

Contents

1. Basic terms
2. Liquidity risk management
3. Operational risk management
4. Operational risk – a case study
5. The future of bank risk management

Source: <https://digneconsult.com/sg/4-reasons-why-self-reflection-is-important/>



I. Basic terms

What's the aim of bank's management?

- To manage a bank with the goal of maximising its value for shareholders under **risk conditions**
- Dealing with information asymmetry
- **Appropriate risk management needed**
- Corporate governance/principal-agent problem



Source: Author, <https://images.app.goo.gl/fVoJxeinzrAhz18s8>
<https://images.app.goo.gl/ZoZV/GaTjJ7tAQ3M38>

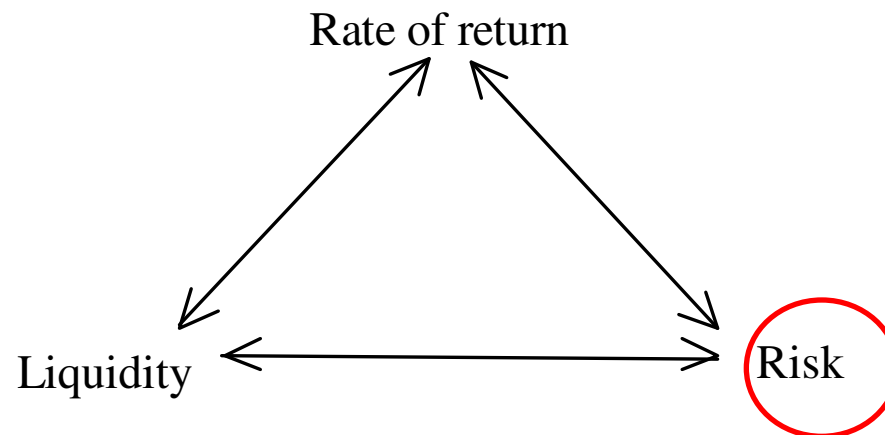
I. Basic terms

Definition of risk and risk management

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).



I. Basic terms

Categorization of risks

Financial risks

- credit risk
- market risk (interest rate risk, FX risk, equity risk, commodity risk)
- liquidity risk

Non-financial risks

- operational
- model
- settlement
- legal
- taxes
- regulation
- political
- reputational.....



more difficult to quantify

Market risk
Credit risk
Liquidity risk
Operational risk
Political risk
Legal and regulation risk



easier to quantify

I. Basic terms

Definitions of main risks 1/2

Credit risk

- risk to the bank of losses resulting from the failure of a counterparty to meet its obligations in accordance with the terms of a contract under which the bank has become a creditor of the counterparty,
- 50–70% of all banking risks (measured by bank capital requirements).

Market risk

- Risk to the bank of losses resulting from changes in prices, exchange rates and interest rates on the financial markets. This is a summary term for interest rate risk, foreign exchange risk, equity risk and other risk associated with movements in market prices,
- 5–20% of all banking risks are accounted for as market risks (measured by bank capital requirements).

I. Basic terms

Definitions of main risks 2/2

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 . It excludes strategic and reputational risk.
- Operational risk represents 5 – 30% of banking risks (measurey by bank capital requirements).
- Depending also on the extent to which it overlaps with the definition of other risks (especially credit risk), see examples below (Barings, SoGe, UBS etc.)

Liquidity risk

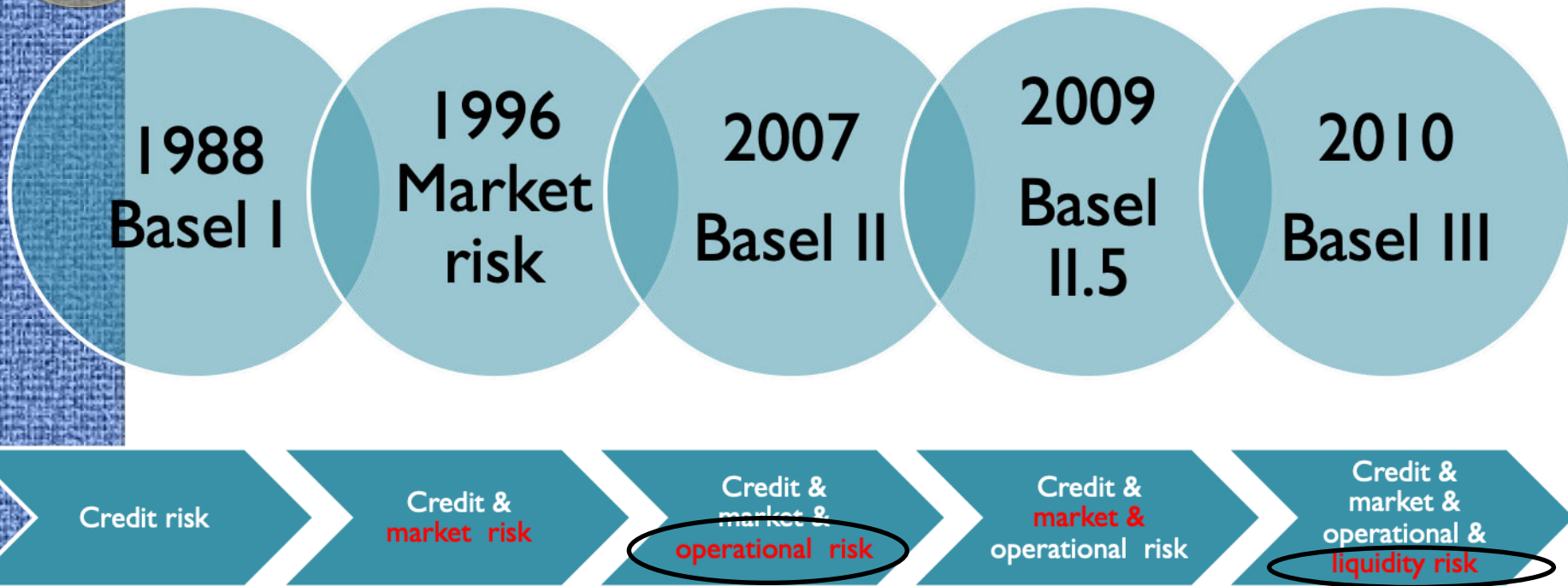
- the risk that the bank will lose its ability to meet its financial obligations as they are due, or the bank will not be able to fund its assets,
- potential loss due to insufficient market depth.

The definitions may overlap!

No single set of risks and definitions of risks exists!

I. Basic terms

Risks covered under Basell I & II & III regulation



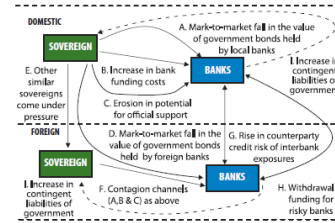
Source: Author

I. Basics terms

Black swan event = a rare event but severe impact

Source:

http://earthquakekocho.blogspot.com/2015/10/tsunami_30.html



Source:

http://gangstersout.com/fraud_watch.htm

Source:

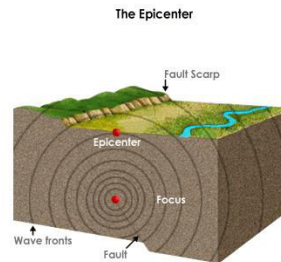
https://www.researchgate.net/figure/Spillovers-from-sovereign-to-banks-and-from-banks-to-sovereigns-Source-IMF-Global_fig2_264156788

$f(x)$



Source:

<https://semanariouniversidad.com/mundo/luxemburgo-bloquea-la-transferencia-de-activos-iranies-a-eeuu/>



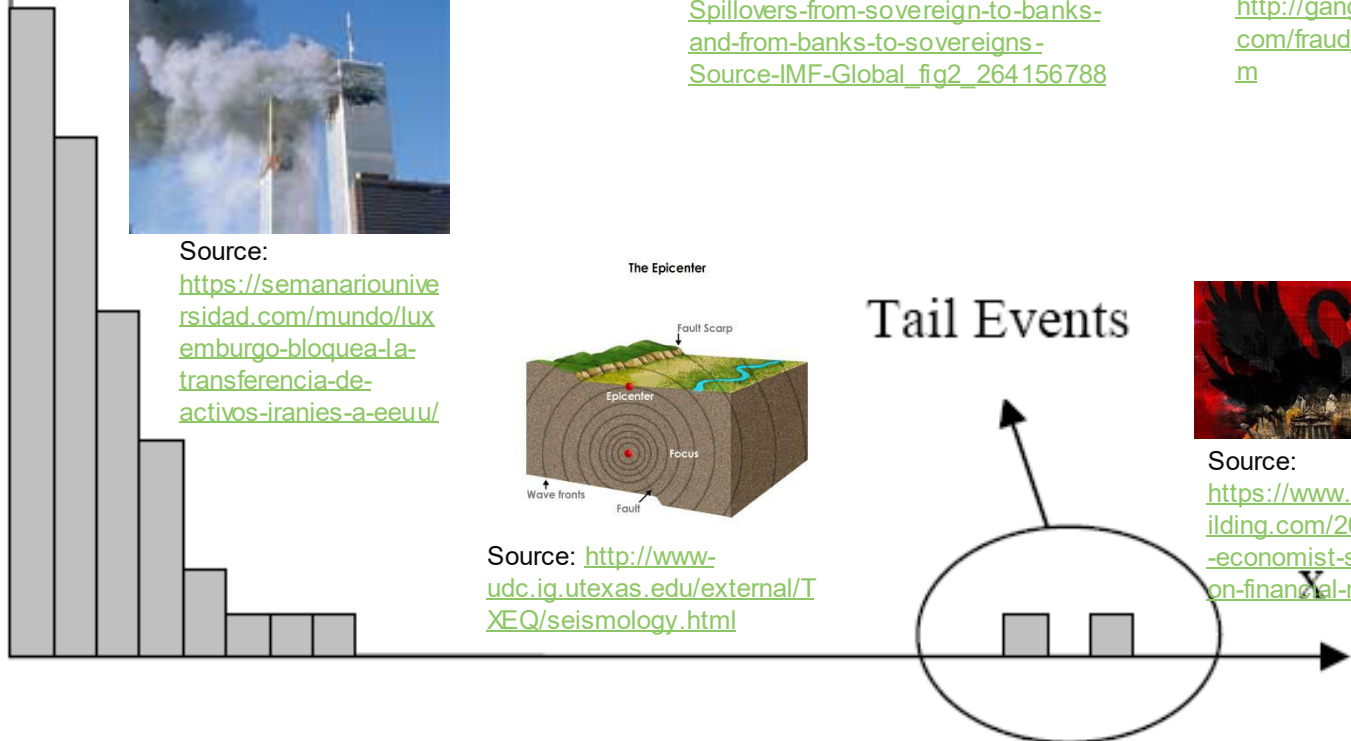
Source: <http://www-udc.ig.utexas.edu/external/TXEQ/seismology.html>

Tail Events



Source:

<https://www.compliancebulletin.com/2010/02/16/the-economist-special-report-on-financial-risk/>



I. Basic terms

Four key functions of a bank

- 1) Effective transformation of capital
- 2) Non-cash money supply
- 3) Providing non-cash payment services
- 4) Maturity transformation
short-term liabilities ->
long-term assets

Bank's balance sheet

ASSETS	LIABILITIES
Cash	Deposits
Securities	Interbank market
Loans	Capital
Other assets	

Diagram illustrating the Bank's balance sheet with annotations:

- 1**: Points to the Deposits and Interbank market sections of the Liabilities side.
- 2**: Points to the Loans section of the Assets side.
- 3**: Points to the Cash section of the Assets side.
- 4**: Points to the Interbank market section of the Liabilities side.

