

Institute of Actuaries of India

October 2009 EXAMINATION

**Subject ST5 — Finance and Investment A
Specialist Technical**

MARKING SCHEDULE

1. Suppose that F_0 is the one-year forward price of gold.

If F_0 is relatively high trader can borrow Rs. 15,000 and buy 10 grams of gold and enter into a forward contract to sell gold in one years' time.

The profit made in one year time is

$$F_0 - 15,000 * (1.08) = F_0 - 16,200$$

If F_0 is relatively low trader can sell 10 grams of gold at Rs. 14,000 and invest the proceeds at 7.5% and enter into a forward contract to buy gold at F_0 in one years' time.

The profit made on this contract in one year time is

$$14,000 * (1.075) - F_0 = 15,050 - F_0$$

This shows that there is no arbitrage opportunity if the forward prices of gold are in the range of Rs. 15,050 and Rs. 16,200.

[5]

2. (i) A Central Bank may have control over:
 Monetary, interest rate and inflation policy
 Banking regulation
 Implementation of government borrowing
 Performance and integrity of financial markets
 Intervention in currency markets
 Printing and minting of money
 Taxation

- (ii) If the Central Bank wishes to stop speculative funds from selling the domestic currency it is advisable to increase the interest rates upwards. This works in stimulating the short-term speculative demand for the domestic currency from overseas investors attracted by the higher interest rates on offer.

One way to increase interest rates is via money market intervention. This is achieved through selling Treasury bills to reduce the level of liquidity within the banking sector and hence will push the short-term interest rates upwards which will increase the attractiveness of the domestic investments for overseas investors.

It may also increase the bank base rates – the rate at which it is prepared to act as lender of last resort to commercial banks, to directly increase interest rates.

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3. (i) There are two suitable measures.

- a. Treynor measure.
 - b. Jensen measure
- Provide the appropriate formulae

ii.

Beta =	Cov (R _i , R _m) / V _m
Beta A	0.825
Beta B	1.1375
Treynor Measure:	
A	9.7%
B	7.0%
Jensen Measure	
A	3.88%
B	2.31%

- The historical returns are same for both the funds
- The Betas of these investments are to be looked in to determining suitability with respect to Growth or Value
- In general companies that have high growth prospects have high Betas due to
 - The company may have high financial or operational gearing
 - It is in a risky industry where growth prospects are high but risk is also high
- It is expected that the Value portfolio to have the lowest beta and the highest risk-adjusted returns

As Beta is low and risk – adjusted measure for A is higher it is expected that M/S. We Value Plc. advise investment in Investment A and M/S. We Grow Plc. are expected to advice in Investment B in anticipation of Growth.

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4. (i) a)
Risk neutral Vs Real world

Risk neutral technique is a method to calculate the present value of cashflows by discounting risk-adjusted future cashflows with risk-free rates based. The risk-neutral method assumes no arbitrage and a complete market where there is no arbitrage opportunity and any derivative instruments can be perfectly available in the market.

If these conditions hold the mathematical theory ensures that the expected value of the present value of the future cashflows based on a risk-free discount rates and a transformed probability distribution is equivalent to the present value of future cashflow based on adequate discount rates and a real-world probability distribution.

A real-world technique is a method to calculate the present value of cashflows by discounting projected cashflows with risk discount rates. Under this method, projected cashflows are not adjusted for uncertainty risk, which is the risk that the future cash flows can be different from those projected. To reflect the "price" of this uncertainty risk, it is common to set the risk-discount rates higher than risk-free rates.

In risk-neutral technique the adjustment for the uncertainty can be consistent with observable market prices of securities

Implied Volatilities:

These are the volatilities implied by option prices observed in the market. Implied volatilities are used to monitor the market's opinion about the volatility of a particular stock. While historic volatilities are backward looking, implied volatilities are forward looking.

Value at Risk: [Two alternates are provided]

Value at Risk (VaR) is the maximum loss in the value of the fund, with a probability of $p\%$ that may be suffered by an institution as a result of market risk over a period of time t .

