

Institute of Actuaries of India

Subject ST5 – Finance and Investment A

September 2018 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) Forward Guidance:**

Forward Guidance is a tool used by some central banks to indicate, in the absence of any unforeseen events, how the central bank believes monetary policy will change in the future – usually over the following 18 to 24 months.

Central banks using QE (Quantitative Easing) as a monetary policy tool typically give a degree of forward guidance to the market regarding the anticipated levels of QE that they intend to conduct in the short to medium term.

It is designed to help people see how the central bank sets interest rates and thus should reduce the uncertainty about the future path of monetary policy. This prevents, to some extent, surprises that might disrupt the markets and cause significant fluctuations in asset prices.

Central bank controls short-term (up to a month) interest rates through its setting of base rate. Forward Guidance allows central bank to influence long-term (up to three years) interest rates by indicating how it expects monetary policy to develop in future.

Forward Guidance allows the central bank to influence inflation expectations.

Forward guidance may consist of telling the public: what the central bank intends to do, what conditions will cause it to stay on the course and what conditions will cause it to change its approach.

Forward Guidance is not a guarantee and central bank can depart from its guidance either due to some unforeseen economic event or if economic outlook changes. [3]

ii) Example:

In UK, the Bank of England Monetary Policy Committee (MPC) made the following forward guidance statement in August 2013...

...“The MPC intends not to raise Bank Rate from its current level of 0.5% at least until the Labour Force Survey headline measure of the unemployment rate has fallen below the threshold of 7% (subject to conditions).”

In US, the Federal Open Market Committee (FOMC) in late 2013 and early 2014 said that

...it would continue to keep the federal funds rate at the lower bound at least until the unemployment rate fell to 6.5% and inflation increased to 2% annually. FOMC also said that reaching these conditions would not automatically lead to an adjustment in Federal Reserve policy. [1]

iii)

A. Forward guidance is used to create expectations that influence the yield curve, strength of the domestic currency and consequently economic activity.

If a central bank believes that the economy would be more stable if the currency is held at a slightly weaker level (to boost exports), then by using forward guidance to forecast low base rates for a long time, it can effectively reduce the attractiveness of the domestic currency. Foreign investors' demand

for the currency will be reduced if they believe that the base rate that they will earn on such an investment will be low for longer.

Likewise, if the central bank believes that bond rates being low in the 2 to 5 year maturity band (for example) would help companies borrow and invest, then forecasting low rates for longer will (through expectation theory) help to reduce 2 to 5 year bond rates.

- B. Primarily it is useful to the central bank in its carrying out of monetary policy and in manipulation / management of the economy.

Suppose forward guidance indicates that central bank expects to raise the base rate in coming 2 or 3 quarters, prospective homebuyers might want to get mortgages ahead of a potential increase in mortgage rates.

It could also be argued that it is useful for investors when making their decisions about which asset category to buy. However, this relies on the belief that the central bank's forecast is better than the investor's own forecast.

[4]

[8 Marks]

Solution 2:

i) **Advantages of the merger of PSBs**

The 4-5 merged PSBs can reap the benefits of **economies of scale** such as...

- ...sharing core services common to constituent PSBs
- ...invest in technology
- ...better realign their ways and methods of credit disbursement
- ...do umbrella branding at low advertising costs

As the economy is large with widespread geography, merged PSBs can **exploit complementary resources** from the experience of constituent small PSBs, focused in regional areas probably with different local languages and cultures, to deal with people having different needs and banking habits.

For example, some regions may be predominantly dependent on farming and some regions on manufacturing and others on tertiary services.

As the economy is growing, the projects will become larger requiring huge funding with specialized skill-set in evaluation of projects. Size will be an important factor and organic growth may take lot of time...

...although syndicate lending by banks is possible but there may be co-ordination problems.

Merged PSBs will have **access to opportunities** only available to larger organizations.

For example, large merged PSBs are able to ...

- ...improve the quality of corporate governance (non-overlap of committees).
- ...obtain finance more cheaply (deemed more creditworthy).
- ...be effective in achieving their objectives of financial inclusion.

...deal with competition of multinationals - foothold on an international scale

Dis-advantages of the merger of PSBs

A more aggressive motive may be to eliminate inefficiencies (including underperforming management)...

