Lecture

INSTITUTE OF ACTUARIAL & QUANTITATIVE STUDIES

Siddharth Jani (CA, CFA, FRM, M.Com)

Class: TY BSc

Subject : Basel

Subject Code: PUSASQF606B

Chapter: Unit 2 Chapter 2

Chapter Name: Market, Credit and Operational risk capital

Today's Agenda

1. Types of risk

2. Approaches
    1. Basic Indicator Approach
    2. The Standardized Approach
    3. Advanced Measurement Approach
    4. Standardized Measurement Approach
        1. Business Indicator
        2. Business Indicator Component
        3. Internal loss multiplier calculation

3. SMA Capital Requirement Calculation

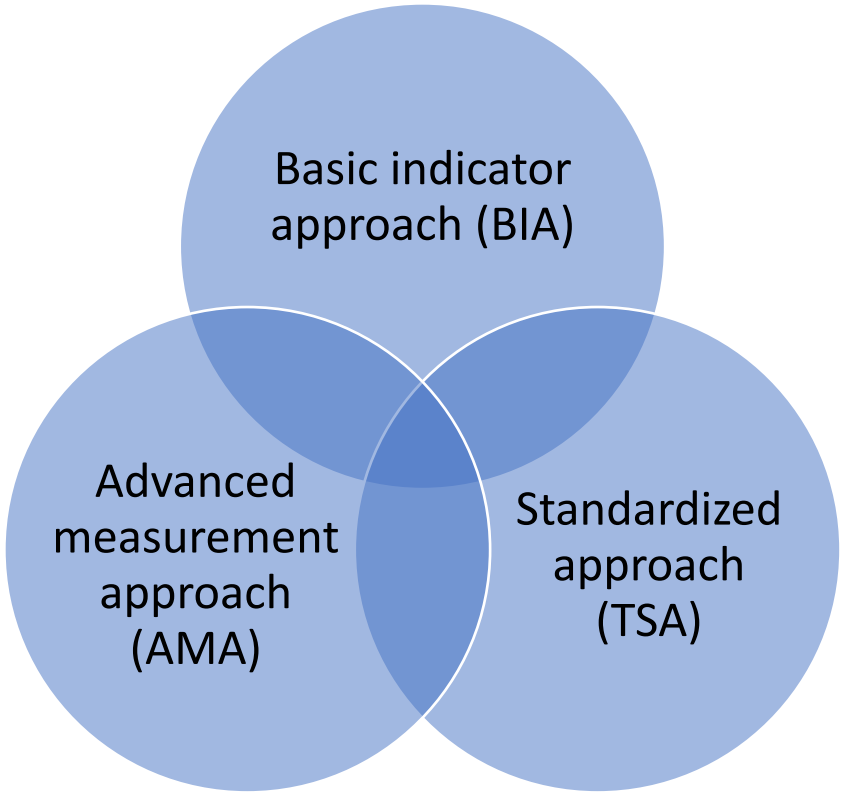
1 Types of risk

For a financial entity like a bank, it may face several types of risks. Some of them are related with the market environment, some related with its internal operations and some related with non-availability of cash. The following are those risks:

Credit Risk	Market risk	Operational Risk
• Credit risk refers to the probability of a borrower not repaying the loan and other contractual obligations. Delays in the payment of the loan also comes under credit risk.	• Market risk refers the probability of occurrence of losses on financial investments caused by adverse price movements. Decline in the price of shares bought by a bank is an example for market risk.	• Operational risk refers to the risk of losses related with the weak or faulty operations of the bank. Internal fraud as happened in the case of Punjab National Bank or faulty governance practices etc. may bring losses to the bank and thus are examples for operational risk.