Arrows indicate maturity transformation:

- From Deposits to Securities: + maturity transformation
- From Interbank market to Loans: + maturity transformation

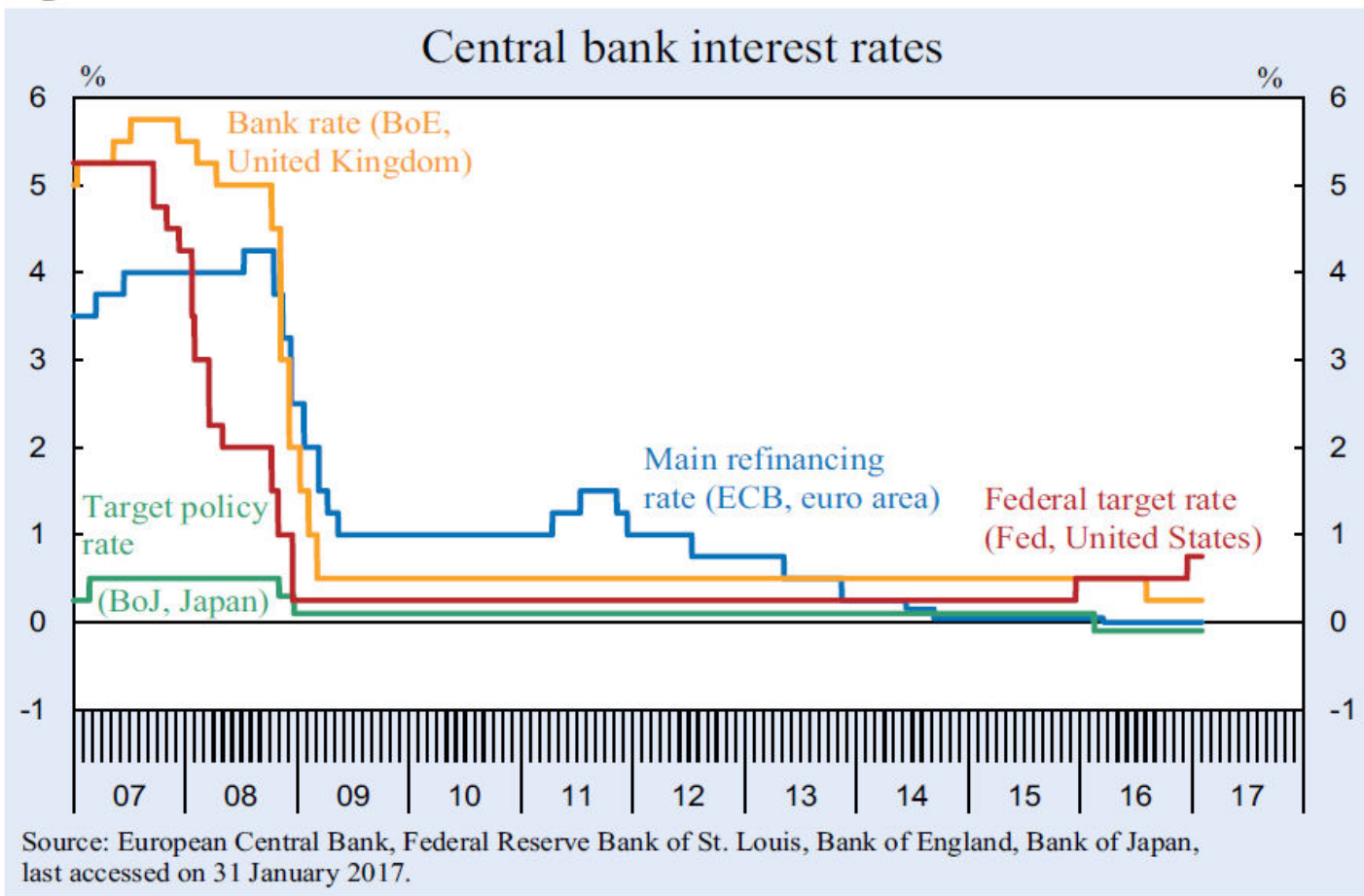
I. Basic terms

Liquidity vs. solvency

- The liquidity of a bank represents its ability to meet proper obligations (short-term, cash or payment) in a corresponding volume and time structure.
- Satisfactory liquidity is the ability to refinance liabilities at or below market rates, or to be financed without excessive costs.
- 3 types
 - i) short-term liquidity (up to 1 month)
 - ii) medium-term liquidity (1 month–1 year)
 - iii) long-term liquidity (over 1 year).
- **Solvency** ≠ **long-term liquidity** (problematic “zombie” banks are liquid by not solvent!)

I. Basic terms

Expansive monetary policies after 2008 were not enough...



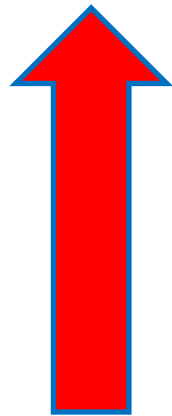
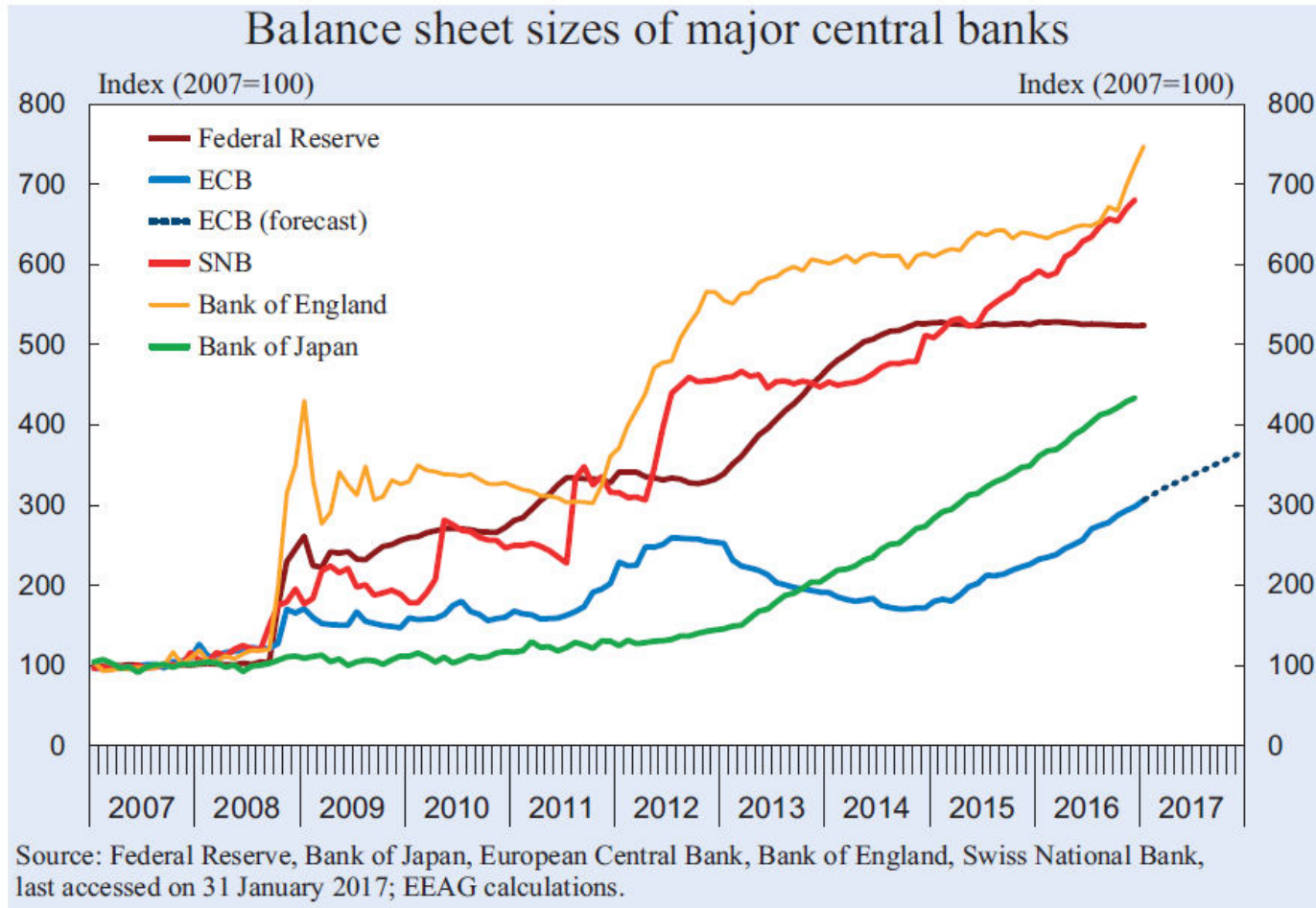
I. Basic terms ...and therefore Quantitative Easing (QE) has come!

- *The Federal Reserve announced that it would buy \$600 billion in Treasuries over the next eight months in a second round of “**quantitative easing**”. The decision to pump more liquidity into the American economy to bring down long-term interest rates and spur growth prompted modest rises in stockmarkets around the world.*



I. Basic terms

QE resulted in increasing central banks' balance sheets



I. Basic terms

The ECB = the only recent rescuer of the Eurozone - but about long-term effects?

Source: <https://finex.cz/evropske-centralni-bance-bude-vladnout-zena/>



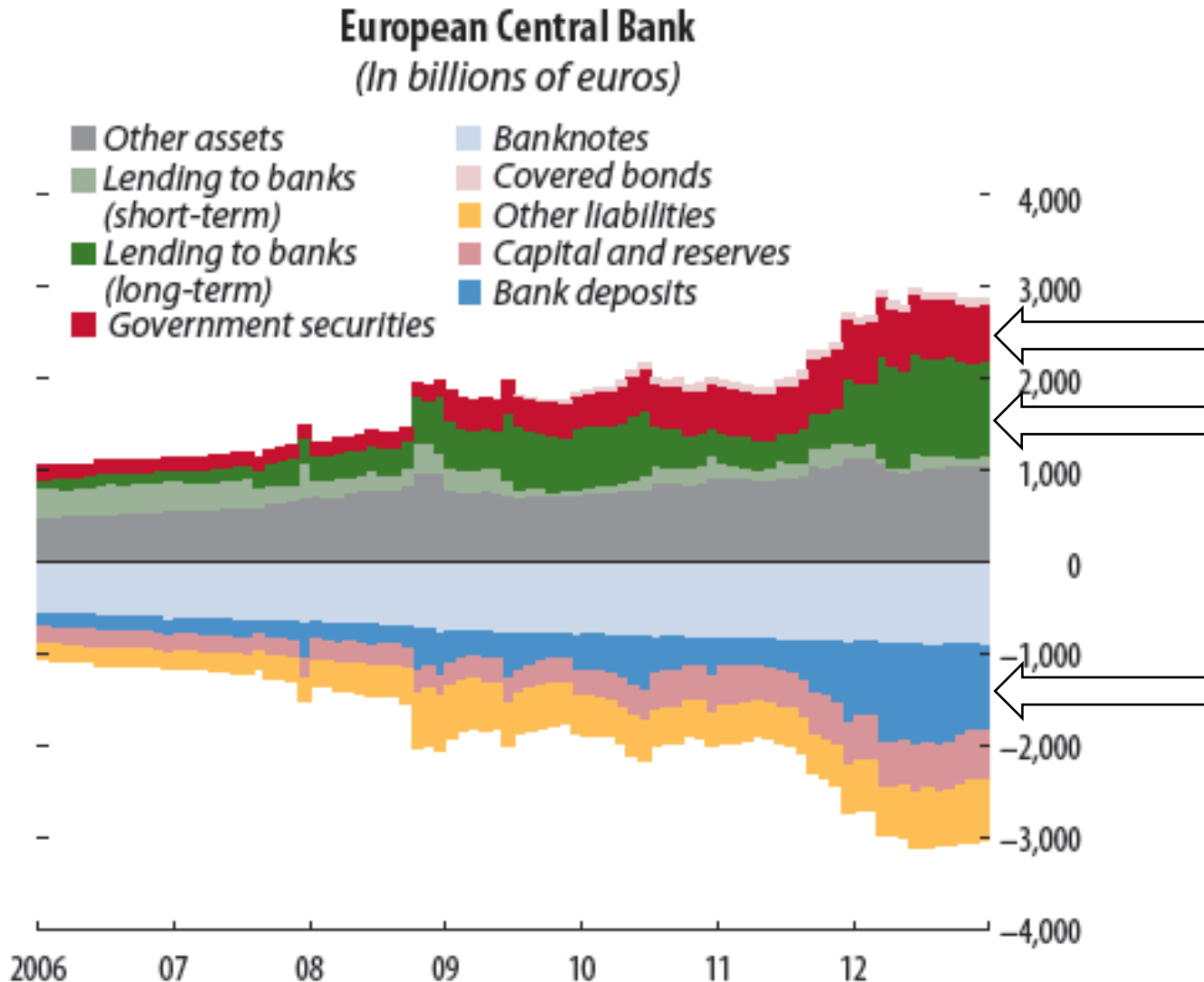
Source: <https://www.anti-k.org/2015/07/13/un-pistolet-sur-la-tempe-de-tsipras-lautre-vision-de-la-crise-grecque/>

