

INTRODUCTORY BANKING



Lecture 9A – Liquidity and operational risk management **Petr Teplý**

Institute of Economic Studies, Faculty of Social Sciences,
Charles University, Czech Republic

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Key terms from Lecture 8/Risk management

- risk = the degree of uncertainty of future net return
- the basic measurement tool: the volatility (standard deviation of price outcomes associated with an underlying asset).
- Types of risks: credit, market, operational, liquidity risk
- different loss distributions (asymmetric: credit, operational vs symmetric: market risk)
- counterparty credit risk (CCR) – counterparty risk arising from derivative deals (OTC derivatives, repo style transactions)
- market risk: the sensitivity to adverse movements in the value of a key variable
- GAP analysis

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1. Basic terms
2. Liquidity risk management
3. Operational risk management
4. Operational risk – a case study



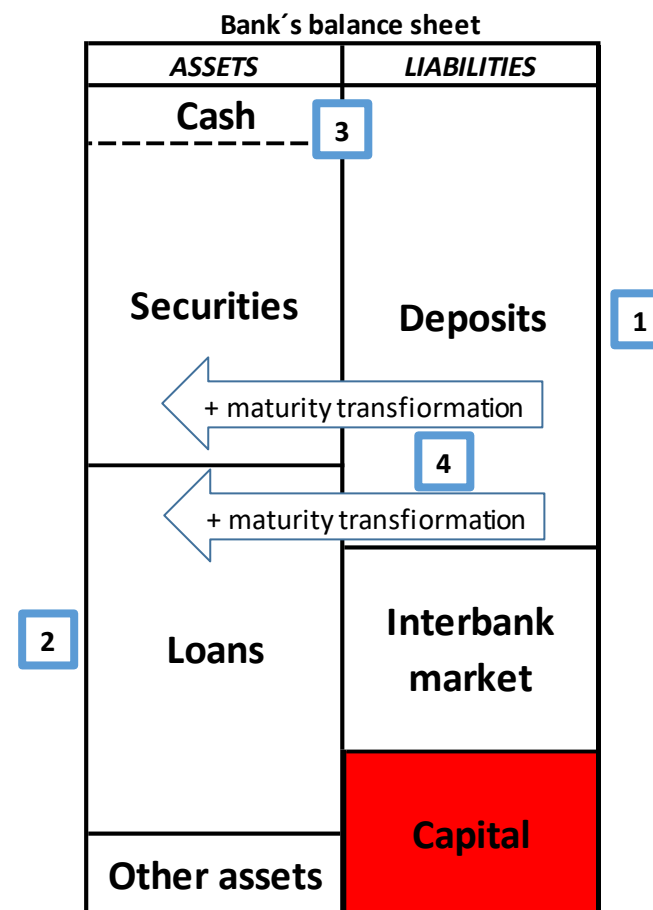
- I. What bank functions are relevant to
- a) liquidity risk,
 - b) operational risk?



I. Basic terms

Four main functions of a bank

- 1) accepting deposits
- 2) granting loans
- 3) providing payments
- 4) providing maturity transformation*



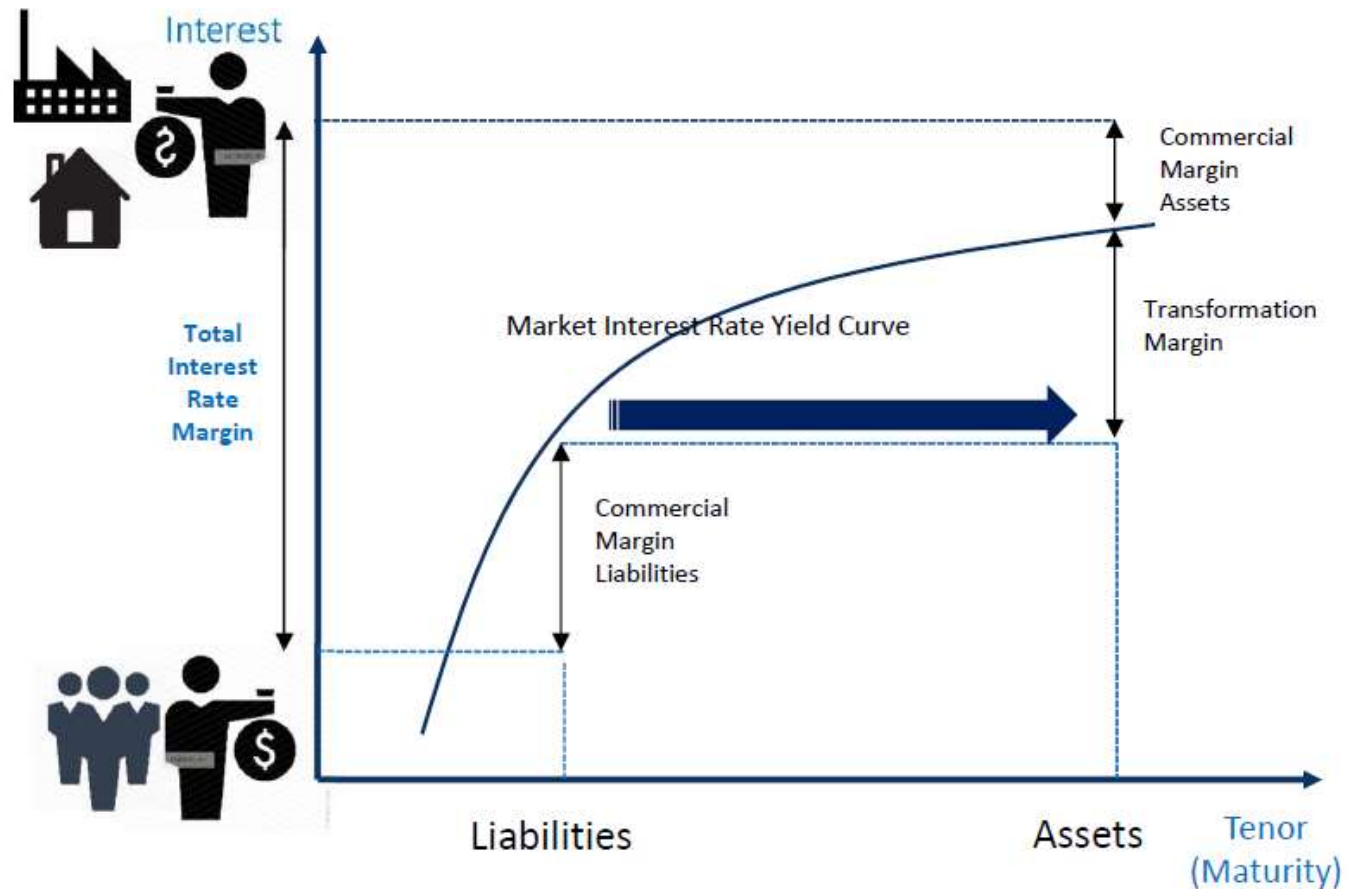
* Banks borrow short and lend long, i.e. from short-term deposits they provide long-term loans and investments (=positive maturity transformation, unlike insurers that provide negative maturity transformation).