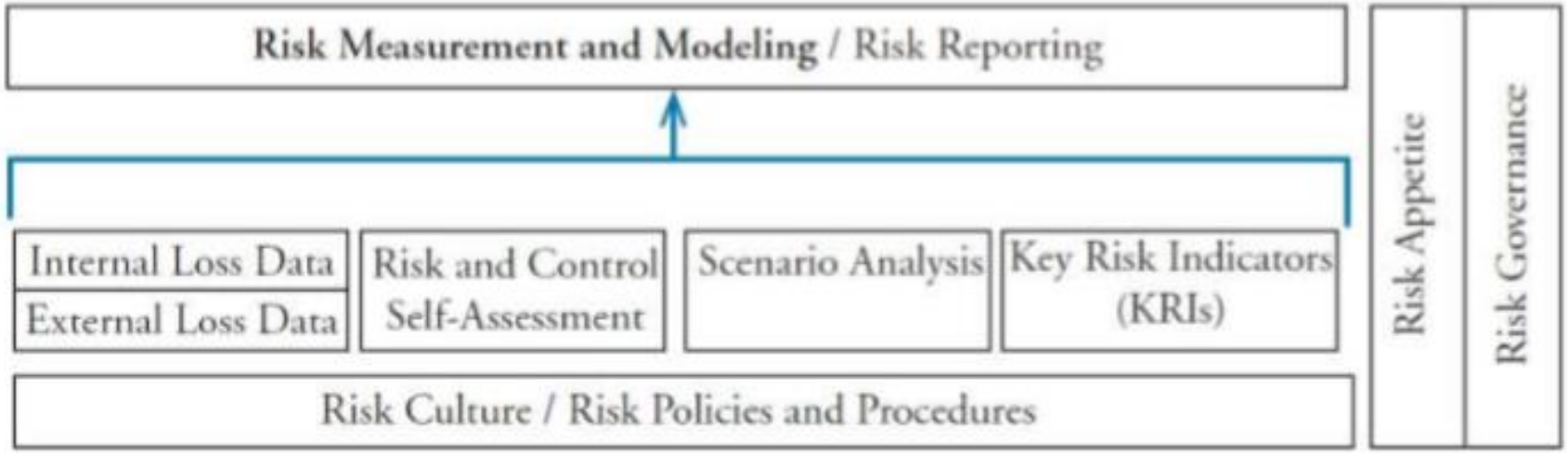
2 Approaches

Basel II proposed three approaches for determining the operational risk capital requirement (i.e., the amount of capital needed to protect against the possibility of operational risk losses).



2 Approaches

Role of Capital Modeling in the Operational Risk Framework



2.1 Basic Indicator Approach

With the BIA, operational risk capital is based on 15% of the banks annual gross income (GI) over a three-year period. Gross income in this case includes both net interest income and noninterest income.
The capital requirement, K_{BIA}, under this approach is computed as follows:

$$K_{BIA} = \frac{(\sum_{i=1}^{a} GI_i \times \alpha)}{n}$$

where:
GI = annual (positive) gross income over the previous three years
n = number of years in which gross income was positive
α = 15% (set by Basel Committee)

2.1 Basic Indicator Approach

- Firms using this approach are still encouraged to adopt the risk management elements outlined in the Basel Committee on Banking Supervision, Risk Management Group, Sound Practices for the Management and Supervision of Operational Risk.

- When a firm uses the BIA, it does not need loss data, risk and control self-assessment, scenario analysis, and business environment internal control factors (BEICF) for capital calculations.

- However, these data elements are needed as part of an operational risk framework to ensure risks are adequately identified, assessed, monitored, and mitigated.

- The BIA for risk capital is simple to adopt, but it is an unreliable indication of the true capital needs of a firm because it uses only revenue as a driver. For example, if two firms had the same annual revenue over the last three years, but widely different risk controls, their capital requirements would be the same.

- Note also that operational risk capital requirements can be greatly affected by a single years extraordinary revenue when risk at the firm has not materially changed.

2.1 Example

Calculating BIA capital charge
Assume Omega Bank has the following revenue results from the past three years:

	Year 1	Year 2	Year 3
Annual Gross Revenue (in $100 millions)	25.	30.	35.

Calculate the operational risk capital requirement under the BIA.

2.1 Example

Solution:

$$K_{BIA} = \frac{[(25+30+35)\times 0.15]}{3} = 4.5$$

Thus, Omega Bank must hold $450 million in operational risk capital under Basel II using the basic indicator approach.

2.2 The Standardized Approach

For the standardized approach (TSA), the bank uses eight business lines with different beta factors to calculate the capital charge. With this approach, the beta factor of each business line is multiplied by the annual gross income amount over a three-year period. The results are then summed to arrive at the total operational risk capital charge under the standardized approach.

The beta factors used in this approach are shown as follows:

- Investment banking (trading and sales): 18%.
- Settlement and payment services: 18%
- Investment banking (corporate finance): 18%
- Commercial banking: 15%
- Agency and custody services: 15%.
- Retail banking: 12%.
- Retail brokerage: 12%.
- Asset management: 12%.

