

# ASI

## Solutions ST 5 June 2005

Q.1] (a) Mergers can lead to a company having a limited number of competitors, thereby giving it a real pricing power both with suppliers and customers. Such pricing power is of concern to governments – the concern is mostly aimed at protection of interests of customers and suppliers.

(1)

The aim behind regulating is to encourage competitors and prevent mergers that would reduce competition through the exercise of market power.

(½)

Regulation can make the merger process transparent to all stakeholders. Particularly important to protect minority interests and also encourage confidence in the stock market and hence encourage investment.

(1)

Regulation can ensure the merger process follows a timely pattern, with adequate time periods for relevant parties to make decisions, and for other parties to get involved if necessary.

(½)

Q.1] (b) Conglomerate merger involves merger of firms in unrelated lines of business – for example, a supermarket chain & a financial services provider.

(1)

Q.1] (c) Motives for conglomerate mergers

- Utilisation of unused tax benefits – if two different companies have different tax positions, then one may takeover the other in order to make sure that any valuable tax shields will definitely be used. (1)

- Utilisation of surplus funds – for example, a company having surplus funds and few profitable investment opportunities, merges with another company with growth opportunities but short of funds. (1)

- Protection against threat of takeover – by increasing the size of the business. (½)

- Diversification – reduces the exposure of the merged company to the fortunes of either sector. (1)

- Enhancement of earning per share – by taking over another company with a lower price earnings ratio. The EPS of the merged company will increase if the merger reduces the total no. of shares in existence without affecting total earnings. (1)

- Exploitation of lower financing costs – often large companies are able to obtain finance more cheaply, perhaps because they are deemed to be more creditworthy, as each merged firm can guarantee the borrowings of the other. (1)

- Scope for other economies of scale. (½)

Q.2] (a) Forms of private equity.

- Venture capital – Capital for business in the conceptual stage or where products are not developed and revenues and / or profits may not have been achieved. (½)

- Leveraged buy-outs – The provision of capital for acquisition or refinancing e.g for a management buy – out. (½)

- Development capital – growth or expansion working capital for mature business in need of product extension and / or market expansion. (½)
- Restructuring capital – new equity for financially or operationally distressed companies. (½)

(b) Venture capital may be an appropriate form of finance for this company because.

- The business is probably too risky for public ownership. (1)
- The company's success probably depends on breakthroughs in R & D, thereby making it difficult to estimate future prospects of the company. This makes setting an appropriate issue price for the public arena difficult. (1)
- It may be possible to reduce the company's cost of capital e.g if cost of capital can be reduced by having a higher level of financial gearing than would be acceptable if the company was quoted. (1)
- Providers of venture capital may provide crucial management expertise and guidance. (1)

Q.3] Credit derivatives are useful in managing credit risk – contracts where the payoff depends partly upon the creditworthiness of other entities. The three main types of credit derivatives are –

1. Credit default swaps [ CDS ]
2. Total returns swaps [ TRS ] (1)
3. Credit spread options. [ CSO ]

Credit default swaps – A credit default swap is a contract that provides a payment if a particular event occurs. Events that trigger payments are known as credit events. Example include

- Bankruptcy
- Rating downgrade (1)
- Repudiation
- Failure to pay
- Cross default

In a credit default swap the party that buys the protection from a credit event pays a fee to the party that sells the protection. If the credit event occurs within the term of the contract a payment is made from the seller to the buyer. If the credit event does not occur within the term of the contract, the buyer receives no monetary payment but has benefited from the protection during the tenure of the contract. (2)

There are two ways to settle a claim under a credit default swap:

- 1] A pure cash payment representing the fall in the market price of the defaulted security. However, the Market Value may be difficult to determine.
- 2] The exchange of both cash and a security (physical settlement). The protection seller pays the buyer the full notional amount and receives, in return, the defaulted security. (1)

In total return swaps, the total return from one asset (or group of assets) is swapped for the return on another. These enable financial institutions to achieve diversification by swapping one type of exposure for another. (1)

In the absence of counter party credit risk, the value of a total return swaps in the difference between the values of the assets generating the returns on each side of the swap. A total return swaps is normally structured so that it is worth zero initially. (1)

A credit spread option is an option on the spread between the yield earned on two assets, which provides a payoff when the spread exceeds some level. The payoff could be calculated as the difference between the value of the bond with the strike spread and the Market Value of the bond. (1 ½)

