REDmoney seminars

Stress testing Credit, Market and Operational risk

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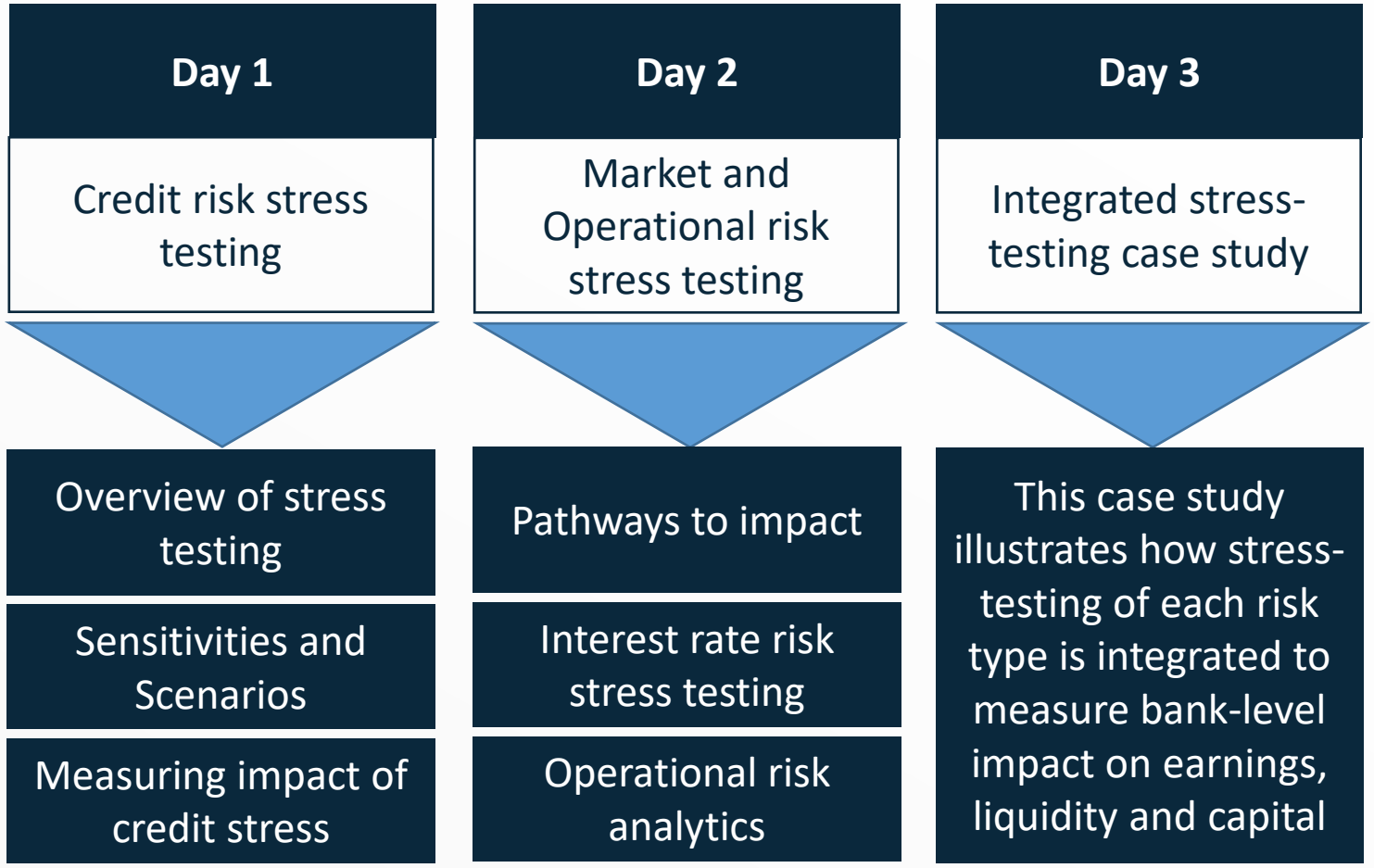
What is This Course About ?



Market risk stress testing

What is this part about?

- Pathways to the impact of market and macroeconomic stress on market risk
- Stress-testing interest rate risk in the banking book
- Stressed Value-at-Risk and losses for FX, equities, and bond investments
- Expected shortfall versus value-at-risk
- Basel III market risk amendment and its relevance to stress testing

What is market risk?

