Lesson 4.1 Quiz: Measuring Market Risk

Module 4: The Risk Problem

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Digital Finance — BSc Course

Q1: VaR Definition

What does a "95% daily VaR of CHF 10,000" mean?

A. You will lose exactly CHF 10,000 every day
B. On 95% of trading days, your loss will not exceed CHF 10,000
C. You will gain at least CHF 10,000 on 95% of days
D. Your maximum possible loss is CHF 10,000

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Answer: (B) VaR is a threshold: on 95% of days losses stay below this number. On the remaining 5%, losses can exceed it.

Q2: Sorted Returns Intuition

You have 1,000 days of historical returns sorted from worst to best. To find the 95% VaR, which value do you look at?

- (A) The 5th worst return
- (B) The 50th worst return
- (C) The 500th worst return
- (D) The 950th return

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Answer: (B) 5% of 1,000 = 50. The 50th worst return is the 95% VaR cutoff.

Q3: ES vs VaR

What is the key difference between Expected Shortfall (ES) and VaR?

A. ES is always smaller than VaR
B. ES measures the average loss in the worst cases beyond VaR
C. ES only applies to bond portfolios
D. VaR captures tail risk better than ES

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Answer: (B) VaR gives the threshold; ES gives the average loss beyond that threshold. ES is always $\geq$ VaR in magnitude and captures tail severity.

Q4: Volatility Definition

In finance, "volatility" most commonly refers to:

A. The maximum daily price change
B. The average daily return
C. The standard deviation of returns
D. The correlation between two assets

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Answer: (C) Volatility is the standard deviation of returns — it measures how much an asset's price fluctuates around its average.

Q5: Volatility Clustering

"Volatility clustering" means:

A. All stocks have the same volatility
B. Periods of high volatility tend to be followed by more high volatility
C. Volatility decreases over time
D. Large positive returns always follow large negative returns

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Answer: (B) Volatility clustering means big moves follow big moves — calm and turbulent periods cluster together.

Q6: VaR Calculation

A portfolio of CHF 200,000 has a daily volatility (σ) of 1.5%. Using the variance-covariance method, what is the approximate 95% daily VaR? (Hint: 95% VaR $\approx 1.65 \times \sigma$)

- A CHF 3,000
- B CHF 4,950
- C CHF 6,600
- D CHF 9,900

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- (D) CHF 9,900

Answer: (B) VaR $= 1.65 \times 1.5\% \times 200{,}000 = 1.65 \times 3{,}000 =$ CHF 4,950.

Q7: ES from Sorted Returns

You sort 200 daily returns from worst to best. The 10 worst are: -5.1%, -4.3%, -3.9%, -3.5%, -3.2%, -2.8%, -2.5%, -2.3%, -2.1%, -1.9%. What is the 95% Expected Shortfall?

- (A) -1.9%
- (B) -2.1%
- (C) -3.16%
- (D) -5.1%

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- (C) -3.16%
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Answer: (C) 5% of 200 = 10 worst returns. ES = average of those 10:
$(5.1 + 4.3 + 3.9 + 3.5 + 3.2 + 2.8 + 2.5 + 2.3 + 2.1 + 1.9)/10 = 31.6/10 = 3.16\%$. So ES $= -3.16\%$. (Note: -1.9% is the VaR, not the ES.)

Q8: Annualizing Volatility

A stock has a daily volatility of 2%. What is the approximate annualized volatility? (Assume 252 trading days.)

- A 8%
- B 15.9%
- C 31.7%
- D 504%

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Answer: (C) Annualized vol $= 2\% \times \sqrt{252} = 2\% \times 15.87 \approx 31.7\%$.

Q9: Monte Carlo Concept

In a Monte Carlo VaR simulation with 10,000 scenarios, how do you find the 99% VaR?

- (A) Take the average of all 10,000 scenarios
- (B) Take the 100th worst outcome
- (C) Take the 9,900th outcome
- (D) Take the single worst outcome

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Answer: (B) 1% of 10,000 = 100. The 100th worst outcome is the 99% VaR threshold.

Q10: EWMA vs Rolling Window

After a sudden market shock, which volatility estimate reacts faster?

- A 20-day rolling standard deviation
- An EWMA estimate with $\lambda = 0.94$
- Both react at the same speed
- Neither reacts to shocks

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Answer: (B) EWMA gives more weight to recent observations, so it reacts faster to new information than a simple rolling window which weights all days equally.

Q11: Correlation Interpretation

Two assets have a correlation of -0.3. What does this mean?

- (A) They always move in opposite directions
- (B) They tend to move in opposite directions, but not always
- (C) They move independently
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Answer: (B) A correlation of -0.3 means they *tend* to move in opposite directions, but it is a moderate negative correlation, not a perfect one. It implies diversification benefit.

