

Institute of Actuaries of India

Subject SA6 – Investment

November 2012 Examinations

INDICATIVE SOLUTIONS

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.

Solution 1 :**A] i) Dealing Systems :**

Quote driven systems – market makers quote both buying and selling prices at which they are prepared to trade up to certain volume of shares (Normal Market Size).

Market makers quote higher prices for selling and lower for buying for a particular share and this bid/offer price spread is the profit made by the market maker.

Different market makers may offer different bid or offer prices

Size of spread depends on the marketability of the shares being traded – actively traded having smaller spread

Prices in UK are disseminated in UK via the Stock Exchange Automated Quotations service – a screen based service on which details of trades that have taken place are displayed along with market makers' quotes and sizes. Dealing is carried out over the telephone between member firms

Order driven systems – buyers and sellers are matched, usually electronically.

Member firms display their bid and offer orders on the system and matching orders are executed automatically.

Four types of order are possible:

- At best- orders are executed immediately at the best possible price
- Limit orders – specify the size, price and expiry time and/or date of the order. They are executed in full or part immediately or they sit on the order book until a matching order is entered or the expiry time is reached
- Execute and eliminate – orders are similar to at best orders but a price limit is specified
- Fill or Kill – these orders may include a limit price and they are either executed in full immediately or totally rejected

Settlement systems :

System to transfer share to buyer and payment to seller.

Use of Crest as an electronic book entry system but option to have paper share certificates.

Standard settlement period of T+3

London Clearing House act as counterparty for all equity transactions eliminating bilateral exposures between counterparties

LCH protects itself by taking initial and variation margins from clearing members

Settlement on a trade-by-trade basis but multilateral settlement netting possible.

Types of dealing costs (Bid/offer price spread, stamp duty /tax on purchase e.g. UK, stamp duty/tax on sale, agency commission, custodial transaction fees.

ii) Stock Lending occurs when the holder (A) of an asset lends it to another party (B) who has gone short by selling the asset to a third party (C) and now needs to deliver that asset to the third party as part of its settlement obligations. B will later need to buy the asset in the market and return it to A.

In the interim B will have posted collateral (e.g. cash or government bonds) with A, and if there is an increase in the value of the stock then B will need to post additional collateral.

A effectively earns an additional return for stock lending.

Stock Lending adds liquidity to the market and helps market making functions

Term of lending can be overnight or longer

The major risk from the perspective of A is that B becomes bankrupt and does not return the asset lent and that in the interim the asset has increased in value so that the collateral does not cover the value of the lent asset.

To mitigate this risk to A another party D will (for a fee) guarantee that A will not suffer financial consequences if B defaults.

Also loans are often over collateralised e.g. value of collateral at end of each day should be 102% of the value of stock lent.

Another risk is to the short term valuation of A's assets – the short seller sells the asset now believing he can repurchase it cheaper later i.e. the asset is overpriced. However, sometimes short selling can move the market and so the value of the asset does fall (especially in very volatile markets) and so after the return of the asset, the net effect is that A has really facilitated in the reduction of the value of its own portfolio.

Sometimes cross-currency collateral is used adding fx risk

(6)

iii)

Are there enough stocks to form a market?

Are stocks traded frequently enough?

Are sufficient volumes traded in each transaction?

Can stocks be fairly valued?

Can an index be structured easily?

Are there issues with insider dealing?

Are there issues with knowing who is the owner of shares and that counterfeit shares are not present?

Should shares be traded in demat form only or does the market "trust" paper more?

Is there enough local expertise (e.g. stock brokers) and appropriate systems to facilitate buying and selling of shares?

Are there any issues with the transaction cycle and settlement system e.g. what to do with bad deliveries, how deal with impromptu public holidays, natural disasters?

Does there need to be limits set so that market does not move too much in one day as small market might be very volatile on occasions?

Is there a need for a transaction tax so that the "hot money" of international capital markets will only invest for the long-term and not have a wave of sells if there is a financial crisis?

Will informal badla systems develop and is this desired?

(5)

iv)

Equity derivatives would add liquidity to the market as speculators take positions and short sellers need to buy stocks

Derivatives would allow investors to hedge their positions against movements in the market and may encourage more investors if their downside can be protected

Derivatives can be used to speculate which may make the market more volatile

Too much short selling of a stock may artificially depress the stock's value

Using a regulated exchange would allow authorities to monitor transactions which might occur anyway over the counter if there was no official exchange.

A regulated exchange can require collateral to be posted on a regular basis (both initial and variational) and so mitigate the consequences of default by one party or another.