2.2 The Standardized Approach

The standardized approach attempts to capture operational risk factors not covered by the BIA by assuming that different business activities carry different levels of operational risk. Any negative capital charges from business lines can be offset up to a maximum of zero capital.

The capital requirement, K_{TSA}, under this approach is computed as follows:

$$K_{TSA} = \frac{\left\{\sum_{3\,years} \max\left[\sum (GI_{1-8} \times \beta_{1-8}), 0\right]\right\}}{3}$$

where:
$GI_{1\text{-}8}$ = annual gross income in a given year for each of the eight business lines
$\beta_{1\text{-}8}$ = beta factors (fixed percentages for each business line)

2.2 Example

Calculating TSA capital charge:
Assume Gamma Bank has the following revenue (in $100 millions) for the past three years for its three lines of business: trading and sales, commercial banking, and asset management.

Business Line	Year 1	Year 2	Year 3
Trading and Sales	10.	15.	20.
Commercial Banking	5.	10.	15.
Asset Management	10.	10.	10.

Calculate the operational risk capital requirement under TSA.

2.2 Example

Solution:
To calculate TSA capital charge, we first incorporate the relevant beta factors as follows:

Business Line	Year 1	Year 2	Year 3
Trading and Sales	$10 \times 18\% = 1.8$.	$15 \times 18\% = 2.7$.	$20 \times 18\% = 3.6$.
Commercial Banking	$5 \times 15\% = 0.75$.	$10 \times 15\% = 1.5$.	$15 \times 15\% = 2.25$.
Asset Management	$10 \times 12\% = 1.2$.	$10 \times 12\% = 1.2$.	$10 \times 12\% = 1.2$.
Total	3.75.	5.4.	7.05.

2.2 Example

Next, enter these totals into the capital charge calculation as follows

$$K_{TSA} = \frac{(3.75 + 5.4 + 7.05)}{3} = 5.4$$

Thus, Gamma Bank must hold $540 million in operational risk capital under Basel II using the standardized approach.

2.3 Advanced Measurement Approach

The advanced measurement approach (AMA) allows banks to construct their own models for calculating operational risk capital. Although the Basel Committee allows significant flexibility in the use of the AMA, there are three main requirements.

A bank must:

- Demonstrate an ability to capture potentially severe fat-tail losses (banks must use 99.9th percentile events with a one-year time horizon).
- Include internal loss data, external loss data, scenario analysis, and business environment internal control factors (i.e., the four data elements).
- Allocate capital in a way that incentivizes good behavior (i.e., create incentives to improve business line operational risk management).

Under the AMA, capital requirements should be made for all seven risk categories specified by Basel II. Some firms calculate operational risk capital at the firm level and then allocate down to the business lines, while others calculate capital at the business line level. Capital calculations are typically performed by constructing a business line/event type matrix, where capital is allocated based on loss data for each matrix cell.

