Institute of Actuaries of India

Subject ST5 – Finance and Financial Investment A

May 2009 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.   a) Types of Merger:
        Mergers can be classified into three forms:
                1.   Horizontal Merger involves merger of two firms engaged in similar activities.
                2.   Vertical Merger involves merger of those companies engaged in different stages of a production process.
                3.   Conglomerate merger which involves firms in unrelated lines of business.

        b) Reasons for Merger:
        In the given context mergers may be necessitated as some of the companies may not have enough capital to weather the difficult times hence may look out for potential buyers.

        Companies with strong financials may look out for companies which are vulnerable to take over to expand.
        The mergers may happen for the following main reasons:
                Economies of Scale: When two or more firms combine, certain economies are realized due to the larger volumes of operations of the combined entity.
                        -   These economies arise because of more intensive utilization of production capabilities, distribution networks, research and development facilities, data processing systems and so on.
                        -   The other principal source of benefits are improved co-ordination of activities, lower inventory levels, simplify administration and so on all lead to reduction of costs.
                        -   A merger can be carried to increase the operation's market share. This may lead to an increased influence on the industry pricing process.
                        -   The aim could be to reduce costs of obtaining finance, both via economies of scale in the issue costs and also by obtaining a lower cost of capital.
                        -   Merger may enable the company to gain tax advantages

                                                                                                        [6]

2.   (i)   The swap rate for a particular term at a particular time is the fixed interest rate that would be exchanged for a floating rate in a new swap with the same principal and term. In other words, if we consider an interest rate swap in terms of swapping a fixed rate bond for a floating rate bond, then the swap rate is the fixed rate such that the two bonds have the same present value at the start of the swap.

        The swap rate for a particular maturity is the average of the bid and offer fixed rates that a market maker is prepared to exchange for floating rate in a standard plain vanilla swap with that maturity.

        The swap rate for a particular maturity is the floating rate /swap par yield for the maturity.

        (ii)   The financial institution will realize a loss if company Y defaults when   rates are high or if company X defaults when rates are low. These events are relatively unlikely since (a) Y is unlikely to default in any circumstances and (b) defaults are less likely to happen when rates are low.

        For the purposes of illustration, suppose that the probabilities of various events are as follows:
        Default by Y: 0.001; Default by X: 0.010
        Rates high when default occurs: 0.7
        Rates low when default occurs: 0.3

The probability of a loss is:
$$0.001 * 0.7 + 0.01 * 0.3 = 0.0037$$
If the roles of X and Y in the swap had been reversed the probability of a loss would be
$$0.001 * 0.3 + 0.01 * 0.7 = 0.0073.$$

Assuming companies are more likely to default when interest rates are high, the above argument shows that the given situation has the effect of decreasing risk of financial institution's swap portfolio.

(iii) The financial institution is in long dollar bond and a short USD bond. The value of the dollar bond in millions of dollars is

$$0.48 * e^{-0.07*1} + 12.48 * e^{-0.07*2} = 11.297$$

The value of the AUD bond in millions of AUD is

$$1.60 * e^{-0.09*1} + 21.60 * e^{-0.09*2} = 19.504$$

The value of the swap in millions of dollars is therefore

$$11.297 - 19.504 * 0.62 = -0.795$$

As an alternate the swap can be valued as a series of foreign exchange contracts. The one year and two year forward exchange rates are as:
$$0.62 * e^{-0.02*1} = 0.6077$$

$$0.62 * e^{-0.02*2} = 0.5957$$

The value of the swap in millions of dollars is therefore

$$(0.48 - 1.6 * 0.6077) * e^{-0.07*1} + (12.48 - 21.6 * 0.5957) * e^{-0.07*2} = -0.795$$

Hence the value of the swap is -7.95 million dollars and it can be seen that both the methods gives the same answer.

[11]

Q3.   Need for regulation of financial services markets:

To ensure confidence in the financial system as a whole, by guarding against the dangers of problems in one area spreading to other parts of the system, and the damage that would be done by a systematical financial collapse.

To compensate for asymmetry of information, expertise and negotiating strength that often exists in financial transactions, particularly in retail markets where the consumer will generally be a lot less well-informed than the financial services' provider and\ or intermediary.

The need is greater because:

-    Company failures elsewhere in the economy are likely to:

- be less contagious between firms in other industries
- have less serious consequences for the economy as a whole

- The financial consequences for the individual of inappropriate decisions are likely to be large, long-term and difficult to rectify.

- Lack of information will be a less of a problem in other markets where the goods and services traded are themselves less complex.

[5]

Q4.

