

# BANKING



## Lecture 7 – Bank Capital

**Adam Gersl**

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

**25 November 2020**

# Key terms from previous lecture on regulation

- Regulation vs supervision (importance of sanctions)
- Objective 1 - lowering the probability of bank failures
- Objective 2 - minimizing the social costs of failures that do occur.
- Importance of bank culture, the endogeneity problem
- 3 reasons for regulation: information asymmetry, high leverage of a bank, systemic risk
- Universal vs separate banking; investment vs. commercial banks; Volcker (US) vs. Liikanen (EU) vs. Vickers (GB)
- The EBU – 3 pillars: single rule book, SSM, SRM & SRF
- The Bank Recovery and Resolution Directive (BRRD)
- bail-in (liabilities  $\Rightarrow$  equity) vs bail-out (external money  $\Rightarrow$  equity)
- Assessment of regulation: cost-benefit analysis

# Contents

**1. Bank capital**

**2. Basel I**

**3. Basel II**

**4. Basel III**



# I. Bank capital

## Four types of bank's capital (but interrelated)

### 1) equity (accounting capital)

- equity = assets - liabilities

Accounting Capital

Assets	Total Liabilities
Assets	Liabilities
	Equity

### 2) economic capital

- a buffer against future unexpected losses

### 3) regulatory capital

- for the computation of capital adequacy (capital to risk-weighted assets) following the regulatory regime (e.g. Basel I, II or III)

### 4) market value of capital

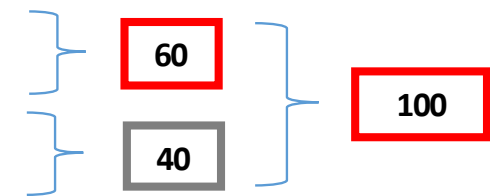
- market capitalization of a bank, reflecting a bank's value on a stock market; calculated as the number of shares issued multiplied by the bank's share price
- highly volatile!

# I. Bank capital

## I) Accounting capital as a cushion to absorb losses

Bank's balance sheet

<i>ASSETS</i>	<i>LIABILITIES</i>
Cash	Deposits
Securities	
Other assets	Interbank market
Loans (credits)	
	<b>Capital</b>
Credit loss 40	Loss absorbing capital

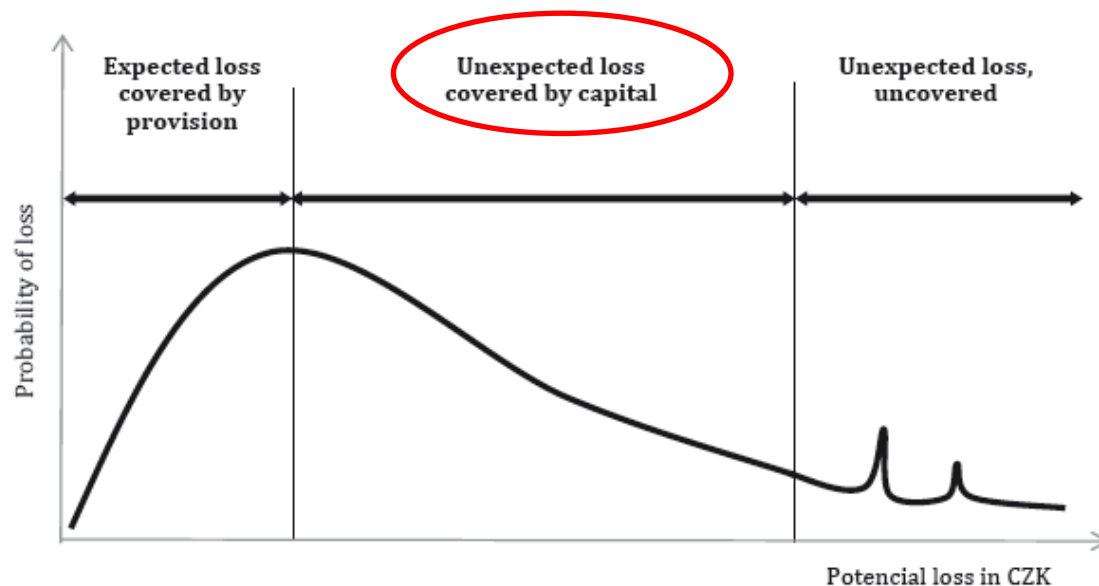


# 1. Bank capital

## 2) Economic capital

- Economic (risk) capital is a buffer against future unexpected losses brought about by credit, market, and operational risks inherent in the banking business
- Typically calculated using a model, assuming a certain level of confidence (e.g. 1% VaR)

Figure VI-2: Economic Capital



Expected loss
- typical losses
- could be predicted
- covered by margin and provisions
- no real risk

Unexpected loss
- extraordinary fluctuation
- hard to predict
- covered by capital
- volatility of expected loss

# I. Bank capital

## 3) Regulatory capital

---

### **Tier 1 capital (absorbs losses on a “going concern” basis)**

- a) Common Equity Tier 1 (CET1) – common shares, retained earnings and other reserves.
- b) Additional Tier 1 (AT1) – cannot be redeemed at the option of the holder; such as capital instruments with no fixed maturity and convertible to equity when a trigger event occurs

### **Tier 2 capital (absorbs losses on a “gone concern” basis)**

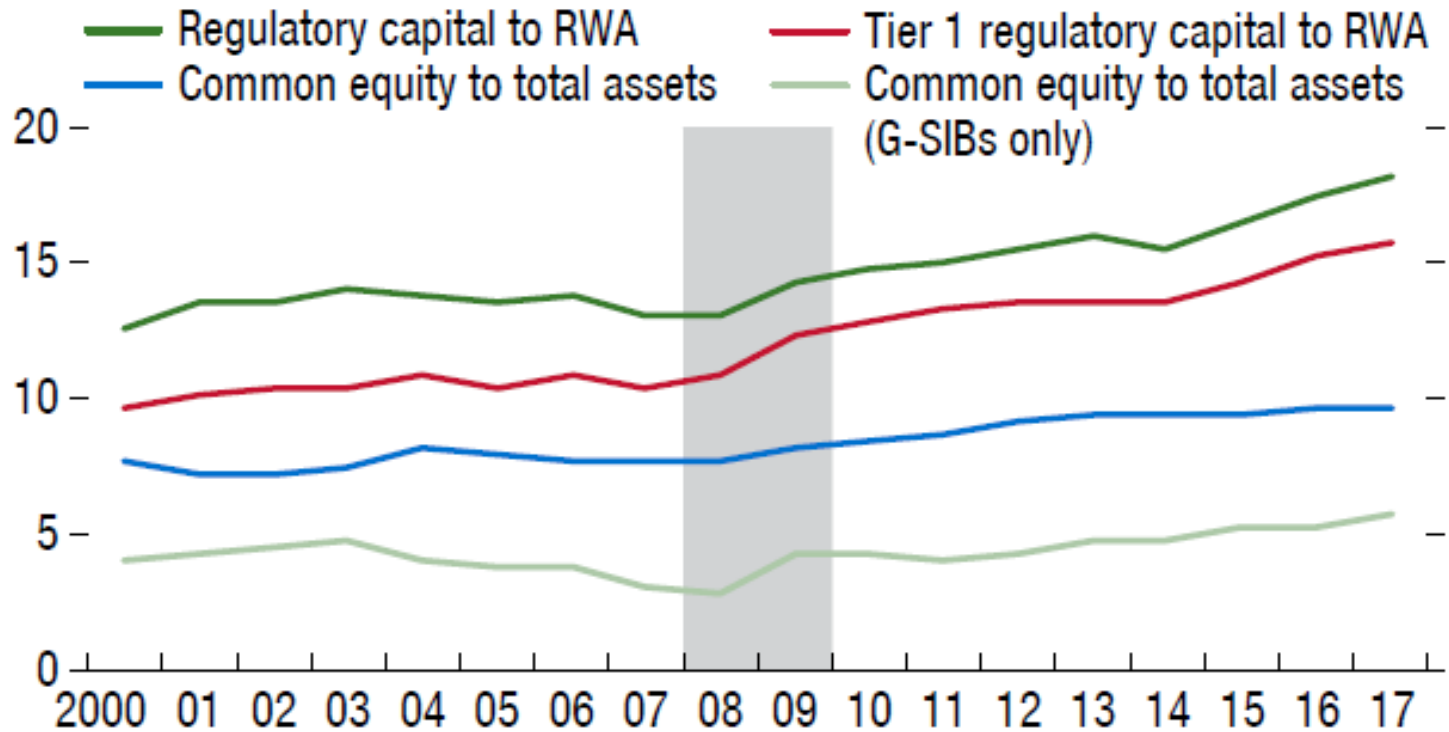
- subordinated debt (more than 5Y maturity)
- general loan-loss reserves (in countries with general provisioning)
- revaluation reserves
- other hybrid capital (convertible bonds etc.)