2. What bank function is the task for ALM?



I. Basic terms

Transformation margin through ALM*



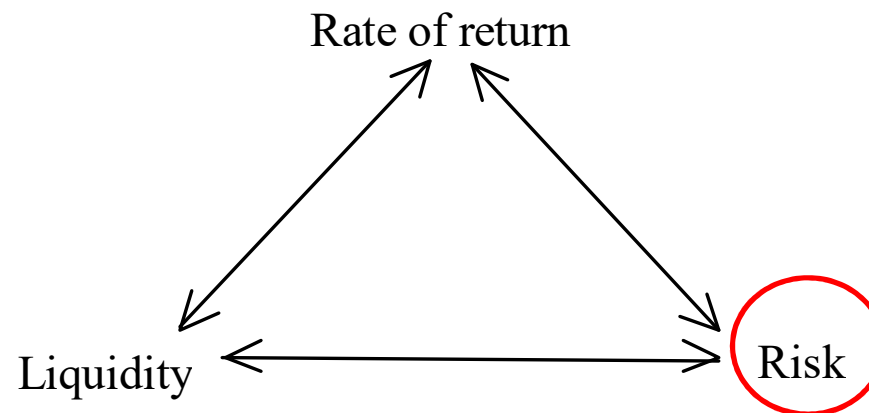
Source: KBC Bank (2020). ALM basics. Internal document
ALM = Asset-Liability-Management

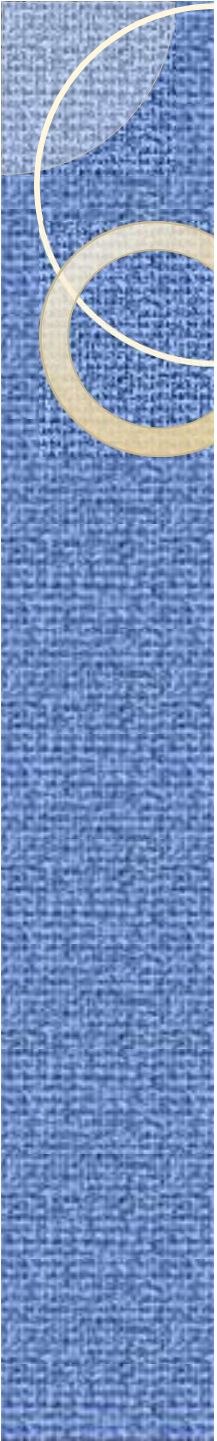
I. Basic terms

Risk and risk management in banking

Risk is the degree of uncertainty of future net returns.

- the basic measurement tool is the volatility (standard deviation of price outcomes associated with an underlying asset).
- four main risks in banking: credit, market, operational, liquidity
- magical triangle of investing





3. What is the most important risk in banking?

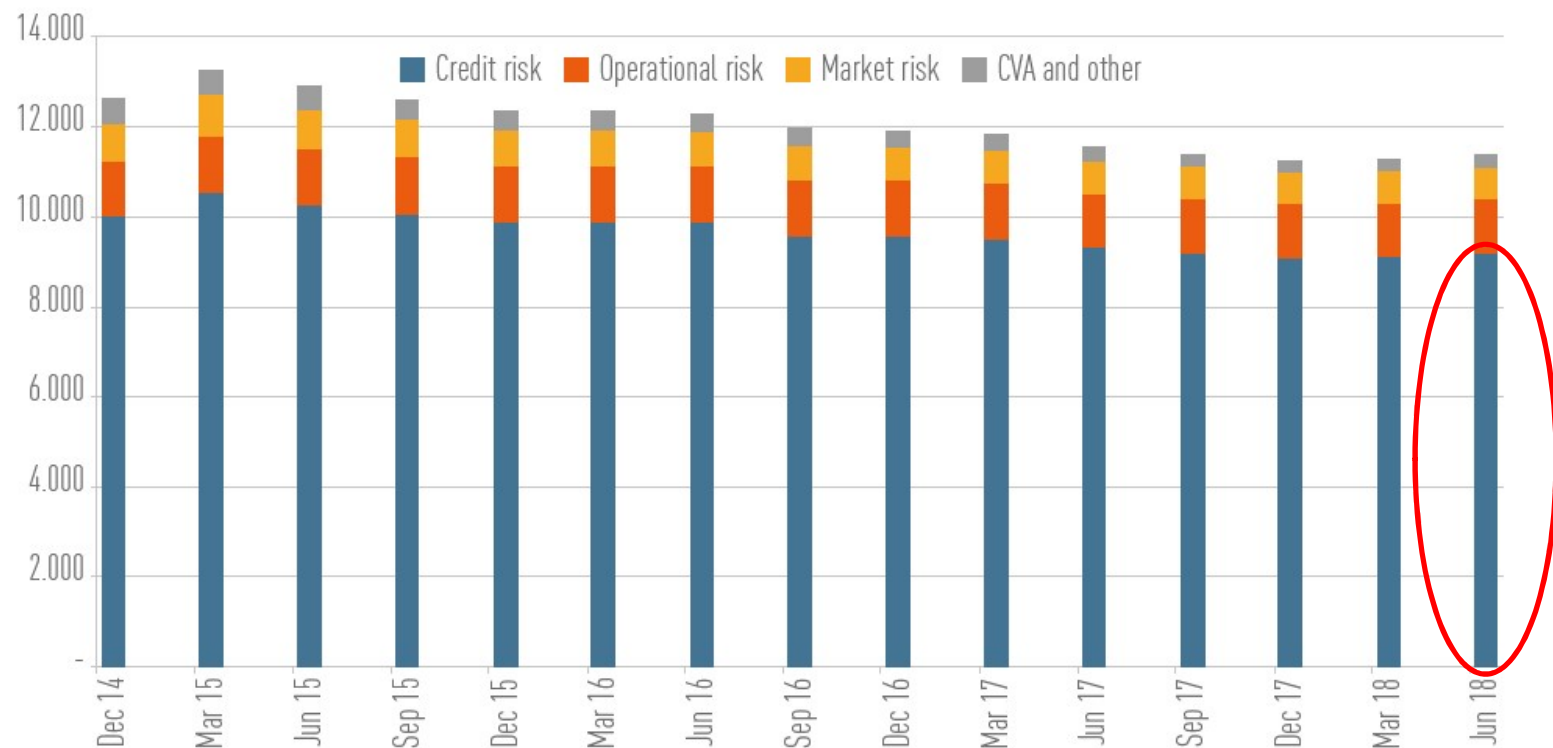


I. Basics of risk management

Main risks in EU banks in terms of regulation (measured by risk-weighted assets „RWAs“)

Figure 53: Evolution of RWAs (EUR bn)

Source: EBA supervisory reporting data



- **Credit risk is the most important risk in banking**

Source: EBA (2019). RISK ASSESSMENT OF THE EUROPEAN BANKING SYSTEM
DECEMBER 2018. European Banking Authority

Notes: RWAs = Risk-Weighted Assets, CVA = Credit Valuation Adjustment

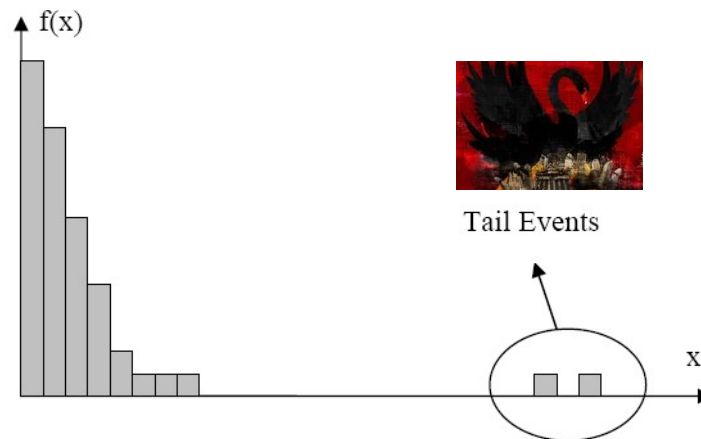
4. For what kind of risk are typical black swan events?