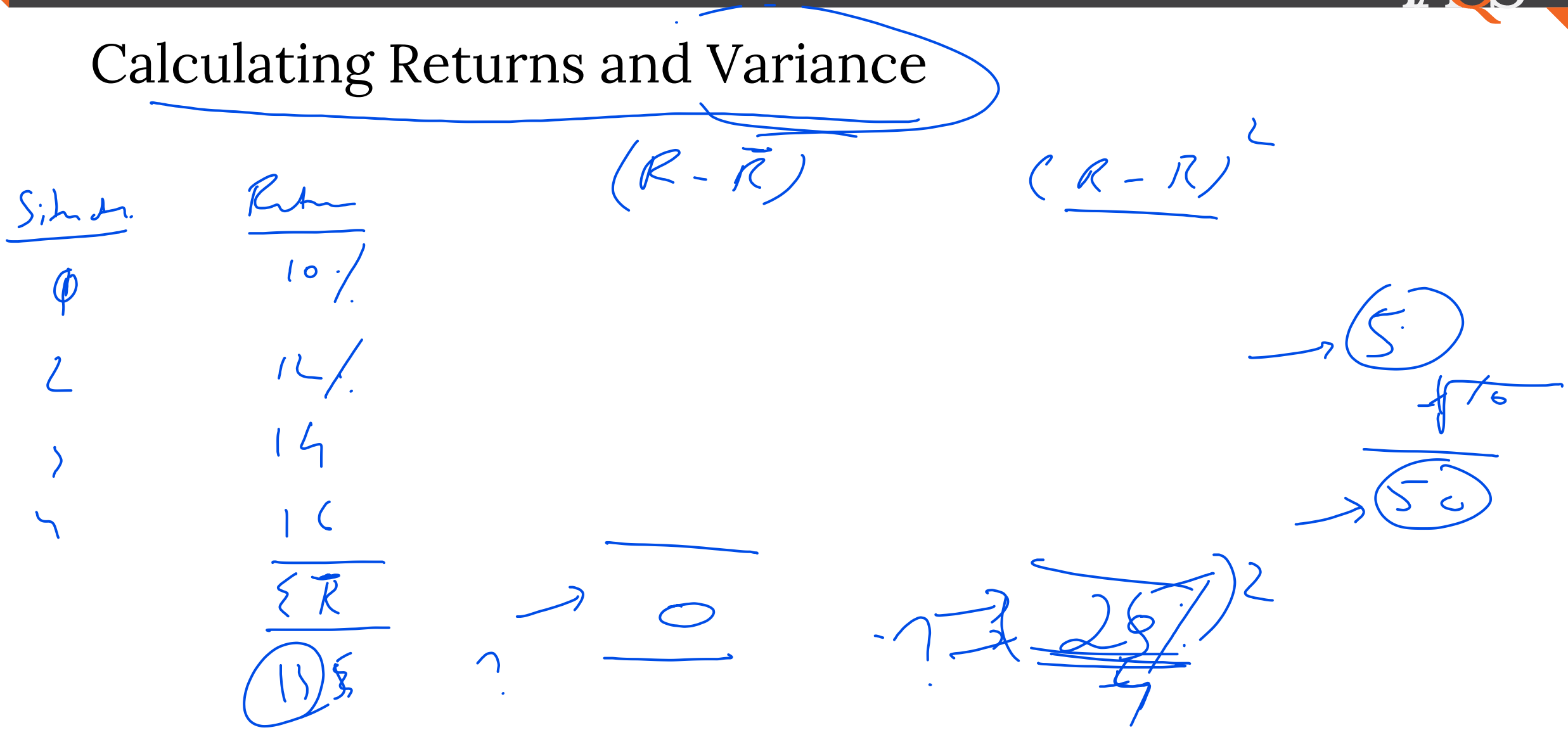
2.3 Advanced Measurement Approach

Additional quantitative requirements under the AMA include:

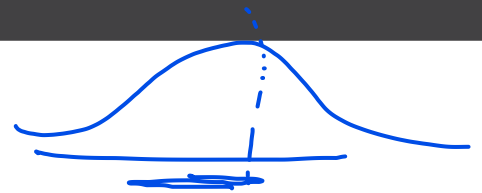
- The approach must capture all expected and unexpected losses and may only exclude expected losses under certain criteria as stated in Basel II.
- The approach must provide sufficient detail to ensure that fat-tail events are captured.
- The bank must sum all calculated cells in the business line/event type matrix and be able to defend any correlation assumptions made in its AMA model.
- All four data elements must be included in the model, including the use of internal and external data, scenario analysis, and business environment factors.
- The bank must use appropriate weights for the four data elements when determining operational risk capital.

While the four data elements must be considered in the capital calculations, many banks use some of these elements only to allocate capital or perform stress tests, and then adjust their models, rather than using them as direct inputs into capital calculations. Regulators have accepted many different types of AMA models, such as the loss distribution approach, given the rapid development of modeling operational risk capital.

