

# **Institute of Actuaries of India**

**Subject SP5 –Investment and Finance**

**December 2022 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.

**Solution 1:**

- i) The overall effect of an interest rate hike is likely to be a reduction in economic activity. [1/2]

The key reasons include:

- Reduction in consumer spending as mortgage payments increase
- Goods and services being more expensive as a result of more expensive credit
- Higher levels of consumer savings to invest rather than spend
- Capital intensive projects for businesses would reduce given higher cost of borrowing
- Lower levels of profit for companies with floating rate debt finance, given higher interest on existing corporate debt [half mark for each point]

The domestic currency is likely to increase in value due to higher interest rates. [1/2]

The reason for this is that foreign investors' demand for the currency will be increased if they believe that the base rate they will earn on such an investment may be higher. [1/2]

This will mean that domestic goods are less attractive and expensive, with a resulting decrease in exports. [1/2]

Similarly, volume of imports may increase given overseas goods may be more attractive. [1/2]

**[Max 5]**

- ii) The principal aims of regulation are:

- to correct market inefficiencies and to promote efficient and orderly markets
- to protect consumers of financial products
- to maintain confidence in the financial system
- to help reduce financial crime. [half mark for each point, **Max 2**]

- iii) ESG factors can improve investment performance through increase returns and/or reducing risk. [1/2]

Companies might avail the following benefits from an emphasis on ESG factors: [1/2 mark each]

- Lower cost through more efficient use of energy and raw materials
- Lower costs if there is an increase in pollution taxes
- Lower incremental costs if governments increase minimum wage which has already been factored in the company's policies
- Attract new customers or charge a premium if ESG practices enhance their brand
- Avoid reputational damage from involvement in controversial practices e.g. child labour
- Perform better through higher staff retention and motivation through good working conditions
- Enhance performance if pay structures align shareholders' long-term interests with executive incentives
- Avoid sudden and significant falls in share price from negligent practices e.g. scandal from emissions or unrest due to income equality **[Max 4]**

- iv) The key risks faced by the construction company are as follows:

- Higher costs than expected due to higher interest rates than expected for borrowing [1/2]
- Higher cost of construction materials than expected [1/2]
- Higher cost of labour than expected [1/2]
- Unforeseen costs, e.g. failure of construction materials or processes [1/2]
- Additional costs, e.g. need to relocate under-street utilities [1/2]
- In the case of these extra costs, any investors who might have helped raised funds, such as through a special purpose vehicle, would lose money. [1]
- This would then increase the construction company's risk through debt or equity exposure. [1/2]
- The construction may take longer than the stipulated period, thus increasing time until positive net cash flows are received and payback is achieved. [1/2]
- The delays could be due to: [1/2 mark for each]

- Poor weather conditions e.g. extreme heat or cold
- Disputes with labourers and/or sub-contractors
- Legal disputes with city council
- Unexpected or additional construction e.g. issues with heritage buildings

Once the construction is complete, additional risks for maintenance include:

- Additional running costs may further increasing running costs [1/2]
- Unforeseen maintenance problems e.g. issues with network, weather [1/2]
- Higher than expected wage or cost inflation [1/2]
- Political interference or change in sharing of profits [1/2]
- Lower than expected revenues due to lower metro usage [1/2]
- Recession or economic downturn leading to less customers [1/2]
- Emergence of alternate transport [1/2]
- Work from home increasing post COVID [1/2]

[Max 10]

[21 Marks]

### Solution 2:

i) The key issues arising from making significant changes to the asset allocation include:

- Possibility of shifting market prices, both on sale of existing portfolio and purchase of new assets) [1]
- Time needed to effect the change may prove challenging whilst ensuring that the changes are advantageous to the company [1]
- Dealing costs may prove to be higher than expected [1/2]
- Possibility of crystallization of capital gains leading to a tax liability [1/2]
- The problem is more acute when unmarketable securities or assets are involved [1/2]
- If the normal market size for deals in the assets held is small, this will lead to additional challenges [Max 4]

ii) The information required to value companies would be the following data:

[1/2 mark for each point]

- Historical financial accounts
- Historical and current accounting ratios
- Dividend cover for the existing private company
- Level and structure of borrowing
- Liquidity level
- Market value of assets
- Details of goods and services provided
- Details of the management – character, ability, qualifications and experience, vision, etc
- Details of business plan and strategies
- Public statements, press information and listing details
- Available competitor analysis and customer strategy.

Trends would be more useful than single data points.

