

Institute of Actuaries of India

Subject ST5 – Finance and Investment A

November 2013 Examination

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 :

i.

When we buy a stock, we are buying a share of that company. This means we are buying into the expected future profits of that company. Unless we are talking about a bank or companies with high debt, small changes in interest rates don't have a significant impact on a company's future earnings.

There are two main components when it comes to valuing a stock. The first is expected future earnings. The second is the discount rate to which we apply to future earnings.

Future Earnings

The shareholders have invested in a company because they expect the company to generate a rate of return in excess of cost of capital. Cost of capital is directly related to level of interest rates. The shareholder value added (say ROE minus expected cost of equity or ROCE minus cost of capital) can increase with a rate cut and vice versa. Extant operations become more valuable in a falling interest rate scenario and vice versa. So an expectation of fall in interest rate is usually cheered by the market and vice versa.

If the rates fall the cost of capital of the company goes down and everything else remaining the same the company can take up many more positive NPV projects which gets reflected as higher stock price. Falling rates also drive consumption related demand. So probability of earnings growth increases in a falling rate environment. The reverse is also true.

Discount rate

The discount rate is a measure of how much we value future earnings relative to current earnings. The higher the discount rate, the less we value future earnings, and the cheaper the stock as a result.

So when the discount rate goes up, stock prices fall and vice versa. This occurs even when expected earnings do not change. When interest rates change, this translates directly into a change in the discount rate. When central banks increase interest

rates, the discount rate goes up, and then stock prices fall. When central banks decrease interest rates, the discount rate goes down, and then stock prices rise.

(6 Marks)

ii.

Quantitative Easing

A government monetary policy used to increase the money supply by buying government securities or other securities from the market. Quantitative easing increases the money supply by flooding financial institutions with capital, in an effort to promote increased lending and liquidity. This leads to lower interest rates and generally has a positive impact on the stock markets.

When the US Federal Reserve hinted at tapering the quantitative easing programme market participants started expecting a tightening of liquidity which could lead to hardening of interest rates which doesn't bode well for the equity market for reasons mentioned above.

(4 Marks)

iii.

The annual return we earn from holding 1-year bond is the same as the annual return from holding a 10-year bond.

The yield curve is a strong indication that the market believes inflation is under control. If the market believed that inflation was going to rise significantly, then the 10-year yield would be much higher than it is now.

The flattening yield curve also indicates that the market expects the central bank may cut short-term interest rates in the near future.

(2 Marks)

[Total Marks-12]

Solution 2 :**i.**

- ✓ A callable bond is a bond that allows the borrower to buyback the bond at predetermined price at certain times in the future.
- ✓ A callable bond is not normally callable during the first few years of its life. Thereafter the predetermined strike price of a callable bond is usually a decreasing function of term.
- ✓ A callable bond will generally offer a higher yield than an otherwise identical bond with no option features.

(3 Marks)**ii.**

- ✓ Callable bonds provide the company with a protection against falling interest rates. When a company issues a non-callable bond then it is effectively locking its interest rate. If the interest rates fall then the company can be at a disadvantage if it continues to finance its debt at old high rates. A callable bond allows the company to redeem the high cost bonds and raise fresh bonds at lower rate in a falling interest rate scenario.
- ✓ A company which is pretty confident of its future prospects may prefer issuing callable bonds. This is because good performance is usually accompanied by increasing strength of the balance sheet which may improve the credit rating of the company. A better credit rating will help the company to refinance at lower rates in the future and callable bonds provide them with this option.
- ✓ A company which is seeking risk capital (say equity) may issue short term callable bonds for their immediate requirement if they feel that the market is under valuing its equity. A callable bond provides the company an option to wait till the market conditions improve after which they can go in for equity for debt swap with much lesser dilution.

(6 Marks)**[Total Marks-9]**

Solution 3 :**i.**

The possible working done by the fund manager could be as follows:

Yield (y) on the callable bond if it is called after one year is calculated by solving the equation

$$99 = \frac{4}{(1 + \frac{y}{2})} + \frac{104}{(1 + \frac{y}{2})^2}$$

The yield works out to 9.07%.