Calculating Returns and Variance

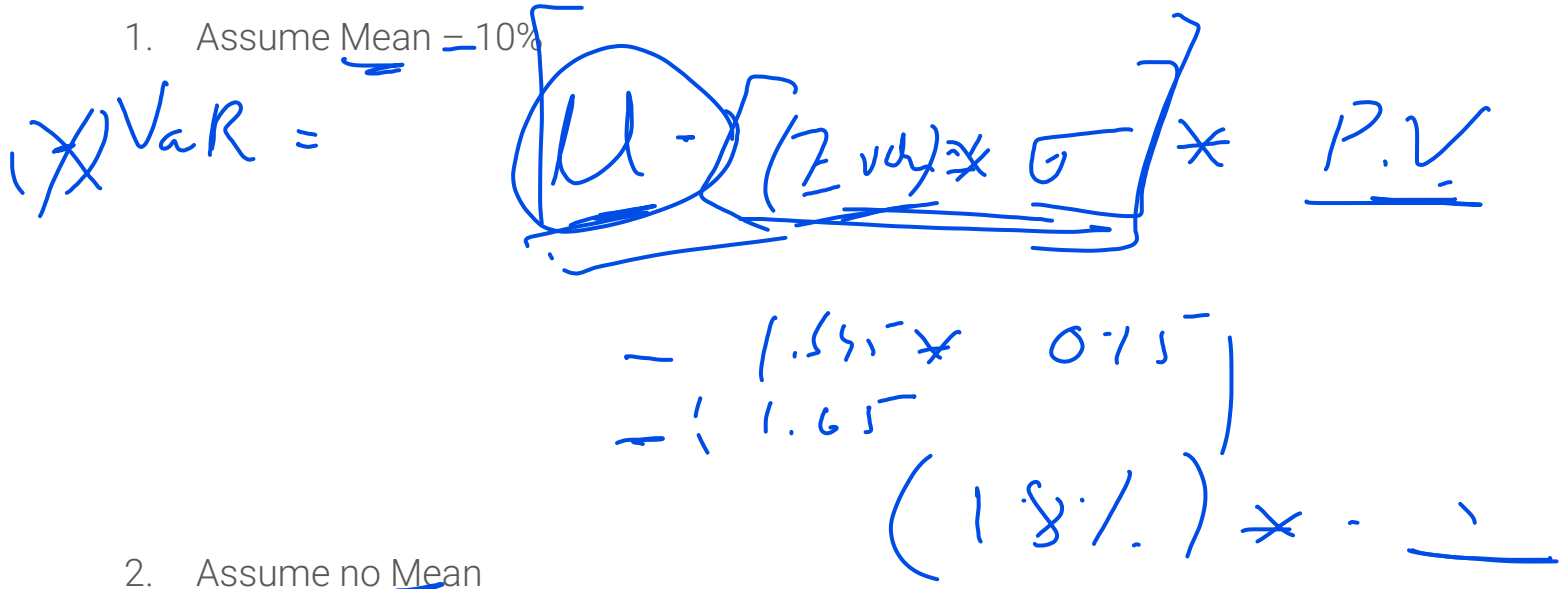


VaR Calculations

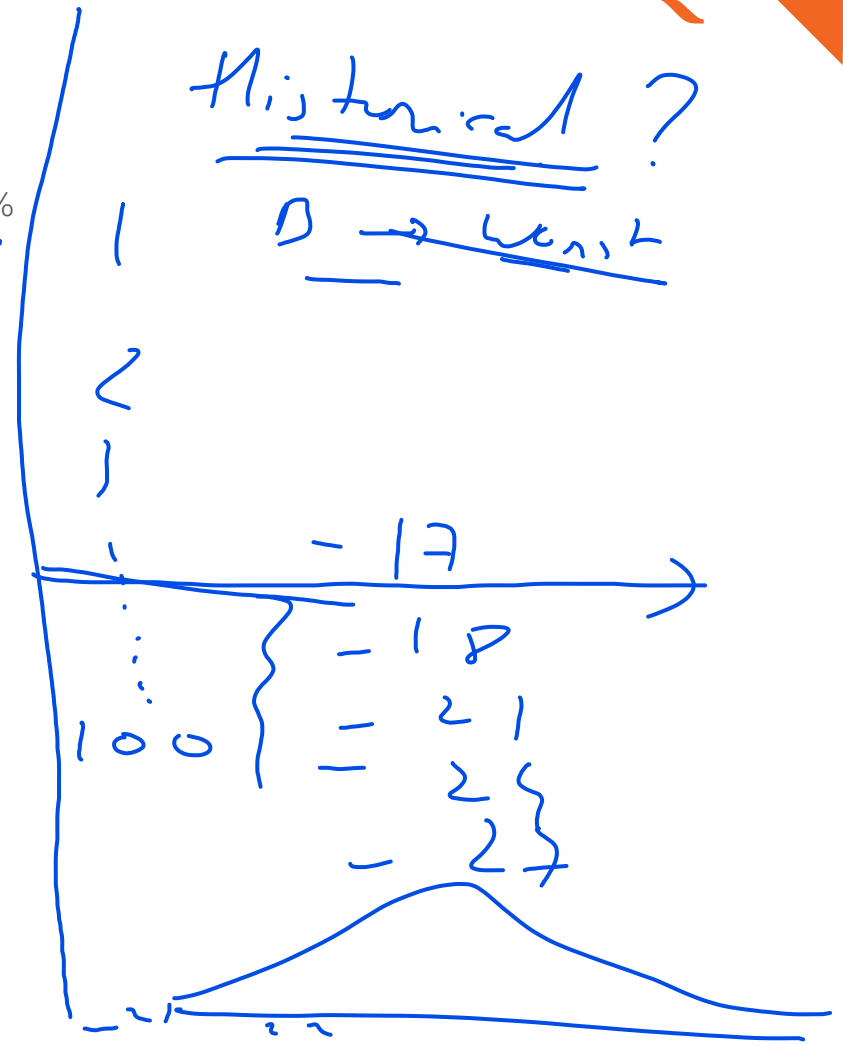


Calculate 1-year 5% Parametric VaR for a portfolio having a value of $1mn and volatility of 15%

1. Assume Mean = 10%



2. Assume no Mean



Changing the Time Period

Annual Data

$$VaR_{1\ year,\ 5\%} = [Mean_{annual} - (z\text{-}value * Standard\ Deviation_{annual})] * Portfolio\ Value$$

Daily Data

$$VaR_{1day,\ 5\%} = [Mean_{daily} - (z\text{-}value * Standard\ Deviation_{daily})] * Portfolio\ Value$$

Square root of Time rule

2.4 Standardized Measurement Approach

- The standardized measurement approach (SMA) represents the combination of a financial statement operational risk exposure proxy (termed the business indicator, or BI) and operational loss data specific for an individual bank.
- Because using only a financial statement proxy such as the BI would not fully account for the often significant differences in risk profiles between medium to large banks, the historical loss component was added to the SMA to account for future operational risk loss exposure.
- As such, the loss component serves to both enhance the SMAs sensitivity to risk and to offer an incentive for a bank to improve on its operational risk management practices. A bank will be required to hold less in operational risk regulatory capital with fewer operational risk losses and a more effective risk management system.

2.4.1 Business Indicator

The business indicator (BI) incorporates most of the same income statement components that are found in the calculation of gross income (GI).

