Banking

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Fall Semester 2024

Course: Banking [2206]

Class 7

Disclaimer: The views expressed are my own and do not necessarily represent the views of Banco de Portugal.

To be covered today

- Market Risk

Press corner

‘Someone will get hurt’: Investors and analysts warn on rising market stress

Big swings across asset markets are raising the risk of a financial accident

As the dollar strengthens and interest rates rise, price swings in the Treasury market are getting mo
Bloomberg/Dreamstime

Eric Platt and **Kate Duguid** in New York OCTOBER 5 2022

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Investors and Wall Street analysts are sounding the alarm about a possible “market accident”, as successive bouts of tumult in US stocks and bonds and a surging dollar cause rising levels of stress in the financial system.

A gauge of strain in US markets — produced by the Treasury’s Office of Financial Research — has soared to its highest level since the coronavirus pandemic ructions of May 2020.

Even as equities on Wall Street start the new quarter with gains, the OFR’s Financial Stress index is near a two-year high at 3.1, where zero denotes normal market functioning. That has added to a growing list of benchmarks which suggest trading conditions in US government debt, corporate bonds and money markets are increasingly stretched.

“The velocity of things breaking around the world . . . is obviously a ‘neon swan’ telling us that we are clearly now in the market accident stage,” said Charlie McElligott, a strategist at Nomura.

Market Risk

Definition

Risk of losses in (on- and off-) balance sheet risk positions arising from movements in market prices.

Drivers

General Risk

Risk of a price change caused by a change in the level of interest rates in the case of debt securities or derivatives, or by a general movement of the stock market.

Specific risk

Includes the risk that an individual debt or equity security moves by more or less than the general market in day-to-day trading and event risk (eg. shock event, risk of default).

Calculation approaches

Standard

Internal Models

For the purpose of calculating capital requirements

Market risk

In the last decade, market risk is emerging as one of the most important risks to measure and manage:

- because even "long term" positions are being converted into marketable securities (securitization of loan book);
- the incredible growth of financial derivatives, with value linked to market prices of underlying assets;
- the widespread of IFRS (International Financial Reporting Standards) that claim for mark-to-market instead of the traditional book value.

Market Risk – Where is the market risk?

Trading Book:

- Trading book instruments comprise financial instruments, foreign exchange (FX), and commodities.
    - Financial instruments include both primary financial instruments (or cash instruments) and derivatives.
- Banks may only include instruments when there is no legal impediment against selling or fully hedging it.
- Banks must fair value daily any trading book instrument and recognise any valuation change in P&L account.
- Portfolio should be actively managed;

Banking Book:

- All other instruments not included in the trading book must be included in the banking book

Segregation between Trading and Banking books is meant to avoid regulatory arbitrage given diferent approaches for calculating capital requirements

Market Risk – Where is the market risk?

The risks subject to **market risk capital requirements** include but are not limited to:

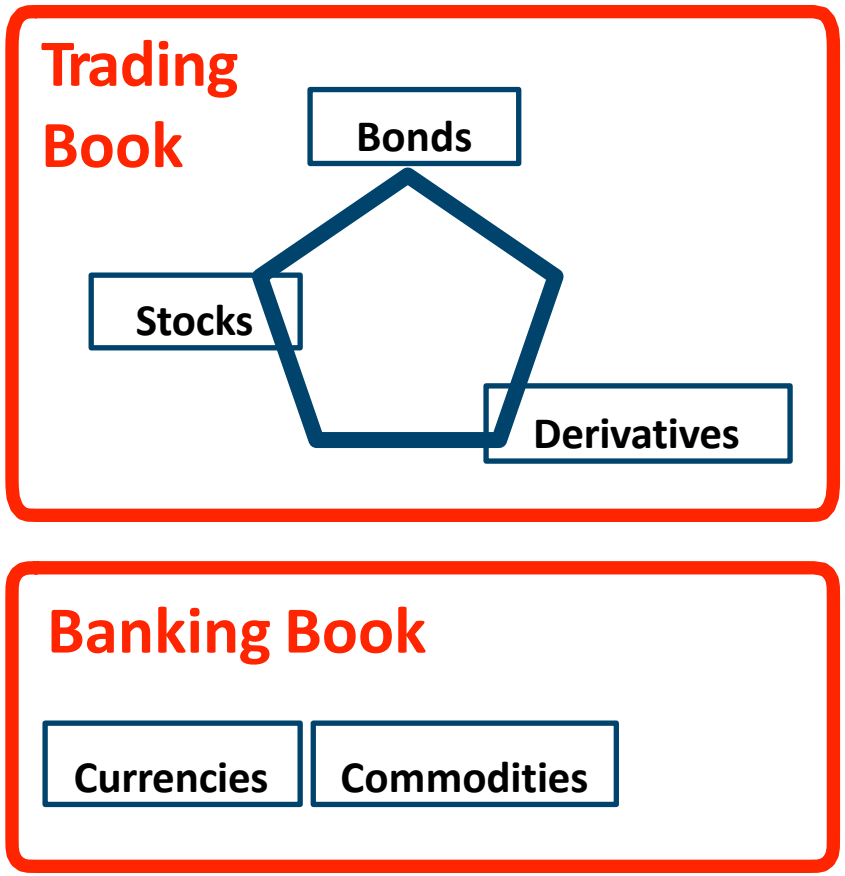
(1) default risk, interest rate risk, credit spread risk, equity risk, foreign exchange (FX) risk and commodities risk for **trading book instruments**; and