- Market risk is the risk of loss due to changes in market prices
- Examples include:
  - Equity price risk
  - Bond price risk
  - Commodities price risk
  - Interest rate risk
    - This risk factor is also a macroeconomic risk
  - FX risk
  - CDS spreads
- Market risk differs from other risks due to *price discovery*
  - Market prices can be observed using financial data providers, such as Bloomberg
  - Other risks, e.g. operational risk, liquidity risk have no “observable prices” as such

Market factors - pathways to impact on market risk

Market factors	Pathways to impact on market risk
Equity prices	• Depreciation in share portfolio value • Deterioration in collateral value for share margin financing business • Prevents share issuance opportunities to raise new equity capital
Commodity prices	• An increase in raw materials input costs for corporate obligors leads to lower net income and higher credit risk • Commodity price risk arises in binding MPO transactions if purchaser reneges (CCR) • Commodity price risk arises in non-binding MPOs and Murabaha as bank takes price risk until commodity is sold
CDS spreads	• Higher CDS spreads indicates tighter credit conditions, higher borrowing costs, and potential liquidity squeeze • Corporate obligor credit ratings can also migrate, causing an increase in credit risk and decrease in bond MTMs (mark to markets)
Bond yields	• Direct impact on bond/Sukuk investment valuation and funding costs
Bond new issuance volumes	• Impacts ability to raise new funding through Sukuk issuance. Hence, liquidity risk
FX rates	• Impacts both stock and flow exposures across multiple asset classes • However, if only serving domestic depositors and loan beneficiaries, risk is minimal

Macroeconomic factors - pathways to impact on market risk

Macroeconomic factors	Pathways to impact on market risk
Inflation/money supply	• Increases price uncertainty and raw materials input costs for corporate obligors, leading to lower net income and higher credit risk • Higher inflationary expectations also increase nominal interest rates
Interest rates	• Higher interest makes debt servicing more difficult for obligors and increases credit risk • However, NIM typically widens if interest rates increase • Changes in LIBOR usually offset between money market placements and takings • Prepayment of fixed rate mortgages as interest rates fall, e.g. BBA structure
GDP growth	• Economic expansion may have ambiguous effects on market risk • For example, if growth is due to weakening the domestic currency to increase exports, then servicing foreign debt is more difficult as foreign currency repayments are more expensive
House prices	• House Price Index is linked to changes in collateral values, so impacts credit risk through LGD
Unemployment	• Impacts credit risk mostly, with no direct effect on market risk

What market risks should stress testing focus on?

Risk type	Sub-category	Pathways to financial impact
Interest rate risk	LIBOR	• Income earned on money market placements • Income earned on variable rate assets, e.g. leases • Expense paid on money market takings (Tawarruk) • Expense paid on floating rate debt, e.g. Sukuk
	Swap rates	• Pricing new mortgages • Exposure to prepayment risk due to fixed rate mortgages • Gain/loss on interest/profit rate swaps if used to hedge
	Treasury Yields	• Pricing newly issued Sukuk • MTM gain/loss on fixed rate bonds and Sukuk investments
FX risk	Exposure currencies	• Exposure arises as transaction exposure (flow risk) and translation exposure (stock risk) • Gain/loss on derivative instruments, e.g. FX forwards
Equity risk	Individual shares versus Equity index (KLCI)	• Impacts collateral value in share margin financing business • Gain/loss on stock portfolios

Stress testing interest rate risk in the banking book

- One of the most important market risks for credit institutions to stress test is *interest rate risk in the banking book*
- Interest rate changes impact cash flows received on assets and cash flows paid on liabilities because the rate characteristics of assets and liabilities are often mismatched
  - Changes in interest rates can cause a net effect on NIM due to *repricing gaps*
  - But interest rate decreases in particular will also cause the spread between asset yields and funding costs narrows
  - This is explained in the next slide
- IRRBB is managed within the bank's Asset/Liability Management framework
  - Hence, stress testing IRRBB is also managed within the same ALM framework

Repricing gap analysis explained using a simplified example

- Consider a bank with the following balance sheet:

Balance sheet	Rate type	Amount	Current Yield
Asset-1	Fixed	100	9%
Asset-2	Floating	100	9%
Liability	Floating	150	3%
Equity	Non-rate sensitive	50	

- Suppose interest rates decrease, what will happen?
  - Asset-1: no change in interest income
  - Asset-2: interest income decreases
  - Liability: funding cost decreases
- Now let's explore the size of these changes

Repricing gap analysis explained using a simplified example

Balance sheet	Rate type	Amount	Initial Rate	New Rate	Change
Asset-1	Fixed	100	9.00%	9.00%	0.00%
Asset-2	Floating	100	9.00%	7.75%	-1.25%
Liability	Floating	150	3.00%	2.00%	-1.00%

- There are 2-things to notice:
  1. Only the rate on the rate sensitive positions decreased
  2. The margin between Asset-2 and the Liability *narrowed*
     - Initially the margin was 6.00%, i.e., 9% minus 3%
     - Then it became 5.75%, i.e., 7.75% minus 2.00%
     - This is typical of rate falls and is called *margin compression*
- So, is the impact on earnings?

