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Question 1

Question Type: MultipleChoice

A stock that follows the Weiner process has its future price determined by:

Options:

A- its expected return alone

B- its expected return and standard deviation

C- its standard deviation and past technical movements

D- its current price, expected return and standard deviation

Answer:

D

Explanation:

The change in the price of a security that follows a Weiner process is determined by its standard deviation and expected return. To get the price itself, we need to add this change in price to the current price. Therefore the future price in a Weiner process is determined by all three of current price, expected return and standard deviation.

Question 2

Question Type: MultipleChoice

Which of the following situations are not suitable for applying parametric VaR:

1. Where the portfolio's valuation is linearly dependent upon risk factors

2. Where the portfolio consists of non-linear products such as options and large moves are involved

3. Where the returns of risk factors are known to be not normally distributed

Options:

A- 1and 2

B- 2 and 3

C- 1 and 3

D- All of the above

Answer:

B

Explanation:

Parametric VaR relies upon reducing a portfolio's positions to risk factors, and estimating the first order changes in portfolio values from each of the risk factors. This is called the delta approximation approach. Risk factors include stock index values, or the PV01 for interest rate products, or volatility for options. This approach can be quite accurate and computationally efficient if the portfolio comprises products whose value behaves linearly to changes in risk factors. This includes long and short positions in equities, commodities and the like.

However, where non-linear products such as options are involved and large moves in the risk factors are anticipated, a delta approximation based valuation may not give accurate results, and the VaR may be misstated. Therefore in such situations parametric VaR is not advised (unless it is extended to include second and third level sensitivities which can bring its own share of problems).

Parametric VaR also assumes that the returns of risk factors are normally distributed - an assumption that is violated in times of market stress. So if it is known that the risk factor returns are not normally distributed, it is not advisable to use parametric VaR.

Question 3

Question Type: MultipleChoice

The sensitivity (delta) of a portfolio to a single point move in the value of the S&P500 is $100. If the current level of the S&P500 is 2000, and has a one day volatility of 1%, what is the value-at-risk for this portfolio at the 99% confidence and a horizon of 10 days? What is this method of calculating VaR called?

Options:

A- $14,736, parametric VaR

B- $4,660, Monte Carlo simulation VaR

C- $14,736, historical simulation VaR

D- $4,660, parametric VaR

Answer:

A

Explanation:

If the current level of the S&P 500 is 2000, and a single day volatility is 1%, and the delta (ie change in portfolio value from a one point change) is $100, then the 1 day volatility for the portfolio in dollars is 2000 * 1% * $100 = $2,000.

At the 99% confidence level, the value of the inverse cumulative density function for the normal distribution is 2.33 (=NORMSINV(99%), in Excel). Therefore the 1 day VaR will be 2.33 * $2000 = $4,660. Extending it to 10 days using the square root of time rule, we get the

10 day VaR as equal to SQRT(10)*4660 = $14,736.

Since this method of calculating VaR relies upon a delta approximation of a risk factor (in this case the S&P500), it is the parametric approach to calculating VaR (the other methods being historical simulation, and Monte Carlo simulation).

The 2015 Handbook provides an excellent example of parametric (and other) VaR calculations in Chapter 3 of Volume III of Book 3. The spreadsheet used for the illustration can be downloaded from http://www.prmia.org/prm-exam/handbook-resources.

Question 4

Question Type: **MultipleChoice**

Pick underlying risk factors for a position in an equity index option:

1. Spot value for the index

2. Risk free interest rate

3. Volatility of the underlying

4. Strike price for the option

Options:

A- 1 and 4

B- 1, 2 and 3

C- 2 and 2

D- All of the above

Answer:

B

Explanation:

The index option is affected by the spot value for the underlying index, as also the risk free interest rate, or the zero rate for the duration of the option. It is also affected by the volatility of the underlying. The 'strike price' is set and is fixed at the time the option is purchased, and therefore is not a risk factor.

Therefore other than IV, all other choices are valid risk factors that underlie an equity index option.

Other instruments may have other risk factors - for example, a long forex position will have the spot exchange rate as the only risk factor.

Question 5

Question Type: MultipleChoice

Which of the following decisions need to be made as part of laying down a system for calculating VaR:

1. How returns are calculated, eg absoluted returns, log returns or relative/percentage returns

2. Whether VaR is calculated based on historical simulation, Monte Carlo, or is computed parametrically

3. Whether binary/digital options are included in the portfolio positions

4. How volatility is estimated

Options:

A- 1, 2 and 4

B- 2 and 4

C- 1 and 3

D- All of the above

Answer:

A

Explanation:

While conceptually VaR is a fairly straightforward concept, a number of decisions need to be made to select between the different choices available for the exact mechanism to be used for the calculations.

There is more than one way to calculate returns. Absolute returns may be relevant for risk factors where the size of the movement is unrelated to its current value. For other risk factors, the returns might scale with the size of the existing value of the risk factor, eg equity prices. The right return definition needs to be adopted for each risk factor, therefore 'I' is a correct choice.

The risk analyst has a Choice 'b'etween parametric VaR, Monte Carlo, and historical simulation based VaR. 'II' therefore is one of the decisions that needs to be made (though historical simulation is the choice most often made).

The decision as to what to include in a portfolio is not a decision that is affected by choices made for VaR calculations. 'III' is therefore not a correct answer.

There are multiple ways to calculate volatility - including decisions on how long back in time to go for the data, and whether volatility clustering needs to be accounted for using EWMA or GARCH. Therefore 'IV' is a correct answer.