(2) FX risk and commodities risk for **banking book instruments**.

Example of the risk position of a bond denominated in a currency different to a bank's reporting currency:

- risk positions in general interest rate risk, credit spread risk (non-securitisation) and FX risk,
    - potential losses to the current value of the instrument that could occur due to a change in the relevant underlying risk factors (interest rates, credit spreads, or exchange rates).

Market Risk – Regulatory Requirements



- According to the current regulatory framework, institutions are required to calculate own funds requirements for market risk for:

- positions held in the trading book;

- positions held in the banking book bearing foreign exchange (FX) or commodity risk.

- EBA is mandated to develop draft regulatory technical standards (RTS) to specify how institutions should calculate the own funds requirements for non-trading book positions that are subject to FX risk or commodity risk in accordance with the alternative standardised approach (SA) and the alternative internal model approach (IMA).

Market Risk - Components

DELTA
Absolute price risk

Impact on the position value by a change in the price of some asset.

GAMMA
Convexity risk

Added risk on top of the linear delta risk when the price change is not infinitesimal.

VEGA
Volatility risk

Impact of value due to changes in underlying asset's volatility.

THETA
Time decay risk

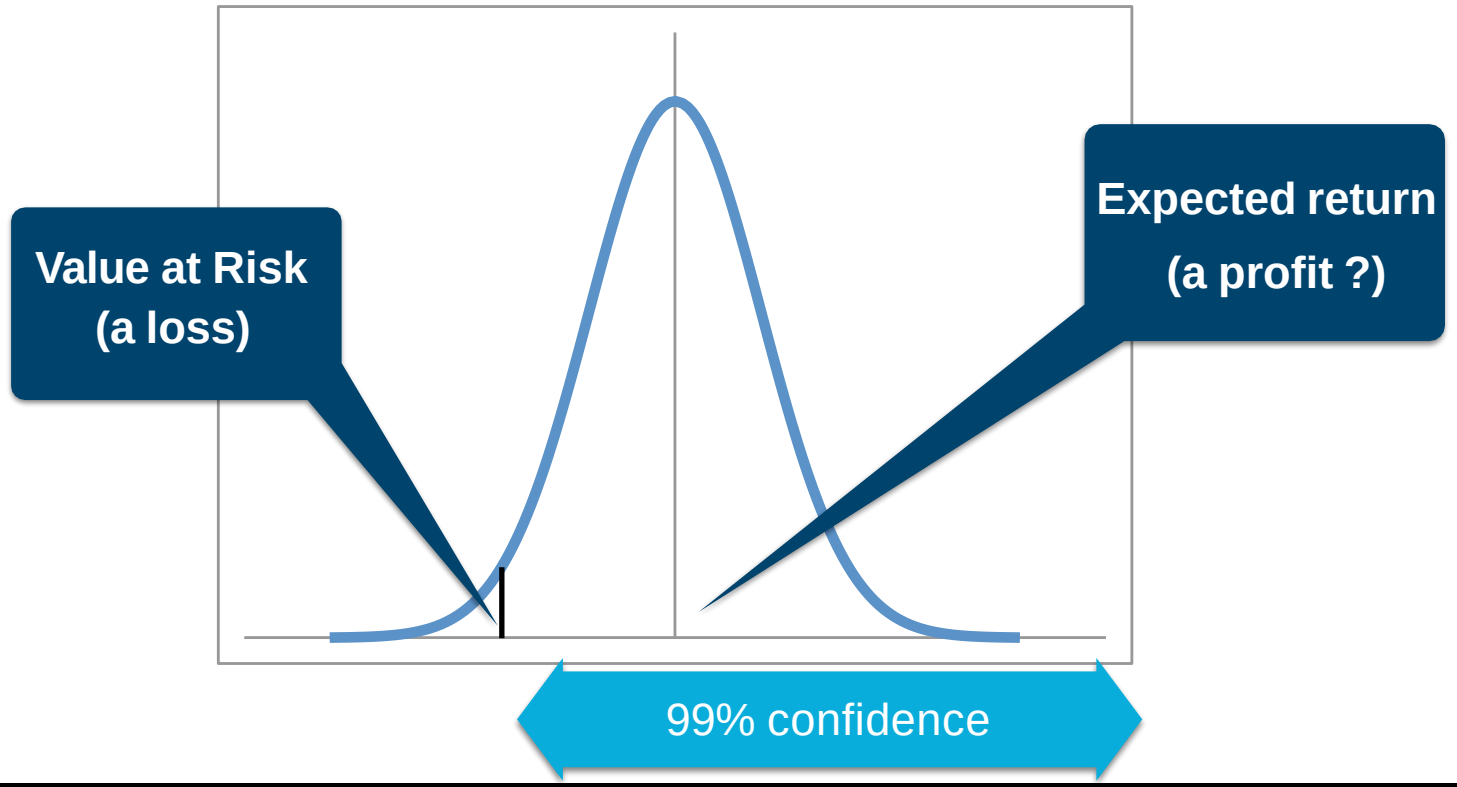
Impact of value due to the reduction of time to maturity - uncertainty is given by optionality.