Source: <http://antisophiste.blogspot.com/2012/01/la-bce-et-le-bazooka.html>

Source: <https://serieosimortais.blogs.sapo.pt/8946.html>



Printing money is not an appropriate word when talking about quantitative easing (QE)



Banks put money back to ECB

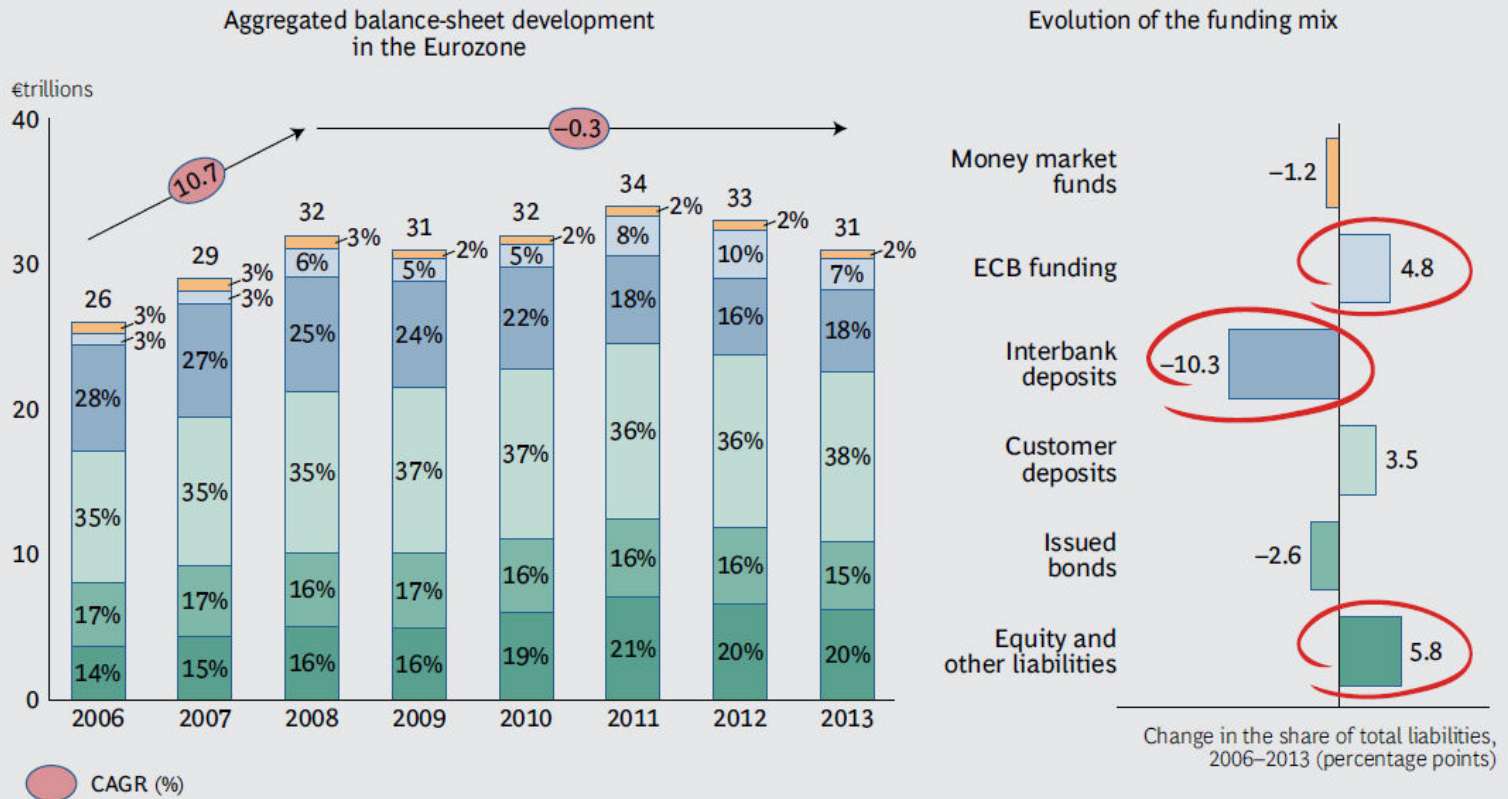
I. Basic terms

An increasing role of the ECB in funding Eurozone banks



Source: <https://fineartamerica.com/art/digital+art/business+suit>

EXHIBIT 1 | Balance Sheet Structures Have Stabilized

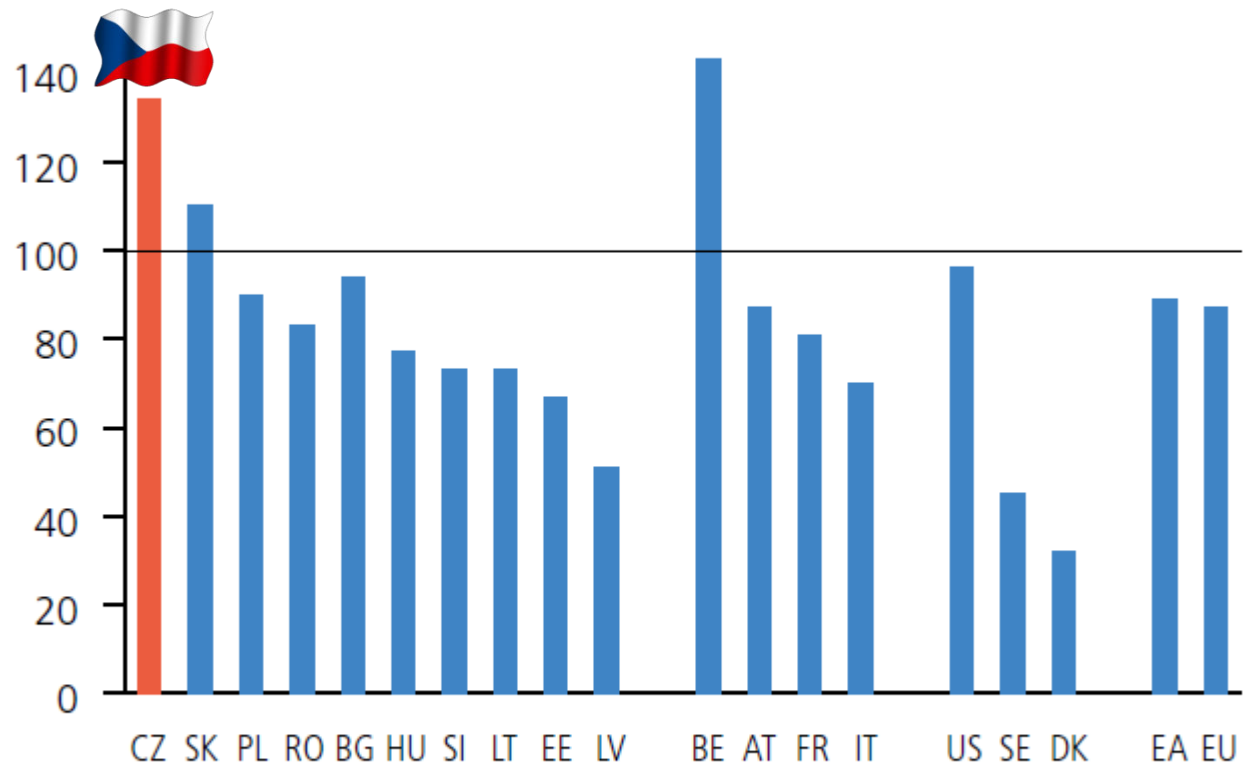


Sources: European Central Bank (ECB); Bloomberg; BCG analysis.
 Note: Because of rounding, not all percentages add up to 100.

I. Basic terms

A high deposit/loan ratio indicates excess cushion of liquidity in the CR

Ratio of deposits to loans granted in selected EU countries
(%; end of 2011; deposits/loans to residents)

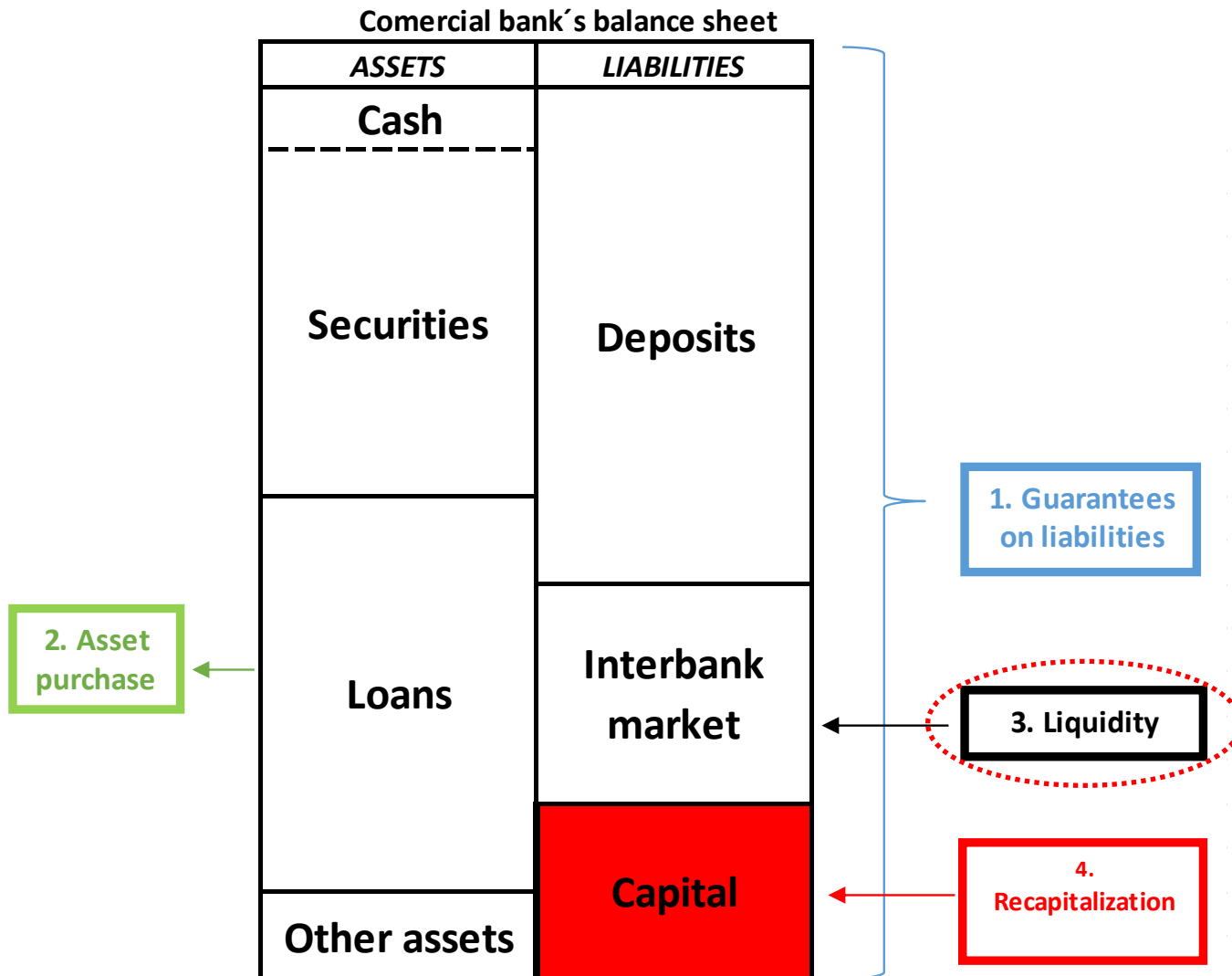


Source: ECB

Note: EA = euro area; EU = average for all EU countries.