I. Basic terms

Operational risk

- = risk to the bank of loss resulting from inadequate or failed internal processes, people and systems, or the risk to the bank of loss resulting from external events, including the legal risk but it excludes strategic and reputational risk.
- Operational risk represents 5–20% of banking risks, depending also on the extent to which it overlaps with the definition of other risks (especially credit risk).
- **Black swans:** rare events with severe impact => tail events (challenge for bank risk management)



5. For what risk does a bank need zero capital requirement?





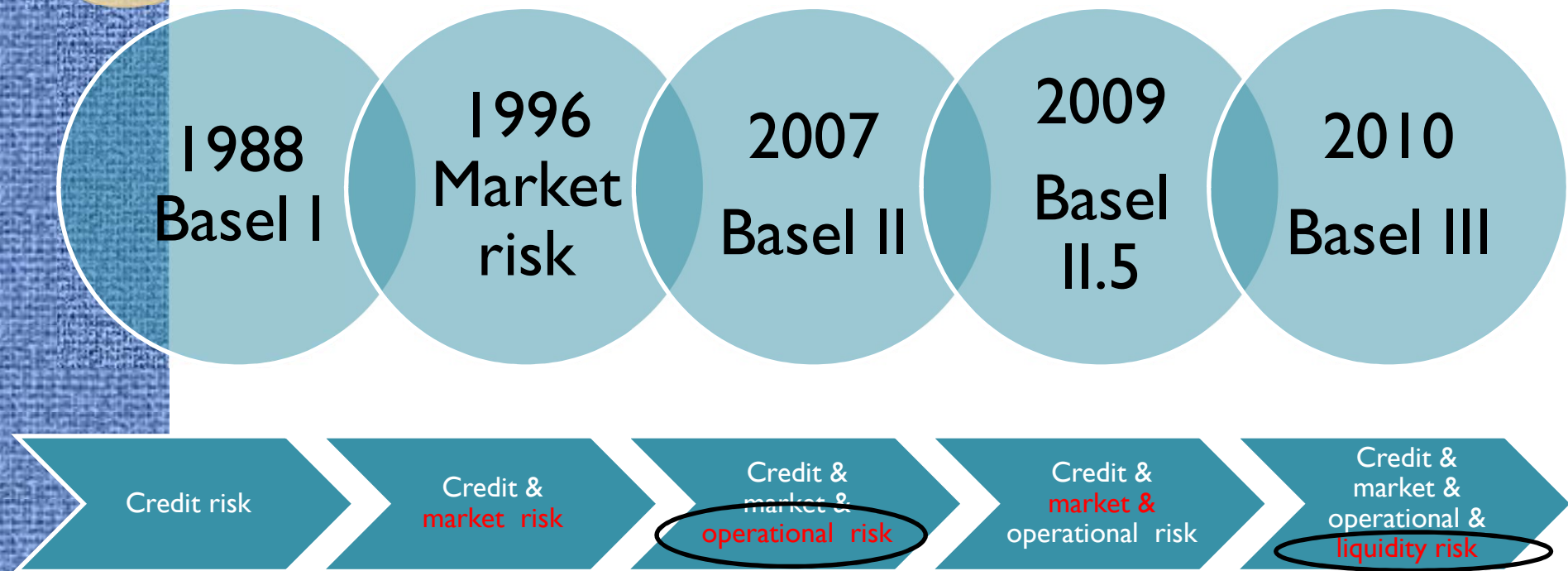
I. Basic terms

Liquidity risk

- Liquidity risk is the probability of a situation when a bank cannot meet its proper (both cash and payment) obligations as they become due or the bank will not be able to fund its assets,
- Potential loss due to insufficient market depth
- Liquidity risk arises from the different timing of the cash flows of assets and liabilities, i.e. liquidity risk arises from positive maturity transformation provided by banks
- No capital requirement on liquidity risk is needed since liquidity is measured differently (in Basel III: Liquidity Coverage Ratio (LCR), Net Stable Funding Ratio (NSFR))
- Banks seek liquidity (quick assets) to cover the need to withdraw deposits and to grant the loans of clients.

I. Basic terms

Risks covered under Basell I & II & III regulation



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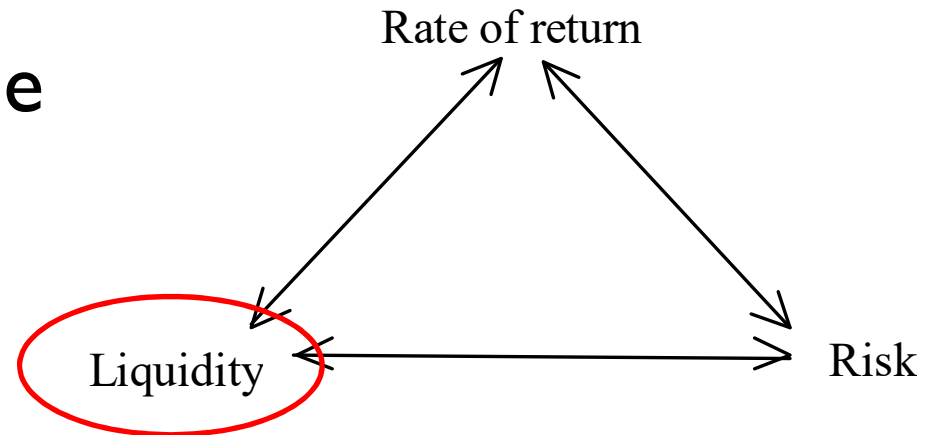
1. Basic terms
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2. Liquidity risk management

Magicle triangle and ALM

- **Magical triangle**



- **Asset-Liability Management (ALM)**

Total Assets	Total Liabilities
Assets	Liabilities
	Equity



2. Liquidity risk management

Liquidity risk management in practice

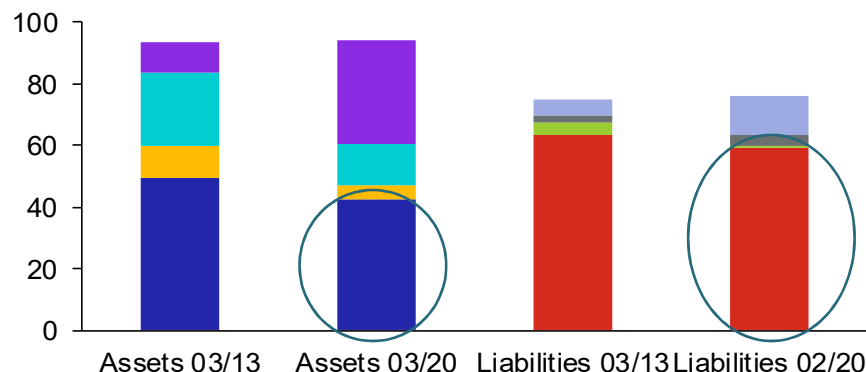
- Satisfactory liquidity is the ability to refinance liabilities at or below market rates, or to be financed without excessive costs.
- 3 types:
 - 1) short-term liquidity (up to 1 month)
 - 2) medium-term liquidity (1 month–1 year)
 - 3) long-term liquidity (over 1 year).
- Solvency \neq long-term liquidity (problematic “zombie” banks (especially in Italy now) are liquid by not solvent)
- Liquidity risk management -> a pond (optimum level of liquidity: sufficient but not redundant)
- **Liquid instruments** bear low interest, but are **needed during market turmoils and crises** (bank runs, wholesale market withdrawals etc.)



2. Liquidity risk management

Liquidity risk in practice

Chart III.15
Selected balance-sheet items of the domestic banking sector
(% of balance sheet)



■ Claims on clients + NTS
■ Claims on CIs
■ Tradable securities
■ Cash + claims on CNB
■ Resident clients
■ Resident CIs
■ Non-resident clients
■ Non-resident CIs

Source: CNB

Note: CIs = credit institutions. NTS = nontradable securities.

