

M U N I

Bank Funding and Capital Management

Contents

1. Bank funding sources: overview
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3. Cost of debt and equity
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5. Role of bank capital
6. Capital adequacy

Liquidity and Funding Sources

- Amount of cash a bank holds is influenced by bank's liquidity requirements.
- Size and volatility of cash requirements affects liquidity position of bank.
 - Transactions that reduce cash force bank to replenish cash assets by issuing new debt or selling assets.
 - Transactions that increase cash provide new investible funds.
- Banks with ready access to borrowed funds can enter into more transactions as they can borrow quickly and at low cost to meet cash requirements.

Bank Funding Sources

- **Retail funding** is considered funding bank receives from consumers and non-institutional depositors.
 - Stable deposits that customers are less likely to withdraw when interest rates on competing investments rise.
- **Borrowed or wholesale funding** consists of government funds purchased, repurchase agreements and other borrowings (e.g., institutional CDs in US)
- **Equity-related funding** consists of subordinated debt, common and preferred stock and retained earnings.
- *Volatile (purchased) liabilities* describe funds obtained from interest-sensitive investors.
 - Investors will move their funds if other institutions are paying higher rates or hear rumors that the bank has financial difficulties.

Transaction Accounts

- **Demand deposits** accounts (DDA) are non-interest bearing accounts held by individuals, businesses and government units.
- **Interest-bearing** (term or time deposits) accounts are accounts that pay interest.
 - In the US: checking and automatic transfers from savings (ATS)
 - ATS customer has both a DDA and a savings account.
 - Bank forces a zero balance in the DDA at the end of each day
 - Often labeled as sweep accounts

Non-transactional Accounts

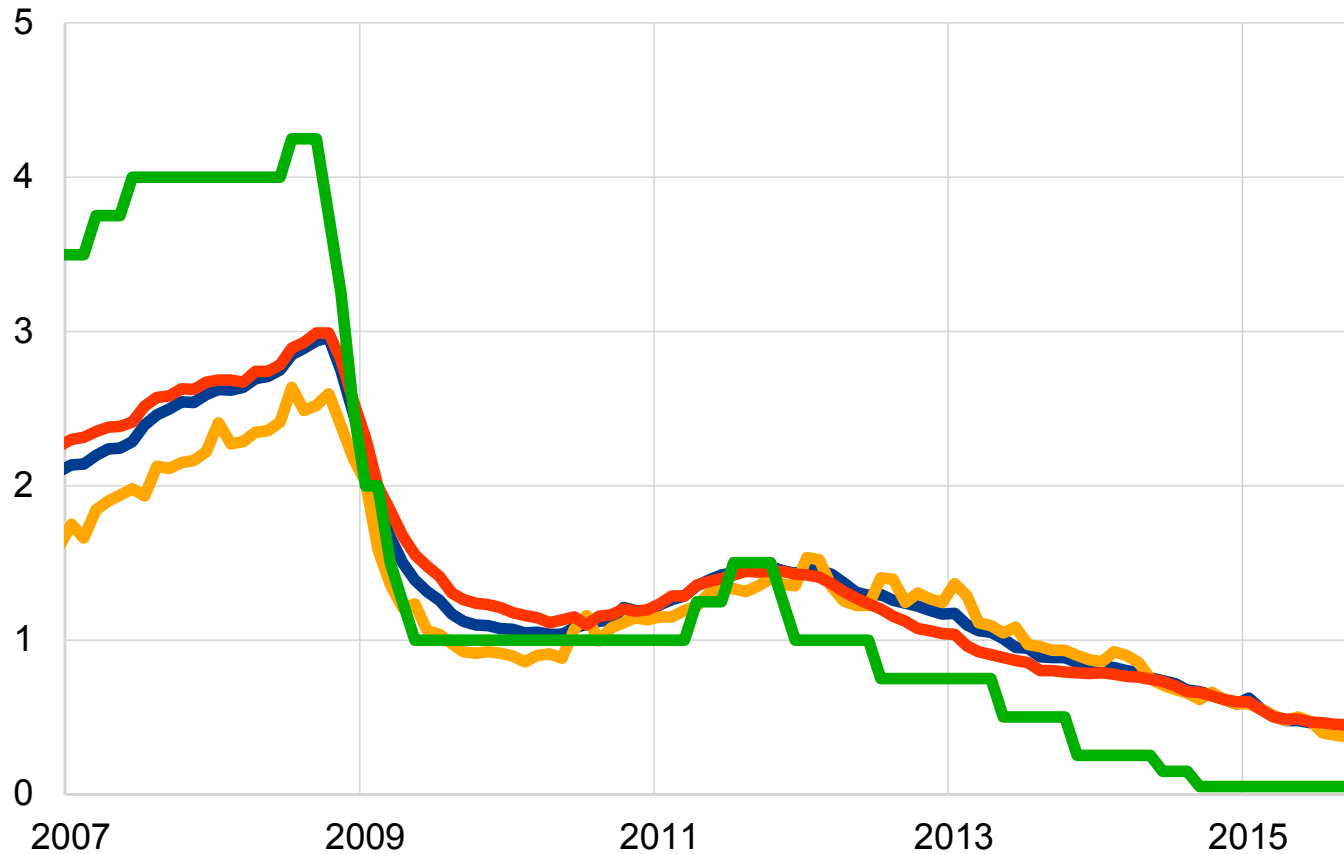
- **Interest-bearing** accounts with limited or no transaction privileges
 - In the US: Money market deposit accounts (MMDA) are time deposits that limit depositors to six transactions per month. Attractive to banks because no required reserves and limited transaction processing reduce effective cost to bank.
- Savings accounts have fixed maturity

Estimating the Cost of Deposit Accounts

- **Cost includes:**
 - **Interest** which may be as low as zero or a fraction of 1%.
 - **Legal reserve requirements** which can equal as much as 10% of the outstanding balance
 - **Processing costs** which are substantial when deposit customers have a large number of transactions
- Cost analysis data indicate demand deposits are the least expensive source of funds.
 - Profitability depends on average balance, number of transactions and fees collected
- Additional fees include overdraft protection or non-sufficient funds fees (represent a risk charge).
 - Overdrafts are an extension of credit