**There are also capital deductions**

# I. Bank capital

Higher regulatory capital ratios (**capital/RWA\***), but still low accounting ratios (**equity/assets**)

## 3. Capital Buffers (Percent)



Source: IMF (2018). Global Financial Stability Report, International Monetary Fund October 2018

\*RWA = Risk-Weighted Assets



# I. Bank capital

## 4) Market capitalization of TOP world banks



Rank	Bank (Group)	Country	Market cap, US\$ billion
1	JP Morgan Chase	USA	368.78
2	ICBC	China	295.65
3	Bank of America	USA	279.73
4	Wells Fargo	USA	214.34
5	China Construction Bank	China	207.98
6	Agricultural Bank of China	China	181.49
7	HSBC Holdings	UK	169.47
8	Citigroup	USA	163.58
9	Bank of China	China	151.15
10	China Merchants Bank	China	133.37

# Contents

1. Bank capital

2. Basel I

3. Basel II

4. Basel III



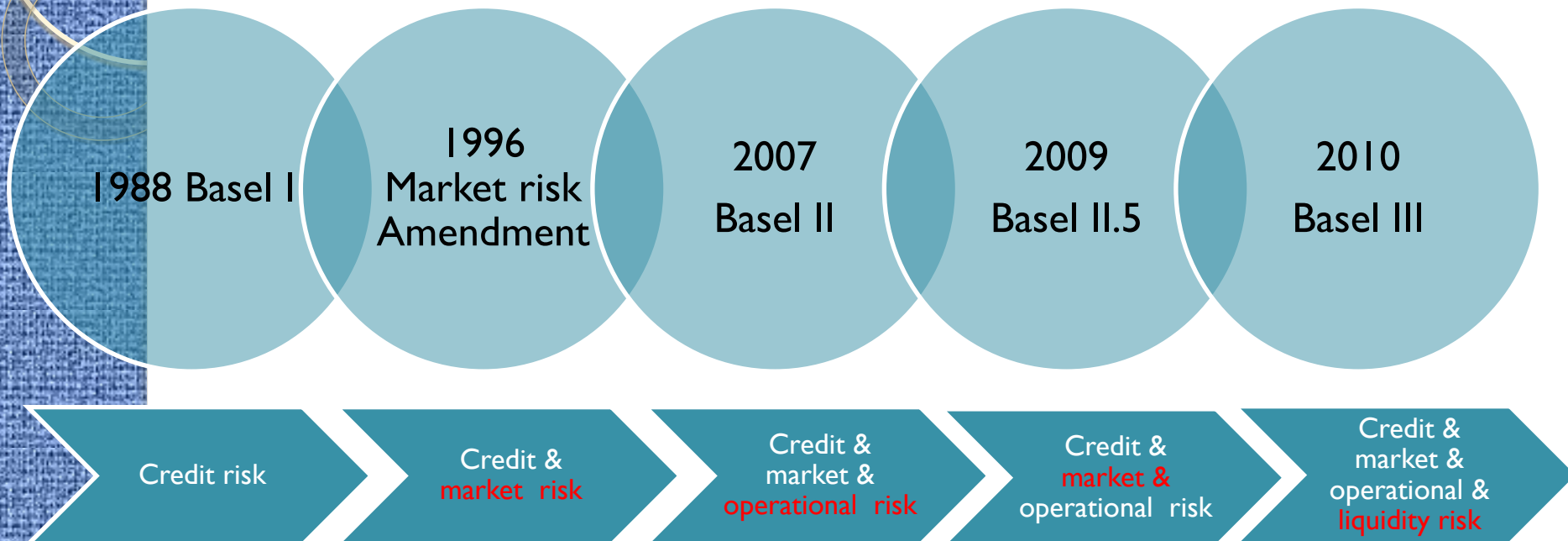
## 2. Basel I

# Basel global banking standards

- The basic framework of bank regulation is set by the Basel Committee on Banking Supervision (**BCBS**), a G-20+ committee and standard-setter, with its secretariat hosted by the Bank for International Settlements (**BIS**).
- The BIS is often known as “a bank of central banks”, with a mission to serve central banks in their pursuit of monetary and financial stability, and to foster international cooperation in those areas.
- The BCBS is the primary global standard setter for the prudential regulation of banks and provides a forum for regular cooperation on banking supervisory matters. Its 45 members comprise central banks and bank supervisors from 28 jurisdictions.
- The BIS is located in Basel, Switzerland, therefore global banking standards are called “**Basel**” **accords**

## 2. Basel I

# Basel Accords and Risks Covered



- A new Basel accord complements and partly (but not fully!) overwrites the previous one
- A set of currently valid standards available at the BIS website:  
[https://www.bis.org/basel\\_framework/](https://www.bis.org/basel_framework/)



## 2. Basel I

# Basel implementation in the EU

- Basel Accords are only recommendations (global standards), but today they are widely accepted by more than 100 countries.
- The EU transforms the Basel rules through directives and regulations that are being adopted by EU member countries, including the Czech Republic.
- In the EU Basel III has been implemented through
  - a) in 2013: Capital Requirements Regulation\*, Capital Requirements Directive\*\*, commonly known as Capital Requirements Directive IV (CRD IV)
  - b) in 2019: CRR II and CRD V (the European banking package of June 2019)

\*Regulation (EU) No 575/2013 of the European Parliament and of the Council (2013)

\*\* Directive 2013/16/EU of the European Parliament and of the European Council (2013)