- The Czech banking sector reports a **low liquidity risk** and a significant excess of deposits over loans (a high **deposit-loan** ratio) -> sufficient funding for granting loans
- Measures of liquidity risk: the Liquidity Coverage Ratio (LCR), an analysis of maturity mismatch / **liquidity gap analysis**

6. What are liquid bank's assets?





3. Liquidity risk management

Quick (liquid) assets

- 1) Cash
 - 2) Receivables from credit institutions payable on demand
 - 3) Cash balances with central banks
 - 4) Bonds issued by central government
- Statistics in the CR (2020)
 - Quick assets / total assets (%) = 42%
 - Quick assets / client deposits (%) = 62%

7. Why liquid instruments are important for banks?



3. Liquidity risk management

Case study: liquidity management in the US (applicable also in the Eurozone and the CR)

T-account Analysis:

Deposit of \$100 cash into First National Bank

Assets	Liabilities
Vault Cash + \$100 (=Reserves)	Checkable Deposits + \$100

Deposit of \$100 check into First National Bank

Assets	Liabilities
Cash items in process of collection + \$100	Checkable Deposits + \$100

First National Bank

Assets	Liabilities
Reserves + \$100	Checkable Deposits + \$100

Second National Bank

Assets	Liabilities
Reserves - \$100	Checkable Deposits - \$100

Conclusion: When bank receives deposits, reserves ↑ by equal amount; when bank loses deposits, reserves ↓ by equal amount

3. Liquidity risk management

Liquidity management (excess reserves)

Reserve requirement = 10%, Excess reserves = \$10 million

Assets		Liabilities	
Reserves	\$20 million	Deposits	\$100 million
Loans	\$80 million	Bank Capital	\$ 10 million
Securities	\$10 million		

Deposit outflow of \$10 million

Assets		Liabilities	
Reserves	\$10 million	Deposits	\$ 90 million
Loans	\$80 million	Bank Capital	\$ 10 million
Securities	\$10 million		

With 10% reserve requirement, bank still has excess reserves of **\$10 million**: no changes needed in balance sheet

3. Liquidity risk management

Liquidity management (no excess reserves)

No excess reserves

Assets		Liabilities	
Reserves	\$10 million	Deposits	\$100 million
Loans	\$90 million	Bank Capital	\$ 10 million
Securities	\$10 million		

Deposit outflow of \$ 10 million

Assets		Liabilities	
Reserves	\$ 0 million	Deposits	\$ 90 million
Loans	\$90 million	Bank Capital	\$ 10 million
Securities	\$10 million		

- The bank has a reserve requirement of 10% of \$90 million, or \$9 million, but it has no reserves
- What can a bank do now? 4 options...

3. Liquidity risk management

Liquidity management (Options 1 and 2)

1. Borrow from other banks or corporations

Assets		Liabilities	
Reserves	\$ 9 million	Deposits	\$ 90 million
Loans	\$90 million	Borrowings	\$ 9 million
Securities	\$10 million	Bank Capital	\$ 10 million

2. Sell Securities

Assets		Liabilities	
Reserves	\$ 9 million	Deposits	\$ 90 million
Loans	\$90 million	Bank Capital	\$ 10 million
Securities	\$ 1 million		

3. Liquidity risk management

Liquidity management (Options 3 and 4)

3. Borrow from Fed

Assets		Liabilities	
Securities	\$10 million	Bank Capital	\$ 10 million
Reserves	\$ 9 million	Deposits	\$ 90 million
Loans	\$90 million	Discount Loans	\$ 9 million

4. Call in or sell off loans

Assets		Liabilities	
Reserves	\$ 9 million	Deposits	\$ 90 million
Loans	\$81 million	Bank Capital	\$ 10 million
Securities	\$10 million		

Conclusion: excess reserves are insurance against above 4 costs from deposit outflows

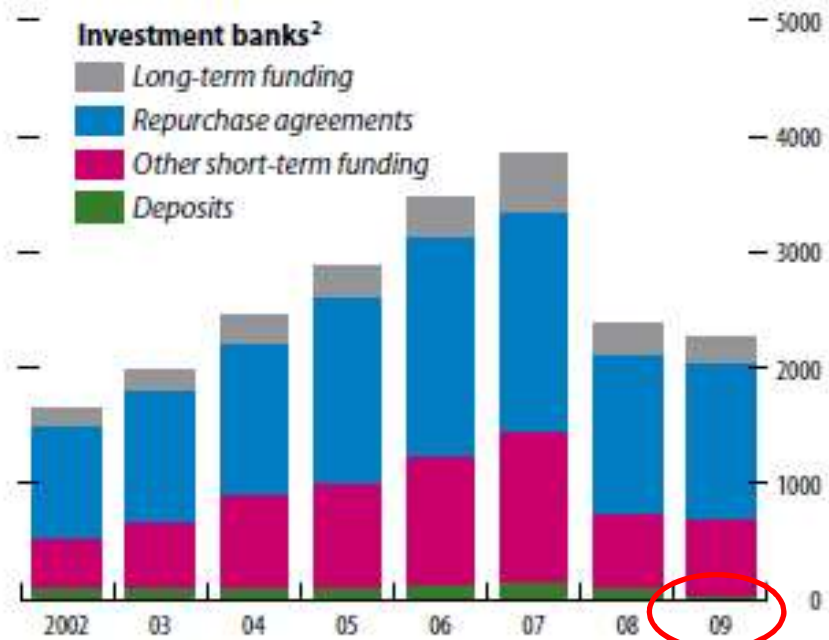
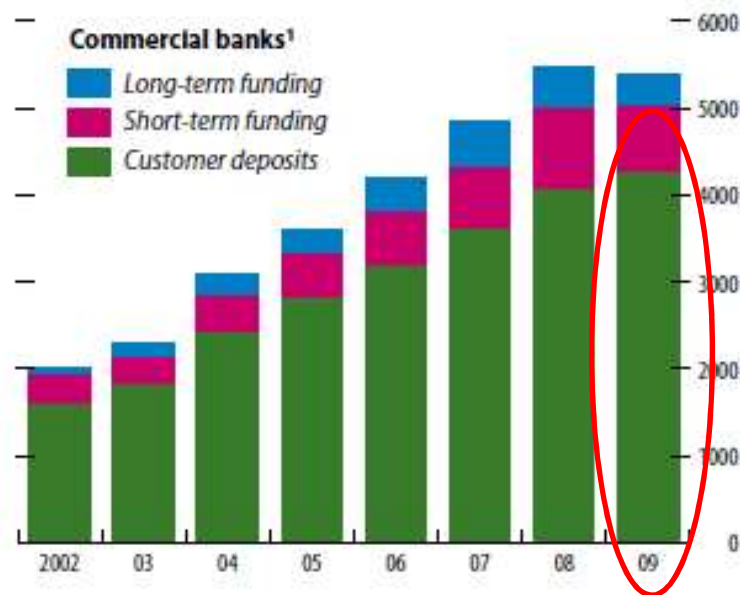
**8. What happened to
global investment banks
during the 2007-9 global
financial crisis (GFC)?**



3. Liquidity risk management

Commercial vs investment banks (without deposits) before 2009

Figure 2.11. United States: Funding Structure of Selected Largest Commercial and Investment Banks
(In billions of U.S. dollars)



Source: ©2003 Bureau van Dijk Electronic Publishing-Bankscope.

Note: Short-term funding is funding with maturity less than one year.

¹Top 10 commercial banks in terms of total assets.

²Data for investment banks capture 60 percent of total investment bank assets as reported by Bankscope. For 2008 and 2009, data exclude Lehman Brothers and Bear Stearns.

