The Institute of Actuaries of India

Subject CT8 – Financial Economics

21st May 2007

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.

Arpan Thanawala
Chairperson, Examination Committee

Q.1)

(i) (a) Homoscedasticity implies that the volatility parameter of the lognormal random walk process is constant.

Examination of historic option prices suggest that volatility expectations fluctuate markedly over time. Estimates of volatility from past data are critically dependent on the time period chosen for the data and how often the estimate is re-parameterized. This implies that that volatility parameter of the model should be heteroscedastic (i.e. vary over time).

Furthermore, historic experience suggests that more extreme events are observed in reality than suggested in the return distribution from a lognormal random walk process. In other words, the distribution of actual returns has fatter tails in reality than implied by the normal distribution.

The "thinner tail" of a normal distribution is therefore likely to lead to underestimating the guarantee costs in extreme scenarios.

(ii) (a) Mean return assumptions for each asset class (equities, bonds, gilts, cash).

Mean returns are best estimate of future long term average.

There is no mean reversion of any returns assumed

Implied credit spread assumption above the corresponding risk free rate for bonds.

Duration/term assumptions (bonds and gilts).

We would be modeling one representative point on the yield curve respectively for bonds and gilts. Bonds may have a shorter duration for example, given a preference for taking shorter term credit risk. An alternative may be to assume no difference between bonds and gilts for modeling purposes.

Volatility/standard deviation assumptions (equities, bonds, gilts, cash)

Correlation assumptions between the asset classes in matrix form.

Volatility, credit spread and correlation parameters are assumed constant over time.

Standard deviation, credit spread and correlation parameters would be based on historic experience over a suitably selected timeframe.

Qualitative adjustments may be made to allow for future expectation differences.

(ii) (b) The recent economic boom has lead to an equity market surge with recent returns way in excess of long term averages. Part of this is likely to be a re-rating of Indian equities in line with long term revised economic growth assumptions, and part over-heating arising from bullish global markets and a preference for developing economies.

So using historic data over a long period of time may lead to an under-statement of μ, and recent data an over-statement.

A sensible adjustment to long term historic averages to allow for revised future promise appears the most pragmatic solution.

It is most important in selecting an assumption that equity, gilt and cash assumptions are consistent, in terms of the relative long term risk premiums implied.

(ii) (c) The RWLN model does not assume mean reversion. Whilst this may be appropriate for equities, it is much less so for dividend yields and interest rates (i.e. the bonds, gilts and cash returns).

Correlations across asset classes are unlikely to be constant over time. Across different time periods, and especially under extreme crisis scenarios, historic relationships are more likely to break down (e.g. all correlations could tend to 1 in a global crisis)

By modeling single points on yield curve for bonds, gilts and cash (with correlations assumed), interest rates generated may lead to abnormal yield curve patterns. Models that generate yield curves may be far more appropriate for generating consistent data points.

The drift parameter say for equities in unlikely to be consistent over time. It's reasonable to assume that investors will want a risk premium on equities relative to bonds and this is highly likely to change in size as interest rate patterns change over time.

Credit spreads on corporate bonds are unlikely to remain constant over time. In different economic scenarios (e.g. interest rate and equity combinations) default risk will differ leading to spread volatility above risk free rates. The LNRW model does not allow for this (except partially and implicitly in the relative correlation matrix between asset classes).

There's evidence in real markets of momentum effects, i.e. where a rise the one day is more

likely to be followed by a rise the next. This is in direct conflict with the independent increments assumption in the RWLN model. This is perhaps less relevant when modeling annual returns?
The distribution of security equity returns also has a taller peak in reality than implied by the normal distribution. This is because there are more days of little or no movement in financial markets.