## 2. Basel I

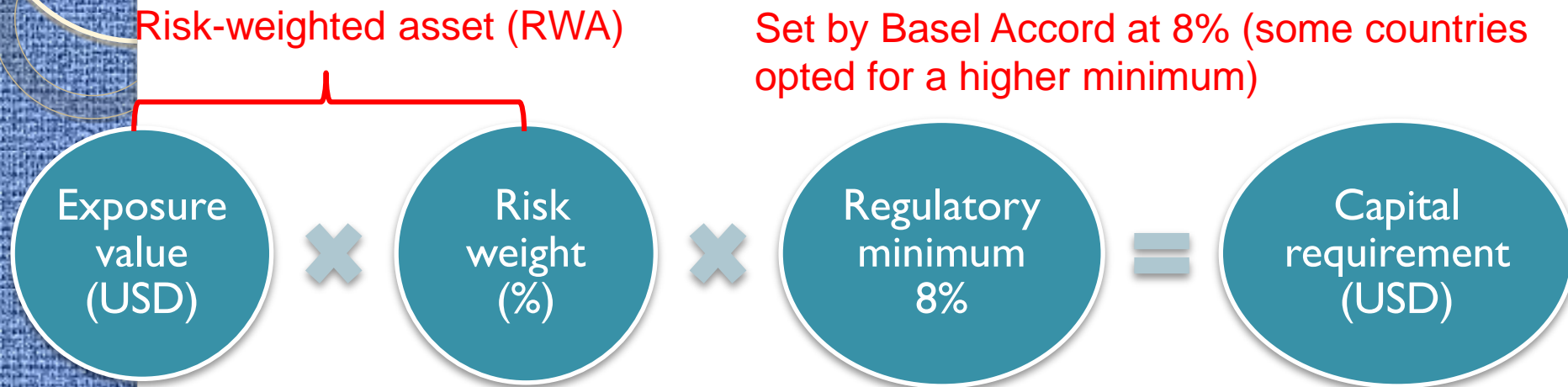
# Two key objectives of Basel I

---

- 1) To assure the stability (“safety and soundness“) of the international banking system
- 2) To safeguard a level-playing field for internationally active banks (the same capital requirements for all global banks)

## 2. Basel I

# Capital requirements and risk-weighted assets



### Example (credit risk):

- Bank holds a mortgage on residential property (\$100,000)
- A prescribed 50% risk weight is applied to mortgage on residential property (under Basel I)
- The risk-weighted asset (RWA): \$50,000
- **Capital requirement:** 8% of 50,000 USD = 4,000 USD

Capital requirements for **other risks** added within the 1996 Market Risk Amendment (**market risk**) and 2007 Basel II (**operational risk**)

## 2. Basel I

# Risk weights under Basel I

Obligor	Risk Weight
OECD central governments	0%
Domestic public sector entities (excluding central governments)	0%, 10%, 20% or 50% Set by domestic regulator
OECD banks and regulated firms	20%
Housing loans fully secured by residential property	50%
Counterparties in derivatives transactions	50%
Public sector corporations; non-OECD banks; <b>private sector debt</b> ; and <b>all other assets</b>	<b>100%</b>



## 2. Basel I

# Solvency assessment: capital adequacy ratio

- We compare the capital held with the total level of risk taken as captured by the RWA:

$$\text{Capital Adequacy Ratio (CAR)} = \frac{\text{Regulatory capital}}{\text{Risk-weighted assets (RWA)}}$$

- RWA should also include capital requirements for other risks (such as market risk), which are usually calculated in currency units (such as VaR)

$$RWA_{\text{market\_risk}} \times 8\% = \text{capital\_requirements}_{\text{market\_risk}}$$

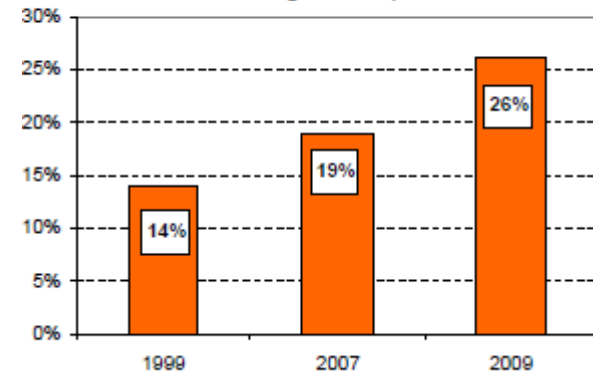
$$RWA_{\text{market\_risk}} = 12.5 \times \text{capital\_requirements}_{\text{market\_risk}}$$

## 2. Basel I

# Result of Basel I: regulatory arbitrage

- 1) Banks moved towards **the riskier, higher-yielding assets** within a given risk bucket (RWA), for example from the US to Korean government bonds
- 2) Banks shifted exposures off the balance sheet => securitization
- 3) The regulation favoured **big international banks**, for which it was easier to conduct regulatory arbitrage

THE SHARE OF THE 10 LARGEST GLOBAL BANKS ( in the assets of the largest 1000)



Basel I



Lower capital  
against the  
risks taken

# Contents

1. Bank capital

2. Basel I

3. Basel II

4. Basel III





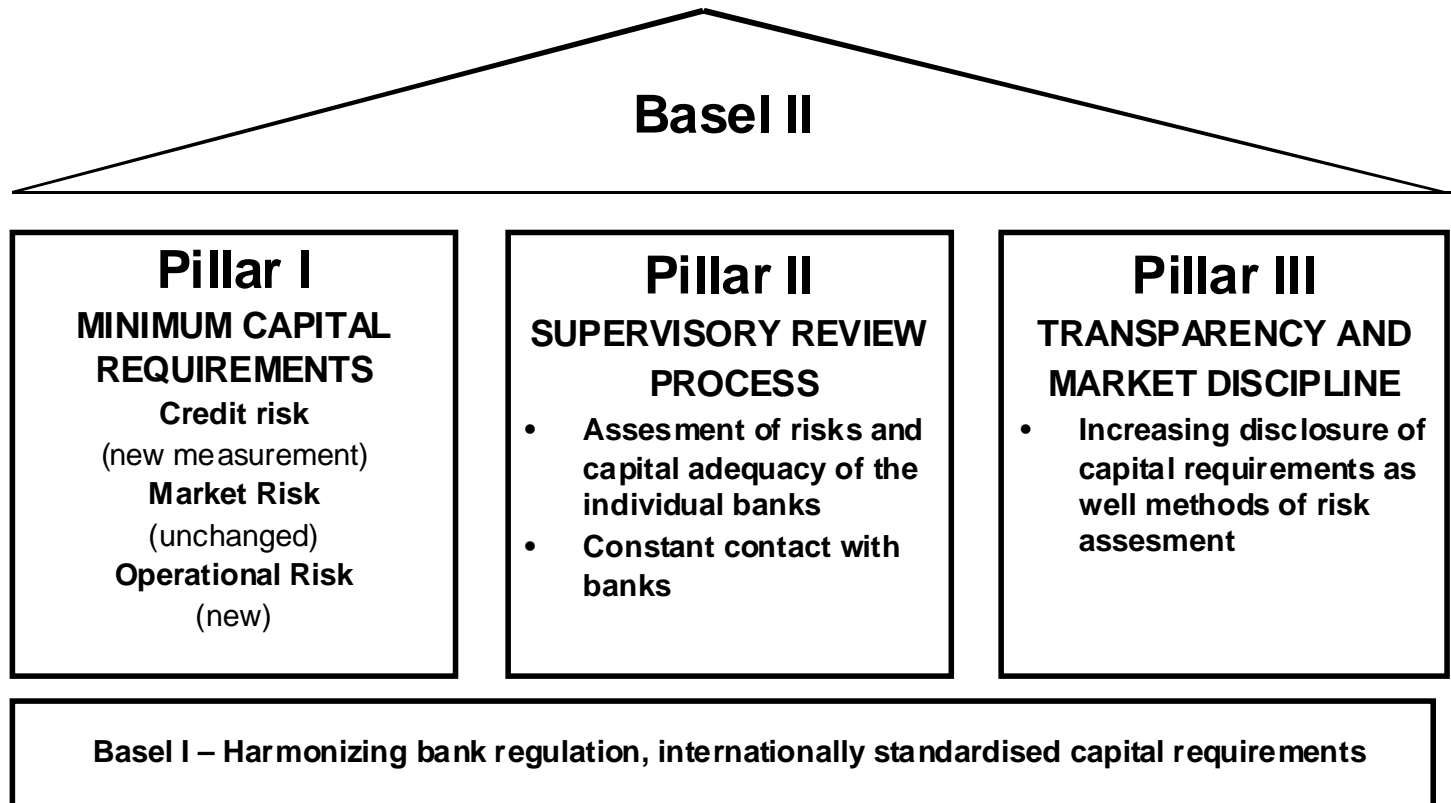
## 3. Basel II

# Three key objectives of Basel II

- 1) The Accord should continue to promote safety and soundness in the financial system and, as such, the new framework should at least maintain the current overall level of capital in the system;
- 2) The Accord should continue to enhance competitive equality;
- 3) The Accord should constitute a more comprehensive approach to addressing risks.