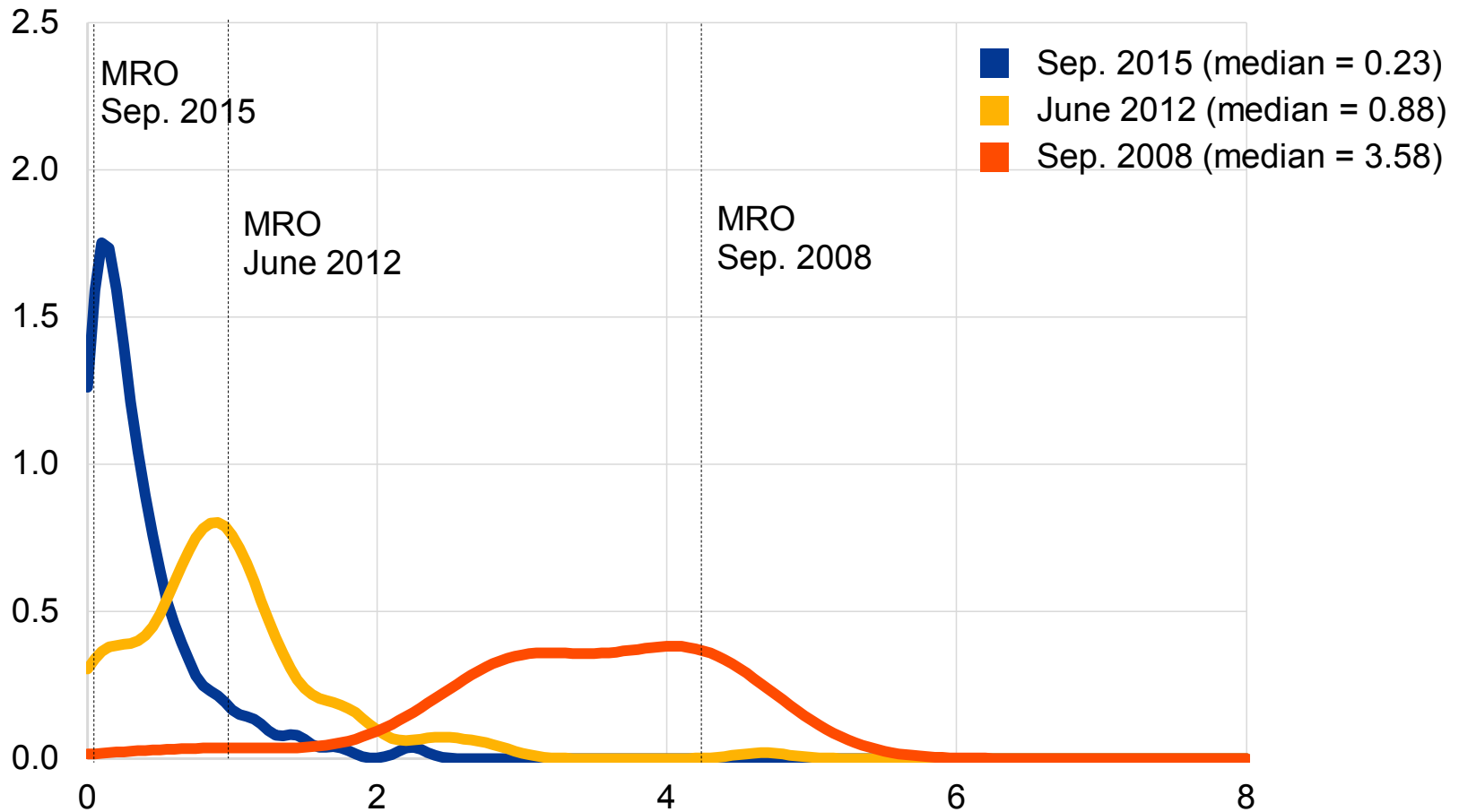
Euroarea Bank Deposit Rates

- euro area
- less vulnerable countries
- vulnerable countries
- MRO rate



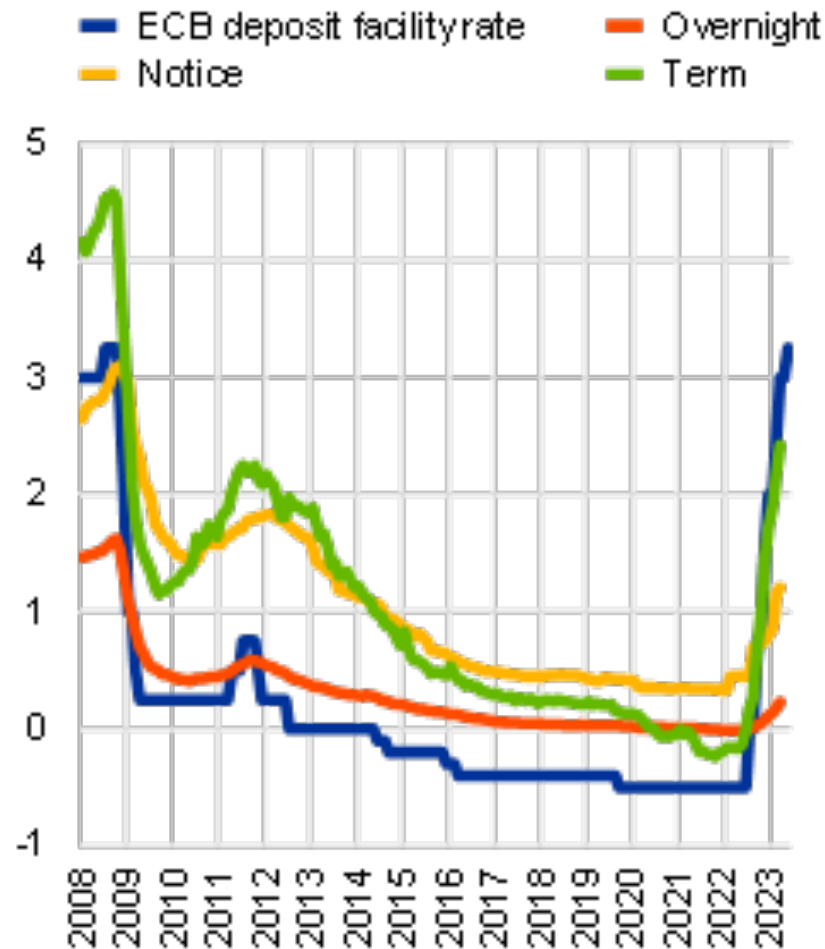
Source: ECB

Distribution of deposit rates



Source: ECB

Euroarea Bank Deposit Rates



Source: ECB

Estimating the Cost of Deposit Accounts

- **Transaction-processing activities:**

- **Deposits or withdrawals:**

- **Electronic** transactions occur through automatic deposits, Internet and telephone payments, ATMs and ACH transactions.

- **Non-electronic** transactions are handled in person or by mail.

- Transit checks deposited or cashed

- **Check-processing activities:**

- Accounts opened or closed

- “On-us” checks/transactions cashed: Checks/transactions drawn on the bank’s customers’ accounts

- General account maintenance:

- General record maintenance and preparing statements.

- With a truncated account checks/transactions are not returned to the customer.

- An official check would be issued for certified funds.

- Net indirect costs are costs not directly related to the product such as general overhead or manager salaries.

Estimating the Cost of Deposit Accounts

Banks pay market rates on deposits and want customers to pay at least what the service costs.

- Has led to *relationship pricing* in which service charges decline and interest rates increase with larger balances.
- Banks have unbundled services and price each separately.
- Some charge for services once considered courtesies such as balance inquiry and in-person banking.
- Has led to a caste system of banking.
 - Large depositors receive highest rates, pay the lowest fees and receive personal attention from their banker.
 - Small depositors earn lower rates, if any, pay higher fees and receive less personal service.

Calculating the Average Net Cost of Deposit Accounts

- **Average historical cost of funds** - measure of average unit borrowing costs for existing funds.
- **Average interest cost** - calculated by dividing total interest expense by the average amount of liabilities outstanding.
- **Average net cost of bank liabilities:**

$$\frac{\text{Interest expense} + \text{noninterest expense} - \text{noninterest income}}{\text{Average balance net of float} \times (1 - \text{reserve requirement ratio})} \times 12$$

- Example: If a demand deposit account does not pay interest, has \$18.69 a month in transaction costs charges, \$10.15 in fees, an average balance of \$8,750, 5% float and 10% reserve requirement, the average net cost would be:

$$\frac{(\$0 + \$18.69 - \$10.15)}{\$8,750 \times 0.95 \times 0.90} \times 12 = 1.37\%$$

US: Certificate of Deposits (CDs)

- Large, negotiable certificates of \$100,000 or more.
 - Minimum maturity of 7 days.
 - Interest rates quoted on a 360-day year basis.
 - Insured up to \$250,000 per investor per institution.
- Considered risky and traded accordingly.
 - Can be issued directly or through dealers or brokers (brokered deposits).
 - Brokers provide small banks access to purchased funds.
 - Packaged in \$250,000 increments so deposits are fully insured.
- When managers expect rates to rise, try to lengthen CD maturities prior to rate move.
 - Opposite occurs when rates are expected to fall.
- Types of CDs:
 - Fixed-rate: Typically 1, 3 or 6 month maturities. Today maturities of up to 5 years are common.
 - Variable-rate: Longer maturities with rates renegotiated at specified intervals.
 - Jump rate (bump-up) CD gives the depositor a one-time option until maturity to change the rate to the prevailing market rate.

Europe: Certificate of Deposits

EBA:

Certificates of Deposit (CDs) are to be treated as debt securities as long as they are negotiable and with the exception of those sold exclusively in the retail market and held in a retail account, in which case those instruments can be treated as the appropriate retail deposit category. Non-negotiable CDs should be treated as deposits of the relevant category.

Foreign Office Deposits

- **Eurocurrency** - financial claim denominated in a currency other than that of the country where the issuing bank is located
- *Example:* **Eurodollar deposits** in the US: dollar-denominated deposits at foreign banks or at the overseas branches of American banks

Borrowing Immediately Available Funds

- Security Repurchase Agreements (**Repos**):
 - Short-term loans secured by government securities that are settled in immediately available funds.
 - Sale of securities with a simultaneous agreement to buy them back later at a fixed price plus accrued interest.
 - Market value of collateral is set above the loan amount. This difference is the margin.
- Normal repos are bullet repos with a fixed rate over a set maturity with no options.
- Structured repo agreements:
 - embeds an option (call, put, swap, cap, floor, etc.) in the instrument to either lower its initial cost to the borrower or better help the borrower match the risk and return profile of an investment.
- A callable repo allows the deposit holder to terminate (call) the CD prior to maturity.

Marginal Cost of Funds

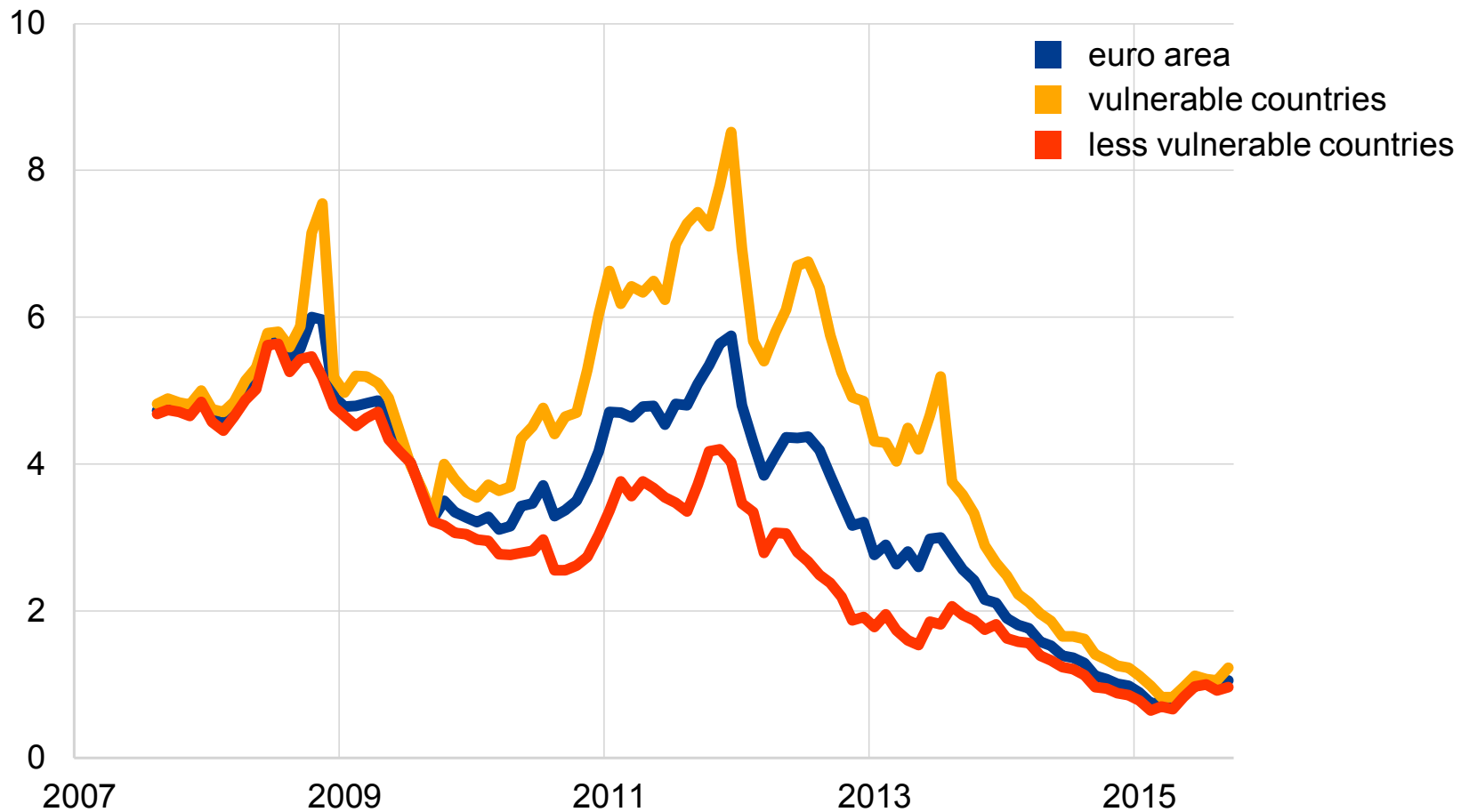
- **Marginal cost of debt** - measure of the borrowing cost paid to acquire one additional unit of investable funds
- **Marginal cost of equity** - measure of the minimum acceptable rate of return required by shareholders
- **Marginal cost of funds** - the marginal costs of debt and equity.
- Difficult to measure marginal costs precisely.
 - Must include both interest and noninterest costs expected to be paid and identify which portion of the acquired funds can be invested in earning assets.
 - Formula for measuring explicit marginal cost of a single source of bank liability:

$$\frac{\text{Interest rate} + \text{servicing costs} + \text{acquisition cost} + \text{insurance}}{\text{Net investable balance of liability } j}$$