B] A CDS is useful when a lender has reached its internal credit limit with a particular client, but wish to maintain the relationship with that client. The lender can provide further loans to its clients, without breaching its credit exposure limit, by entering into a CDS with another entity. (1)

TRS - A bank that thinks it is over exposed to bonds issued by utility companies could swap some of its exposure for some of another bank's exposure to say, retailing companies. (1)

CSO – Suppose that Bank X is concerned about the risk that its portfolio of utility company long-term bonds might fall greatly in value. Bank X could purchase a CSO, which provides a payoff whenever the average yield on its portfolio of utility company long-term bonds exceeds that on a portfolio of similar government bonds by more than say 2 % p.a. By doing so, it would limit its exposure to possible falls in the value of its utility bone portfolio. (1)

Q. 4]  $S_T$  = Stock Price  
 $X$  = Strike Price

Payoff from a straddle

Range of Stock Price	Payoff from call	Payoff from put	Total payoff
$S_T \leq X$	0	$X - S_T$	$X - S_T$
$S_T > X$	$S_T - X$	0	$S_T - X$

The strategy also costs an upfront investment equal to the costs of call and put. (3)

In this case,  $X = 60$  and upfront investment is 10 (= 6 + 4)

The maximum loss is the upfront investment of Rs. 10 and this happens when  $S_T = X$ . The straddle would lead to a loss when  $50 < S_T < 70$  (2)

Q.5] (a) Interest Rate cap is an over the counter interest rate option that is designed to provide insurance against the rate of interest on an underlying floating rate note rising above a certain level. This level is known as the cap rate,  $R_x$  (2)

As an example, consider a 3 year interest rate cap based on a principal amount of \$ 1 mn., in which interest rate is reset every 3 months, and with a cap interest rate of 6% p.a. compounded quarterly. If the relevant LIBOR rate exceeds the cap rate, the interest rate cap will make a payment equal to the difference between the two payments; no payment is made otherwise. In practice the payment, if any, occurs at the end of the three month period concerned. (1)

**Q.5**

b) The caplet price,  $C = Ld_k P(0, t_{k+1}) [F_k f(d_1) - R_x f(d_2)]$  [1]

Where

$L$  = principal amount

$R_x$  = cap rate (and assumed to be lognormal with volatility  $s_k$ , implying

$f(d_1) = N(d_1)$  and  $f(d_2) = N(d_2)$  )

$F_k$  = forward rate for the period between time  $t_k$  and  $t_{k+1}$

$d_k = t_{k+1} - t_k$

$P(0, t_{k+1})$  is the discount factor

$$d_1 = \frac{\ln\left(\frac{F_k}{R_x}\right) + s_k^2 t_k / 2}{s_k \sqrt{t_k}}$$

$$= d_1 - s_k \sqrt{t_k}$$

$C$  can be rewritten as

$$C = Ld_k P(0, t_{k+1}) [F_x N(d_1) - R_x N(d_2)]$$
 [2]

In this case,

$L = 10,000,000$

$d_k = 0.25$

$F_x = 0.0375$

$R_x = 0.04$

$P(0, t_{k+1}) = e^{-0.0325 \cdot 1.25} = 0.96019$

$s_k = 0.20$

$t_k = 1.0$

$$d_1 = \frac{\ln\left(\frac{0.0375}{0.04}\right) + 0.2^2 / 2}{0.20} = -0.2227$$

$$d_2 = d_1 - 0.20 = -0.4227$$

$$C = 10,000,000 \cdot 0.25 \cdot 0.96019 [0.0375 N(-0.2227) - 0.04 N(-0.4227)]$$

$$N(-0.2227) = 0.4119$$

$$N(-0.4227) = 0.3362$$

$$C = 4797$$
 [4]

It is important that the particular structure of the model and value of the parameters depend on the purpose of the model. It will also be necessary to apply judgment in establishing the most appropriate form and appropriate value of the parameters. The use of stochastic approach is highly dependent on whether we can specify probability distribution functions that reflect the true level of uncertainty. Thus, the two main risks in the development of an asset liability model are:

1] model risk : the risk that the model structure is wrong.

(1)

2] parameter risk, the risk that the model parameters, such as expected future return, are incorrectly specified.