## 3. Basel II

# Three pillars of Basel II



\*Except for interest rate risk in the banking book.

### 3. Basel II

# Credit Risk Capital Requirements

Banks can choose between

- **standardized approach** (STA, similar to Basel I), or
- **internal-rating based approach** (IRB, a new concept)

Compared to Basel I, STA better accounts for the risk by basing the risk weight for sovereign, banks and corporates on a **credit rating**

Rating of Entity	Risk Weights		
	Sovereigns	Banks	Corporates
AAA to AA-	0%	20%	20%
A+ to A-	20%	50%	50%
BBB+ to BBB-	50%	50%	100%
BB+ to BB-	100%	100%	100%
B+ to B-	100%	100%	150%
Below B-	150%	150%	150%
Unrated	100%	50%	100%

### 3. Basel II

# Sovereign exposures under Basel I&II STA

	Basel I	Basel II Standardized Approach
Claims on <u>Sovereigns</u> (and Central banks)	<ul style="list-style-type: none"><li>▪ OECD: 0%</li><li>▪ Non-OECD: 100%</li></ul> <p>National discretion: exposures to own sovereign in domestic currency: 0%</p>	<ul style="list-style-type: none"><li>▪ AAA to AA-: 0%</li><li>▪ A+ to A-: 20%</li><li>▪ BBB+ to BBB-: 50%</li><li>▪ BB+ to B-: 100%</li><li>▪ Below B-: 150%</li><li>▪ Unrated: 100%</li></ul> <p>National discretion for exposures to own sovereign in domestic currency: 0%</p> <p>IMF, BIS, ECB and EC: 0%</p>

- Risk weight (RW) = 0%
- Capital adequacy (CAD) = 8%
- Exposure (E) = EUR 1,000,000,000
- Capital requirement =  $RW \times 8\% \times E = 0\% \times 8\% \times 1,000,000,000 = \text{EUR } 0$

## 3. Basel II

# Retail portfolios and other changes in STA

- Eligible mortgage loan (well collateralized)
  - 35% “preferential” risk weight rather than 50%
- Consumer loans (incl. credit cards etc.): 100% risk weight kept
- Inclusion of off-balance sheet items with a “credit conversion factor” (CCF)
  - For example, an undrawn commitment, original maturity of 6 months, has a 20% CCF
- An increased risk weight for residual (net) value of non-performing (defaulted) loans
  - 150% rather than 100% if not sufficiently provisioned for (less than 20%)
- Preference risk weight of 75% for SMEs



### 3. Basel II

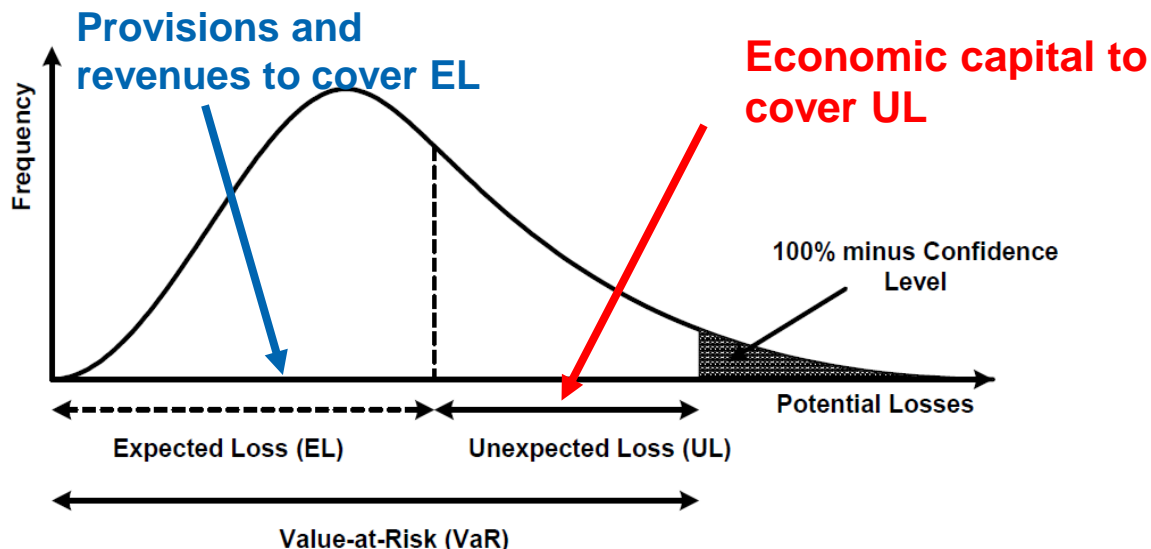
# Comparing Basel I and Basel II STA

	Basel I				Basel II (Standardized approach)			
	Nominal value	Exposure value	Risk weight	RWA	Nominal value	Exposure value	Risk weight	RWA
	(A)	(B)	(C)	(D)=(B)*(C)	(A)	(B)	(C)	(D)=(B)*(C)
1. Sovereign bond with an A rating	1000	1000	0%	0	1000	1000	20%	200
2. Loan to a corporate, B rated, no collateral or guarantee	1000	1000	100%	1000	1000	1000	150%	1500
3. Loan to a corporate, BBB rated, no collateral or guarantee	1000	1000	100%	1000	1000	1000	100%	1000
4. Undrawn commitment, original maturity of 6 months, counterparty has an A rating	1000	0	100%	0	1000	200	50%	100
5. Loan to a corporate, B rated, past due 100 days, with specific provision of 10%	1000	900	100%	900	1000	900	150%	1350
6. Eligible residential mortgage loan	1000	1000	50%	500	1000	1000	35%	350
7. Term loan to a small company	1000	1000	100%	1000	1000	1000	75%	750
<b>Total</b>	<b>7000</b>	<b>5900</b>		<b>4400</b>	<b>7000</b>	<b>6100</b>		<b>5250</b>

## 3. Basel II

# Understanding the IRB Approach

- IRB introduced to bring capital regulation in line with prevailing credit risk management practices at banks!
  - Banks allowed to use their **risk management models** (after validation) to calculate capital requirements
- IRB capital requirement based on an economic capital concept, using a portfolio approach to credit risk based on a model
  - **Capital requirement = Credit VaR – Expected Loss (EL)**, where Credit VaR is the maximum loss experienced at a 99.9% confidence level



## 3. Basel II

# IRB Approach (I): Expected Loss

- Expected (credit) loss (in units of currency) of a particular exposure:

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

PD (probability of default)

LGD (loss given default)

EAD (exposure at default)

} All can be modeled

- In a portfolio context, the expected loss of the portfolio equals
  - the sum of expected losses, or
  - a weighted average (by EAD) of the EL (in % of EAD) of the individual exposures, **even if the exposures are not independent**

## 3. Basel II

# IRB Approach (2): Credit VaR

- Credit VaR = **extreme (stressed) credit loss** in the tail of the distribution
- Expressing the credit loss as a % of EAD and keeping the LGD stable, this is equivalent to finding **a stressed PD** and calculate  $PD^{\text{stressed}} \times LGD$
- Basel Committee used a portfolio-invariant Asymptotic Single Risk Factor (ASRF) model (Gordy 2003 based on Vasicek 2002, extending the Merton 1974 model) to calculate a “stressed PD” out of the “normal” PD
- Key assumptions of the model:
  - Exposures are small and portfolios are well diversified (idiosyncratic risk small)
  - The key driver of risk in the portfolio is a systematic risk factor (with a standardized normal distribution) – such as state of the economy
  - Borrowers’ risks are interlinked, captured via correlation with the systematic factor
  - Marginal risk contribution (MRC, i.e. increase in credit VaR) of each exposure depends only on the risk of the exposure (and not on the portfolio it is added to)