...Since PSBs cannot fire excess staff, voluntary retirement benefits would hit their earnings in the short term;

The mergers may result in large-scale financial repression and banking system may become more inefficient and too-big-to fail.

The proposed merger will result in economies of scale but that needs ***both time and money*** (*due to challenges in merged PSBs as discussed in next part*). These mergers could bring a large balance sheet but weak(er) fundamentals.

Most of the PSBs have weak capital and merging two or more of these banks will result in creating larger entities with weak capital levels.

PSBs have exposure to the same set of stressed assets, mostly in infrastructure sector. A merger increases the concentration risk as the merged entity will end up holding a larger exposure to stressed sectors.

Conclusions

There are three purposes that the merger would serve –

- increase in efficiency (primarily through ***economies of scale*** and ***exploiting complementary resources***),
- increase in market power (by ***access to opportunities*** available only to larger organizations), and
- consequently better accounting ratios.

The economy needs strong banks and consolidation does not automatically make banks strong. Just by taking four challenged banks, one cannot create a fifth one, which is stronger.

Central bank, the regulator of banking system, and the Government being the significant owner, should play supportive roles in the task of banking consolidation based on commercial considerations, with a view to further strengthening the financial sector and support growth while securing the stability of the system.

The Government, while making decisions, should keep in mind factors like regional balance, geographical reach, financial burden and smooth human resource transition.

[12]

ii)

- First challenge is related to integration of human resources, particularly at junior and middle level. Integrating human resources in matters such as compensation, deployment and performance appraisal could pose several challenges.
- Bank employee Unions will oppose the pursuits of mergers and amalgamation of banks.
- Merged bank need to absorb all employees of the merging banks. The salaries, pension and retirement benefits are expected to take a dent on profitability for several years.

- There also exist challenges in evaluating the issue of rationalizing / relocating the branch network post-merger.
- To cater wider geographies' customer base, merged PSBs face challenge in enhancing the skill levels of the employees of erstwhile banks who had so far worked with regional focus.
- Another major challenge may be that PSBs not having uniformity in the information technology architecture. If many banks have developed a unique system by engaging with different vendors then creating an entity that can seamlessly cover all aspects of the banking business will take a long time. [3]

iii) Letter of undertaking (LOU) is a form of bank guarantee, issued by a bank that allows its importing customer to raise money from another domestic bank's foreign branch in the form of a short-term credit. [1]

iv) New share price
 = Old share price less value of loss per share due to fraud
 $= 150 - \frac{140}{2} = 80$ [1]

v) New share price
 = Old share price plus value of confiscated assets recovered per share
 $= 80 + \frac{60}{2} = 110$ [1]

vi) Existing Total capital = (No. of shares) (Share price) = (2) (110) = 220 billion

Existing Government capital

= (Old Government shareholding) (Existing Total capital) = 60% (220) = 132 billion

New Total capital = Existing Total capital + Capital infused = 220 + 30 = 250 billion

New Government capital

= Existing Government capital + Capital infused = 132 + 30 = 162 billion

New Government shareholding

= (New Government capital) / (New Total capital) = 162 / 250 = 64.8%

Assumption: It is assumed that govt infused money at the same market price (or premium) over face value as was prevalent on the date of infusion. [2]

[20 Marks]

Solution 3:

- i) End-points given: Index at 10500 and 11500;
 Turning points occur when Index is at the strike prices; and
 Break-even point (i.e. portfolio value is zero) occurs between any two consecutive Index level points (an end-point and a turning point or two turning points) where portfolio values have opposite signs.

Value of portfolio = 75 times the sum of payoffs of individual contracts.

Let S be the settlement price of the index at end of the day; K is strike price;

Payoff of short put = premium – max (0, $K - S$)

Payoff of long put = – premium + max (0, $K - S$)

Payoff of short call = premium – max (0, $S - K$)

Payoff of long call = – premium + max (0, $S - K$)

Consider the payoffs of Strategy A:

Spot price and future price of the index is 11,000 as basis of the future is zero.

