

FRM Part I Exam

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Questions - Valuation and Risk Models

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Reading 47: Measures of Financial Risk

Q.939 Billy Marquette has recently joined a small company that provides private commercial jets to royal families, government officials, and directors of big firms. Marquette is a retired commercial pilot with a very basic understanding of finance. On his first day, he is handed a report on risk management measures. The excerpt from the report says “due to volatility in oil prices, the company has a weekly 90% VaR of €20,000”. Which of the following is the most appropriate explanation of the excerpt?

- A. There is a 90% probability that the company will experience a loss of €2,000 on a weekly basis.
 - B. There is a 10% probability that the company will experience a loss of €20,000 in any given week.
 - C. There is a 90% probability, in any given week, that the company will experience a loss of more than €20,000.
 - D. There is a 10% probability, in any given week, that the company will experience a loss in excess of €20,000.
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Q.3328 An investment company has a portfolio which has the following ordered performance by historical data. Calculate the expected shortfall $ES_{0.95}$.

Probability	1%	5%	10%	12%	15%
Profit/Loss	-500	-300	-100	-90	-50

- A. 300
 - B. 340
 - C. 400
 - D. 425
-

Q.3329 An investment company has a portfolio which has the following ordered performance by historical data. Calculate the expected shortfall, $ES_{0.99}$, i.e., at 99% level of confidence

Probability	1%	5%	10%	12%	15%
Profit/Loss	-500	-300	-100	-90	-50

- A. 168
 - B. 400
 - C. 460
 - D. 500
-

Q.3397 A hypothetical portfolio of securities exhibits the following expected losses shown:

Name	Loss (million dollar)	Probability (%)
1	10	40%
2	20	35%
3	50	15%
4	100	5%
5	200	2.5%
6	225	2%
7	250	0.5%

Calculate the expected shortfall at the 95% and 99% confidence level?

- A. $ES(95\%) = \$225$ million; $ES(99\%) = \$237.5$ million
 - B. $ES(95\%) = \$215$ million; $ES(99\%) = \$237.5$ million
 - C. $ES(95\%) = \$217.5$ million; $ES(99\%) = \$250$ million
 - D. $ES(95\%) = \$225$ million; $ES(99\%) = \$250$ million
-

Q.3398 The VaR of a loan portfolio is computed at various confidence levels:

Confidence Level	VaR
95.0%	2%
95.5%	5%
96.0%	6%
96.5%	7%
97.0%	9%
97.5%	10%
98.0%	13%
98.5%	15%
99.0%	20%
99.5%	30%

What is the expected shortfall at the 97.5% confidence level?

- A. 0.1
 - B. 0.15
 - C. 0.195
 - D. 0.2
-

Q.4639 A hypothetical portfolio has an annual 1% VaR of \$45,000. Which of the following statements is the **most likely** correct about the portfolio?

- A. The loss over the next year is expected to be at most \$45,000 in 1% of the cases.
 - B. There is only a 1% chance that we will gain more than \$45,000 over the next year.
 - C. The likelihood of losing more than \$45,000 over the next year is 1%.
 - D. The likelihood of losing no more than \$45,000 over the next year is 1%.
-

Q.4640 The investment returns and the corresponding probabilities are given in the following table:

Returns	Probability
20%	0.1
30%	0.3
-10%	0.2
15%	0.3
7%	0.1

What is the standard deviation of the investment returns?

- A. 0.142
 - B. 0.154
 - C. 0.132
 - D. 0.138
-

Q.4641 An investor invests his funds in two correlated assets, A and B. The standard deviation of asset A is 20%, and that of B is 15%. The portfolio variance is 2.84%. Given that the investor has three times as much money in asset A than he has in asset B, what is the correlation coefficient between assets A and B?

- A. 0.0962
 - B. 0.2133
 - C. 0.3994
 - D. 0.8078
-

Q.4643 The losses from a portfolio for one year are normally distributed with mean -10 and standard deviation 20. What is the value of the 99% expected shortfall?

- A. 52.85
 - B. 37.4
 - C. 42.85
 - D. 26.43
-

Q.6218 An investor is evaluating two portfolios to determine which lies on the efficient frontier. For each point on the efficient frontier, at least one portfolio can be constructed from all available investments with the expected risk and return corresponding to that point. How does the inclusion of a risk-free asset impact the efficient frontier?

