

SEACEN Course on Bank Examiner Foundational Skills Development

Introduction to Market Risk

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Course contents

Market Risk

- Interest rate risk
- Equity risk
- Foreign Exchange risk
- Commodity risk
- Options risk

Measurement methodologies

- Value-at-risk (VaR)

Market Risk Management Control functions

- Board
- Senior Management Oversight
- Risk Management

Market Risk

Define:

- Market risk is the risk of adverse deviations of market value transactions due to market moves during the time required to liquidate or off-set positions.
- Market risk exposures can be reviewed and assessed at instrument, portfolio and bank-wide level.
- Typically refers to risk arising from trading portfolio;
- Usually has a short-term time horizon
- Marked-to-market on daily basis



Trading Vs Banking Book

Trading Book Exposures

- Proprietary positions whereby instruments are:
 - Intentionally held for short-term resale;
 - Held with the intention to generate profit from short-term variations in market prices and rates;
 - From broking or market making;
 - Taken to hedge other elements of the trading book; and
 - Usually marked-to-market daily



Market Risk

Banking Book Exposures

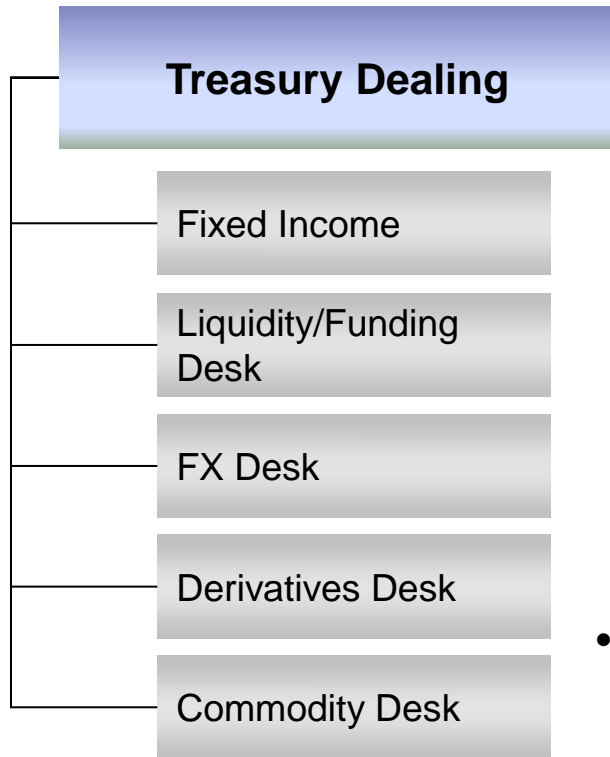
- Long-term investment, held to maturity.
- Not marked-to-market
- Market risk is not as obvious as for a trading book



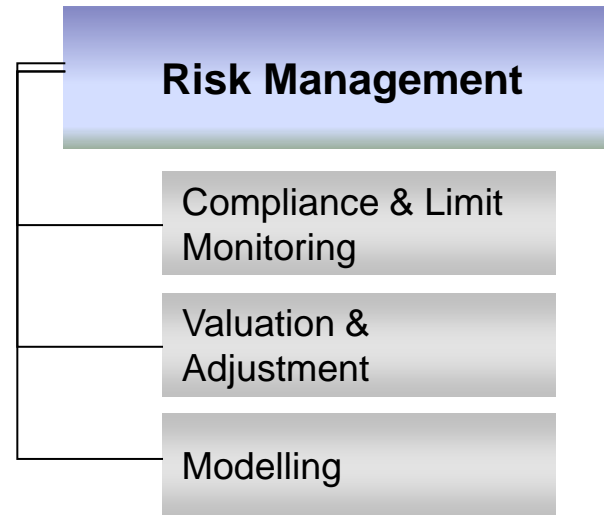
Interest rate in the banking book (IRRBB)