Money-weighted rates of return of the two portfolios

Equity portfolio:

$8400(1+i) + 480(1+i)^{0.5} = 7800$

$i = -12.49\%$

Fixed interest portfolio:

$1600(1+i) + 250(1+i)^{0.5} = 1650$

$i = -11.57\%$

Assumptions
- Net new money is received halfway through the year.
- Expenses and tax have been ignored.

Benchmark returns

Equity index:

$(9626 / 12365)*(1.0865) = -15.42\%$

The 31 December dividend yield is used both for consistency with the 31 December Index value and also because the dividend yields on the ALL-Share Indices are historical. The equity portfolio manager therefore appears to have out-performed the benchmark by about 2.93%.

Fixed interest index:

$((2019+105.4)/2345) - 1 = -9.41\%$

The fixed interest portfolio manager therefore appears to have under-performed the benchmark by about 2.16%.

We have assumed that both the equity and fixed interest funds received dividends and coupons at the end of the year (i.e. no reinvestment). The investment managers would have actually been able to reinvest dividends and coupons as they were paid, which would have a negative effect on performance in a falling market).

[7]

Q5 (i)

▪ Actuarial risk: The inability of the company to meet the liabilities and the guarantee when it falls due. If the value of assets is less than the guaranteed amount,

the additional amount to be paid has to be borne by the shareholders having capital implications.

▪ Interest rate risk: There is a significant exposure to the interest rate movements under the product. This arises primarily due to the interest rate guarantee of 6% provided in the product and the actual earnings could deviate significantly from the rate that is guaranteed.

Even if a full matching strategy is followed the residual interest risk will be present as the matching may always not be perfect in the absence of long term hedging instruments available in the market. The full matching strategy may also entail significant costs to the company

▪ Reinvestment rate risk: This is a risk that the interim cash flows from the fixed interest securities cannot be invested at the rate that is required to meet the interest rate guarantee or with the term that is required to meet the liability out go on maturity.

▪ Credit risk: This emanates from the fact that the investment manager has taken a strategy to track an index which contains high quality corporate bonds. The risk here is a possibility of defaults or downgrading of some issues of fixed interest portfolio. As the strategy here is to track a specific index and due to downgrading of a particular issue the investment manager may have to exit the exposures of these bonds and any losses due to that may be quite significant.

▪ Mis-matching risk: This arises as there may not be availability of fixed interest bonds that exactly match the duration of the liability. This risk is increased due to the situation that there is no possibility to invest fully in zero-coupon bonds.

▪ Operational risk: These types of products require regular monitoring of the portfolio and the company may incur higher costs in order to ensure that the investment strategy is closely tracking the expected liabilities by getting the required skill sets

▪ Market Value Risk: Even though the investment manager matches the duration of assets and liabilities and track the performance based on the bond index, there may be market value risk if the strategy is not buy and hold.

▪ Basis Risk/ Tracking Risk : This risk may arise due to the investment manager's passive strategy as the duration of bond index may be different and may not be matching with the liability duration of 10 years. The duration of the two portfolios may be matched by suitable selection of bonds within the index.

ii. Differences between active and passive fund management strategies:
- Passive management is based on the belief that the markets are efficient
- Passive management involves a long-term, buy-and-hold approach.
- Passive investment manager selects an appropriate target and buys a portfolio designed to closely track the performance of that target.
- Once the portfolio is purchased, little additional trading occurs, beyond re-investing investment income or minor rebalancing necessary to accurately reflect the target.
- Active management is based on the belief that the markets are not efficient and it is possible to out perform the available bond indices
- Active management involves a systematic effort to exceed the performance of a selected target
- Active management entails the search of these mis-priced securities or group of these securities
- In this process the active investment manager involves in buying and selling frequently in the hope of achieving higher return

(iii) Two ways in which bond portfolio can be management actively are:

   i)   Anomaly Switching:

- Anomaly switching involves moving between stocks with similar volatility, thereby taking advantage of temporary anomalies in bond prices.
- In an anomaly switch an investor spots that similar individual stocks appear to be temporarily cheap or dear.
- The investor can profit by selling dearer stocks and replacing them with cheaper stocks.
- It is a relatively low-risk strategy because the move is from the core portfolio into broadly similar stocks (in terms of coupon and term to maturity, and hence volatility).
- The basis here is that the anomaly will prove temporary and that the switch can be reversed for a profit, when the situation returns to what is regarded as "normal".

   ii) Policy Switching:

- Policy switching is a more aggressive and hence risky approach which involves taking a view on future changes in shape or level of the yield curve and moving into bonds with quite different terms to maturity and /or coupon.
- An investment manager wants to take advantage of a movement in the level or change in the shape in the yield curve
- A policy switch offers the prospect of greater profit if expectations are fulfilled, but can be much riskier than an anomaly switch.
- If the strategy does not work as expected, it may lead increase in cost of guarantees.