Cost of Debt

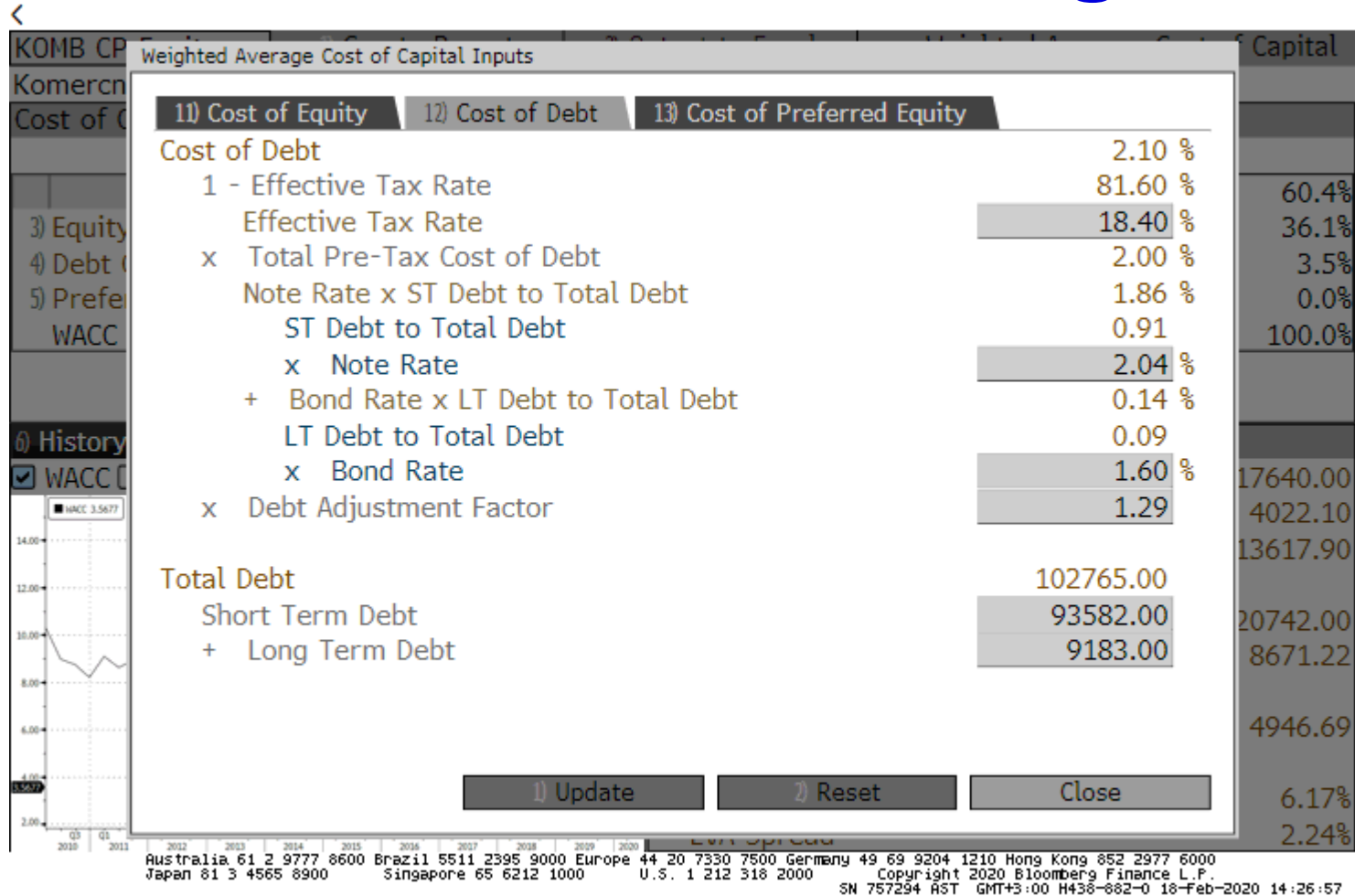
- Marginal cost of different types of debt varies according to the magnitude of each type of liability.
 - High-volume transactions accounts have substantial servicing costs and highest reserve requirements and float.
 - Purchased funds pay higher rates but smaller transaction costs and zero reserve requirements (greater investable balances).
- Cost of long-term non deposit debt equals effective cost of borrowing from each source.
 - This is the discount rate, which equates the present value of expected interest and principal payments with the net proceeds to the bank from the issue.

Bank bond yields



Source: ECB

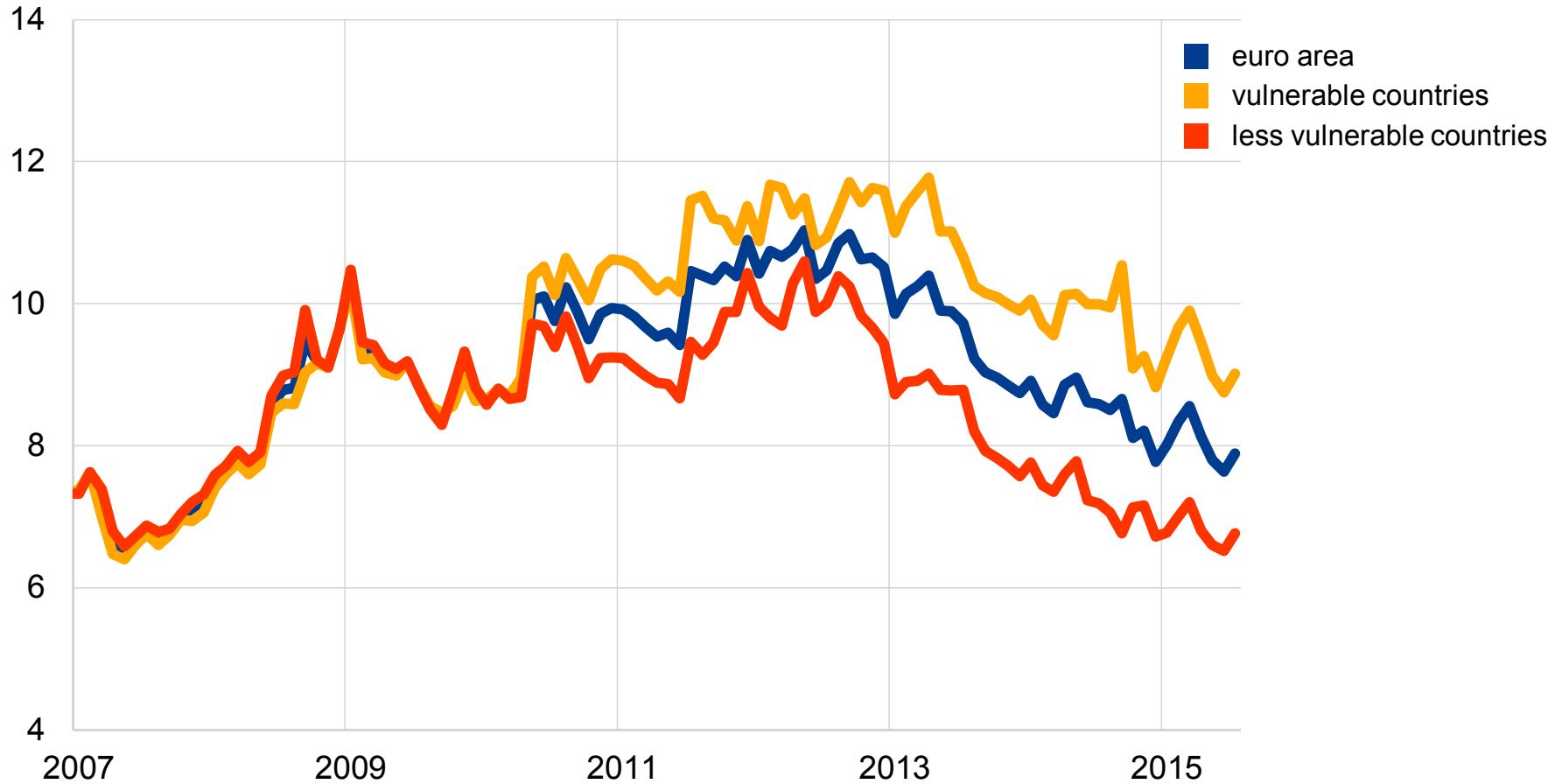
Cost of Debt - Bloomberg



Cost of Equity

- The marginal cost of equity equals the required return to shareholders.
- Not directly measurable because dividend payments are not mandatory but several methods are used:
 - **Dividend Valuation Model:** The cost of equity equals the discount rate (required return) used to convert future cash flows to their present value equivalent
 - **Capital Asset Pricing Model (CAPM):** Required return to shareholders equals the riskless rate of return plus a risk premium on common stock reflecting non-diversifiable market risk
 - **Targeted Return on Equity Model.** Cost of debt plus a premium to evaluate the cost of equity. Assumes book value = market value.

