Institute of Actuaries of India

Subject SA5 – Finance

May 2011 Examination

INDICATIVE SOLUTION

Introduction

The indicative solution has been written by the Examiners with the aim of helping candidates. The solutions given are only indicative. It is realized that there could be other points as valid answers and examiner have given credit for any alternative approach or interpretation which they consider to be reasonable

Q.1]

(i)

Credit rating

Duration matching

Coupons/yields , the margin of yield over and above the yield on govt securities and the yield offered is commensurate with the credit rating/risk of the bond

Internal investment policies regarding subscribing to these bonds

Whether approved investment as per Investment regulations and the company has appetite for unapproved investments if, they are unapproved bonds

Security offered -whether first charge on the assets being created

How the debt equity ratio will change

Covenants restricting the company to issue any further bonds unless the D:E ratio is below a certain specified limit say 1.25:1 etc., restriction on payments of dividends unless the interest is paid etc

No call option

Whether the bonds are going to be listed for trading

Creation of sinking fund, defeasance etc

(ii)

The assessment is based on objective factors like financial statements, subjective factors like quality of management, technology, regulatory environment etc. the key factors it would consider among other things are as follows:

- Industry outlook such as supply and demand for electric power
- New Capacity creations in the near future
- Economic outlook
- Legislative changes or any regulatory prescriptions that may have an impact on the industry

- Encouragement being provided to alternate sources of energy which may impact the demand for conventional power supply companies

Specific to the Company:

- Current capacity utilizations,
- Technology , whether modern, outdated etc.
- Sources of raw material and the supply agreements for the same
- Technical skills
- Management capabilities

- Power purchase agreements with the customers/electricity boards
- Financial statements and the analysis of the same in terms of cost ratios, creditors, debtors, liquidity, ability to service the debt
- Shareholders' capability to arrange for additional capital if required
- Forex risk if the raw materials imported
- Environmental impacts or risks pertaining to it

Based on the above factors , visits to the company and having discussions with the management regarding their perceptions about the industry, their own company's financial & strategic positions.

iii)

1. $F_0 = S_0 e^{(r)T}$

Explanation: you could buy the gas today by borrowing at the risk-free rate.

Can take into account other items like storage costs, borrowing at risk free assumptions etc which might change the price.

The fixed price of gas means you have bought call options from the gas company. If the price of gas increases, you benefit and when the price drops, you lose nothing.

You can use the black scholes formula, using the rdr and implied vol. given above.

Note that you would have to sum the price of European call options at 3,6,9,12 month maturities to come up with amount U.

iv)

We are using risk neutral valuation (black scholes) to value the option prices and hence it does not matter what the "real" growth rate is.

v)

Sell out-of the-money European call options at 3,6,9,12 month maturity @ 1.2 S(0) where S(0) is the current stock prices, in the option market.

The risk is that if the investment team is incorrect and the prices rise beyond 20%, this can result in unexpected losses.

Also, the assumption of perfect correlation between the stock price of Shello and gas prices should hold in the future.

vi)

- Whether the company has the capacity to fund the investment with additional capital as the investment required is significant by rights issue
- If the investment goes wrong can the company's financials withstand the loss or it will impact its existing business in a material way
- In view of the significant debt raised recently for its expansion program, it has to evaluate whether the company has the capacity to take additional debt. Even if the company has the capacity , will there be willing lenders in view of the untested technology for which the debt is being sought
- Does it have the expertise to manage this kind of new technology development etc

- Alternatively if this is spun off into a new company, the company may attract venture funding without a significant impact on the parent company's financials if the investments goes wrong.
- The company will stand to lose to the extent of share capital it has provided.
- If venture funding is done, typically venture capital funds would have an evaluation process and also handhold the management till the company stabilizes
- The likely costs of venture capital funding may have to be compared

vii)

Venture capital will be primarily an equity investment once the fund is convinced of the venture .

It is typically a medium to long term investment

The venture capital will gets its rewards through dividends, management fee and equity appreciation

Closely involved in the management of the venture in which it puts in investments as its financial rewards are intertwined with the success of the venture

Venture capital funds typically bring in expertise in marketing, management etc and guide the company's management with its expert advice so as to enhance the probability of success of the venture

In case of business failure, the venture capital's equity investment will rank alongside other shareholders' investments after bank debt & mezzanine finance

Venture capital typically monitors the performance of the venture very closely in order to identify any problem areas /risks and hence enable the fund to advise the management to suitably remedy the same

Venture capital can be flexible in tailoring the funding either by equity or debt or a combination of the same.