Q12: Portfolio Diversification

Two stocks each have 20% volatility. If their correlation is 0.0 (completely uncorrelated) and you invest 50% in each, what is the portfolio volatility?

A. 20%
B. 14.1%
C. 10%
D. 0%

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Answer: (B) $\sigma_p = \sqrt{0.5^2 \times 0.20^2 + 0.5^2 \times 0.20^2 + 2 \times 0.5 \times 0.5 \times 0 \times 0.20 \times 0.20} = \sqrt{0.02} = 0.1414 = 14.1\%$. Diversification reduced risk from 20% to 14.1%.

Q13: Fat Tails Impact

A risk manager uses the variance-covariance VaR method (which assumes normally distributed returns). Real returns have fat tails with excess kurtosis of 5. What is the most likely consequence?

- **A** The model overestimates VaR (too conservative)
- **B** The model underestimates VaR (too optimistic)
- **C** The model is unaffected by fat tails
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Answer: (B) The normal distribution underestimates the probability of extreme events. Fat tails mean more extreme losses than the model predicts, so VaR is underestimated.

Q14: Method Comparison

Which VaR method makes **no assumption** about the shape of the return distribution?

A. Variance-covariance
B. Historical simulation
C. Both make distribution assumptions
D. Neither makes distribution assumptions

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Answer: (B) Historical simulation uses actual past returns without assuming any distribution shape. Variance-covariance assumes normality. (Monte Carlo can be flexible depending on the model used.)

Q15: Crisis Correlations

During the 2008 financial crisis, correlations between most asset classes increased sharply. What does this imply for VaR models that use historical correlations from calm periods?

A. VaR was accurately estimated during the crisis
B. VaR was overestimated (too conservative)
C. VaR was underestimated because diversification benefit was overstated
D. Correlations do not affect VaR calculations

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Answer: (C) Models using calm-period correlations assumed more diversification benefit than actually existed during the crisis. This led to underestimating portfolio risk.

Q16: Systematic vs Diversifiable Risk

Adding more stocks to a portfolio reduces volatility but only to a floor. What is this floor called?

- A. Diversifiable risk
- B. Idiosyncratic risk
- C. Systematic (market) risk
- D. Total risk

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- (D) Total risk

Answer: (C) Systematic (market) risk is the risk that affects all stocks and cannot be diversified away. Only hedging or reducing total exposure can address it.

Q17: VaR Limitation

Two portfolios have the same 95% VaR of CHF 50,000. Portfolio X's worst-case loss is CHF 55,000; Portfolio Y's worst-case loss is CHF 500,000. Which statement is true?

- A VaR correctly identifies Y as riskier
- B VaR treats both as equally risky, which is misleading
- C VaR always captures tail risk accurately
- D Portfolio Y's worst case is irrelevant to risk measurement

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- (B) VaR treats both as equally risky, which is misleading
- (C) VaR always captures tail risk accurately
- (D) Portfolio Y's worst case is irrelevant to risk measurement

Answer: (B) VaR only measures the threshold, not what happens beyond it. Both portfolios have the same VaR, but Y has catastrophic tail risk. Expected Shortfall would distinguish them.

Q18: GARCH Concept

A risk analyst says: "After yesterday's 4% drop, I expect tomorrow's volatility to be higher than usual." Which concept supports this statement?

- A The normal distribution assumption
- B Volatility clustering / GARCH
- C The risk-return trade-off
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- (B) Volatility clustering / GARCH
- (C) The risk-return trade-off
- (D) Diversification

Answer: (B) Volatility clustering (formalized by GARCH) means that large moves predict further large moves. Yesterday's big drop increases the forecast of tomorrow's volatility.

Q19: VaR Method Selection

A bank manages a complex portfolio of stocks, bonds, derivatives, and currencies. Which VaR method is most appropriate and why?

- **A** Historical simulation — it requires no assumptions
- **B** Variance-covariance — it is fastest to compute
- **C** Monte Carlo — it can handle complex, non-linear payoffs
- **D** All methods give identical results for complex portfolios

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Answer: (C) Monte Carlo is the most flexible method. It can model non-linear instruments (like options and derivatives), complex dependencies, and fat-tailed distributions. Historical simulation is limited to scenarios that actually occurred; variance-covariance assumes normality and linearity.

Q20: Regulatory Shift

Basel III regulations shifted from VaR to Expected Shortfall (ES) as the primary risk measure for banks. What is the most compelling reason for this change?

- A ES is easier to compute than VaR
- B ES captures the severity of losses beyond the VaR threshold, not just the threshold itself
- C ES always gives a lower (less conservative) risk estimate
- D VaR was never used by banks before Basel III

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- (D) VaR was never used by banks before Basel III

Answer: (B) ES measures the average loss in the tail, capturing how bad things get beyond VaR. After the 2008 crisis showed that VaR underestimated tail losses, regulators adopted ES to better reflect catastrophic risk.