Institute of Actuaries of India

Subject ST5 – Finance and Investment A

November 2008 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

1. (i) - Diversification of assets
- Liabilities
- Liquidity
- Uncertainty over future income and outgo
- Tax
- Level of investment expertise
- Stability of asset values
- Investment and risk characteristics of available assets
- Attitude to risk

(ii)   As they have a relatively small amount of wealth to invest and hence hold critical importance for them
Most of it may be tied-up in the property- viz., house/land

[6]

2.

(i)   Company accounts
Company trading statement
Visits to company
Management meetings
Financial press
Trade papers
Competitor intelligence
Stock broker papers
Stock exchange information
Government sources of statutory information

(ii)   Your role will involve stock analysis within your sector. Additionally, you will be involved in assessing the prospects for your sector within the overall economy.

Given that the oil is an essential commodity and most of the demand is met by imports in India, you will look at the international oil prices, the international demand and supply and the dollar exchange rates and the trends in the international markets on the control of oil prices by the major oil producing companies

When a particular company's prospects are analyzed, you may look at whether the company has any captive oil fields or does it have long term oil supply agreements etc.

Government policies-any subsidies provided- and the investments on the up stream facilities such as oil exploration etc need to be examined.

You will attempt to establish whether a stock is, according to your analysis, under or over valued by the market by looking at the P/E ratios of the particular stock and comparing it with that of the industry, long term profit trends for the company, the other financial parameters such as free reserves, refining margins etc.

Part of the assessment will involve construction of a model to help estimate future cash flows and earnings.

The valuation results will depend upon the robustness of the valuation model and the quality of the data that goes into the model.

The modeling process will help to identify the key drivers to profitability.

Further analysis can then be targeted at the most important areas. Sensitivity/scenario analyses can be used with economic projections to assess the robustness of the profit stream.

The output will be an indication of the fundamental value of a share given the underlying assumptions and input data.

(iii)   The company's financials need to be looked at and the information may show worse accounting ratios compared to those of other companies in the sector

It might have been adversely affected by any possible changes in the government policies

The company may be adversely hit by the rising dollar if has not had adequate forward contracts to cover the risk of exchange rates

The company may be entirely dependent upon imports of crude oil and if the oil prices are increasing steeply and if the company does not have the ability to pass on the increase in input costs to the consumers either due to competition or government policies. As a result the company might be incurring losses.

The company might have suffered any production losses due to break-down in the refinery or due to labor unrest.

[20]

3   All forms of regulation have a cost.

The aim of regulation should be to maximize the benefits and minimize cost so that the benefits outweigh the costs

Direct costs arising from regulation:
Administering the regulation
Compliance for regulated firms
Other economic costs of regulation:
Altering behavior of consumers, who may be given a false sense of security and a reduced sense of responsibility for their actions.

An undermining of the sense of professional responsibility amongst intermediaries and advisors.
A reduction in consumer protection mechanisms developed by the market itself.

Reduction in product innovation

Reduction in competition   [5]

4.   (a) An American option is one that can be exercised on any date before expiry. A European   option can only be exercised at expiry. Assuming all the other terms and conditions of the two options are identical, the American option will have the greater market price. Its value includes scenarios which can profitably be exercised prior to expiry, as well as at   Expiry.

(b) (i) The option strategy will be either to buy put options on the stocks comprising the equity portfolio or to buy a put option on an equity index which closely mirrors the equity portfolio. This strategy is referred to as a protective put strategy.

   Appropriate Pay Off Diagram

(ii) The option strategy will be to buy a call and put with the same strike price and expiration date on all stocks comprising the equity portfolio. If there is a sufficiently large move in either direction, a significant profit will result. This strategy is referred to as a "long straddle" strategy (or buying a straddle). Alternatively the fund manager can buy a straddle on an equity index which closely mirrors the equity portfolio.