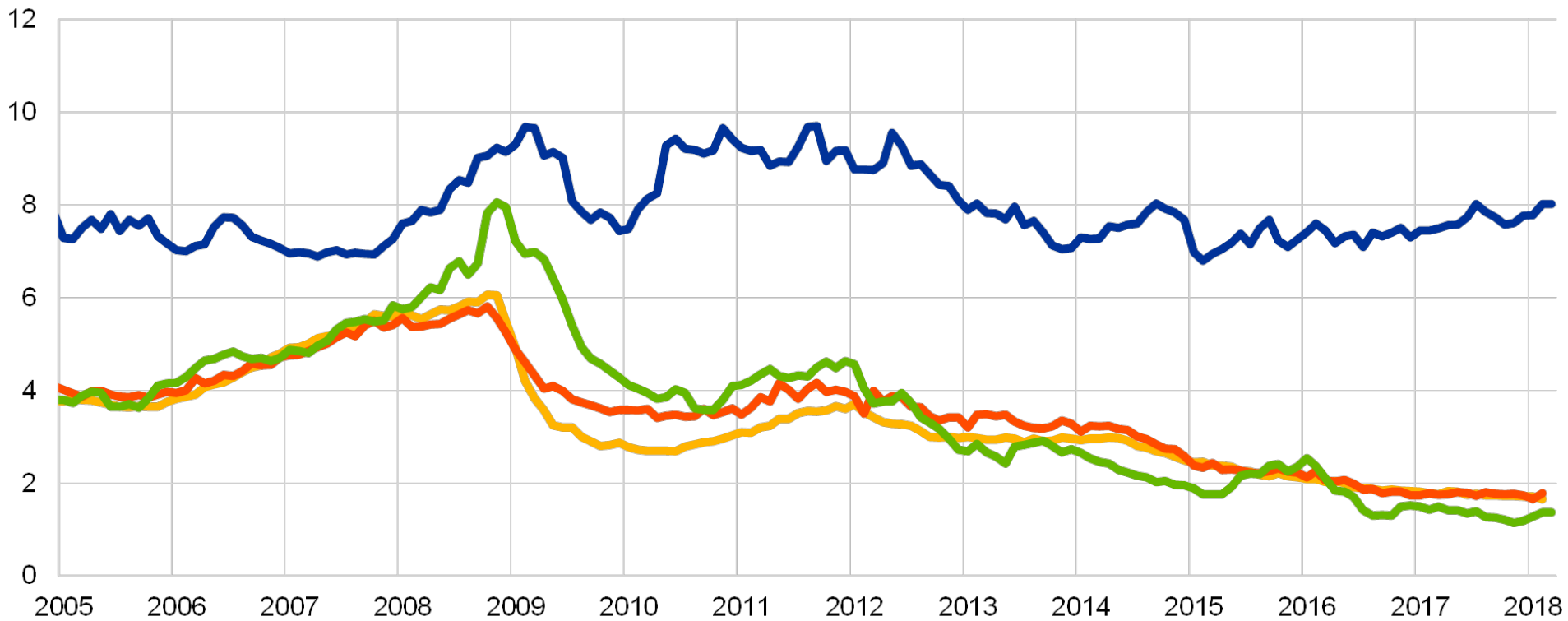
Cost of bank equity



Source: ECB

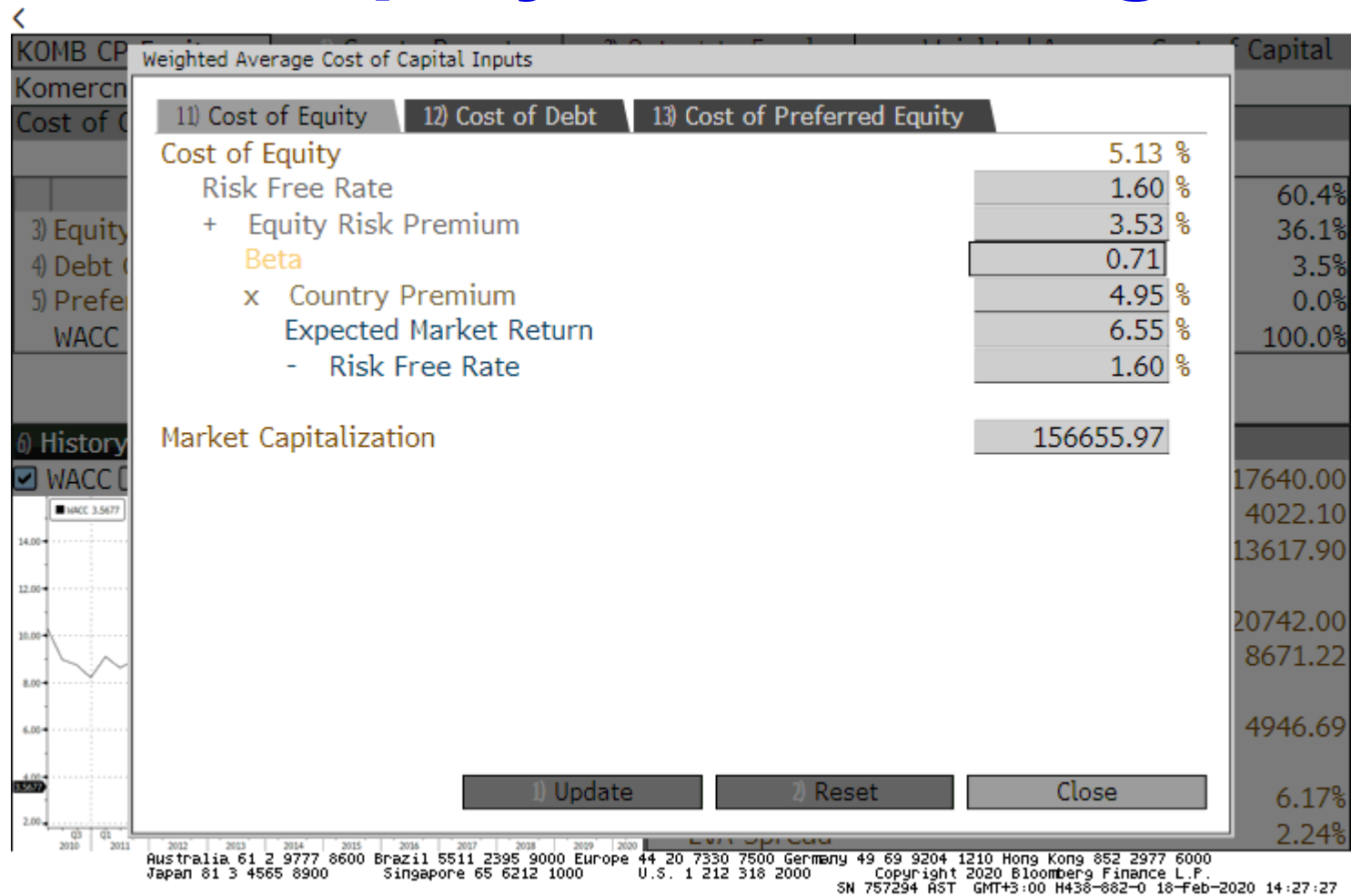
Cost of bank equity

- cost of listed equity
- short-term bank lending rate
- long-term bank lending rate
- cost of market-based debt



Source: ECB

Cost of Equity - Bloomberg




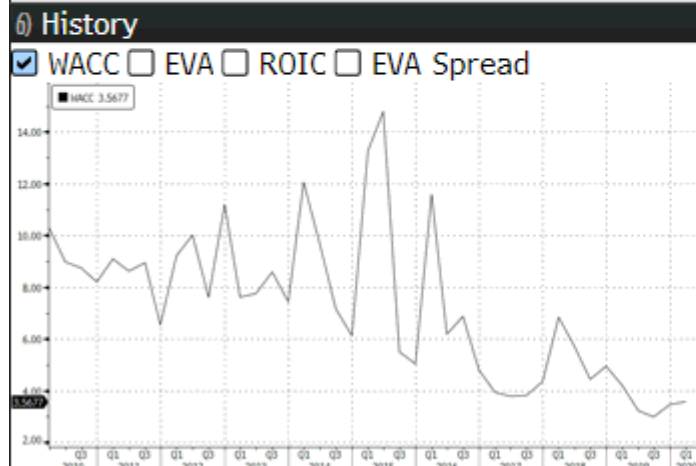
Cost of Capital - Bloomberg

KOMB CP CZK ↓ 791.00 +4.00 P790.50 / 791.00P 20x1835
 At 13:44 d Vol 24,562 0 791.50K H 793.00K L 787.00K Val 19.41M

KOMB CP Equity Create Report Output to Excel Weighted Average Cost of Capital

Komerčni banka as Period MR 2019 Q4

Cost of Capital - Current Market Value				Capital Structure (Millions of CZK)		
	Weight	Cost	W x C		Market Cap	156,656.0 60.4%
3) Equity	60.4%	5.1%	3.1%		ST Debt	93,582.0 36.1%
4) Debt Cost (A-T)	39.6%	2.1%	0.8%		LT Debt	9,183.0 3.5%
5) Preferred Equity	0.0%	0.0%	0.0%		Pref. Eqty	0.0 0.0%
WACC			3.9%		Total	259,421.0 100.0%



Economic Value Added (Millions of CZK)	
7) Net Operating Profit	17640.00
8) Cash Operating Taxes	4022.10
NOPAT	13617.90
9) Total Investment Capital	220742.00
Capital Charge	8671.22
Economic Value Added	4946.69
ROIC	6.17%
EVA Spread	2.24%

Australia 61 2 9777 8600 Brazil 5511 2395 9000 Europe 44 20 7350 7500 Germany 49 69 9204 1210 Hong Kong 852 2977 6000
 Japan 81 3 4565 8900 Singapore 65 6212 1000 U.S. 1 212 318 2000
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Weighted Marginal Cost of Total Funds

- Best cost measure for asset-pricing purposes.
 - Recognizes both explicit and implicit costs associated with any single source of funds.
- Computed in three stages:
 - Forecast desired dollar amount of financing to be obtained from each individual debt and equity sources.
 - Estimate marginal cost of each source of funds.
 - Combine the estimates to project the weighted cost:

$$WMC = \sum_{j=1}^m w_j k_j$$

Funding Sources and Banking Risks

- Banks face two fundamental problems in managing liabilities or uncertainty over:
 - what rates they must pay to retain and attract funds.
 - likelihood customers will withdraw money regardless of rates.
- Basic fear is vulnerability to a liquidity crisis from unanticipated withdrawals and depositors and lenders refusing to provide funds.
 - Banks must have the capacity to borrow in financial markets to replace deposits outflows and remain solvent.

Funding Sources: Liquidity Risk

- Liquidity risk of deposit base is a function of:
 - Number and location of depositors
 - Average size of accounts
 - Specific maturity and rate characteristics of each account
 - Competitive environment
- Interest elasticity of customer demand for each funding source is equally important.
 - How much can interest rates change before bank experiences deposit outflows?
 - If a bank raises its rates, how many new funds will it attract?

Funding Sources: Interest Rate Risk

- Many depositors and investors prefer short-term instruments that can be rolled over quickly as interest rates change.
 - Banks must offer premiums to lengthen maturities.
 - Many banks have chosen not to pay premiums and reprice liabilities more frequently than in the past.
- One strategy is to aggressively compete for retail core deposits.
 - Once a bank attracts deposit business, many will maintain those balances as long as bank provides good service.

Definition of bank capital

– **Equity**

- Common stock, preferred stock, surplus, and undivided profits equals the book value of equity
- Market value of equity

– **Long-term debt**

- Subordinated notes and debentures
- Interest payments are tax deductible

– **Reserves**

- Provision for loan losses (PLL) is expensed on the income statement
- Reserve for loan losses is a capital account on the right-hand-side of the balance sheet

Role of bank capital

- *Source of funds*
 - Start-up costs
 - Growth or expansion (mergers and acquisitions)
 - Modernization costs
- *Cushion to absorb unexpected operating losses*
 - Insufficient capital to absorb losses will cause insolvency
 - Long-term debt can only absorb losses in the event of institution failure
- *Adequate capital*
 - Regulatory requirements to promote bank safety and soundness
 - Mitigate moral hazard problems of deposit insurance by increasing shareholders' exposure to bank operating losses
 - Public confidence is important to depositors and other bank claimants

Bank Capital: Regulators

- Bank capital serves to protect the deposit insurance fund in case of bank failures.
- **Regulatory capital** is the minimum amount of capital that a bank must hold (for an individual deal or for the whole bank) according to the regulator.
- Bank capital reduces bank risk by:
 - providing a cushion for firms to absorb losses and remain solvent.
 - providing ready access to financial markets, which guards against liquidity problems from deposit outflows.
 - constraining growth and limits risk taking.