Repricing gap analysis explained using a simplified example

Balance sheet	Rate type	Amount	Initial Rate	Income/exp	New rates	Income/exp
Asset-1	Fixed	100	9.00%	9.00	9.00%	9.00
Asset-2	Floating	100	9.00%	9.00	7.75%	7.75
Liability	Floating	150	3.00%	4.50	2.00%	3.00
Net Gain/Loss				13.50		13.75

- There is a net gain for the bank! This is because the repricing gap is negative, i.e., there are more liabilities than assets which reprice as rates fall
  - The repricing gap = 100 – 150 = (50)
  - Hence, a rate fall of 1% would create additional income of 0.50
- But the actual increase was 0.25, i.e., less than 0.50
- The difference due to *margin compression* (which individually, always creates a loss)
  - There is a <u>further</u> 0.25% fall in asset yields impacting 100 assets

Repricing gap analysis explained using a simplified example

- The main problem with the previous analysis is that we assumed asset and liability amounts did not change!
  - In a stress in which interest rates fall, some assets will run-off without replacement, and the balance sheet will shrink
  - Consequently, the NIM will be collected on a smaller amount of net assets
  - This will result in a stress loss compared to the base case scenario
- How do assets and liabilities change in a stress?

Stress testing interest rate risk in the banking book

1. Slow down in economic growth impacting the size of the banking book
   - Existing loans run-off and are replaced at a far slower rate, causing the banking book to contract
   - Undrawn commitments are drawn as loan beneficiaries take advantage of funding opportunities still available to them
2. Prepayment of fixed rate mortgages as homeowners refinance at cheaper rates
3. Government moratoriums on loan repayments reduces income and cash inflows in the banking book
4. Deposits run-off, with replacement funding at a higher cost
   - Depositors experience financial stress, e.g., become unemployed, and ultimately consume savings

Stress testing interest rate risk in the banking book

Example

- Bank XYZ prepares a repricing gap analysis for FY-0

	FY-0	Below 12m	After 12m	NRS
Cash	675			675
Investment securities	6,500	3,250	3,250	
Loans advances financing	23,000	6,900	16,100	
Other	4,825	1,206	1,206	2,413
Total assets	35,000	11,356	20,556	3,088
Deposits	20,500	12,300	4,100	4,100
PSIAs	3,400	2,720	680	
Interbank	2,900	2,900		
Other	5,200	1,300	1,300	2,600
Total Liabilities	32,000	19,220	6,080	6,700
Equity	3,000			3,000
Total liabs. and equity	35,000	19,220	6,080	9,700
Incremental gap		(7,864)	14,476	(6,613)
Cumulative gap		(7,864)	6,613	0

Due to the large amount of deposit funding and fixed rate assets, the bank is *net liability sensitive*
i.e., NIM will decrease if interest rates rise, and increase if interest rates fall

Stress testing interest rate risk in the banking book

12m repricing gaps	FY-1	Ave. Yields	FY-2	Ave. Yields	FY-3	Ave. Yields
Base case						
Assets	11,356	9.00%	12,100	9.00%	11,900	9.00%
Liabilities	(19,220)	3.00%	(19,890)	3.00%	(19,720)	3.00%
12m net gap	(7,864)		(7,790)		(7,820)	
NIM		6.00%		6.00%		6.00%
Bad case						
Assets	9,346	8.25%	6,486	7.25%	8,472	7.50%
Liabilities	(15,818)	2.50%	(10,661)	1.75%	(14,040)	1.75%
12m net gap	(6,472)		(4,175)		(5,568)	
NIM		5.75%		5.50%		5.75%
Worst case						
Assets	7,370	7.25%	3,604	5.75%	9,177	7.75%
Liabilities	(12,473)	1.75%	(5,924)	0.75%	(15,208)	2.25%
12m net gap	(5,103)		(2,320)		(6,031)	
NIM		5.50%		5.00%		5.50%

Observations:

1. The stress scenarios use the same interest rate changes we used in credit risk stress testing
   - So, we have integrated credit and market risk stress testing
2. Asset returns and cost of funds both fall as interest rates fall
3. The margin between asset returns and funding cost narrows as rates fall, i.e., margin compression