[1/2]

[Max 5]

iii) The process by which you will ask the team to determine the price range of any share offer would require a fundamental share analysis. [1/2]

This would require a prediction of the future earnings of the company using a financial model of its cashflows and future earnings. [1/2]

This would require a forecast of the following:

[1/2 mark each, total 3]

- Future sales and costs (allowing for price and wage inflation)
- Estimates of rates of interest on overdrafts and loans
- Consideration of management ability, product quality and prospects for market growth

- Expected changes in company's competitive environment including market and sector movements
- Estimated earnings to provide forecast P&L accounts
- Expected payout ratios to derive dividend streams to shareholders

The payout ratios should be based on previous distribution to private shareholders, allowing for any adjustments based on expert judgement. [1/2]

Alternatively, payouts of similar but listed companies or any estimates by the company itself may be used to determine future dividends. [1/2]

The dividend streams could be valued using a discounted value of future dividends... [1/2]

... or using a simplified approach, such as:  $D1 / (i-g)$  [1/2]

Where:

$D_t$  = dividend = dividend payment at time  $t$

$i$  = required rate of return (derived from market valuations of similar companies)

$g$  = continuous rate of growth of dividends (based on financial model). [1]

The price range should be derived based on upper and lower estimates of  $i$  and  $g$ . [1/2]

This can be done using a set of scenarios with reasonable assumptions. [1/2]

Alternatively, next year's earnings could be estimated using the above analysis and a price derived by applying a market PE ratio. [1/2]

**[Max 7]**

iv) Reasons to suggest a price different from the fair market value based on the models might include: [1/2 mark each]

- Consideration of investor sentiment, e.g. creating positive sentiment through price rising upon listing
- To ensure that the share is fully subscribed by offering a lower price
- Consideration of risks in the investment based on an assessment of pros and cons
- Economic or market conditions at the time of subscription
- Incentive scheme for investors to switch from similar companies
- Allowance for any significant expert opinions e.g. positive outlook on management team, if not reflected in price from financial models.
- Allowance for any prudence margins if appropriate on any assumptions in the financial model.

**[Max 3]**

**[19 Marks]**

### **Solution 3:**

The existing sales volume related incentives are intended to ensure that executives are interested in ensuring that the company generates sufficient revenues. [1/2]

In particular, providing share options is useful to align the interests of executives with those of shareholders. [1/2]

Shareholders might want the share option incentives to continue for executives, to maximise the market price of the company's shares on their behalf. So, before making any changes, careful consideration and management of shareholder expectations is critical. [1 1/2]

Other than the new alternatives suggested, you may wish to consider new longer term share options vesting after a period of time. This will align executive interests not just with current year performance or profits, but long-term sustainability of the company. [1]

In addition, if the existing options are set up so that executives need to surrender them on leaving, this will help retain successful staff. [1]

### **Risk-weighted return on capital based bonus approach**

In practice, calculating RAROC (risk-adjusted return on capital) is extremely difficult to calculate with any degree of confidence. [1/2]

Hence, replacing a simple measure linked to sales with RAROC might prove challenging, and shareholders and executives may all be reluctant to accept the new measure. [1]

In particular, determination of the capital employed within the company would be subjective. [1/2]  
This is because most assets are likely to be intangible (e.g. contracts with clients). [1/2]

Executives are likely to be better placed to assess and potentially influence such asset valuations, leading to a potential conflict of interests. [1/2]

Non-executive directors are unlikely to have the same level of insight into these calculations and hence unable to help ensure the objectivity. [1/2]

The riskiness of the company (represented as beta of its shares) would be difficult to estimate accurately. [1/2]

This is especially the case as the company has recently expanded and increase its range of services. [1/2]

Overall, RAROC proves to be a more challenging measure to link with executive incentives given the above points. Sales volumes or even share prices would be a better measure given less subjectivity and less control under the executives under assessment. [1]

### **Profit-based bonus approach**

A profit-based approach is also prone to being manipulated by the executives in question. [1/2]

In addition, if the profits are based on the current year, this will lead to short-term thinking rather than alignment with long-term company objectives. [1/2]

For instance, assets could be sold or expense cutbacks could be made to maximise short-term profits, even if it is not in the best interests of shareholders. [1/2]

Deriving a measure linked with long-term profitability is more subjective, and would be challenging to implement. [1/2]

Other issues arise as less prudent accounting policies could be adopted, while keeping within the letter of accounting standards and/or the law. [1/2]

Over the longer term, a desire for higher profits may lead to executives taking undue risks and taking an aggressive approach to increase total profits. [1/2]

Such misalignment may lead to additional costs to shareholders, for e.g. not considering the amount of capital that shareholders had to invest to achieve the profits. [1/2]