Bank Capital: Shareholders

- Corporate control
 - Greater debt increases the concentration of ownership among shareholders
 - In banks that are not closely held there is the potential for agency costs related to conflicts of interest between owners and managers.
 - Hostile takeovers of banks with undervalued shares is a potential threat that tends to reduce agency costs.
 - Link management compensation to performance (e.g., stock options) to decrease agency costs.
 - Preemptive rights of shareholders reduces shareholder dilution and reduces agency costs to the extent that owner concentration is increased.

Bank Capital: Shareholders

- Market timing (debt versus equity usage, interest rate levels, and stock market levels)
- Asset investment considerations (asset risk and capital needs to absorb potential losses)
- Dividend policy (fixed dividend policy versus fixed payout dividend policy)
- Debt capacity (financial slack or flexibility)
- Transactions costs (private and public sales of equity)
- Mergers and acquisitions
- Internal expansion (internal capital generation rate)
 - $ICR = (1/\text{capital ratio}) \times ROA \times \text{Earnings retention ratio}$
 - Rate at which a bank can expand its assets and still maintain its capital ratio.

Capital Adequacy

- Bank regulators and bank shareholders have different views of capital adequacy
 - Regulators are more concerned with the lower end of the distribution of bank earnings.
 - Shareholders focus more on the central part of the distribution, or the expected return available to them.
 - Regulators perceive that financial risk increases the probability of insolvency, as greater variability of earnings makes it more likely that negative earnings could eliminate bank capital.
 - Regulators must close banks due to capital impairment.
 - Excessive capital regulation could inhibit the competitiveness and efficiency of the banking system.

Effective Use of Capital

- Capital reduces risk by cushioning earnings volatility and restricting growth opportunities.
- Reduces expected returns to shareholders as equity is more expensive than debt.
- Decreasing capital increases risk by increasing financial leverage and the risk of failure.
- Firms with greater capital can borrow at lower rates, make larger loans and expand faster through acquisition or internal growth.

Risk-Based Elements of Basel I

1. Classify assets into one of four risk categories.
2. Classify off-balance sheet commitments into the appropriate risk categories.
3. Multiply the dollar amount of assets in each risk category by the appropriate risk weight to calculate risk-weighted assets.
4. Multiply risk-weighted assets by the minimum capital percentages, 4% for Tier 1 capital and 8% for total capital.

Risk weights	Amount EUR	Bank	
		Assets	Liabilities
50%	100	Residential mortgages	Liquid deposits
100%	100	Corporate loan	
0%	100	Liquid assets (T-Bill)	Capital (CET1 + aT1 + T2)

$$8\% * (50\% * 8\% * 100 + 100\% * 8\% * 100 + 0\% * 8\% * 100) * 12.5 \leq \text{Capital} \quad \Leftrightarrow \quad 8\% \leq \text{Capital} / \text{RWA}$$

Risk-weighted assets (RWA)

Regulatory capital

What Constitutes Bank Capital?

- **Capital** (Net Worth) - the cumulative value of assets minus the cumulative value of liabilities or ownership in the firm.
- **Total Equity Capital** - sum of common stock, surplus, retained earnings, capital reserves, net unrealized holding gains (losses) and perpetual preferred stock.
- **Tier 1 (Core) Capital:**
 - Common stockholders' equity, noncumulative perpetual preferred stock and any related surplus.
 - Minority interest in consolidated subsidiaries, less intangible assets such as goodwill.
- **Tier 2 (Supplementary) Capital:**
 - Preferred stocks and any surplus.
 - Limited amounts of term-subordinated debt and a limited amount of the allowance for loan and lease losses (up to 1.25 percent of gross. risk-weighted assets)

Tier 1

Components	Minimum Requirements
<i>Tier 1 (Core) Capital</i>	
Common stockholders equity*	Must equal or exceed 4 percent of risk-weighted assets.
Noncumulative perpetual preferred stock and any related surplus	No limit; regulatory caution against undue reliance.
Minority interests in equity capital accounts of consolidated subsidiaries	No limit; regulatory caution against undue reliance.
Less: goodwill, other disallowed intangible assets, and disallowed deferred tax assets, and any other amounts that are deducted in determining Tier 1 capital in accordance with the capital standards issued by the reporting bank's primary federal supervisory authority	

Tier 2

Components	Minimum Requirements
<i>Tier 2 (Supplementary) Capital</i>	
Cumulative perpetual preferred stock and any related surplus	Total of Tier 2 is limited to 100 percent of Tier 1 [†] .
Long-term preferred stock (original maturity of 20 years or more) and any related surplus (discounted for capital purposes as it approaches maturity)	No limit within Tier 2.
Auction rate and similar preferred stock (both cumulative and noncumulative)	No limit within Tier 2.
Hybrid capital instruments (including mandatory convertible debt securities)	Subordinated debt and intermediate-term preferred stock are limited to 50 percent of Tier 1, amortized for capital purposes as they approach maturity.
Term subordinated debt and intermediate-term preferred stock (original weighted average maturity of five years or more)	50 percent of Tier 1 capital (and discounted for capital purposes as they approach maturity).
Allowance for loan and lease losses	Lesser of the balance of the allowance account or 1.25 percent of gross risk-weighted assets.

Basel II concepts

3 Pillar concept

1

2

3

Assets	Liabilities
(i) Banking book	(i) Banking book
(ii) Trading book	(ii) Trading book
Other assets	Equity

(i) Banking book

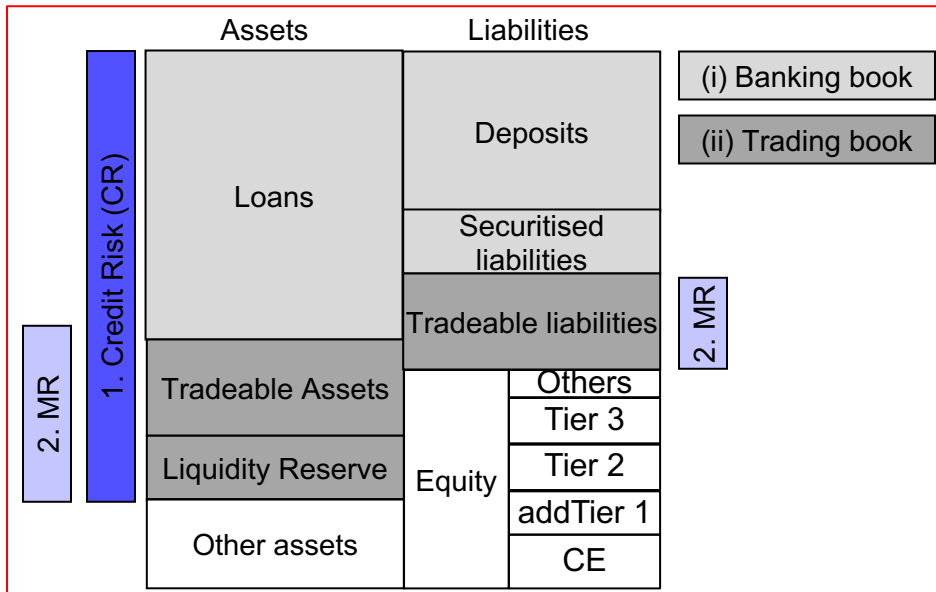
(ii) Trading book

Loans	Deposits	
	Securitised liabilities	
	Tradeable liabilities	
Tradeable Assets	Equity	Others
Liquidity Reserve		Tier 2
Other assets		addTier 1
		CE

Basel II concepts

3 Pillar concept

1 2 3

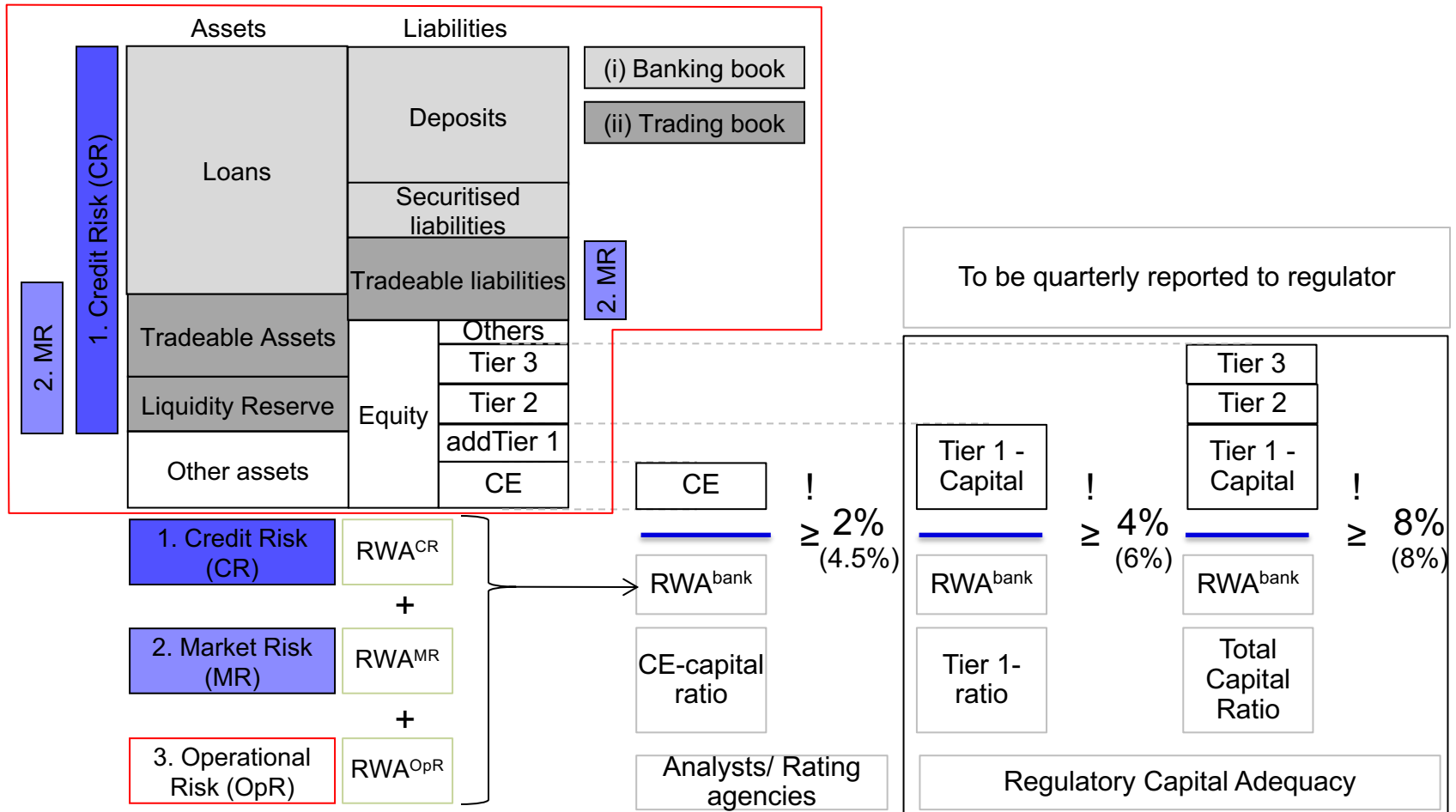


1. Credit Risk (CR)	RWA ^{CR}	St'ed Appr.	RW ¹ (regul. segment, ext. rating) x 8%	} x EaD ^{Ex-/Internal}
		IRBA	K (PD ^{Internal} , R, ...) * LGD ^{Ex-/Internal}	
2. Market Risk (MR)	RWA ^{MR}	St'ed Appr.	RW ¹ (regul. segment, instrument characteristics)	} x 12.5
		Internal	$VaR_{99\%,10d}^{Internal} = \max \{VaR_{10,1\%,t-1}; \frac{m_c}{60} \cdot \sum_{i=1}^{60} VaR_{10,1\%,t-i}\}, 3 \leq m_c \leq 4$	
3. Operational Risk (OpR)	RWA ^{OpR}	Basic/ St'ed	Risk weight (regulatory segment) x Gross income	}
		Internal	$VaR_{99.9\%,1Y}^{AMA} = VaR(severity, frequency)$	