VaR generalizes the likelihood of under-performing by providing a statistical measure of downside risk. VaR assesses the:

- potential losses on a portfolio
- over a given future time period
- with a given degree of confidence

Stress Test:

VaR methodology does not take into account the simultaneous increase in asset returns volatilities and correlations that is often observed during extreme market events.

The risks that are incurred by extreme market events can be identified and investigated by the process of financial stress testing.

This involves subjecting the portfolio to extreme market moves by radically changing the underlying portfolio assumptions and characteristics, in order to gain insight into portfolio sensitivities to pre-defined risk factors.

This pertains in particular to asset correlation and volatilities.

Back Testing:

Back testing is an important reality check, irrespective of the method used to calculate VaR.

Back testing involves how well the VaR estimates would have performed in the past. For example, in calculating a 1-day 99% VaR, Back testing would involve looking at how often the loss in a day exceeded the 1-day 99% VaR that would have been calculated for that day.

(ii) b) Answer will be sent shortly.

The variance of the portfolio is:

$$\begin{aligned} &= 0.015^2 * 500^2 + 0.018^2 * 400^2 + 2 * 500 * 400 * .015 * .018 * .6 \\ &= 56.25 + 51.84 + 64.80 \\ &= 172.89 \end{aligned}$$

The standard deviation is $\sqrt{172.89} = 13.15$

Since Normal $(-2.33) = 0.01$, the 1-day 99% VaR is
 $= 13.15 * 2.33 = 30.64$

The 10-day VaR is

$$= \sqrt{10} * 30.64 = 96.88$$

The 10-day VaR for the Gold Investor is

$$\begin{aligned} &= 0.015 * 500 * 2.33 * \sqrt{10} \\ &= 56.26 \end{aligned}$$

The 10-day VaR for the Global Investor is

$$\begin{aligned} &= 0.018 * 400 * 2.33 * \sqrt{10} \\ &= 53.05 \end{aligned}$$

The benefit of diversification is

$$= 56.25 + 53.05 - 96.88 = 12.42$$

The benefit of diversification is 12.42 m.

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5. (i)
- Actuarial risk: The risk that the company cannot meet its liabilities.
 - Relative Performance risk: The risk that poor performance is achieved relative to competitor's funds.
 - Credit risk: The risks that counterparty to an agreement will be unable or unwilling to fulfill their obligations.
 - Operational Risk: The risk of loss due to fraud or mismanagement within the Life Insurance Office.
- (ii)
- There is a risk from long term performance and in the short term the small companies' performance may be better than that of the Nifty-50 Stocks
 - If the fund manager can cherry pick small and emerging companies which have robust business models, then these companies may give far larger returns than the Nifty-50 companies which will help enhance the overall returns of the funds.
 - The enhanced returns may lead to higher sales thus leading a large AUM which may reduce the volatility in returns given the larger base.
 - The smaller companies may have lower marketability than the larger companies and hence investing in smaller companies introduces liquidity risk

- Even if the buyers are found the transaction costs may be higher and results in increase in overall expenses of managing the fund
- The performance cannot be benchmarked against a particular index and may result into challenges in customer communication and hence reputation
- It may require to calculate risk-adjusted measures
- There will be less information that is publicly available with respect to small companies and greater research and effort is needed in identifying the stocks.
- The company may need to expand the investment team as it needs more analysts given the expanded basket of equity stocks .
- If the economy is in recession or in a falling market, the mid cap and small cap companies may lose more than those in the Nifty-50 stocks
- The future fund management charges depend on the value of the fund and if the value doesn't rise sufficiently then the fund management charges may be inadequate or lower than what is assumed in pricing.
- Corporate governance could be an issue with small cap companies

[12]

6. a)

- The company typically will float a special purpose vehicle (SPV) to which the tranche of loans that are securitized are sold off.
- SPV in turn issues bonds known as Mortgage Backed Securities (MBS) to the investors at an appropriate yield so that the investors are attracted to these bonds
- With help of interest payments and repayments happen on the tranche of securitized loans, the coupons are paid to the investors of the bonds and also re-pay the principal amount of the bond
- This helps the company to improve liquidity even though the loans are yet to mature to expand the business
- The risk of default on the loans sold to SPV is transferred to the SPV bond holders thus helping the company to transfer the risk to the bond holders.
- Typically the assets backing the MBS will be higher than the face value of the MBS. The assets to face value ratio will always be greater than 1 depending upon the credit quality of the assets being securitized.
- The MBS will also be generally credit rated so that investors will have confidence in the quality of these bonds
- The agreement with the SPV will typically state that if any residual cashflows remain in the SPV after paying back all the liabilities due to the MBS holders, these cash flows will go back to the company which is known as the Originator of the deal.

