

# **Institute of Actuaries of India**

## **Subject SA6 – Investment**

**May 2010 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

**Sol -1 a) Indian Economy**

- i) BSE Sensex increased from below 9,000 in February 2009 to 16,000 at the end of February 2010
- ii) GSec curve steepened between February 2009 to February 2010 ( 10 year GSEC change from 5.9% to 7.8% - CCIL Economic Research – weekly market analytics)
- iii) India has not been affected by the global recession to the extent of other countries and GDP growth projected to be about 7%.
- iv) Banks in India were seen as a source of strength during the global economic crisis.
- v) Difficulties associated with timing of reversal of quantitative easing practiced by RBI so that inflation is held in check but growth is not impacted
- vi) Food price inflation rising to 18% in January 2010, with significant increase in WPI as well.
- vii) US dollar has weakened compared to Rupee over most of the period February 2009 to February 2010, and many IT companies and export companies earnings are in US dollars.
- viii) Food prices and need to fight inflation and reduce government expenditure will create difficulties e.g. increasing petroleum prices and excise duty
- ix) FII investors have increasing inflows – need to manage speculative foreign capital against need for foreign capital investing in infrastructure – with many countries considering a Tobin tax on financial transactions
- x) Need for India to continue investing in infrastructure
- xi) Political uncertainty due to Naxalite activity in commodity rich states of India and other terrorist activity elsewhere
- xii) Exports increasing due to overseas market demand reviving.
- xiii) Corporate bond market relatively moribund but new efforts such as repoing corporate bonds, changing structure by which banks lend money based on base rate instead of a deduction from the prime lending rate should help to develop this market.
- xiv) Poor monsoon in many areas in 2009 may have an impact on rural states and even Mumbai due to water cuts.

**Sol -1 b)**

## Process for selection of fund manager

- i) Set out process for managing current investment department as their expertise will be needed to select the fund managers but, at best, they will have fewer assets to manage. Also for managed funds the need to determine the tactical proportion of assets to allocate to equity or bond will still be determined by the in-house management team (with strategic benchmarks set by the investment committee).
- ii) Treat outsourcing equity and bond fund mandates separately
- iii) Carry out basic research on various potential fund managers to whom you might send the request for proposal (RFP)

- Obtain discrete fund performance over past 5 years to ensure not “lucky” one year and average performance in other years
- Obtain fund performance of all relevant similar funds – fund managers tend to only advertise their successful funds
- Check whether performance figures are time weighted or money weighted returns.
- Compare investment performance against relative index/benchmark
- Obtain risk-adjusted (e.g. Sharpe, Jensen etc) measures
- What is fund manager’s investment style/philosophy e.g. growth/value
- Does stated fund manager’s style consistent with performance and economic cycle over the relevant period
- Check with SEBI or other relevant regulator that there have been no material compliance breaches
- Review last 3 years financial statements of fund manager to ensure they are not qualified and company is profitable
- Review recent publicity regarding the fund manager – would public knowledge that a particular fund manager managed your assets be beneficial or detrimental to your brand; alternatively they may have a star fund manager with an investor following.

iv) Prepare RFP requesting following information

- Recent fund performance and comparison with index/benchmark
- Attribution analysis results e.g. from investing in large cap or small cap stocks
- Investment style/philosophy
- Investment process – themes, quantitative, structure of strategy meetings, frequency of meetings with companies, is equity analyst a separate role from fund manager
- Names of fund managers and experience/biography, stability of staff, remuneration package/retention strategy
- Total funds under management, total number of funds and total number of fund managers
- Details of support staff (e.g. numbers) in administration and research
- Procedures to control market, credit and operational risks
- How conflicts of interest are managed e.g. between different clients which client will benefit from IPO issues
- Policy on broker commissions and obtaining research
- Request samples of in-house research ideas
- Processes regarding corporate governance and compliance checks
- Quality of business management to support fund managers e.g. in portfolio construction
- Indication of fees

v) Following internal agreement issue RFP to selected fund managers. The fund manager will need adequate time to prepare the response to the RFP.

vi) Receive proposals and review and cross-check to independent information where possible.