Short future = 11,000 – S

Short put = 15 – max (0, 10,900 – S)

Long two put = 2 (– 5 + max (0, 10,700 – S))

Long call = – 10 + max (0, $S - 11,300$)

If $S < 10,700$ then,

Strategy A = 11,000 – S + 15 – 10,900 + S – 2 (5) + 2 (10,700) – 2 S – 10 + 0
= 21,495 – 2 S

If $S \geq 10,700$ and $S < 10,900$ then,

Strategy A = 11,000 – S + 15 – 10,900 + S – 2 (5) + 2(0) – 10 + 0 = 95

If $S \geq 10,900$ and $S < 11,300$ then,

Strategy A = 11,000 – S + 15 + 0 – 2 (5) + 2(0) – 10 + 0 = 10,995 – S

If $S \geq 11,300$ then,

Strategy A = 11,000 – S + 15 + 0 – 2 (5) + 2(0) – 10 + $S - 11,300 = -305$

The six key points on chart of Strategy A (Index level; Portfolio value):

(10500; 37125); (10700; 7125); (10900; 7125); (10995; 0); (11300; – 22875); and (11500; – 22875)

Consider the payoffs of Strategy B:

Short call = 120 – max (0, $S - 10,900$)

Long call = – 80 + max (0, $S - 10,950$)

Long put = – 70 + max (0, 11,050 – S)

Short put = 110 – max (0, 11,100 – S)

If $S < 10,900$ then,

Strategy B = 120 + 0 – 80 + 0 – 70 + 11,050 – S + 110 – 11,100 + $S = 30$

If $S \geq 10,900$ and $S < 10,950$ then,

Strategy B = 120 – S + 10,900 – 80 + 0 – 70 + 11,050 – S + 110 – 11,100 + S
= 10,930 – S

If $S \geq 10,950$ and $S < 11,050$ then,

$$\text{Strategy B} = 120 - S + 10,900 - 80 + S - 10,950 - 70 + 11,050 - S + 110 - 11,100 + S = -20$$

If $S \geq 11,050$ and $S < 11,100$ then,

$$\begin{aligned} \text{Strategy B} &= 120 - S + 10,900 - 80 + S - 10,950 - 70 + 0 + 110 - 11,100 + S \\ &= S - 11,070 \end{aligned}$$

If $S \geq 11,100$ then,

$$\text{Strategy B} = 120 - S + 10,900 - 80 + S - 10,950 - 70 + 0 + 110 + 0 = 30$$

The eight key points on chart of Strategy B (Index level; Portfolio value):

(10500; 2250); (10900; 2250); (10930; 0); (10950; -1500); (11050; -1500); (11070; 0); (11100; 2250); and (11500; 2250)

[8]

- ii) The investor might choose Strategy A because he/she may feel that the index will go down ...

...and the options markets are underestimating scope for negative equity returns and overestimating scope for positive returns over the day.

The investor might choose Strategy B because he/she may feel that the options markets are underestimating (implied) volatility of equity returns for the day.

[2]

- iii) The forward rate can be calculated from the equation:

Forward rate = Futures rate $-\frac{1}{2}\sigma^2 t_1 t_2$ where:

$t_1 = 1$ is the time (in years) to maturity of the futures contract.

$t_2 = 1.25$ is the time (in years) to maturity of the rate underlying the futures contract.

$\sigma = 0.04$ is the standard deviation of change in short-term interest rate in one year.

Forward rate and futures rate are both forces of interest.

The appropriate quotation is the 12-month contract, which implies a future rate of $i^{(4)} = 6.2\%$.

This equates to a continuously compounded rate of:

$$r = \ln\left(1 + \frac{0.062}{4}\right)^4 = 6.1524\%$$

Therefore, the continuously compounded forward rate is:

$$= 6.1524\% - \frac{1}{2}0.04^2 (1) (1.25) = 6.0524\%$$

Converting back to the quarterly compounded rate, the forward rate is:

$$i^{(4)} = 4\left(e^{0.060524(0.25)} - 1\right) = 6.09846\%$$

[4]

[14 Marks]

Solution 4:

We should consider the quality of the firm's management and the personnel (drivers, cleaners, mechanics etc.) that it employs.