Overall, a profit-based approach also does not sound more suitable and you must be cautious in your consideration. In particular, if you have been approached by executives to consider these measures, as a non-executive director it is your responsibility to be objective and represent the interest of shareholders. [1]

[Max 10]

#### **Solution 4:**

##### **i) Market risk**

The risk relating to the changes in the value of the portfolio due to the movements in the market value of the assets held. [1/2]

Both these asset classes would be exposed to high level of volatility and market risk attached to the portfolio. [1/2]

There would be challenges with respect to measuring the market value for private equity investments. [1/2]

##### **Liquidity Risk**

The risk of not having sufficient cash to meet operational needs at all times. It is related to market risk in as much as the liquidity of the overall portfolio needs to be taken into account in portfolio selection. [1/2]

Even though cryptos are traded in open market but these are not regulated markets and the markets may not be large or liquid enough for big fund to be managed [1/2]

Private equity are illiquid assets and liquidation of such assets at reasonable cost would be a big risk for investing in these assets. [1/2]

##### **Credit Risk**

It is the risk that a counterparty to an agreement will be unable or unwilling to fulfil their obligations. [1/2]

Since both these asset classes are not regulated, credit ratings would not be available, and the company will be exposed to credit risk by investing in these assets. [1/2]

Also, since both these asset classes come with high risk, the risk of default would also be high. [1/2]

##### **Operational Risk**

Risk of loss due to fraud or mismanagement within the fund management organization. [1/2]

Since these are relatively new assets classes and the company will be investing in these for the first time, there will be a need to have robust processes, specialist investment managers and controls in place which exposes the company to high operational risk. [1/2]

##### **Relative performance Risk**

The Risk of under-performing comparable institutional investors. Since these assets classes are volatile and not regulated. [1/2]

The returns could be volatile and the company would be exposed to high risk of underperformance compared to other assets classes or funds investing in similar asset classes.

[1/2]

Also, the past performance records would be volatile for such funds.

[1/2]

[1 Mark Each for each Individual

Risk, **Max 5]**

ii) Actions that the company can take to monitor and control the funds risk are as follows:

#### Market Risk

- The company would need to define what they mean by market risk and over what period they are measuring it. [1/2]
- The risk needs to be either absolute or relative to an index. [1/2]
- It must be possible to calculate the risk level on a regular basis and that the systems are in place to perform the calculations [1/2]
- Have an effective risk budgeting process with limits defined for each asset class [1/2]
- Need to understand the effect on the risk profile of changes they make to their portfolios. They may look at Value at Risk, load ratios Or stress testing. [1/2]

#### Liquidity risk

- A detailed analysis of the liquidity requirements under various scenarios should be carried out. This will involve classifying the assets into liquidity bands [1/2]
- Allowance also needs to be made for the costs of liquidation [1/2]
- Liquidity Duration of Liquidity risk elasticity could be calculated or a liquidity gap analysis may need to be undertaken [1/2]
- The position may be improved by introducing deferment periods so the clients may be forced to wait to receive the proceeds of their investments especially for funds managing these highly volatile illiquid assets. [1/2]
- A cash buffer could be held [1/2]

#### Credit Risk

- Have an effective risk budgeting process within each asset class as well. [1/2]
- There should be limits on the total exposure to any one counterparty [1/2]
- They could also require collateral where investing in private equities, have assets on the fund's name, have a seat on the board etc. [1/2]
- The total exposure to any one group should also be considered, this should include both debt and equity. [1/2]

#### Operational risk

- Hiring special fund managers to manage cryptos and private equity. [1/2]
- This can be reduced by senior management understanding the risks being taken [1/2]
- Operational risk can be reduced by having clear processes and robust systems combined with effective training [1/2]

#### Relative performance risk

- These risks are similar to market risk and should be monitored in the same way, however attention needs to be given to the performance of competitors as well as the market. [1/2]
- Employing good specialist fund managers could reduce this risk. [1/2]
- Understanding the valuation methodology for underlying assets would be important for private equity when looking at performance of competitors. [1/2]

[1 Mark Each for each Individual Risk,

**Max 5]****[10 Marks]****Solution 5:**

- i) The Covid -19 significantly impacted the stock market and had some extreme market events over the last two years. The market events demonstrated specific behavioral biases from the investors which can be described as follows:

40% fall in equity markets at the onset of Covid-19 in March 2020

- Spurious herding is where many investors make the same investment decisions based on some real piece of economic or political news or some event. [1/2]

In this case, onset of covid led to people panicking and selling even companies with strong track records with highly cash generating, profitable businesses with strong balance sheets ignoring the underlying fundamental value. [1/2]