(iv)

- Absolute matching of assets and liabilities involves structuring the flow of income and maturity proceeds from the assets and liabilities so that they will coincide precisely with the outgo in respect of liabilities under all circumstances. This requires the sensitivity of the timing and amount of both the asset proceeds and the liability outgo to be known with certainty and to be identical with respect to all factors.
- In reality it is not possible to absolutely match the assets and liabilities due to which there is a potential possibility that timing of liability outgo and / or amount of liability outgo may not match with that of the liability.
- In order to avoid possible levels of shortfalls a reserve can be set up covering these short falls and this reserve is called as an asset liability mismatching reserve.
- The starting point will be to model the features of the product's asset proceeds and the liability out go over the policy term which is 10 years
- Realistic values will be chosen for all the parameters. These include the mean return, variance of return and correlations between the returns on the main asset categories.
- A large number of simulations are then carried out, based on the asset distribution of the product
- The results may be rank ordered in terms of a target measure such as short fall of assets relative to a liability as at the end of the policy term
- A suitable risk measure such as that the probability of asset proceeds being less than that of liability is to be less than 1% is to chosen.
- Additional reserves are then set up at a level sufficient to cover the shortfall. For example if the 10th worst out come out of 1000 simulations produced a shortfall of

Rs. 5 crores then the company should set up a reserve to match this shortfall.
[23]

Q6.

(i)

- Monetary, interest rate and inflation policy
- Banking Regulation
- Implementation of Government borrowing program
- Performance and integrity of financial markets
- Controlling the currency markets
- Printing and minting of notes and coins

(ii)

- Reduced CRRs will increase the liquidity thus allowing the banks to lend more to the private sector which enhances the overall economic activity. Simultaneously the interest rates are also reduced which will have a positive impact on the lending rates to the private sector
- The industry may embark upon capital expenditure to enhance the production capacities or undertake new projects as the cost of borrowing is expected to come down
- Individuals may increase their expenditure as
  - o The interest outgo on floating rate mortgage loans will reduce
  - o Cheaper consumer finance may be available
  - o Lesser incentive to save

- Lower interest rates may reduce the attractiveness for foreign currency inflows into the bond markets leading to the devaluation of the domestic currency which in turn makes the exports attractive
- The interest burden will reduce thus increasing the profits which lead to more economic activity
- The increased economic activity may lead to more demand than the supply thus may lead to higher inflation

(iii)

- Government borrowings from the market may be higher than expected thus crowding out the private investment
- The private investment may not be taking place at the desired level as they may expect lower interest rates in future
- The banks may be more cautious in lending as the recession may have increased their non – performing assets .
- There may not be enough confidence in the economy and may be fearing lowering of the ratings by the rating agencies for both the country debt as well as individual corporate debts .

(iv)

Impact on bond markets:

- With enhanced liquidity and general reduction in interest rates, the yields on bonds are expected to come down thus increasing the capital values of the bonds.

- However, the new money may have to be invested at lower interest rates thus making the bond markets not so attractive.
- Further if the interest rates increase in future, the capital values may reduce thus leading to mark to market losses
- For individual investors the lower interest rates may lead to lower incomes thus lesser incentive to invest in the fixed income bonds
- On the other hand, the borrowing by the private may increase as it would reduce the overall costs of capital

Impact on equity markets:

- As the reduced interest rates increase the profits , the dividend pay outs may increase leading to attractive dividend yields at the current equity prices, which may lead to more investments in the equity markets
- As the long term returns on equity are expected to be higher than those on fixed income securities, coupled with higher dividends may attract more investment in the equity markets
- The individual investors may also start investing in equities given the unattractive interest rates
- Given the increased activity in the equity markets , companies may plan to raise more equity capital to meet their financing needs at attractive equity premiums

[21]

Q7

(i)

The fund manager only has to track the performance of the index.
So replicating the index is not essential.

Investing in many stocks and having relatively small individual holdings in each stock will result in high dealing costs (necessary each time the relative sector weightings change).

This would reduce the performance of the fund and so cause underperformance relative to the index.

Therefore not including all the stocks will reduce the dealing costs.

Holding some stocks in each of the industry sector that constitute the index may well replicate the performance of the index rather than including all the stocks as the price movements in the stocks of in the same industry may move in the similar direction since the macro economic factors impact all the companies in the same industry in a similar fashion. However the performance of the individual companies will be impacted by its own performance also.

This may increase the research costs as the fund manager has to pick the stocks that perform.