We should consider the quality of its core products, i.e. for passengers the cars and buses (with or without A/C) and for cargo lorry, van and containers that it provides.

The input costs (at both current level and projected future levels) of vehicles (available for lease / for purchase), spare parts, repair costs, fuel costs etc.

The extent to which profit is retained and reinvested in the firm.

The extent of the current and likely future competition in the market for such services, e.g. are there significant barriers to entry or actual or potential competitors?

The possibility that the firm may be able to expand into new markets that might include:

- other states within the domestic market
- the neighboring countries
- shipping / air transportation.

The possibility of takeover by or merger with another firm

The recent trend (history) in performance of the firm will influence how the current performance is interpreted.

Relationships with other stakeholders like...

...producers of vehicles and spare parts

...vendors providing vehicles on lease

...regular clients using vehicles on lease

... RTO / RTA (Regional Transport Office/Authority).

The demand for the road transportation services which the firm currently provides.

The demand for road transportation services in general, which is likely to reflect both

- the overall state of the economy and structural changes
- statutory/regulatory changes that may affect road transportation

[8 Marks]

Solution 5:

- i) The risk of the individual share relative to the overall market which cannot be eliminated by diversification. It is measured by the beta factor.
 A share with a beta greater than 1 is said to be aggressive, i.e. the price of the share is expected to do better than the market when prices rise.
 Conversely, a share with a beta less than 1 is a defensive stock, i.e. its price will be expected to fall by less than the market when prices fall. [2]

- ii) Using derivatives as opposed to direct investment in portfolio management is termed as Synthetic Portfolio management.

Derivatives, like Interest rate and inflation swap, may have longer maturities available than direct investment instruments like bonds.

Derivatives markets may have greater liquidity and lower transaction costs.

Derivatives permit hedging to be achieved without full asset cover being required.

Bespoke derivatives contracts allow greater flexibility within the schedule of payments.

Derivatives generally are subject to collateralization (to mitigate credit risk), this requires the movement and investment of collateral on a daily or weekly basis.

Closing of bespoke derivative contracts is more complex than selling a bond.

However, in a liquid market closing out a swap may in fact have lower transaction costs than selling a government bond.

Derivatives are subject to counterparty risk, if the counterparty bank defaults. Whilst collateralization will limit losses, if this happens a new derivative will need to be put in place at potentially higher cost (replacement risk) or the hedge lost.

Under an interest rate swap, the receiver of the fixed interest rate will need to pay a floating interest rate to the counterparty. To the extent that there is investment risk in the assets that are used to generate the floating rate (e.g. cash or other assets), the swap will not mitigate these risks, whereas a government bond portfolio is intrinsically low risk from a credit standpoint.

Derivatives introduce basis risk - If the swap interest rate curve moves differently to the government bond interest rate curve then this could lead to a mark to market loss.

Derivatives can be used to alter the characteristics of a portfolio without disturbing the underlying assets. Trading in exchange-traded derivatives is usually quicker, cheaper and easier than trading in the underlying assets, especially where large trades are concerned.

In short-term transition management, like tactical asset allocation, instead of holding the market directly, the investor takes a derivative position in the index – a “synthetic” holding of the market portfolio very quickly and at low cost.

In long-term transition management, for e.g. rebalancing of portfolio of selling equity and buying bonds, investor takes a “synthetic” holding, the underlying securities could then be bought and sold over an

extended period giving opportunities to buy and sell at favorable prices. In addition, selling the shares over an extended period would allow time for careful analysis of which shares to sell and which bonds to buy. Synthetic portfolio management can be used for index tracking.

[10]

[12 Marks]

Solution 6:

i)

Financial Year	Market Equity Index return (%)	Return ABC (%)	Return XYZ (%)	Return ABC-Return Market (%)	Return XYZ-Return Market (%)	Square of [Return ABC-Return Market] (%)	Square of [Return XYZ-Return Market] (%)
2011-12	2.4%	5.10	2.98	2.67	0.55	7.13	0.31
2012-13	1.2%	7.92	4.98	6.74	3.81	45.46	14.50
2013-14	1.3%	6.62	8.53	5.36	7.27	28.70	52.85
2014-15	1.6%	-9.33	7.69	-10.89	6.14	118.51	37.66
2015-16	2.4%	2.99	-6.06	0.55	-8.51	0.30	72.35
2016-17	2.4%	2.17	8.87	-0.21	6.49	0.05	42.06
2017-18	1.8%	9.51	4.81	7.73	3.03	59.75	9.20
Total				11.95	18.78	259.90	228.92

