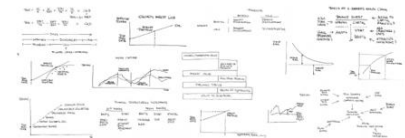# Risk Management in Banking
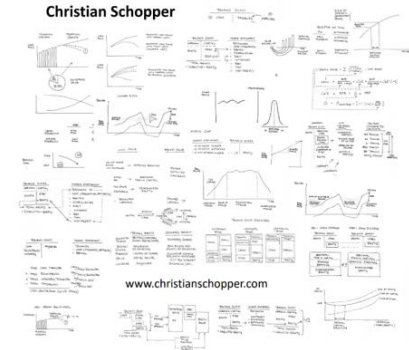
2015

For more concepts click on:

Corporate Finance Concepts

Christian Schopper

www.christianschopper.com
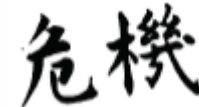
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What is Risk?

- In traditional terms, risk is viewed as a 'negative'
  - Webster's dictionary, for instance, defines risk as "exposing to danger or hazard"
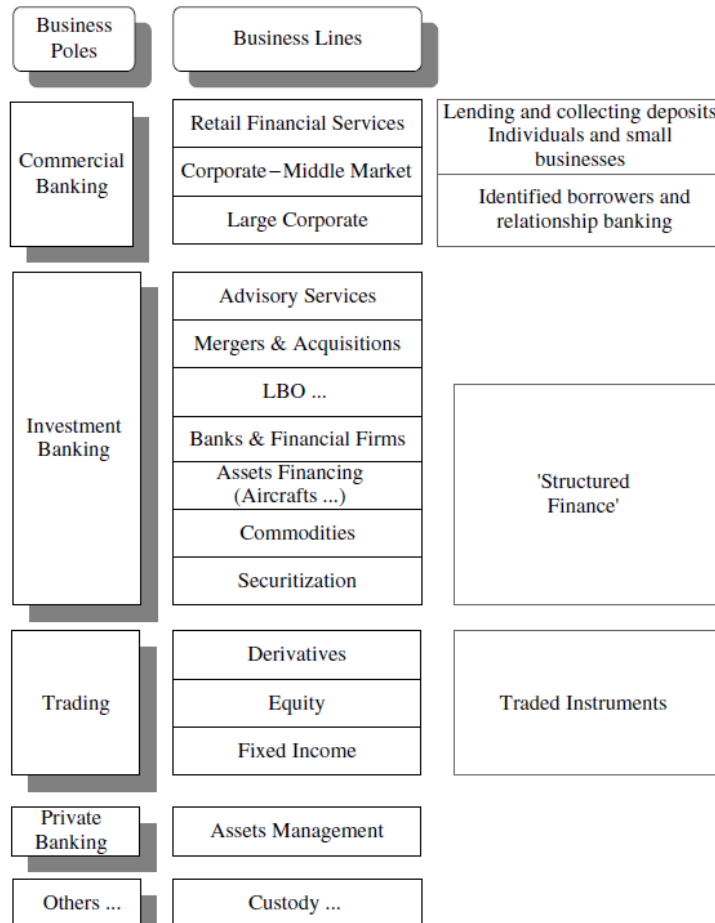
- The Chinese give a more appropriate description of risk

危機

- The first element is the symbol for "**danger**"

- The second element is the symbol for "**opportunity**", making risk a mix of danger and opportunity

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Risk Management

- Risk management is present in **all aspects of life**
  - It is about the everyday trade-off between an expected reward an a potential danger

- In the business world, risk is often associated with some variability in financial outcomes
  - However, the notion of risk is much larger. It is universal, in the sense that it refers to human behaviour in the decision making process

- Risk management is an attempt to **identify,** to **measure,** to **monitor** and to **manage uncertainty**

Bank Portfolio along Organizational Dimensions

Main Risks in a Financial Institution

Income statement and earnings

Interest margin plus fees
Capital gains and losses
−Operating costs
=Operating income (EBTD)[a]
−Depreciation
−Provisions
−Tax
=Net income

[a]EBTD = Earnings Before Tax and Depreciation.

Simplified balance sheet

Assets	Equity and liabilities
Cash	Short-term debt
Lending	Deposits
Financial assets	Financial assets
Fixed assets	Long-term debt
	Equity
Off-balance sheet (contingencies received)	Off-balance sheet (contingencies given)

Banking Risks
- Credit
- Interest rate
- Market
- Liquidity
- Operational
- Foreign exchange
- Other risks: country risk, settlement risk, performance risk …

Classification of Risks in a Financial Institution

Risk types		Risk sub-types	
Credit risk		Counterparty / default risk	
Market risk		Equity risk	
Operational risk[1]		Country and transfer risk	
Liquidity risk		Securitization risk	
Interest rate risk in the banking book		Credit risk concentrations	
Other risks		Residual risk arising from credit risk mitigation techniques[1]	

[1] In general, legal risks fall into the category of operational risk. However, legal risks arising from transactions intended to reduce credit risk are explicitly defined as a subtype of credit risk (residual risks arising from credit risk mitigation techniques).

Market risks in the trading book
Foreign exchange risk in the banking book

Strategic risk
Reputation risk
Capital risk
Earnings risk

Risk Management with Business Lines and Central Functions
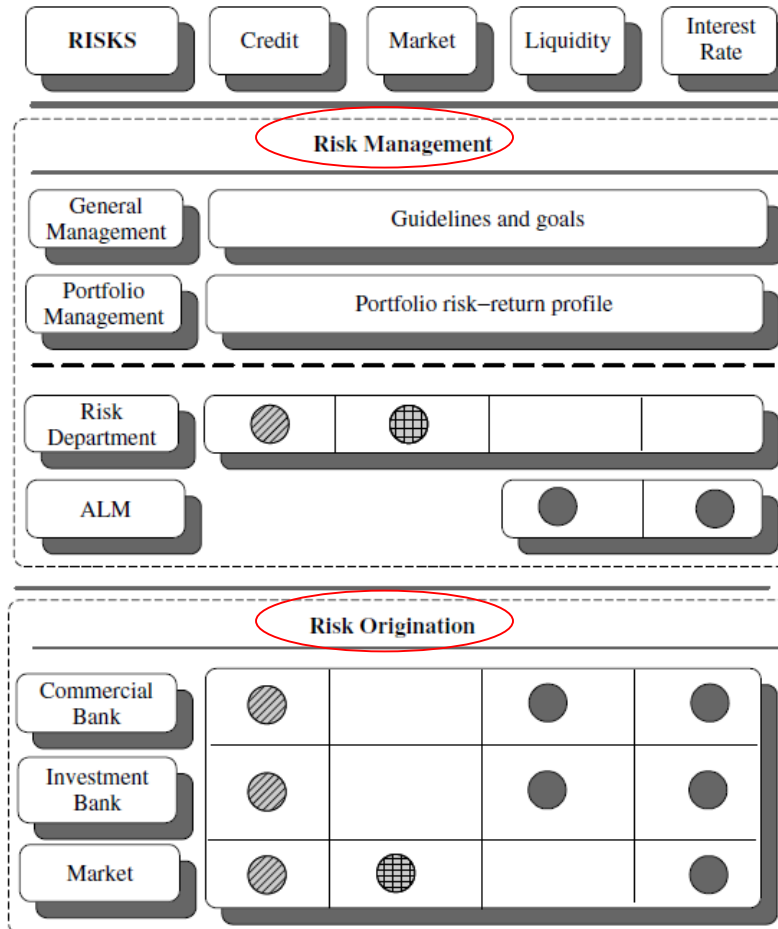
Functions of Central Units and of the Risk Department

Control

- Accounting
- Regulatory compliance
- Cost accounting
- Budgeting and planning
- Monitoring and control
- Monitoring performances
- Reporting to general management

ALM

- Liquidity and interest rate risk management
- Measure and control of risks
- Compliance
- Hedging
- Recommendations: balance sheet actions
- Transfer pricing systems
- ALCO
- Reporting to general management

Credit Risk

- Credit policy
- Setting credit risk limits and delegations
- Assigning internal ratings
- Credit administration (credit applications and documentation)
- Credit decisions (credit committees)
- Watch lists
- Early warning systems
- Reporting to general management

Risk Department

- Monitoring and control of all risks
- Credit & market, in addition to ALM
- Decision-making
- Credit policy
- Setting limits
- Development of internal tools and risk data warehouses
- Risk-adjusted performances
- Portfolio actions
- Reporting to general management

Portfolio Management

- Trading credit risk
- Portfolio reporting
- Portfolio restructuring
- Securitizations
- Portfolio actions
- Reporting to general management

Market Risk

- Limits
- Measure and control of risks
- Compliance
- Monitoring
- Hedging
- Business actions
- Reporting to general management

Role and Type of Capital in a Financial Institution

Role of Capital

- **Absorb** large unexpected **losses**

- **Protect depositors** and other claim holders

- Provide enough **confidence** to external investors and rating agencies on the financial **health** and viability of the institution

Type of Capital

- **Economic Capital (EC) or Risk Capital**
  – An **estimate** of the level of capital that a firm **requires** to operate its **business**

- **Regulatory Capital (RC)**
  – The capital that a bank is **required** to hold by **regulators** in order to operate

- **Bank Capital (BC)**
  – The **actual** physical capital held

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Economic Capital

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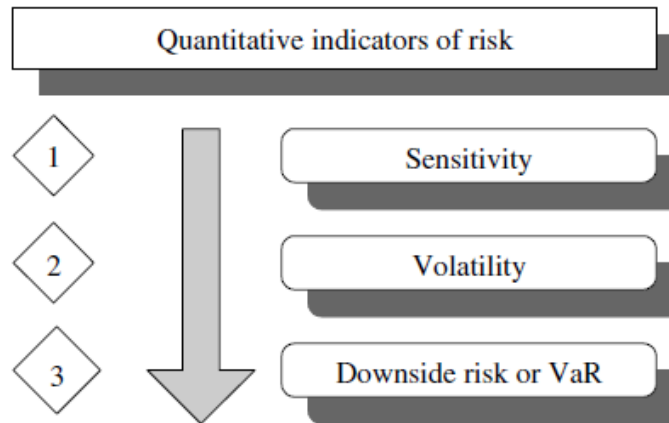Corporate Finance Central Europe

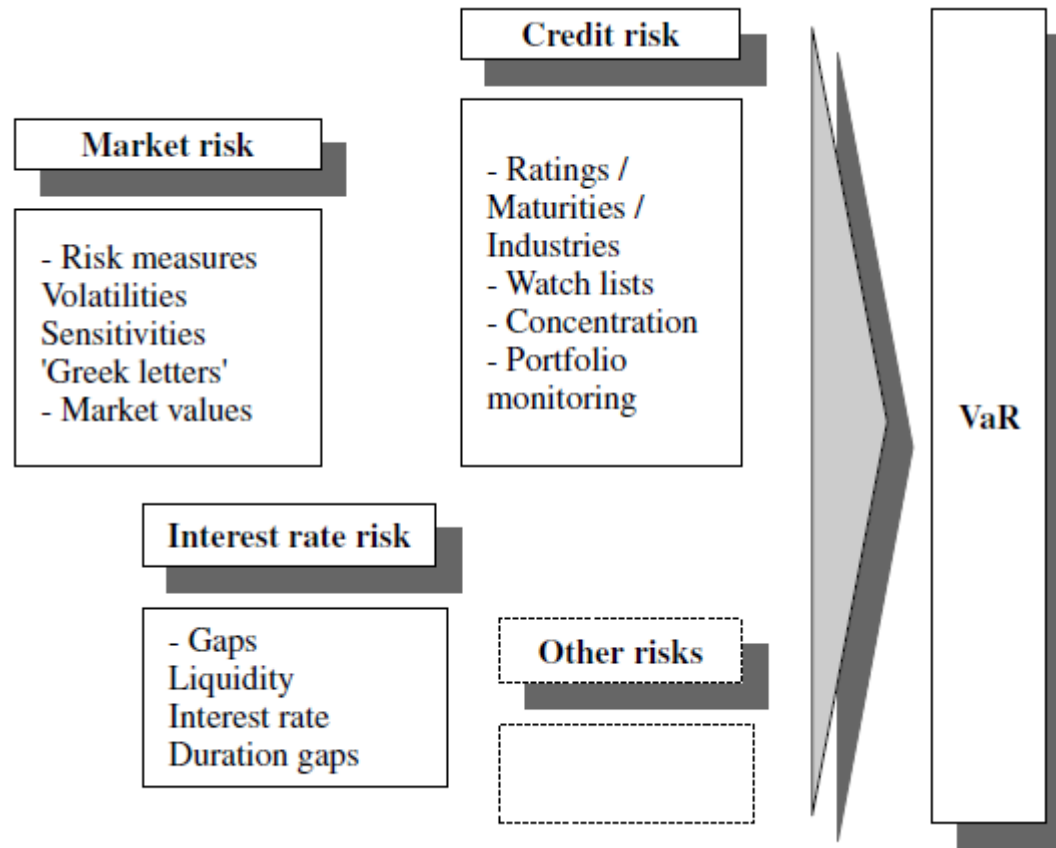# Why Economic Capital?