Typical Trading Structure

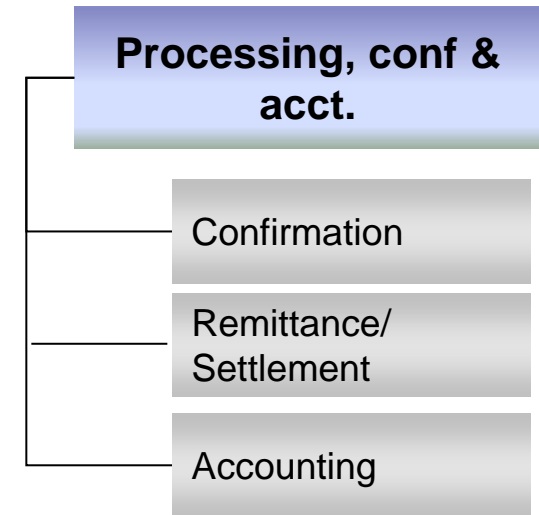
FRONT OFFICE



MIDDLE OFFICE



BACK OFFICE



- Separation between front, middle and back offices to ensure proper controls.
 - Risk taking activities take place in the dealing room (front office).
 - Monitoring of limits and risk evaluation (middle office).
 - Processing, accounting and remittances (back office).

Conceptual regulatory approach: Market Risk Capital Adequacy Framework (MRCAF) and IRR Banking Book (IRRBB)

Market risk in trading book (Pillar 1)

Standardised Approach (SA)

- BIs use standardised methodology and framework to compute minimum capital requirement for market risk in trading book
- All BIs are currently adopting this approach

-or-

Internal Models Approach (IMA)

- BIs use results of internal market risk models to compute minimum capital requirement for market risk
- BIs can opt to use this approach, however, must satisfy a list of qualifying criteria in order to obtain BNM explicit approval

IRR in banking book (Pillar 2)

Standardised Framework

- BIs use standardised methodology and framework to compute minimum capital requirement for IRR/RoR in banking book
- All BIs must also use this approach to calculate IRR/RoR in banking book

- **All** on and off balance sheet items which are exposed to interest rate risk/benchmark rate risk, with the exception of:-
 - positions covered by the trading book definition
 - positions which are deducted from capital base

Sources of market risk



Treasury Market Risk

Trading Activities

1 Proprietary Trading

2 Customer Flow

3 Funding

Trading Instruments

Bonds, equities, FX spot, commodities, derivatives (forward, futures, swaps, options, credit derivatives)

Product category

Interest Rates Products	Foreign Exchange	Equity	Commodity	Options
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Risk Factors

Interest rates risk (IRR)	Exchange rates risk (FX)	Equity prices/ Index (EQ)	Commodity Prices (COM)	Options Greeks (OP) (Delta, Vega, Gamma, Theta, Rho)
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Risk Management Strategy