(3)

B)

i) A company may need to pay debt or interest or share dividends in a foreign currency

The company will have international operations which may be paying debt or interest or share dividends in a foreign currency to the parent

The company might have sales in a foreign currency from that which it reports in its statutory accounts

Company may have purchases of resources or services from a foreign country in a currency different from which it reports in its statutory accounts

Company may be buying a commodity (e.g. oil) which is priced in US dollars even though it was extracted and refined locally

The currency hedge might be a proxy for another correlated risk

(2)

ii) Currency risk could be hedged via currency swaps, fx options and currency futures

(1)

iii) A currency speculator takes a position in the currency market. An unhedged international conglomerate has a position in the currency market and so is a speculator (though perhaps a passive or ignorant one). If the company has actively decided not to hedge it is betting that fx rates will be favourable in the future.

(2)

C)

i) The company could invest in a government bond to provide the capital guarantee. Hence if interest rates were 8% then the company could invest approximately 86% of the premium in zero coupon government bonds. This might leave 2% commission to a broker, 2% to meet the insurer's expenses and profit (and mortality charges for minimum mortality cover) and say 10% to buy an option for the coupon payment from an investment bank. Internationally, often insurance company may just be fronting for an investment bank as the life insurance provides a tax wrapper.

(2)

ii) There is a capital guarantee so the customer should get their money back

Commodities would offer diversification from other more traditional asset classes

The coupon payment is very complex and may make it unsuitable for many retail markets

Many customers may not understand the impact of the barrier

i.e. if one week from maturity each of the three commodities has risen 145%, customers would be looking for a large coupon payment at maturity in one week's time. However, if the commodities markets increased and rose to 155%, the 150% barrier would come into force and the coupon payment would only be 7%. Product has a cliff edge feature. This is likely to lead to disappointment and reputational risk/charges of misspelling

A stochastic analysis could be used to compare how often the return of such a product outperforms a retail deposit and so give an indication of the appropriateness of the product to various market segments and what proportion of an individual customer's savings should be invested in the contract.

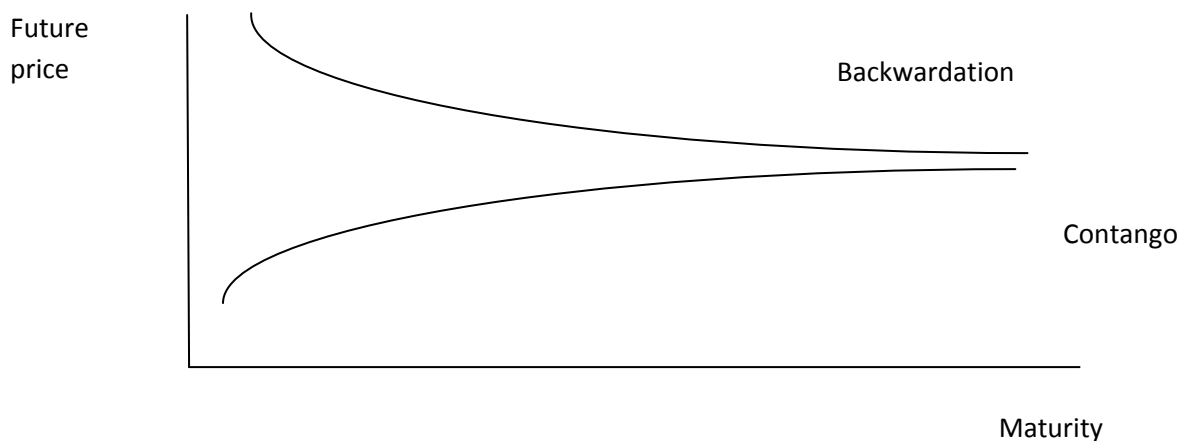
(5)

iii) The barrier is tested daily for each commodity and so the cliff edge feature could occur on any day for a commodity and return in respect of that commodity would be locked in to 7%. However, if this event occurred the sophisticated customer could surrender the policy and obtain the market value as of the prior week which may be sufficiently higher than the current daily value. This may be a particular risk near the end of the contract.

(2)

iv) Contango –future price exceeds the spot price

Backwardation – future price is less than the spot price due to the convenience yield of the commodity.