Source: IMF (2010)



3. Liquidity risk management

The 2007-2009 global financial crisis = end of an era of investment banks

- **Lehman Brothers'** bankruptcy
- **Merrill Lynch** taken over by Bank of America
- **Morgan Stanley** and **Goldman Sachs** applied to become regulated banks (broker-dealers became banks)
- **Deutsche Bank** has survived but recently in huge problems...

3. Liquidity risk management

Liquidity support to banks due to the Covid-19 pandemic (from central banks)

Policy measure	United States	Euro area	United Kingdom
Liquidity support	<p>Plan to purchase \$75 billion Treasury securities and \$50 billion GSE MBS</p> <p>PDCF lending to security firms and MMLF to assist MMFs in meeting demand for redemptions</p> <p>Provide up to \$2.3 trillion in loans, mainly through the PPP, MSLP and TALF</p>	<p>Additional LTROs and new PELTROs to safeguard money market conditions</p> <p>TLTRO III can be as low as 50 basis points below the average deposit facility rate</p> <p>PEPP to purchase public and private securities of €1.35 trillion until at least June 2021</p>	<p>Introduction of TFSME, financed by the issuance of central bank reserves</p> <p>CCFF will purchase commercial paper to provide support to firms with liquidity shortages</p>

Notes: CCB: Capital Conservation Buffer. CCFF: Covid Corporate Financing Facility. CSPP: Corporate Sector Purchase Programme. CTRF: Contingent Term Repo Facility. EBA: European Banking Authority. FIMA: Foreign and international monetary authorities. FPC: Financial Policy Committee. GSE: Government Sponsored Enterprise. IFRS: International Financial Reporting Standards. LCR: Liquidity Coverage Ratio. LTROs: Long Term Refinancing Operations. MBS: Mortgage-Backed Security. MMF: Money Market Fund. MMLF: Market Mutual Fund Liquidity Facility. MSLP: Main Street Lending Program. NPL: Non-performing loans. PELTROs: Pandemic Emergency Long Term Refinancing Operations. PEPP: Pandemic Emergency Purchase Program. PDCF: Primary Dealer Credit Facility. PRA: Prudential regulatory authority. PPP: Paycheck Protection Program. P2G: Pillar 2 Guidance. TALF: Term Asset-Backed Securities Loan Facility. TFSMF: Term Funding for Small and Medium-sized Enterprises. TLAC: Total Loss Absorbing Capacity. TLTRO III: Targeted Longer-Term Refinancing Operations.

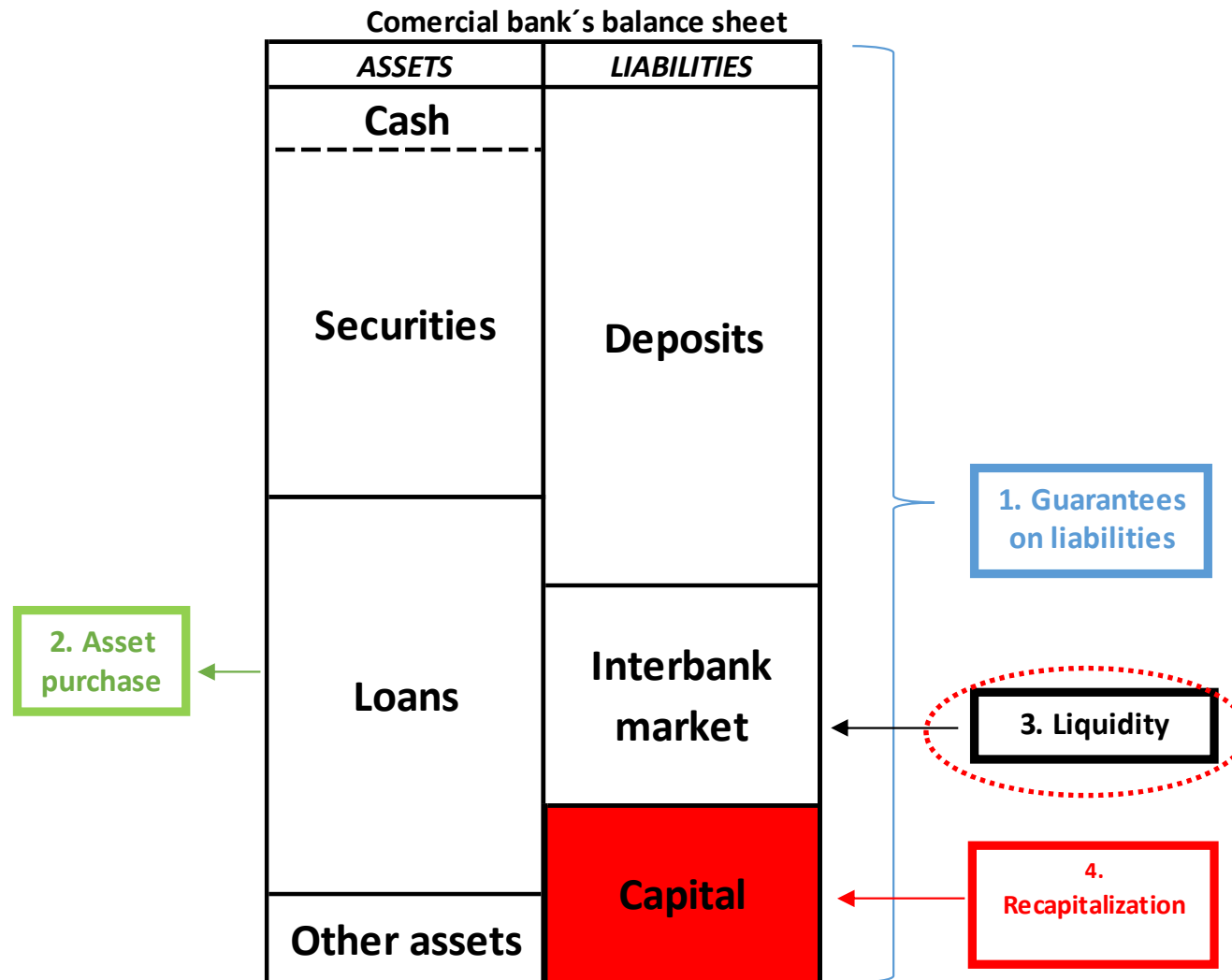
Source: Carletti, E., Claessens, S., Fatás, A. & Vives, X. (2020): The Bank Business Model in the Post-Covid-19 World. London: Centre for Economic Policy Research.

9. What are three other types of bank's rescues (apart from liquidity support)?



3. Liquidity risk management

Liquidity support as 1 out of 4 types of bank's rescues



I. Basic terms

Reading 3 – Liquidity surplus in the US banks

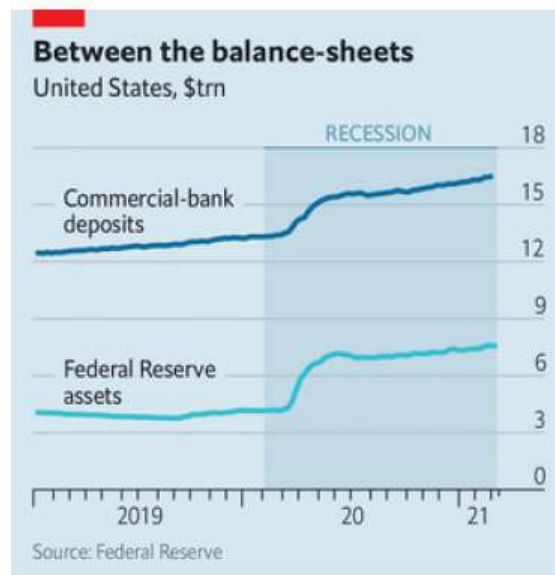
Finance & economics

Mar 20th 2021 edition

More is sometimes enough

America's banks have too much cash

Abundant liquidity is meant to help markets. It might soon cause trouble



The Economist

- 2 effects of the abundance of cash
 1. lower interest rate in the US;
 2. a lower ratio of equity capital to assets of the US banks (supplementary leverage ratio “SLR“ > 5%) resulting from a higher volume of total assets