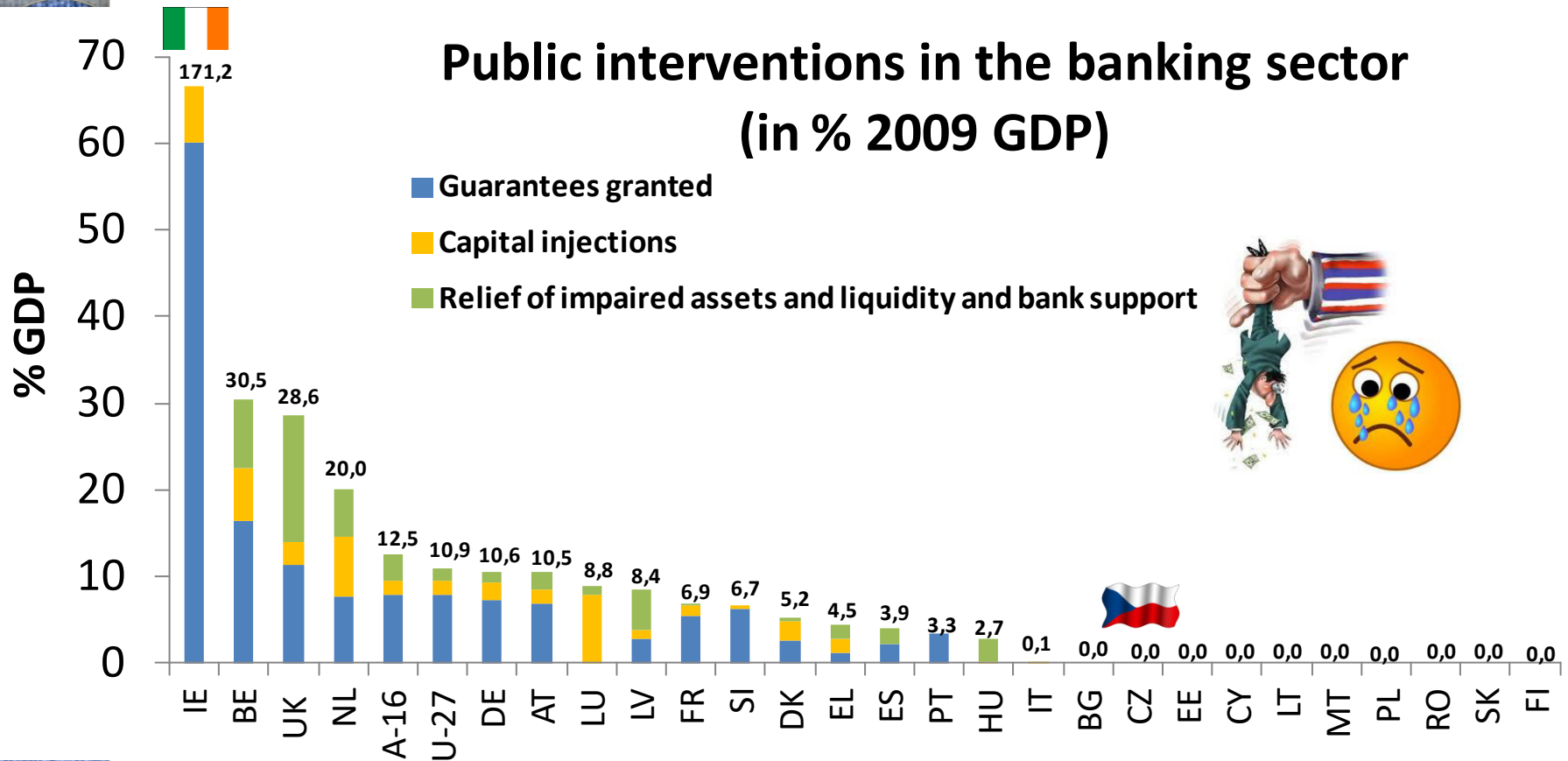
I. Basic terms

Liquidity support as 1 out of 4 bank's rescues



I. Basic terms

Public interventions in banks in the EU



- No public intervention needed in the Czech Republic!
- ...resulting from a healthy Czech banking sector with liquidity and capital surplus

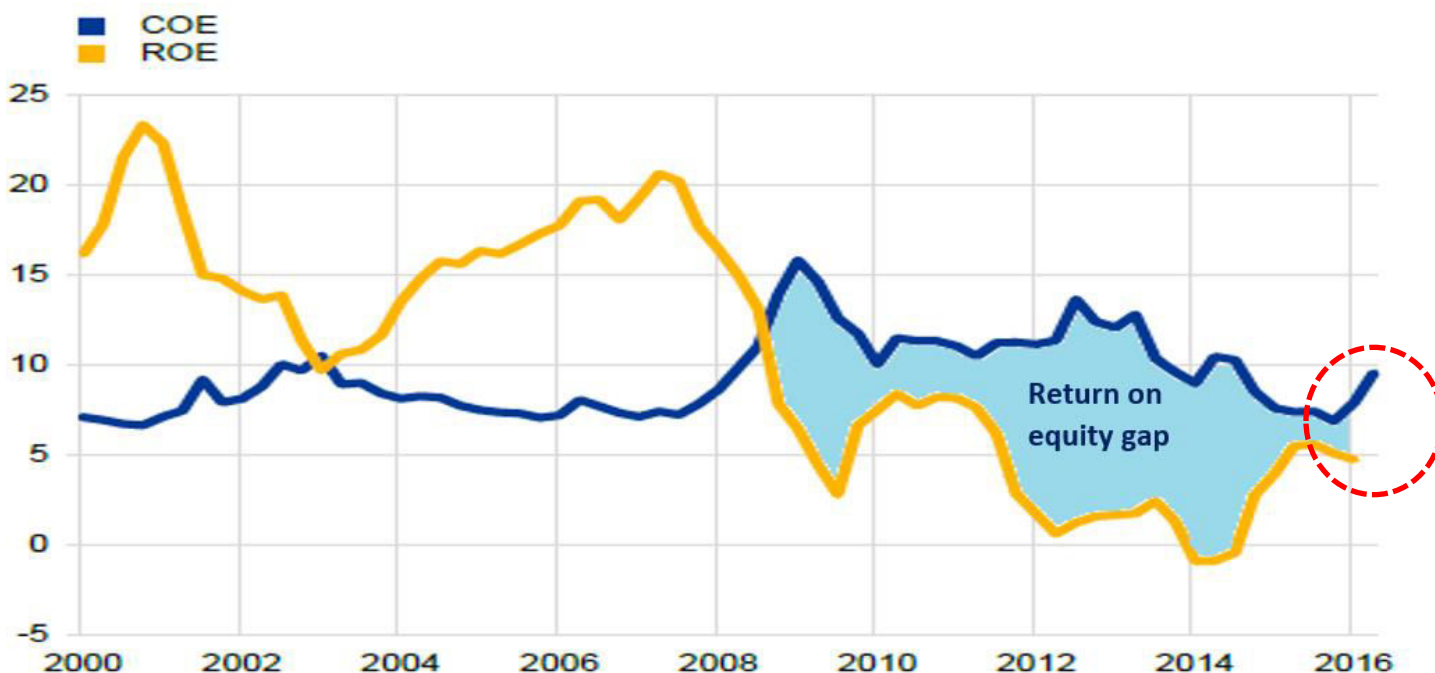
Source: European Commission (2009)

Weak performance of Euro area (EA) banks

- Return on Equity (ROE) has been lower than Cost of Equity (COE) of Euro area banks since 2009, i.e. EA banks do not create economic value to their shareholders

Return on equity and cost of equity for listed Euro area banks

(Q1 2000 – Q2 2016; percentages)



Source: Bloomberg, Datastream, Consensus Economics, ECB Calculations. Retrieved from: ECB presentation from 7 July 2016

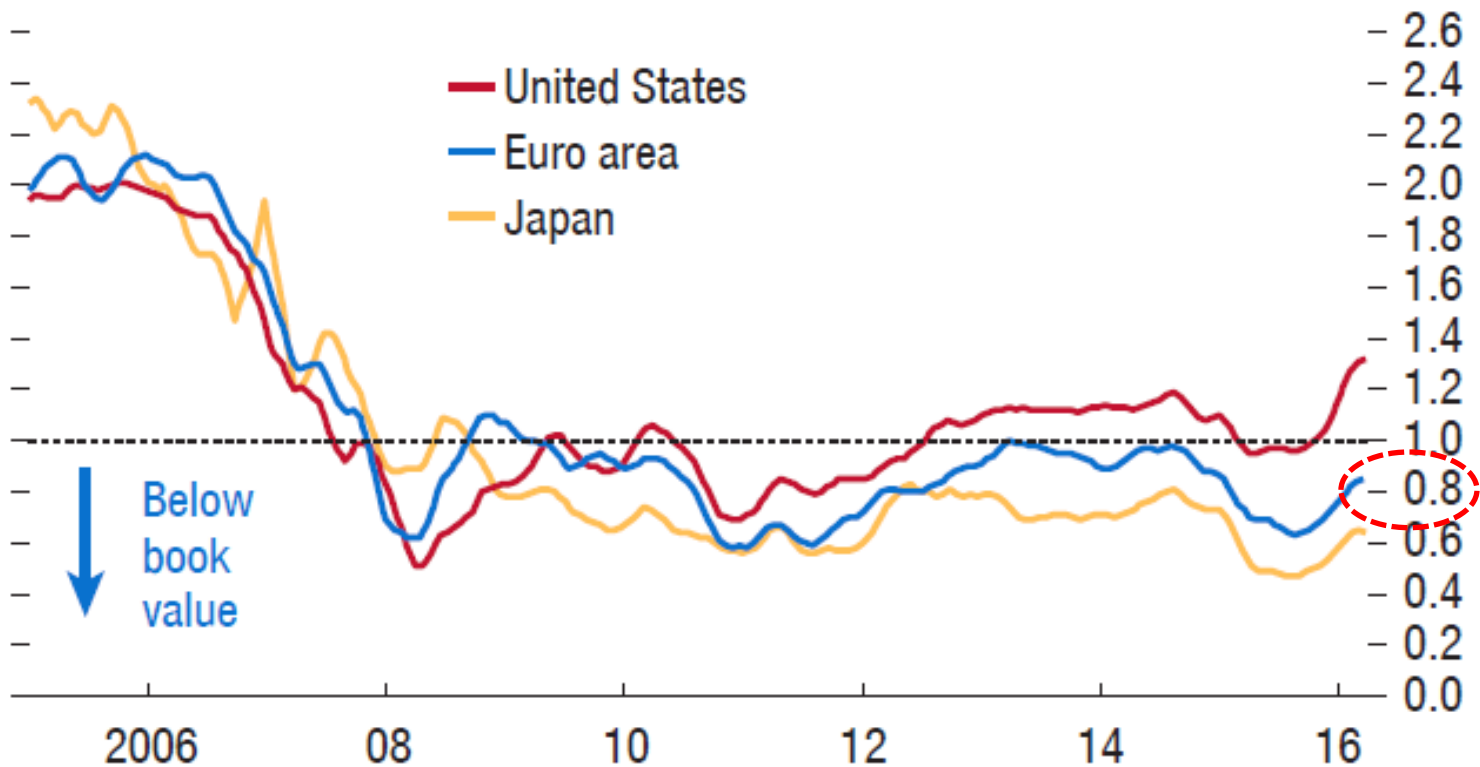
“Challenges for the European banking industry”

Note: Latest observations are for Q1 2016 (ROE) and Q2 2016 (COE)

Depressed valuations of Euro-Area banks

- The subdued profitability is reflected in depressed Euro area bank valuations (price-to-book value (P/BV) ratio < 1)

Bank Price-to-Book Ratios
(Multiple)