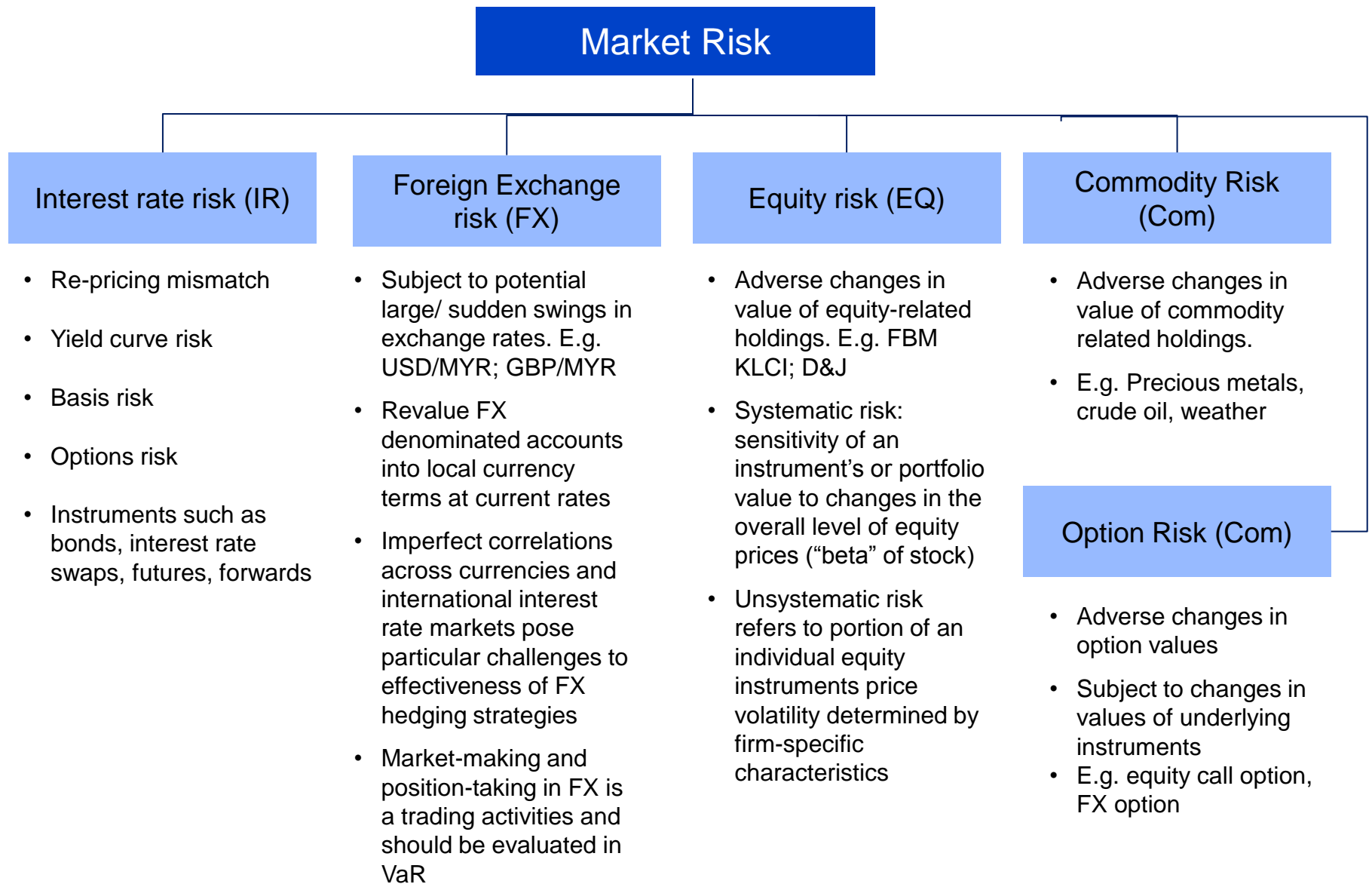
- Do nothing
- Do the opposite trade
- Use derivatives (forward, futures, swaps, options, credit derivatives)

Hedging Instruments

<ul style="list-style-type: none"> • KLIBOR Futures • IRS • Caps/ Floors 	<ul style="list-style-type: none"> • FX Forward • CCRS 	<ul style="list-style-type: none"> • Warrants 	<ul style="list-style-type: none"> • Oil Futures
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Market Risk Factors