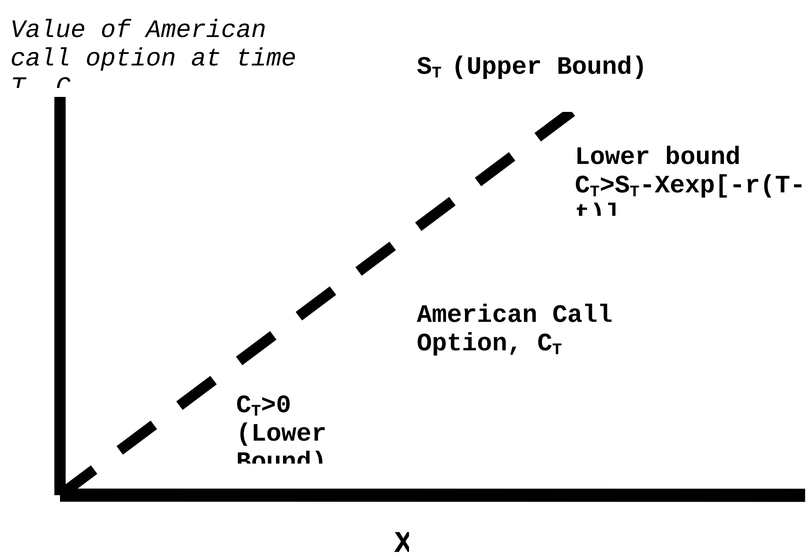
(ii) (d) The CIO is correct in his suggestion.
Take for instance an example where property is added as an asset class to the fund. Assume it had a higher mean and lower standard deviation assumptions than equities (which in many markets it has shown).
In this instance the most efficient strategy with respect to reserving may be to recommend a significantly higher allocation to property than equity. In reality most fund managers/life companies would not adopt this, preferring equities, and hence suggesting an inconsistency with efficient markets theory.
Any similar example would suffice. Inconsistencies in short and longer interest rate patterns could also introduce such arbitrage.

(ii) (e) No it wouldn't.
If markets were efficient, we would expect the equity risk premium to fluctuate in a narrow range. However, the Wilkie Model exhibits wide variations in the risk premium.
Thus, assuming the risk premium in respect of equities and index linked gilts is mean reverting, it would be possible to make excess returns using trading rules based on the variations in the risk premium from its long term mean value. So for example, if the equity risk premium is currently above its long term average, then we could profit by buying equities and selling index linked gilts, and then reversing the position as the risk premium level normalizes.
In an efficient market, if all investors realized this, then the excess premium would quickly be competed away, removing any profit potential.

[12]

Q.2)

(i)



(ii) The underlying share price (S_T) is an upper bound
because if the call (C_T) were priced higher than the share it would be possible to sell the call and buy the share to make a risk free profit.
The value of the call must also be greater than zero
and greater than the share price less the present value of the exercize price discounted at the risk free rate.

If the call were priced less than this, it would be possible to make a risk free profit by buying the call, selling the share and investing the discounted exercise price at the risk free rate.

(iii) If there is a dividend between time t and expiry, it may be beneficial to exercise the option early in order to receive this dividend.
Also for options where there is not an active market with high trading volumes, there is the possibility that you may not be able to find a buyer at the time you want to sell. So exercising may be your only option.

[5]

Q.3) (i) A would be a little greater than Rs 10 (i.e. Rs 310 – Rs 300) as the time value with such a short time to expiry will be very small.
B > A as this option has the same intrinsic value but greater time value
E < A as this option has no intrinsic value but the time value would be of similar magnitude to that in A (and certainly less than Rs 10)
F could either be > or < A depending on the magnitude of time value
C < A as this option has no intrinsic value and little time value
D could either be > or < A depending on the magnitude of time value
G > A as the intrinsic value of this option is Rs 20
H > A as the intrinsic value is the same as G but the time value is greater (and G > A)

[4]

Q.4)

(i) **Delta:**
$\Delta = \partial f / \partial S_t$
= rate of change in the derivative price with respect to a change in the underlying share price