A few differences include:
Positive values are used in the BI (versus some components incorporating negative values into the GI). The BI includes some items that tie to operational risk but are netted or omitted from the GI calculation.

The BI is calculated as the most recent three-year average for each of the following three components:

$$BI = ILDC_{avg} + SC_{avg} + FC_{avg}$$

where:
ILDC = interest, lease, dividend component
SC = services component
FC = financial component

2.4.1 Business Indicator

Interest, lease, dividend component (ILDC) = $\min[\text{abs}(II_{avg} - IE_{avg}), 0.035 \times IEA_{avg}] + \text{abs}(LI_{avg} - LE_{avg}) + DIavg$

where:
abs = absolute value
II = interest income (excluding operating and finance leases)
IE = interest expenses (excluding operating and finance leases)
IEA = interest-earning assets
LI = lease income
LE = lease expenses
DI = dividend income

2.4.1 Business Indicator

Services component (SC) = $\max(OOI_{avg}, OOE_{avg}) + \max\{abs(FI_{avg} FE_{avg}), \min[\max(FI_{avg}, FE_{avg}), 0.5 \times uBI + 0.1 (\max(FI_{avg}, FE_{avg}) - 0.5 \times uBI)$

where:
OOI = other operating income
OOE = other operating expenses
FI = fee income
FE = fee expenses
uBI = unadjusted business indicator

2.4.1 Business Indicator

Financial component (FC) = abs(net P&LTB$_{avg}$) + abs(net P&LBB$_{avg}$)

where:
P&L = profit & loss statement line item
TB = trading book
BB = banking book

2.4.2 Business Indicator Component

For the purposes of calculating the SMaA, banks (based on their size for the BI component) are divided into five buckets as shown