### 3. Basel II

## IRB Approach (3): Final capital requirement

$$CR = \overbrace{[LGD * PD_{stressed} - PD * LGD]}^{\text{Credit VaR}} - \overbrace{PD * LGD}^{\text{Expected loss}} * MA$$

MA: Maturity adjustment (ASRF model based on 1Y)

Capital requirements in % of EAD

Inverse of standard normal distribution applied to high confidence level (to arrive at 0.1% VaR)

$$PD_{stressed} = N \left( \frac{\underbrace{N^{-1}(PD)} + N^{-1}(0.999)R^{\frac{1}{2}}}{(1 - R)^{\frac{1}{2}}} \right)$$

Inverse of standard normal distribution applied to PD to derive “average” default threshold

Correlation (set by BCBS for different asset classes)

### 3. Basel II

## LGD, EAD, EL and risk weighted assets in IRB

- No modelling of stressed LGD and/or EAD, but
  - A requirement for a “downturn” LGD (typically, LGD is higher in bad times, as recoveries are low due to a decline of collateral values);
  - can be estimated by banks themselves or given by supervisor
- EAD: supervisory guidance or estimates by banks
- Expected loss:  $PD \times LGD \times EAD$  needs to be covered by provisions in IRB approach, otherwise the shortfall is deducted from capital
- Risk weighted assets (RWA) can be calculated by multiplying the capital requirements (CR) by EAD and the reciprocal of the minimum capital ratio of 8%, i.e. by a factor of 12.5, similarly as in the case of market risk VaR

$$RWA = 12.5 * \text{capital requirements} * EAD$$

### 3. Basel II

## IRB Approach: Example

$$K = \left[ LGD \times N \left[ \frac{1}{\sqrt{1-R}} \times G(PD) + \sqrt{\frac{R}{1-R}} \times G(0.999) \right] - PD \times LGD \right] \times \left( \frac{1 + (M - 2.5) \times b(PD)}{1 - 1.5 \times b(PD)} \right)$$

#### Example: **Corporate Loan**

- the (annual) **PD** for this loan (with **Maturity of 4 years**) is **1%** (a quite typical value), and that
- the **LGD is 45%** (a number recommended by the Basel Committee for the Foundation IRB; unsecured senior claims).

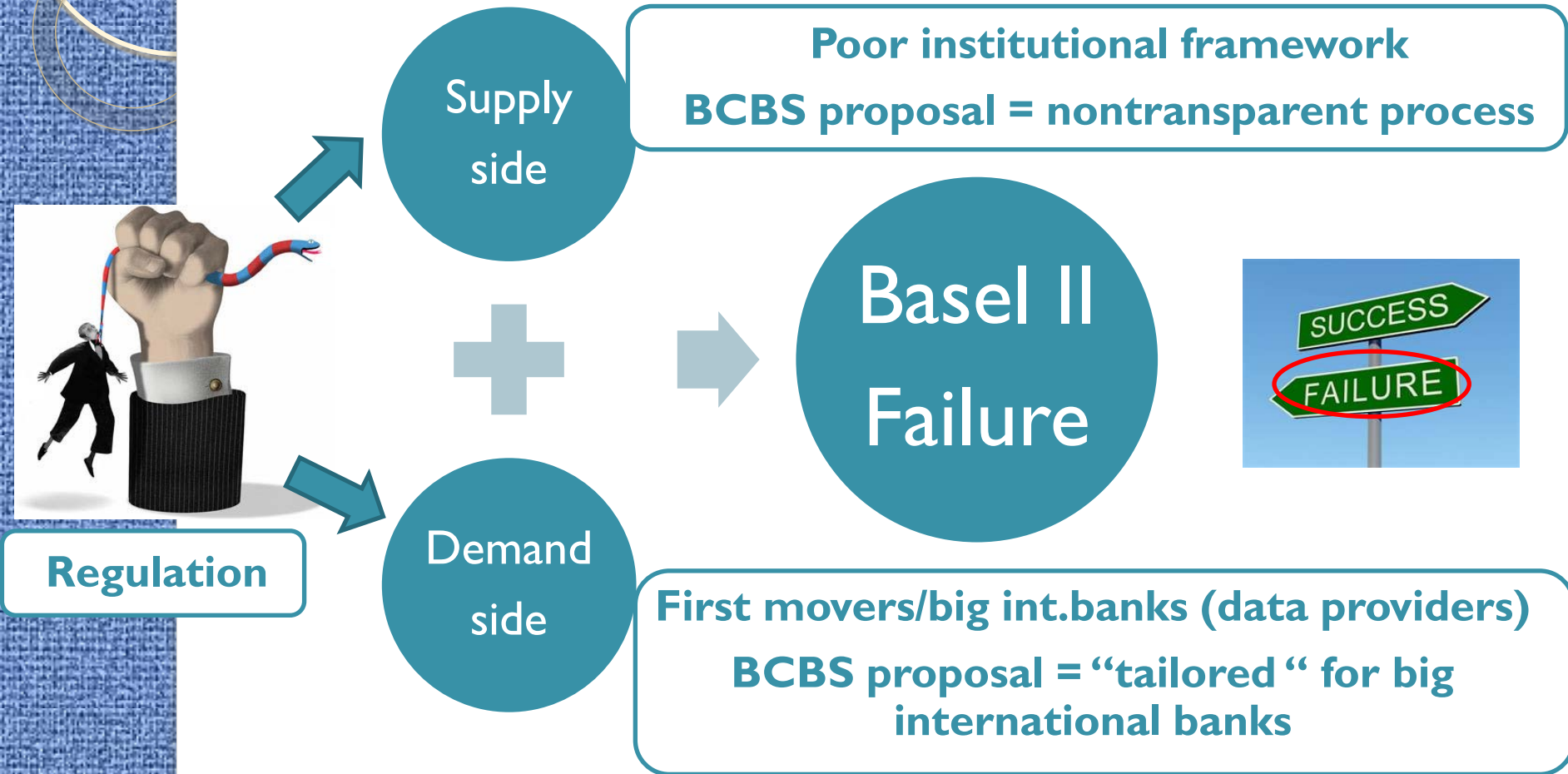
Using the IRB formula above, the capital requirement turns out to be **8.9% of EAD**.

If the PD was 2% , for instance, capital requirement would be **10.7% of EAD**.

In case of STA approach, depending on the rating (risk weights between 50% to 150%), the capital requirement would be from 4% to 12%.

### 3. Basel II

Basel II – fundamentally flawed process of creating global standards (Lall, 2012)



Source: Lall, R. (2012). From Failure to Failure: The Politics of International Bank Regulation, *Review of International Political Economy*, 19(4): 609–38.