   Appropriate Payoff Diagram

 (iii) Advantages of Using Swap Transactions:
- The costs can be reduced for large switches if the fee payable to the arranging bank is less than the dealing charges on equities and bonds
- There may be advantages if the bonds to be purchased are relatively illiquid. In such a case buying the bonds in the cash market can push up the prices of such bonds.

- The increased exposure to bonds can be structured in such a manner as to suit the fund in terms of duration

- Swap deals can be completed quickly and can be reversed at short notice
- Swap transactions can be used to change the fund's exposure quickly thereby enabling the fund manager to make the

necessary changes slowly in the cash market. As the cash market deals are made, the overlay strategy can be unwound.

- Selling the physical equities may give rise to a tax liability which can be avoided through the use of derivatives

Disadvantages of Using swap Transactions

- An OTC (Over the counter) swap exposes the fund to counter party credit risk.
- It may only be possible to arrange the swap using indices of bonds and equities which may not be suitable for the bonds and equities the funds would otherwise buy and sell.

- It is generally difficult to account, report, value and manage the risk of a portfolio comprising swaps and other derivatives.

[13]

5. General Industries:

Dependent on the level of investment spending - level of economic investment i.e. capital formation
Cyclical
Company profits tend to move ahead of the trade cycle as capital expenditure is generally very high at the beginning of the economic growth
Dependent on government spending as government largely controls the general infrastructure
Volatile profits
High profit margins when conditions are good
Low gearing because of volatile profits
Possibly exposed to overseas markets and competition
Utilities:
These are involved in the supply of continuously demanded services to households and business premises
Demand is very stable as most of the services provided by these companies are essential and hence market share will be stable
Vulnerable to political risk and change in regulations
Require extensive physical infrastructure
Most of them are natural monopolies
Generally subject to tight government regulation of prices and vulnerable to other forms of political risk
Generally have low growth prospects thus leading to high gross dividend yield
Gearing is low despite stable demand and large capital requirements
Largely dependent upon domestic market
Financial Services:
Consists of various financial services like banking, investment banking, general insurance & life insurance companies, and investment trusts etc.

Capital Intensive

Banks are highly geared and have volatile profits as they operate on margins between lending and borrowing rates

General insurers also have volatile profits with little or no borrowings

Labor costs are important for many companies in this group

Domestic market is very important   [9]

6.   (a) Standard deviation of the daily change in the investment in each asset
$$= 0.01 * 1,000,000$$
$$= 10,000$$
Variance of the portfolio's daily change
$$= 10000^2 + 10000^2 + 2 * 0.3 * 10000 * 10000$$
$$= 260,000,000$$
Standard deviation of the portfolio's daily change
$$=260,000,000^{\wedge}(0.5)$$
$$= 16,124.5$$
Standard deviation of the 5 day change
$$= 16,124.5 * 5^{\wedge} (0.5)$$
$$= 36055$$
From the Normal Table, we find that
$N(-1.645) = 0.05$
(This means that 5% of the normal distribution lies beyond 1.645 standard deviations below the mean)
Therefore the 5 day 95 percent VaR
$$= 1.645 * 36,055$$
$$= Rs. 59,310$$

(b) VaR can be used to measure the riskiness of the two equity portfolios (based on historical data) as follows:
- Collect historical data on the investment returns of the two equity portfolios, based on, say, quarterly performance   .
- Fit these data to an appropriate distribution (typically normal distribution) – the mean for each portfolio would be its quarterly out performance (or under performance).
- Calculate the standard deviation of the two distributions.

- For each portfolio, estimate the point below which there is (say) 5% chance of falling
- The reported VaR for each portfolio will be the level of underperformance equated to this 5% tail.
- The two VaRs can be compared to establish the relative downside risk of the two equity portfolios

(c)
- The change in the value of an option is not linearly related to the change in the value of the underlying variables (stocks)

- Therefore even if the change in the value of the underlying variables (stocks) follows the normal distribution, the change in the value of the options will follow a non normal distribution.