Venture capital fund will be more hands on in terms of monitoring the progress of the venture

Typically expects higher returns given the high risks it takes in investing in untested ventures

viii)

Evaluate the robustness of the technology and the possibility of getting the patents quickly

Timelines estimated to make the concept commercially viable –gestation period

The strength of the technical skills

The commitment of the management and the parent company

The availability of other investors in order to tie-up the total fund requirements

The exit routes for the fund

The expected return on the investment and whether it compares with the return with projects with similar risks

The maximum estimated loss if the venture does not progress as estimated

The likely fee it would get in addition to the capital appreciation if the fund is going to help in managing the new company

The commercial opportunity available by estimating the current transmission losses and how much can be saved by using this device – cost benefit analysis

The estimate of costs of production, set up costs, marketing costs and the margins available

The entry barriers for this technology i.e., can this technology be cloned or replicated quickly once it hits the market

Possibility of emergence of alternate technologies

Any environmental risks/impacts

Any tax concessions available for these kinds of new technologies

Legislative/regulatory environment

Any other relevant factors

ix)

Could be a combination of equity & debt

Could be ordinary stock ranking alongside other investors

Preferred stock which ranks ahead of ordinary stock for income and capital repayment

Preferred stock with an option to convert into ordinary stock

Debt could be secured or unsecured. Could be convertible or non-convertible debt

It could exit by way of :

-Selling the stock in IPOs

Buyback arrangement with the parent company

Sell their investment to another investor

Sell the entire company to another company

Merge the company with the parent company with an appropriate swap ratios.

[Marks – 47]

Q.2]

In India, as per the current IRDA (Registration of Indian Insurance Companies) Regulations 2000, a mutual company is not allowed to be formed. Therefore, the current company must be under shareholding structure.

Shareholder's would require a return on their investment. This return is provided through the profits made by the company which should be the sum of profits earned from each product. Evaluation of the product cash flows may be done at a composite required return for share holders or it may be done with regard to the riskiness of the product cash flows.

Among the different type of products written by a life insurance company – Unit Linked, Participating and Non-Participating, it may be argued that non-participating is the most risky line of business since total investment risk is retained by the company.

Therefore, the discount rate for this product should be higher than the average return required by the shareholders if it is assumed that the pricing approach uses different return for different risks else the discount rate used should be same as required by the share holders.

The equity risk premium assumed by the actuary seems to be low considering the riskiness of emerging market and cost of capital in developed economies itself being higher than 5% (specified by Solvency II regime is 6%).

Assuming ERP of 5% and risk free rate of 8% we get a beta of 1.4 which seems to be ok as beta for a generic life insurance company is found to be higher than one.

This product is likely to be most competitive as everything is guaranteed in advance making it easy to compare against other similar products. This implies more accurate pricing is required. Considering that this is also most risky – it would be appropriate to discount it at a higher price than the required rate of return for the share holders.

According to financial theory, one should discount the post tax expected cash flows with the appropriate discount rate to make the NPV to be zero. In this case, the cash flows are calculated with a margin which probably is not required.

The IRR requirement is easily met as VNB margin at 15% discounting should be 3% .

This means that the required rate of return implicitly assumed to be higher than 15%. As per finance theory it would be better to specify the required rate of return explicitly as per the riskiness of the cash flows and then use the mean cash flows and the required rate of return to price the premium.

The discounted payback period is used at times to see the return of the initial capital. In case of life insurance this may not be that meaningful as it is possible that increases in solvency margin may be required at a later period which may result in net negative cashflows for shareholders even after this discounted payback period. However, depending on the product design this may be a meaningful in the current context.

Considering that the company would not be taxable in the initial years, it is not clear whether the tax treatment considers this aspect in pricing. If not considered, then it may be an under-estimate as the initial losses are estimated to provide savings in tax with subsequent higher tax payouts from profits.

The tax rate itself may be under litigation. It is not clear whether the shareholder taxation would be at the lower rate considered or would it be under full corporate tax rate. To the extent the tax authorities' treatment is at a higher rate, the company would not meet the target. Either the tax rate needs to be modified or the riskiness of this needs to be factored in the discount rate.