Bucket	BI Range	BI Component
1	€0 billion–€1 billion	0.11 × BI
2	€1 billion–€3 billion	€110 million + 0.15(BI − €1 billion)
3	€3 billion–€10 billion	€410 million + 0.19(BI − €3 billion)
4	€10 billion–€30 billion	€1.74 billion + 0.23(BI − €10 billion)
5	€30 billion − +∞	€6.34 billion + 0.29(BI − €30 billion)

2.4.3 Internal Loss Multiplier Calculation

Through the addition of a loss component, the SMA becomes more sensitive to risk than it would be with just the BI component alone. As highlighted above, internal losses become a relevant factor for banks in buckets 2 - 5.
Internal losses are factored into the SMA calculation via the internal loss multiplier, which is calculated as follows:

$$\text{Internal loss multiplier} = \ln\left(e^{1} - 1 + \frac{losscomponent}{BIcomponent}\right)$$

where:
loss component = 7 average total annual loss + 7 average total annual loss only including loss events above 10 million + 5 average total annual loss only including loss events above 100 million

2.4.3 Internal Loss Multiplier Calculation

- The loss component serves to reflect the operational loss exposure based on a banks internal loss experiences. To differentiate between banks with similar average loss totals but differing loss distributions, the loss component distinguishes between smaller loss events versus those above 10 million and 100 million.

- A bank whose exposure is considered average relative to its industry will have a loss component equivalent to its BI component; this implies an internal loss multiplier equal to one and an SMA capital requirement equal to its BI component.

- If a banks loss experience is greater (less) than the industry average, its loss component will be above (below) the BI component and its SMA capital will be above (below) the BI component.

3 SMA Capital Requirement Calculation

The SMA is used to determine the operational risk capital requirement and is calculated as follows:

For BI bucket 1 banks:
SMA capital = BI component

For BI bucket 2 - 5 banks:
SMA capital = 110M + (BI component 110M) internal loss multiplier

- For banks that are part of a consolidated entity, the SMA calculations will incorporate fully consolidated BI amounts (netting all intragroup income and expenses).
- At a subconsolidated level, the SMA uses BI amounts for the banks that are consolidated at that particular level.
- At the subsidiary level, the SMA calculations will use the BI amounts from the specific subsidiary.
- If the BI amounts for a subsidiary or subconsolidated level reach the bucket 2 level, the banks must incorporate their own loss experiences (not those of other members of the group).
- If a subsidiary of a bank in buckets 25 does not meet the qualitative standards associated with using the loss component, the SMA capital requirement is calculated using 100% of the BI component.

3 SMA Capital Requirement Calculation

It is possible that the Committee will consider an alternative to the calculation of the internal loss multiplier shown earlier, which would replace the logarithmic function with a maximum multiple for the loss component.
The formula for the internal loss multiplier would then be updated as:

$$\left(\frac{\mathbf{m}\times\mathbf{LC}+(\mathbf{m}-1)\times\mathbf{BIC}}{\mathbf{LC}+(2\mathbf{m}-2)\times\mathbf{BIC}}\right)$$

where:
m = factor to be calibrated
LC = loss component
BIC = business indicator component

4.1 Questions

Pillar 1 of the Basel II framework allows banks to use various approaches to calculate the capital requirements for credit risk, operational risk, and market risk. Which of the following Basel II approaches allows a bank to use its own estimates of recovery rates?

A. The standardized measurement approach for operational risk
B. The advanced internal ratings-based approach for credit risk
C. The foundation internal ratings-based approach for credit risk
D. The fundamental review of the trading book (FRTB) approach for securitized products

4.2 Questions

Pillar 1 of the Basel II framework allows banks to use various approaches to calculate the capital requirements for credit risk, operational risk, and market risk. Which of the following Basel II approaches allows a bank to explicitly recognize diversification benefits?

A. The basic indicator approach for operational risk.
B. The standardized approach for market risk.
C. The internal models approach for market risk.
D. The standardized approach for operational risk.

4.3 Questions

In the Basel framework, a penalty is given to banks that have more than four exceptions to their 1-day 99% VaR over the course of the last 250 trading days. Which of the following causes of exceptions is most likely to lead to a penalty?

A. A large move in interest rates was combined with a small move in correlations.
B. The bank's model calculates interest rate risk based on the median duration of the bonds in the portfolio.
C. A sudden market crisis in an emerging market, which leads to losses in the equity positions in that country.
D. A sudden devastating earthquake that caused major losses in the bank's key area of operation.