Question 6

Question Type: **MultipleChoice**

Which of the following decisions need to be made as part of laying down a system for calculating VaR:

1. The confidence level and horizon

2. Whether portfolio valuation is based upon a delta-gamma approximation or a full revaluation

3. Whether the VaR is to be disclosed in the quarterly financial statements

4. Whether a 10 day VaR will be calculated based on 10-day return periods, or for 1-day and scaled to 10 days

Options:

A- 1 and 3

B- 2 and 4

C- 1, 2 and 4

D- All of the above

Answer:

C

Explanation:

While conceptually VaR is a fairly straightforward concept, a number of decisions need to be made to select between the different choices available for the exact mechanism to be used for the calculations.

The Basel framework requires banks to estimate VaR at the 99% confidence level over a 10 day horizon. Yet this is a decision that needs to be explicitly made and documented. Therefore 'I' is a correct choice.

At various stages of the calculations, portfolio values need to be determined. The valuation can be done using a 'full valuation', where each position is explicitly valued; or the portfolio(s) can be reduced to a handful of risk factors, and risk sensitivities such as delta, gamma, convexity etc be used to value the portfolio. The decision between the two approaches is generally based on computational efficiency, complexity of the portfolio, and the degree of exactness desired. 'II' therefore is one of the decisions that needs to be made.

The decision as to disclosing the VaR in financial filings comes after the VaR has been calculated, and is unrelated to the VaR calculation system a bank needs to set up. 'III' is therefore not a correct answer.

Though the Basel framework requires a 10-day VaR to be calculated, it also allows the calculation of the 1-day VaR and and scaling it to 10 days using the square root of time rule. The bank needs to decide whether it wishes to scale the VaR based on a 1-day VaR number, or compute VaR for a 10 day period to begin with. 'IV' therefore is a decision to be made for setting up the VaR system.

Question 7

Question Type: **MultipleChoice**

Which of the following is not a measure of risk sensitivity of some kind?

Options:

A- PL01

B- Convexity

C- CR01

D- Delta

Answer:

A

Explanation:

Measures of risk sensitivity include delta, gamma, vega, PV01, convexity and CR01, among others. They allow approximating the change in the value of a portfolio from a change (generally small) in one of the underlying risk factors.

Risk sensitivity measures are derivatives of the value of the portfolio, calculated with respect to the risk factor. Some risk sensitivity measures are second derivatives, and allow a more precise calculation of the change in the value of the portfolio. Many risk sensitivities are represented by Greek letter, but not all.

Delta () is a measure of the change in portfolio value based on a 1% change in the value of the underlying. Gamma () is a second order derivative that improves the calculation as part of a Taylor expansion. CR01 is a measure of the change due to a 1 basis point change in the credit spread. PL01 is not a measure of any kind of risk sensitivity, it does not mean anything.

Question 8

Question Type: MultipleChoice

Which of the following are true:

1. The total of the component VaRs for all components of a portfolio equals the portfolio VaR.

2. The total of the incremental VaRs for each position in a portfolio equals the portfolio VaR.

3. Marginal VaR and incremental VaR are identical for a $1 change in the portfolio.

4. The VaR for individual components of a portfolio is sub-additive, ie the portfolio VaR is less than (or in extreme cases equal to) the sum of the individual VaRs.

5. The component VaR for individual components of a portfolio is sub-additive, ie the portfolio VaR is less than the sum of the individual component VaRs.

Options:

A- 2 and 5

B- 2 and 4

C- 1 and 2

D- 1, 3 and 4

Answer:

D

Explanation:

Statement I is true - component VaR for individual assets in the portfolio add up to the total VaR for the portfolio. This property makes component VaR extremely useful for risk disaggregation and allocation.

Stateent II is incorrect, the incremental VaRs for the positions in a portfolio do not add up to the portfolio VaR, in fact their sum would be greater.

Statement III is correct. Marginal VaR for an asset or position in the portfolio is by definition the change in the VaR as a result of a $1 change in that position. Incremental VaR is the change in the VaR for a portfolio from a new position added to the portfolio - and if that position is $1, it would be identical to the marginal VaR.

Statement IV is correct, VaR is sub-additive due to the diversification effect. Adding up the VaRs for all the positions in a portfolio will add up to more than the VaR for the portfolio as a whole (unless all the positions are 100% correlated, which effectively would mean they are all identical securities which means the portfolio has only one asset).

Statement V is in incorrect. As explained for Statement I above, component VaR adds up to the VaR for the portfolio.

Question 9

Question Type: **MultipleChoice**

Which of the formulae below describes incremental VaR where a new position 'm' is added to the portfolio? (where p is the portfolio, and V_i is the value of the i-th asset in the portfolio. All other notation and symbols have their usual meaning.)

A)

$$VaR_{p+a} - VaR_p$$

B)

$$MVaR_i V_i$$

C)

$\delta\,\gamma$

D)

$$\sum_{i=1}^{n} CVaR_i = VaR_p$$

Options:

A- Option A

B- Option B

C- Option C

D- Option D

Answer:

A

Explanation:

Incremental VaR is the change in portfolio VaR resulting from a change in a single position. This is accurately described by VaR_(p+a) - VaR_p. The other answers are incorrect, and describe other concepts.

It is important to know and understand the ideas behind MVaR (marginal VaR), CVaR (component VaR) and iVaR (incremental VaR), and the differences between them.