RHO
Discount rate risk

Associated with changes in the discount rate.

Market Risk assessment: Value-at-Risk

What is the maximum loss which could be suffered over a certain time period so that there is a very low probability that the actual loss will exceed that amount?



VaR is…

- The maximum loss you can have on your portfolio in given period.
- With 1% probability you will lose more than the VaR in a given period.
- The expected loss you can have on your portfolio, in the 1% worse cases in a given period.
  - > **cVaR**

DEAR and VaR for an asset

Daily earnings at risk (DEaR) is the statistical measure of the potential loss in value of a financial asset or portfolio due to adverse changes in market conditions over a 24-hour period. Value at risk (VAR) is the cumulative daily earnings at risk.

$$DEAR = MV \times \sigma \times \alpha \times \delta$$

MV is the asset market value

Sigma is the standard deviation of daily returns for the proxy asset

Alpha is the coefficient of the standard normal distribution for a given confidence level

Delta is the sensibility of asset price to the proxy asset price changes

$$VaR = DEAR \times \sqrt{days}$$

VaR for a portfolio

$$VaR_p = \sqrt{\sum_{i=1}^{N}\sum_{j=1}^{N} VaR_i \times VaR_j \times \rho_{i,j}}$$

If the correlation coefficient **rho** between any two assets is 1, meaning no diversification effect, the VaR of the portfolio would be the sum of the individual assets's VaR.

Fine tunning

- In this VaR approach, each asset can only be subject to a single risk factor. When that is not the case, we have to split the asset in components
    - if an European bank has a stock exposure in USD, it can be split into a stock with a US stock market risk factor and a spot position in USD subject to the currency volatility
- It is not feasible to use all risk factors.
    - A portfolio of 100 stocks cannot be tracked against 100 stock price volatilities. It is better to use the market index and use beta as delta adjustment.
    - The same can be said on bond yields.

VaR assumptions and limitations

- VaR assumes that returns follow a random normal distribution, where the volatility coefficient is stable over time.
  - empirical studies point to the existence of fat tails
  - financial asset returns tend to have more extreme losses than extreme gains (negative skewness)
  - short term interest rates are influenced by monetary policy, which is not random
- The model assumes no serial autocorrelation. Also, the relationship between exposure values and risk factors are linear (ignoring convexity or option gamma).
- Beyond the confidence level, we have a black hole…
- The computed figure is the loss by selling immediately the portfolio at the prevalent market prices. Is that possible?
- It is pro-cyclical: at low vol, VaR allows to increase positions; at high vol it is the opposite. When there is a significant drop, VaR tells the bank to sell at the same time.
- If everyone uses the same tool, this has a very relevant systemic risk.

Other possible market risk models

Stressed Value-at-Risk (SVaR):

- calculates a stressed value-at-risk measure based on a one year period of significant market stress.

- How to implement it?
  - A possibility is to calculate it using a 99% confidence level and a holding period of ten days.
  - Historical market data and observed correlations from a period of significant financial stress (i.e., characterized by high volatilities) is used as an input for the Historical Simulation.