Stratified sampling of the performance of each sector may have shown that the performance of the chosen stocks is a very accurate measure of the performance of the sector as a whole.

Sampling may enable the fund to choose its timing in addressing whether or when to replicate changes to the underlying index.

Selecting a few stocks may lead to a greater tracking error in the performance measurement of the fund.

It would be difficult to exit the stocks immediately, if these stocks go out of the index and simultaneously purchasing the stocks that enter the index.

This would entail greater costs as the fund manager may be forced to exit even if the timing is not right as these stocks may be impacted by marketability issue and also due to the necessity to buy the newly added stocks at a price which may not be advantageous for the fund performance. This may impact the performance of the fund adversely.

ii)   Compare dividend yields, earnings growth and price earnings ratios with the Index.
        For example, within each sector for the fund and the index:
        • Rank the holdings by increasing yield
        • Split each sector into an equal number of holdings (e.g. quintiles)
        • Calculate the weighted average yield of each quintile allowing for the value of
           shareholdings as weights

        This will help to determine:

        • Consistency with the portfolio
        • Identify any style biases (e.g. growth or value)
        • How risky the portfolios are relative to the index
        Historic comparison of the fund performance with the index quarterly over a period of around three years to determine how well the fund has tracked the index.
        Comparison of risk adjusted performance measures e.g. Sharp or pre-specified standard deviation.

iii)

        MPT provides the framework for constructing a portfolio that gives the maximum return for a specific risk .In other words it provides the maximum return for a given amount of risk or the minimum risk for a given return.

        This theory enables the investor to choose the portfolio that has an optimal balance between the risk and the return and thus maximizing the investor's expected utility after defining the opportunity set of portfolios.

        The key assumptions are:

        All expected returns, variances and co-variances of pairs of assets are known
        Investors make their decisions based on the expected return and risk
        Investors are non-satiated
        Investors are risk averse
        Fixed single-step time period
        Taxes and transactions costs are ignored
        Markets are efficient
        Assets may be held in infinitely divisible holdings and short selling is possible

No maximum investment limits

(iv)   The theory does not take into account the investor's liabilities and propounds optimization of the asset portfolios without taking into consideration the liability profile of the investor

The theory can be modified such that the net assets i.e. excess assets over liabilities is optimized

$S = A \sum x_i(1_+R_i) _- L$

Where i= 1 to n.

S = the surplus at the end of the period
A = Value of the assets at the start of the period
x_i = proportion invested in asset i
R_i = return on security i
L = projected value of the liabilities at the end of the period

The theory can be applied to minimize the variance of the surplus for a given expected return treating the liability as a negative asset.

In practice we need to decide not only how to determine the expected value of the liabilities but also its variance and covariance with the assets.

[19]

Q8   (i)

The valuation method used for the assets should be consistent with the valuation method used for the liabilities. If the market value of assets is used then that would generally imply that the liabilities should be valued using a consistent rate of discount as no market value of liabilities currently exists.

This valuation approach may lead to volatile values of the assets and if liabilities are not appropriately adjusted based on the market yields, there will be no consistency in valuing the assets and liabilities. Such inconsistency in valuation may lead to volatile solvency ratios which may lead to confusion in the market place when analysts attempt to assess the performance of the company.

Given the appropriate market values of the insurance liabilities, it is at the discretion of the valuation actuary to set the valuation interest rate for the liabilities.

If there is a constant change in the valuation interest rates so as to be in line with the market value of assets, the value of liabilities may exhibit a great deal of volatility leading to a significant impact on the income statement of the company. This reduces the predictive ability for estimating the profit/loss and the required capital for the company while doing the business plans.

The valuation method of the assets should also take into account the purpose of the valuation. When the liabilities are assessed on a going concern basis, one might prefer to value assets in a different way to avoid a misleading result and to ensure that assets and liabilities are valued in a consistent way. Perhaps the amortised book value of the assets may be more appropriate if the assets are going to be held till maturity and the

company does not intend to trade in these assets.   Correspondingly the liabilities also can be assessed based on a stable long term assumptions.

If we wish to value the assets and liabilities for the purpose of a possible merger/acquisition, market value of assets & liabilities will be more appropriate

One possible method is to adopt a rolling average or smoothed value of assets and to correspondingly value the liabilities using relatively stable assumptions. The choice of the smoothing technique is of course subjective.

Alternatively, the assets might be valued using a discounted cash flow approach.   The liabilities can be separated product wise, duration wise and use appropriate valuation interest rates based on the yield on the assets backing these liabilities. However one needs to take care while setting the valuation interest rate by appropriately allowing for reinvestment risk, default risk, liquidity etc.

This approach involves a great deal of calculation.

[8]
[Total 100 Marks]

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