

AFIN8003 - Workshop 5

Banking and Financial Intermediation

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! Workshop 5: measuring what could go wrong

Last week you learned what VaR and ES mean. Today you compute them, first by hand and then in Excel.

Plan for the hour:

1. **Part A: Concept check** (about 10 min). Five questions. Self-mark.
2. **Part B: A worked example** (about 20 min). A 99% VaR and ES calculation, step by step.
3. **Part C: VaR and ES in Excel** (about 25 min). Live demo, and the method you will use for the **individual assignment**. Follow along on your laptop.
4. **Part D: Take-home practice set**. The full drill. Do these before next week.

Bring a laptop with Excel if you can, plus a calculator.

1 Part A: Concept check

1. The risk related to the uncertainty of an FI's earnings on its trading portfolio caused by changes in market conditions is:
 - ☐ liquidity risk
 - ☐ interest rate risk
 - ☐ credit risk
 - ☐ market risk
2. Market risk, as measured by daily earnings at risk (DEAR), includes which of the following components?
 - ☐ potential adverse move in yield
 - ☐ price sensitivity of the position
 - ☐ dollar market value of the position
 - ☐ All of the listed options are correct.
3. Price volatility includes which of the following components?
 - ☐ potential adverse move in yield and price sensitivity of the position
 - ☐ potential favourable move in yield and price sensitivity of the position
 - ☐ potential adverse move in yield and dollar market value of the position
 - ☐ potential favourable move in yield and dollar market value of the position
4. Which of the following is often criticised for its need to assume a normal or symmetric distribution for all asset returns?
 - ☐ back simulation
 - ☐ RiskMetrics
 - ☐ Monte Carlo simulation

☐ CreditMetrics

5. The expected shortfall (ES) approach to measuring market risk has the advantage that it:

- ☐ measures tail risk precisely
- ☐ is less comprehensive than VAR
- ☐ will not be considered in Basel III
- ☐ measures credit risk

2 Part B: A worked example

! The setup

The equity desk at **Meridian Bank** holds a **\$50 million** position in an index fund. The risk team estimates that daily returns have a **mean of zero** and a **standard deviation of 1.2%**, and assumes they are normally distributed. The Board wants two numbers at 99% confidence: how bad is a bad day, and how bad is it when it is worse than that?

2.1 Step 1: the 99% VaR

For a normal distribution, the cut-off sits a fixed number of standard deviations below the mean:

$$\text{VaR} = \underbrace{2.33}_{99\% \text{ multiplier}} \times \underbrace{1.2\%}_{\sigma} \times \underbrace{\$50\text{m}}_{\text{position}}$$

99% one-day VaR = \$_____

2.2 Step 2: the 99% ES

VaR told us where the tail begins. ES tells us the **average loss once we are inside it**.

For a normal distribution the ES multiplier at 99% is **2.665** in place of 2.33:

$$\text{ES} = 2.665 \times 1.2\% \times \$50\text{m}$$

99% one-day ES = \$_____

2.3 Step 3: scale it to 10 days

Regulators usually want a 10-day figure, not a one-day figure. Assuming daily shocks are independent:

$$10\text{-day VaR} = 1\text{-day VaR} \times \sqrt{10}$$

10-day 99% VaR = \$_____

2.4 Step 4: the assumption that did all the work

Every number above rests on one line: *“assume returns are normally distributed.”*

Discuss briefly:

- Suppose the desk's worst day last year was -3.8% . How many standard deviations is that, and roughly how often should a normal distribution produce such a day?
- If days like that happen more often than the model says, which of your two numbers is more wrong: the VaR or the ES?

3 Part C: VaR and ES in Excel

! Follow along

This section is a live demo, and it is also the **method you will use in the individual assignment**. The spreadsheet `Workshop5.xlsx` is on iLearn. Open it now and build the formulas along with me rather than reading them later.

4 Part D: Take-home practice set

These consolidate the mechanics. Attempt them before next week; worked answers are released with the solutions version.

4.1 Q1

The mean change in the daily yields of a 15-year, zero-coupon bond has been 5 basis points (bp) over the past year with a standard deviation of 15 bp. Use these data and assume the yield changes are normally distributed.

- (a) What is the highest yield change expected if a 99 per cent confidence limit is required; that is, adverse moves will not occur more than one day in 100?
- (b) What is the highest yield change expected if a 95 per cent confidence limit is required?

4.2 Q2 - DEAR

Bank Alpha has an inventory of AAA-rated, 15-year zero-coupon bonds with a face value of \$400 million. The bonds are currently yielding 9.5% in the over-the-counter market.

- (a) What is the modified duration of these bonds?
- (b) What is the price volatility if the potential adverse move in yields is 25 basis points?
- (c) What is the DEAR?
- (d) If the price volatility is based on a 99% confidence limit and a mean historical change in daily yields of 0.0%, what is the implied standard deviation of daily yield changes?

4.3 Q3 - VaR and ES

Consider the following discrete probability distribution of payoffs for two securities, A and B, held in the trading portfolio of an FI:

Probability	A	Probability	B
50%	\$80m	50%	\$80m
49%	\$60m	49%	\$68m
1%	-\$740m	0.6%	-\$740m
		0.4%	-\$1393m

Which of the two securities will add more market risk to the FI's trading portfolio according to the VaR and ES measures?

4.4 Extra

Today is 3 September 2026. Suppose you are the head of risk management of a financial institution (FI) that engages in fixed-income securities investment. The FI is financed by long-term borrowings and equity. The balance sheet (in millions) of the FI today is as below.

Assets		Liabilities and Equity	
Treasury bonds	\$300	Long-term borrowings	\$350
Corporate bonds	\$200	Equity	\$150
Total	\$500	Total	\$500

The risk management team estimates that the standard deviation of the Treasury bonds' daily returns is 2% and the standard deviation of the corporate bonds' daily returns is 5%. The mean return of both bonds is 0%. The correlation between the daily returns of Treasury and corporate bonds is estimated to be 0.7.

- (a) What is the 5-day Value at Risk (VaR) of the bond portfolio at a 99% confidence level? Assume that returns follow a normal distribution.
- (b) How to interpret the calculated VaR from (a)? What is conditional VaR or Expected Shortfall?