- Hence the linear model based on the normality assumption tends to provide only an approximate estimate of VaR for a portfolio containing

(d)
- VaR methodology does not take into account the simultaneous increase in asset volatilities and correlations that are observed during extreme market events
- The risks that result from extreme market events can be identified and investigated using the process of financial stress testing. This involves subjecting a portfolio to extreme market moves by radically changing the underlying portfolio assumptions and characteristics, in order to gain insight into portfolio sensitivities to pre defined risk factors. This pertains in particular to asset correlations and volatilities
- In other words, stress testing can be considered as a way of taking into account extreme events that do occur from time to time but that are virtually impossible according to the probability distributions assumed for the market variables. For example, a five standard deviation daily move in a market variable is one such extreme event. Under the assumption of a normal distribution, it happens about once every 7,000 years. But in practice, it is not uncommon to find a five standard deviation daily move once or twice (say) every 10 years.
- Back testing is an important reality check on VaR. It involves testing how well the VaR estimates would have performed in the past. Suppose that we are calculating a 1 day 99% VaR. Back testing will involve looking at how often the loss in a day exceeded the 1 day 99% VaR. If this happened on about 1% of the days, we can feel reasonably comfortable with the methodology for calculating VaR. If it happened on, say, 7% of the days, the methodology for calculating VaR is suspect.

[13]

7. (i) The formula for Treynor measure is $(Rp - r)/\beta p$

Treynor Measure for the fund is $(24\%-6.5\%)/1.5 = 11.7\%$

Treynor Measure For the Index $= (18\%-6.5\%)/1 = 11.5\%$

The formula for Sharpe measure is $S = (Rp - r)/\sigma p$.

Sharpe measure for the fund is $(24\% - 6.5\%)/27\% = .65$.

Sharpe measure for the index is $(18\%-6.5\%)/21\%=0.54$

Both Treynor measure and Sharp measure indicate that the fund has out performed the index in terms of the risk adjusted returns.

7 (ii)

(a)   The fund has invested in top 100 stocks as well as in the next 100 stocks. Unless there was stress in the markets, these stocks are expected to give higher return as compared to the bench mark BSE250 stock index as the risk is higher and hence the expected return. The Beta of the portfolio also indicates that the risk is higher for this as compared to the index.

7   (b)   The fund manager has taken greater risks than the market in the pursuit of higher returns. The Beta of the fund and the higher standard deviations compared to those of the market indicate that the fund had higher volatility

If the members of the fund are young, the strategy of pursuing higher returns with higher risk may be justified.

However the trustees also are interested in the safety of the funds. Hence the fund manager may need to re-look at the strategy in order to reduce the beta of the fund or standard deviation in consultation with the trustees.

The Treynor ratio indicates that the risk adjusted return of the fund at 11.7% is just marginally higher than the return on the index. However the fund has a significantly higher beta than the market which indicates that if the market returns go in the negative direction, the portfolio is expected to lose much more than the market.

The overall volatility of the fund is also higher than that of the index although the Sharp ratio indicates that the risk premium per unit of risk for the fund is higher than that for the market [as represented by the index].

In short the fund manager has performed better than the market with higher risks. However the fund manager may need to review the strategy for reducing Beta of the portfolio in order to reduce the volatility in returns.

[13]

8.   (i) Under the classical split rate system of corporation tax, the company is taxed at one rate on retained profits and another rate on the distributed profits

An investor is subject to income tax on the whole of distribution and capital gains tax arising from increases in the share price.

(ii)   Each investor, individual or institutional, will attempt to maximize after tax returns and will therefore attempt to find tax-efficient investments.
The government wants to encourage longer term investment; however, it would prefer to avoid a taxation system that hampers the operation of a price-efficient market.
The Government can contemplate the following measures:

[a] The Government can levy tax on Purchase & Sales of investments. This measure will discourage frequent purchase and selling of investments

[b] The Government can levy a higher tax rate on investment income and reduce the tax burden if this investment income is reinvested in the same or similar type of investments.
[c] The Government can tax short term capital gains at a higher rate than the long term capital gains. Alternatively the proportion of taxable capital gains can be reduced depending on the length of time for which the investment is held.
[d] There can be a reduced or deferred tax on gains where capital is reinvested.