Besides, the company may consider at least future tax rate under the Direct Tax Code regime which is far higher than the one currently assumed for pricing basis.

[Marks – 10]

Q.3]

(i)
Risk free interest rate in finance is the rate at which money can be invested with 100 per cent certain payoff in future. In short, it is known interest rate with zero default on interest and principal.(1) In other words, the standard deviation of the realized return would be zero and it would always equal the expected return.

(ii)
It is not only different for different countries but it also differs over time for the same country. This is reflective of the demand and supply of money denominated in the local currency at any point in time. The local government being the largest player usually plays a major role in determination of the interest rates.

Generally, arbitrage will not exist in a free market where exchange rates/forward rates would adjust to nullify any arbitrage opportunity.
However, in a restrictive and controlled market, arbitrage opportunities may exist though it would be difficult to exploit such opportunities given the controls restricting the free entry.

(iii)
Risk free rate is central to the theory of finance and is used in various concepts.

The risk-free return is used in Markowitz portfolio theory to argue that every investor will hold a market portfolio and would adjust the risk by lending at the risk free rate.

It is used in derivative pricing to create a replicating portfolio. Many derivative assets are priced easily due to the presence of the risk free assets giving an easy arbitrage free price.

It is central to CAPM or any cost of capital phenomenon. Risk free return is usually a floor to add for any additional risk. This required return is central in corporate finance for any capital budgeting. Capital projects are evaluated using NPV at the required rate of return which is benchmarked against the risk free assets.

The above concept is also central in corporate financing.

Portfolio management is easy as it is easy to alter the risk of the portfolio without reducing the diversification of the portfolio by just mixing it with more or less risky assets.

iv)

If a country's currency is not an international currency than it is easy to see why the country may default on foreign currency loan as it needs to repay the debt in the foreign currency which may not be available.

The government cannot print any other country's currency and it must have significant export or capital inflows to pay the foreign currency debt.

The local currency default may happen under the following conditions:
1) Under the gold standard era – the countries can print money only to the extent they have the gold reserves and since gold reserves are limited the countries may default
2) **Common Currency:** As Euro is a common currency there is an agreement reached among the countries limiting the printing capability of any single nation. So, under difficult situation it may not be easy to print (just as in case of Greece)
3) There are costs of defaults like reputation loss, economic recession, political instability etc. However, excessive printing of money also has costs like hyper inflation, devaluation etc. At times, cost of printing money is far higher than the cost of defaulting leading countries to default. For example, if foreign currency is funding all the local assets than a devaluation would imply reduction in value of the assets without any change in liabilities leading the government to take a decision to default rather than printing money and consequent devaluation.

(v)

Since the sovereign is also risky it is imperative that we identify the risk premium associated with the government default. It can be gauged by various methods as given below:

1) Rating agencies give sovereign ratings and that may be used to estimate the default spread by averaging the default spreads over a similar rated sovereign/multi-national bonds
2) Government may have issued foreign currency bonds and difference from the foreign currency risk free return and the government bond would give the market estimate of the default risk associated with the government
3) Credit default spreads may be traded on the local government(or similarly rated sovereign) and that may be used to identify the spread associated with the risk
4) Fundamental analysis – Full projections of government finances may be modeled and analyzed to identify the probability of default and consequently that may be allowed for in the estimation of the risk premium

The risk spread so calculated may be subtracted from the government interest rates to get an estimate of the risk free return.

(vi)

This may have a significant impact altering the behavior of investors and managers. It is possible that in the absence of risk free assets the investors decide to hold less diversified portfolio (in place of market portfolio and risk free asset) to meet their risk requirements. However, this would then leas to sub-otimal allocation of resources for everyone.

It is also possible that risk premium increase as the investors would be looking for safer alternatives in the absence of risk free assets. Investors may be less willing to take risks as a consequence of absence of the risk free assets.

Cash investment within the companies would also be risky (as risk free does not exists) leading the companies with large cash to be perceived as risky compared to the risk-free. It is also possible that the companies may not be able to hold back the dividends as idle cash may not be seen favorably y the investors since it will be risky.