Relative returns of mutual fund ABC = 1.71

Tracking error of ABC = 5.85

Information Ratio of ABC = 0.29

Relative returns of mutual fund XYZ = 2.68

Tracking error of XYZ = 5.05

Information Ratio of XYZ = 0.53

[6]

ii) Both funds generated a positive relative return – i.e. they both out-performed the market.

XYZ higher relative return indicates that it out-performed ABC in terms of investment return alone.

ABC's higher tracking error suggests that it adopted a riskier approach than XYZ did in order to generate the higher investment returns.

XYZ's higher information ratio suggests that it out-performed ABC over the last 7 years even after allowing for the additional risk – i.e. it out-performed in risk-adjusted terms.

We should also note that the above results relate only to past 7 years and may not produce similar results in the future.

[4]

iii) The information ratio is a risk-adjusted performance measurement.

It measures the expected active return of the manager's portfolio divided by the amount of risk that the manager takes relative to the benchmark.

In other words, it tells us how efficiently additional risk can be converted into additional return.

Higher the information ratio, better is the performance of fund manager.

It is useful in comparing funds with similar management styles

[4]

[14 Marks]**Solution 7:**

i) Approximation used: $(1 + i)^n = (1 + n i)$

Notional sector, notional bonds, notional residential properties

FY 2015-16 = 5.0%

FY 2016-17 = 5.0%

FY 2017-18 = 5.7%

Aggregate CAGR = 5.3%

Actual sector, notional bonds, notional residential properties

FY 2015-16 = 5.0%

FY 2016-17 = 5.0%

FY 2017-18 = 5.8%

Aggregate CAGR = 5.3%

Actual sector, notional bonds, notional commercial properties

FY 2015-16 = 5.8%

FY 2016-17 = 6.2%

FY 2017-18 = 6.6%

Aggregate CAGR = 6.1%

Actual sector, Actual bonds, Actual commercial properties

FY 2015-16 = 9.2%

FY 2016-17 = 9.4%

FY 2017-18 = 12.7%

Aggregate CAGR = 10.4%

FY	Attribution			
	Sector (Bond vs. Property)	Residential vs. commercial Property	Stock selection	Total
2015-16	0.0%	0.7%	3.5%	4.2%
2016-17	0.0%	1.1%	3.2%	4.4%

2017-18	0.1%	0.8%	6.2%	7.0%
Aggregate CAGR	0.0%	0.9%	4.3%	5.2%

[12]

ii)

1. There is no significant impact on performance by going over-weight in Bond.
2. The manger was sensible to invest in commercial property rather than residential property.
3. The manager's individual stock selection was very good throughout the years.
4. Overall, the manager has out-performed by mismatching the benchmark and being overweight in the best-performing asset category.
5. Also, the performance was fairly consistent over the year. The overall performance was very largely attributable to good stock selection and good choice of commercial property over residential.
6. It is difficult to draw definitive conclusions from three year's data. [6]

iii) Set out the key objectives that investment and funding policy should aim to achieve.

For a pension fund these would involve:

- a. future ongoing funding levels,
- b. future solvency levels,
- c. future company contribution rates and
- d. the level of risk that is prepared to be taken.

Suitable assumptions to use in the study need to be agreed.

Collate the liabilities data to carry out the projections. For detailed liability analysis data on individual members is required to build up an accurate assessment of the future cashflow projections.

Consider the overall nature of the liabilities. An analysis of current funding level, maturity and cash flow projections under different scenarios needs to be considered

Projected the future cash flows. This would involve projecting values of assets and liabilities, surplus/funding levels, contribution rates etc. These would be analyzed according to the assumed mix of bonds and equities.

To assess which scenario is most plausible to meet the investor's investment objectives, analyze the different asset mixes to assess the risks (relative to the liabilities) and the rewards of each alternative under consideration.

[6]

[24 Marks]