Terminology

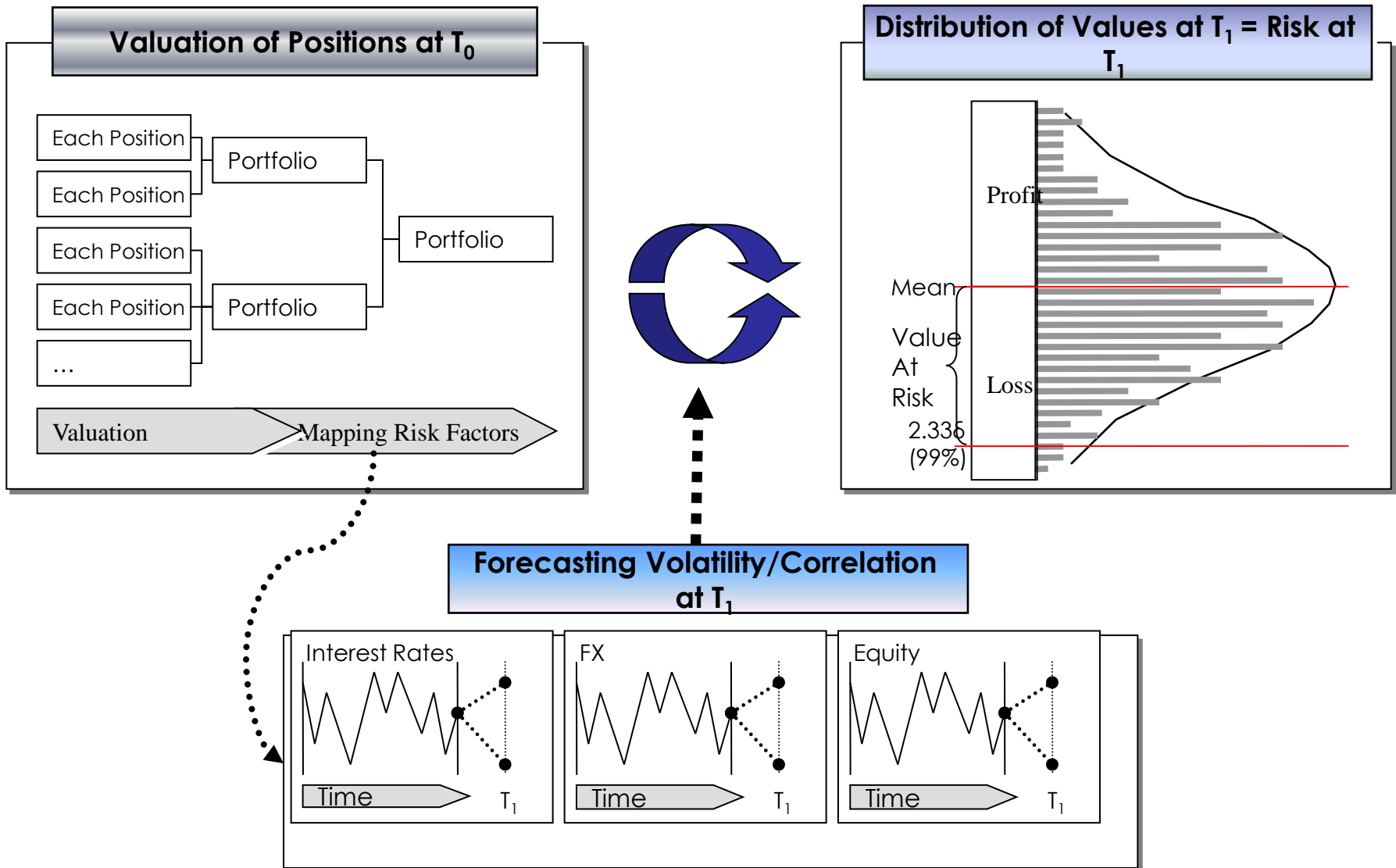
Buy	vs	Sell
Long	vs	Short
Long bond	➤	Receive Fixed
Long swap	➤	Pay Fixed / Receive float
Long 'Apple' share	➤	EQ & FX risks
Long crude oil	➤	Com risk
Long equity call	➤	Option & EQ risks
Long IR ?	➤	Pay/ receive fixed?

Measurement Methodology



Concept of Value-at-Risk (VaR)

... a potential loss in the portfolio value during a holding period (e.g. 10-day) under a certain confidence interval (e.g. 99%)