The Issue of Volatility
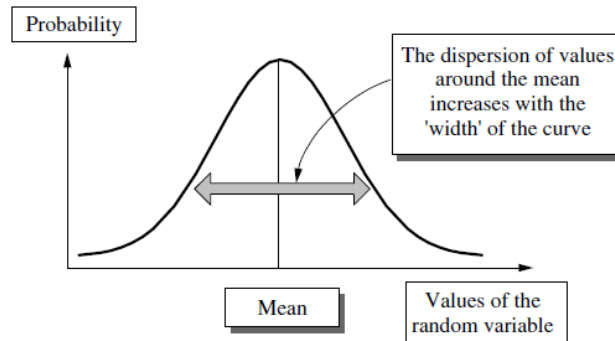
- Economic Capital acts as a **buffer** that provides **protection** against all the credit, market, operational and business **risks** faced by an institution

- Economic Capital is set at a **confidence level** that is less than 100% (e.g. 99.9%), since it would be too costly to operate at the 100% level

Risk Measures

Quantitative indicators of risk

1 → Sensitivity

2 → Volatility

3 → Downside risk or VaR

Probability — The dispersion of values around the mean increases with the 'width' of the curve

Mean — Values of the random variable

Market risk — Gains / Losses

Credit risk — Losses

- Large losses
- Low probability
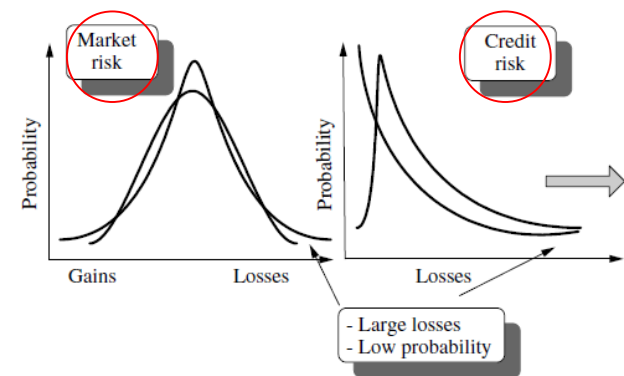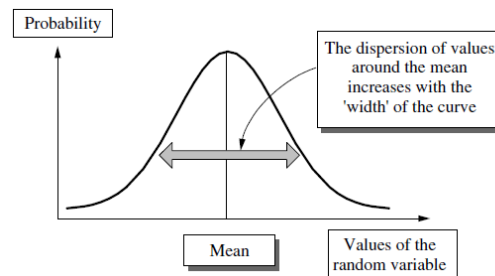
From Traditional Measures of Risk to VaR

Market risk

- Risk measures
Volatilities
Sensitivities
'Greek letters'
- Market values

Credit risk

- Ratings /
Maturities /
Industries
- Watch lists
- Concentration
- Portfolio
monitoring

Interest rate risk

- Gaps
Liquidity
Interest rate
Duration gaps

Other risks

VaR

The VaR Question

- **Volatility** does **not care about the direction** of an investment's movement …
- … whereby **VaR** focuses on the odds of **losing money**
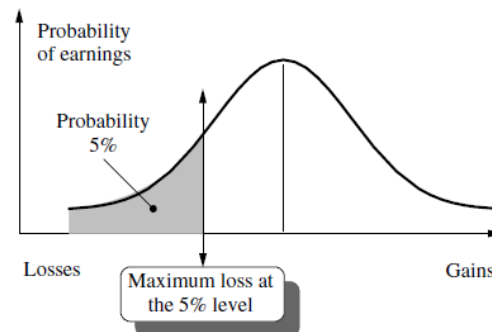
"What **loss level** is such …

… that we are *X*% **confident** …

… it will **not** be **exceeded** …

… in *N* business days?"
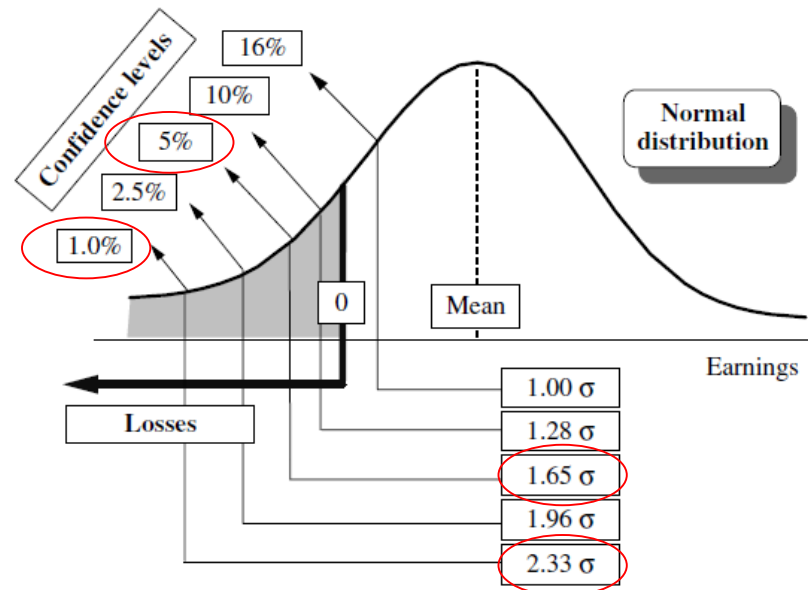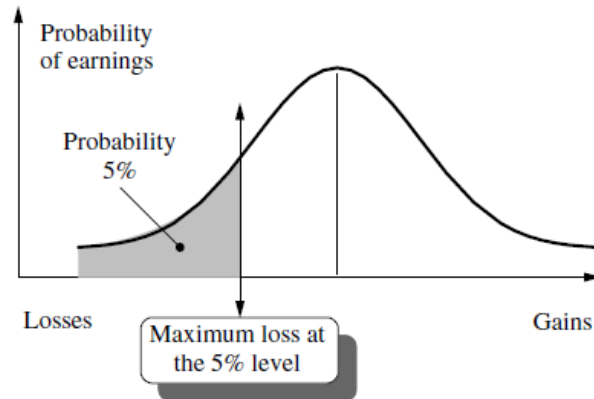
Simplified: "**How bad can things get**?"

- It captures an important aspect of risk in a **single number**
- **It** is **easy** to understand
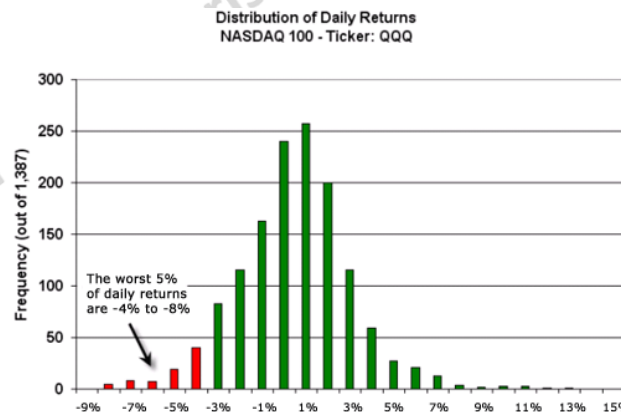- It can be **applied to both, loan as well as securities portfolios**

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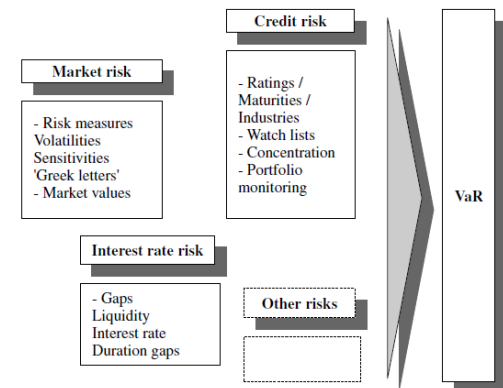
The Normal Distribution
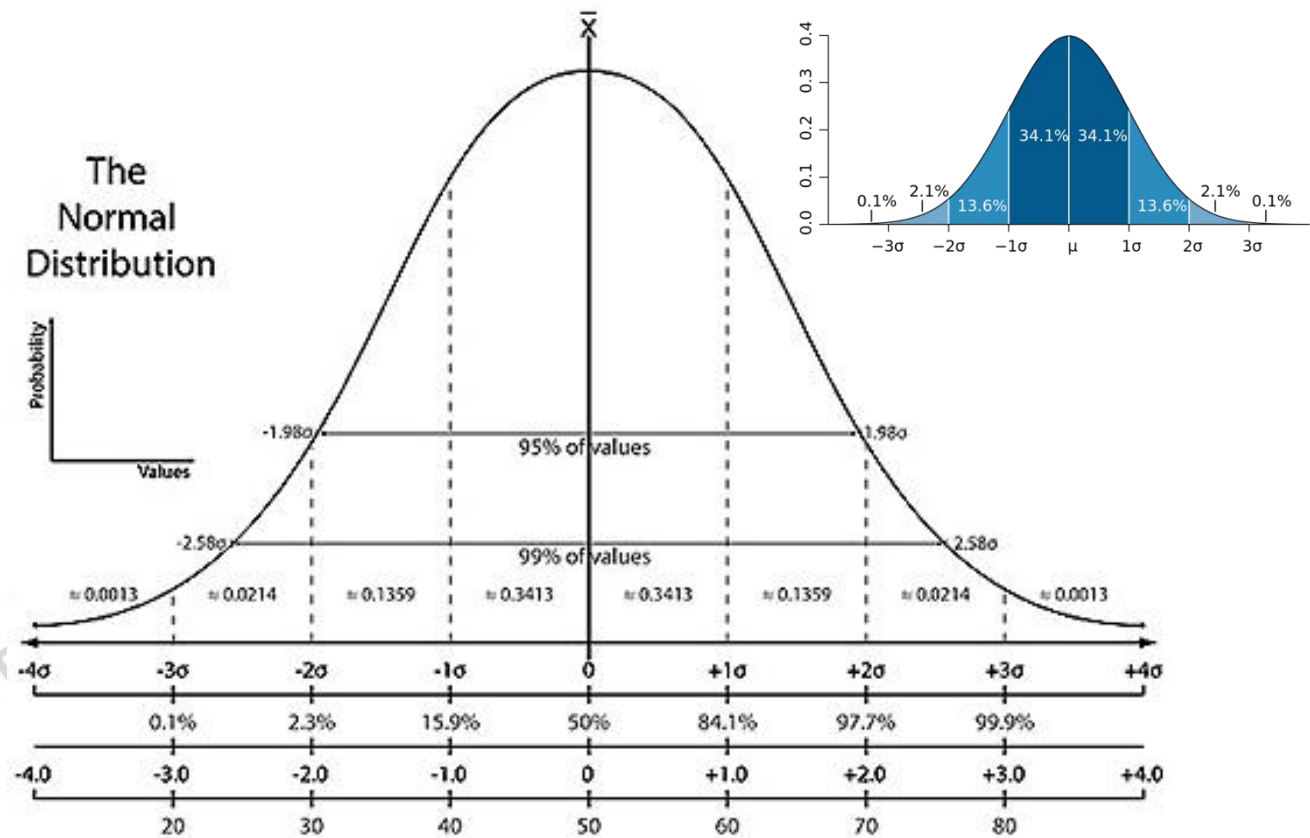
Confidence Levels and Normal Distribution