- vii) Select a number of fund managers based on proposals received and other relevant information and invite them to an interview to discuss the proposal in more depth (the so called 'beauty parade'). The actual individual who would be managing the fund should be present at the interview.
- viii) Question in detail the fund manager about the investment process and philosophy to ensure consistency to performance previously achieved.
- ix) Check and review the back office processes for making investments
- x) Understand how assets would be transitioned from your investment team to the fund manager and make an impact of the cost e.g. new fund manager may wish to significantly alter the investment portfolio
- xi) Make recommendation to investment committee to short list say 3 fund managers for each of the equity and bond portfolios and enter into further discussion on details, and mechanics of moving future policyholders' premiums from your bank account to the fund manager to invest and the reverse for paying claims. Existing processes may need to be amended. Keeping 3 fund managers at this stage creates price tension which is helpful in the fee negotiation.
- xii) Select one fund manager for each of equity and bond portfolios and compare costs and benefits with maintaining in house fund management or a tracker fund.
- xiii) Make recommendation to investment committee
- xiv) If appropriate sign legal documents and service level agreement about exchange of information/monies and frequency of reviews and benchmarks.

**Sol -1 c)**

- Growth – growth stocks are expected to experience rapid growth. Such stocks can be identified by selecting stocks with high price to book values or choosing stocks with certain growth features e.g. sales growth, earnings growth, forecast earnings growth, return on equity, earnings revisions.
- Value – value stocks are expected to have good value in terms of certain accounting ratios e.g. book value per share or low price to book values or choosing stocks with certain value features e.g. dividend yield, earnings yield, cash flow yield, sales to price.
- Momentum – purchasing (selling) those stocks which have recently risen (fallen) significantly in price on the belief that they will continue to rise (fall) owing to an upward (downward) shift in their demand curves.
- Contrarian - doing the opposite to what most other investors are doing in the market in the belief that investors tend to overreact to news.
- Rotational – moving between value and growth depending on which style is believed to be attractive at any particular point in time /part of economic cycle
- Top-down approach to constructing and managing a portfolio involves a structured decision making process which starts by considering the asset allocation at the highest level i.e. between different asset classes. Within each asset class an analysis is then made of how to distribute the

available fund between different sectors (e.g. different industries for equities) and finally the selection of the individual assets to purchase is made.

- Bottom-up – this approach seeks to identify the best value individual investments, irrespective of their geographic or sectoral spread and so build up the portfolio.
- Passive management – a passive manager attempts to match the investment portfolio of a benchmark/index by, in principle, investing in each asset of the index in the same proportion as that asset contributes to the index. In practice this can be via full replication for large funds, stratified sampling, (multi-factor model) optimisation or synthetic funds.

#### **Sol -1 d) Mandate Compliance Reports**

Where appropriate, the below reports should provide information at an individual fund level and also for the whole company:

- Asset allocation strategic benchmarks not breached
- Counterparty Exposure Limits e.g. total exposure to an entity/conglomerate shares held, bonds held, deposits with bank within conglomerate
- Derivative Exposure by counterparty and limits, and for efficient portfolio management purposes only
- Equity trades with brokers to ensure diversification and best terms being achieved
- Fixed income trades by counterparty to ensure best terms being achieved
- Commissions/gifts received by investment team/fund manager e.g. higher brokerage charges in return for research or fund manager accepting paid holidays for doing business with a particular broker
- Segregation of operational duties – front office and back office separated
- Regulatory breach report – breach of limits should be split between breach of more prudent internal limit ('near misses') and breach of regulatory limits
- Related party transactions
- Stock Loss trigger report for stock loss limits
- FX exposure
- Credit limits for corporate bonds (and reinsurers if part of terms of reference of investment committee)
- Property limits
- Policyholder and staff loans limit
- Asset allocation limits
- Internal audit review of processes

#### **Sol -1 e) ALM**

i) ALM concerns optimal strategic planning for management of financial resources and liabilities in stochastic environments, with market, economic and insurance risks. The aim is to meet the cash flows as they fall due, including all guarantees, whilst meeting the necessary solvency standards and giving maximum risk adjusted return. Difficulties arise due to:

- Stochastic nature of asset returns and liabilities, including correlations,

- Long investment horizon – e.g. liabilities of 30-50 years with assets of less duration and so future reinvestment risk occurs and rebalancing must occur
- Solvency constraints
- Since active modelling of fund need to model bid-offer spreads, taxes and other frictional costs

## ii) ALM modelling approach

- Consideration as to whether ALM will be concerned with solvency purposes or economic capital
- Obtain economic, market data and policyholder data
- Produce asset return statistical model for equities, corporate bonds, government securities, inflation etc
- Produce a liabilities statistical model e.g. stochastic mortality for annuities, dynamic lapses for unit linked policies – so linked to asset returns, similarly with profit bonuses are linked to asset returns along with complicated smoothing rules
- Monte Carlo simulations to determine liabilities forecast and asset returns forecast
- Optimise matching allowing for fund objectives and constraints, time horizon, risk appetite etc.
- Need to allow for nature, term, certainty and currency of liabilities
- Carry out robustness tests for changes in model or parameters
- Carry out 1 in 200 stresses to ensure solvency in those scenarios
- Need to consider scenarios with new business and stresses on the new business
- Need to confirm that sufficient working capital (liquidity) at all times and not just solvency capital (e.g. unit linked FFA cannot be spent)

## iii) Lines of business

- All assets should be Rupee denominated.
- Unit Linked – for unit assets match unit liabilities to policyholders so matching occurs automatically assuming no actuarial funding. Non unit liabilities matched by cash or liquid GSecs
- Annuities – backed by long term GSecs and high quality corporate bonds – less need to be concerned with liquidity if a bond buy and hold policy is adopted.
- Term Assurance – pattern of mortality should be fairly predictable and so can match liabilities with cash and bonds. Volatility can occur due catastrophe e.g. in group term insurance so hedge risk with reinsurance.
- Watermark unit linked product – uses a constant proportion portfolio investment approach whereby the initial split between equities and bonds is determined such that the largest likely equity fall over say 2 weeks would be offset by the growth in the value of the GSecs/bonds in the fund over the ten year term to meet the initial NAV. The fund is rebalanced regularly to ensure that the highest NAV in the first 7 years is met at the ten year maturity. Hence if there is a large fall in equities, the fund will switch completely to GSecs/bonds and will remain locked into GSec/bonds until maturity. Given trading in equities, only top quality equity should be in fund and the exposure to highly rated corporate bonds capped (and no low rated corporate bonds). The fund manager's processes will need to be efficient to react quickly to market movements so that rebalancing occurs in

a timely manner to mitigate guarantee risk. However, there is a systemic risk if all companies have this product and a similar threshold for selling equities.

- Universal Life – Crediting rate to policyholders is the rate earned by the fund less a margin (stated in the policy provisions) for expenses and life office profit. If no guarantee this is effectively a unit linked policy and the risk is transferred to the policyholder. Inevitably there is usually a minimum guarantee crediting rate (or at very least a capital guarantee that the fund value will not fall). Hence the investment should be in high quality corporate bonds, cash and government securities so that the likelihood of the guarantee biting is small. New business needs to be monitored, if yields are set prospectively and apply to new business. If market yields reduce significantly below the guaranteed rate then a lot of unprofitable new business may be written unintentionally.

#### **Sol -1 f)** Index Linked Government securities

##### Features

- i) Government issued security where coupon and maturity payments are linked to an inflation index and so a secure investment in real terms
- ii) Government will need to decide what inflation index to use e.g. WPI or CPI
- iii) Time lag in determining inflation – base month will be x months prior to issue of security and inflation factor applied to coupon and maturity payments will be inflation factor x months prior to the coupon/maturity payment date. Hence, there is still a small amount of inflation risk.
- iv) If such securities are issued in significant volumes, then it is an indication that the government is determined about tackling inflation as it cannot use inflation to reduce the real amount of index linked debt issued, which is possible with fixed income securities.
- v) To be effective, the government will need to issue sufficient volumes of index linked securities and provide a transparent trading platform such that a liquid secondary market can develop.