### 3. Basel II

The 0% sovereign risk weight amplified the 2010-2013 Eurozone sovereign crisis



## 3. Basel II

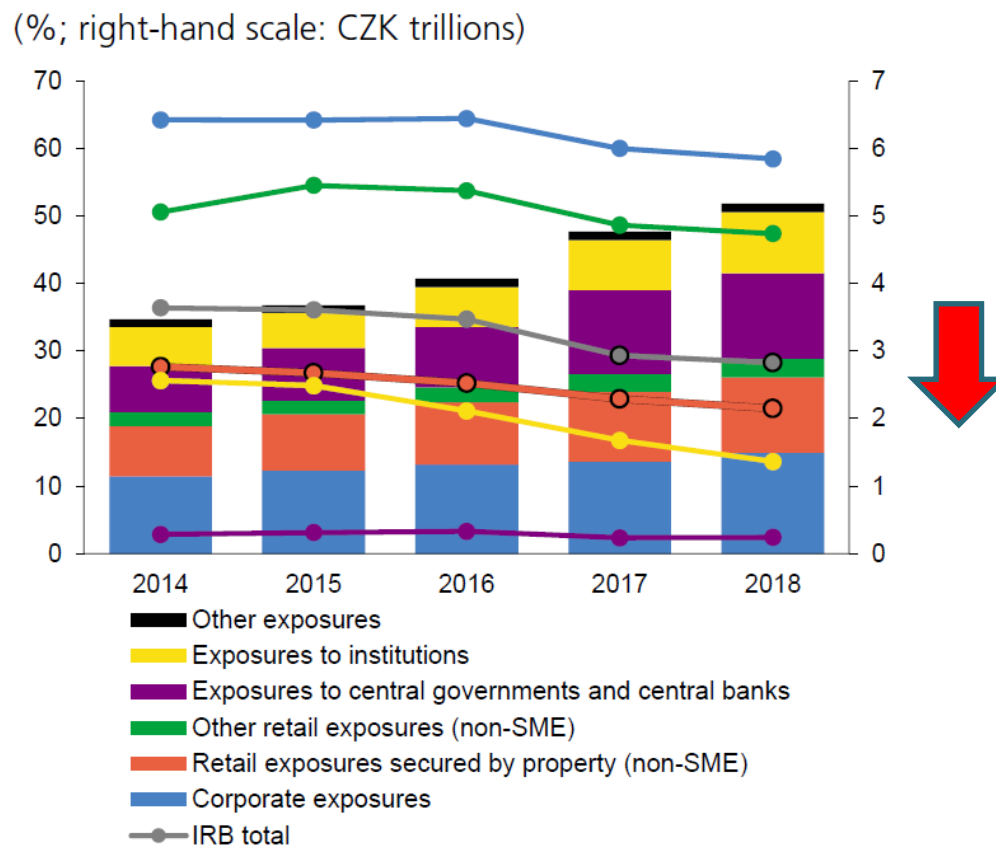
### Other critiques and identified deficiencies of Basel II

- 1) **Procyclicality** of capital requirements, especially in IRB, fuelling the (credit) booms and leading to accumulation of systemic risk
- 2) Excessive use of external ratings, applied also on innovative instruments (CDOs)
- 3) Insufficient capital for market risk and securitization
- 4) Overall relatively low CET1 capital requirements (2% only)
- 5) Missing liquidity regulation, underestimating a possibility of systemic liquidity squeeze



### 3. Basel II

## Average risk weights (RWs) and the size of the main categories of exposures under the IRB approach in Czech banking sector: decreasing RWs in 2015-18



Source: CNB

Note: The points connected by lines denote the level of the risk weights for individual categories of exposures (left-hand scale). The height of the columns denotes the size of the exposure (right-hand scale). The colour coding of the points corresponds to the colour coding of the columns.

# Contents

1. Bank capital

2. Basel I

3. Basel II

4. Basel III



## 4. Basel III

# Basel III

---

- The Basel III framework is a central element of the Basel Committee's response to the global financial crisis.
- It addresses a number of shortcomings in the pre-crisis regulatory framework and provides a foundation for a resilient banking system that will help avoid the build-up of systemic vulnerabilities.
- The framework will allow the banking system to support the real economy through the economic cycle.
- The first draft published in 2010, the finalization in 2017

## 4. Basel III

### Three key objectives and targets of Basel III

---

#### Objectives

- 1) Improve the **banking sector's ability to absorb shocks** arising from financial and economic stress, whatever the source
- 2) Improve **risk management and governance**
- 3) Strengthen banks' **transparency** and disclosures.

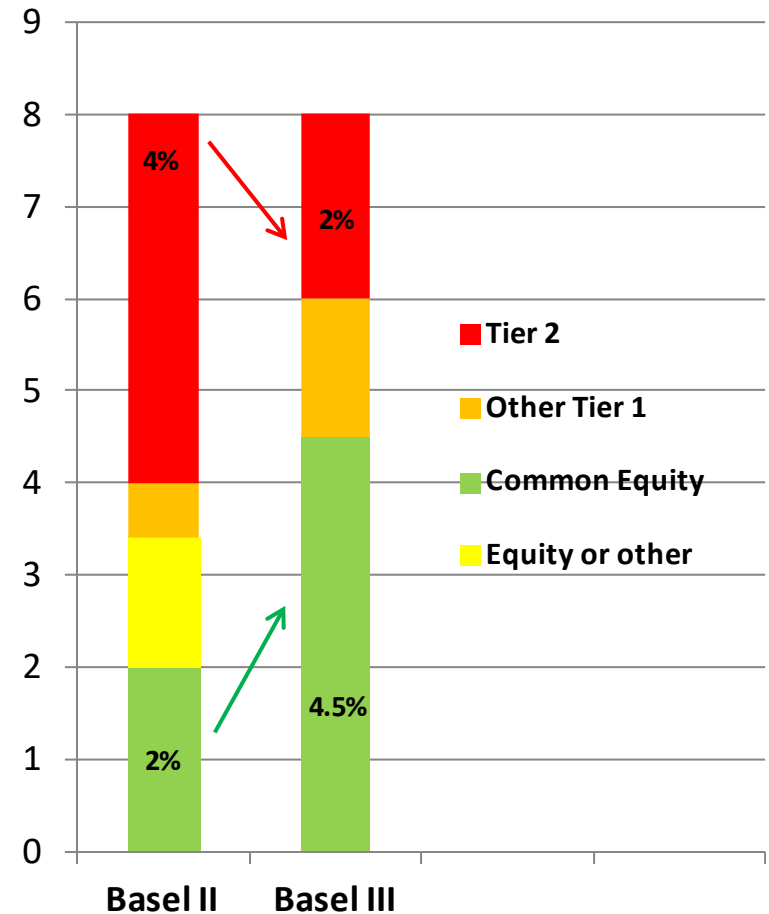
#### Targets

- 1) bank-level, or **microprudential**, regulation, which will help raise the resilience of individual banking institutions to periods of stress.
- 2) **macroprudential**, system wide risks that can build up across the banking sector as well as the procyclical amplification of these risks over time.

## 4. Basel III

# Basel III proposal (2010)

- 1) Increasing the quantity and improving the quality of **bank capital**;
- 2) introduction of **new liquidity standards** for internationally active banks (LCR, NSFR)
- 3) addressing the **systemic risk** and interconnectedness via raising the trading book capital requirement, motivating banks to use central counterparties, and creating additional capital buffers
- 4) Imposing a gross **leverage ratio** as backstop.