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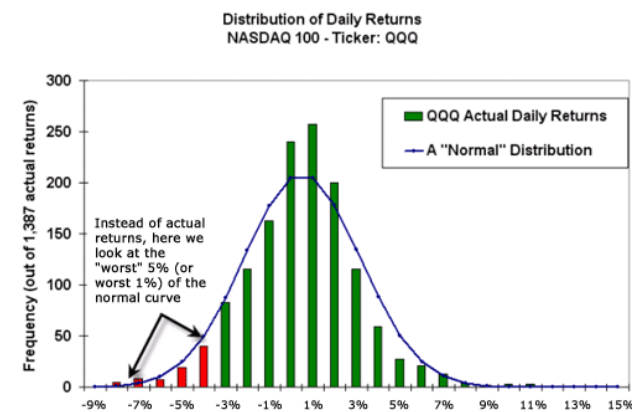
VaR Approach in Measuring Volatility

Historical Simulation

- Create a database of the **daily movements** in **all market variables**
  - The historical method **simply re-organizes actual historical returns**, putting them in order from worst to best
  - It then assumes that history will repeat itself, from a risk perspective

Distribution of Daily Returns
NASDAQ 100 - Ticker: QQQ

The worst 5% of daily returns are -4% to -8%

Model Building Approach

- **Assuming** that stock returns are **normally distributed**, expected return and a standard deviation are estimated
  - … also called the **variance-covariance approach**

- Advantage: Knowing the σ we know where the worst 5% and 1% lie on the curve

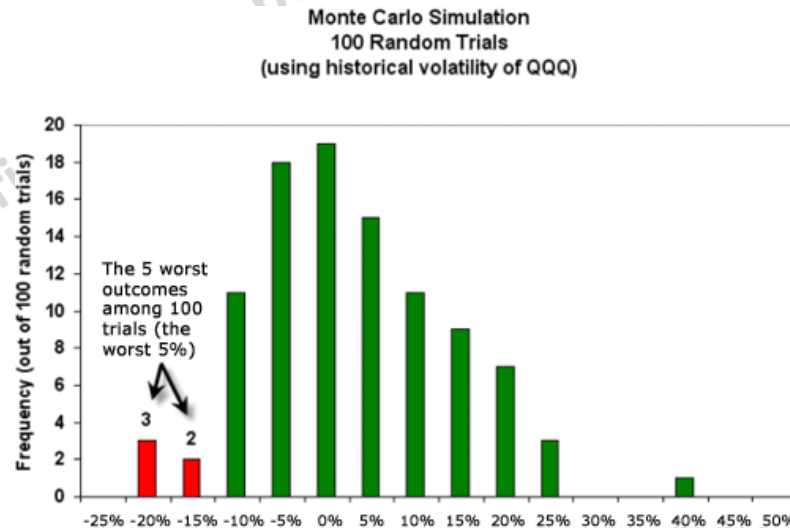**Distribution of Daily Returns**
NASDAQ 100 - Ticker: QQQ

- QQQ Actual Daily Returns
- A "Normal" Distribution

Instead of actual returns, here we look at the "worst" 5% (or worst 1%) of the normal curve

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• Note: While the previous graphs have shown daily returns, this graph displays monthly returns

Monte Carlo Simulation

• Involves developing a **model for future stock price returns and running multiple hypothetical trials** through the model

  – A Monte Carlo simulation refers to any method that randomly generates trials, but by itself does not tell us anything about the underlying methodology

  – For most users, a Monte Carlo simulation amounts to a "black box" generator of random outcomes …

Monte Carlo Simulation
100 Random Trials
(using historical volatility of QQQ)

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VaR and Time Horizon

VaR and Regulatory Capital

- In principle, also regulators base the capital they require banks to keep on VaR, foremost though on risk clusters

- Regulators require calculating the 10-day, 99% VaR …
- … whilst analysts usually calculate a 1-day 99% VaR

- Switch from a 10-day, 99% VaR ⟶ to a 1-day 99% VaR

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

- This is exactly true when **portfolio changes** on successive days come from **independent identically distributed normal distributions**

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Example: Microsoft / 10-day 99% VaR

- We have a position worth **$10m in Microsoft shares**
- Question: **What is the VaR with a 99% confidence level over a period of 10 days?**

- The **volatility** of a Microsoft share is **2% per day**
  - In **option pricing** we measure volatility "per year"
  - In **VaR** calculations we measure volatility "per day"

$$\sigma_{day} = \frac{\sigma_{year}}{\sqrt{252}}$$

➡ Microsoft´s volatility equals about 6.3% over 10 days or 31.7% per year

- Hence, the standard deviation of the change in the $10m Microsoft position with a daily 2% volatility is $200,000

➡ The standard deviation of the change of the position in 10 days is

$$200,000\sqrt{10} = \$632,456$$

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Example: Microsoft / 10-day 99% VaR

- For the calculation of a 10-day 99% VaR we use a **confidence level of 99%** (X=99)

- **Assumptions**:

  Expected **change in the value** of the portfolio is **zero** and …

  This is a fair assumption for short time periods

  … change in the value of the portfolio is **normally distributed**

- In the VaR calculation we are **only interested in the loss**, so on **one side of the tail**
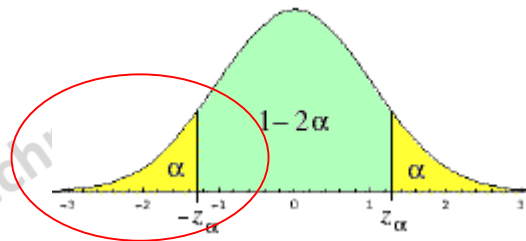
α = tail area	central area = $1 - 2\alpha$	z_α
0.10	0.80	$z_{.10} = 1.28$
0.05	0.90	$z_{.05} = 1.645$
0.025	0.95	$z_{.025} = 1.96$
0.01	0.98	$z_{.01} = 2.33$
0.005	0.99	$z_{.005} = 2.58$

- Since N(–2.33) = 0.01, the 10-day 99% VaR is

$$2.33 \times 632,456 = \$1,473,621$$

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Example: AT&T / 10-day 99% VaR

- We have a position worth **$5m in AT&T shares**
- Question: **What is the VaR with a 99% confidence level over a period of 10 days?**

- The **volatility** of an AT&T share is **1% per day**
  - hence approximately 3.2% over 10 days or 15.9% per year

- The standard deviation of the change in the $5m AT&T position with a daily 1% volatility over a 10-day period is $158,144

$$50,000\sqrt{10} = \$158,144$$

- The 10-day 99% VaR is

$$158,114 \times 2.33 = \$368,405$$

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Example: Portfolio of Microsoft and AT&T   / 10-day 99% VaR

- Now consider a **portfolio consisting of $10m Microsoft and $5m AT&T shares**

- Suppose that the **correlation between the returns is 0.3**

- The standard deviation of a portfolio of 2 stock is defined as:

$$\sigma_{X+Y} = \sqrt{\sigma_X^2 + \sigma_Y^2 + 2\rho\sigma_X\sigma_Y}$$

- In this Microsoft / AT&T portfolio case
  - $\sigma X = 200,000$
  - $\sigma Y = 50,000$
  - $r = 0.3$

- The standard deviation of the change in the portfolio value in one day is therefore $220,227

- The 10-day 99% VaR for the Microsoft / AT&T portfolio is
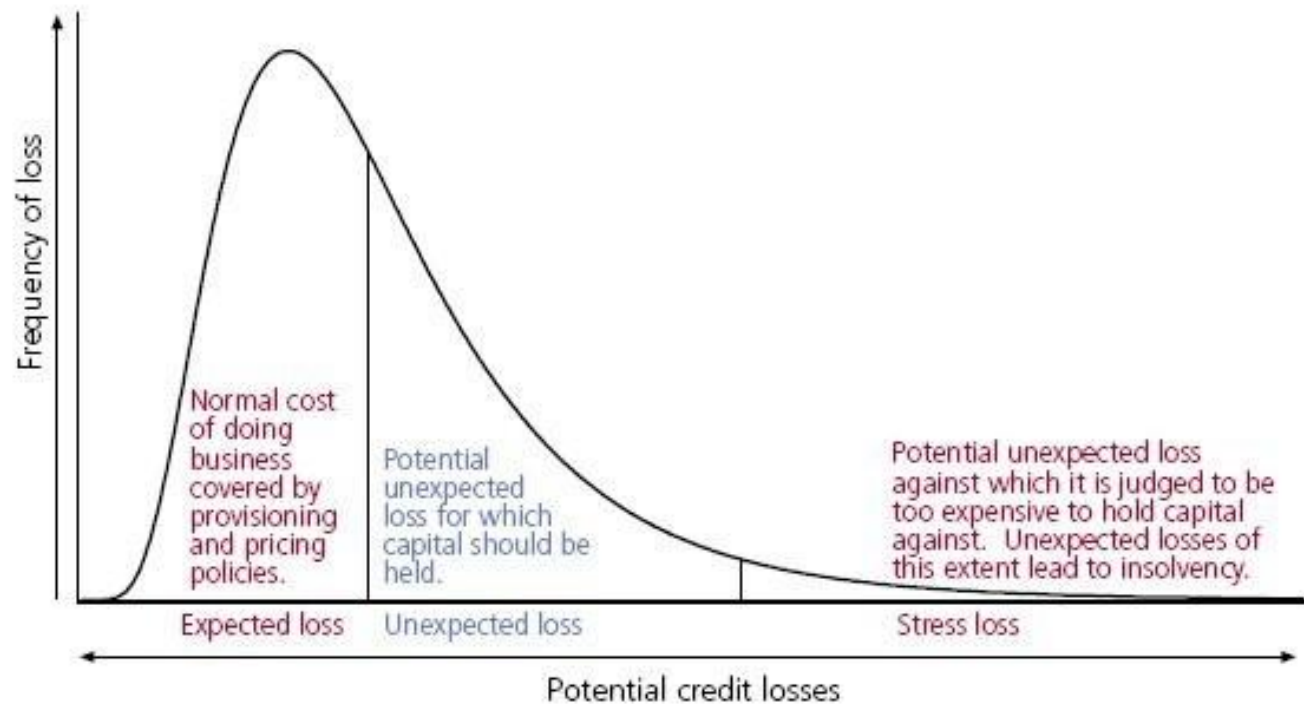$$220,227 \times \sqrt{10} \times 2.33 = \$1,622,657$$

- The **benefits of diversification** are (1,473,621+368,405) −1,622,657 = $219,369