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3. Operational risk management

Recapitulation: operational risk

- **Operational risk (OR)** = risk to the bank of loss resulting from inadequate or failed internal processes, people and systems, or the risk to the bank of loss resulting from external events, including cyber risk, model risk, legal risk, but it excludes strategic and reputational risks.
- **Cyber risk** means any risk of financial loss, disruption or damage to the reputation of an organisation from some sort of failure of its information technology systems.
- **Model risk** means the risk that a bank uses an incorrect model in the risk management
- Operational risk management (ORM)



3. Operational risk management

Increasing role of cyber risk

JEROME POWELL · Updated on 14 hours ago

Fed's Powell reiterates cyber threat as bigger danger to US economy than 2008-style financial crisis

Cyber threats could cost banks about \$100B annually, IMF says

Federal Reserve Chairman Jerome Powell reiterated on Wednesday that cyber threats pose a bigger threat to the U.S. economy than the risk of another systemic breakdown in the financial system seen during the 2008 recession.

In an interview with David Rubenstein at the Economic Club of Washington D.C. on Wednesday, Powell said that "cyber is the new frontier" and financial institutions are devoting resources to thwart attacks.

Source: <https://www.foxbusiness.com/economy/federal-reserve-jerome-powell-cyber-threats-us-economy>, updated 15. 4. 2021

3. Operational risk management

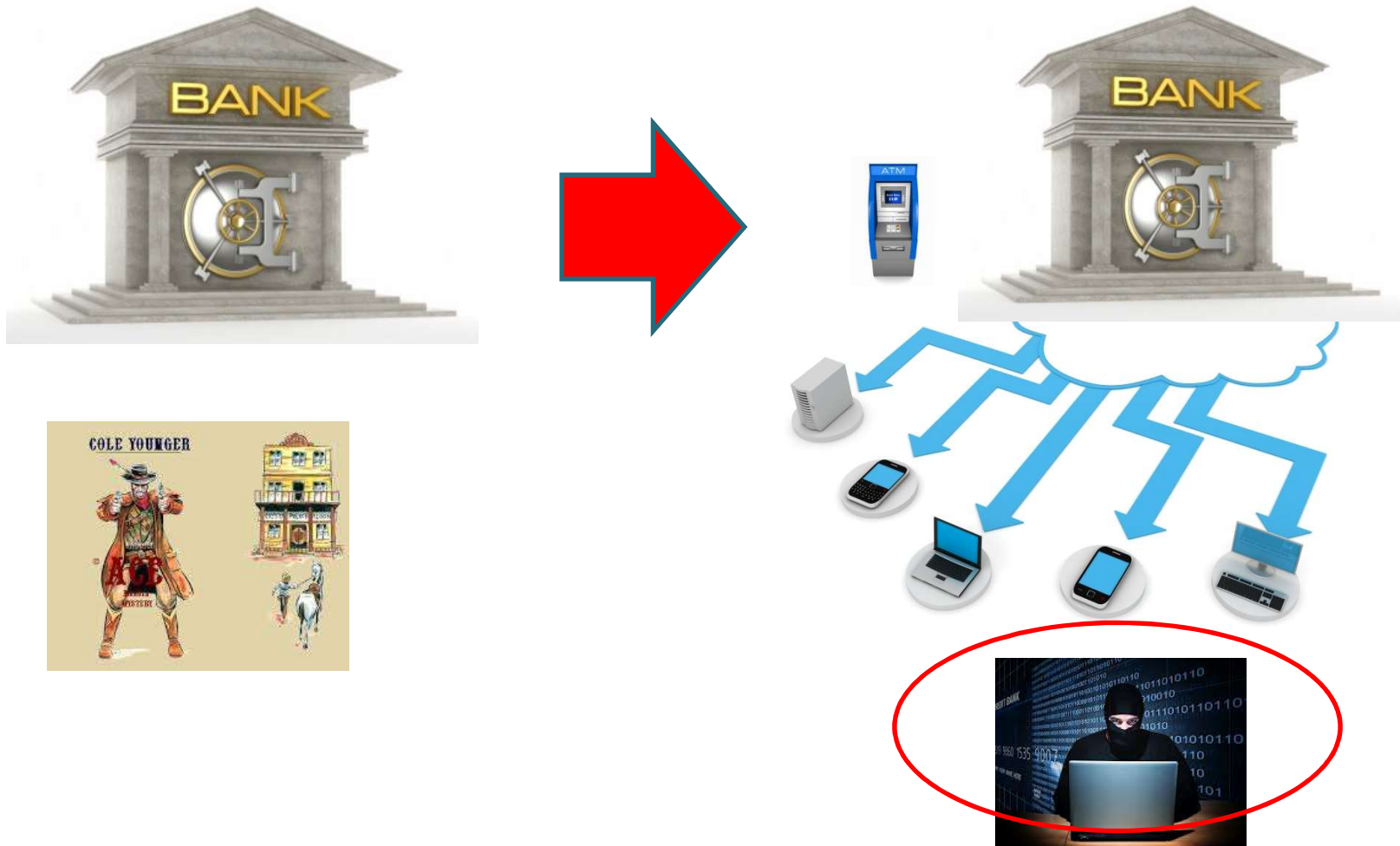
Main factors of operational risk

People	Systems	Processes	External Events
Fraud, collusion and other criminal activities	IT problems (hardware or software failures, computer hacking or viruses etc.)	Execution, registration, settlement and documentation errors (transaction risk)	Criminal activities (theft, terrorism or vandalism)
Violation of internal or external rules (unauthorized trading, insider dealing etc.)	Unauthorized access to information and systems security	Errors in models, methodologies and mark to market (model risk)	Political and military events (wars or international sanctions)
Errors related to management incompetence or negligence	Unavailability and questionable integrity of data	Accounting and taxation errors Inadequate formalization of internal procedures	Change in the political, legal, regulatory and tax environment (strategic risk)
Loss of important employees (illness, injury, problems in retaining staff etc.)	Telecommunications failure	Compliance issues Breach of mandate	Natural events (fire, earthquake, flood etc.)
Violations of systems security	Utility outages	Inadequate definition and attribution of responsibilities	Operational failure at suppliers or outsourced operations

Source: Teplý, P. (2012): The Application of Extreme Value Theory in Operational Risk Management. *Journal of Economics*, 60(7):698–716.