Differences with Unsecured Loans:

- Unsecured loans stay on the balance sheet of the company
- Unsecured bond holders will have a right over the assets of the company before the equity holders.
- The assets and liabilities are transferred out of the balance sheet of the company
- For holders of MBS, they do not have any recourse to the company's other assets in case of default from the mortgages that are securitized.

- The MBS will reduce the cost of borrowing as these are backed by assets and hence yields have to be lower than that available on unsecured bonds
- b)
- The equity tranche has been created to protect purchasers of higher tranches against the value of the asset being lower than calculated.
 - If the equity tranche is purchased by the company itself, it instills confidence in the investors of the other two tranches
 - Defaults in the customer contracts would first be set against the equity tranche, then the subordinated debt and finally the senior debt
 - The yield on the senior debt would be the least followed by that on subordinated debt and equity will not carry any coupon
 - The senior debt has a coverage ratio of about 1.33 and may have the yields that are on par with any AAA rated bonds of 10 year tenor in the market .
 - The subordinated debt has a coverage ratio of 1.25 and also will be repaid only after the senior debt has been completely paid. Hence the yield will be higher than that provided on senior debt.
 - Equity will be unrated and will have the residual yield after both the above debts have been paid and if no defaults occur will earn the yield which will be more than the company gets on the mortgage loans as the yield differential between the mortgage loans and the other two debts ranked above equity would accrue to the equity subscriber which is the company.
 - The MBS has been structured in this way to reduce the cost of borrowing
 - The company would be subscribing to the equity tranche as it is confident that the asset has been conservatively valued, and therefore does not want to give up excess returns to other parties.
 - In practice it may be difficult to market the equity tranche as contract and customer retention is to some extent under the control of the company, and some level of company participation in the issue would be needed to avoid moral hazard
- c)
- MBS bondholders may not understand all the risks such legal, financial and liquidity inherent in such securities in view of these securities being new to Indian Market
 - Default risk by mortgage borrower not paying mortgage payments (interest or capital)
 - Default risk of the company receiving the payments from borrower but not paying them to the SPV which in turn pays to the investors of the MBS bonds
 - Co-mingling risk of money in the event of insolvency of the company as the liquidator not recognizing the special characteristics of the loans sold to the SPV and hence treating the MBS bond holders on par with other creditors.

- Prepayment risk – mortgage borrowers may repay their mortgage early and the economic structure of the MBS is based on an assumption of mortgage borrowers paying high interest rates for a long time
- Low Floating rates: The mortgage borrowers who have borrowed on floating rate basis might end up paying lower interest than the coupons on the MBS bonds when the general interest rate regime is very benign.
- Liquidity risk if a mortgage is foreclosed and although market value of property is high it takes time to convert it into liquid cash (property is not fungible) to pay MBS investors and hence the need for additional assets backing the MBS bonds.
- Asset Liability Mismatch : If majority of the loans securitized have a tenor longer than 10 years then there may be asset liability mismatch as the bonds are expected to mature at the end of 10 years. The company has to take care while selecting the loans for securitisation
- The MBS bonds may not tradable in the market as the market is still in a nascent stage and hence the proper price discovery may not happen
- Mortgage borrower may not have been fully truthful in his mortgage application and so the actual risk of the portfolio may not be understood.
- Due diligence by mortgage lender of mortgage applications may not be so thorough as they are transferring risk to a third party which to some extent is mitigated by the equity tranche .
- Properties may be geographically or socially concentrated and so benefits of a diversified portfolio may not be available.
- Economic scenario may change dramatically like in recent times that there may be large scale defaults and hence the security provided in terms of additional assets may not be sufficient

[25]