Gamma:
$\Gamma = \partial^2 f / \partial S_t^2$
= rate of change of Δ with respect to a change in the underlying share price

Vega:
$V = \partial f / \partial \sigma$
= rate of change in the derivative price with respect to a change in the assumed level of volatility of S_t

Theta:
$\Theta = \partial f / \partial t$
= rate of change in the derivative price with respect to a change in time

(ii) (a) Delta hedging creates an explicit intention to keep the sum of deltas of the assets in a portfolio = 0. In order to consistently maintain this, it will be necessary to rebalance the portfolio on a regular basis.
If the portfolio has a high value of Gamma (i.e deltas more sensitive to changes in the underlying asset prices), then the portfolio will require more frequent rebalancing or larger trades than one with a low value of Gamma.
It is recognized that continuous rebalancing of the portfolio is not possible and that frequent rebalancing increases costs.
The need for rebalancing can therefore be minimized by keeping Gamma close to zero.

(ii) (b) The Gamma of an underlying asset is zero.
The portfolio Gamma = sum of gammas of constituents. Hence, adding or removing the underlying asset to or from the portfolio will leave the portfolio Gamma unchanged. Hence the underlying asset can't be used to Gamma hedge.

(ii) (c) Where European call options near maturity approach "at the money" status, the Gamma curve peaks sharply (i.e. Delta can vary very rapidly).
Delta hedging thus becomes more intensive (i.e. much more rebalancing required) as S_T approaches the strike price near maturity.

(iii) Theta = risk free growth rate on portfolio if, for the portfolio
Delta = 0
and Gamma =0 at the same time

(iv) Put-call parity: Put + $Se^{-q\,(T-t)}$ = Call + $Xe^{-r\,(T-t)}$
Hence, using the partial derivative equations in (i):
(a) $\Delta_{PUT} + e^{-q(T-t)} = \Delta_{CALL}$
(b) $\Gamma_{PUT} = \Gamma_{CALL}$
(c) $V_{PUT} = V_{CALL}$
(d) $\Theta_{PUT} + qSe^{-q(T-t)} = \Theta_{CALL} + rXe^{-r\,(T-t)}$

[10]

Q.5)

(i) Call = $Se^{-v\,(T-t)\,call}\,\Phi(d_1) - X_{call}\, e^{-r\,(T-t)\,call}\,\Phi(d_2)$
Put = $X_{put}^{-r\,(T-t)\,put}\,(1-\Phi(f_2)) - Se^{-v\,(T-t)\,put}\,(1-\Phi(f_1))$
Using d1, d2 and f1, f2 to represent the cumulative normal evaluation points for the call and the put respectively, we have
d_1 = [ln (150) – ln (160) + (0.01 – 0 +0.5*0.15^2)*2] / [0.15 * 2^0.5]
= -0.1039
$d_2 = d_1$ – 0.15 * (2^0.5)
= -0.3160
f_1 = [ln (150) – ln (145) + (0.01 – 0 +0.5*0.15^2)*3] / [0.15 * 3^0.5]
= 0.3759
$f_2 = f_1$ – 0.15 * (3^0.5)
= 0.1161
φ (d_1) = (2 Π)^-0.5 exp (-0.5 * (d_1^2)) = 0.3968
φ (d_2) = (2 Π)^-0.5 exp (-0.5 * (f_1^2)) = 0.3717
Φ (d_1) ≈ 0.4602 + 0.39 * (0.4562 – 0.4602) = 0.4586
Φ (d_2) ≈ 0.3783 + 0.60 * (0.3745 – 0.3783) = 0.3760
Φ (f_1) ≈ 0.6443 + 0.59 * (0.6480 – 0.6443) = 0.6465
Φ (f_2) ≈ 0.5438 + 0.61 * (0.5478 – 0.5438) = 0.5462
Using the formulae for call and put at the top
Call = 9.82
and Put = 10.83
Please note that if interpolation result slightly different or if interpolation not used in calculating Φ (d_1) and Φ (d_2), award full marks for answers within 1.5% of stated values above .