Challenges are reflected in factors of weak EA banks' profitability

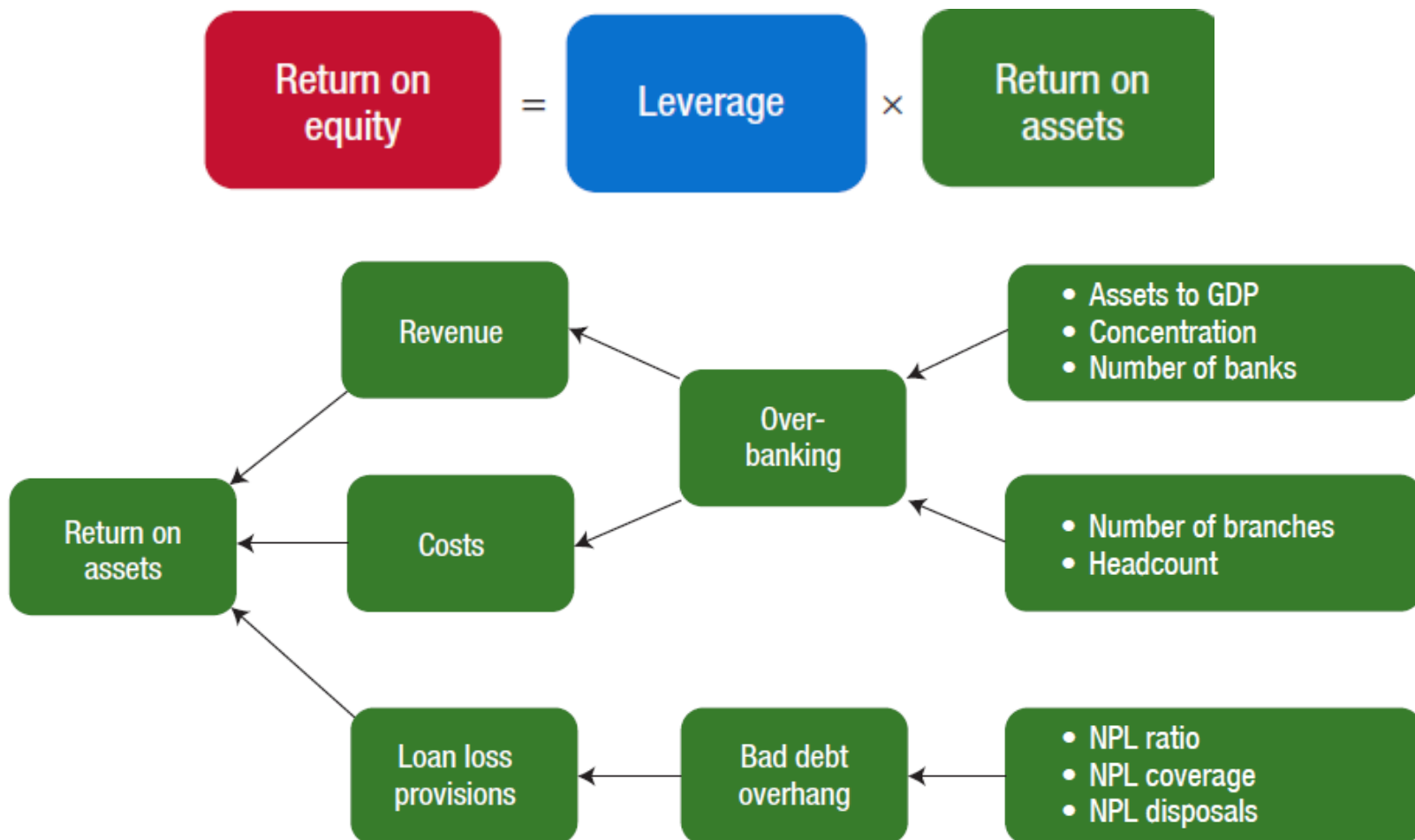
1) Cyclical factors

- ✓ the difficulties in increasing revenues in a low nominal growth and low interest rate environment and a relatively flat yield curve (result: lower net interest income).

2) Structural factors

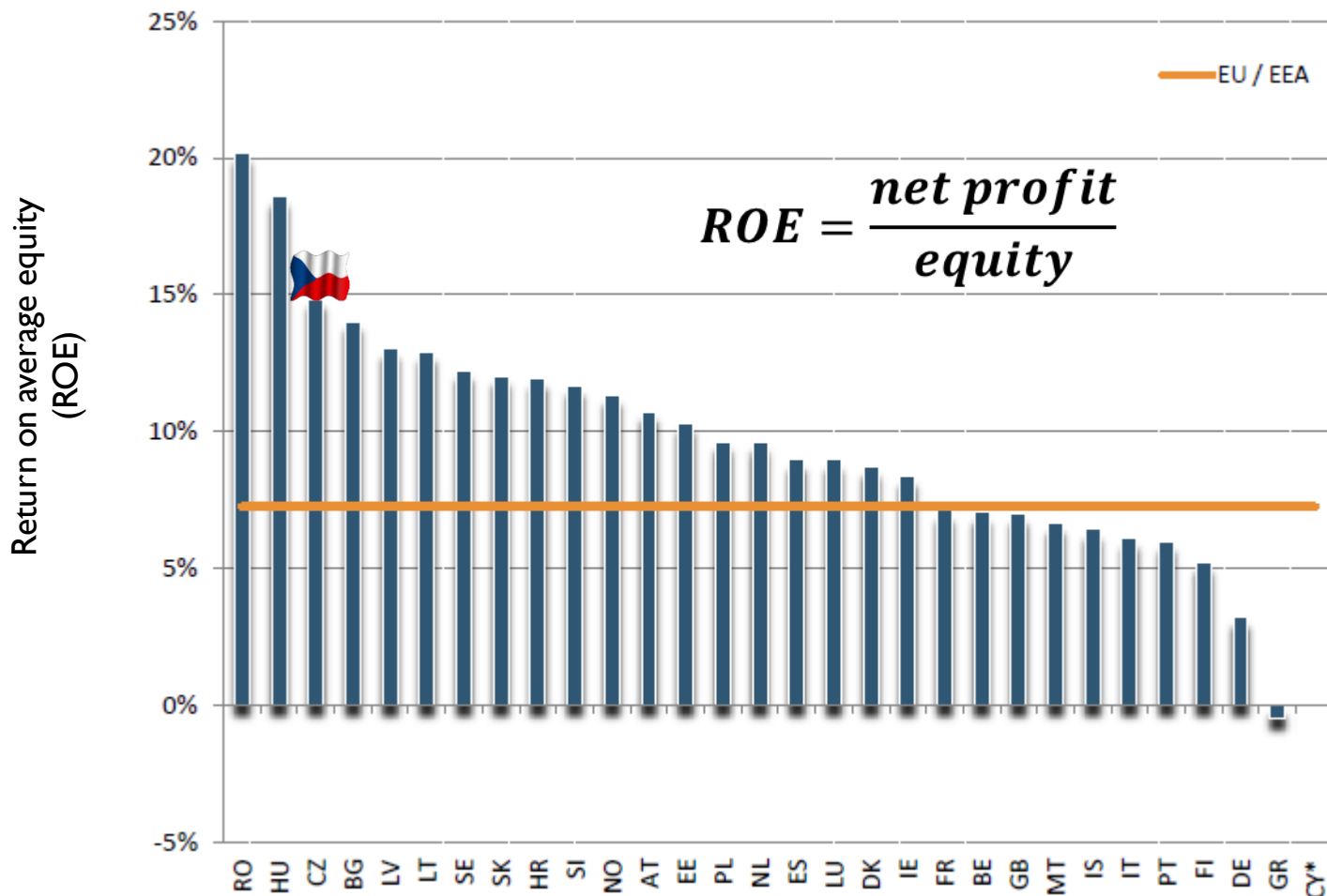
- ✓ the large stock of non-performing loans (NPLs),
- ✓ a legacy of the 2008 financial crisis,
- ✓ cost inefficiency,
- ✓ excess capacity (overbanking).

Structural factors of banks' profitability



I. Basic terms

High profitability of Czech banks in 3Q-2018 compared to EU banks because of 3 main reasons

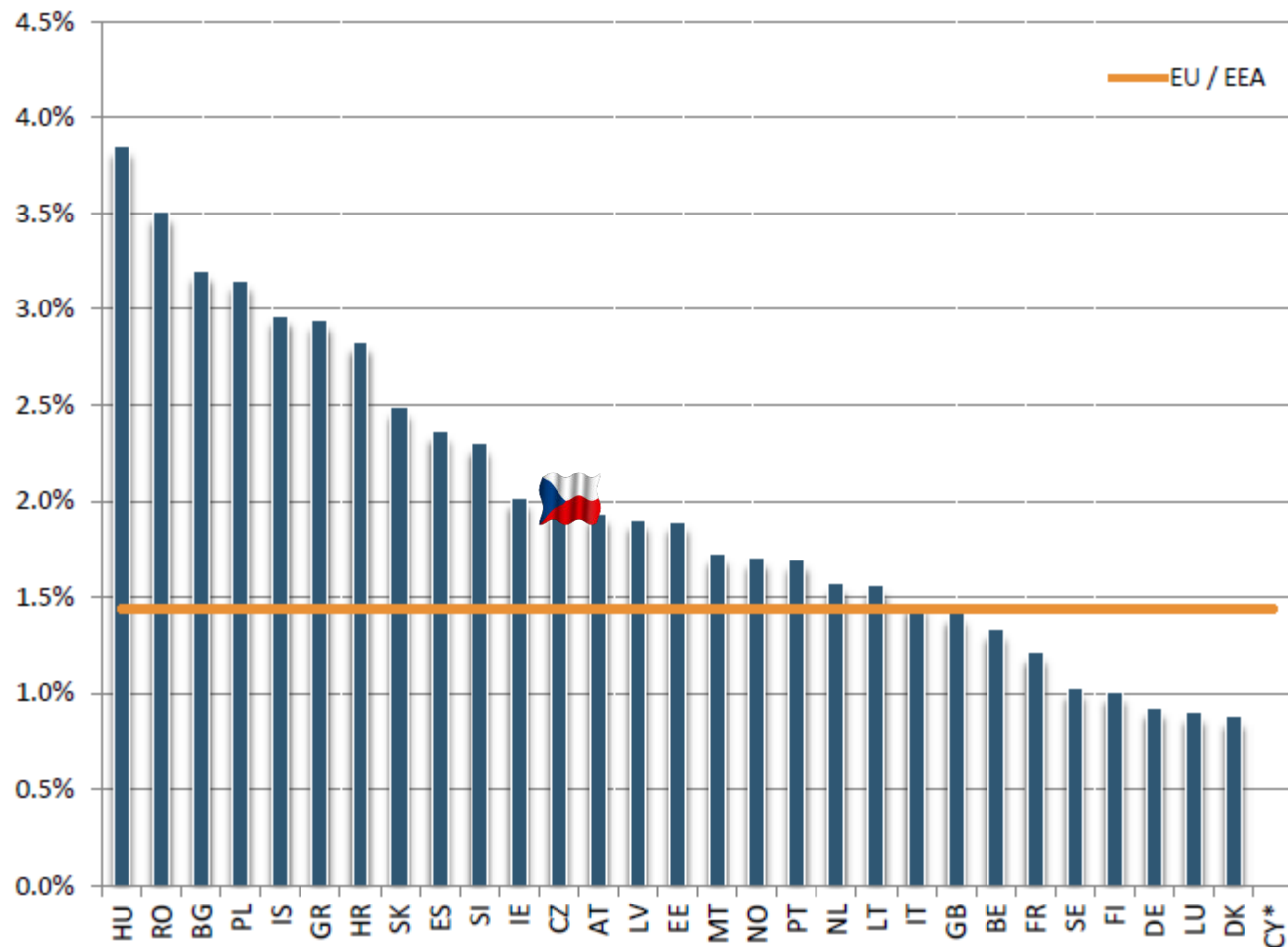


Source: EBA (2019). RISK DASHBOARD Q3-2018. The European Banking Authority, <https://images.app.goo.gl/oSLx1qttUzhHnFmm8>