3. Operational risk management

Cloud banking model and increasing cyber risk



10. What are examples of failed operational risk management?





3. Operational risk management

Examples of failed ORM

- Past OR losses
 - Barings Bank in 1995 (\$1bn, Nick Leeson), Daiwa Bank in 1995 (\$1.1bn), Sumitomo Corporation in 1996 (\$2.9bn) CSOB Bank in 2000 (\$53m), Busan Savings Bank in 2011 (\$4.3bn)
- Recent OR losses/rough traders in banks
 - Jerome Kervile in SOGE in 2008 (\$7.3bn)
 - Kweku Adoboli in UBS in 2011 (\$2bn)
 - ‘London Whale’ in JPMorgan in 2012 (\$2bn)
- Ponzi schemes
 - Mr. Bernard Madoff in 2008 (\$65bn)
 - Sir Allen Stanford in 2009 (\$8bn)

3. Operational risk management

Higher penalties for banks (regulatory new normal) as a result of failed ORM



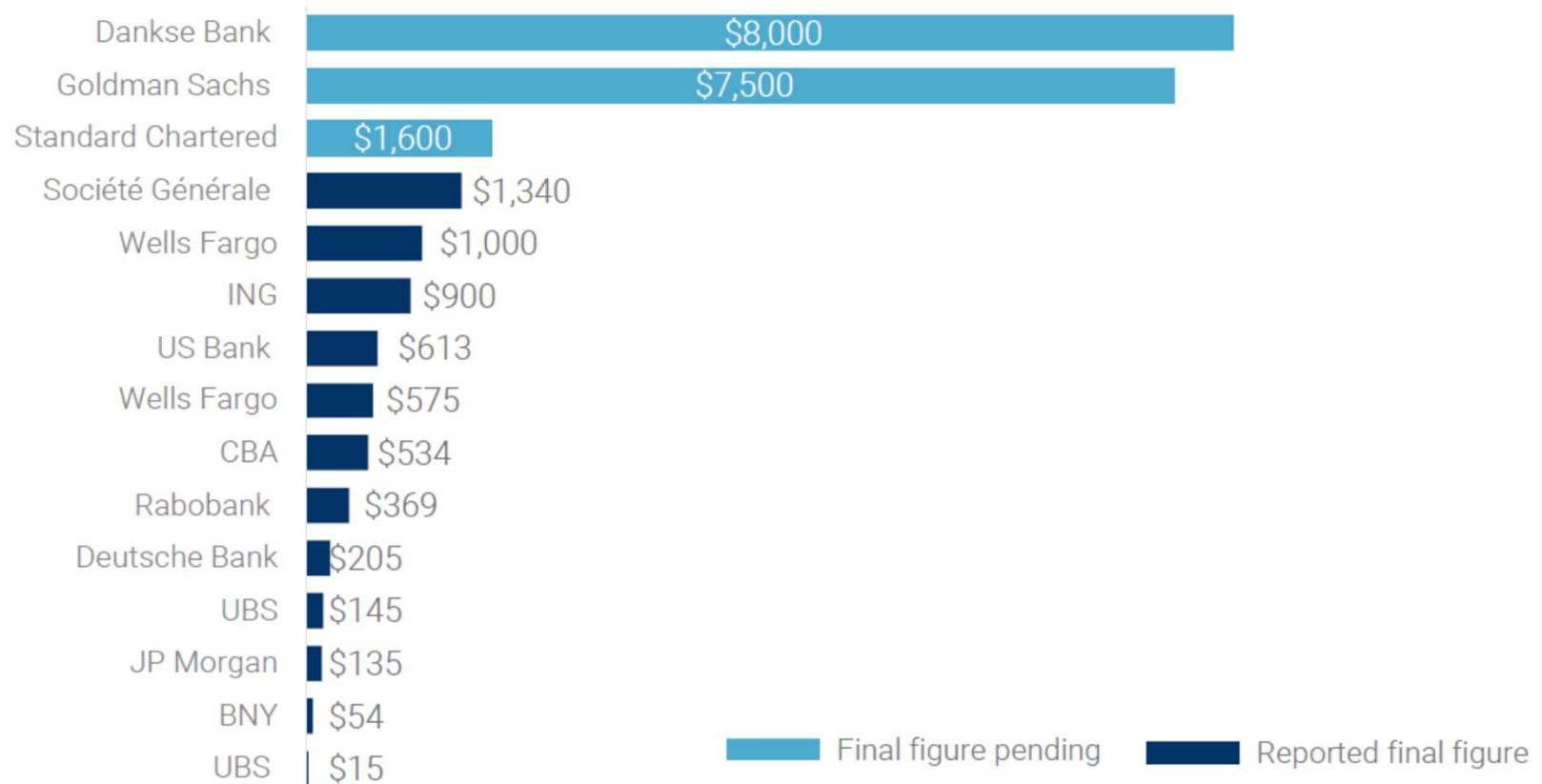
Source: Annual reports; press reports; BCG analysis.

Note: The sample covers the 50 largest European and North American banks. Data through 2015 includes only the penalties, fines, and settlements that surpass \$50 million; data since 2015 includes only the penalties, fines, and settlements that surpass \$20 million. Values may not add up to totals shown because of rounding.

- USD 381 billion in penalties (fines) paid by TOP global banks for their misconduct (violation of sanctions, mis-selling financial products, non-compliance with AML, KYC etc.)

3. Operational risk management

Examples of penalties for selected banks



Source: CB Insights (2019). Fintech Trends to Watch
Note: volume in \$ millions

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3. Operational risk management

Basel II distinguishes three main approaches to ORM

- 1) Basic Indicator Approach (BIA) – regulatory benchmark
- 2) Standardised Approach (SA)
- 3) Advanced Measurement Approach (AMA) – an internal bank model (see a case study below)

The capital charge (K_{BIA}) can be expressed as follows:

$$K_{BIA} = \frac{\left[\alpha \cdot \sum_{t=1}^n GI_t \right]}{n} \quad (1)$$

GI_t - gross income at time t

n - the number of the previous three years for which gross income was positive

α - the fixed percentage of gross income (15%)



3. Operational risk management

Case study on Advanced Measurement Approach (AMA)

The Application of Extreme Value Theory in Operational Risk Management

Petr TEPLÝ*

Abstract

This paper focuses on modeling the real operational data of an anonymous Central European bank. We have applied the Extreme Value Theory, in which we have used two estimation methods – the standard maximum likelihood estimation method and the probability weighted moments (PWM). Our results proved a heavy-tailed pattern of operational risk data as documented by many researchers. Additionally, we showed that the PWM is quite consistent when the data is limited as it was able to provide reasonable and consistent capital estimates. Our findings show that when using the Advanced Measurement Approach rather than the Basic Indicator Approach used in Basel II, the researched bank might save approx. 6 – 8% of its capital requirement on operational risk.

Keywords: *operational risk, economic capital, bank, extreme value theory, probability weighted method*

JEL Classification: G18, G21, G32

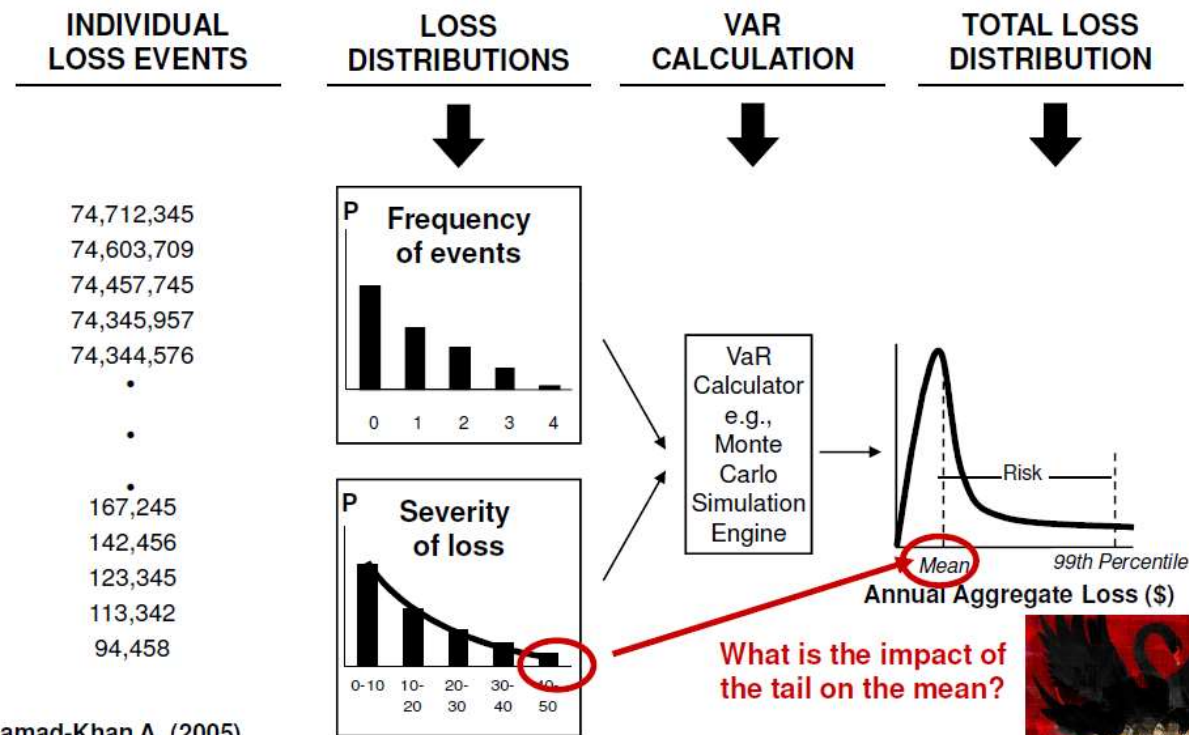
Source: Teplý, P. (2012): The Application of Extreme Value Theory in Operational Risk Management. *Journal of Economics*, 60(7):698–716.