If the bond is held till maturity its yield will be calculated by solving the following equation:

$$99 = \frac{4}{(1 + \frac{y}{2})} + \frac{4}{(1 + \frac{y}{2})^2} + \frac{4}{(1 + \frac{y}{2})^3} + \frac{104}{(1 + \frac{y}{2})^4}$$

The yield works out to 8.56%.

So the yield on the callable bond is at least 8.56% {MIN (8.56%, 9.07%)} which is higher than the yield on both the one year and 2 year bonds. This is probably what the fund manager would have meant when he talks of mispricing. **(5 Marks)**

ii.

The fund manager's assessment is incorrect. This can be shown by mapping the actual cash flow from the callable bond under 2 scenarios – call is exercised and call is not exercised.

Time	1 Year Non Callable (A)	2 Year Non Callable (B)	Callable (C)
6 months	4	4	4

1 Year	104	4+Market price of B after 1 year	4+MIN{100,Market Price of B after 1 year}
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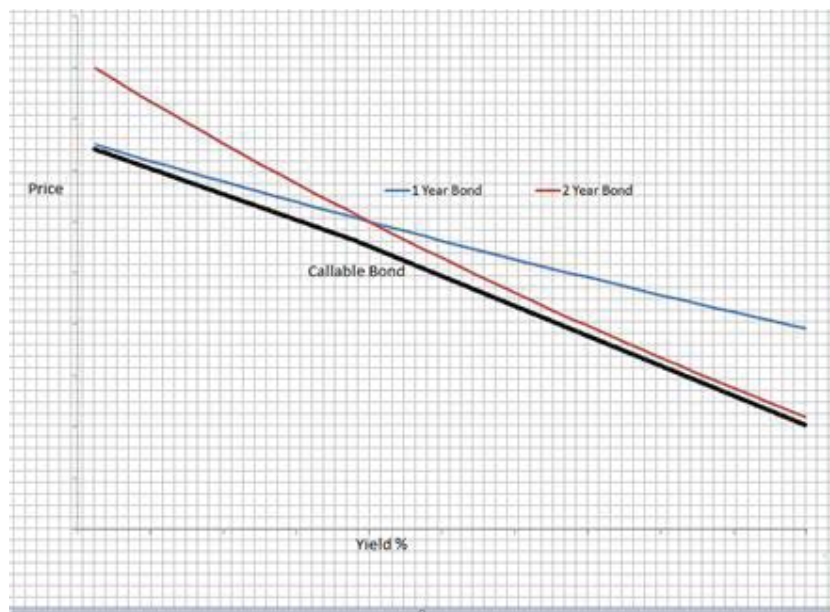
The cash flow after 6 months for all the 3 bonds are same. After one year the issuer of the callable bond has to make a decision as to whether the bond should be called or not. He exercises the call if the price of B is more than 100. So cash flow of C will be less than the cash flow of B and equal to the cash flow of A.

If the price of B after 1 year is less than 100 then the call option will not be exercised. So the cash flow from C will be less than the cash flow from A and equal to cash flow from B.

So cash flow from C will always be less than or equal to cash flow from A and B. So the callable bond has to be cheaper than both 1 year and 2 year non-callable bonds.

(6 Marks)

iii.



The price of the callable bond is capped by the price of the 2 year or one year bond (whichever is lower). At high interest rates the possibility of calling the bond is very low and hence the price is pretty close to the 2 year bond. At low interest rate the probability of calling the bond is high and hence the price approaches the one year bond.

When interest rate falls the price difference between the callable bond and 2 year non callable bond increases. The price difference is the value of the callable feature attached to the callable bond. As interest rate falls the price of the bond increases. But the rate of increase of the price of callable bond is much lesser than that of the non callable 2 year bond.

In the intermediate range of interest rates the price of the callable bond displays a negative convexity. **(10 Marks)**

[Total Marks-21]

Solution 4 :

i.