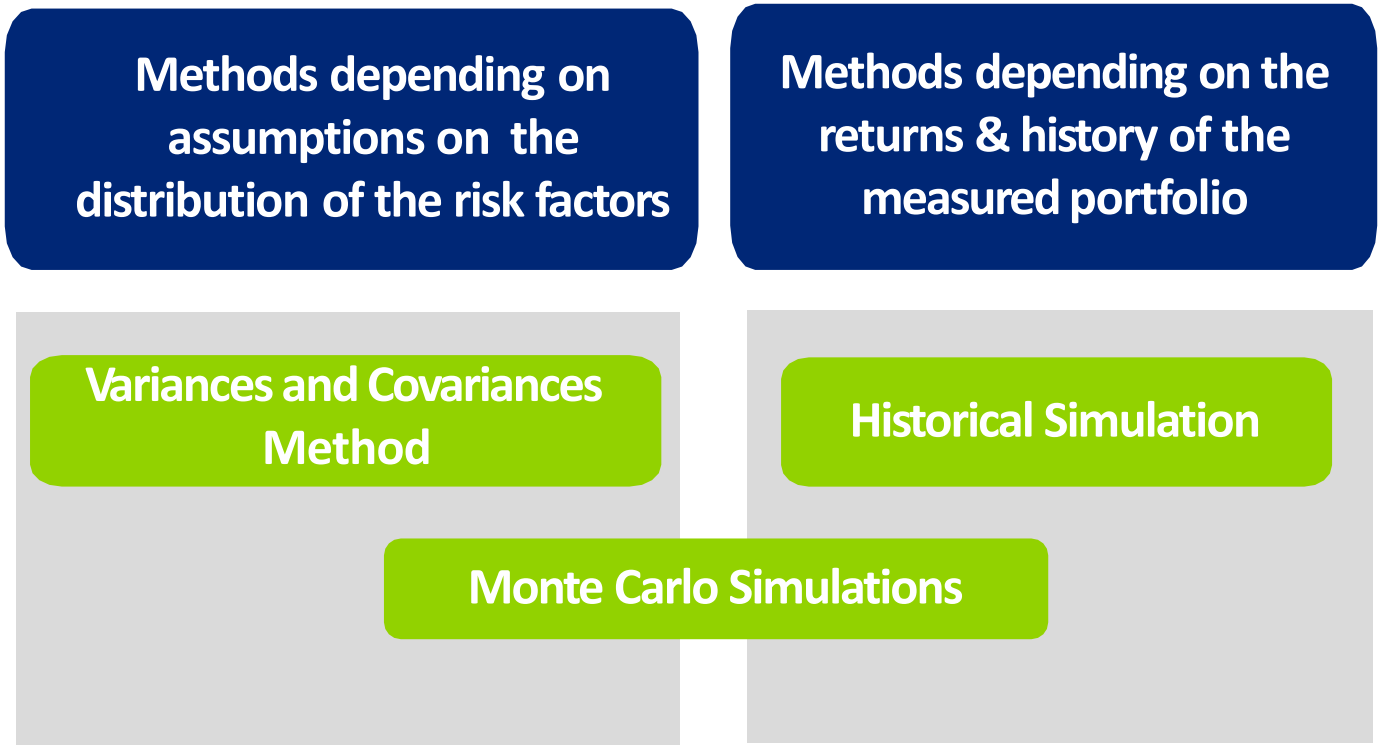
Incremental Risk Charge:

- captures default and credit rating migration risks for credit-sensitive positions in the trading book.

- How to implement it?
  - Using a Monte Carlo Simulation for calculating incremental risk charge as the 99.9% quantile of the portfolio loss distribution over a one-year capital horizon under a constant position approach and for allocating contributory incremental risk charge to individual positions.

- Important parameters for the incremental risk charge calculation are exposures, recovery rates, maturities, ratings with corresponding default and migration probabilities and parameters specifying issuer correlations.

Market Risk - VaR model types



Market Risk – Approaches compared

	Advantages	Disadvantages
Variances and Covariances Method	•Sets of reduced data; •Variance and covariance matrices may be obtained externally; •Incorporates portfolio diversification effects through correlations; •Fast calculation.	•Assumes that the portfolio is composed of assets with a linear delta and does not include non-linear products; •Assumes stable correlations and variances; •Assumes a normal distribution for the assets' price return; •Not able to predict anything that is not in the variance and covariance matrix.
Historical Simulation	•Does not assume stability of the correlations, since it does not make any assumptions; •Due to the fact that it includes historical sets of data, it considers that all the relevant information is in the set. •Does not assume any probability distribution shape for the returns.	•Not able to predict anything that is not in the set of data; •Needs profound historical data; •Possibility of performance problems.
Monte Carlo Simulations	•Better treatment and measurement of non-linear risks; •Easier and more flexible for sensitivity analysis; •Considers path-dependent effects; •Possibility to incorporate trends and volatilities not considered in price behaviour models.	•Needs great computational capacity; •Difficulty in real-time valuation; •Needs to pre-fix price behaviour models.