(ii) Question requires the composition of a delta- and gamma- neutral portfolio. This requires 3 sets of simultaneous equations:
$(\alpha\,\Pi / P_{call}) * \Delta\text{ call} + (\beta\,\Pi / P_{put}) * \Delta\text{ put} + (\gamma\,\Pi / P_{underlying}) * \Delta\text{ underlying} = 0$
$(\alpha\,\Pi / P_{call}) * \Gamma\text{ call} + (\beta\,\Pi / P_{put}) * \Gamma\text{ put} + (\gamma\,\Pi / P_{underlying}) * \Gamma\text{ underlying} = 0$
α + β + γ =1
Dividing through by Π and inserting numerical values yields:
0.04670 α – 0.03264 β + 0.006γ = 0
0.0012699 α – 0.0008808 β + 0 = 0
α + β + γ =1
… the solution to which is
α = -0.069
β = 0.099
γ = 0.970
So 97% of the portfolio is invested in the underlying asset,
with a further 9.9% invested in puts,
funded by short sales of calls to the value of 6.9% of the portfolio

[11]

Q. 6)

(i) (a) Constructing the **replicating portfolios** for the contingent claim, we get
48□ + 1.05φ = 0
38□ + 1.05φ = 4

- ⇨ $\varphi = 18.29$
- ⇨ So put value = 18.29*1 – 0.4*40 = 2.29

(i) (b) **Adopting the EMM approach:**

$q = (e^r - d) / (u-d) = (1.1 - (38/40)) / (48/40) - (38/40)) = 0.6$

Put Value = $E_Q [e^{-r}X]$

$= e^{-r} [q*0 + (1-q) * 4] = 1.6/1.1 = 1.45$

Note that in (a) and (b) the methods adopted could be used in reverse order to achieve the same results.

(ii) (a) No change

since the value of any contingent claim/option is independent of the real world probability.

Choose one other real world probability and illustrate that @ 5%, the value of the put remains unchanged.

(ii) (b) The value of a contingent claim is dependent on the risk free rate of interest.

The put under consideration decreases in value as interest rates increase.

The replicating portfolio contains a short position in the stock and a long position in cash.

The price of the put is equal to the excess of the long cash position over the short stock position.

As interest rates rise, the cost of entering into the long cash position with a fixed terminal payoff decreases, while the proceeds from the short stock position remain constant. Thus the put price falls.

(iii) In the risk-averse universe, investors must be paid a premium for carrying risk.

Thus, we must have $E_p[e^{-r} S_1] > S_o$

This implies that where:

- r = 5%, 48*p + 38*(1-p) > 40*1.05 => p > 0.4
- r = 10%, 48*p + 38*(1-p) > 40*1.1 => p> 0.6

So where r = 5%, p = 90%, 66% and 50% provide a positive risk premium, and are therefore plausible

Where r = 10% only p = 90% and 66% have positive risk premiums and are therefore plausible.

The others carry negative risk premiums which are inconsistent with non satiation and can thus be discarded.

[6]

Q.7)

(i) The payoff profiles are:

$$\begin{pmatrix} 1.12 \\ 150 \\ 100.3 \\ 10 \end{pmatrix} \quad 130 \quad \begin{pmatrix} 1.12 \\ \\ 82.4 \\ 18 \end{pmatrix} 100 \begin{pmatrix} 1.12 \\ \\ 61.8 \\ 16 \end{pmatrix}$$

The first line is R1 of cash invested @ 12 %

The second line is 1 share in 1 year's time (at the 3 possibilities)

The third line is 1 Euro invested at 3% valued in Rupees in 1 yr @ Rs 100, Rs 80 and Rs 60 (i.e. 1.03*100, 1.03*80, 1.03*60)

The final line is the pay-off of the option i.e.