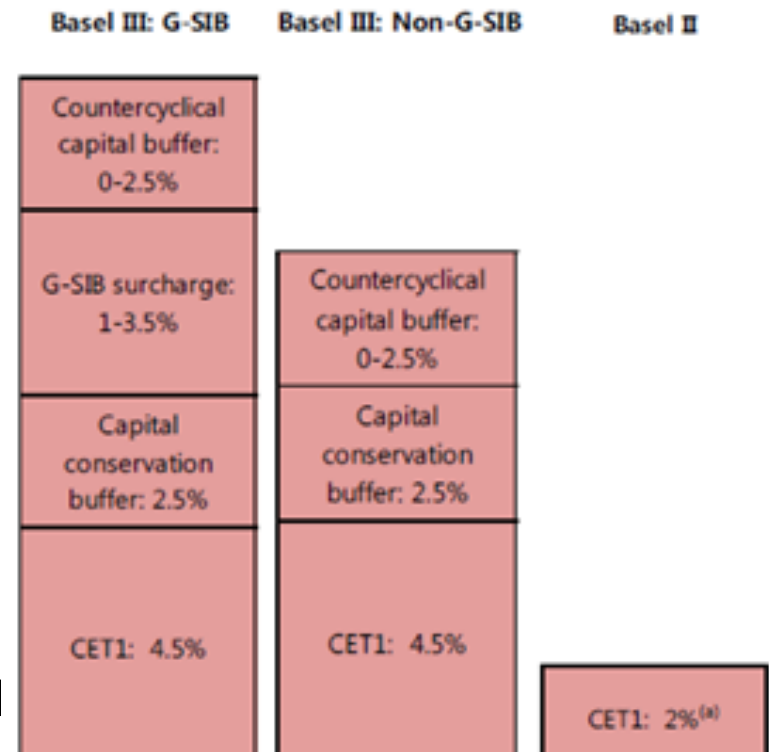


Source: BIS (2010). A global regulatory framework for more resilient banks and banking systems

## 4. Basel III

# The Basel III innovation: a “buffer” regime

- Capital conservation buffer, equivalent to 2.5% of RWA.
- Discretionary counter-cyclical capital buffer, allowing national regulators to require up to an additional 2.5% of CET1 capital during periods of high credit growth.
- G-SIB buffer for global systemically important banks (0-3.5%)
- Other buffers possible (Pillar 2, domestic SIBs)
- **Buffers created out of retained earnings in good times! -> limiting procyclicality in capital requirements**

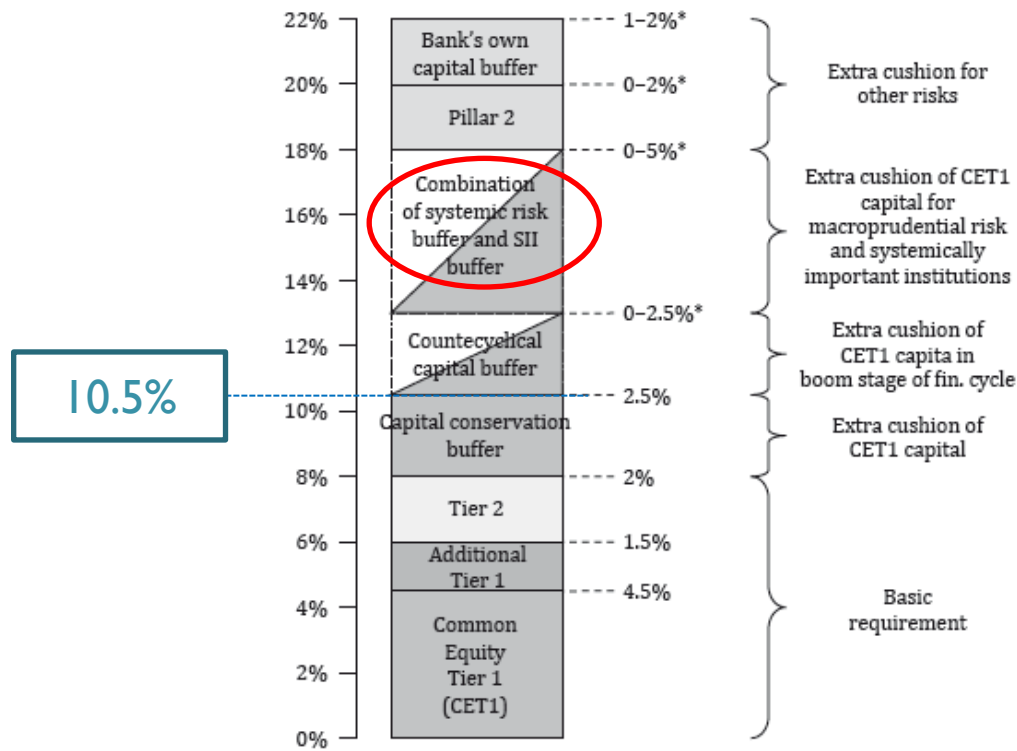




# 4. Basel III

## Structure of reg. capital requirements in the EU (CRD IV\*)

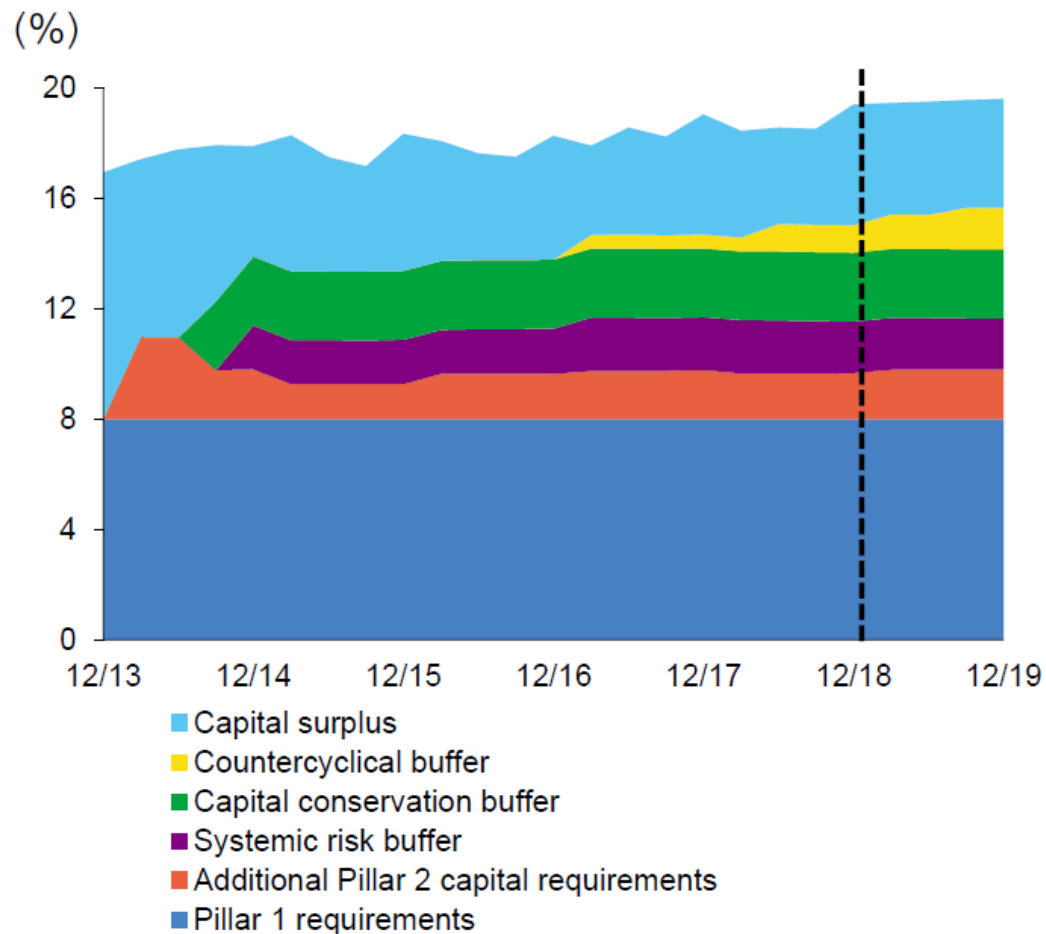
Figure VI-17: Capital requirements stipulated by CRD IV (in % of risk weighted assets)



Note: \* Expected upper limits, although actual values can be higher

## 4. Basel III

# Structure of reg. capital requirements in the Czech banking sector



## 4. Basel III

# The 2017 Basel III finalization

---

- The Committee's Basel III reforms complement the initial phase of the Basel III reforms announced in 2010.
- The 2017 reforms seek to restore credibility in the calculation of risk-weighted assets (RWAs) and improve the comparability of banks' capital ratios.
- RWAs are an estimate of risk that determines the minimum level of regulatory capital a bank must maintain to deal with unexpected losses.
- A prudent and credible calculation of RWAs is an integral element of the risk-based capital framework
- Basel III is implemented in the EU through CRR II and CRD V (the European banking package in June 2019)

## 4. Basel III

# Why were the 2017 changes necessary?

- The 2017 reforms address additional weaknesses that were revealed by the first years of the Basel III implementation, such as:
  - I. **Wide variation in RWAs** across banks that cannot be explained solely by differences in the riskiness of banks' portfolios.
  - II. **Potential misuse of internal models**: Internal models should allow for more accurate risk measurement than the standardised approaches developed by supervisors. However, incentives exist to minimise risk weights when internal models are used to set minimum capital requirements.