Alternative methods

- Historical distributions
  - using actual factor returns from the past, we compute the value of each asset in the portfolio using a given pricing model (CAPM, discounted cash flow, Black Scholes). The risk is computed as the difference from the chosen quantile (1% for instance) valuation and current valuation.

- Monte Carlo simulation

  - each risk factor can have the most suitable distribution
  - 95% confidence VaR is the difference between actual portfolio value and the 5%-percentile worse valuation using the historical or Monte Carlo scenarios

- Stress Testing
  - just a couple of feared scenarios are used

Market Risk regulatory requirements: Fundamental Review of the Trading Book (FRTB)

- **Purpose**: Aims to address structural deficiencies in the calculation of market risk capital requirements.
- **Background**: Initiated by the Basel Committee on Banking Supervision (BCBS) to enhance the stability of the banking system post-2008 financial crisis.
- **Key Components**:
    - **Revised Market Risk Framework**: Introduces a more risk-sensitive approach to calculating capital requirements for trading activities.
    - **Boundary Definition**: Clarifies the distinction between trading books and banking books.
- **Implementation Timeline**: Initially proposed for 2019...
- **Capital Requirements**:
    - Establishes a Minimum Capital Requirement (MRC) for market risk, relying on both standardized and internal models.

Market Risk regulatory requirements – e.g. solvency ratio

Minimum Capital Required

$$\frac{\text{Total capital}}{\text{RISK WEIGHTED ASSETS}} > 8\,\%$$

RWA

(Credit + MARKET + Operational Risks + others)

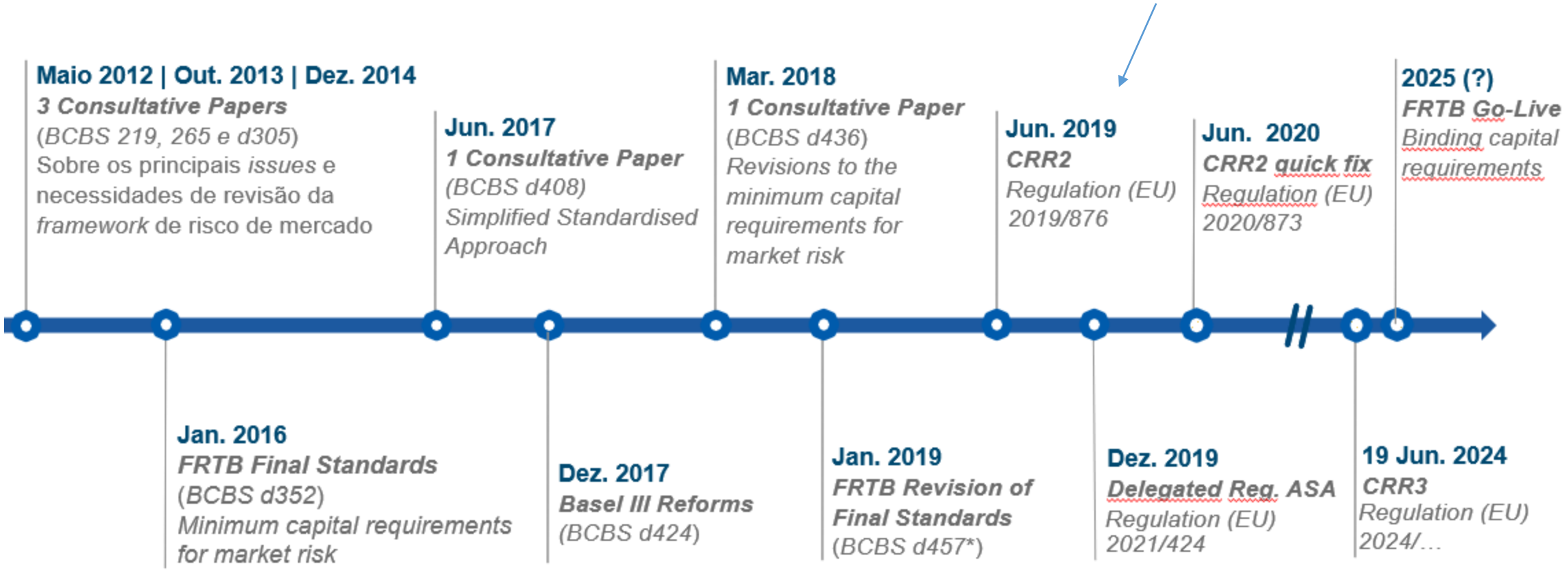
Market Risk regulatory requirements: Fundamental Review of the Trading Book (FRTB)