- Therefore, there is an incremental effect of holding AT&T additionally on VaR
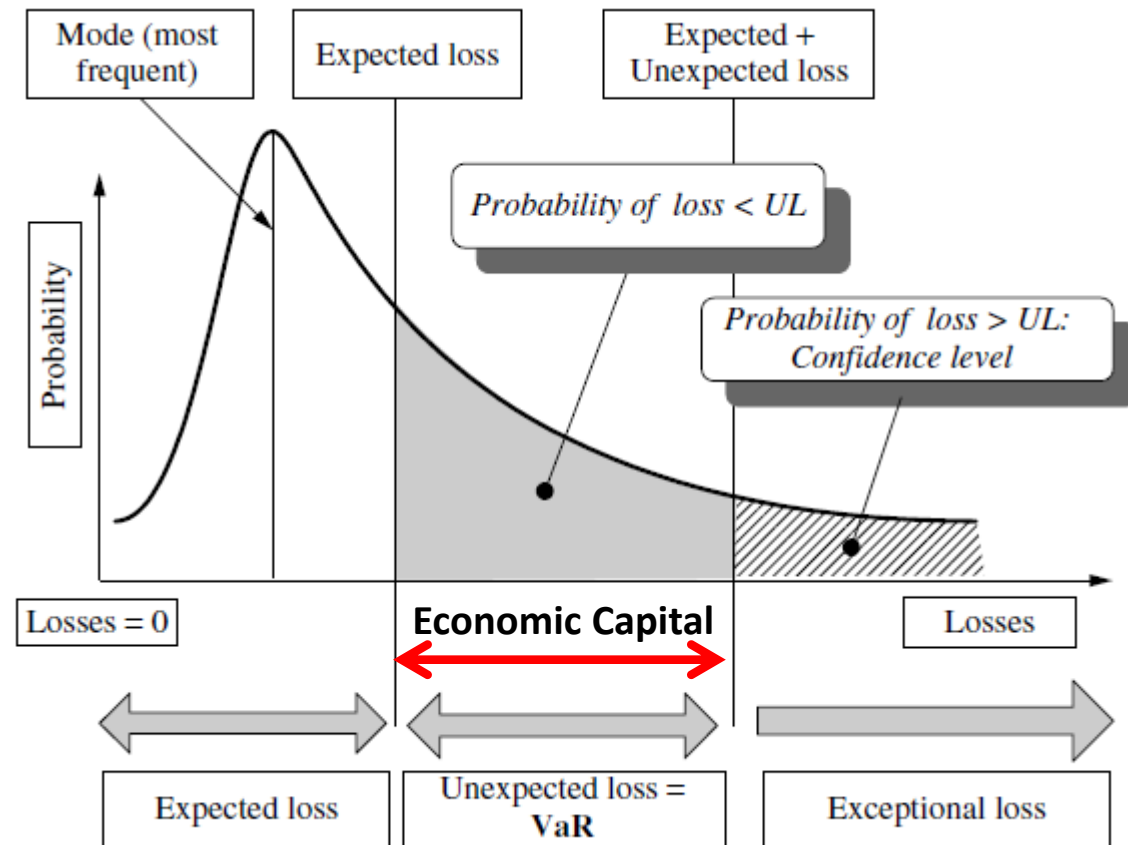
The Coverage of Credit Losses

- What to look for in a bank´s financial statements:
  1. The **adequacy** of **general and specific loan loss provisions**, and
  2. The **size of the general and specific loan loss reserve in relationship to the total exposures** of the bank
     - Allowance for loan losses creates a cushion of credit losses in the bank's credit portfolio
     - Primarily intended to absorb the bank's expected loan losses

- **Historically** credit decisions were made in a **case by case** basis

- Growing sophistication and automation of lending and the increasing complexity of credit products have spawned the **development of computational approaches to credit assessment and evaluation** of individual retail and commercial borrowers
  - Introduction of bank-wide credit risk software has accelerated
  - In part driven by regulatory pressures, as regulators demanded improved analysis and oversight of the risk assessment process

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The Assessment of Credit Losses

Frequency of loss (y-axis) vs **Potential credit losses** (x-axis)

- **Expected loss:** Normal cost of doing business covered by provisioning and pricing policies.
- **Unexpected loss:** Potential unexpected loss for which capital should be held.
- **Stress loss:** Potential unexpected loss against which it is judged to be too expensive to hold capital against. Unexpected losses of this extent lead to insolvency.

Credit Losses, Economic Capital and VaR

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Expected and Unexpected Losses

Expected loss

… from an exposure

- In statistical terms, the expected loss is the average credit loss that we would expect from an exposure or a portfolio over a given period of time

- The **total expected loss of a portfolio** will simply be the **summation of expected losses of individual assets**
  - This is because the mean of the sum is the same as the sum of the mean.

- Since the expected loss is what a business expects to lose in a year, the business will generally have budget for it and the losses can be **borne as a part of the normal operating cash flows**

Unexpected loss

… loss that **exceeds** the **expectations**

- The unexpected loss is the **average total loss over and above the mean loss**

- It is calculated as a **standard deviation from the mean at a certain confidence level**. It is also referred to as **Credit Value at Risk** (**VaR**)

- A business will safeguard itself from **unexpected losses by allocating capital**

- Apart from the expected and unexpected losses, there are also **catastrophic losses**, which are covered by **insurance**

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Estimating Expected Credit Losses
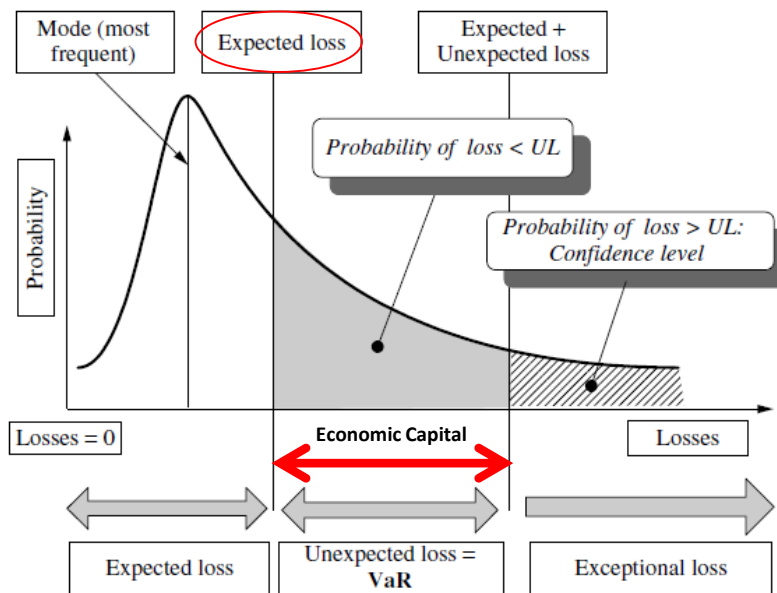
Estimating Expected Credit Losses (cont´d)

$$EL = PD \times LGD \times EAD$$

- **Probability of Default (PD)**
  - The likelihood that the borrower will fail to make full and timely repayment of its financial obligations
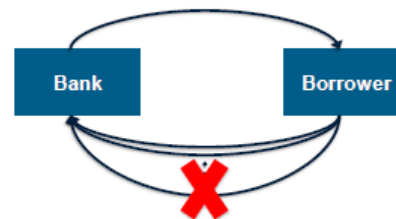
- **Exposure At Default (EAD)**
  - The expected value of the loan at the time of default

- **Loss Given Default (LGD)**
  - The amount of the loss if there is a default, expressed as a percentage of the EAD

- **Recovery Rate (RR)**
  - The proportion of the EAD the bank recovers

- Banks are expected to hold reserves against expected credit losses which are considered a cost of doing business
- The most basic model of expected loss considers two outcomes: default and non-default.
  - In the event of non-default, the credit loss is 0.
  - In the event of default, the loss is loss given default (LGD) times the current exposure (EAD)

Event	Loss	Probability
No default	0	1 - PD
Default	LGD x EAD	PD

Expected Loss = (1-PD) x 0 + PD x LGD x EAD = PD x LGD x EAD

Example: Estimating Credit Losses

Distressed Loan: How much can Bank ABC expect to lose?

* A borrower (Company X) takes out a **loan** from Bank ABC for **$10 m** (EAD)

* Company X pledges **$3m collateral** against this loan
    – … for simplicity, let's say the collateral is cash

* The Company's PD is determined by analyzing their credit risk aspects
    – … evaluate the financial health of the borrower, taking into account economic trends, borrower relationship with the bank, etc.

* For Company X, let's say the **PD is 0.99**
    – This means that the Company is extremely risky; the probability of them defaulting on the loan is 99%

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Example: Estimating Credit Losses (cont´d)

Loss given default (LGD)

- Company X defaults
  - … is unable to pay back the $10m to Bank ABC
- The Bank will be able to recover $3m
  - … this is the cash-secured collateral

- **LGD = 1 – Recovery Rate (RR)**
  - The **Recovery Rate (RR)** is defined as the proportion of a bad debt that can be recovered

- **RR = Value of Collateral / Value of the Loan**
  - The recovery rate for Bank ABC = $3m/ $10m= 30%

- So % LGD = 1- 0.30 = 0.70 or **70%**
- $ LGD = 70% of a $10m (EAD) loan is equal to $7m
- **$ LGD = $7m**

Expected Loss (EL)

- What a bank can expect to lose in the case that their borrower defaults

- EL = PD * LGD * EAD
- EL= 0.99* 70% * $10m
- **EL = $6.93m**

Bank ABC can expect to lose $6.93m

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Estimating Economic Capital for Credit Losses

Rating target	Confidence level
AAA	99,97%
AA+	99,95%
AA	99,93%
AA-	99,90%
A+	99,87%
A	99,83%
A-	99,73%
BBB+	99,48%
BBB	99,16%
BBB-	98,25%
BB+	96,60%
BB	94,10%
BB-	91,33%
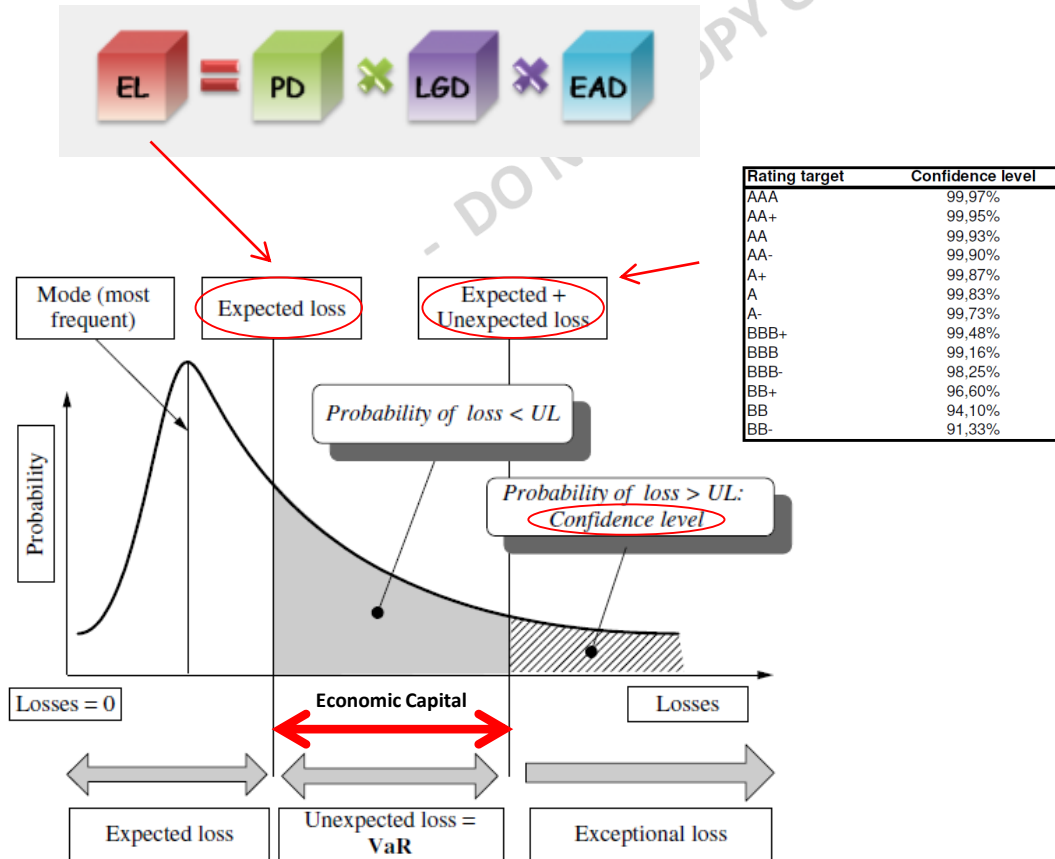
Unexpected Credit Loss - Credit Value at Risk (CVaR)