- ✓ Such an approach requires a bond asset to be held that is equal in present value to the future payments discounted at bond yields (using the full yield curve). Therefore, only a partial hedge is possible if asset cover is less than 100%.
- ✓ Due to “gaps” between bond maturities (particularly at longer durations), there may be a need to reinvest or disinvest bonds prior to maturity, and the hedge may therefore be imperfect.
- ✓ Coupon bearing bonds would mean reinvestment risk on each coupon payment.
- ✓ For long duration liabilities there may not be appropriate long duration bonds available. **(4 Marks)**

ii.

The fund manager is right to an extent. The 2 lines of business that the company predominantly writes are Motor and Health. While Health and Own Damage part of Motor is a short tail business the Motor third party and Liability business has a longer tail. But in all these cases it may not be very difficult to get matching bonds for the projected liabilities as short term bonds are more easily available and pretty liquid too.

The price sensitivity of short term bonds (duration) is also not very high compared to long term bonds and liquidity is also not much of a problem for short term bonds. In this context, under current circumstances, the fund manager's opinion is acceptable. **(5 Marks)**

iii.

- ✓ Choose an appropriate interest rate model along with the required parameters (Say Vasicek model or any other interest rate model)
- ✓ Generate 'n' number of interest rate paths
- ✓ Price of the callable bond is recursively determined based on each path to generate prices (P_1, P_2, \dots, P_n)
- ✓ The current price of the bond is $\{P_1 + P_2 + \dots + P_n\} / n$
- ✓ Let the current price be V_0
- ✓ Push each path up by a small rate say Δy and find the price V_+
- ✓ Push the original paths down by Δy and find the price V_-
- ✓ The duration of the bond is given by $\frac{(V_+ - V_-)}{2V_0 \Delta y}$

(6 Marks)

iv.

If a callable bond issuer's borrowing rates track swap rates closely, then the issuer can try to monetize the value of the option embedded in its callable bond by selling a receiver swaption (receive fixed). If the rates decline, and the swaption holder exercises against the issuer, the issuer can call the old bonds, sell new non-callable bonds with the same coupon and maturity, and use the refunding profit to cover the cost of the swaption exercise. If the investors have not demanded full compensation for the value of call option embedded in the corporate bond then the corporation can issue callable bonds and strip off the option by selling a receiver swaption thereby reducing the effective cost of borrowing.

(4 Marks)

[Total Marks-19]

Solution 5 :

- ✓ Loss Aversion:- Waiting for ABC stock price to come back to 1,000 even though the expected reason for that to happen has not materialized.
- ✓ Cognitive dissonance:- Finding new reasons to justify an earlier decision even after contradicting facts have emerged. Banking on ABC's land sale when there is no certainty that the event will materialize
- ✓ Anchoring:- Fixated with the number around 514 which he initially saw and unwilling to change that in spite of news flows that indicate that he is still better off buying the stock at a higher price.
- ✓ Hindsight bias:- Benefit of hindsight leads to Shyam attributing a much higher probability to an event (Reliable finding oil) than what it actually should be. He himself has not acted with conviction on his recommendation which clearly reveals hindsight bias in his response.
- ✓ Denial:- Still not accepting the fact that his performance had been poor despite underperforming the passive index investing strategy.

- ✓ Confirmation bias:- finding information (another investor's performance which has been poorer) to justify one's belief (that his performance was not really bad)
- ✓ Overconfidence:- Getting into areas without competence (derivatives/commodities) placing too much faith in himself.
- ✓ Prospect theory:- Getting into commodities/derivatives – risk seeking behavior (not expected from a rational person) when faced with losses.

(12 Marks)

Solution 6 :

i. Advantages

- Diverse businesses help the company to achieve diversification leading to risk reduction as over dependence on one line of business is not there.
- Better capital allocation. Mature business lines with low growth but strong cash flows fund the high growth business lines.
- Increase market value by acquisitions – acquiring a low valuation company and the earnings from the new company get the higher multiple which the conglomerate gets.
- More stable cash flows and reduced earnings volatility helps the company to reduce cost of capital.