I. Basic terms

I) High interest rate margin

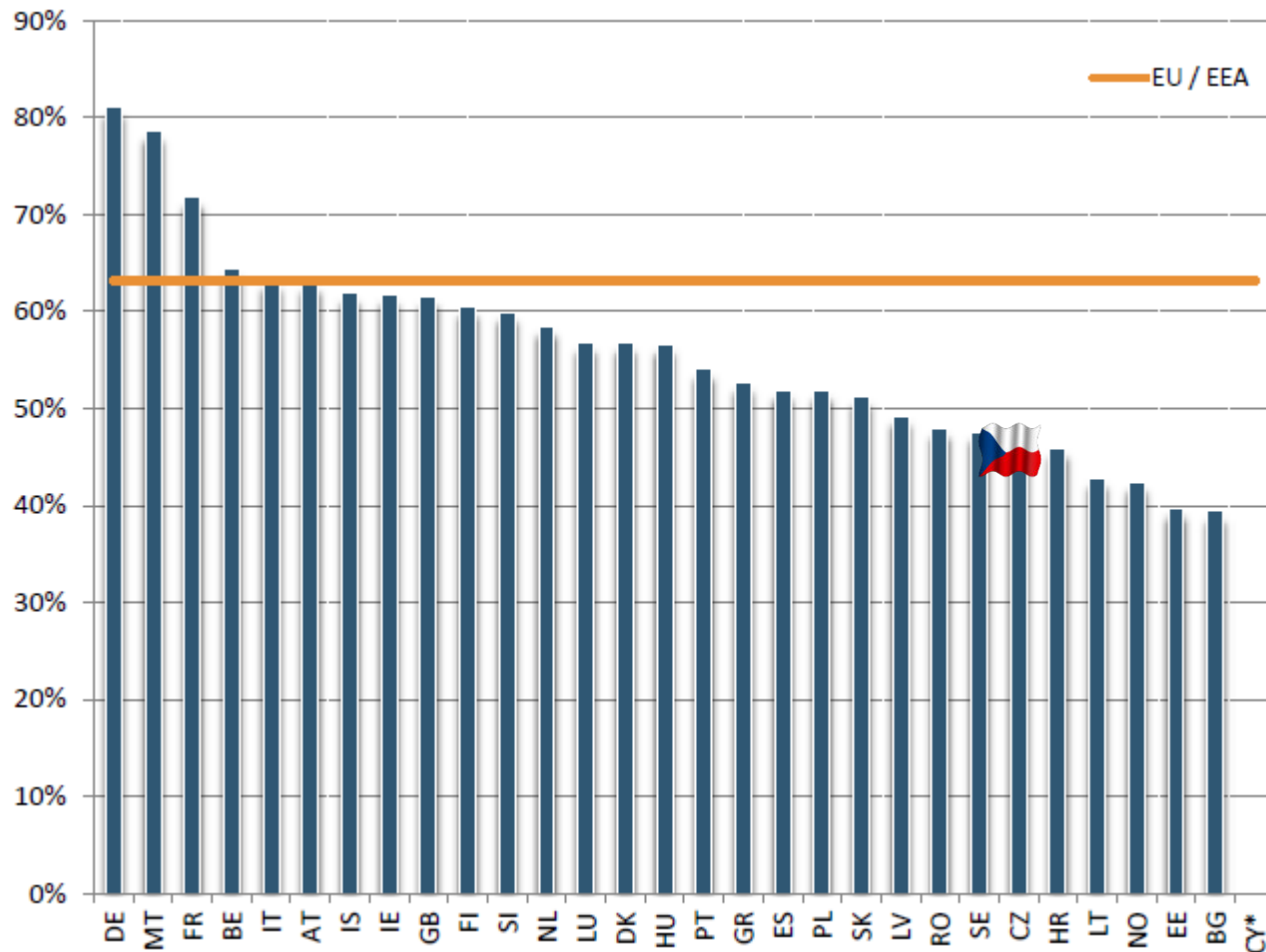
(measured by net interest income/interest bearing assets ratio)



Source: EBA (2019). RISK DASHBOARD Q3-2018. The European Banking Authority, <https://images.app.goo.gl/oSLx1qttUzhHnFmm8>

I. Basic terms

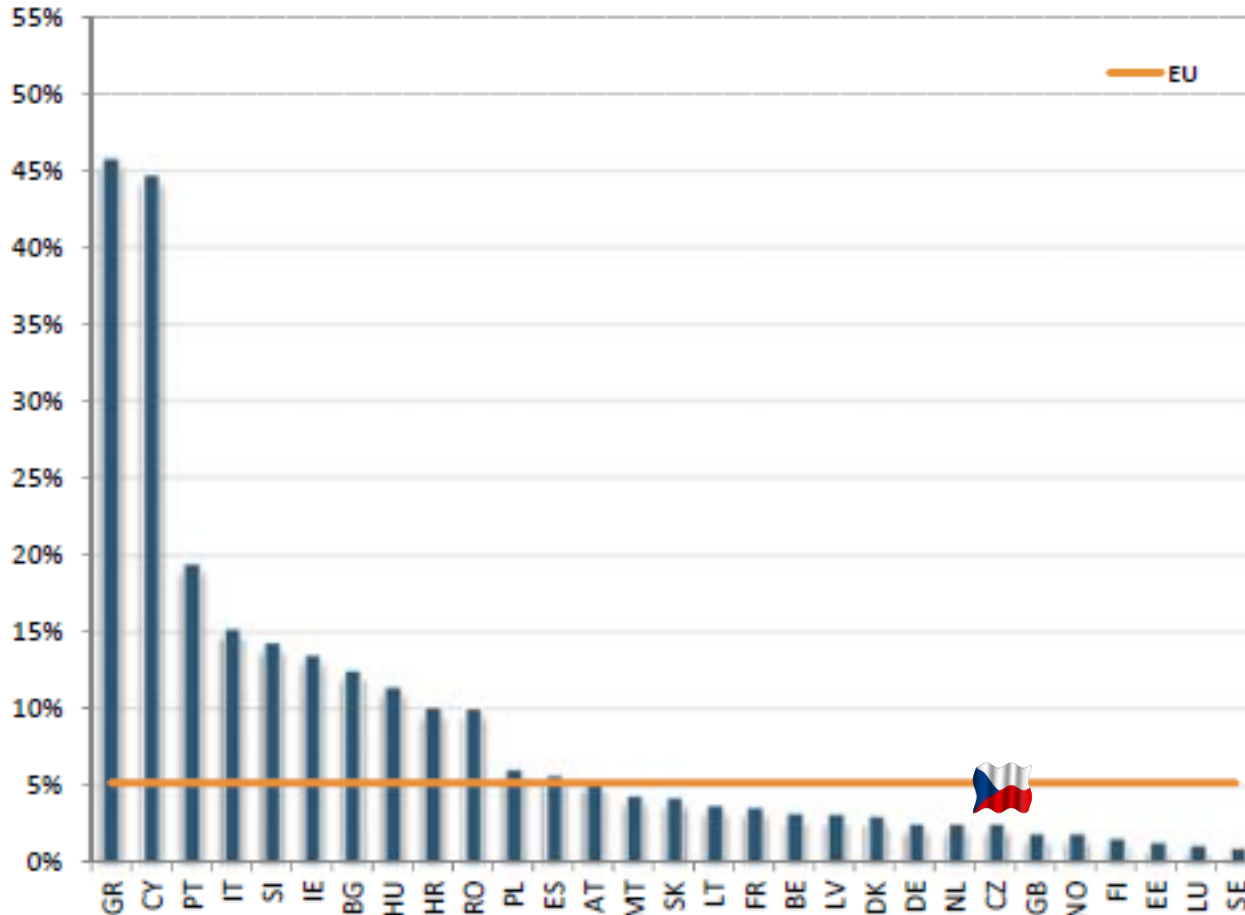
2) High operational efficiency (measured by cost-income (C/I) ratio)



Source: EBA (2019). RISK DASHBOARD Q3-2018. The European Banking Authority, : <https://images.app.goo.gl/oSLx1qttUzhHnFmm8>

I. Basic terms

3) Low credit risk (measured by NPL/total loans ratio)



Source: EBA (2019). RISK DASHBOARD Q3-2018. The European Banking Authority,
<https://images.app.goo.gl/oSLx1qttUzhHnFmm8>

Contents

1. Basic terms
2. Liquidity risk management
3. Operational risk management
4. Operational risk – a case study
5. The future of bank risk management

Source: <https://digneconsult.com/sg/4-reasons-why-self-reflection-is-important/>



3. Liquidity risk management

Liquidity risk in theory

- 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.

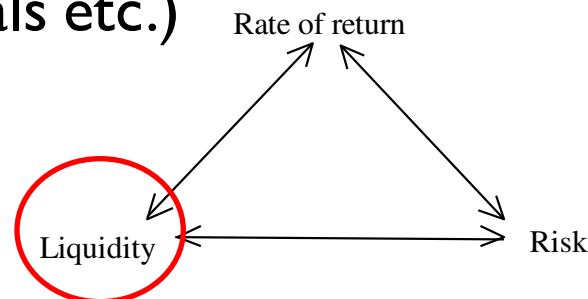
I. Basic terms

Liquidity risk management in practice



Source: <http://obrazky.4ever.sk/priroda/vodny-mlyn-176450>

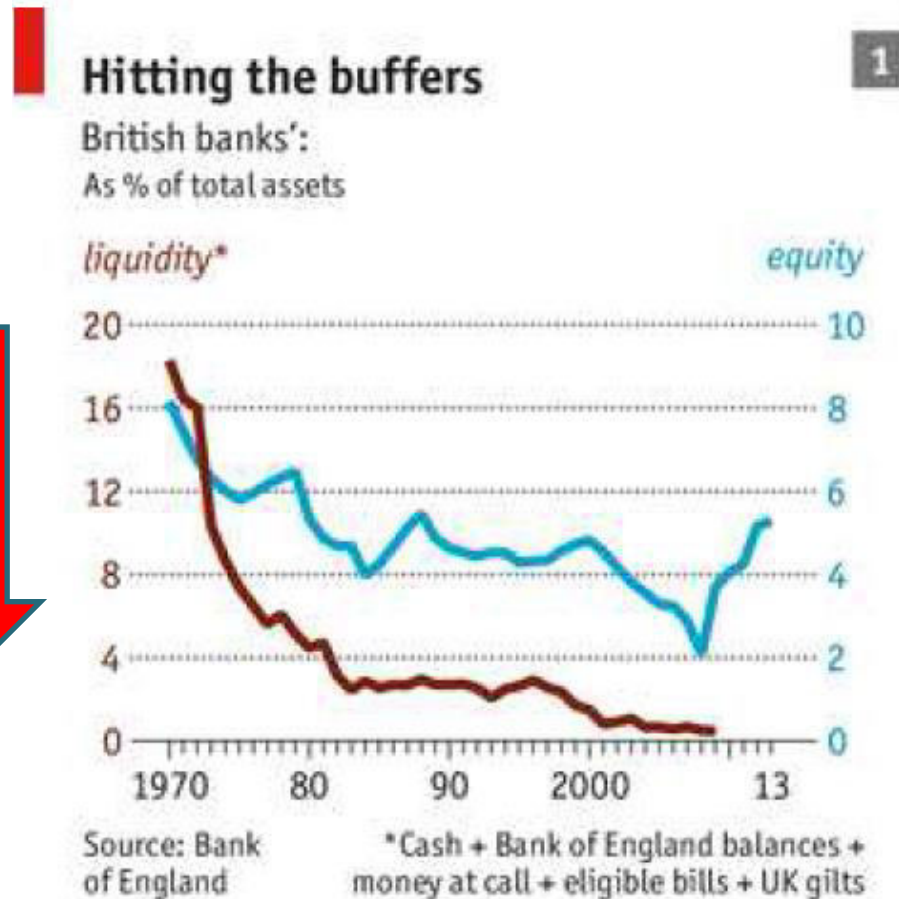
- Liquidity risk management -> a pond (optimum level of liquidity: sufficient but not redundant)
- Liquid instruments bear low interest, but are needed for during market turmoils (bank runs, wholesale market withdrawals etc.)



Source: Author

3. Liquidity risk management

Bank's shareholders vs. regulators/clients: liquidity standards vs ROAE



3. Liquidity risk management

Banks' balance sheet in the US

Table 1 Balance Sheet of All Commercial Banks (items as a percentage of the total, January 2003)

Assets (Uses of Funds)*		Liabilities (Sources of Funds)	
Reserves and cash items	5	Checkable deposits	9
Securities		Nontransaction deposits	
U.S. government and agency	15	Small-denomination time deposits	
State and local government and		(< \$100,000) + savings deposits	42
other securities	10	Large-denomination time deposits	14
Loans		Borrowings	28
Commercial and industrial	14	Bank capital	7
Real estate	29		
Consumer	9		
Interbank	4		
Other	8		
Other assets (for example,			
physical capital)	6		
Total	100	Total	100

*In order of decreasing liquidity.
Source: www.federalreserve.gov/releases/h8/current/.