- Banks take inevitably **a lot of illiquid assets** in their balance sheet held till maturity
  - Cannot easily be managed or hedged
- Hence, banks expect and anticipate some losses
  - … but losses have to be long-term lower than the revenues and provisions
- **Unanticipated losses** are twofold
  - **Obligor defaults – even having a non-zero probability** of default but generally not anticipated - and may cause large losses on a loan portfolio
  - Unanticipated risk are unexpected **credit migrations**, that make **future defaults** of the obligors **more probable**
- The sum of expected loss and extreme losses the bank has to set aside in order to maintain its solvency
  - **Unexpected losses** are not anticipated, though predictable
  - **Extreme losses** are highly rare, though not improbable

- The methodology adopted for **measuring credit risk** over the bank's portfolio is called Credit Value at Risk (CvaR)
  - The **relationship between a loss level and its probability of occurrence is called the loss probability distribution**
  - The goal is to estimate the loss level that is going to occur …
  - … alas: The probability that the bank's portfolio suffers losses larger than the sum of expected and unexpected losses is equal to the confidence level

Illustrative Example

$$P[L \leq CVaR_{99.9\%}] = 99.9\%$$

Rating target	Confidence level
AAA	99,97%
AA+	99,95%
AA	99,93%
AA-	99,90%
A+	99,87%
A	99,83%
A-	99,73%
BBB+	99,48%
BBB	99,16%
BBB-	98,25%
BB+	96,60%
BB	94,10%
BB-	91,33%

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Calculation of the CVaR

- As an approximation one could use for the calculation of CVaR corresponding (high yield) portfolios …
- … however, such are usually more volatile and overstate the corresponding CVaR, as – eg - syndicated loans are commonly a relatively more stable asset class

- The **most popular formula** of parametric CVaR is to assume that **economic capital** is a **multiple of the standard deviation of the credit losses**
  - The parametric CvaR depends on the standard deviation of the loss on each line of the portfolio and on the correlations between each line

- The **second method** consists in generating the loss distribution by direct **Monte-Carlo simulations** and to find the loss level corresponding to the confidence level (eg 99.9% for a AA- credit rating*)*
  - Estimate the **defaults and losses over each obligor** of the portfolio. It consists in assigning a rating and a loss given default to any obligor
  - Estimate the **dependence between obligors**. In practice, either we determine pairwise asset correlations or obligors are assigned an industry sector and a country, and we determine industry and country correlations
  - Generate the **correlated defaults and loss given defaults**. Take into account guarantees, collaterals…
  - Compute the losses at the transaction level and add them at the portfolio level.
  - By **repeating the above steps a large number of times**, compute the loss distribution and the relevant indicators

  - **Illustrative Example**: 10,000 times, BB, 3 yrs simulation

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Regulatory Capital

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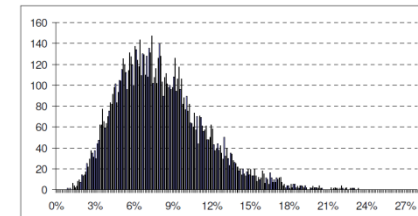
Economic vs Regulatory Capital

Without regulatory capital requirement, **banks may not have an incentive to keep a large amount of capital** as they have alternative use of the funds to engage in risk-taking business initiative(s) with a view to create profits …

- Economic capital is the capital that **shareholders would choose** in the absence of regulation

- Regulatory capital depends on the **confidence level set by the regulator**, while economic capital depends on the intermediation margin and the cost of bank capital
    - Usually, economic capital is above regulatory capital for low values of the cost of capital, and when this cost increases, the former quickly falls below the latter

- Variables that affect both economic and regulatory capital, such as the loans' probability of default and loss given default, have a positive impact on both capital levels for reasonable values of these variables
    - But when they reach certain critical values their effect on economic capital becomes negative, increasing the gap with regulatory capital

- In reality banks choose their capital structure considering the regulations in place, i.e. they choose actual rather than economic capital
    - Actual capital is the equity capital chosen by the bank shareholders when their choice is restricted by two regulations: (i) an initial capital greater than or equal to the minimum required by regulation, and (ii) a closure rule for critically undercapitalized banks

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Risk Management and Handling

From Basel I to Basel II

Business risks of a bank

Credit risk

Credit risk / Market risk

"Operational" risks

Basel I (1988)

Basel I (1995)

Credit risk / Market risk

Credit risk / Market risk / Operat. risk

Residual risks
e.g. strategic or reputational risk

Basel II (2004)
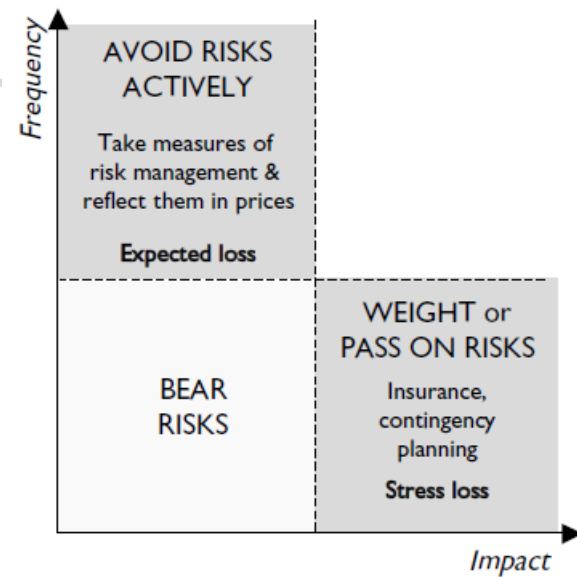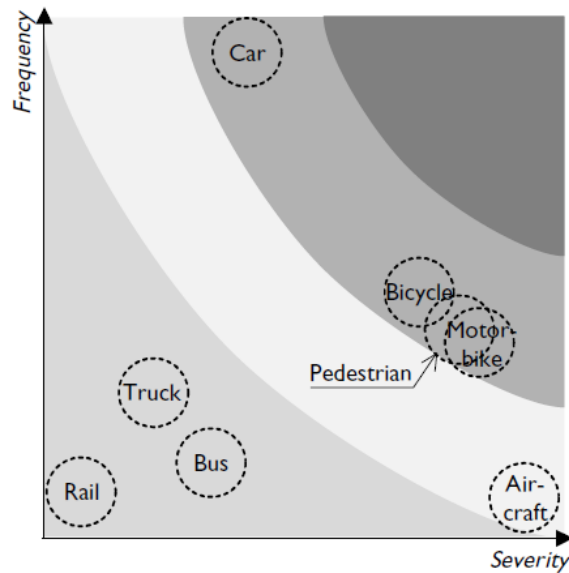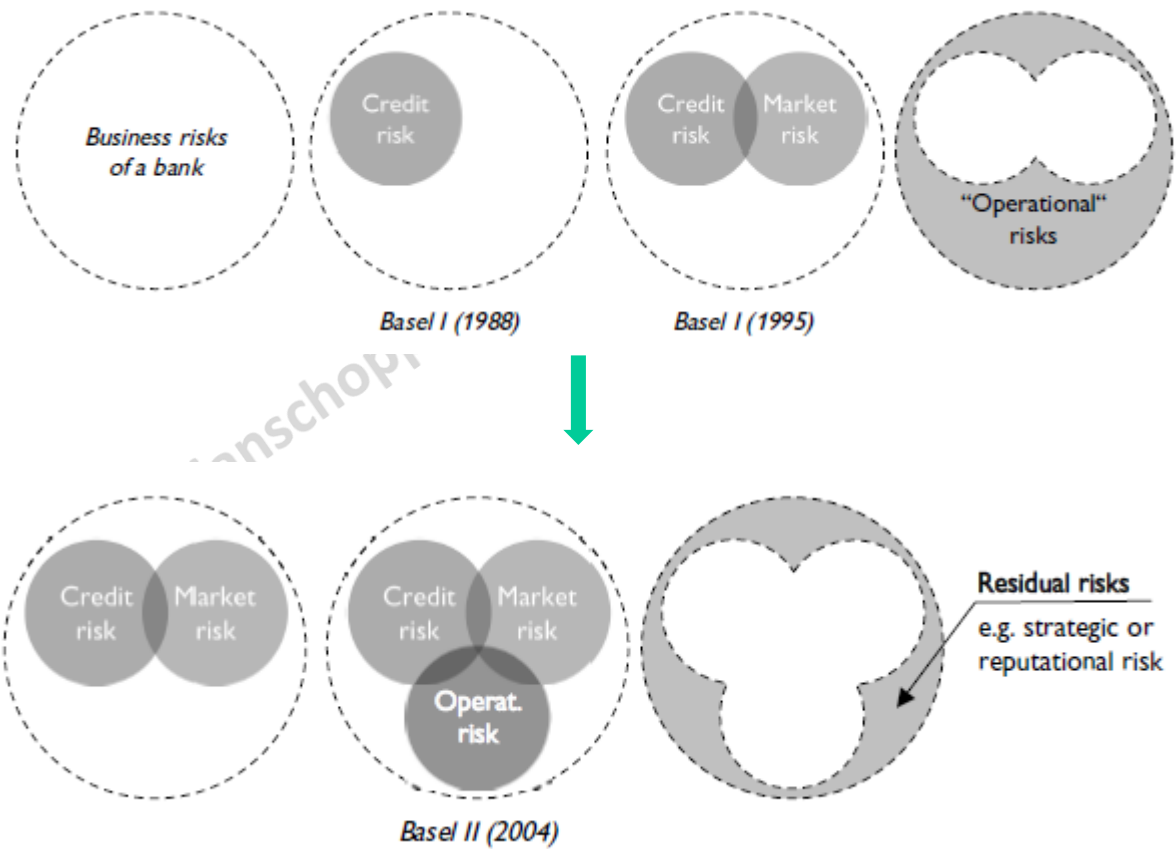
Basel II was Based on Three Pillars …

Pillar 1 - Minimum Capital Requirements

- Establishes minimum standards for **management of capital** on a more risk sensitive basis
  - Credit Risk
  - Operational Risk
  - Market Risk

Pillar 2 - Supervisory Review Process

- Increases the responsibilities and levels of discretion for **supervisory reviews and controls** covering
  - Evaluate Bank's Capital Adequacy Strategies
  - Certify Internal Models
  - Level of capital charge
  - Proactive monitoring of capital levels and ensuring remedial action

Pillar 3 - Market Discipline

- Bank will be required to increase their **information disclosure**, especially on the measurement of credit and operational risks
  - Expands the content and improves the transparency of financial disclosures to the market

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… with all Pillars Posing Problems …

Pillar 1

- No concentration penalty
- No country-specific risk
- CDS destroys notions of ex ante risks in the specific financial Institutions
- Contagion and counterparty risk as hallmarks
- The capital regulations are procyclical… …particularly when banks estimate
    – Probability of Default
    – Loss Given Default
    – Exposure at Default

Pillar 2 and 3

- Supervisors can't be forward looking
- Markets just aren't efficient

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… Leading to the Basel III Proposals for Reform

1. To raise the **quality, consistency and transparency of the capital base**
- Common equity is good
- Remove goodwill, minority interests, deferred tax assets and investments in other financial Institutions

2. Enhancing **risk coverage**
- Use „stressed" inputs
- Wrong-way risk
- Correlation multiplier
- Margining periods
- Centralised exchange incentives

3. **Leverage** ratio
- 'Backstop' leverage ratio

4. **Pro-cyclicality**
- Forward-looking
- Provisioning buffers are very important

The Need for Regulation: Basel III Banking Supervision

Basel Committee on Banking Supervision reforms - Basel III

Strengthens microprudential regulation and supervision, and adds a macroprudential overlay that includes capital buffers.