Q.6] (a) i) The rationale is to encourage socially responsible behaviour on the part of the company. The directors could have felt that in the context of the nature of life insurance business investing in such companies could be viewed as unethical. (1)

Further, discouraging consumption of tobacco and alcohol is expected to lead to better healthy living thereby improving the life insurance companies' claims experience. (1/2)

Such a restriction, however, curtails the range of allowable investment and could affect the investment returns. (1)

ii) Buying and selling of stocks involve incurring dealing expenses. Frequent churning of stocks would actually depress the net investment returns. If the company is investing in fundamentally sound stocks it might be advisable to hold on to the stocks for a longer period as long as the fundamentals of these stocks remain strong. Also, life insurance liabilities are of longer term in nature. The downside is (1) that the investment managers are not allowed to take advantage of opportunities to book gains that exist in the market from time to time. All players in the stock market do not behave rationally at all times. Loss of such an opportunities could result in a reduced rate of return vis – a - vis competition. (1)

The restriction could be modified to allow some trading in certain types of stocks (1/2)

iii) The directors may be concerned that derivatives are risky investments (in particular when used for speculative purposes) and hence are an unsuitable investment for a life insurance company to hold. (1)

However, derivatives can be used in other ways, for example to hedge risk. As an alternative the restriction could be changed to only exclude the holding of derivatives for speculative purposes. (1)

Also the derivatives market may be more liquid than the underlying asset class. So it may be appropriate to invest in derivatives (e.g : commodities) (1/2)

b] One of the main objectives of the company is to meet the liability payouts as and when they arise. (1/2)  
A complexity that arises is the investment guarantees in a market linked product. (1/2)

The extent of complexity depends on the investment asset classes offered in the product, nature of guarantee (i.e when it applies) and extent of guarantee. (1)

The starting point will be to model the key features of the company's asset proceeds and liability outgo that have to be projected into the future. (1/2)

Realistic values will be chosen for all the parameters. These include the mean return, variance of return and correlations between the return on the main asset categories. (1/2)

A large number of simulations (say 10,000) are then carried out. The results may be presented / analyzed in a number of ways. For example, the number of times (e.g out of 10,000) in which the fund is below the guaranteed benefit amount over a given period (e.g 50 years) could be calculated. Alternatively the test could be for "insolvency". (1)

It is also important to model policyholder behaviour. (1/2)

## Q.7

### (a) (8 marks)

Purpose - (3 marks)

- i) assess performance relative to an index
- ii) assess performance relative to other funds but also used for secondary purposes  
e.g.
  - a) to incentivise key staff
  - b) to reward staff and organisations appropriately
  - c) to monitor and assess decision making of all or parts of a process
  - d) to establish where the risks are in funds or in a process (through attribution)
- iii) ultimately to aid improvements to an investment process

Methods - (5 marks)

*Money weighted*

- (i) measure of absolute return
- (ii) relatively easy to calculate
- (iii) compare with actuarial return expected of fund
- (iv) affected by cash flows and especially by the timing and size of them
- (v) not good for comparing with an index or with other funds

*Time weighted*

- i) overcomes the problems caused by cash flows
- ii) more difficult and time consuming to calculate - fund values needed each time there is a cash flow
- iii) good for comparative purposes
- iv) a good e.g. of a perfect time weighted return is the unit price of a pooled fund
- v) Approximations to a time weighted return can be made e.g. money weighted returns over short periods e.g. monthly or quarterly and chain linked together.
- vi) Better approximations to the returns can be made by day dating any cash flows.
- vii) Analysts use of the fact that the relative money weighted return is a very good approximation to the relative time weighted return i.e.  $MWR \text{ of fund} / MWR \text{ of index} = TWR \text{ of fund} / TWR \text{ of index}$

### (b) (8 marks)

Formula used is

$$(EMV - SMV - \text{Net Cashflow}) / (SMV + \text{time weighted cashflow}) - (1 \text{ mark})$$

Assumptions - (3 marks)

For Manager A cash flows are uniformly spread throughout the quarter.

For Manager B cash flows are exactly at the end of each quarter.

There are no other cash flows.

Income can be ignored or is similar to both funds and to the benchmark.

Expenses on the raising and investing of cash flows is ignored.

Calculation & Layout - (4 marks)

	31/12	31/03	30/06	30/09	31/12	Total
Index	100	110	104.5	114.95	120.70	
% Return		10	(5)	10	5	20.70
Fund Value A	75	84.75	82.5	92.25	98.25	
% Return A		10.89	(4.38)	9.91	4.84	22.17
Fund Value B	75	84	75	97.5	99	
% Return B		12	(7.41)	12.07	4.76	21.75

**(c) (6 marks)**

Both started with the same amount of money.