Possible future equity price in Rupees less strike price in Rupees

= (150-1.4*100, 130 – 1.4*80, 100-1.4*60)

So there are three simultaneous equations:

$1.12*\alpha + 150*\beta + 100.3*\gamma = 10$

$1.12*\alpha + 130*\beta + 82.4*\gamma = 18$

$1.12*\alpha + 100*\beta + 61.8*\gamma = 16$

Solving the simultaneous equations …. We get

$\alpha = 0$, $\beta = 1$ and $\gamma = - 1.359$

i.e. we should hold no Rupees cash, borrow Euros 1.359 and purchase 1 share.

(ii) In finding the arbitrage free price, the call option should always have the same price as the replicating portfolio …
i.e. 1*100 – 1.359 * 70 = Rs 4.87
In this model, the call option is always exercized, i.e. the call will have the same value as a forward contract. The replicating portfolio is as we would expect for a forward, long one unit of the underlying and short the discounted value of the strike price (discounted at the European rate of interest)

[6]

Q.8)

(i) The formula for a zero-coupon bond using the Vasicek model is:
$B(t,T) = e^{a(T-t) - b(T-t)\, r(t)}$
Where
$b(T-t) = (1-\exp(-\alpha(T-t))) / \alpha$ and
$a(T-t) = (b(T-t)-(T-t)) * (\mu-\sigma^2/(2\alpha^2)) - (\sigma^2/(4\alpha))*(b^2(T-t))$
So, the Vasicek model has 3 parameters μ, α, and σ.
As we already have α, we only need to estimate the remaining two, and hence only need 2 data points.
Take the 1 and 2 year maturity bonds (although any two will suffice)
$b(1) = (1 - \exp(-\alpha*1))) / \alpha = 0.884797$
$b(2) = (1 - \exp(-\alpha*2))) / \alpha = 1.573877$
We can reduce ln B(0,1) and ln B (0,2) to two simultaneous equations:
$LnB(1) = -b(1)* 0.06701 - (1-b(1))*\mu + \sigma^2 * (b^2(1)/4\alpha - (1-b(1))/2\alpha^2)$
And
$LnB(2) = -b(2)* 0.06701 - (1-b(2))*\mu + \sigma^2 * (b^2(2)/4\alpha - (1-b(2))/2\alpha^2)$
Where R(0) = 0.6701
Which are solved …
$\mu = 7.5\%$
$\sigma = 5\%$

(ii) We know that:
$r(t) = r(0)e^{-\alpha t} + \mu(1-e^{-\alpha t}) + \sigma \int_0^t e^{-\alpha(t-u)}\, d\hat{W}_u$
So when we are looking ahead to time T over time Δt, we know that
$r(t+\Delta t) = r(t)e^{-\alpha(\Delta t)} + \mu(1-e^{-\alpha(\Delta t)}) + \sigma \int_t^{t+\Delta t} e^{-\alpha(t+\Delta t-u)}\, d\hat{W}_u$
(integral over u = t through to $t+\Delta t$)
Under the risk neutral probability measure, the Ito integral here has mean zero and variance:
$\sigma^2 \int_t^{t+\Delta t} e^{-2\alpha(t+\Delta t-u)}\, du$
$= \sigma^2/2\alpha\,(1-e^{-2\alpha(\Delta t)})$
⇨ $r(t+\Delta t) \sim N\,[r(t)e^{-\alpha(\Delta t)} + \mu(1-e^{-\alpha(\Delta t)}),\ \sigma^2/2\alpha\,(1-e^{-2\alpha(\Delta t)})]$

(iii) We need to be able to determine the parameters α, σ and μ.
Finding μ
Assuming investors are risk neutral (as stated in the question),
μ (risk neutral) = (μ real world)
& μ real world = simple average of the short term rates given,
assuming the short rate process follows a mean-reverting Brownian motion
Finding α
α takes on the same value in the risk neutral world as the real world.
We already have an estimate for α which accordingly remains unchanged.
Finding σ
Given the normal distribution of $r(t+\Delta t)$, we can regress $r(t+1/12)$ on $r(t)$.
From this we can deduce the residuals and the sum of squared errors (i.e. each residual is squared).
From the sum of squared errors we can estimate the variance of $r(t+1/12)$
And solve for σ accordingly.
Once more σ in the real world = σ (risk neutral).