	Capital					Liquidity
	Pillar 1			Pillar 2	Pillar 3	**Global liquidity standard and supervisory monitoring**
	Capital	**Risk coverage**	**Containing leverage**	**Risk management and supervision**	**Market discipline**	
All Banks	**Quality and level of capital** Greater focus on common equity. The minimum will be raised to 4.5% of risk-weighted assets, after deductions. **Capital loss absorption at the point of non-viability** Contractual terms of capital instruments will include a clause that allows – at the discretion of the relevant authority – write-off or conversion to common shares if the bank is judged to be non-viable. This principle increases the contribution of the private sector to resolving future banking crises and thereby reduces moral hazard. **Capital conservation buffer** Comprising common equity of 2.5% of risk-weighted assets, bringing the total common equity standard to 7%. Constraint on a bank's discretionary distributions will be imposed when banks fall into the buffer range. **Countercyclical buffer** Imposed within a range of 0-2.5% comprising common equity, when authorities judge credit growth is resulting in an unacceptable build up of systematic risk.	**Securitisations** Strengthens the capital treatment for certain complex securitisations. Requires banks to conduct more rigorous credit analyses of externally rated securitisation exposures. **Trading book** Significantly higher capital for trading and derivatives activities, as well as complex securitisations held in the trading book. Introduction of a stressed value-at-risk framework to help mitigate procyclicality. A capital charge for incremental risk that estimates the default and migration risks of unsecuritised credit products and takes liquidity into account. **Counterparty credit risk** Substantial strengthening of the counterparty credit risk framework. Includes: more stringent requirements for measuring exposure; capital incentives for banks to use central counterparties for derivatives; and higher capital for inter-financial sector exposures. **Bank exposures to central counterparties (CCPs)** The Committee has proposed that trade exposures to a qualifying CCP will receive a 2% risk weight and default fund exposures to a qualifying CCP will be capitalised according to a risk-based method that consistently and simply estimates risk arising from such default fund.	**Leverage ratio** A non-risk-based leverage ratio that includes off-balance sheet exposures will serve as a backstop to the risk-based capital requirement. Also helps contain system wide build up of leverage.	**Supplemental Pillar 2 requirements.** Address firm-wide governance and risk management; capturing the risk of off-balance sheet exposures and securitisation activities; managing risk concentrations; providing incentives for banks to better manage risk and returns over the long term; sound compensation practices; valuation practices; stress testing; accounting standards for financial instruments; corporate governance; and supervisory colleges.	**Revised Pillar 3 disclosures requirements** The requirements introduced relate to securitisation exposures and sponsorship of off-balance sheet vehicles. Enhanced disclosures on the detail of the components of regulatory capital and their reconciliation to the reported accounts will be required, including a comprehensive explanation of how a bank calculates its regulatory capital ratios.	**Liquidity coverage ratio** The liquidity coverage ratio (LCR) will require banks to have sufficient high-quality liquid assets to withstand a 30-day stressed funding scenario that is specified by supervisors. **Net stable funding ratio** The net stable funding ratio (NSFR) is a longer-term structural ratio designed to address liquidity mismatches. It covers the entire balance sheet and provides incentives for banks to use stable sources of funding. **Principles for Sound Liquidity Risk Management and Supervision** The Committee's 2008 guidance *Principles for Sound Liquidity Risk Management and Supervision* takes account of lessons learned during the crisis and is based on a fundamental review of sound practices for managing liquidity risk in banking organisations. **Supervisory monitoring** The liquidity framework includes a common set of monitoring metrics to assist supervisors in identifying and analysing liquidity risk trends at both the bank and system-wide level.
SIFIs	In addition to meeting the Basel III requirements, global systemically important financial institutions (SIFIs) must have higher loss absorbency capacity to reflect the greater risks that they pose to the financial system. The Committee has developed a methodology that includes both quantitative indicators and qualitative elements to identify global systemically important banks (SIBs). The additional loss absorbency requirements are to be met with a progressive Common Equity Tier 1 (CET1) capital requirement ranging from 1% to 2.5%, depending on a bank's systemic importance. For banks facing the highest SIB surcharge, an additional loss absorbency of 1% could be applied as a disincentive to increase materially their global systemic importance in the future. A consultative document was published in cooperation with the Financial Stability Board, which is coordinating the overall set of measures to reduce the moral hazard posed by global SIFIs.					

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The Need for Regulation: Basel III Phase-In Arrangements

Basel III phase-in arrangements
(All dates are as of 1 January)

Basel Committee on Banking Supervision
BANK FOR INTERNATIONAL SETTLEMENTS

	Phases	2013	2014	2015	2016	2017	2018	2019
Capital	Leverage Ratio		Parallel run 1 Jan 2013 – 1 Jan 2017 Disclosure starts 1 Jan 2015				Migration to Pillar 1	
	Minimum Common Equity Capital Ratio	3.5%	4.0%	4.5%				4.5%
	Capital Conservation Buffer				0.625%	1.25%	1.875%	2.5%
	Minimum common equity plus capital conservation buffer	3.5%	4.0%	4.5%	5.125%	5.75%	6.375%	7.0%
	Phase-in of deductions from CET1*		20%	40%	60%	80%	100%	100%
	Minimum Tier 1 Capital	4.5%	5.5%	6.0%				6.0%
	Minimum Total Capital		8.0%					8.0%
	Minimum Total Capital plus conservation buffer		8.0%		8.625%	9.25%	9.875%	10.5%
	Capital instruments that no longer qualify as non-core Tier 1 capital or Tier 2 capital		Phased out over 10 year horizon beginning 2013					
Liquidity	Liquidity coverage ratio – minimum requirement			60%	70%	80%	90%	100%
	Net stable funding ratio						Introduce minimum standard	

* Including amounts exceeding the limit for deferred tax assets (DTAs), mortgage servicing rights (MSRs) and financials.

– – transition periods

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The Basel III Principles

Capital requirements

- A minimum Common Equity Tier 1 (CET1) ratio of 4.5% must be maintained at all times $\frac{\text{CET1}}{\text{RWAs}} \geq 4.5\%$

- Minimum Tier 1 capital increases to 6%

- Mandatory "capital conservation buffer", equivalent to 2.5% of RWA (resulting in a total of 7% CET1 capital, from 2019 onwards)

- "Discretionary counter-cyclical buffer" up to an additional 2.5% of capital during periods of high credit growth imposed by regulators (to be met by CET1 capital)

Leverage ratio

- Non-risk-based leverage ratio calculated by dividing Tier 1 capital by the bank's average total consolidated assets (sum of the exposures of all assets and non-balance sheet items) in excess of 3%

$$\frac{\text{Tier 1 Capital}}{\text{Total exposure}} \geq 3\%$$

- In the U.S. the minimum leverage ratio is 6% for 8 Systemically important financial institution (SIFI) banks and 5% for insured bank holding companies

Liquidity requirements

- The "Liquidity Coverage Ratio" is supposed to require a bank to hold sufficient high-quality liquid assets to cover its total net cash outflows over 30 days

$$LCR = \frac{\text{High quality liquid assets}}{\text{Total net liquidity outflows over 30 days}} \geq 100\%$$

- The Net Stable Funding Ratio is to require the available amount of stable funding to exceed the required amount of stable funding over a one-year period of extended stress

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The Basel III Capital Requirements

Risk Weighted Assets

Portfolio			AAA to AA-	A+ to A-	BBB+ to BBB-	BB+ to BB-	B+ to B-	Below B-	Not rated	OECD	Non-OECD
			Basel II (standardised approach)							Basel I	
Corporate			20%	50%	100%	100%	150%	150%	100%	100%	100%
Bank[a]	Option 1		20%	50%	100%	100%	100%	150%	100%	LT 20%	LT 100%
	Option 2	LT	20%	50%	50%	100%	100%	150%	50%		
		ST	20%	20%	20%	50%	50%	150%	20%	ST 20%	ST 20%
Sovereign			0%	20%	50%	100%	100%	150%	100%	0%	100%

Note: [a] The distinction between Option 1 (risk-weight one category below that of the sovereign) and Option 2 (risk-weight based on the rating of the bank) applies only in Basel II

Source: Basel Committee on Banking Supervision (2004)

Minimum Capital Requirements

Elements of regulatory capital under Basel 2 and 3: minima

Elements of regulatory capital	Basel 2 rules	Basel 3 rules
Core Tier 1 capital	At least 2% of RWA	At least 4.5% of RWA
Tier 1 capital	At least 4% of RWA	At least 6% of RWA
Total capital	Tier 1 + Tier 2 + Tier 3 capital: at least 8% of RWA	Tier 1 + Tier 2 capital: at least 8% of RWA

$$\text{Capital Ratios} = \frac{\text{Eligible Capital}}{\text{Risk Weighed Assets}}$$

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Risk Weighted Assets – Credit Ratings

Credit quality	Credit rating agency		
	Moody's	S&P	Fitch
Investment grade			
Highest credit quality	Aaa	AAA	AAA
High credit quality	Aa1 to Aa3	AA+ to AA-	AA+ to AA-
Strong payment capacity	A1 to A3	A+ to A-	A+ to A-
Adequate payment capacity	Baa1 to Baa3	BBB+ to BBB-	BBB+ to BBB-
Speculative grade			
Possibility of credit risk	Ba1 to Ba3	BB+ to BB-	BB+ to BB-
Significant credit risk	B1 to B3	B+ to B-	B+ to B-
High credit risk	Caa1 to Caa3	CCC+ to CCC-	CCC+ to CCC-
Default is likely	Ca	CC	CC
Default is imminent	C	C	C
In Default	-	D, SD	DDD, DD, D

Source: Basel Committee on Banking Supervision (2000) and website of the three credit rating agencies

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Risk Weighted Assets - Weighting

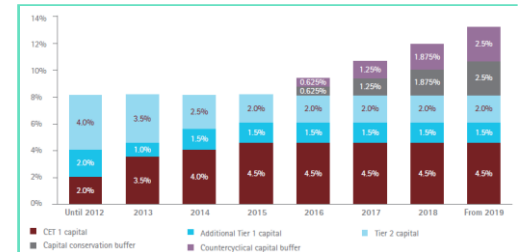| Portfolio			Basel II (standardised approach)							Basel I	
			AAA to AA-	A+ to A-	BBB+ to BBB-	BB+ to BB-	B+ to B-	Below B-	Not rated	OECD	Non-OECD
Corporate			20%	50%	100%	100%	150%	150%	100%	100%	100%
Bank [a]	Option 1		20%	50%	100%	100%	100%	150%	100%	LT 20%	LT 100%
	Option 2	LT	20%	50%	50%	100%	100%	150%	50%		
		ST	20%	20%	20%	50%	50%	150%	20%	ST 20%	ST 20%
Sovereign			0%	20%	50%	100%	100%	150%	100%	0%	100%

Note: [a] The distinction between Option 1 (risk-weight one category below that of the sovereign) and Option 2 (risk-weight based on the rating of the bank) applies only in Basel II

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Example: Calculation Total Capital Requirement

RWA & Capital Adequacy Calculation

(In Million)

Customer Title	Rating	Outstanding Balance	Risk Weight	RWA = RW * Outstanding	CAR (%)	Total Capital Required
PAKISTAN STATE OIL	AAA	100	20%	20	8%	1,6
DEWAN SALMAN FIBRE LIMITED	A	100	50%	50	8%	4,0
RELIANCE WEAVING MILLS (PVT) LTD	BBB+	100	100%	100	8%	8,0
RUPALI POLYESTER LIMITED	B	100	150%	150	8%	12,0
Total:		400		320		25,6

Portfolio			AAA to AA-	A+ to A-	BBB+ to BBB-	BB+ to BB-	B+ to B-	Below B-	Not rated	OECD	Non-OECD
					Basel II (standardised approach)					Basel I	
Corporate			20%	50%	100%	100%	150%	150%	100%	100%	100%
Bank ª	Option 1		20%	50%	100%	100%	100%	150%	100%	LT 20%	100%
	Option 2	LT	20%	50%	50%	100%	100%	150%	50%	ST 20%	20%
		ST	20%	20%	20%	50%	50%	150%	20%		
Sovereign			0%	20%	50%	100%	100%	150%	100%	0%	100%

Note: ª The distinction between Option 1 (risk-weight one category below that of the sovereign) and Option 2 (risk-weight based on the rating of the bank) applies only in Basel II

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Minimum Capital Requirements - Components

CORE CAPITAL (Tier 1)

• Common stockholders' equity

• Qualifying, noncumulative, perpetual, preferred stock

• Minority interest in equity accounts of consolidated subsidiaries

Less: goodwill and other intangible assets.