Stress testing interest rate risk in the banking book

Gain/loss: bad case versus base case

	FY-1	Rate chge	FY-2	Rate chge	FY-3	Rate chge
Bad case						
Assets	(251)		(619)		(436)	
Liabilities	181		410		346	
	(70)		(209)		(90)	
Attribution analysis:						
Asset volume	(181)		(505)		(309)	
Liabilities volume	102		277		170	
Rate change on assets	(70)		(114)		(127)	
Rate change on liabilities	79		133		176	
	(70)		(209)		(90)	
Rate change decomposition						
General level	32	-0.50%	52	-1.25%	70	-1.25%
NIM compression	(23)	-0.25%	(32)	-0.50%	(21)	-0.25%
	9		20		48	

Explanation of Rate change decomposition for FY-1

General level = -0.50% x Net gap in bad case = -0.50% x (6,472) = 32

NIM compression = -0.25% x 9,346 = (23)

Gain/loss method, e.g., for FY-1

Overall G/L Assets:
8.25% x 9,346 – 9.00% x 11,356 = (251)

Overall G/L Liabilities:
2.50% x (15,818) – 3.00% x (19,220) = 181

G/L due to change in Asset volume:
(9,346 – 11,356) x 9.00% = (181)

G/L due to change in Liability volume:
((15,818) - (19,220)) x 3.00% = 102

G/L due to Rate change on assets:
9,346 x (8.25% - 9.00%) = (70)

G/L due to Rate change on liabilities:
(15,818) x (2.50% - 3.00%) = 79

Stress testing interest rate risk in the banking book

Gain/loss: worst case versus base case

	FY-1	Rate chge	FY-2	Rate chge	FY-3	Rate chge
Worst case						
Assets	(488)		(882)		(360)	
Liabilities	358		552		249	
	(129)		(330)		(110)	
Attribution analysis:						
Asset volume	(359)		(765)		(245)	
Liabilities volume	202		419		135	
Rate change on assets	(129)		(117)		(115)	
Rate change on liabilities	156		133		114	
	(129)		(330)		(110)	
Rate change decomposition						
General level	64	-1.25%	52	-2.25%	45	-0.75%
NIM compression	(37)	-0.50%	(36)	-1.00%	(46)	-0.50%
	27		16		(1)	

Observations:

1. For both bad and worst cases, the fall in P&L is driven by a shrinking balance sheet
2. Since the bank is net liability sensitive, a fall in rates actually reduces funding costs faster than decreasing asset yields, which would have a positive P&L impact if the balance sheet did not contract.
3. Also note that a fall in rates causes margin compression, which reduces the gain from falling interest rates for a net liability sensitive bank.

Stress testing market risk: FX

- For BAU conditions, FX risk is usually measured using
  - Gross and Net open exposure
  - FX value-at-risk
- For stressed conditions, there are (at least) 2-reasons why VaR is not useful
  1. VaR does not capture *directional changes* in FX rates that matter to the bank due to assets and liabilities in each currency. Instead, it is based on a probability distribution of gains/losses. Hence, there is no way to reconcile losses to directional rate changes.
  2. VaR cannot be used to describe what happens in the tails of the distribution, which is where extreme losses arise.

Stress testing market risk: FX

- The method for FX stress testing:
  1. Determine which FX rates the bank is exposed to
  2. Determine the direction of change for each FX rate that would cause losses
  3. Determine the largest possible *plausible* rate change (based on historic rates) that would cause losses
  4. Measure the total loss that arises for each stressed change in FX rate
- Consistent with scenario analysis, note that:
  - There is no need to assess likelihood
  - The method does not need to recover historic correlations. For example, if historically MYRUSD is positively correlated with MYRGBP *on average*, then each rate is allowed to move in opposite directions in the stress scenario

Stress testing market risk: FX example

- XYZ bank has the following FX exposures

	USD	GBP
Assets	100	200
Liabilities	50	500
Net assets	50	(300)

- The bank is exposed to the risk of loss from: a) weakening of USD against MYR, and b) strengthening of GBP against MYR
- Bad-case and worst-case scenarios for FX then partially or fully apply the largest historic weaking or strengthening of the foreign currency against MYR.