- Myopic Loss Aversion: Investors overfocused on short-term losses and underemphasized the potential for long-term gains and underlying fundamental value of the stocks. [1/2]

This led to selling of stocks with strong fundamental value and avoid buying quality stocks cheaply available. [1/2]

- Momentum or extrapolation Bias: The assumptions that the worst was not yet over, and it would continue indefinitely into the future. [1/2]
- Mood based anomalies – The overall impact of the pandemic impacted the decision making with outlook being negative in general. [1/2]

This led to negative sentiments and selling of stocks ignoring the underlying fundamental value. [1/2]

- Framing: Investment decisions weren't made based on facts, but on how information was being presented during the pandemic [1/2]

120% recovery from March 2020

- Herd Behavior: Again, the herd behavior and fear of missing out led to investors following decisions taken by others. [1/2]
- Framing: Investment decisions weren't made based on facts, but on how information was being presented during the pandemic [1/2]
- Optimism and overconfidence – People demonstrated overconfidence and optimism post the stock market recovery leading to much higher recovery compared to the fall in 2020. [1]
- Confirmation Bias: We choose what information we consume about our decisions, and we gravitate towards data that validates them. [1/2]
- Anchoring Bias: Investors were fixating on the higher, earlier price and hence jumped at the big percentage drop not realizing that something alarmingly expensive had become only slightly less so. [1/2]  
Moreover, after realizing gains at a higher price, investors weren't anxious to selling at a lower one. [1/2]
- Self-serving bias: people credited favorable and positive outcomes to their own stock picking abilities and skills than look at the external factor like cheap interest rates and boosts provided. [1]

**[Max 7]**

- ii) Herding is bad for the financial markets as it increases volatility and threatens the integrity of the whole system if markets are driven to extremes. [1]  
 If all investors herd together, it can cause bubbles in asset prices which may then burst suddenly, leaving investors and potentially institutions with large losses. Such inefficiencies in markets are costly to the economy. [1]  
 Research can also be subject to herding, whereby all analysts come to the same conclusions because it is risky to be out on a limb, and easier to be with a crowd. This can reduce the quality of research in the market and lead to inefficient capital allocation. [1]

[Max 3]

[10 Marks]

**Solution 6:**

- i) The key risks for the liabilities would be the interest rate risk, minimum guarantee risk and longevity risk. [1]  
 Since the annuity payment is guaranteed for life, the duration of the liabilities would be higher and hence greater interest rate risk. [1]  
 Interest rate risk can be managed by investing in instruments which match the duration and value of the base annuity cashflows outgo, such as interest rate swaps or bonds. [1]  
 However, the company is currently investing only in index linked government securities and corporate bonds. However, due to longer duration of liabilities it would be challenging to find suitable longer duration bonds to match the duration. [1]  
 Rolling over the bonds can be employed but this would expose to reinvestment risk. [1]

[Max 4]

- ii) Use of interest rate swaps to hedge the interest rate risk:  
 Swaps can be designed to have longer maturities than the available bonds in the market. [1]  
 Swaps have greater liquidity and lower transaction costs than the bond market and hence can be tailor made to meet the schedule of the payments. [1]  
 Since the company invests in index linked securities to meet the guarantee pay-outs, it is still exposed to the minimum guarantee risk in case the inflation falls below the guaranteed rate. [1]  
 To hedge this risk, the company can use an inflation swap for the schedule of payments against the benchmark index. [1]

[Max 3]

- iii) The modelling can be done deterministically or stochastically for the purpose of setting the asset liability reserve. [0.5]  
 In a deterministic framework, the company can decide the nature and extent of the scenarios to be tested for the purpose of setting the reserves. [1]  
 As majority of the assets are invested in Government securities and Corporate Bonds, so we might consider the impact of immediate increase of 100 basis points in bond yields. [1]  
 The value of assets and liabilities would be compared, and the asset liability mismatch reserves can then be set up to cover the possible levels of shortfall identified. [1]  
 In a stochastic framework, we can make multiple projections to generate many possible future economic scenarios. [0.5]  
 The stochastic element of the projections would apply to the asset portfolio and investment returns, in order to assess exposure to systematic risk. [1]

The assessment of the results could be carried out in the form of ruin probability. That is, the outcomes are ranked in terms of a target measure (such as the shortfall of assets relative to liabilities at a specified future date). [1]

Additional reserves are then set up at a level sufficient to cover all but a specified proportion of such shortfalls. [1]