SUPPLEMENTARY CAPITAL (Tier 2)

• ALLL (Allowance for Loan and Lease Losses)

• Perpetual preferred stock and related surplus

• Hybrid capital instruments and mandatory convertible debt securities

• Term subordinated debt and intermediate-term preferred stock, including related surplus

• Revaluation reserves (equity and building)

DEDUCTIONS (from sum of Tier 1 and Tier 2)

Investments in unconsolidated subsidiaries

Reciprocal holdings of banking organizations' capital securities

Other deductions (such as other subsidiaries or joint ventures) as determined by supervisory authority

Elements of regulatory capital under Basel 2 and 3: minima

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Management of Credit Risk – Approach via Basel II

- Probability of Default (PD)
  - The likelihood that the borrower will fail to make full and timely repayment of its financial obligations

- Exposure At Default (EAD)
  - The expected value of the loan at the time of default

- Loss Given Default (LGD)
  - The amount of the loss if there is a default, expressed as a percentage of the EAD

- Recovery Rate (RR)
  - The proportion of the EAD the bank recovers

Bank → **Borrower**

+

Credit quality	Credit rating agency		
	Moody's	S&P	Fitch
Investment grade			
Highest credit quality	Aaa	AAA	AAA
High credit quality	Aa1 to Aa3	AA+ to AA-	AA+ to AA-
Strong payment capacity	A1 to A3	A+ to A-	A+ to A-
Adequate payment capacity	Baa1 to Baa3	BBB+ to BBB-	BBB+ to BBB-
Speculative grade			
Possibility of credit risk	Ba1 to Ba3	BB+ to BB-	BB+ to BB-
Significant credit risk	B1 to B3	B+ to B-	B+ to B-
High credit risk	Caa1 to Caa3	CCC+ to CCC-	CCC+ to CCC-
Default is likely	Ca	CC	CC
Default is imminent	C	C	C
In Default	-	D, SD	DDD, DD, D

Source: Basel Committee on Banking Supervision (2000) and website of the three credit rating agencies

Standardised Approach

- RWA based on externally provided:
  - Probability of Default (PD)
  - Exposure At Default (EAD)
  - Loss Given Default (LGD)

- Limited recognition of credit risk mitigation & supervisory treatment of collateral and guarantees

Internal Ratings Based (IRB) Approaches

Foundation

- RWA based on internal models for:
  - Probability of Default (PD)
- RWA based on externally provided:
  - Exposure At Default (EAD)
  - Loss Given Default (LGD)

- Limited recognition of credit risk mitigation & supervisory treatment of collateral and guarantees

Advanced

- RWA based on internal models for
  - Probability of Default (PD)
  - Exposure At Default (EAD)
  - Loss Given Default (LGD)

- Internal estimation of parameters for credit risk mitigation – guarantees, collateral, credit derivatives

Increasing complexity and data requirement →

Decreasing regulatory capital requirement →

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Management of Credit Risk – Approach via Basel II (cont´d)

- **Standardised Approach**
  - Under this approach the banks are required to use **ratings** from External Credit Rating Agencies to quantify required capital for credit risk

- **Internal Ratings-Based Approach**
  - Under this approach the banks are allowed to develop their own empirical model to estimate the **PD** (probability of default) for individual clients or groups of clients
  - Banks can use this approach only subject to approval from their local regulators

Internal Ratings Based (IRB) Approaches

Standardised Approach	Foundation	Advanced
• RWA based on externally provided: – Probability of Default (PD) – Exposure At Default (EAD) – Loss Given Default (LGD) • Limited recognition of credit risk mitigation & supervisory treatment of collateral and guarantees	• RWA based on internal models for: – Probability of Default (PD) • RWA based on externally provided: – Exposure At Default (EAD) – Loss Given Default (LGD) • Limited recognition of credit risk mitigation & supervisory treatment of collateral and guarantees	• RWA based on internal models for – Probability of Default (PD) – Exposure At Default (EAD) – Loss Given Default (LGD) • Internal estimation of parameters for credit risk mitigation – guarantees, collateral, credit derivatives

Increasing complexity and data requirement

Decreasing regulatory capital requirement

- **Advanced Internal Ratings-Based Approach**
  - Under this approach the banks are allowed to develop their own empirical model to quantify required capital for credit risk
  - Hence, banks are supposed to use their own quantitative models to estimate **PD** (probability of default), **EAD** (exposure at default), **LGD** (loss given default) and other parameters required for calculating the RWA
  - Banks can use this approach only subject to approval from their local regulators

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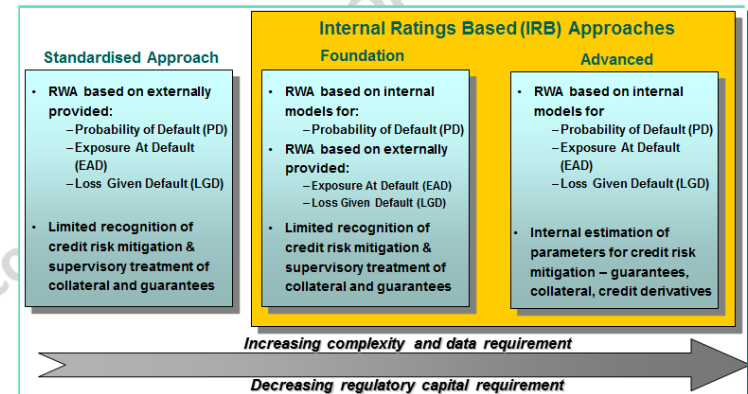
Management of Credit Risk – Approach via Basel II (cont´d)

- **Calculating LGD under the Internal Ratings-Based Approach (for corporate, sovereign and bank exposure)**
    - **Exposure without Collateral:** BIS prescribes fixed LGD ratios for certain classes of unsecured exposures:
    - Senior claims on corporates, sovereigns and banks not secured by recognized collateral attract a 45% LGD
    - All subordinated claims on corporates, sovereigns and banks attract a 75% LGD
    - **Exposure with Collateral**
    - As previous example: If the client defaults, with an outstanding debt of 200,000 (EAD) and the bank is able to sell the collateral for a net price of 160,000, then 40,000, or 20%, of the EAD are lost - the LGD is 20%

- **Calculating LGD under the Advanced Internal Ratings-Based Approach (and for the retail-portfolio under the foundation approach)**
    - The bank itself determines the appropriate Loss given default to be applied to each exposure, on the basis of robust data and analysis
    - The analysis must be capable of being validated both internally and by supervisors
    - Thus, a bank using internal Loss Given Default estimates for capital purposes might be able to differentiate Loss Given Default values on the basis of a wider set of transaction characteristics (e.g. product type, wider range of collateral types) as well as borrower characteristics
    - These values would be expected to represent a conservative view of long-run averages
    - A bank wishing to use its own estimates of LGD will need to demonstrate to its supervisor that it can meet additional minimum requirements pertinent to the integrity and reliability of these estimates

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Management of Credit Risk – Approach via Basel II (cont´d)

- Credit rating is **not mandatory** under the Basel Framework …
- … **but banks are likely save capital** if they get their loan portfolios rated
  - If a bank chooses to keep some of its loans **unrated, it may have to provide a risk weight of 100%** for credit risk on such unrated loans

- A bank could insist on rating a loan / facility before sanction / renewal, as it would help the bank save on capital, …
- … and provide it with additional inputs to decide on the terms of the loan
  - External Credit Rating Agencies (ECAIs) rate all types of bank loans and working capital facilities
  - **ECAIs assign ratings to each facility separately**
  - The validity of each rating is linked to the tenure of the rated facility

| Criteria | Standardized Approach | Internal Ratings Based (IRB) Approach | |
		Foundation Approach	Advanced Approach
Data Requirements	■ Provision dates ■ Default events ■ Exposure data ■ Customer segmentation ■ Data collateral segmentation ■ External ratings ■ Collateral data	■ Rating data ■ Default events ■ Historical data to estimate PDs (5 years) ■ Collateral data	■ Same as IRB Foundation, plus: ■ Historical loss data to estimate LGD (7 years) ■ Historical exposure data to estimate EAD (7 years)
Credit Risk Mitigation Techniques (CRMT)	Defined by the supervisory regulator; including financial collateral, guarantees, credit derivatives, "netting" (on and off balance sheet), and real estate	All collaterals from Standardized Approach; receivables from goods and services; other physical securities if certain criteria are met	All types of collaterals if bank can prove a CRMT by internal estimation

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Credit Risk Mitigation

- Where a transaction is secured by eligible **collateral**
- Meets the eligibility criteria and **minimum requirements**
- Banks are allowed to reduce their exposure under that particular transaction by taking into account the risk mitigating effect of the collateral

Simple Approach

- Under the Simple Approach the **risk weight of the counterparty is replaced by the risk weight of the collateral for the part of the exposure covered** by the collateral
- For the exposure not covered by the collateral, the risk weight of the counterparty is used
- Collateral must be revalued at least every six months
- Collateral must be pledged for at least the life of the exposure

Comprehensive Approach

- Under the Comprehensive Approach, banks **adjust the size of** their **exposure upward** to allow **for possible increases** …
- … and adjust the value of collateral **downwards** to allow for possible **decreases in the value of the collatera**l
- A new exposure equal to the excess of the adjusted exposure over the adjusted value of the collateral
- Counterparty's risk weight is applied to the new exposure

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Example: Credit Risk Mitigation

- A US$ 80m exposure to a particular counterparty is secured by collateral worth US$ 70m
- The collateral consists of bonds issued by an A-rated company
- The counterparty has a rating of B+
- The risk weight for the counterparty is 150% and the risk weight for the collateral is 50%

Simple Approach

50% * 70m + 150% * 10m = 50m
Risk-adjusted assets   = **50m**

Comprehensive Approach

Adjustment to **exposure** to allow for *possible future increases* in the exposure is +10% and the adjustment to the **collateral** to allow for *possible future decreases* in its value is -15%

The new exposure is:
110% * 80m – 85% * 70m = 28.5m

Then, a risk weight of 150% is applied to this exposure
Risk-adjusted assets = 28.5m * 150% =
42.75m

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Operational Risk – Background

- Operational risk is defined as: The risk of loss resulting from inadequate or **failed internal processes**, people and systems or from external events
  - This definition includes legal risk, but excludes strategic and reputation risk

- Operational risk is now to be considered as a fully recognized risk category on the same footing as credit and market risk
  - Under Basel 1, capital adequacy rules did not specifically require firms to hold capital to cover their operational risk
  - However, this has first time under Basel 2 been recognized as an important and potentially major risk faced by firms

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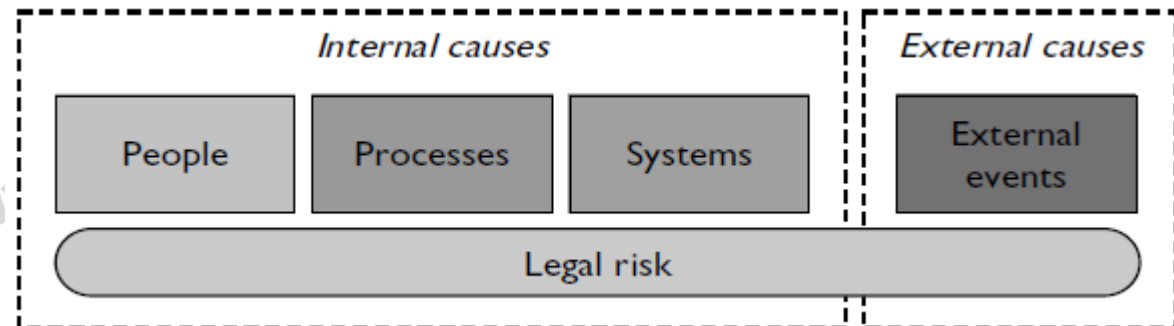
The financial industry is facing significant challenges around non-financial risks and controls.