[Marks - 21]

Q.4]

(i)
ABC:
t = 3 r_f = .05
X =200 S_0 = 300
σ = .5 σ^2 = .25
SOS:
t = 3 rf = .05
X =50 S_0 = 100
σ = .7 σ^2 = .49

(ii)
Computations are as follows:
ABC:
d_1 = 1.074 $N(d_1)$ = .859
d_2 = .208 $N(d_2)$ = .583
c_0 = 157.32 Cr = equity value
p_0 = 29.46 Cr
D = 172.14 – 29.46 = 142.67 Cr

(iii)
SOS:
d_1 = 1.3016 $N(d_1)$ = .903
d_2 = .089 $N(d_2)$ = .536
c_0 = 67.30 Cr = equity value
p_0 = 10.34 Cr
D = 43.04 – 10.34 = 32.70 Cr

Using the simple two-security risk equation, we find that the combined firm standard deviation of returns equals .429 because the correlation coefficient is .1 and the weights are ¼ and ¾:
.429 = sqrt{$(.75^2 * .5^2) + (.25^2 * .7^2) + 2(.75 * .25 * .5 * .7 * .1)$}

Combined firm:
X =250 S_0 = 420 (Including synergies)

$d_1 = 1.271$ $N(d_1) = .898$
$d_2 = .527$ $N(d_2) = .701$
$c_0 = 226.38$ Cr = equity value
$p_0 = 21.56$ Cr
$D = 215.18 - 21.56 = 193.62$ Cr

(iv)
Note that the combined firm equity has been increased by 1.75 Cr and creditor wealth has increased by 18.25 Cr. Note that the sum of the wealth increases equals 20.00 Cr the value of the synergies.

It is possible that both the share holders share the gain of 1.75 Crore among themselves. Though, the gain is quite small. Shareholder of ABC may offer 0.70 Crore more i.e. 68 Cr compared to the current equity of 67.30 Crore to SOS. Then ABC shareholders would have retained 1.05 Crore of gain for themselves.

Most of the gain is cornered by the creditors as there is a significant increase in security of their money due to reduction in the overall standard deviation.

[Marks – 10]

Q.5]

(a)

Disadvantages of option a

Under Indian regulations, Stock Exchanges act as self regulating agencies – regulating the trading / listing environments and participants. Consequently onus exists on stock exchanges to produce an orderly trading environment by dissemination of information and conduction of trades by its members. There may be conflict of interest by allowing raising of equity/debt traded on same/other stock exchanges (or bad competition)

Stock exchanges are likely to act as a natural monopoly due to significant advantages of networking and economies of scale. Considering these aspects, allowing a significant profit motive may lend it to maximize the economic rent at the cost of public – the market will not reach economic equilibrium price of perfect competition.

Being a regulator and also being in business of profit making probably does not go well together. It is possible that the regulatory objective become subsidiary to profit making objective of business. This conflict needs to be controlled. Allowing public scrutiny (being a publicly listed) may not bode well for the stock exchange when they also need to perform other roles.

Advantages of Public Listing

It allows public to invest and diversify through a different risk/return combination compared to the current available set. It may be noted that a similar result may be achievable through option b also by indirectly investing in financial corporations holding shares in this exchange.

It certainly allows the exchange to raise the capital freely from public and also increases the responsibility of the exchange to its shareholders who are now general public. This opens the exchange to a greater public scrutiny.

Disadvantage of Mutual Exchange

In case neither of these is selected than the exchanges would remain mutual exchanges which means the member brokers are also the owners of the exchanges. This system has worked well over the years but recently with a large investment requirement of the exchanges this system has failed for want of capital investment. There is a significant investment requirement in technology which changes every few years. The mutual exchanges are limited by the resource availability. Besides, in today's world the exchange needs to be pro-active and quick. Under mutual exchange system the management was not always totally professional and there were few concerns.

Disadvantage of holding by financial institutions and limitations on profit

It has been found that financial institutions failed to monitor and save companies even though being on the board of directors of various companies. It is questionable whether financial institutions would be able to provide the monitoring level that is required and expected from an independent shareholder.

Additionally, there also exists a conflict here. Financial Institutions have a major role in stock exchanges and nearly half of the trading belongs to them. Being a shareholder in the exchange they may take advantage of this conflict of interest.

A way to balance out the conflict is to make multiple shareholders with minor interest with no major share holder. This would reduce the conflict but then it may result in destruction of investor's wealth and that needs to be safe-guarded. It may be noted that at times of common interests most financial institutions behave in a similar manner and that may mean that conflicts of common interest may not be resolved by the above solution.

[Marks – 12]

[Total Marks – 100]

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