Stress testing market risk: FX example

- Analysis of historic FX rates reveals the largest weakening/strengthening over different horizons, from which worst-case stress losses in each projection year are calculated:

	FY-1	FY-2	FY-3
Largest weakening of USD	10%	18%	25%
Largest strengthening of GBP	12%	23%	37%
Cumulative loss			
USD	5.0	9.0	12.5
GBP	36.0	69.0	111.0
Incremental loss			
USD	5.0	4.0	3.5
GBP	36.0	33.0	42.0

Stress testing market risk: equity investments

- Equity portfolios may consist of a large number of stocks
- It is therefore impractical to assess each stock individually
- The method:
  1. Calculate the volatility of the historic portfolio returns
  2. A stress scenario is then described in terms of the number of standard deviations of loss, e.g., 2 standard deviations for bad-case, and 3 standard deviations for worst-case. Note, however, that
     - volatility is not additive over time
     - variance is additive over time
     - Hence, calculation of losses is via calculating variances from volatility, recalling that variance is the square of volatility

Stress testing market risk: equity investments example

Initial value	10 MYR (million)		
	FY-1	FY-2	FY-3
Volatility	15%	15%	15%
Incremental variance	0.0225	0.0225	0.0225
Cumulative variance	0.0225	0.0450	0.0675
Cumulative volatility	15%	21%	26%
3 x cum. Vol.	45%	64%	78%
Stress cumulative loss	4.50	6.36	7.79
Stress incremental loss	4.50	1.86	1.43

Stress testing market risk: bond investments

- During a severe economic stress, the following things happen:
  1. The prices of all traded securities falls as perceived risk increases
     - This increases the YTMs of bonds, even though central bank lending rates are lowered to stimulate the economy
  2. CDS spreads widen significantly
     - This is due to the increased probability of default of bond issuers
     - Credit risk premiums increase more for lower rated bonds
  3. Bonds are downgraded
     - For example, AA rated bonds are downgraded to A or below
     - Many investment grade bonds are downgraded to junk
     - This is referred to as *credit ratings migration*

Stress testing market risk: bond investments

- To measure the financial impact of stress on bond portfolio valuations
  1. The MTM of the portfolio is recalculated using a *stressed bond YTM curve* for each bond rating
  2. The YTM curves are built using the historic relationship between macroeconomic factors, i.e., GDP, unemployment etc. and bond yields
     - The scenario YTMs at each maturity are then calculated using the scenario values of macroeconomic factors
     - The full scenario yield curve is constructed using a yield curve model (e.g., Moody's Analytics uses the Nelson-Siegal model)
  3. The financial impact is the difference in bond portfolio value between base case scenario and stress scenario

Stress testing market risk: bond investments example

- Suppose that historic analysis reveals the following relationship between 5-year AA-rated bond yields GDP, unemployment, inflation and HPI

$$YTM = 0.04 - 0.50GDP + 0.40UNEMP + 0.45INT + 0.015HPI$$

- Therefore, the 5-year YTMs are:

5-Year YTM (AA bonds)	Current	FY-1	FY-2	FY-3
Base case	4.45%	4.82%	5.18%	5.26%
Bad case	4.45%	7.99%	7.12%	6.10%
Worst case	4.45%	9.70%	13.20%	5.95%

Stress testing market risk: bond investments example

- Suppose that
  1. bonds are replaced as they run-off so that the maturity profile of the portfolio is maintained, and
  2. the entire portfolio is initially AA-rated

Initial MTM ($MM)	1000						
		Change in YTM - Worst case			Change in MTM - Worst case		
Duration	%age by val.	FY-1	FY-2	FY-3	FY-1	FY-2	FY-3
1.0	25%	Similar Calculations					
2.0	20%						
3.0	15%						
4.0	10%						
5.0	10%	5.25%	3.50%	-7.25%	-26.27	-17.04	34.68
7.0	10%	Similar calculations					
10.0	10%						

Stress testing market risk: bond investments example

- To illustrate the calculations for the sub-portfolio with 5-year duration:
  - The FY-1 bond loss is -$100MM * 5.0 * 5.25% = - $26.27MM
  - Then, for FY-2, the starting value of the sub-portfolio with 5-year duration = $100MM - $26.27MM = $73.73MM
  - Then, the FY-2 bond loss is -$73.73MM * 5.0 * 3.50% = -$17.04MM
  - Finally, the starting value of the sub-portfolio with 5-year duration = $73.37MM - $17.04MM = $56.33MM
  - Then, the FY-3 bond loss is - $56.33MM * 5.0 * (-7.25%) = $34.68MM, i.e., an incremental gain

*For simplicity, we have ignored convexity, and assumed that the %age of the portfolio by value in each duration is maintained through rebalancing

How to use expected shortfall for market risk capital requirements

- In response to extreme market risk losses during the Global Financial Crisis 2007-9, Basel released the “market risk amendment” in 2016
  - The market risk amendment is a further evolution of Basel III, and had to be implemented by European banks by 1 January 2020
- It requires the internal model calculation of market risk for capital adequacy requirements to adopt the method of *expected shortfall*
  - The idea of expected shortfall is to take the average market risk loss conditional on the VaR loss being exceeded
  - For example, if the VaR is $100,000, the expected shortfall is the average value of all losses bigger than $100,000, i.e., the arithmetic average of the tail losses
- Consequently, the market risk capital charge is much higher than if calculated using the previous VaR method