Source: Mishkin, F.S. (2009). The Economics of Money, Banking & Financial markets. Boston: Addison-Wesley

3. Liquidity risk management

Basic bank operations

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

Reserves	\$10 million
Loans	\$90 million
Securities	\$10 million

Liabilities

Deposits	\$100 million
Bank Capital	\$ 10 million

Deposit outflow of \$ 10 million

Assets

Reserves	\$ 0 million
Loans	\$90 million
Securities	\$10 million

Liabilities

Deposits	\$ 90 million
Bank Capital	\$ 10 million

Source: Author

- The bank has a reserve requirement of 10% of \$90 million, or \$9 million, but it has no reserves
- What can 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		

Source: Author

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

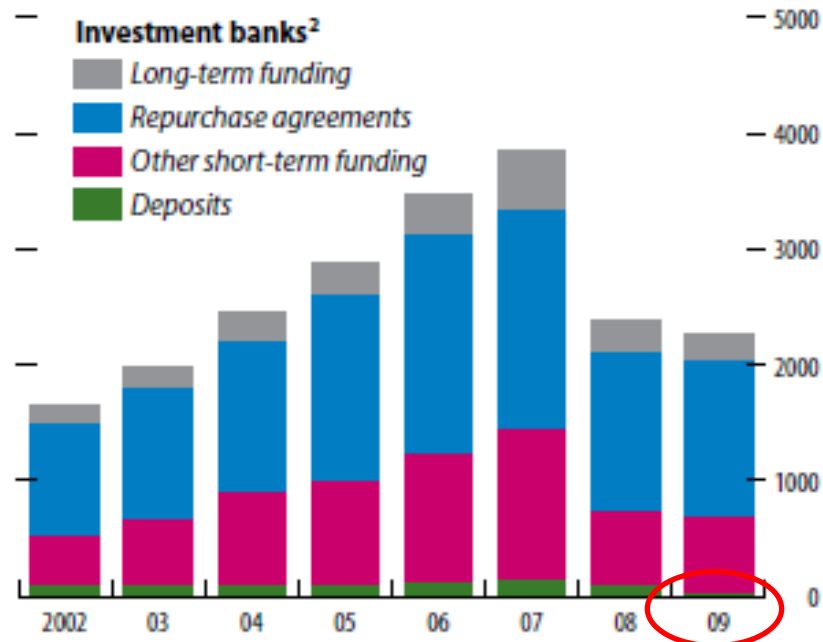
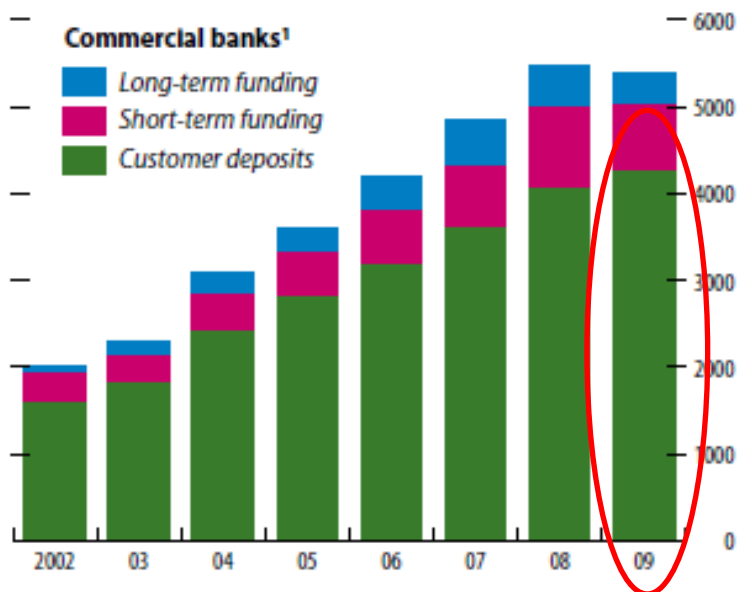
Assets		Liabilities	
Reserves	\$ 9 million	Deposits	\$ 90 million
Loans	\$81 million	Bank Capital	\$ 10 million
Securities	\$10 million		

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

3. Liquidity risk management

Commercial vs investment banks

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.

3. Liquidity risk management

The 2007-9 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 risk under Basel III

- The liquidity framework concentrates on two complementary objectives differing in time frame.
 - 1) Short term resilience is covered by the **Liquidity Coverage Ratio (LCR)** – min. 60% from 2015
 - 2) Medium to long term resilience by the **Net Stable Funding Ratio (NSFR)** – set at 100% from 2018

3. Liquidity risk management

Source:
<https://images.app.goo.gl/oSLx1qttUzhHnFmm8>



Liquidity GAP analysis of UniCredit Bank

- Liquidity risk can be measured by a liquidity GAP analysis that divides all bank's assets and liabilities into different time buckets
- GAP in a time bucket vs cumulative GAP

Table VII-2: Gap analysis of UniCredit Bank Czech Republic as of December 31, 2012

mil. Kč	Up to 1 month	1-3 months	3 months - 1 year	1-2 years	2-3 years	3-4 years	4-5 years	Over 5 years	Unspecified	Total
Cash in hand and balances with central banks	4,473	-	-	-	-	-	-	-	1,657	6,130
Financial assets hed for trading	121	122	730	817	732	355	2,232	2,556	19	7,684
Receivables from banks	26,112	3,959	91	629	-	-	1,257	-	125	32,173
Receivables from clients	19,388	13,309	26,264	24,589	18,797	17,114	13,426	48,586	3,242	184,715
Financial investments	2,707	8,598	16,445	2,320	,	,	29,590	20,460	,	80,120
Property and equipment	-	-	-	-	-	-	-	-	1,085	1,085
Intangible assets	-	-	-	-	-	-	-	-	2	2
Deferred tax asset	-	-	-	-	-	-	-	-	385	385
Other assets	54	24	151	251	548	652	519	2,508	1,890	6,597
Non-current assets held for sale	-	-	18	-	-	-	-	-	-	18
Celkem	52,855	26,012	43,699	28,606	20,077	18,121	47,024	74,110	8,405	318,909
Deposits from banks	17,642	3,958	4	10	3,604	-	1,429	7,583	-	34,230
Deposits from clients	172,344	7,791	8,316	3,766	389	268	106	32	2,108	195,120
Debt securities issued	1,160	235	2,858	5,730	-	-	22,682	3,006	523	36,194
Financial liabilities held for trading	112	167	421	761	927	457	189	2,922	-	5,956
Provisions	-	-	-	-	-	-	-	-	1,027	1,027
Deferred tax liability	-	-	-	-	-	-	-	-	970	970
Other liability	185	-	160	89	460	143	-	1,864	3,574	6,475
Equity	-	-	-	-	-	-	-	-	38,937	38,937
Total	191,443	12,151	11,759	10,356	5,380	868	24,406	15,407	47,139	318,909
Gap	-138,588	13,861	31,940	18,250	14,697	17,253	22,618	58,703	-38,734	-
Cumulative gap	-138,588	-124,727	-92,787	-74,537	-59,840	-42,587	-19,969	-	-	,

Source: Author

Contents

1. Basic terms
2. Liquidity risk management
3. Operational risk management
4. Operational risk – a case study
5. The future of bank risk management

Source: <https://digneconsult.com/sg/4-reasons-why-self-reflection-is-important/>



4. Operational risk management

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.
- OR represents 5–30% of banking risks, depending also on the extent to which it overlaps with the definition of other risks (especially credit risk).
- **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)

4. 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.

4. Operational risk management

Operational risk peculiarities

Market and Credit Risks	Operational Risks
Consciously and willingly face	Unavoidable
“Speculative” risk, implying losses and profits	Pure risks, implying losses only*
Consistent with an increasing relationship between risk and expected return	Not consistent with an increasing relationship between risk and expected return
Easy to identify and understand	Difficult to identify and understand
Comparatively easy to measure and identify	Difficult to measure and identify
Large availability of hedging instruments	Lack of effective hedging instruments
Comparatively easy to price and transfer	Difficult to price and transfer

* with few exceptions

4. Operational risk management

Reasons for past attention on 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)

4. Operational risk management

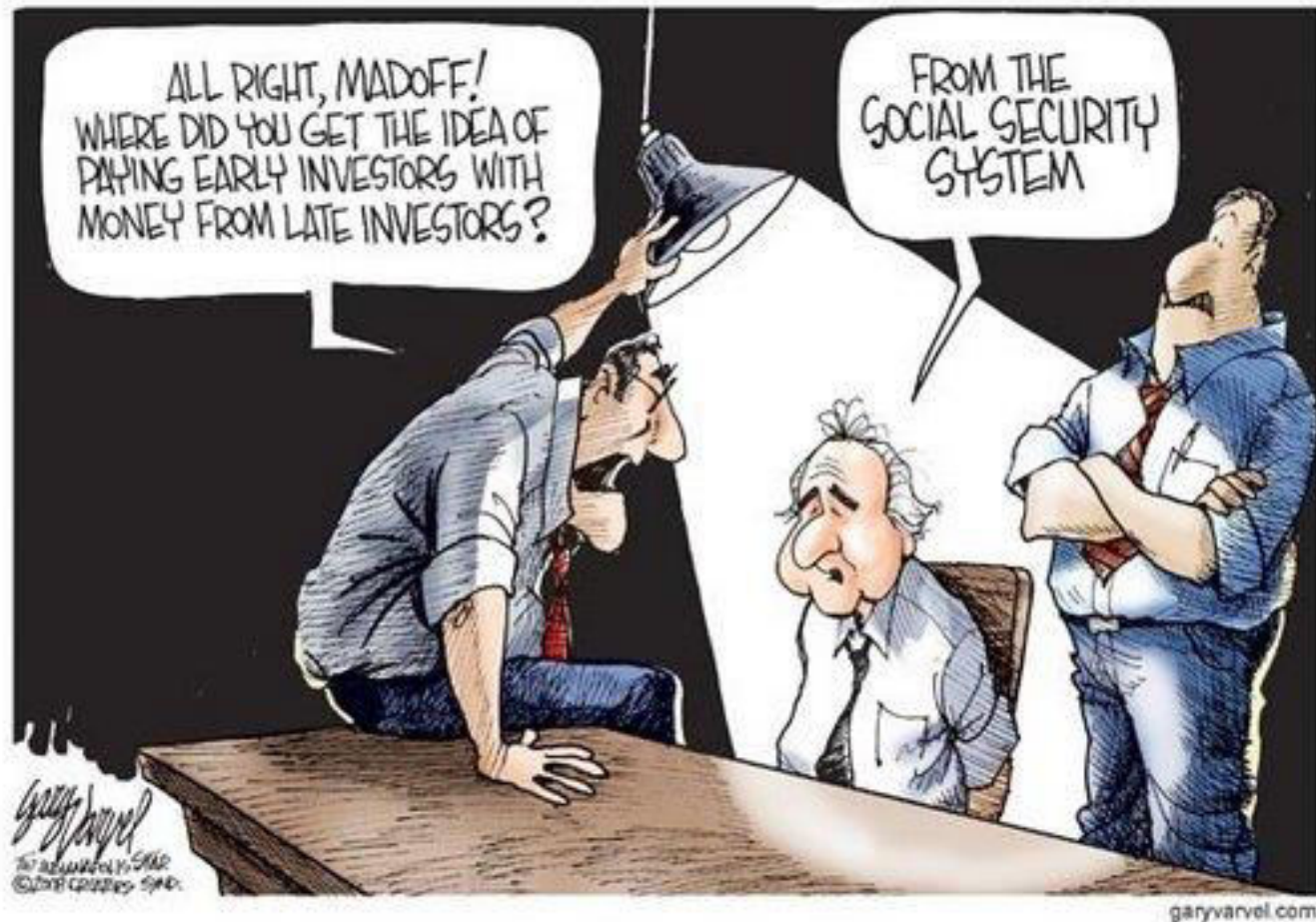
Example of failed ORM in JPMorgan = London Whale



"TIGHTER REGULATIONS?! YOU CANNOT BE SERIOUS!"

4. Operational risk management

Example of Ponzi Planet = **Bernard Madoff** inspired by the US social security system



4. Operational risk management

Reasons for future attention on ORM

- 1) information systems and technology
(cloud banking)
- 2) the increasing wave of mergers and acquisitions
- 3) emergency of new financial instruments
- 4) the growth of electronic dealing
- 5) compliance with Basel II

4. Operational risk management

The rising role of information

EXHIBIT 3: THE SHIFTING BALANCE OF MONEY AND INFORMATION

EARLY 90s TO MID 00s



MONEY



INFORMATION

- High risk-free rates
- Low recent losses
- High leverage
- High cost
- Low coverage
- Easy decisions

TODAY



MONEY



INFORMATION

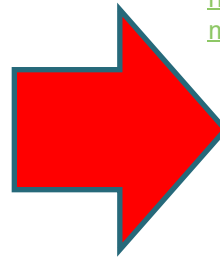
- Low risk-free rates
- High recent losses
- Low leverage
- Low cost
- High coverage
- Hard decisions

Source: Oliver Wyman (2013). A money and information business

4. Operational risk management

Cloud banking model and cyber risk

Source: <https://stebok.net/interesnoe/18289-kartinki-bank-18-foto.html>



Source: <https://www.majorgeeks.com/news/image/8472.html>



Source: <https://stebok.net/interesnoe/18289-kartinki-bank-18-foto.html>



Source: <https://www.bsbs.co.uk/service-itstrategyreview.html>



Source: <https://nld.com.vn/tin-tuc/kaspersky-bi-tan-cong-mang-trong-thoi-gian-dai-20150611174223494.htm>

4. Operational risk management

How will cloud banking will affect banks' risk management?