(2)

v) Commodity futures and forward contracts are used for risk management by:

commodity producers who wish to reduce uncertainty in the future cash flows that they will receive for their product (e.g. farmers) and commodity consumers who wish to reduce the uncertainty in the amount that they will have to pay for their future supplies (e.g. electricity companies protecting oil supply costs or gas costs)

Users of futures contracts are contracting to supply or take delivery of a specified quantity of the commodity at some future date – reduction in uncertainty has a cost in reduced flexibility

Commercial users of commodity futures may not deliver or take delivery of physical commodities internationally but close out the transaction at a later date e.g. commodity future may be being used as a proxy hedge for another commodity

There are generally more producers wanting to have a guaranteed price on their products than consumers wishing to guarantee to purchase at a certain future price. Hence in isolation future prices tend to fall, but if fall too far speculators will invest to buy the future as they believe it is underpriced and so they can make a profit

(4)

vi) Commodities are a diversifying asset class

especially in stressed times for other financial assets (rising inflation, excessive global demand, supply disruptions) commodities tend to produce higher returns than other asset classes used by institutional investors

Commodities offer significant real returns produced by doing real economic work

and returns accrue to the long-only investor without the need for active management

Commodities are concerned with short-term supply and demand and short-term risk

but commodities are very volatile

high level of expertise required to trade profitably

ethical/moral dilemma – is it right to speculate on food when people are going hungry or does the speculator over the cycle help guarantee prices and so encourage more production of food?

Danger of political intervention especially if food shortages

(4)

[Total Marks – 50]

Solution 2. (i)

A) Such schemes which are in the nature of a defined benefit pension scheme have a specific level of (guaranteed) payouts to the employees post retirement, death etc and are thus exposed to the following risks.

- Interest rate risks wherein the interest rate falls below the assumed liability valuation rate
- Longevity Risks, wherein the group of pensioners live much longer than projected
- Salary escalation risks, wherein salaries grow at a higher rate than assumed
- Duration mis-match risks wherein asset durations may be shorter than liabilities
- Reinvestment risks, wherein the assets on maturity may be reinvested at lower interest rate

Higher than expected in service mortality, ill-health retirements and early retirement [due to other causes] can lead to higher than expected payouts and a more volatile claim payout pattern

The few options to hedge against such risks are given below:

- Deferred annuities (if available)/ Immediate annuities from Insurers can be purchased
- Some reinsurers offer longevity swaps to hedge the longevity risks.
- Reducing duration mis-match by making investments in long duration assets would help reduce the interest rate and reinvestment risks.
- Interest rate futures may be used to enhance the duration of the assets
- Insuring death-in-service benefits and disability benefits can dampen the volatility in claim payouts and mitigating the liquidity risk associated with the payout of lumpsum death benefits.
- Average of the pensionable salary over a period of time up to retirement [example: the last 3 years before retirement]. Averaging can remove some of the volatility in the earnings.

(4)

- B)** An alternative is to create a contributory scheme in the nature of defined contribution wherein the employer sets aside a fixed amount of contribution every year and does not run the investment risks. The liabilities are determined by the assets held in the fund.

(1)

(ii)

- A)** The various investment constraints would relate to:

- Liquidity (the ability to sell the investments and convert them into cash)
- Term or Time Horizon (time between making the investments and need of utilising them)
- Tax concerns (short term, long term taxes, taxes on different components like interest, capital gains etc)
- Regulatory constraints (cap on holding of assets of similar groups, types)
- Nature of liabilities including specific needs or requirements also create additional constraints
- Risk appetite of the fund including funding levels

(2)

- B)** The DC schemes pass on the investment risks to the employees. In case of DB schemes the investment risks, reinvestment risks, longevity risks arise for the employer because of the guaranteed nature of the liabilities.

- The DC schemes would manage assets for the benefit of the plan participants and may try to enhance the returns on the money set aside (contributions made each year). For DB schemes guarantees will mean the return expectations will be slightly toned down. Also the idea is to manage it for the benefit of the scheme participants and not to push for highest returns so that the employer contribution required can be low.
- Risk tolerance is higher in DC schemes as compared to DB schemes
- Time horizons are generally longer for the retirement schemes (for both DC and DB) and hence liquidity requirements are lower.
- Liquidity as well as time horizons do not act as a major constraint for the DC schemes and the fund value determines the liabilities. For the DB schemes the retirement age, employee retention and current age of the employees along with proportion of retired employees vs currently on payrolls would determine the liquidity needs and time horizon of the liabilities.
- The pension payouts in the form of annuities etc are taxable in India irrespective of whether it is from a DC scheme or a DB scheme.

(5)

- C) Investment policy statement for the Defined Benefit scheme for the Bank employees is given below:

Risk Tolerance:

Ability to take Risks:

- Currently the ability to take risks seems to be low given the scheme is underfunded.
- Average age is high and gradually moving towards the retirement age thus time horizon is also becoming small.
- Liquidity required to pay is high (since for every 100 employees currently working there are 40 others who have already retired).
- The VRS scheme announced by the bank will lead to higher liquidity requirements in the short term.