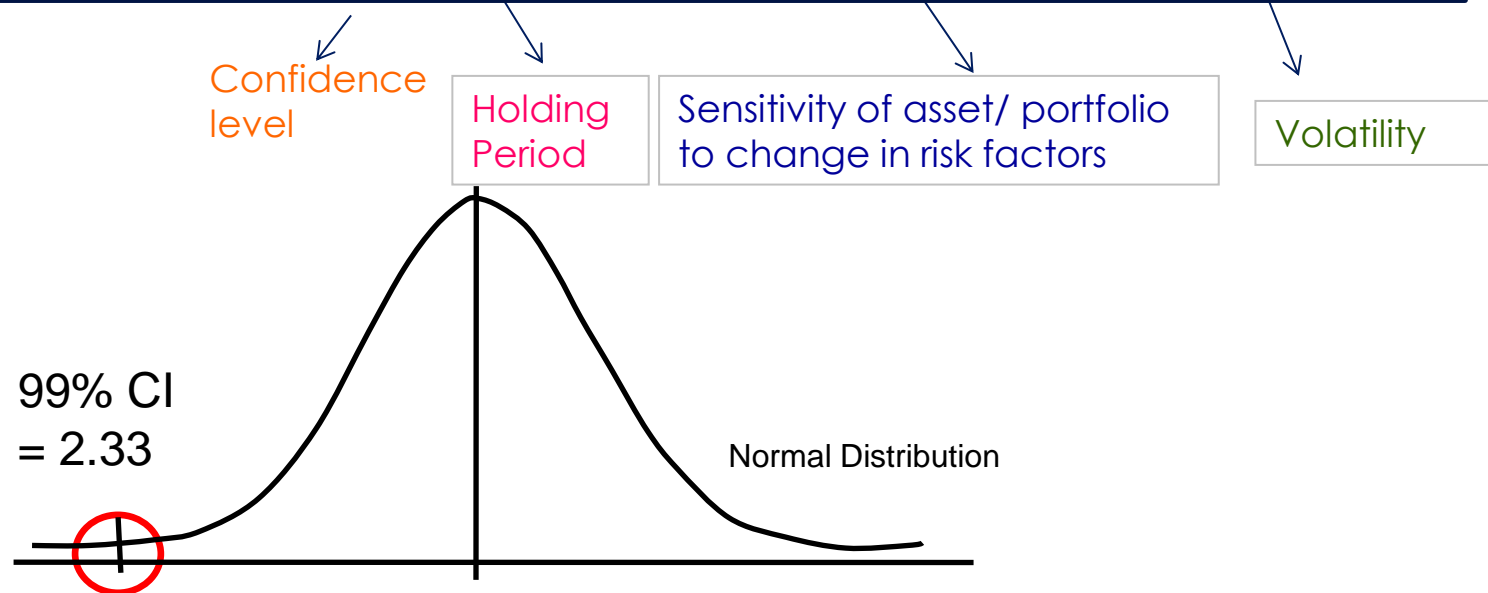
VaR Methodology

VaR Methodology	Features
Variance Covariance/ Parametric	<ul style="list-style-type: none">• Calculate change in portfolio value• Suitable for linear products
Historical Simulations	<ul style="list-style-type: none">• Compute portfolio value based on historical values• Able to cater for non-linear products
Monte Carlo Simulations	<ul style="list-style-type: none">• Compute portfolio value based on generated scenarios• Able to cater for non-linear products

Parametric VaR

- Compute the following parameters:
 1. Volatility (daily, weekly etc...) using statistical formula
 2. correlation between risk factors
 3. sensitivity of instruments (duration, beta)
- Multiply the 3 parameters with holding period (e.g. 10-days) and confidence interval (99-percentile) as prescribed by BIS
- Assume financial returns are normally distributed.

$$\text{Parametric VaR} = \eta \times \sqrt{T} \times \sqrt{\text{Position Sensitivity} \times \sigma \times \rho_{i,j}}$$



Historical VaR

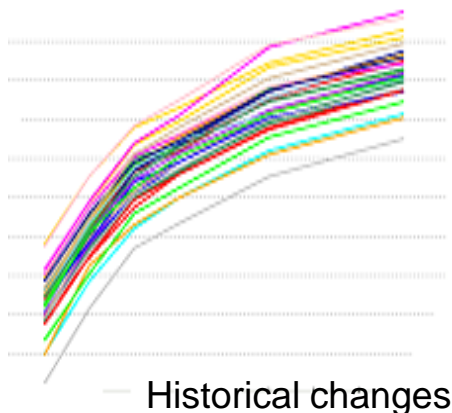
- Assume Future Returns follows Historical Returns
- Time period of Selection (Worst Case)
- Number of Data Points eg: if 100 historical returns selected then VaR is based on 1 data point in 99% CI

INPUT:

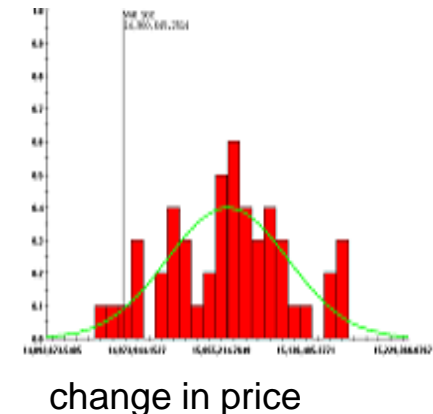
- Mark to Market Portfolio
- Historical changes in Market Risk Factors (FX, yields, equity Indexes, etc..)

OUTPUT:

- Simulated distribution of changes in portfolio value and confidence interval statistics



→ Pricing



Monte Carlo VaR

- Monte Carlo simulation is to repeatedly simulate the random behaviour processes that govern market prices and rates
- Each scenario generates a possible value of the portfolio at the target horizon (e.g 1 day or 10 days)
- If we generate enough scenarios the simulated distribution of the portfolios values will converge towards the relatively true value.
- The VaR can be read off the distribution like in the case of historical simulations
- Assumption: The probability distribution of risk factors is known
- Common Approach: The daily logarithmic risk factor changes are multivariate and normally distributed

Back Testing

Basel Standards & requirements:

- Policy & procedures
 - Institutionalisation of back testing requirement
 - Adequate documentation to ensure consistency
 - Escalation process
- The time frame
 - Moving window of 250 business days for internal model recognition
- Like with like comparison
 - Must compare the VAR_{n-1} with $(MTM_n - MTM_{n-1})$
 - Must exclude fee income
 - Must exclude intra day transaction
- Number of exception must conform with the set confidence level.
 - i.e @ 99% confidence level, <3 exceptions in 250 data points
 - i.e @ 95% confidence level, <5 exceptions in 100 data points

Stress Testing

... a routine and rigorous stress testing should be in place to supplement risk analysis

Qualitative criteria

Policies & procedures

- Institutionalisation of stress testing requirements
- Adequate documentation to ensure consistency

Board and senior management oversight

- Understands the assumptions underpinning stress tests
- Approves stress scenarios based on recommendations of risk control unit
- Results are incorporated into the limit-setting process
- Reflect results in the internal capital assessment
- Assess at least quarterly the scenarios, assumptions and results of stress test.

Quantitative criteria

Methodology

- Cover all significant risk taking activities
- Granular stress test at portfolio level; broad risk categories
- Sensitivity stress test which takes into account movement in risk factors such as:
 - yield curves; swap curves; exchange rates; equity index; stock prices; and commodity prices
- Gauge the potential loss from market risk factors.
- Analyse the potential loss impact on PBT, RWCR or Tier-1 capital of banking institutions
- Frequency of stress test : daily, monthly to quarterly.

Market Risk Management



RMCF – Board Oversight

The board of directors has the ultimate responsibility for the understanding and oversight of the nature of treasury operations and the level of market risk taken by BI.

approves and review policies relating to management of market risk on annual basis. Eg. TBPS

at least 1-2 independent directors with appropriate skills

assesses performance of senior management in monitoring and controlling market risk

sets and reviews market risk appetite/ tolerance at least once a year



fully appraised of the BI's risk exposure from its risk taking activities through regular periodic reporting by senior management/ RMU

review of strategies and engage actively in discussions/ deliberations with senior management or risk unit

approves lines of authority for managing market risk with clear independent reporting to board from risk management functions



RMCF – Senior Management

Ensure adherence to the lines of authority and responsibility that the board has established for measuring, managing and reporting market risk.

Develop and implement procedures and practices that translates the board's goals, limits into operating standards that are well understood by bank's personnel and that are consistent with the board's intent.



Establish effective internal controls over the liquidity/ interest rate risk management process

Oversee the implementation and maintenance of management information and other systems that IMMC risks.

Ensure analysis and risk management activities related to market risk are conducted by competent staff consistent with nature and scope of activities.

RMCF – Risk Management