Disadvantages

- Extra layers of management which increases cost of operations
- Accounting disclosures (to outside world) are less useful as numbers are presented as consolidated ones of different business lines which don't give out meaningful information.
- Slow pace of decision making.
- Management's lack of focus

- Investors may give a valuation discount because of the inability to assess the company properly.

(4 Marks)

ii.

- ✓ The management feels that the individual business lines may get better valuations as investors understand the company better. Sum of parts more than the whole.
- ✓ Helps to bring in focus.
- ✓ The business lines demerged have developed sufficient cash flows to stand on their own without outside support.
- ✓ To meet some regulatory requirement.
- ✓ Easier to dispose non-core business as a going concern.
- ✓ If the business needs funds to grow and the parent doesn't want to bring in capital and dilute stake in the whole business they may try to raise funds at the demerged entity level.

(3 Marks)

iii.

- ✓ The stock index should be such that it is affected only by the movement in the prices of underlying stocks and not by corporate action.
- ✓ Demerger of REL will lead to a fall in price of REL. This should not affect the index as demerger is a corporate action.
- ✓ The exchange has to readjust the composition such that the index is unaffected by the demerger.
- ✓ The futures and options of all maturity dates will have to be closed out before the ex-demerger date. Fresh series needs to be opened for REL post demerger on the day the demerged entity starts trading.
- ✓ The key factor to readjusting the index is to know at what price REL will trade post demerger. The exchange cannot take an arbitrary value as the post demerger price as this has to be market determined. This may be done by the

exchange by having a special trading session on REL alone on a post demerger basis to discover the price and this can be used to adjust the base.

Numerical example to adjust the index

Assume that the index is at 1000 and REL accounts for 100 points (10%). If the price of REL will fall by 20% then that will bring down the index to 980.

	Before Demerger	% Weight	After Demerger before adjustment	After demerger and adjustment	% Weight
REL	100	10%	80	82	8.2%
Others	900	90%	900	918	91.8%
Index	1000	100%	980	1000	100%

The demerger reduces the weight of REL in the index by 1.8% and adds the weight of all the other components by 1.8%. Each non-REL entity thus sees a small increase in its weight depending on its size.

(9 Marks)

[Total Marks-16]

Solution 7 : i.

- ✓ Their view is that the general level of interest rate in the economy is not going to fall further
- ✓ The yield curve was pretty flat and there was not much of a difference between yield on a shorter term bond (say 30 years). Since the rate on offering was attractive they went for the longest duration possible. **(2 marks)**

ii.

- ✓ Entities with long dated liabilities like pension funds and life insurance companies may find this bond attractive. Usually the longest dated security available is the 30 year G-Sec. But pension funds have liabilities much longer than that leading to asset liability mismatch. Availability of such long

duration bonds can probably help them to create portfolios with duration similar to that of liabilities

- ✓ A category of bond investors may also be interested in subscribing to this bond. If your view is that the interest rates are going to fall maximum returns are earned on long duration bonds
- ✓ Bond investors who want to manage the interest rate volatility may also look at these bonds. A 50 year bond has much convexity than say a 10 year bond. This means that the 50 year bond outperforms the 10 year bond when rates compress but underperforms to a much lesser degree when rates increase.

(3 Marks)

Solution 8 :

Personal Sector

- Immediate increase in the price of goods and services
- Greater impact on lower income households
- Consumption likely to fall generally over medium term
- Potential increase in unemployment in the medium term

Business Sector

- Consumption will fall leading to lower sales volumes
- Wage increases may be demanded in the medium term
- Corporate profitability is likely to fall over time
- Combination may reduce employment prospects

Government sector

- In the near to medium term, tax receipts will rise
- In the long term tax receipts will depend on whether the increased tax permanently contracts the economy
- Reducing public sector debt will reduce outstanding gilt volumes
- Long term gilt yields should fall, all things equal

(6 Marks)