Willingness to take risks:

The CIO wants to move into equities to tide over the deficits (underfunding), he is also willing to take more dynamic interest rate calls thereby showing willingness to take risks but the scheme is for the beneficiaries and hence the trustees / participants willingness to take risk needs to be considered not the investment manager's risk appetite.

In DB schemes the participants get fixed benefits (no upside). The good performance on the asset side would mean lower contribution required from the employer but in case of default etc the participants run the risk of not getting the promised fixed benefits. Given the high average age and no upside benefits in taking higher risks the willingness to take risks can be considered to be low.

Thus Overall risk tolerance is low:

Investment Return Objectives:

The scheme is currently underfunded, the proportion of retired employees to currently working would gradually increase since average age is moving gradually towards the retirement age.

This means the volatility in returns should be lower and thus the return expectations need to be kept low. Please note that in such situations many of the Investment Managers may want to take more investment risk to enhance returns and reduce the underfunding but the whole situation needs an exactly opposite approach since the risk tolerance as described above is quite low.

(4)

- D) The various investment constraints for the Defined Benefit scheme for the Bank employees are given below:

Time Horizon:

The time horizon is long to medium since it is a retirement scheme but is gradually reducing with more employees moving towards the retirement age and a good number of them already in retirement.

Liquidity:

The cash outgo required to make the payments for the retired employees is quite high and is increasing hence liquidity requirements may be high. With 80% employees already completing more than 20 years of service if they decide to take early retirement it would compound the liquidity requirements.

Regulatory:

The regulations require a large part of the assets under the scheme to be invested in g-secs thus having limited flexibility in managing these assets. The bank has encouraged voluntary retirements in the past. If the bank is likely to resort to such VRS schemes in the future then the need for liquidity under such contingencies can constrain the selection of investments.

Taxes:

The returns on the assets in the accumulation stage (till retirement) are not taxable; however during the payout stage the returns are taxable in the hands of the recipients.

Specific Requirements leading to constraints:

The VRS scheme is leading to higher constraints in the short term since it will involve high upfront cash outgo (Rs 5 lacs to each employee who opts for the scheme). The scheme offers protection of all the retirement benefits. It is not clear whether it protects the pension for people who have not completed 20 years. But even otherwise it creates significant resource requirements and liquidity constraints. **(4)**

- E) The major chunk of investment performance can be attributed to good asset allocation decisions. Stock selection is also important but it has been seen that asset allocation decisions influence the returns more than anything else. Thus the important decisions in investment strategy are as follows:

- The universe of asset classes from which the investment manager can choose to invest.
- The standard allocation percentages to different asset classes. Risk tolerance, diversification issues are important considerations here.
- The deviation limits, from the standard allocation i.e. the investment manager is allowed to deviate within a limit.
- Stock selection strategy. Choice of securities within each asset category. **(2)**

F) The real returns (inflation adjusted returns) on fixed instruments may not be very high and Equities through capital appreciation over long term give higher real returns and hence some proportion of such retirement assets need to be invested in Equities. The Equity investment also serves to reduce overall risks due to diversification in another asset class (other than debt). **(2)**

G) Credit Var is the minimum credit loss at some given significance level within a given time period. It can also be defined as the maximum credit loss at some given confidence interval over a given time period.

Credit Var is difficult to obtain since the credit defaults are not a frequently occurring event and hence the data points are very few in number.

Also it is difficult to obtain the correlation between different credit events. The Credit Var would require some estimate of the residual amount which can be recovered in case of credit event and is also difficult to estimate.

(3)

(iii)

A) The switch between long term to short term g-secs is an active trading call and can go either way. It is not aligned to an asset-liability matching approach. In underfunded schemes the fund manager should not be taking higher risks. If the call goes wrong and interest rates continue to fall then the risk is that the funds will have to be invested in further lower rates and may increase the underfunding.

(2)

B) The Equities by nature being volatile can have a short term downside and thereby the underfunding may increase. Small percentage of Equities in a portfolio serves to generate better risk adjusted returns (diversification and better long term real returns on Equities) however in a scheme which is underfunded the conservation of the capital and returns is more important. Equities may not be ideal given the current situation.

(2)

(iv)

A) The Required rate of return (nominal rate) comprises of three components:

- Real risk free rate of return
- Expected Inflation
- Risk Premium

(2)

B) The expected return and systematic risk relationship is best expressed by the Security Market Line (SML). The SML equation is given by $R(\text{expected}) = R(f) + \beta \{R(m) - R(f)\}$ where $R(m)$ is the required return from the market and $R(f)$ is the risk free rate of return. β is the systematic risk.