##### Advantages and Disadvantages

- i) Facilitate matching the liabilities of immediate annuities which escalate with inflation
- ii) An additional real assets so allowing diversification from equities and property
- iii) However, risk in a deflationary market if escalating annuity liabilities cannot decrease.
- iv) Securities may be an appropriate investment for gratuity scheme or defined benefit pension scheme were benefits increase with salary inflation (which is correlated with CPI)
- v) Would allow company to understand market expectations of future inflation which will help in setting reserving bases
- vi) Assuming that the government only needs to raise a fixed amount of debt, issuing index linked debt means that there will be less fixed income debt in the future. Reduced supply of fixed income debt will tend to increase prices and reduce yield on GSecs.

**Sol -2 1)**

- a) The Expected Equity Return = Dividend Yield + Growth Rate (Real Terms) + Inflation  
 $= 2.2\% + 4.0\% + 6.2\% = 12.4\%$   
 The Equity Risk Premium = Equity return as above (in nominal terms) – Government Bond yield (nominal) =  $12.4\% - 8.1\% = 4.3\%$
- b) The P/E repricing has contributed another 1.2% so the Expected Equity Return and hence the Equity Risk Premium would go up by 1.2 %. Thus the recalculated Equity Risk premium is 5.5%
- c) The P/E repricing adds to the Expected Equity return and increases it by 1.2% to 13.6% (from the 12.8% calculated before) and after the allowance for repurchase yield (the yield which was used to make repurchases rather than giving dividends or growth) the Equity return would increase to 14.1% ( $13.6\% + 0.5\%$ ) and the Equity Risk Premium will be 6% ( $14.1\% - 8.1\%$ ).
- d) More transparency in reporting and higher diversification opportunities with lower risks for customers would mean higher P/E ratios and higher expected equity returns. This in turn will imply a higher Equity Risk Premium in the coming years.

**2) (a) i)**

The P/E ratio is gone down but is expected to go back. We can make gains by being Long in stocks at the reduced P/E level and then reduce our exposure when the P/E level rises back. Since the dip in the P/E ratio is perceived to be a temporary phenomenon we may use the Futures to gain exposure instead of actual stock purchase since the position is likely to be reversed and it will be easier to liquidate the futures contract once the P/E ratio goes back to its previous levels.

If the P/E level is not restored before the expiry of the futures contract we would require to roll over the futures contract till we achieve our desired P/E level reversal.

The equity exposure is to be increased from 11% of the total portfolio currently to 14%. Thus 60 crores of new Equity exposure needs to be taken through futures. We need to go long on futures contract on NIFTY. Similarly the debt exposure has to be reduced from the current 89% to 86% of the total portfolio.

We can execute the same by converting 60 crores of debt into cash position (shorting the bond futures) and using the cash to go long on stock index futures.

The lot size of the futures contract on NIFTY being 50 and the current market price of the futures being 5075 we need to purchase  $60 \text{ crores} \div (50 \times 5075) = 2364.53$  contracts (rounded to 2365 contracts).

If the target beta of the portfolio is 1.05 and the stock index futures beta is 1.1 then for investing the cash obtained by selling bonds into stocks through index futures the same has to be adjusted for the beta as follows:

$2364.53 \times 1.05 / 1.1 = 2257.05$ , rounded to 2257 contracts (where 1.05 is the beta of the target stock portfolio and 1.1 is the beta of the futures). We find that since futures have higher beta than targeted stock portfolio a lesser number of futures would serve the purpose. Thus we need to go long on 2257 contracts.



The bond exposure has to be reduced 60 crores.

This can be achieved by going short on interest rate futures.

Interest rate contracts to be shorted =  $1 \times (60 \text{ crores} \div 200000) \times (0.25 - 7.8) \div 7.2 = -3146$

Where yield beta = 1.

Value of the debt holding to be reduced = 60 crores.

Each futures contract size is Rs 200000.

Durations of bond portfolio, futures contract and cash are 7.8, 7.2 and 0.25 respectively.

Thus we have to short Interest Rate futures 3146 contract ( 3145.8 rounded to 3146).

**ii)**

The futures contract have a duration and would be sensitive to interest rate movements. The yield on the notional underlying bond (the underlying in Interest rate futures contract) is the implied yield on the Interest rate futures.