Basel II concepts

3 Pillar concept

1 2 3



Basel III Capital Standards

- When implemented, banks must hold a capital conservation buffer plus old RBC minimums.

$$\text{CET1} = \frac{\text{Common Equity Tier 1 Capital}}{\text{Risk-weighted Assets}}$$

- Minimum capital requirements

	Basel II Minimum	Basel III Rule		
		Minimum	Buffer	Total
Tier 1 capital/risk-weighted assets	4%	6.0%	2.5%	8.5%
Total capital/risk-weighted assets	8%	8.0%	2.5%	10.5%
Leverage ratio	4%	4.0%	–	–
CET1 ratio	–	4.5%	2.5%	7.0%

Risk capital requirements approaches

CRSA

Based on external ratings

Supervisory risk weights

No specific minimal requirements

No permission needed

IRBA

Based on internal ratings (with exceptions)

Individually calculated risk weights

Minimal requirements

Permission/approval required

Risk weights

Risk-weighted assets: **RW** * 8% * EaD * 12.5

(For comparison: RW=100% ↔ Basel I) Capital charge

1. Risk-sensitive (different to Basel I):

Borrower segment	Class External Rating	1	2	3	4	5	6	Unrated
		AAA to AA-	A+ to A-	BBB+ to BBB-	BB+ to BB-	B+ to B-	Less than B-	
I	Central governments	0%	20%	50%	100%	100%	150%	100%
II	Financials	20%	50%	100%	100%	100%	150%	100%
III	Covered bonds	10%	20%	50%	50%	50%	100%	50%
IV	Corporates	short-term	20%	50%	100%	150%	150%	100%
		long-term	20%	50%	100%	100%	150%	100%
V	Multi-lateral development banks	20%	50%	50%	100%	100%	150%	50%
VI	Mutual funds shares	20%	50%	100%	100%	150%	150%	100%
	Regional governments/ local administrations	Analog to I and II	Other public entities		Analog to I and II, else 100%	Other positions		

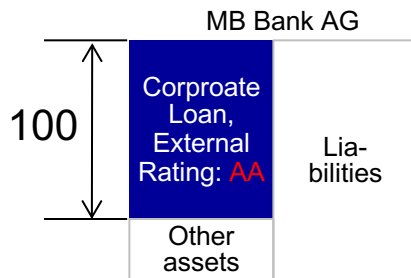
2. Not risk-sensitive (same as in Basel I):

International organisations	0%	Residential Mortgage	35%	Cash	0%
Retail	75%	Commercial mortgage	50%	Past due items	20%
Participations	100%	Loans to property savers	50%	Tangible assets	100%

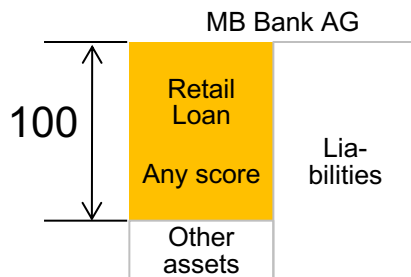
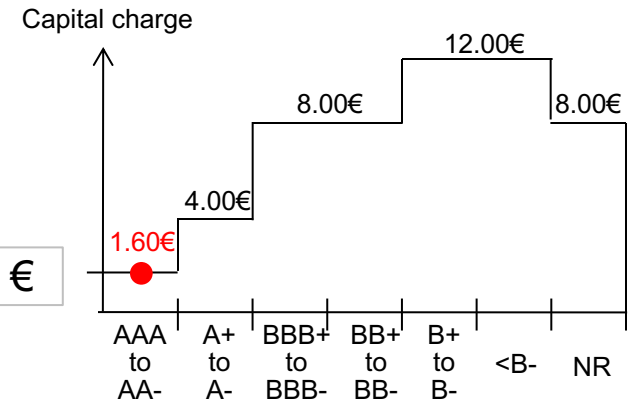
Risk weights

Risk-weighted assets: $RW * 8\% * EaD * 12.5$
 Capital charge

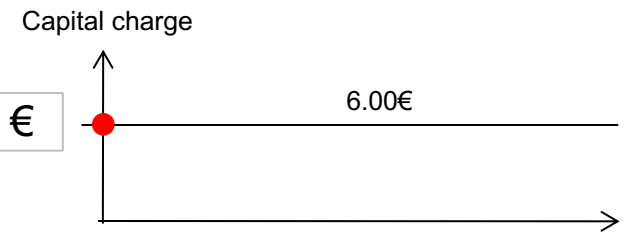
Borrower segment	Class External Rating	1	2	3	4	5	6	Unrated
		AAA to AA-	A+ to A-	BBB+ to BBB-	BB+ to BB-	B+ to B-	Less than B-	
IV Corporates	short-term	20%	50%	100%	150%	150%	150%	100%
	long-term	20%	50%	100%	100%	150%	150%	100%
Retail		75%						
Residential mortgage		35%						



$20\% * 8\% * 100 = 1.60 \text{ €}$
 Capital charge



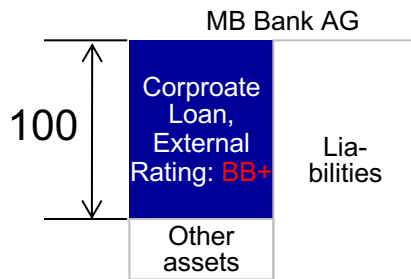
$75\% * 8\% * 100 = 6.00 \text{ €}$
 Capital charge



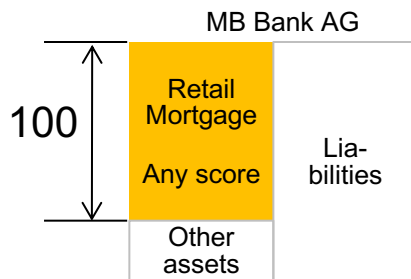
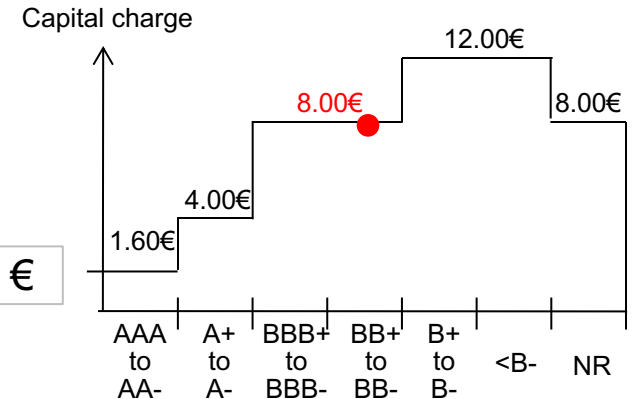
Risk weights

Risk-weighted assets: $RW * 8\% * EaD * 12.5$
 Capital charge

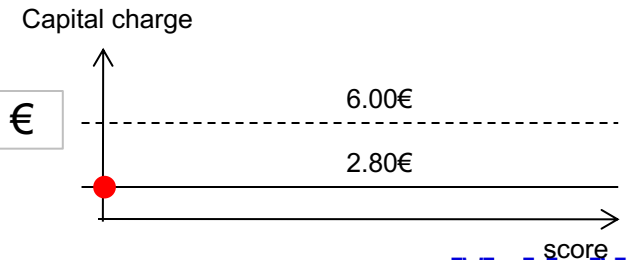
Borrower segment	Class External Rating	1	2	3	4	5	6	Unrated
		AAA to AA-	A+ to A-	BBB+ to BBB-	BB+ to BB-	B+ to B-	Less than B-	
IV Corporates	short-term	20%	50%	100%	150%	150%	150%	100%
	long-term	20%	50%	100%	● 100%	150%	150%	100%
Retail		75%						
Residential mortgage					● 35%			