- Traditional bank model: credit risk



Source: <https://stebok.net/interesnoe/18289-kartinki-bank-18-foto.html>

- Future cloud banking model: operational risk



Source: <https://truedemocracyparty.net/2016/11/fractional-reserve-wars-part-2-the-empire-strikes-back-with-blockchain-central-bankers-want-digital-currency-digital-slavery-total-control-of-you/>

4. 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) – 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%**

Contents

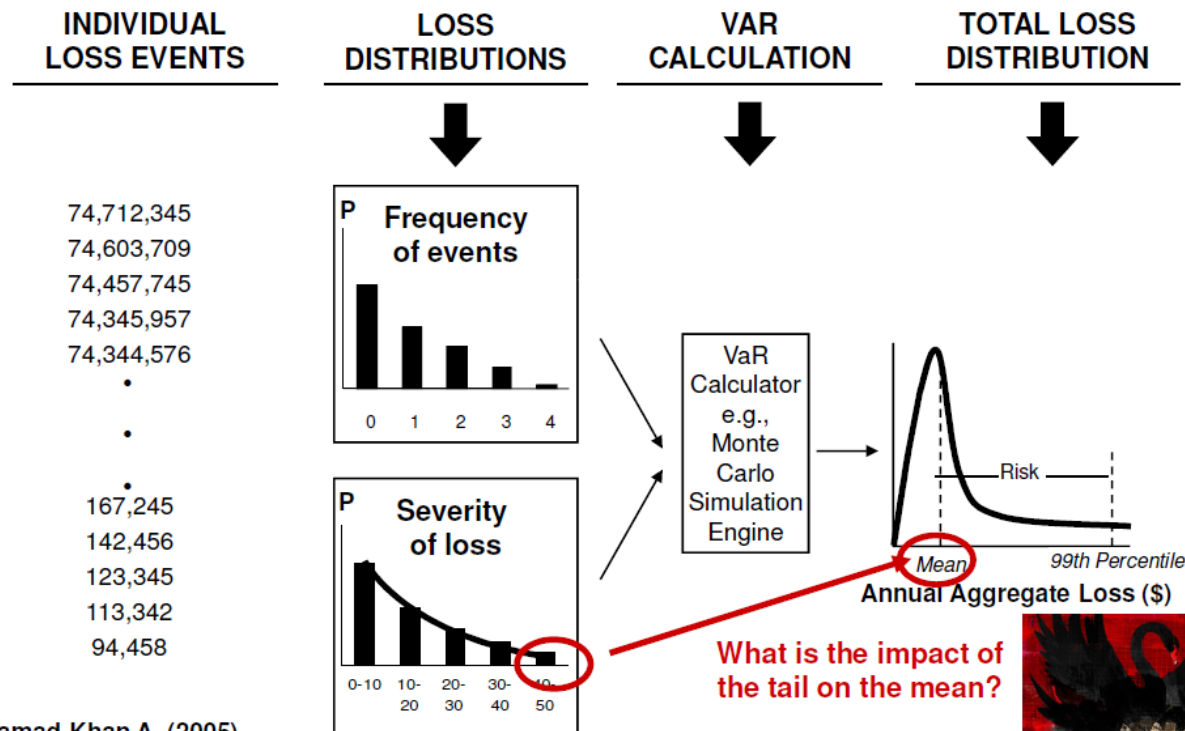
1. Basic terms
2. Liquidity risk management
3. Operational risk management
4. Operational risk – a case study
5. The future of bank risk management

Source: <https://digneconsult.com/sg/4-reasons-why-self-reflection-is-important/>



5. Operational risk – a case study

How to model tail events in ORM?



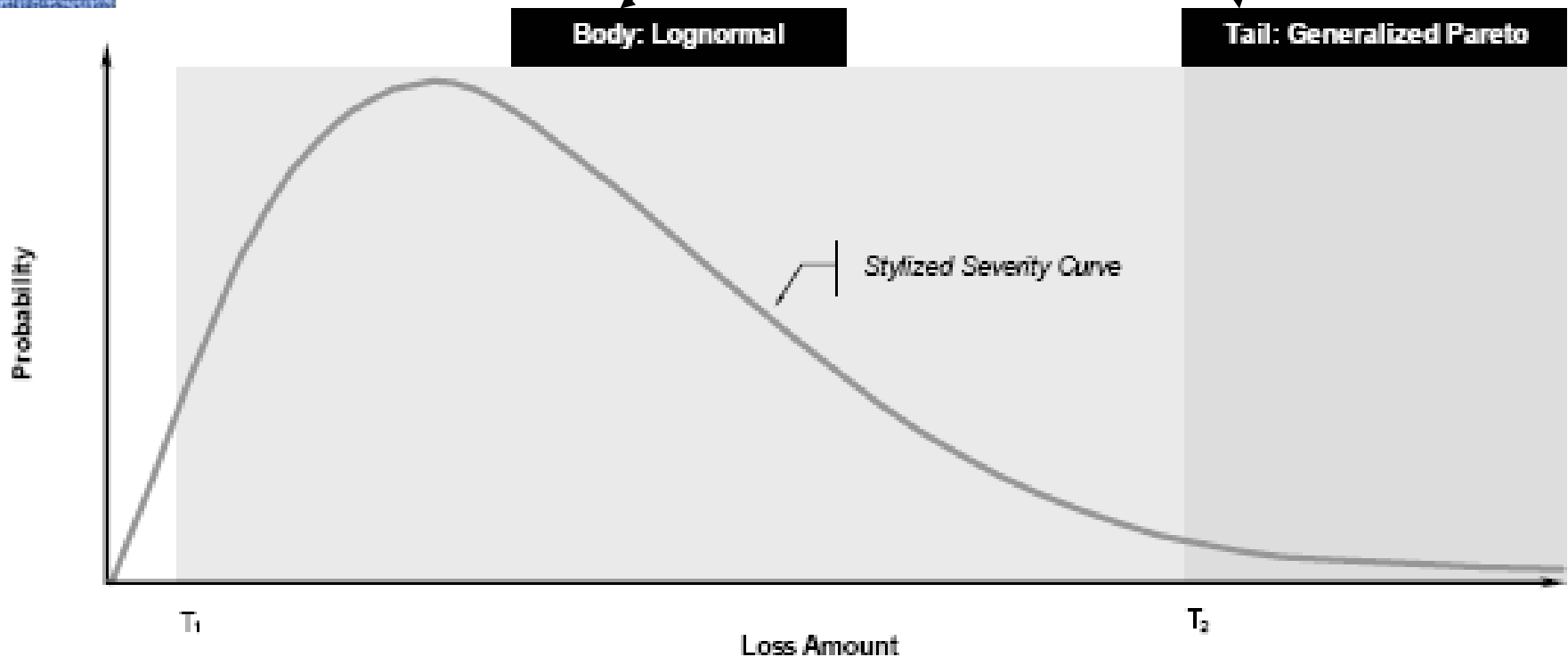
Source: Samad-Khan A. (2005)



Source:
<https://www.compliancebuilding.com/2010/02/16/the-economist-special-report-on-financial-risk/>

5. Operational risk – a case study

Separate a data set into Body and Tail and then provide modelling in these two parts separately



Source: Author

5. Operational risk – a case study

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

5. Operational risk – a case study

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.

Contents

1. Basic terms
2. Liquidity risk management
3. Operational risk management
4. Operational risk – a case study
5. The future of bank risk management

Source: <https://digneconsult.com/sg/4-reasons-why-self-reflection-is-important/>





5. Future of risk management

Structural trends will transform bank risk management until 2025

1. Continued expansion of the breadth and depth of regulation
2. Changing customer expectations
3. **Technology and analytics as a risk muscle**
4. **Additional (nonfinancial) risk types are emerging** (contangion, model, cyber)
5. Better risk decisions through the elimination of biases
6. Need for strong cost savings

5. Future of risk management

Trend 3: Technology and analytics as a risk muscle

I. Big data

- ✓ Today, a vast amount of customer data is available and accessible to banks. Faster, cheaper computing power enables banks to leverage new information—for instance, granular customer-payment and spending behavior, social-media presence, and online browsing activity—in risk decision making

II. Machine learning

- ✓ The rapid adoption of a new breed of models is offering much deeper insights into data. Machine learning identifies complex, nonlinear patterns in large data sets and makes more accurate risk models possible

III. Crowdsourcing

- ✓ The Internet enables the crowdsourcing of ideas, which many incumbent companies use to improve their effectiveness in certain areas (i.e. application of data science)



5. Future of risk management

Trend 4: Additional (nonfinancial) risk types are emerging: contagion risk

- ✓ **Contagion risk** is the risk that financial difficulties at one or more bank(s) spill over to a large number of other banks or the financial system as a whole (i.e. related to systemic risk).
- ✓ Financial and macroeconomic connectedness makes economies, corporations, and banks more vulnerable to financial contagion. Negative market developments can spread to other parts of a bank, other markets, or involved parties and can cause a bank's operating environment to deteriorate quickly and significantly.
- ✓ Reducing this risk can reduce the bank's total risk and lower its capital requirements, because a bank's exposure to contagion risk is one of the main underlying drivers for its classification as a global systemically important bank (G-SIB) and for **G-SIB capital surcharges**.

5. Future of risk management

Trend 4: Additional (nonfinancial) risk types are emerging: model risk

- ✓ **Model risk** is the risk that a bank uses an incorrect model in risk management.
- ✓ Increased data availability and advances in computing, modeling, and algorithms have expanded model use. However, errors from suboptimal models can lead to poor decision making and increase banks' risks.
- ✓ Some banks have experienced model-risk-related losses, although most of these cases are not reported publicly. For instance, one large **US bank had losses of \$6 billion**, which were partially due to **value-at-risk model (VAR) risk** (i.e., lack of modeling experience by the operator, no back-testing, and operational problems in the model)
- ✓ Model errors stem from issues with data quality, conceptual solidity, technical or implementation errors, correlation or time inconsistencies, and **uncertainties about volatility**.
- ✓ Multiple mitigation strategies: validation, and constant monitoring and improvement of the model.

5. Future of risk management

Trend 4: Additional (nonfinancial) risk types are emerging: cyber risk

- ✓ **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 (i.e. it is part of operational risk).
- ✓ Most banks have already made protection against cyberattacks a top strategic priority, as these attacks can have devastating consequences. This is partially due to **the banks' heavy reliance on software, systems, information technology (IT), and data**, but also to the fact that that these attacks would risk not only the banks' operations but also **confidential customer data**.
- ✓ Given the current geopolitical context and its likely evolution, we expect cybersecurity only to increase in importance and require an even greater deployment of resources at the individual-institution level, as well as much greater **cross-industry and industry-government collaboration**.



Source: <https://nld.com.vn/tin-tuc/kaspersky-bi-tan-cong-mang-trong-thoi-gian-dai-20150611174223494.htm>

5. Future of risk management

Case study of McKinsey: Banks need to start transforming their risk functions through initiatives

Initiative 1: Digitization of core processes

Initiative 2: Experiment with advanced analytics and machine learning

Initiative 3: Enhanced risk reporting

Initiative 4: Balance-sheet optimization

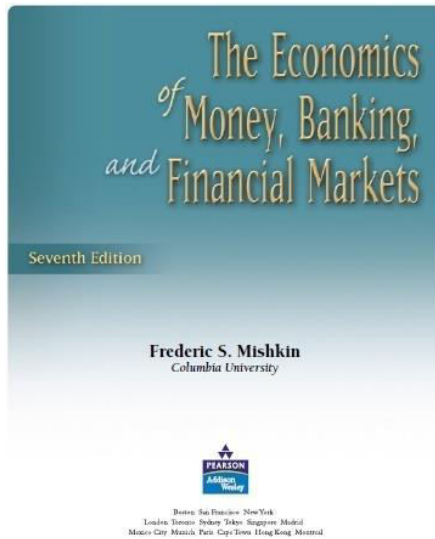
Initiative 5: Putting the enablers in place

- ✓ Shift the risk function's recruiting focus
- ✓ Create data infrastructure
- ✓ Enhance risk culture

Reading for the this lecture



Source: <http://clipart-library.com/clipart/887869.htm>



✓ Chapter 9/Banking and Management of Financial Institutions

Source: <https://www.passeidireto.com/arquivo/6676804/the-economics-of-money-banking-and-financial-markets-7th>



✓ Chapter 4/Principles of risk measurement and risk management

Source: <https://www.megaknihy.cz/odborna-naucna/195343-bankovnictvi-v-teorii-a-praxi-banking-in-theory-and-practice.html>