- A. The efficient frontier becomes a straight line, representing a linear relationship between expected return and standard deviation.
 - B. The efficient frontier bends upwards, with higher risk for each level of expected return.
 - C. The efficient frontier remains a curve but shifts upwards, providing higher returns for each level of risk.
 - D. The efficient frontier shifts downwards, providing lower returns for each level of risk.
-

Q.6219 Financial analysts often assume that returns of risky financial assets such as equities follow a normal distribution. However, empirical evidence shows that actual returns exhibit characteristics different from the normal distribution. Which of the following is a significant difference between the normal distribution and the actual return distribution of equities?

- A. The returns of equities usually exhibit lighter tails compared to a normal distribution.
 - B. The returns of equities often exhibit lower kurtosis compared to a normal distribution.
 - C. The returns of equities generally display skewness and heavier tails than those of a normal distribution.
 - D. The returns of equities usually show fewer extreme values compared to what is predicted by a normal distribution.
-

Q.6220 A financial risk manager is using the VaR measure to evaluate the risk of a portfolio over a specific time period and confidence level. VaR is commonly used due to its simplicity and the ease of understanding the associated risk under normal market conditions. However, what are the major limitations of VaR despite its widespread use?

- A. VaR can be subadditive, which violates one of the desirable properties of a coherent risk measure.
 - B. VaR does not capture the potential losses in the tail beyond the confidence level.
 - C. VaR assumes normal distribution of returns, which may not accurately reflect the actual distribution of asset returns.
 - D. VaR does not consider the correlations between different assets during periods of market stress.
-

Q.6221 Which of the following statements correctly describes the property of subadditivity in the context of a coherent risk measure?

- A. A risk measure is subadditive if adding a risk-free asset to a portfolio does not change its risk measure.
 - B. A risk measure is subadditive if the risk of a combined portfolio does not exceed the sum of the risks of the individual portfolios.
 - C. A risk measure is subadditive if increasing the size of a portfolio proportionally increases its risk measure.
 - D. A risk measure is subadditive if the risk of a portfolio decreases linearly with additional diversification.
-

Q.6222 Value at Risk (VaR) is a widely used risk management tool that estimates the potential loss in value of a portfolio over a defined period for a given confidence interval. Despite its popularity, there are significant limitations to VaR that question its effectiveness as a comprehensive risk measure. Why is VaR not considered a coherent risk measure?

- A. VaR fails to account for the current size of the portfolio.
 - B. VaR fails the monotonicity property of coherent risk measures.
 - C. VaR does not account for the skewness and kurtosis of return distributions.
 - D. VaR fails the subadditivity test required for coherent risk measures.
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Q.6685 A portfolio manager operates within the mean-variance framework, having constructed an efficient frontier using only risky assets. Upon introducing a risk-free asset available for both borrowing and lending at a single rate, the investment opportunity set is fundamentally reshaped. The manager must now advise a diverse client base, ranging from extremely risk-averse to highly risk-seeking investors. How does the introduction of this risk-free asset alter the composition of the optimal portfolio of risky assets for all investors, regardless of their individual risk tolerance?

- A. All investors hold a unique portfolio of risky assets tangent to the new frontier.
 - B. All investors hold the same portfolio of risky assets tangent to the new frontier.
 - C. Risk-averse investors combine the risk-free asset with a unique risky portfolio.
 - D. Risk-seeking investors leverage a unique risky portfolio using the risk-free rate.
-

Q.6686 A risk analyst at a large investment bank is reviewing the daily returns of a major equity index over the last 20 years. When comparing the empirical distribution of these returns to a normal distribution with the same mean and standard deviation, she observes that the actual distribution is more peaked around the mean and has a significantly higher frequency of extreme movements (both positive and negative) than the normal distribution would predict. Which statement correctly characterizes the relationship between the observed distribution of the index returns and the theoretical normal distribution, based on these common findings?

- A. Both small changes and large changes occur more frequently than the normal distribution predicts.
 - B. Both small changes and large changes occur less frequently than the normal distribution predicts.
 - C. Small changes occur more frequently, while large changes occur less frequently than predicted.
 - D. Small changes occur less frequently, while large changes occur more frequently than predicted.
-

Q.6687 A firm's risk manager is analyzing two portfolios, A and B, composed of different assets. Both portfolios are found to have a one-day 97.5% VaR of \$5 million. A stress test reveals that for Portfolio A, losses in the worst 2.5% of scenarios are uniformly distributed between \$5 million and \$7 million. For Portfolio B, losses in the worst 2.5% of scenarios are uniformly distributed between \$5 million and \$15 million. The manager decides to calculate Expected Shortfall (ES) to better distinguish the risk profiles. Given this information, how would the one-day 97.5% Expected Shortfall (ES) of the two portfolios compare?