Hence we have our estimate for σ.

(iv) The SDE for the C-I-R model is:

$dr(t) = \alpha (\mu - r(t))\, dt + \sigma\, \mathrm{sqrt}(r(t))\, d\hat{W}(t)$

whereas for Vasicek it is

$dr(t) = \alpha (\mu - r(t))\, dt + \sigma\, d\hat{W}(t)$

The key difference between the 2 models occurs in the volatility, which is increasing in line with the square root of r(t).

Volatility then diminishes to zero as r(t) approaches zero and the random increments get smaller and smaller.

r(t) will never reach zero provided $\sigma^2 \le 2\alpha\mu$.

Consequently all other interest rates will remain strictly positive.

This is in contrast to the Vasicek model where interest rates can go negative.

(v) Assuming interest rates can never go negative, this imposes upper bounds on bond prices, and lower bounds on bond yields across the yield curve.

For bonds of medium or long terms, this lower bound on the yield is often well above zero.

This can create problems, especially given that the model assumes perfect correlation of bond prices across the yield curve, which is counter to empirical evidence.

For example, during 1998, many countries saw their longer bond yields drop significantly as governments planned for the introduction of the Euro. In many cases, 10 year yields fell to levels which would have seemed impossible according to a CIR model calibrated a few years earlier. Insurers using CIR-type models to analyse their interest rate risk found they had substantial risk exposure which their models were ignoring.

Please note that any example explaining the same concept as outlined above should be awarded the full designated mark

[14]

Q.9)

(i) The outcome of a default may be that the contracted payment is:

- rescheduled
- cancelled by the payment of an amount which is less than the default-free value of the original contract
- cancelled and replaced with freshly issued equity in the company
- continued but at a reduced rate
- totally wiped out

(ii) A reduced form model is a statistical model, which uses observed market statistics rather than specific data relating to the issuing corporate entity to model the movement of the credit rating of bonds issued by the corporate entity over time

The J-L-T model utilizes such market statistics in the form of multiple state default likelihoods established from credit rating transition probabilities drawn from established rating agencies.

(iii) The JLT model assumes that the transition intensities between default states are deterministic.

An adaptation could be to assume that the transition intensity between states is stochastic and dependent on a separate state variable process.

By using the stochastic approach, the transition intensities could vary with various economic factors. For example, a rise in interest rates could increase default risk and so the variable process could include appropriate allowances for a change in interest rates.

[6]

Q.10)

(a) The single-index model is a special case of the multifactor model that includes only one factor, normally the return on the investment market as a whole. It is based upon the fact that most security prices tend to move up or down with movements in the market as a whole. The single-index model is sometimes also called the *market model*.

The single-index model expresses the return on a security as:

$R_i = a_i + b_i R_M + e_i$

where:

R_i is the return on security i

a_i , b_i are constants

R_M is the return on the market

e_i is a random variable representing the component of Ri not related to the market.

(b) According to the single-index model, the return on security i is given by:

$R_i = a_i + b_i R_M + e_i$

Where all the components are defined above

By the linear additivity of expected values, we have:

$E(Ri) = E(a_i) + E(b_i R_M) + E(e_i)$

Since a_i and b_i are constants and a_i is chosen so that $E(e_i) = 0$, we have:

$E(Ri) = a_i + b_i E_M$

as required.