Capital Market Line (CML) uses total risk in the portfolio as given by the standard deviation instead of only the systematic risk (β) used by the SML. The CML equation is given by

$R(\text{expected}) = R(f) + \sigma(p) \left[\frac{R(m) - R(f)}{\sigma(m)} \right]$ where $\sigma(p)$ is the standard deviation of the given portfolio and $\sigma(m)$ is the standard deviation of the market portfolio.

(2)

- C) The change in slope of the SML signifies change in the market risk premium. Thus if the slope of the SML, denoted by $R(m) - R(f)$, becomes more steep it denotes that the market risk premium has increased which means for every unit of risk the return requirement has gone up.

The parallel shift of the SML means Required Return for same level of systematic risk has gone up. This will happen if there is inflation leading to higher nominal return requirement. The growth in the economy can be another reason for higher return requirement for every unit of risk.

(4)

- D) $R(\text{expected}) = R(f) + \beta \{R(m) - R(f)\}$

$R(f) = 8\%$, $R(m) = 14\%$, $\beta = 1.1$

Hence expected return $R(e)$ from the stock as per the systematic risk is equal to

$R(e) = 8\% + 1.1 \times (14\% - 8\%) = 14.6\%$.

However the stock is currently selling at Rs 200 and expected to grow to 225 along with a dividend of Rs 15 which means at this price level it can give a return of Rs

$\left[\frac{(225 - 200) + 15}{200} \right] = 20\%$. This is better than the 14.6% above hence the stock is undervalued at Rs 200 and can be purchased.

(2)

(v)

- A) The spread of the AA corporate bond over the g-sec is $8.75\% - 8\% = 0.75\%$

The spread of the AAA rated residential mortgage backed security (MBS) is $9\% - 8\% = 1\%$

The spread of the AAA rated commercial MBS is $9.5\% - 8\% = 1.5\%$

It appears that the MBS are giving higher returns as compared to corporate bond and with lower risks since they have a AAA rating vis-a-vis the AA rating of the corporate bond.

However the MBS have a prepayment risk which is not there in the corporate bond until and unless they carry such an option to prepay to investors and close the bond. The extra return may be a reward for that extra pre-payment risk which the investors in the MBS have. Also MBS are less liquid than corporate bonds.

(3)

- B) In the residential mortgages the obligations to pay is that of the home-owner. Commercial mortgages are backed by lease rentals etc (income from the commercial real estate) paid by the investors in commercial properties who receive income by letting out these properties and the ultimate obligation is on the tenants. The investors in residential mortgage backed security (RMBS) can go back to individual borrowers in case of default whereas in case of commercial mortgage backed securities (CMBS) the cashflows from tenants are the only of

income and they are generally non-recourse in their structure wherein the investors in CMBS cannot approach the tenants personally for recovery etc.

(2)

(vi)

A) The CPPI strategy would do better in a rising market as explained below:

In the Constant Proportion Portfolio Insurance (CPPI) strategy the aim is to protect a targeted value of the portfolio and it calculates the level of debt investment which can give an assured return thus protecting the required value on a target date in future (maturity or closure of portfolio). Thus if Rs 60 worth of bond holding is sufficient to give Rs 100 after say 10 years (which let us say is the maturity term for the portfolio) then there is a floor or cushion of 40 available (100-60). The CPPI strategy has a multiple of this cushion (in general greater than 1) invested in equities. Thus if the multiple is 2 then the CPPI strategy would put 80% of the portfolio in equities and 20% in debt (g-sec).

In a constantly growing market, under the CPPI strategy the equity investments will gradually increase since the cushion or floor will keep on increasing with the growth in the value of equities. Thus with the multiple being greater than 1, new investments are made into equity as market grows. Buy and hold strategy is also good since it will keep on holding to the growth in the equities and would not reduce its proportion just because markets have gone-up (unlike the constant mix or proportion strategy which rebalances by selling the equities on every gain to bring back the proportion of equities to the constant proportion as decided for the portfolio). Buy and Hold is more like having a multiplier of 1 so it buys and holds the equities with no change even if the markets increase thus leading to further growth in same equities. Yet the Buy and Hold strategy does not do as good as CPPI in rising market since CPPI has in general a multiplier of more than 1 (2 in this example assumed) hence it invests more into equities as market grows and thus yielding superior returns if they do continuously better.

(2)

B) Here the constant mix strategy will work better because it will enable more purchase of equities when markets go down and will increase the debt investments by selling equities when markets go up thus cashing-in on the volatility of the market.

(2)

[Total Marks – 50]