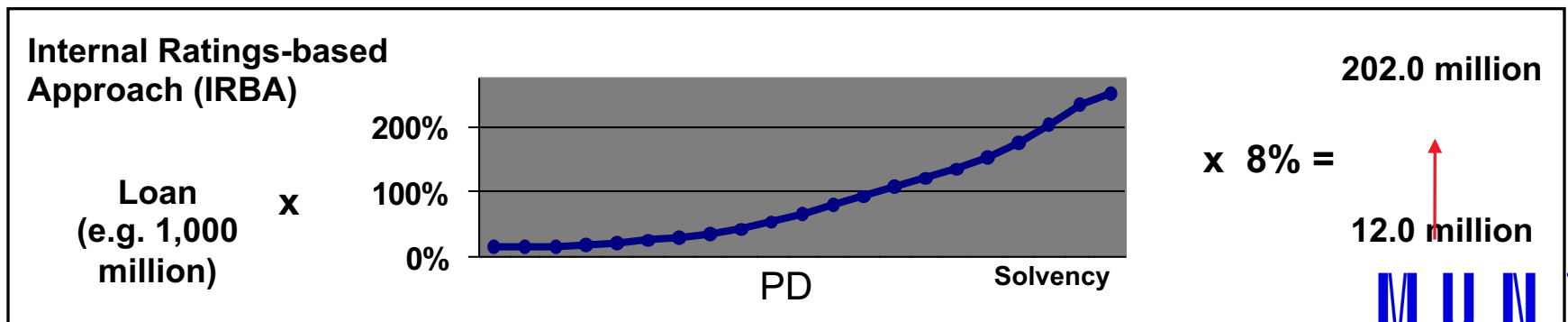
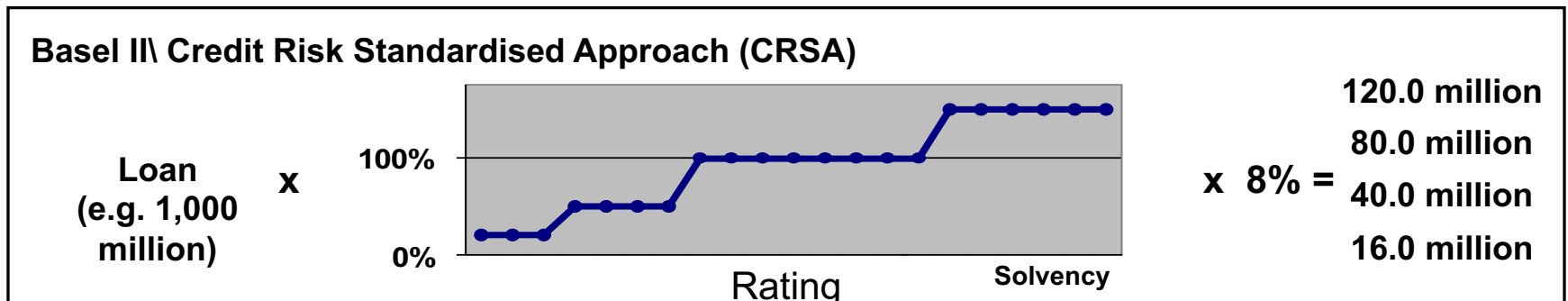
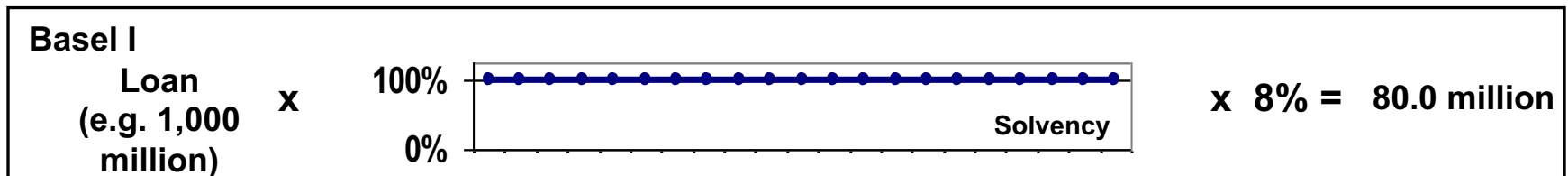
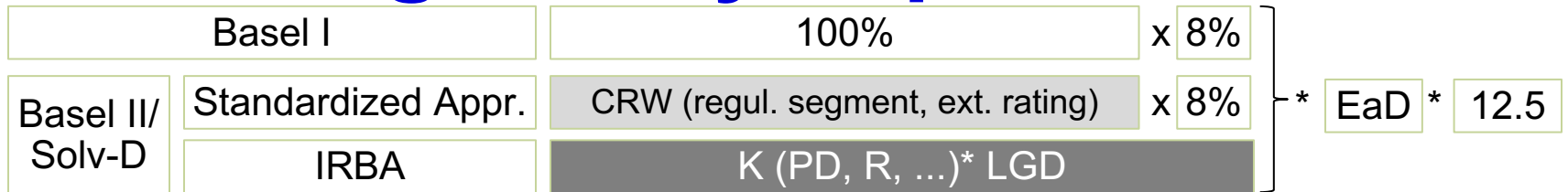
$100\% * 8\% * 100 = 8.00 \text{ €}$
 Capital charge



$35\% * 8\% * 100 = 2.80 \text{ €}$
 Capital charge



Bank regulatory capital



Internal rating based approach

1. Risk drivers

PD = Probability of Default
EaD = Exposure at Default
LGD = Loss Given Default
M = Maturity

In part, compute its own estimates, in part, given by supervision; which components have to be estimated, **depends on the exposure class** and the selected approach (Foundation Approach vs Advanced Approach)

2. Risk weighting formula

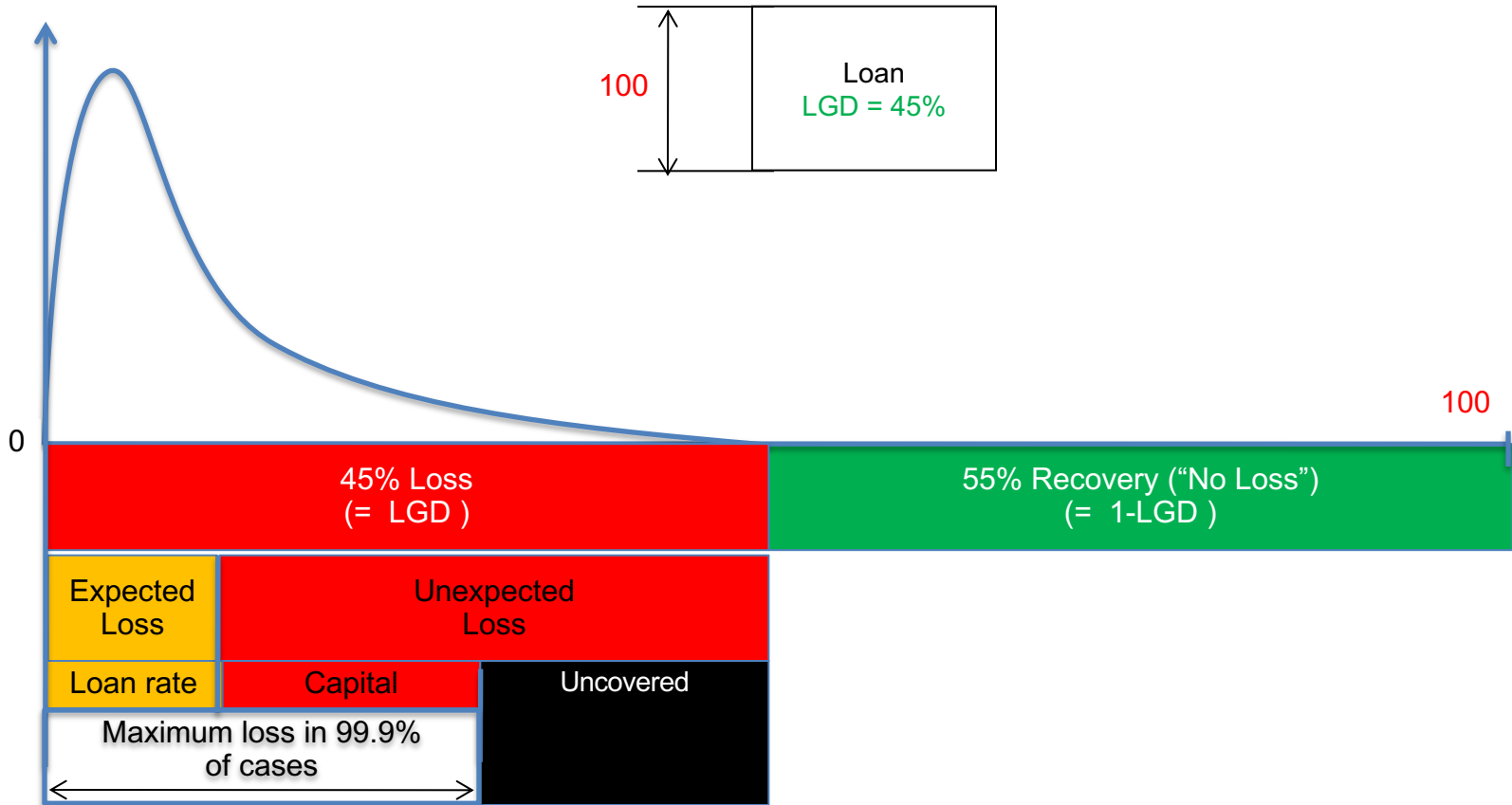
defines, how the risk components are converted into risk-weighted assets; bases upon credit risk model; dependant on the exposure class and the selected approach (Foundation Approach vs Advanced Approach)

3. Minimum requirements

Minimum standards, which have to be complied with appliance of the IRB Approach by a bank
Dependant on the exposure class and the selected approach (Foundation Approach vs Advanced Approach)