Overview of the FRTB

- The Basel Committee on Banking Supervision (BCBS) undertook a fundamental review of market risk capital requirements to address structural deficiencies in the calculation of own funds requirements.
- This review led to the publication of a revised market risk framework in January 2016.
- In December 2017, the BCBS postponed the implementation date to allow institutions to develop necessary system infrastructures and to resolve specific issues regarding the new standards.
- The Capital Requirements Regulation 2 (CRR2) incorporated Basel III standards related to the FRTB as concluded by the BCBS in 2019, strictly for reporting purposes.

Market Risk regulatory requirements: Fundamental Review of the Trading Book (FRTB) -

Timeline of the legislative process and implementation



Market Risk regulatory requirements: Fundamental Review of the Trading Book (FRTB) -

CRR2:

- Introduction of new FRTB methods as reporting requirements: alternative standard method and alternative internal models method.
- Standard method and internal models method remain as methods for calculating own funds requirements.
- New rules regarding the delineation between portfolios were only partially introduced in CRR2 (e.g., reclassification of positions between Trading Book (TB) / Banking Book (BB), internal risk transfers).

CRR3:

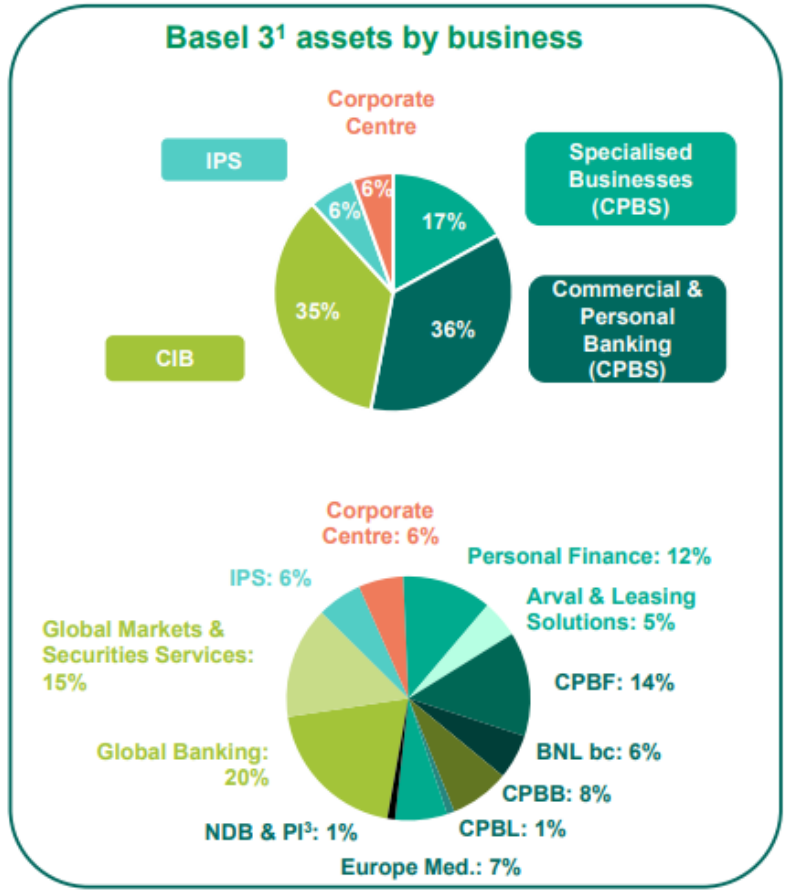
- Introduction of the remaining elements concerning the delineation between TB/BB.
- New methods: reporting requirements now turn into own funds requirements.
- Introduction of some adjustments to the currently applicable rules.
- Introduction of transitional provisions allowing the European Commission to adjust, through a Delegated Act, the calculation of capital requirements for market risk or the implementation date of the new FRTB methods.