Basel III market risk amendment and stress testing

- The use of internal models for market risk (as opposed to the standardised approach) for risk capital calculations has evolved over time:
  - Basel II (2004) – risk charge is based on VaR x 3.0
  - Basel III (2010) – risk charge is based on {BAU VaR + stressed VaR} x 3.0 (or up to 4.0 if back-testing results are weak)
  - Basel III (2017) – introduced a new method for bonds and moved from VaR to expected shortfall
- The market risk amendment (2016) impacts stress testing through introducing the "jump to default" within the risk treatment of bonds, i.e. including a credit risk stress within the market risk stress-testing framework for bonds

Quiz: Market Risk Stress Testing

Which of the following best describes the expected change in net income due to a stressed decrease in interest rates for a bank which is *net asset sensitive*?

A. Net income decreases because assets are more sensitive than liabilities to rate changes
B. Net income decreases because liabilities are more sensitive than assets to rate changes
C. Net income increases because liabilities reprice faster than assets
D. Net income will not change because assets reprice as quickly as liabilities
E. None of the above

Operational risk stress testing

What is this part about?

- What is operational risk?
- Calculation methods for operational risk stress-testing
- Business continuity plans and stress testing
- Changes to operational risk analytics in the Basel III 2017 reforms

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What is operational risk?

- The risk of loss due *to failed people, processes, and systems, or from external events*
  - Includes legal risk, but excludes reputational and strategic risks
  - For example, a bank's IT system fails, leaving bank account holders unable to withdraw cash or make online payments
- Operational risk is extremely hard to measure because losses are hard to predict
  - The reason is that operational risk is net of mitigating controls, e.g., background checks on employees, delegated authority limits etc. It is difficult to *quantitatively* assess the effectiveness of controls
  - There are also many ways in which losses can arise. It is difficult to say with any certainty how large potential losses could be if an operational loss event arises

Calculation method: the steps

1. Create a universe of operational risks that can impact the bank
2. Identify frequency and severity for each risk. Most risks fall into the following categories
   - Type A: High frequency, Low impact, e.g., transactional failures
   - Type B: Low frequency, High impact, e.g., IT system failures
3. The quality of controls identifies the likelihood of operational losses
   - Stress scenarios can then be built around a story of the most likely possible failures which lead to losses
4. Calculate operational risk losses as the sum of the following:
   - Type A losses: A multiple of the standard deviation of *actual* historic operational risk losses
   - Type B losses: include an add-on loss for low frequency high impact operational loss events in stress scenarios

Stress testing operational risk: Historic loss event data

- There are 3 main challenges to calculate the standard deviation of historic losses:
  1. Number of historic operational loss events
     - Banks are required to keep a register of operational losses
     - The average (or median) loss is usually a poor indicator of potential future losses if calculated using too few data points
       - This is because the actual losses (and near misses) could be drawn from only a small section of the operational loss distribution
       - To resolve this issue, banks sometimes share operational loss data between themselves to increase sample size and estimate a probability distribution which better represents the incidence of loss events

Stress testing operational risk: Historic loss event data

2. Cataloguing operational loss “near miss” events and potential losses
    - Banks are required to keep a register of actual operational losses and near misses
        - Near misses are occurrences in which an operational loss could have arisen if a corrective action was not taken in time or circumstances had not changed favorably to prevent the loss
        - The problem with this is that if the near miss arises as a result of human error, then people may not disclose the near miss
        - As a result
            - the control remains weak and future actual losses are still likely
            - the operational loss event register omits important data

Stress testing operational risk: Historic loss event data

3. The use of multipliers for stress losses
    - Once the historic standard deviation of losses is calculated, a multiplier is used to increase future possible losses (based on history) to account for the fact that the future is rarely ever like the past
    - In other words, an upwards adjustment is made to increase the standard deviation of historic losses to account for future uncertainty
    - The question is, what is the required multiplier?
        - One solution is to use Key Risk Indicators (KRI) to project future changes in the operational risk environment, e.g., staff turnover
        - Operational risk may also be higher in the future due to greater reliance on technology, e.g., Fintech