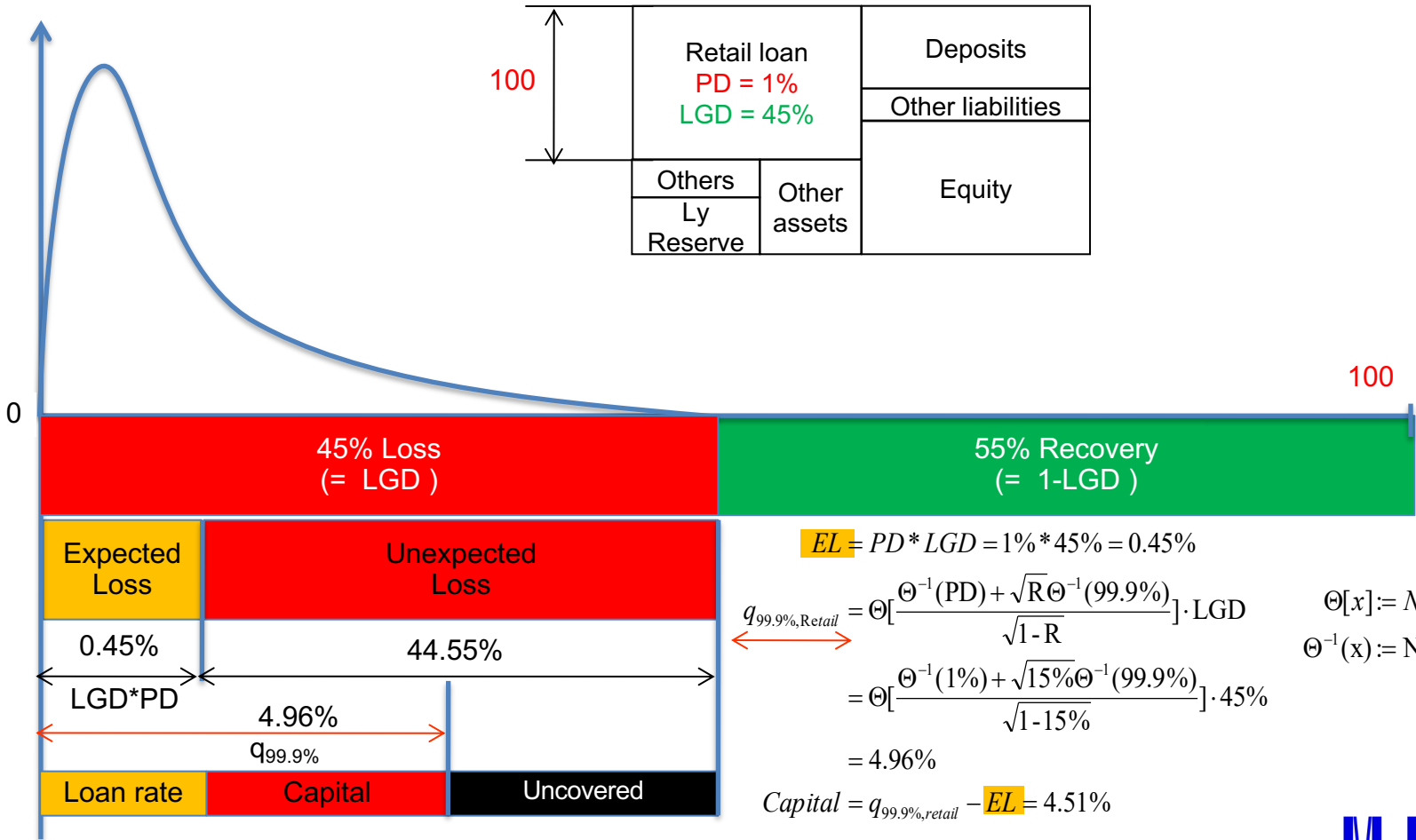
Internal rating based approach

Loss probability



Internal rating based approach

Loss probability

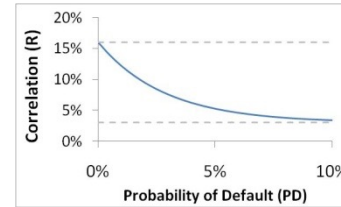


Internal rating based approach

Retail,
Non-mortgage

$$R = 3\% \cdot \frac{1 - e^{-35 \cdot PD}}{1 - e^{-35}} + 16\% \cdot \frac{1 - (1 - e^{-35 \cdot PD})}{1 - e^{-35}}, \quad 3\% \leq R \leq 16\%$$

$$K = \left[\Theta \left[\frac{\Theta^{-1}(PD) + \sqrt{R} \Theta^{-1}(99.9\%)}}{\sqrt{1-R}} \right] - PD \right]$$



Corporates

$$R = 12\% \cdot \frac{1 - e^{-50 \cdot PD}}{1 - e^{-50}} + 24\% \cdot \frac{1 - (1 - e^{-50 \cdot PD})}{1 - e^{-50}} - \begin{cases} 4\% \cdot \left(1 - \frac{TAS - 5}{45}\right) & \text{SME} \\ 0 & \text{Non-SME} \end{cases} \quad \begin{matrix} 8\% \dots 12\% \leq R \leq 20\% \dots 24\%, \\ \text{ATS} = 5\text{m€} \dots 50\text{m€} \end{matrix}$$

$$b = (11.852\% - 5.478\% \cdot \ln(PD))^2$$

$$M = \min(5Y, \max(1Y, Duration))$$

Maturity
Adjustment

$$K = \left[\Theta \left[\frac{\Theta^{-1}(PD) + \sqrt{R} \Theta^{-1}(99.9\%)}}{\sqrt{1-R}} \right] - PD \right] \cdot \left[\frac{1 + (M - 2.5)b}{1 - 1.5b} \right] \cdot \begin{cases} \frac{8\%}{10.5\%}, \text{SME} \\ 1, \text{Non-SME} \end{cases}$$

CRR-SME-multiplier
CRR, Article 501(1)

Risk weight

$$RW^{internal} = \frac{1}{8\%} \cdot K \cdot \begin{cases} LGD^{Regulatory} & \text{IRBA-Foundation [45\%: first, 75\%: subordinated, 12.5\%: lien]} \\ LGD^{Internal} & \text{IRBA-Advanced} \end{cases}$$

Required capital

$$\text{Required capital} = EaD \cdot RW^{internal} \cdot 8\% \quad (\text{Note: Standardised Approach: } RW^{external} \text{ (segment, external rating)})$$

Risk-weighted
assets

$$RWA^{Credit risk} = 12.5 \cdot \text{Required capital}$$

Total Capital Ratio

$$TCR = \frac{\text{Capital}^{Tier 1 + Tier 2 + Tier 3}}{RWA^{Credit risk} + RWA^{Market risk} + RWA^{Operational risk}}$$

Regulatory capital overview

Pillar 1 (CRR)		Pillar 2	Pillar 3 (CRR)
<ul style="list-style-type: none"> • Finance department: regulatory reporting • Treasury: ensure compliance 		<ul style="list-style-type: none"> • Sound risk management processes, methods, systems, governance 	<ul style="list-style-type: none"> • Disclosure => www....
<ul style="list-style-type: none"> • Regulatory capital- and liquidity adequacy: 		<ul style="list-style-type: none"> • Internal capital- and liquidity adequacy: 	
<ul style="list-style-type: none"> • RWA: only credit-, market and operational risk • External model (standardized approach) or approved internal model 		<ul style="list-style-type: none"> • Risk-bearing capacity/ Internal capital adequacy 	
Core Equity Tier 1 - ratio	$\frac{\text{Core Equity Tier 1}}{RWACR + RWAMR + RWA_{OpR}} \geq 4.5\% + 2.5\% + x\%^1 + y\%^2$	<p>All available financial resources $\geq 100\%$</p> $\frac{VaR^{Group}}{VaR^{CR} + VaR^{MR} + VaR^{OpR} + VaR^{Business} + \dots} \geq 100\%$ <p style="text-align: center;"> </p>	
Tier 1 – ratio	$\frac{\text{+ additional Tier 1 Core Equity Tier 1}}{RWACR + RWAMR + RWA_{OpR}} \geq 6\% + 2.5\% + x\%^1 + y\%^2$		
Total capital-ratio	$\frac{\text{+ Tier 2 capital + additional Tier 1 Core Equity Tier 1}}{RWACR + RWAMR + RWA_{OpR}} \geq 8\% + 2.5\% + x\%^1 + y\%^2$		
Leverage ratio	$\frac{\text{+ additional Tier 1 Core Equity Tier 1}}{\text{Total assets} + z\% \cdot \text{OBS}^4} \geq 3\%$		
Liquidity Coverage ratio	$\frac{\text{Liquidity buffer}}{\text{Outflows} - \text{Inflows}} \geq 100\%$	<ul style="list-style-type: none"> • Own capital definition • Internal models (models do not need approval from regulator) • Diversification effects possible (aggregation) 	
Net Stable Funding ratio	$\frac{\text{Long-term funding}}{\text{Long-term investments}} \geq 100\%$	<ul style="list-style-type: none"> • Internal models for cash flows • For risk management and planning • Internal stress tests 	

¹⁾ x% : buffer for systemically important financial institutions (SIFI), 1% - 3.5%

²⁾ y% : countercyclical buffer for slowing down lending, 0% - 2.5%

⁴⁾ OBS: Off-Balance sheet items

Capital Requirements and Bank Operating Policies

Limiting Asset Growth:

- Minimum capital requirements restrict bank's ability to grow. Additions to assets mandate additions to capital to meet minimum capital-to-asset ratios.
- Each bank must limit asset growth to some percentage of retained earnings plus new external capital.
- Must determine growth strategy while meeting minimum capital requirements. Higher ROA is one option:

$$\text{Undivided profits} = \text{Total assets} \times \text{ROA} \times (1 - \text{dividend payout rate})$$

- The relationship for internally generated capital:

TA = total assets
 EQ = equity capital
 ROA = return on assets
 DR = dividend payout rate
 EC = new external capital

$$\Delta TA/TA_1 = \Delta EQ/EQ_1$$

$$\Delta TA/TA_1 = (EQ_2 - EQ_1)/EQ_1$$

$$= \frac{EQ_1 + ROA(1 - DR) \times TA_2 + \Delta EC - EQ_1}{EQ_1}$$

$$= \frac{ROA(1 - DR) + \Delta EC/TA_2}{[EQ_2 - ROA(1 - DR) \times TA_2 - \Delta EC]/TA_2}$$

$$\Delta TA/TA_1 = \frac{ROA(1 - DR) + \Delta EC/TA_2}{EQ_2/TA_2 - ROA(1 - DR) - \Delta EC/TA_2}$$

$$\Delta TA/TA_1 = \frac{ROA(1 - DR) + \Delta EC/TA_2}{EQ_1/TA_1}$$

Capital Requirements and Bank Operating Policies

- Changing the Capital Mix
 - Internal versus external capital
- Changing Asset Composition
 - Shift from high-risk to lower-risk categories
- Pricing Policies
 - Raise rates on higher-risk loans
- Shrinking the Bank
 - Fewer assets requires less capital

Characteristics of External Capital Sources

- Subordinated debt advantages:
 - Interest payments are tax-deductible.
 - Shareholders do not reduce proportionate ownership.
 - Generates additional profits as long as earnings before interest and taxes exceed interest payments.
- Subordinated debt disadvantages:
 - Does not qualify as Tier 1 or core capital.
 - Interest and principal payments are mandatory.
 - Many issues require sinking funds.
 - Fixed maturity and banks cannot charge losses against it.

Contingent Convertible Capital

- Common stock advantages:
 - No fixed maturity and thus a permanent source of funds
 - Dividend payments are discretionary
 - Losses can be charged against equity
- Common stock disadvantages:
 - Dividends are not tax-deductible
 - Transactions costs on new issues exceed new debt costs
 - Shareholders sensitive to earnings dilution and possible loss of control in ownership
- Trust Preferred Stock:
 - Hybrid form of equity capital at banks
 - Effectively pays dividends that are tax deductible
 - To issue the security, bank establishes a trust company
 - Trust company sells preferred stock to investors and loans the proceeds of the issue to the bank.
 - Interest on the loan equals dividends paid on preferred stock
 - Interest on loan is tax deductible such that the bank deducts dividend payments.
 - Counts as Tier 1 capital

Bank Optimal Capital Structure

Gropp and Heider (2010):

- Capital regulation constitutes the overriding departure from the Modigliani and Miller propositions (theoretically)
- Determinants of firms' capital structures also apply to large publicly traded banks, except for the banks close to the minimum capital requirement
- Banks that would face a lower cost of raising equity at short notice (profitable, dividend paying banks with high market to book ratios) tend to hold significantly more capital.
- Banks have stable capital structures at levels that are specific to each individual bank
- Banks' capital structures are the outcome of pressures emanating from shareholders, debt holders and depositors
- Capital regulation and buffers may only be of second-order importance in determining the capital structure of most banks

Literature

- KOCH, T.W. and S.S. MacDONALD (2015). Bank Management. Chapters 10, 12.
- CHOUDRY M. (2022). The Principles of Banking, 2nd ed. – Chapter 3
- HORVÁTOVÁ, Eva. Ekonomika a riadenie bánk. S. 3-26.
- ECB (2016). Recent developments in the composition and cost of bank funding in the euro area. *ECB Economic Bulletin*, 1, pp. 26-45.
- GROPP, R. and F. HEIDER (2010). The Determinants of Bank Capital Structure. *Review of Finance*, 14, pp. 587-622.