RWA - BNP Paribas

Basel 3 Risk-Weighted Assets[1]

- €699bn as at 30.09.23 (€698bn as at 30.06.23)

€bn	30.09.23	30.06.23
Credit risk	533	533
Operational Risk	58	58
Counterparty Risk	47	45
Market vs. Foreign exchange Risk	27	28
Securitisation positions in the banking book	16	15
Others[2]	18	18
Basel 3 RWA[1]	**699**	**698**



1. CRD5; 2. Including the DTAs and significant investments in entities in the financial sector subject to 250% weighting; 3. New Digital Businesses & Personal Investors

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Third quarter 2023 results | 77

Source: [Microsoft PowerPoint - 3q23-slides - v2.pptx (invest.bnpparibas)]

Market Risk – Internal models approach to the trading book [*to be explored in a future class*]

Own funds regulatory requirement =

- VaR (99% to 10 days of holding positions) of the previous day
- Average daily VaR from the last 60 days, multiplied by a factor.

+

- Last VaR in a stressed situation
- Average of the stressed VaR of the last 60 days, multiplied by a factor.

Note: Regulators allow banks to use the Internal Ratings based approach once a series of requirements has been complied with (eg: clear risk management strategy, robust backtesting, regular stress testing, independent model validation). Otherwise, capital requirements are calculated through fixed risk factors provided by the regulator (standard approach).

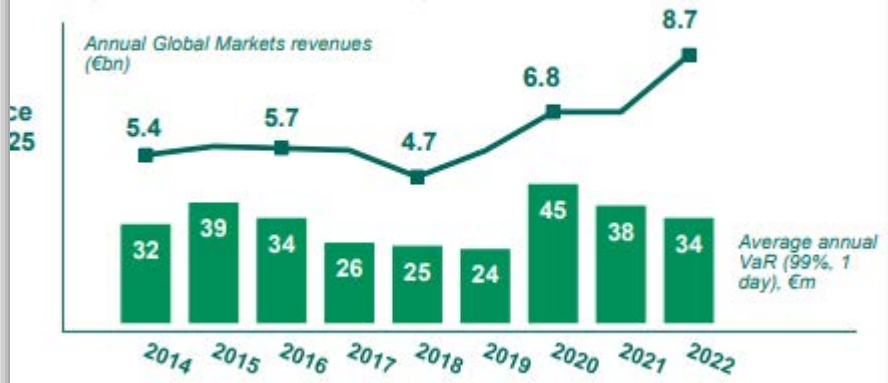
Market Risk - Deutsche Bank

Development of risk-weighted assets for Market Risk

						Dec 31, 2022
in € m.	VaR	SVaR	IRC	Other	Total RWA	Total capital requirements
Market risk RWA balance, beginning of year	**3,538**	**9,360**	**3,657**	**3,219**	**19,773**	**1,582**
Movement in risk levels	(175)	1,986	(17)	266	2,061	165
Market data changes and recalibrations	2,651	(617)	0	(593)	1,441	115
Model updates/changes	100	(650)	0	0	(550)	(44)
Methodology and policy	1,299	2,142	0	0	3,441	275
Acquisitions and disposals	0	0	0	0	0	0
Foreign exchange movements	0	0	0	113	113	9
Other	0	0	0	0	0	0
Market risk RWA balance, end of year	**7,413**	**12,221**	**3,639**	**2,857**	**26,131**	**2,091**

Market Risk – BNP Paribas

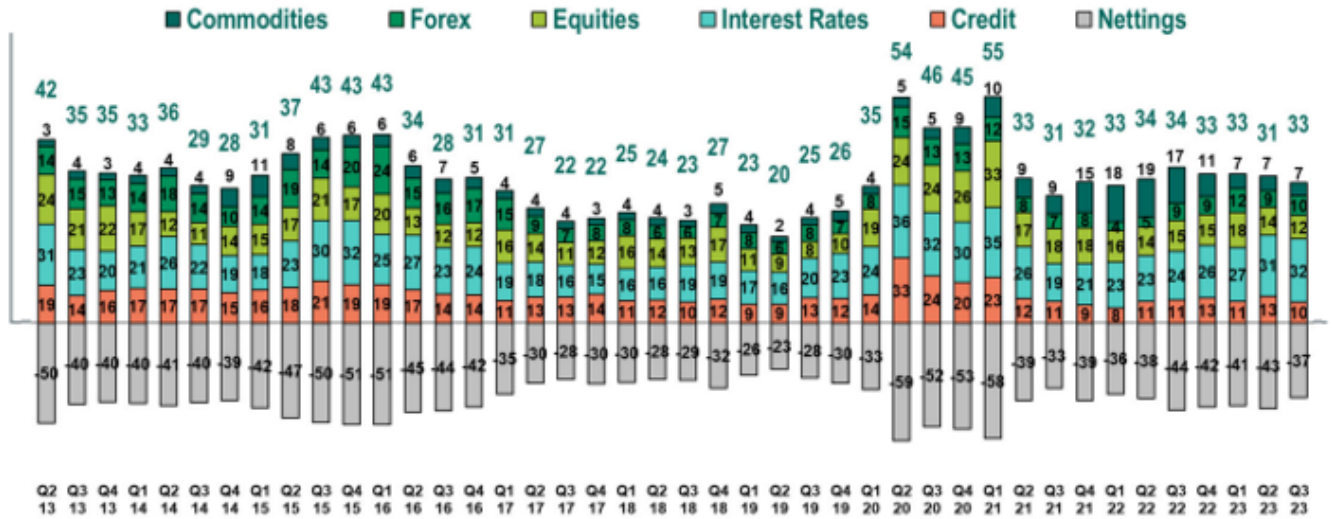
Prudent growth of market activities: stable VaR
(a measure of market risk)