$ Billion

Examples of control-related failures in the industry

		Fines	Losses
J.P.Morgan, Bank of America, Wells Fargo, citigroup	Mortgage misselling	96.5[1]	n/a
BARCLAYS, RBS, LLOYDS BANK, HSBC	Payment protection insurance	●——36.2[2]——●	
SOCIETE GENERALE	Rogue trader	0.1	7.2
J.P.Morgan	London Whale	0.9	6.0
RBS, UBS, Rabobank	LIBOR manipulation	5.9	n/a
UBS	Rogue trader	0.1	2.3
HSBC	AML[3] failure in Mexico	1.9	n/a
UBS	Tax evasion	0.8	n/a
Standard Chartered, BNP PARIBAS	Embargo violation	9.6	n/a

Significant increase in regulatory scrutiny

— Number, intensity of regulatory reviews and investigations increasing

— New, more complex regulation issued on a continued basis including further localization

Addressing the control environment one of, if not the biggest, industry challenges

— A question of survival vis-à-vis regulators and public perception

— A competitive advantage in the ability to capture new opportunities and work with clients
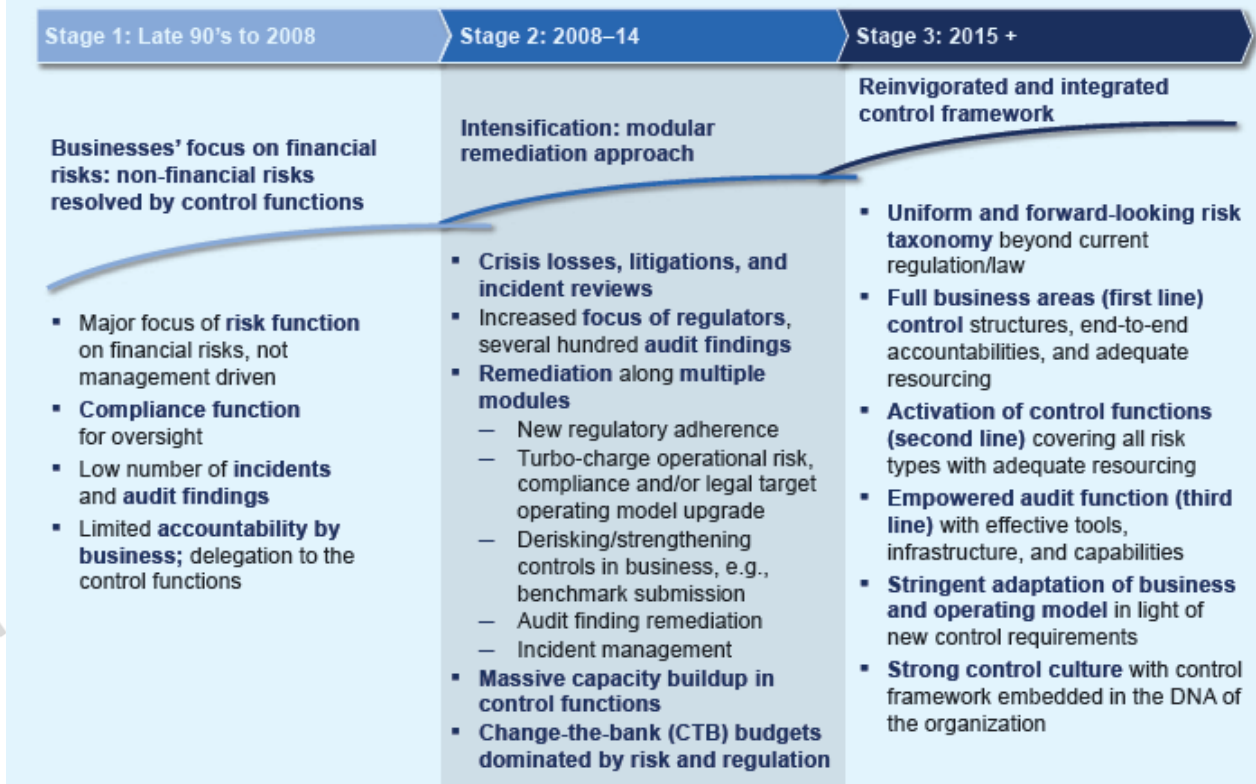
1 Fines and settlements connected to mortgage misselling, not including protection insurance or other related cases.
2 £22 billion set aside for claims.
3 Anti money laundering.

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Challenges in effective non-financial risk compliance and controls have become transformational for leading institutions.

Focus of most banks in the past years

Stage 1: Late 90's to 2008	Stage 2: 2008–14	Stage 3: 2015 +
Businesses' focus on financial risks: non-financial risks resolved by control functions	**Intensification: modular remediation approach**	**Reinvigorated and integrated control framework**

Businesses' focus on financial risks: non-financial risks resolved by control functions

- Major focus of **risk function** on financial risks, not management driven
- **Compliance function** for oversight
- Low number of **incidents** and **audit findings**
- Limited **accountability by business;** delegation to the control functions

Intensification: modular remediation approach

- **Crisis losses, litigations, and incident reviews**
- Increased **focus of regulators,** several hundred **audit findings**
- **Remediation** along **multiple modules**
  - New regulatory adherence
  - Turbo-charge operational risk, compliance and/or legal target operating model upgrade
  - Derisking/strengthening controls in business, e.g., benchmark submission
  - Audit finding remediation
  - Incident management
- **Massive capacity buildup in control functions**
- **Change-the-bank (CTB) budgets dominated by risk and regulation**

Reinvigorated and integrated control framework

- **Uniform and forward-looking risk taxonomy** beyond current regulation/law
- **Full business areas (first line) control** structures, end-to-end accountabilities, and adequate resourcing
- **Activation of control functions (second line)** covering all risk types with adequate resourcing
- **Empowered audit function (third line)** with effective tools, infrastructure, and capabilities
- **Stringent adaptation of business and operating model** in light of new control requirements
- **Strong control culture** with control framework embedded in the DNA of the organization

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- **The three key components of an integrated NFR Management approach are :**
  - an enhanced governance framework,
  - a set of enablers, and
  - changes in the front office's approach and mind-set

The nine paradigm shifts are divided among three categories.

Overall roles and responsibilities

1. Invigorate the first line with real end-to-end NFR accountability
2. Align second-line responsibilities to increase effectiveness and efficiency
3. Better engage the board on NFR appetite, top-risk assessment, execution, and remediation

Classic risk-management enablers

4. Make integrated NFR risk taxonomy the norm
5. Set up an effective, structured control framework focused on prevention
6. Deliver management-level, forward-looking risk assessment
7. Enter the domain of quantitative NFR assessment

Business transformation

8. Organize the process around structural and strategic remediation
9. Transform the culture in both first and second lines

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Operational Risk – Background (cont´d)

In line with regulatory expectations, banks are building a governance model with three lines of defense

- The first line **owns and manages risks**
  - Central-infrastructure areas, such as IT and operations do not take on financial risks from the balance sheet, but they are where the risk of most operational failure resides
  - Hence, many banks have extended the definition of the first line to include them

- The second line **sets control standards and monitors** adherence to them
  - Beyond the risk and compliance functions includes areas such as legal, HR, finance, and tax, recognizing their role in managing the institution's control framework in their respective areas of risk expertise

- The third line — audit — **checks on the adequacy of the first two**
  - Essential that the bank defines a consistent set of principles that reflect its governance structure, operational complexity, and specific regulatory requirements
  - These principles need to be permanent enough to guide future adjustments to the organization and operating model

Operational Risk – Evaluation Assessment

Three methods for calculating operational risk capital charges are available, representing a continuum of increasing sophistication and risk sensitivity:

- Basic Indicator Approach (BIA)
- Standardised Approach (TSA)
- Advanced Measurement Approaches (AMA)

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Operational Risk – Basic Indicator Approach

- The BIA is the simplest method of determining a firm's Operational Risk, and uses **income as an indicator** of operational risk
    - The ORCR is calculated by taking **15% of the three-year average of the sum of net-interest income and net non-interest income**. This three-year average must be calculated using the financial year-end data. If audited figures are not available, business estimates may be used. .

Capital Charge = α * Gross Income

   α is currently fixed as 15%

Operational Risk – Standardised Approach

- TSA is more risk sensitive than the BIA and separates a firm's activities into eight **business lines** each attracting a different percentage charge (risk weighting)
  - The BIA, in contrast, applies a single percentage to the relevant indicator
  - The ORCR is the **average over three years of the risk-weighted indicators calculated each year across these business lines**. The capital charge for each business line is the net interest income and net non-interest income for that business line multiplied by a factor. The respective gross income of each business line is taken as to represent the scale of business operations within that business line. In this way, the scale of exposure to operational risk is highlighted across each business line within a particular firm. As such, the total relative exposure to operational risk can be fairly accurately calculated.

Capital Charges = $\sum \beta$ * Gross Income

(gross income for business line = i=1,2,3, ….8)

Corporate finance	(18%)
Trading and sales	(18%)
Retail brokerage	(12%)
Commercial banking	(15%)
Retail banking	(12%)
Payment and settlement	(18%)
Agency services	(15%)
Asset management	(12%)

Operational Risk – Advanced Measurement Approach

- Under the Advanced Measurement Approaches, the regulatory capital requirements will equal the risk measure generated by the bank's **internal measurement system** and this without being too prescription about the methodology used

- This system must reasonably estimate unexpected losses based on the combined use of internal loss data, scenario analysis, bank-specific business environment and internal control events and support the internal economic capital allocation process by business lines.

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Market Risk - Background

- Market Risk is the risk that the **value of on and off-balance sheet positions** of a financial institution will be **adversely affected by movements in market rates or prices** such as interest rates, foreign exchange rates, equity prices, credit spreads and/or commodity prices resulting in a loss to earnings and capital

The focus on Market Risk is driven by

- Convergence of economies
- Easy and faster flow of information
- Skill enhancement
- Increasing market activity

… which has led to

- Increased volatility
- Need for measuring and managing Market Risks
- Regulatory focus
- Profiting from Risk

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Market Risk – Example: Selected Country Crises

COUNTRY	YEAR	NATURE	RESULTS
Mexico	1994-95	Exchange rate crisis	Budget deficit increased leading to massive government borrowing. The resultant money supply expansion pushed up prices.
East Asia	1997	Bank run crisis	Capital flight. Bank run crises and currency run crises latter in 1999.
Russia	1998	Interest rate crisis.	Huge rise in budget deficit.
Ecuador	1999	Currency crisis	Currency depreciated by 66.3% against the US dollar.
Turkey	2001-02	Interest rate instability	Overnight interbank interest rate increased by 1700%. Domestic interest rate reached 60%. Domestic stock market crashed.
Argentina	2001-02	Debt crisis	Default on public debt.

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www.christianschopper.com

Market Risk – Measure, Monitor and Manage: Value at Risk

- Value at Risk is a measure of Market Risk, which measures the **maximum loss in the market value of a portfolio with a given confidence**

- VaR is denominated in units of a currency or as a percentage of portfolio holdings

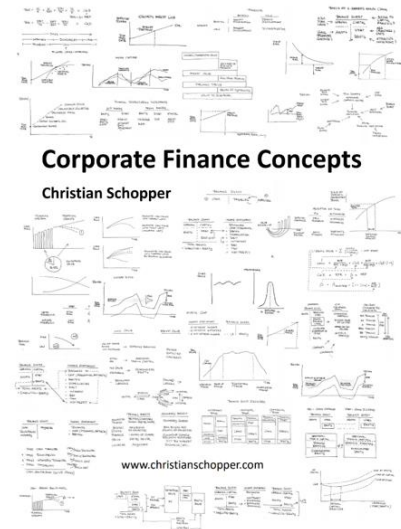- It is a probability of occurrence and hence is a statistical measure of risk exposure

VaR and Regulatory Capital

- Regulators base the capital they require banks to keep on VaR

- The market-risk capital is k **times the 10-day 99% VaR** …
- … where k **is at least 3.0**

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Contact

Christian Schopper
Private: christian.schopper@aon.at
Business: christian.schopper@corpfince.com

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Christian Schopper

www.christianschopper.com

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