## II. Basel III

**Huge differences in risk weights attributed to categories of credit risk (due to internal bank models/IRB approach\*)**

	Mortgages	Corporates	Institutions	Other retail
<b>Autonomous</b>	5% - 20% - 53%	32% - 59% - 76%	n/a	n/a
<b>Barclays</b>	7% - 15% - 49%	33% - 55% - 89%	n/a	n/a
<b>BBVA</b>	8% - 15% - 23%	37% - 52% - 78%	4% - 16% - 27%	14% - 33% - 48%
<b>BNP</b>	6% - 13% - 25%	27% - 54% - 75%	n/a	10% - 38% - 156%
<b>KBW</b>	6% - 18% - 53%	26% - 55% - 158%	6% - 19% - 34%	7% - 36% - 64%
<i>Average</i>	<i>6.4% - 16.2% - 40.6%</i>	<i>31% - 55% - 95.2%</i>	<i>5% - 17.5% - 30.5%</i>	<i>10.3% - 35.7% - 89.3%</i>

Source: analyst reports, based on Pillar 3 disclosure, company data and analysts' estimates Autonomous – 22 European banks, 2 Canadian and 2 Australian banks – corporate loans and mortgages only Barclays – 21 European banks – corporate loans and mortgages only – full set of data for 2009 (used), as 2010 is partial. BNP Exane – 22 European banks covered – 2010 data – Median – KBW – 27 European banks – BBVA – 12 European banks.

- Mortgages: 6.4% - 40.6%
- Corporates: 31.0% - 95.2%
- Institutions: 5.0% - 30.5%
- Other retail: 10.3% - 89.3%



Source: IMF (2012). Revisiting Risk-Weighted Assets “Why Do RWAs Differ Across Countries and What Can Be Done About It?”, WP/12/90

\*Internal Rating Based models (IRB) – see also below section Basel III (2017)

## 4. Basel III

# Key issues in Basel III (2017) for banks

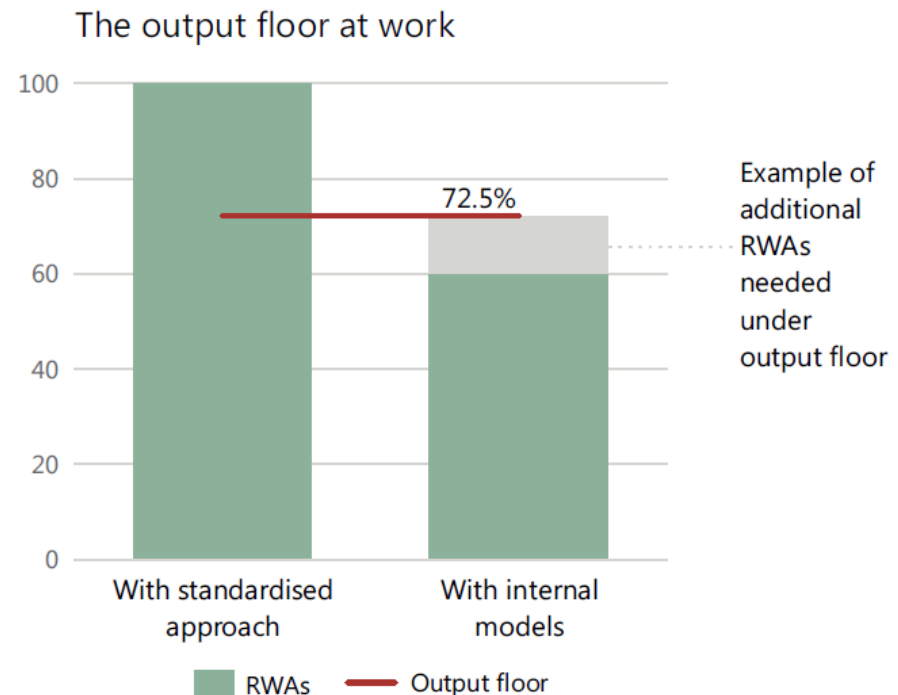
---

- 1) Changes in the STA approach for risk-weighted assets (especially for mortgages)
- 2) Streamlining the treatment of operational risk
- 3) Add a leverage ratio surcharge for the largest banks (in line with G-SIB buffer)
- 4) **Create a more robust, risk-sensitive output floor**

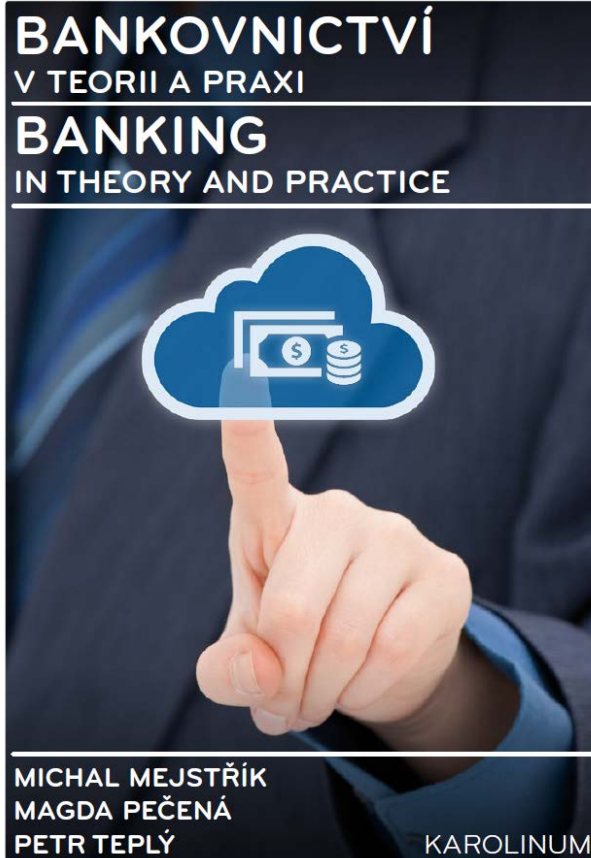
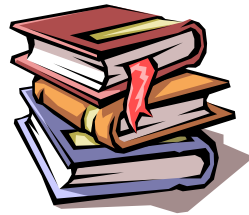
## 4. Basel III

# Risk-sensitive output floor

- The revised output floor limits the amount of capital benefit a bank can obtain from its use of internal models, relative to using the standardised approaches.
- Banks' calculations of RWAs generated by internal models cannot, in aggregate, fall below **72.5%** of the risk-weighted assets computed by the standardised approaches. This limits the benefit a bank can gain from using internal models to **27.5%**.



# Reading for this lecture



- ✓ **Chapter VI/Bank Capital**
- ✓ **Chapter V/Bank regulation**