in terms of 'risk-averse' or 'risk-aware'.

Q.11) The expected return on the All –Share index is given by:

$d + g + \text{expected inflation}$

where d is the dividend yield on the All-share index

g is the real dividend growth

The required return on the All-Share index is given by:

$r_f + \text{expected inflation} + ERP$

where r_f is the index-linked government bond yield

ERP is the equity risk premium

Equating expected and required returns for the All-Share index gives:

$$d + g = r_f + ERP$$

Total [3]

- (a) Comparison with the yield on a 3½% undated government bond
Equating expected and required returns on 3½% undated government bonds gives:

$$GRY = r_f + \text{expected inflation} + IRP \quad [2]$$

Where GRY is the yield on 3½% undated government bond

r_f is the index-linked government bond yield

IRP is the inflation risk premium

Subtracting (2) from (1) and rearranging gives:

$$D = GRY + ERP - IRP - \text{expected inflation} - g \quad [3]$$

- (b) Comparison with the real yield a long dated index linked government bond

Equating expected and required returns on long dated index linked government bonds gives :

$$ILRY = r_f \quad [3]$$

Where $ILRY$ is the real yield on a long-dated index linked government bond

r_f is the index-linked government bond yield

Subtracting (3) from (1) and rearranging gives:

$$d = ILRY + ERP - g \quad [3]$$

(c) Comparison with the yield on prime offices

Equating expected and required returns on prime offices gives:

$$r_y + r_g + \text{expected inflation} = r_f + \text{expected inflation} + PRP \quad [4]$$

where r_f is the prime yield on offices

r_g is the real rental growth

PRP is the property risk premium

Subtracting (4) from (1) and rearranging gives:

$$d = r_y + ERP - PEP - r_g - g \quad [3]$$

Total [12]

A well answered question.