Stress testing operational risk: Stress scenarios - IT

- Given the importance of client and transactional data to the operations of credit institutions, IT disruptions are amongst the top-most important operational risks
- IT disruptions arise in a number of ways
- For example:
  - Core banking systems go offline for a number of hours on a given day, or fail intermittently over a number of months
  - Data warehouses are destroyed, e.g., by fire, or cooling systems fail leading to overheating of data storage units and servers
  - Loss of data integrity leading to mismanagement of client accounts

Stress testing operational risk: Stress scenarios - IT

- The main financial impact of IT failures are:
  - Cost and time for repair/remedy
  - Disruption to operational processes and workflows
  - Loss of income for service-oriented business lines, e.g. ,brokerage fees
  - Reputational damage and loss of customers, e.g., due to ATM failures and loss of online banking facility, causing loss of income and liquidity outflows
  - Regulatory fines/penalties

Stress testing operational risk: Stress scenarios – BCPs and DRPs

- Business Continuity Plans (BCPs) are plans to keep operations running after a severe disruption, e.g., a flood, by moving to another location
- Disaster Recovery Plans (DRPs) are plans to resume normal operations following a disaster
  - Both BCPs and DRPs have information which can be used to evaluate the potential financial losses incurred in the event of IT failures in particular
  - The DRP usually includes a Business Impact Analysis (BIA) detailing:
    - System downtime until recovery plan is activated
    - Sub-systems considered most important to the bank's operations in order of importance, e.g., treasury operations
    - Likely impact if a failure arises from which the cost of recovery can be calculated

Stress testing operational risk: Stress scenarios - Other

- Other operational risk loss events typically used in stress scenario development include:
  - Internal and external Fraud, which is more likely in economic downturns
  - Product mis-selling, leading to compensation claims and regulatory penalties
  - Outsourcing failures, e.g., service disruption, turnaround times
  - New products, e.g., lack of staff training
  - Cyber-security, e.g., disclosure of private customer information
  - Breach of legal requirements related to physical storage of documents
  - Breach of AML and counter-terrorism laws, e.g., due to weak KYC practices
  - Breach of health and safety regulations
  - Loss of banking license
  - Physical damage to assets not adequately insured

Stress testing operational risk: Example calculation

- Bank XYZ has the following loss event data collected over the last 12-months

Loss event data	**Total**	IT	Conduct and practice	Physical assets	Health and Safety	Transaction processing	External Fraud	Internal Fraud
Actual losses								
No. of cases	186	22	13	0	1	101	49	0
Loss $	205,500	11,500	45,000	0	10,000	72,000	67,000	0
Near misses								
No. of cases	11	3	1	0	5	2	0	0
Loss $	893,000	578,000	15,000	0	50,000	250,000	0	0
Total losses								
No. of cases	197	25	14	0	6	103	49	0
Loss $	**1,098,500**	589,500	60,000	0	60,000	322,000	67,000	0

- Interestingly, the total annual operational loss is typically 1%-2% of the bank's capital charge for operational loss, and operational losses are therefore more than adequately covered by capital

Stress testing operational risk: Example calculation

- The bank changed its technology platform and working practices 5-years ago, and has collected the following loss event data since then:

		FY-16	FY-17	FY-18	FY-19	FY-20
No. cases		232	198	167	181	197
Total loss		2,789,000	867,000	1,978,000	1,101,000	1,098,500
No. cases	Average					195
	Median					197
	Std dev					24
Total loss	Average					1,566,700
	Median					1,101,000
	Std dev					804,496

- The stress operational loss for *high-frequency low impact* events used in each scenario is the average loss in the base case, + 1 Std Dev in bad case, +2 Std Devs in worst case

Stress testing operational risk: Example calculation

- The bank also includes a forward-looking stress scenario in which it suffers severe IT outages. These impact the bank in the following way:

Low frequency high impact operational loss

	FY-1	FY-2	FY-3
Base case	0	0	0
Bad case	0	500,000	0
Worst case	0	1,500,000	0

Stress testing operational risk: Example calculation

- Hence, the total operational risk loss in each year in the stress scenarios is as follows:

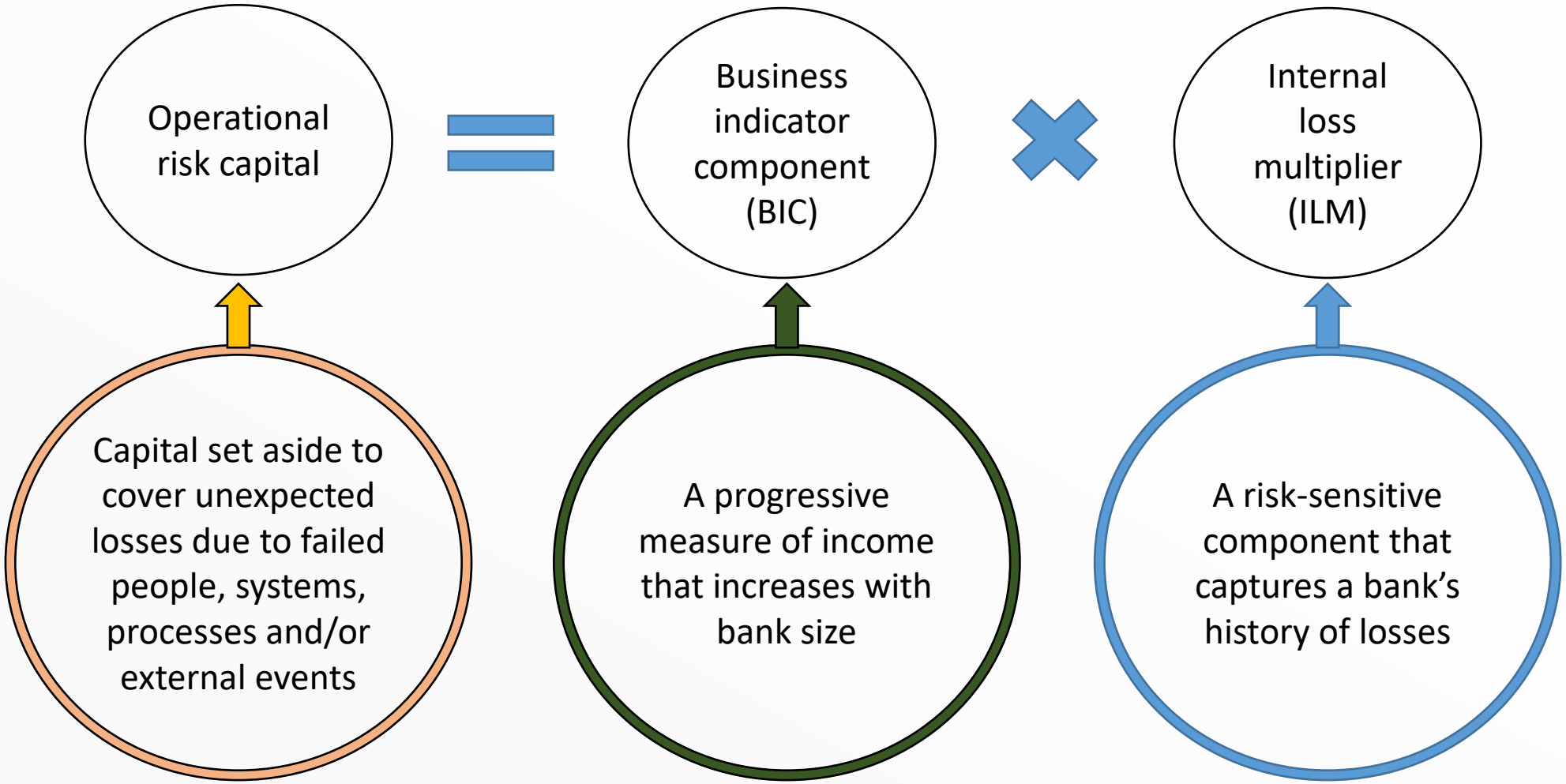
Total stressed operational risk losses

	FY-1	FY-2	FY-3
Base case	1,566,700	1,566,700	1,566,700
Bad case	2,371,196	2,871,196	2,371,196
Worst case	3,175,691	4,675,691	3,175,691

Basel III reform (2017) – New method for operational risk

- It is worth pointing out that the Basel method for operational risk charge calculation is changing
- In common with Basel III 2010, the reformed standard continues to assume that exposure to operational risk increases with gross income
- However, the new method also assumes that if a bank has experienced operational losses in the past, then it is more likely to do so in the future
  - The loss history is captured by the ILM (internal loss multiplier)
  - The ILM serves as a scaling factor for operational risk proxied by gross income (BIC, i.e. business indicator component)
- The new method has to be implemented in European banks by 1 January 2022

Basel III reform (2017) – New method for operational risk



Quiz: Operational Risk Updates

Which of the following is <u>true</u> of operational risk?

A. The Basic Indicator Approach (BIA) applies different %ages to revenue from each line of business in calculating the operational risk charge for a bank
B. The Standardised Approach (SA) calculates operational risk charges as 15% of total gross revenue
C. Stress testing operational risk uses loss event history for low frequency high impact event losses
D. Stress testing operational risk includes losses due to high frequency low impact events
E. None of the above

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Thank You