For example, suppose that the 10th worst outcome out of 1,000 simulations produced a shortfall of 10 lakhs. This suggests that an extra 10 lakh of reserves would be required if the aim of the investor is to ensure that the probability of ruin is no greater than 1%. [1]

[Max 7]

[14 Marks]

### **Solution 7:**

i) This is an example of an anomaly switch where the investor is taking advantage of temporary anomaly between the price of two similar Government securities. [1]

The investor in this case may investigate the price ratio which is the ratio of two bond prices  $(105/95) = 1.1053$ . The ratio is expected to be stable over time as the two bonds are very similar in characteristic (duration and volatility). [1]

If the ratio has moved from the long term average, then this may present an anomaly which might reverse itself, allowing the investor to switch back to the original bond. [1]

A similar investigation can be carried out using the historical trends of the yield ratio  $(7.8\%/8.6\%) = 0.9070$  [1]

Alternatively, the investor could build a model of bond yields, or of bond prices, using factors such as term, marketability, size of the issue, special features etc. and compare the prices of the two bonds to the model prices, to look for anomalies. [1]

[Max 4]

ii) This is an example of a policy switch where the investor is switching into a longer, more volatile bond. [1]

It may be that the investor expects yields in the market generally to fall, and prices to rise. If this happens, then all bonds will rise in price, but the longer bond will rise further giving the investor a profit. [1]

Similarly, if the investor expects the yield curve to flatten in shape, then the long bond yield will fall (and prices rise) and the shorter bond yield will rise (and prices fall), delivering a profit on the switch [1]

Both the above strategies may be due to the investor's view on spot and forward rates, and how they compare to the market's estimates. [1/2]

The investor may have evaluated the rate at which the shorter bond would have to be reinvested on maturity in 2030 to achieve the same overall return to 2040 as the long bond offers. If this rate is higher than the rate investor believes is possible, then he/she may switch into the longer bond to lock in the yield. [1]

It may also be due a change in the liability profile of the investor. [1/2]

[Max 4]

iii)

- Bond market trading is often less transparent, so accurate and objective determination of the index value can be more difficult [1/2]
- Active managers are unconstrained in this way. [1/2]
- However, it is hard to know which active managers will outperform in the future. [1/2]
- Passive management has lower fees. [1/2]
- Needs less expertise [1/2]
- Active managers may also incur higher transaction costs or taxes [1/2]
- If the market is efficient [1/2]
- It may be better for matching liabilities [1/2]
- Opportunities for added value are limited for actively managed bonds whereas downside risk is significantly greater (e.g., insolvency) [1/2]

- Active management may be better suited to loss avoidance than outperformance and may therefore be suited to riskier markets (e.g., high yield, emerging markets) [1/2]
- It may be difficult to find an index that matches the fund's liabilities [1/2]
- And it may be difficult to replicate an index if a suitable one is found [1/2]

**[Max 3]**

iv) The considerations that the insurance company should be taking in deciding between active or passive management approach to manage the bond portfolio:

- Active management will be more expensive [1/2]
- Opportunities to add value may be limited whereas downside risk is significantly greater (e.g., insolvency) [1/2]
- Active management may be better suited to loss avoidance than outperformance and may therefore be suited to riskier markets (e.g., high yield, emerging markets) [1/2]
- It may be difficult to find an index that matches the fund's liabilities [1/2]
- And it may be difficult to replicate an index if a suitable one is found [1/2]
- Is the market efficient [1/2]
- How much risk the insurance company wants to take [1/2]
- The strength of the insurance company [1/2]
- What is permitted by regulations [1/2]
- The insurance company's annuity liabilities will have a specific profile (duration, inflation-linkage). [1/2]
- A passive portfolio is unlikely to be able to replicate this. [1/2]
- Likely to want to use a range of bonds (government, corporate, credit, MBS, etc.) unlikely to be easily available through passive routes [1/2]
- May also want to use derivatives (e.g., swaps) to control risk a cash-flow matching strategy [1/2]
- The insurance company can control its own costs, so the additional costs of active management less likely to be too burdensome. [1/2]
- Above issues indicated an active strategy more likely to be suitable. [1/2]
- "Core-satellite" approach may be adopted in which certain elements of the portfolio (e.g., government bonds) are passively managed and others actively managed [1/2]
- Passive may be an attractive option if the insurer has an asset management arm that sells passive products. [1/2]
- Active may be an attractive option if it has a skilled bond team. [1/2]
- The degree to which an active or passive approach may be successful may depend on the transparency of the bonds that are being invested in. [1/2]
- The strength of the insurance company may also be a factor in selecting a passive or active approach [1/2]

**[Max 5]****[16 Marks]**

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