Corporate and Institutional Banking
Market risks – 9M23

Average 99% 1-day interval VaR (Value at Risk)

In €m



Average VaR stable at a low level[1]

- A low level but up slightly vs. 2Q23
- No theoretical back-testing event this quarter
- 3 theoretical back-testing events over the past 12 months and only 21 since 01.04.2013, a little more than two per year over a long period, including crises, in line with the internal (1 day, 99%) VaR calculation model

1. VaR calculated to monitor market limits

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Market Risk – Santander

Market risk

The risk associated with global corporate banking trading activity is focused on serving the needs of our customers. It is measured in terms of daily VaR at 99% and is mainly produced by possible interest rate movements.

In the third quarter, average VaR was EUR 11 million. Although uncertainty continues regarding the inflation performance and its final impact on economic growth, less volatility was observed in the markets than in the first half of 2023 (marked by several events, such as those related to some regional banks in the US and Europe, or the negotiation of the debt ceiling in the US). By market factor, VaR continued to be driven mainly by interest rate risk. These risk figures remain low compared to the size of the Group's balance sheet and activity.

Trading portfolios.[1] VaR by geographic region

EUR million

	2023		2022
Third quarter	Average	Last	Average
Total	**10.9**	**11.7**	**14.6**
Europe	8.2	9.4	14.1
North America	4.5	5.5	2.0
South America	7.2	7.5	7.7

1. Activity performance in Santander Corporate & Investment Banking markets.

Risk.net

When the mandarins at the Basel Committee on Banking Supervision *mooted a sweeping overhaul of trading book capital rules, the intention was for banks' advanced models to form a key part of the new regime.* ***The reality is very different.***

- Just four banks are known to be applying to use their own models to calculate their trading book capital requirements.
- Experts blame regulators for blindly setting rigid criteria for new tests guarding entry to the internal models approach. Banks had to cut corners when simulating these new tests during the drafting of the standard.
- A further handicap is the Basel III output floor, which limits the capital benefits that banks can derive from using their own models. Credit risk accounts for most, if not all, the internal modelling headroom at many banks.
- "We're being thrown back into the Stone Age," says a senior risk modeller at a North American bank.
- Experts have suggested that separate output floors for each type of risk might ease the problem.

IRB as percentage of total RWAs

Bank	Total RWAs	IRB RWAs	IRB RWAs/Total RWAs
Barclays	£342,717,000,000	£114,985,000,000	34%
BNP Paribas	€703,694,000,000	€287,009,000,000	41%
Crédit Agricole	€609,852,000,000	€296,106,000,000	49%
Deutsche Bank	€349,742,000,000	€189,532,000,000	54%
Groupe BPCE	€457,606,000,000	€186,262,000,000	41%
HSBC	$854,114,000,000	$477,458,000,000	56%
ING	€323,071,000,000	€208,905,000,000	65%
Intesa Sanpaolo	€302,110,000,000	€136,505,000,000	45%
MUFG	¥135,149,165,000,000	¥42,428,289,000,000	31%
Mizuho	¥76,039,413,000,000	¥39,638,730,000,000	52%
Nomura	¥18,344,672,000,000	¥1,455,697,000,000	8%
Royal Bank of Canada	C$590,257,000,000	C$285,804,000,000	48%
Santander	€623,731,000,000	€195,107,000,000	31%
Societe Generale	€388,825,000,000	€171,007,000,000	44%
SMFG	¥81,613,040,000,000	¥42,804,763,000,000	52%
Toronto Dominion	C$579,424,000,000	C$360,933,000,000	62%
UBS	$546,505,000,000	$206,896,000,000	38%

NB Dark-shaded banks are known to be applying for IMA. Data for Canadian banks is January 31, 2024; data for all other banks is December 31, 2023.

Source: *Bank Pillar 3 disclosures*

Banking

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Fall Semester 2024

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