7. a)

	Forwards	Futures
Maturity Date Choice	Tailored to portfolio's needs	Standardised. Considerable basis risk if closed out early to match transactions in underlying portfolio
Contract Price	Quoted by foreign exchange dealers at a number of different banks	Arrived at in the exchange futures largely by screen based trading
Dealing Expenses	Very low for large transactions	Very low for large transactions
Margins	Depending on the credit rating of the portfolio there may be initial margins and some marking to market.	Initial and variation margins required. Contracts are marked to market on a daily basis
Availability	Major players in the foreign exchange markets will quote forward prices for a wide range of currencies over a wide range of terms.	Limited to a few currencies. Limited set of maturity dates which means contracts need to be rolled to provide a long-term hedge.
Accessibility	Limited to large customers	Contract size significantly smaller

		than in the forward market. Open to speculators, hedgers and arbitrageurs
Clearing & Settlement	The quality of clearing and settlement is at the discretion of the bank counterparty.	All trades cleared and settled via the exchange clearing house
Credit Risk	Depends on the bank you are dealing with	Guarantee of the clearing house available to general clearing members. Other participants bear credit exposure to their futures broker.
Closing Out a Position;	Negotiate with the counterparty bank. Very little competition on the unwind price for exotic currency forward contracts	Enter an offsetting contract

Despite the risks in terms of closing out a position and credit risk, forwards may score over futures in this case as there are very limited rupee currency hedging futures and also due to the unavailability of futures that exactly match the size and tenor of the portfolio which may create a significant basis risk and the risk in rolling over futures contracts over a longer period.

b)

1. Hedging:

Protecting against a fall in the market by buying suitable put options in order to limit the loss on portfolio if there is a fall in the market. This is typically known as portfolio insurance

For this hedge to be effective, the value of options should increase by exactly the same amount as the decrease in asset prices.

Similarly when the fund is expecting huge in-flows in a short time, you may buy call options in order to protect yourself against rise in prices

2 Income enhancement:

Fund managers may enhance income by writing suitable options on the assets they hold. This will be useful if the markets are expected to move sideways for some time. Else this may lead to sacrifice of potential future gains

3 Trading or speculation

A combination of options can be used to design option strategies. However these strategies are risky in nature

4 Arbitrage

The relationships between the prices of put and call options, underlying securities mean that different portfolios can be constructed which may give the same return in all circumstances. If investors can identify such equivalent portfolios with different portfolios may be able to make profit by buying the cheaper ones and selling the dearer ones

5. Portfolio management

Call options allow exposure to be gained to upside movements in the price of the underlying asset. Put options allow exposure to downside risks to be removed. Therefore calls and puts on different assets can be combined to change a fund's exposure either across asset categories or within an asset category Option Strategy to be followed:

c)

Assuming that the announcement would lead to a significant enhancement in shareholder value, the stock price of the company will increase sharply .

Assuming that to be true it is likely that if it acquires the targeted company the share price will rise, if, alternatively the company does not acquire, the share price will fall.

If the fund manager believes that the company's chances of acquiring the targeted company are low, she may sell the existing shares to buy them at a cheaper price later when the announcement comes through.

Similarly if she feels that the chances of acquiring are very high, she may accumulate more shares.

Alternatively she does not have a particular view but would like to benefit from movement of the share price significantly in either way, a suitable option strategy needs to be followed in order to allow the fund to profit from either a rise or a fall in the share price. Such a strategy is called a strangle.

In a strangle the fund buys a put and a call with the same expiration date and different strike prices.

The fund manager must ensure that the date of expiration is after the date when the contract will be announced.

The put would be bought with a strike price below the current price. The call would be bought with a strike price above the current price.

If the company is successful in acquiring the targeted company, then the share price will rise giving the fund a profit from the purchase of the call. The fund would incur a loss on the purchase of the put.

If the company did not win the contract then the share price would fall and the fund would profit from its purchase of the put but make a loss from its purchase of the call.

It is important when setting up the strangle to satisfy oneself that the expected profit will exceed the expected loss, this can be done by careful selection of both the strike price and the expiry date.

[23]
[Total 100 Marks]