Both have received Rs6 crores of new money on average roughly half way through the year.

However results have been affected by the timing of the cash flows.

Both A and B out-performed the benchmark.

Although B has more money at the end of the year, A has performed better.

B was helped by the fact that it received a large inflow of money when the markets were at a low point. This was out with the manager's control and he should not be given credit for this.

A outperformed steadily each quarter.

B had a much more volatile ride and hence if risk adjusted measures were used this would tip the balance even further in favour of A.

**(d) (2 marks)**

Risk adjusted measures try to factor in the risks taken in achieving the returns e.g.

1% out-performance achieved with a low level of risk should be regarded as a better result than the same level of out-performance from a very risky portfolio.

Various measures include

Treynor

Sharpe

Jensen

Pre-specified SD

**(TOTAL 24 MARKS)**

**Q.8**

**(a) (3 marks)**

Policy switching is taking a view on future changes in shape of the yield curve or level of the yield curve and moving into gilts with quite different terms to maturity or different coupons or both.

For example, if yields generally were expected to fall, the portfolio might be switched into longer-dated more volatile stocks.

**(b) (8 marks)**

There are at least three methods of identifying policy switches; let's give them the names "volatility", "re-investment rates", "spot rates and forward rates".

Volatility – (3 marks)

Calculations of volatility or duration together with forecasts for changes in yield at different points along the yield curve can be used to estimate percentage changes in value and so to determine the area of the market which will give the best returns if the forecasts prove accurate

Re-investment Rates – (3 marks)

Consider two bonds, A & B, the latter having a longer term to maturity.

Knowing their terms to maturity, it is possible to compute a rate at which the proceeds of the first bond A would have to be re-invested, up to the maturity of the second bond B, to match its total return. If this reinvestment rate is particularly high, it may be considered unattainable, leading to a conclusion that bond B offers better value. The method involves selecting representative bonds at various points along the maturity range and working out the reinvestment rates between each bond and the next.

Examination of the series of reinvestment rates can help to identify areas which seem cheap or dear in relation to neighbouring areas

Spot Rates and Forward Rates – (2 marks)

A similar technique to using reinvestment rates is to derive forward and / or spot rates from the yield curve This may reveal unusual features in the term structure of interest rates which give rise to a policy switch opportunity

**(c) (4 marks)**

Assume reinvestment of coupon on bond A at gross redemption yield.

If you don't switch, then a yield of 6.65% over 10 years can be achieved

Bond A is worth  $(112.96875) * (1.0665)^{10} = 215.064$

The alternative is to make the policy switch into bond B which has 3 years to maturity i.e. sell Bond A for 112.96875 and buy Bond B for 102.6875 and then achieve a yield of 7.13% over 3 years

So, after 3 years, bond B will be worth  $(112.96875) / (102.6875) * (1.0713)^3 = 1.35215$

So, over the 7 years following the maturity of bond B, an investor would need a return of  $(\{215.064 / 1.35215\}^{1/7} - 1)$  per annum or 6.854% per annum to get the same return as holding bond A to maturity

I would not expect 7 year yields in three years time to be as high as 6.854% (personal opinion) therefore, do not make the policy switch

**(TOTAL 15 MARKS)**

**Q. 9**

**(a) (5 marks)**

Company A borrows in dollars and company B borrows in sterling. They then use a currency swap to transform A's loan into sterling and B's loan into a dollar loan.

**There are a number of ways the swap can be arranged however whatever method is chosen there needs to be some benefit to both companies.**

One solution is:

Company A borrows dollars at 7% and swaps it with the bank for a sterling loan at 10.5%. Company B borrows sterling at 11% and swaps it with the bank for a dollar loan at 9.0%. Both company A and company B achieve a better rate than they would otherwise. The bank makes a loss of 0.5% on the sterling loan but makes a profit of 2% on the dollar loan.

**(b) (5 marks)**

The risks the bank faces are currency and default, as the bank loses on the sterling deal and gains on the dollar deal it will be short of sterling and long of dollars. As the bank has two separate agreements with the two companies it is exposed if either of the companies defaults on its agreement. The currency risk could be eliminated by using currency hedging and the bank could minimise the risk of default by thorough investigation of the companies' balance sheets.

**(TOTAL 10 MARKS)**