- A. The ES for Portfolio A would be significantly lower than the ES for Portfolio B.
 - B. The ES for Portfolio A would be significantly higher than the ES for Portfolio B.
 - C. The ES for both portfolios would be equal to their VaR of \$5 million.
 - D. The ES for both portfolios would be equal and greater than their VaR.
-

Q.6688 A team of quantitative analysts is developing a new internal risk measure and must ensure it is coherent. They are testing the property of homogeneity. They begin with a base portfolio and calculate its risk measure. They then create a second portfolio by exactly doubling the position size of every asset in the base portfolio, with no change in market conditions or liquidity. According to the homogeneity property of a coherent risk measure, what should be the relationship between the risk measure of the new, larger portfolio and the original portfolio?

- A. The new risk measure should be exactly double the original risk measure.
 - B. The new risk measure should be less than double the original risk measure.
 - C. The new risk measure should be equal to the original risk measure plus a constant.
 - D. The new risk measure should be equal to the original risk measure squared.
-

Q.6689 A bank's risk department analyzes two distinct, independent portfolios, A and B. For a 99% confidence level, the VaR of Portfolio A is \$2 million and the VaR of Portfolio B is \$3 million. The sum of the individual VaRs is \$5 million. After merging the two portfolios, the department calculates the 99% VaR of the combined portfolio (A + B) and finds it to be \$6 million. Which property of a coherent risk measure has been violated by Value-at-Risk (VaR) in this scenario?

- A. The subadditivity property.
 - B. The monotonicity property.
 - C. The translation invariance property.
 - D. The homogeneity property.
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Q.6690 An asset manager is building an efficient frontier based on the mean-variance framework. The initial analysis includes a universe of 50 large-cap domestic stocks. The manager then decides to expand the investment universe to include 50 international stocks and 20 real estate investment trusts (REITs). The new assets exhibit different expected returns and volatilities, and crucially, their returns are imperfectly correlated with the initial set of domestic stocks. What is the most likely effect on the efficient frontier of risky assets when these additional, imperfectly correlated investments are included in the optimization?

- A. The new efficient frontier will offer superior risk-return combinations.
 - B. The new efficient frontier will offer inferior risk-return combinations.
 - C. The new efficient frontier will offer identical risk-return combinations.
 - D. The new efficient frontier will offer higher returns only for the same level of risk.
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Q.6691 A risk measure's coherence can be assessed by examining how it assigns weights to the different percentiles of a loss distribution. A measure is deemed coherent only if these weights satisfy a specific condition. Consider a proposed risk measure where the analysis of its weighting scheme reveals that the weight assigned to the 98th percentile of the loss distribution is 1.0, while the weight assigned to the 99th percentile is 0.0. Based on this weighting scheme, which statement correctly assesses the coherence of this risk measure?

- A. The measure is not coherent because the weights are not a non-decreasing function of the percentile.
 - B. The measure is coherent because the weights are a non-decreasing function of the percentile.
 - C. The measure is not coherent because only Expected Shortfall is a coherent spectral risk measure.
 - D. The measure is coherent because it correctly identifies a specific percentile as the risk threshold.
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Q.6692 A regulator is drafting new capital adequacy rules and is focused on ensuring the mandated risk measure promotes sound risk management. A key principle is that diversification should be encouraged, not penalized. An analyst's report demonstrates a scenario where merging two separate portfolios leads to a required capital charge (based on the risk measure) that is greater than the sum of the capital charges for the individual portfolios. The regulator must choose between Value-at-Risk (VaR) and Expected Shortfall (ES). How do VaR and Expected Shortfall (ES) respectively relate to the subadditivity axiom, which is central to the regulator's diversification principle?

- A. Expected Shortfall always satisfies subadditivity, whereas Value-at-Risk can violate it.
 - B. Value-at-Risk always satisfies subadditivity, whereas Expected Shortfall can violate it.
 - C. Both Value-at-Risk and Expected Shortfall always satisfy the subadditivity axiom.
 - D. Both Value-at-Risk and Expected Shortfall can violate the subadditivity axiom.
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Q.6693 A quantitative hedge fund designs its own internal capital allocation model using a spectral risk measure. This approach allows the fund to reflect its unique risk aversion profile. The fund's management is particularly concerned with avoiding catastrophic "black swan" events and wants the risk measure to be disproportionately influenced by the most extreme potential losses in the tail of the distribution. To implement this high degree of tail-risk aversion within a coherent spectral risk measure, how should the weights assigned to the percentiles of the loss distribution be structured?