The variance of returns for Security i is:

$Vi = \text{var}[a_i + b_i R_M + e_i]$

As a_i and b_i are constant, this is equal to:

$Vi = \text{var}[b_i R_M + e_i]$

Now, recall that the single-index model assumes that:

$\text{cov}(e_i, R_M) = 0$

Hence:

$Vi = \text{var}[\text{b}iRM] + \text{var}[ei]$

ie $Vi =. b_i^2 VM + Vei$

as required.

The covariance between Securities i and j is given by:

$\text{Ci,j} = \text{cov}[\text{Ri,Rj}]$

$= \text{cov}[a_i + b_i R_M + e_i,\ a_j + b_j R_M + e_j]$

Again, since a_i and b_i are constant, this is equal to:

$\text{Ci,j} = \text{cov}[b_i R_M + e_i, b_j R_M + e_j]$

As before, recall that the single-index model assumes that:

$\text{cov}(e_i, R_M) = 0$

Hence:

$\text{Ci,j} = \text{cov}[b_i R_{M,} b_j R_M] + \text{cov}[e_i, e_j]$

$= b_i b_j \text{cov}[R_{M,} R_M] + \text{cov}[e_i, e_j]$

We also have the assumption that cov(ei,ej) = 0 when i *not equal to j*.

So: $Ci,j = b_i b_j \text{cov}[R_{M,} R_M]$

$= b_i b_j V_M$

[10]

Q.11)

(i) The shortfall probability is:

$$P(X < L) = \int_{-\infty}^{L} f(x)dx$$

where L is the chosen benchmark level of wealth.

(ii) (a) ***Downside semi-variance***

The expected return on the bond is given by:

0.80 □×1□% + 0.10 ×□□% + 0.10 ×□0% = 10.4%

So the downside semi-variance is equal to:

$(10.4 – 8)^2$×□0.10 + $(10.4– 0)^2$ ×□0.10 = 11.39%%

(ii) (b) ***Shortfall probability***

The probability of receiving less than 8.5% is equal to the sum of the probabilities of receiving 8% and 0%, *ie* 0.20.

(ii) (c) ***Expected conditional shortfall***

The expected shortfall below the risk-free rate of 8.5% is given by:

$(8.5 - 8) \times 0.10 + (8.5 - 0) \times 0.10 = 0.90\%$ [1]

The expected shortfall below the risk-free return conditional on a shortfall occurring is equal to:
Expected shortfall/shortfall probability = 0.90%/0.2 = 4.5%

[6]

Q.12)

(i) **Strong form EMH:** market prices incorporate all information, both publicly available and also that available only to insiders.

Semi-strong form EMH: market prices incorporate all publicly available information.

Weak form EMH: the market price of an investment incorporates all information contained in the price history of that investment.

Publicly available information is a subset of all information, whether publicly available or not. Consequently strong form efficiency implies semi-strong form efficiency, in the sense that if a market is strong form efficient, then it must also be semi-strong form efficient. Similarly as historical price data is a subset of all publicly available information, so a market that is semi-strong form efficient must also be weak form efficient.

(ii) ***Major difficulties***

The major difficulties are:

- It is empirically difficult to determine exactly when a particular piece of information becomes available. When does the information become available to anyone (strong form efficiency) or publicly available (semi-strong form efficiency)?
- In order to test for strong form efficiency, you need access to information that is not publicly available.
- It can be difficult to decide exactly what constitutes publicly available information when testing the semi-strong form.

It is difficult to judge exactly the extent to which the market price should react to a particular event and hence to determine whether or not it has in fact under- or over-reacted to that event. (This applies to all three forms.)

(iii) ***Three examples of under-reaction to events***

1. Stock prices continue to respond to earnings announcements up to a year after their announcement. [½]
2. There are abnormal excess returns for both the parent and subsidiary firms following a de-merger. [½]

Abnormal negative returns tend to follow mergers (with agreed takeovers leading to the poorest subsequent returns). The market appears to over-estimate the benefits from mergers. The stock price slowly reacts as its optimistic view is proved to be wrong.

[10]

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