The yield of the bond held in the portfolio of the company and the implied yield on the futures contract will change with a change in interest rates.

Yield beta = the change in the yield of the bond portfolio  $\div$  the change in implied yield

- (b)** To reduce the Large Cap exposure we need to short the NIFTY (Index) Futures and the number of futures to be shorted is calculated as below:

$800000000 \times (1.05/1.1) \div (5075 \times 50)$  adjusted for the beta difference in the existing Large Cap portfolio and the beta of the NIFTY Futures = 3009 (3009.4 rounded to 3009) Futures contract.

Then to gain exposure in the Mid Cap stocks we need to go long on the mid cap futures. The exposure amount is still 80 crores. Thus  $800000000 \times (1.25/1.3) \div (2550 \times 300) = 1006$  contracts (1005.5 rounded to 1006) of NIFTYMCAP 50 Futures needs to be purchased.

(The beta of the current Large cap stocks is 1.05 and for NIFTY Index futures it is 1.1. Similarly the mid-cap stocks have beta of 1.25 and the beta of the mid-cap futures i.e. NIFTYMCAP 50 is 1.3).

- (c)** The P/E based fund is likely to underperform the index fund during that period when the markets are continuously growing. Such sustained increase would mean that the P/E based fund would gradually decrease its exposure to equities where they are still growing and thus underperform an index fund.
- (d)** The investment in index fund may not happen in the same proportion as the equity indices are constructed of. This may be due to reasons wherein the fund size may be small or a new stock may be added or removed from the index and there would be a lag in adjusting for the same in the index tracking fund.

At times the regulations do not allow funds to invest in their group companies and an index fund may have a tracking error since that group company may be part of the index.

The IRDA regulations do not allow more than 10% of the total corpus in any fund to be invested in one single company stock. A large company may constitute more than 10% of the total market capitalization of all index stocks. This may lead to tracking error if the index fund is not allowed to have exposure to such large capitalization company in the same proportion as its weight in the index.

The index funds would have a fund management fees charged for managing the funds / tracking the index. This fee would mean that the index fund performance would trail the total return produced by the index.

- (e) Call money market is an overnight market between banks wherein banks and other financial institutions can borrow and lend from 1 day to 14 days. If the borrowing is for one day it is called “call money” otherwise for borrowings of more than one day it is called “notice money”.

It is very liquid and the call money rates are indicator of short term liquidity. MIBOR is the average of the call money rates offered by select banks and is calculated on a daily basis by National Stock Exchange.

Repo is a short term borrowing against debt securities (mainly government securities). The securities are sold with an agreement to repurchase it in future. The securities are approved securities such as Treasury Bill and Central/State government securities. The repo transactions are also mostly on overnight basis. For the party on the other side of the repo contract it is a reverse repo wherein it purchases the securities with an agreement to sell it back. Reverse repo transactions are safer than call money investments, for banks and others willing to park their surplus cash for short term since they are backed by collateral.

The repo rates are a function of the collateral quality offered, the credit worthiness of the borrower and rates on other money market instruments at that time. The sale price of the security is the current market price and repurchase price is determined by the current market price, coupon offered under the securities and the repo rate.

- (f) i) If the actual bonds are allowed as underlying then there may be too many futures contract one on each of the available bonds and the liquidity in such future contracts would be low.

Allowing futures on actual bonds will create problems related to delivery of such bonds if the volumes are high.

Selection of a single notional bond which is linked to all the identified deliverable bonds of different terms to maturity and different coupons, through a conversion factor helps address liquidity and in overcoming shortages of deliverable bonds. This conversion factor is a multiplier which brings the deliverable bonds at par with the notional bond.

ii) The seller of futures contract receives selling price of futures  $\times$  conversion factor + accrued interest and he has to purchase the bond from the spot market for delivery for which he has to pay the spot price + accrued interest. Thus the seller would try and maximize his gains by delivering the cheapest bond wherein the gain = futures price  $\times$  conversion factor less the spot price to be paid.