- A. Weights must be non-decreasing and increase more sharply at higher percentiles.
 - B. Weights must be non-decreasing but increase less sharply at higher percentiles.
 - C. Weights must be zero below a threshold and constant for all higher percentiles.
 - D. Weights must be zero for all percentiles except for one specific high percentile.
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Q.6694 An analyst is examining the diversification benefits of combining two risky assets, Asset X and Asset Y. She plots the set of all possible risk-return combinations for portfolios of X and Y under different assumptions for the correlation coefficient (ρ) between their returns. How does the curvature of the efficient frontier for this two-asset portfolio change as the correlation coefficient (ρ) decreases from +1.0 toward -1.0?

- A. The frontier becomes more curved, shifting further to the left.
 - B. The frontier becomes less curved, shifting further to the right.
 - C. The frontier's curvature decreases, but its position is unchanged.
 - D. The frontier's curvature increases, but its position is unchanged.
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Q.6695 Consider two investment portfolios, Portfolio P and Portfolio Q. Due to their structuring with complex derivatives, it has been mathematically proven that in every possible future market state, the loss from Portfolio P is guaranteed to be greater than or equal to the loss from Portfolio Q. No scenario exists where Q loses more than P. According to the properties of a coherent risk measure, what must be the relationship between the risk measures of Portfolio P and Portfolio Q?

- A. The risk measure of P must be greater than or equal to the risk measure of Q.
 - B. The risk measure of P must be strictly greater than the risk measure of Q.
 - C. The risk measure of P must be equal to the risk measure of Q.
 - D. The risk measure relationship cannot be determined without knowing the probabilities.
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Q.6696 An aggressive investor, operating within the mean-variance framework, decides that the expected return of the market portfolio is insufficient for her goals. She borrows funds at the risk-free rate and invests the total amount (her own capital plus the borrowed funds) into the market portfolio. Where will this investor's final portfolio be located on the risk-return graph?

- A. On the Capital Market Line, at a point beyond the market portfolio.
 - B. On the Capital Market Line, at a point between the risk-free asset and the market portfolio.
 - C. On the original curved efficient frontier, at a point with higher return.
 - D. Outside the efficient frontier, in a previously unattainable region.
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Q.6956 A key limitation of Value-at-Risk (VaR) that makes it not a coherent risk measure is that it:

- A. ignores the distribution of losses beyond the specified confidence level.
 - B. is not subadditive.
 - C. cannot be calculated using the historical simulation method.
 - D. always assumes returns are normally distributed .
-

Reading 48: Calculating and Applying VaR

Q.972 After using of the historical simulation method, you have been provided with the following 30 ordered percentage returns for an asset:

[-18, -16, -14, -12, -10, -9, -7, -7, -6, -6, -6, -5, -5, -4, -4, -4, -2, -1, 0, 0, 2, 3, 6, 12, 12, 13, 15, 15, 18, 28]

The value-at-risk (VaR) and expected shortfall (ES), at 90% confidence level, respectively, are closest to:

- A. Var: 14; ES: 17
 - B. Var: 14; ES: 16
 - C. Var: 12; ES: 16
 - D. Var: 12; ES: 24
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Q.973 Stuart Broad, a risk analyst working with Macquarie Bank compiles data of 100 simulated percentage returns of the bank's assets:

[-13.33, -12.25, -11.75, -10.66, -8.45, -7.13, -6.48, -5.29 ... 2.89, 3.56, 4.29, 5.38, 6.65, 7.89, 8.54, 9.64, 10.27, 12.28, 13.25]

Using the data, he calculates the expected shortfall (ES) and the value at risk (VAR) of the bank's assets at the 95 percent confidence level using the historical simulation method. What is the expected shortfall and the value at risk computed by Stuart Broad?

- A. Expected shortfall: 12; Value at Risk: 9.45
 - B. Expected shortfall: 11.49; Value at Risk: 9.95
 - C. Expected shortfall: 12; Value at Risk: 8.45
 - D. Expected shortfall: 11.49; Value at Risk: 8.45
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