11. How to model tail events in ORM?



3. Operational risk management

ORB and tail events modelling

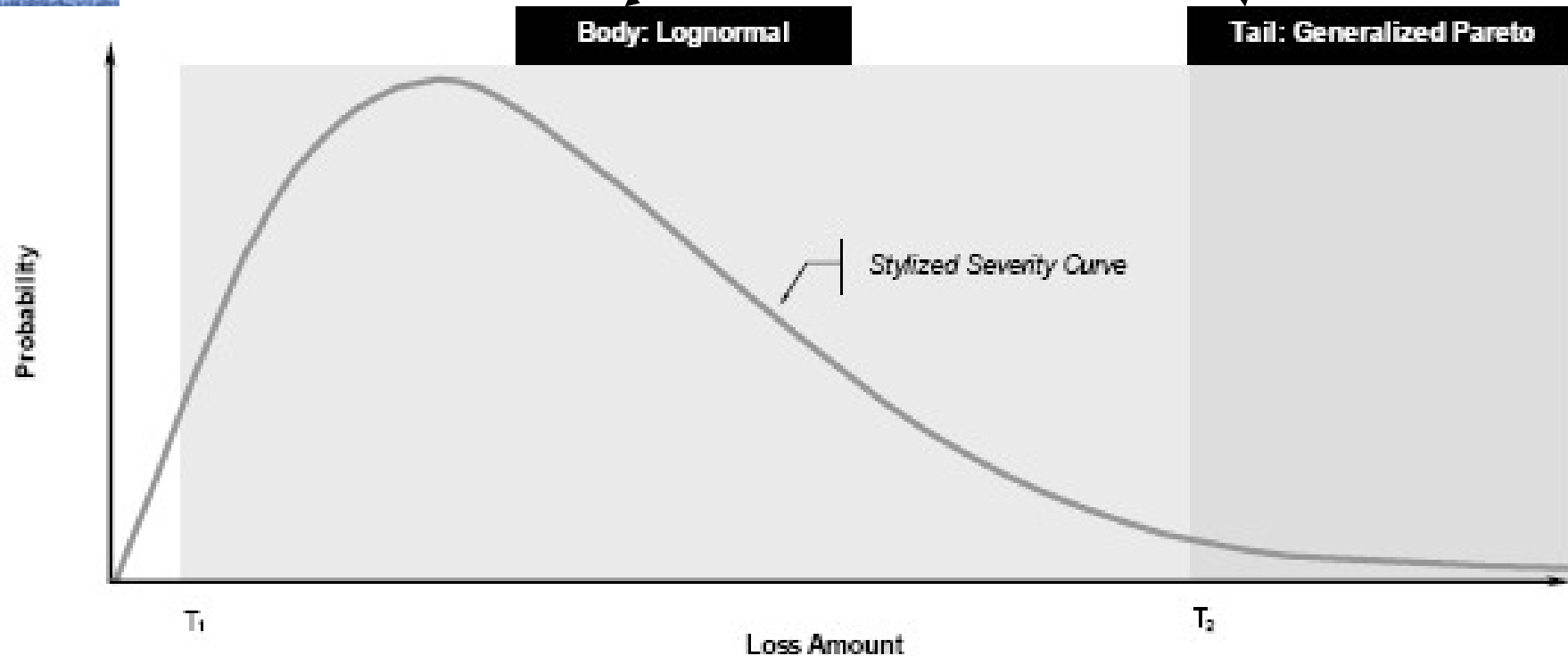


Source: Samad-Khan A. (2005)



3. Operational risk management

Separate a data set into **body** and **tail** and then provide modelling in these two parts separately



3. Operational risk management

Summary of results

Body	Tail	Statistical fit	Capital estimate* (99.9%)
Exponential	Exponential	very poor	2.7%
Gamma	Gamma	very poor	2.1%
Lognormal	Lognormal	poor	2.0%
Log-logistic	Log-logistic	poor	9.5%
GH distribution	GH distribution	poor	>100%
Empirical sampling	EVT** (block maxima, max. dozen, PWM***)	excellent	6.2%
Empirical sampling	EVT** (block maxima, max. 2%, PWM***)	excellent	8.2%

Notes: * As % of gross banking income (vs. regulatory benchmark 15% of gross banking income under the BIA)
 ** EVT = Extreme Value Theory, *** The Probability Weighted Moments

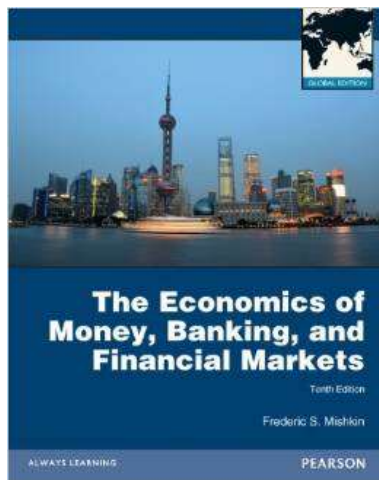
Source: Teplý, P. (2012): The Application of Extreme Value Theory in Operational Risk Management. *Journal of Economics*, 60(7):698–716.

Discussion

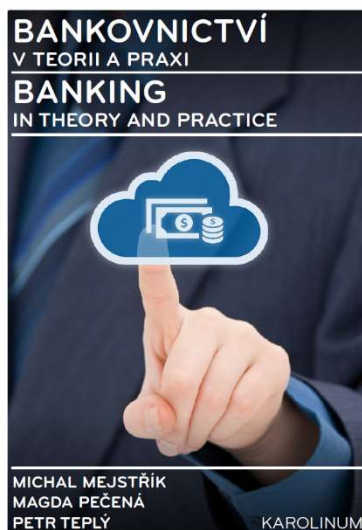
Thanks for your attention.
Let's discuss it now!



Reading for the this lecture



✓ **Chapter 9/Banking and Management of Financial Institutions**



✓ **Chapter 4/Principles of risk measurement and risk management**



Contact

Prof. PhDr. Petr Teplý, Ph.D.

Professor of Finance

Institute of Economic Studies

Faculty of Social Sciences

Charles University

Opletalova 26

110 00 Prague

Czech Republic

Tel: +420 222 112 326

e-mail: petr.teply@fsv.cuni.cz

<http://ies.fsv.cuni.cz>