Cost	Futures Price=92	Earnings	Gains
Quoted Spot Price	Conversion Factor	Futures Price × Conversion Factor	Earnings - Cost
95.70	1.01	92.920	-2.780
97.20	1.03	94.760	-2.440
99.20	1.05	96.600	-2.600

Amongst all the three bonds the loss is minimum on the second bond hence the cheapest to deliver is the one which has the quoted spot price as 97.20

(iii) Cost of Carry = Cost of Financing the bond - Coupon receivable from the bond

Cost of financing the bond till the settlement period =  $101 \times 45/365 \times 4.5\% = 0.5603$

Coupon Receivable from the bond =  $100 \times 45/360 \times 7.5\% = 0.9375$

Thus cost of carry =  $0.5603 - 0.9375 = -0.3772$ .

Arbitrage opportunity:

Cost of the bond in spot market	101
Cost of financing the bond purchase in spot	0.56034247
Coupon received by purchasing the bond	0.9375
Total cost for the bond in spot market	100.622842
Futures price	98
Conversion Factor	1.04
Money Received from the futures sale	101.92
(Futures Price * conversion factor)	
Arbitrage opportunity exists: Buy the bond in spot and sell the futures	
Arbitrage gain (Futures sale revenues- total cost of spot)	1.29715753

(g) (i)

- Life Companies are doing large volumes of business and have been investing large sums of money into Equity market (Cash market in Equities). Currently it is seen that all insurers put together are putting almost 10% of the total free float available in the market and are putting more money in Equity markets than Mutual Funds thus their participation in derivatives market would help in making the same more efficient.
- The Mutual Funds and FIIs are already allowed to participate in derivatives market.
- It will put India on a similar footing as some of the advanced countries like USA, UK, France where Insurance companies are allowed to hedge their assets / liabilities using exchange traded derivatives contract.

- Equity derivatives may allow to hedge against asset price volatilities and manage the Equity portfolios better. Thus giving more flexibility to manage the risk exposures and opportunities to reduce risks.
- It would allow hedging of guaranteed liabilities (guarantees of return and guaranteed NAVs being offered in various ULIP funds).
- It can allow creation of new products wherein for risk averse investors equity exposure may be offered with some guarantees attached.
- The Cash markets offer opportunities to profit from spotting low priced stocks but do not allow opportunities for guarding against risks in the price movements. Derivatives would allow opportunities to trade on prices as well as volatilities. The Insurers would be able to hedge against uncertainties in the prices.
- It will create avenues to hedge the asset price and volatility risks ( decreasing risk) , arbitrage, creating new strategies , allowing higher leverage if required (increasing risks) and also to take position based on views about future price movements and or changes in volatilities.
- The volumes in derivatives markets are far more than the cash market. With a very deep and liquid market the price discovery is quick and efficient.
- The benefit of derivatives arises mainly from the low transaction costs involved as compared to cash markets.
- Derivatives provide the flexibility to create any kind of strategy desired/required making it extremely potent (though this may also turn ugly if the strategies backfire).
- The derivatives can be extremely useful in not only creating the strategy but also continuously maintaining the same.

(ii)

- The exchange traded derivatives would be very liquid.
- The derivatives traded on exchanges have significantly low counterparty risks. Performance by both the parties to the contract is guaranteed by the clearing corporation.
- Trading and settlement is regulated by the stock exchanges along with the clearing corporations.
- Provides more transparency and details of the contracts traded are easily available.

(iii) The benefits associated with the derivatives bring along with them the potential for misuse and give rise to high risks if not properly used or managed. The main risks are as below:

- It provides very high leveraging opportunities since quite a small amount of upfront cash is required as margins for futures contracts or prices of options as compared to actual outflow required for taking position in the cash market.
- The high leverage makes them attractive to dealers for creating speculative strategies and enhances the risk manifold.
- The complex structures make the derivatives contracts difficult to value and present in the accounting statements.
- The assumptions used by models behind the pricing of such derivatives contract ( Black and Scholes) are not realistic and do not allow fully for the big downturns and crashes which happen more frequently than predicted by the models.

The trade volumes in some contracts are very low and their pricing is not efficient.

**[50]**

**[Total Marks 100]**

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