[6]

9. (a)

(i) The forwarded exchange rates at the end of year 6 are as follows:

Spot	: 0.8000
1 Year forward	: 0.8 * (1.08/1.03) = 0.8388
2 Year forward	: 0.8 * (1.08/1.03)^2 = 0.8796
3 Year forward	: 0.8 *(1.08/1.03)^3 = 0.9223
4 Year forward	: 0.8 * (1.08/1.03)^4 = 0.9670

(ii) The value of the swap at the time of default can be calculated on the assumption that forward rates are realized. The "cash flows lost" as a result of default are as follows:

Year	Dollars due to be Paid (A)	Swiss Francs due to be Received (B)	Forward rate (C)	Dollar Equivalent of Swiss Francs Amounts (D)=(B)*(C)	Cash Flow Lost (E) =(D)-(A)
6	560,000	300,000	0.8000	240,000	(320,000)
7	560,000	300,000	0.8388	251,640	(308,360)
8	560,000	300,000	0.8796	263,880	(296,120)
9	560,000	300,000	0.9223	276,690	(283,310)
10	7,560,000	10,300,000	0.9670	9,960,100	2,400,100

The present values of the "cash flow" lost are given in the following table:

Year	Cash Flow Lost (USD)	PV Factor @ 8%pa	PV
6	(-) 320,000	1.000	(-)320,000
7	(-) 308,360	0.926	(-)285,541
8	(-) 296,120	0.857	(-) 253,775
9	(-) 283,310	0.794	(-)224,948
10	2,400,100	0.735	1,764,074
Total			679,810

Note: The negative cash flows in the above tables denote the cash flows gained by the financial institution as a result of default.

Hence the cost of default to the financial institution as at the end of year 6 is USD 679,810

(b)
The statement is true.
In an interest rate swap, the financial institution's exposure depends on the difference between the fixed rate of interest and the floating rate if interest. It has no exposure to the notional principal. In the case of a loan, the whole principal can be lost.

(c)
The two year swap rate is 5.4%.
It means that a two year LIBOR bond paying semiannual coupons at the rate of 5.4% pa sells for par.
Let x is the two year LIBOR zero rate. X can be determined from the equation:
2.7 * exp (-0.05 * 0.5)
+ 2.7 * exp (-0.05 * 1.0)
+ 2.7 * exp (-0.05 * 1.5)
+102.7 * exp (-x * 2.0)
= 100
Solving for x, we get x = 0.05342 i.e., 5.342%
The 2.5 year swap rate is 5.5% pa (average of 5.4% and 5.6%)
It means that a 2.5 year LIBOR bond paying semiannual coupons at the rate of 5.5% pa sells for par.
Let y be the 2.5 year LIBOR zero rate. Y can be determined from the equation:
2.75 * exp (-0.05 * 0.5)
+ 2.75 * exp (-0.05 * 1.0)
+ 2.75 * exp (-0.05 * 1.5)
+2.75 *exp (-0.05342*2.0)
+102.75 * exp (-y * 2.5)
= 100
Solving for y, we get y = 0.05442 i.e., 5.442%

Hence the zero rates for maturities 2.0 and 2.5 years are 5.342% and 5.442% respectively.

(d)
The typical credit events that are likely to impact a credit default swap are as follows:
- Bankruptcy (insolvency, winding up, appointment of a receiver)
- A rating downgrade
- Repudiation – a debt issuer chooses to cancel all of the interest payments and the capital repayment of the debt
- Failure to pay a particular interest payment

- Cross default – where a default on another security of the debt issuer will be considered as a default on the bond under consideration

[15]

(Total 100 Marks)

********END*******