# Capital requirements

### Motivation

- The financial and crisis is primarily due to excessive lending, and the lowering or credit standards
- The focus was initially on how to solve the crisis. Gradually, the focus is shifting toward better regulation to prevent the occurrence of similar crisis in the future.
- At the core of the regulation, is the banks behavior. Lower risk-taking could be achieved by, among other things:
  - Better incentives structures. Feasible?
  - Preventing banks from taking excessive risk. Role of capital requirements.

### Capital regulation

banks are required to hold more capital when they lend more, or lend to riskier borrowers

Reasons for capital regulation:

- Because of deposit insurance, the losses resulting from a bank default are not borne by the shareholders or bondholders. Hence, the costs of failure are not fully internalized, which induces excessive risk-taking. Capital requirements act as a buffer in case of losses.
- Incentives alignment: by increasing the economic exposure of shareholders, capital regulation boost their incentives to monitor the management.
- Capital requirements will prevent banks from taking too much risks: the riskier the lending, the higher the capital to be raised

### Lecture plan

- How does capital requirements works?
- What are the problems with the current system ?
- Possible solutions and better regulation

### Basel I

- Since 1978, bank capital has become a focal point of bank regulation
- With increasing international competition among banks, regulators have recognized the need to coordinate capital requirements for banks across countries
- In 1987, the Bank of International Settlements provided capital standard for all banks in US, Japan and the 10 Western European countries
- The accord was fully implemented in 1993
- Relates required capital to the composition of the bank's assets

### Basel I

• The minimum capital ratio is 8% of the risk-weighted assets

 $Capital \ge 0.08 \sum C_i A_i$  $Tier1\_capital \ge 0.04 \sum C_i A_i$ 

wher C is the risk-weight of each risk bucket, and A is the total assets in that category

- Tier-1 capital (core capital): Equity, disclosed reserves
- Tier-2 capital (supplemantary capital): undisclosed reserves, subordinated debt, etc.

#### **Risk-weighting**

- 0% weight: loan to OECD banks, sovereign debt
- 20% weight: non-OECD bank debt
- 50% weight: mortgages
- 100% weight: corporate debt

### Merits of Basel I

- Substantial increase in capital ratios
- Simple structure
- Worldwide adoption
- Increased competitive equality among international banks

## Criticisms

- The risk classes are incoherent: Mortgages require half the capital of business loans, although it is not hard to find mortgages that are more risky
- Interest-rate risk is not taken into account
- Assumption that banking risk is the same in different countries
- No recognition of the portfolio aspects of bank balance sheets since requirements are linear in individual asset categories

### Basel II mian objectives

- Adopt more risk-sensitive capital requirements
- Make greater use of bank's own internal risk assessments
- Cover a more comprehensive set of risks, including credit risk, interest rate risk and operational risk
- Account for the risk mitigation efforts of banks

### Basel II timeline

- 1996: Amendment to Basel I to incorporate market risk
- 1999: A new capital adequacy framework discussion paper
- 2001: A new capital adequacy framework revised draft
- 2003: Third draft
- 2004-2007: Additional refinements and final draft
- 2006-2007: start of the implementation
- Now: in doubt

### Basel II: The three pillars



### **Pillar I: Introduction**

#### Recognition of drivers of credit risk

Example: Loan to Tesco of £500,000, of which £100,000 is collateralized by UK government bonds, maturity 3 years.

Basel II tries to take into account:



## Types of banks



### Standardised approach

- The objectvie is to have a wider differentiation of risk weights.
- Simplest of the three approaches
- Supposed to be used by most banks
- Uses risk buckets, but refined compared to Basel I

### Standardised approach

	AAA- to AA-	A+ to A-	BBB+ to BBB-	BB+ to B-	Below B-	Unrated
OECD Sovereign	0%	0%	0%	0%	0%	0%
Banks	20%	20%	20%	20%	20%	20%
Corporate	100%	100%	100%	100%	100%	100%
Basel II						
Sovereign	0%	20%	50%	100%	150%	100%
Banks	20%	50%	50%	100%	150%	50%
Corporate	20%	50%	100%	100%	150%	100%

### IRB approach

- Relies on bank's assessment of risk factors
- Based on three main elements:
  - risk components (Pr(default), loss given default, exposure at default)
  - risk weight function
  - minimum requirements
- Separate approach for each portfolio of assets
- Subject to supervisory approval

### IRB approach

Component	FIRB	AIRB	
Pr(default)	bank	bank	
LGD	45%	bank	
EAD	100%	bank	
Maturity	2.5 years	bank	
Correlation	built into risk weight function		

### IRB approach

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

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$$MA = \left(\frac{1}{1 - 1.5b}\right) \left(1 + (M - 2.5)b\right)$$

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$$b = (0.11852 - 0.05478\ln(PD))^2$$

$$R = 0.12 \frac{1 - e^{-50PD}}{1 - e^{-50}} + 0.24 \left( 1 - \frac{1 - e^{-50PD}}{1 - e^{-50}} \right) - 0.04 \times (1 - (S - 5)/45)$$

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### Example: Sovereign Capital Charges

Type of

Sovereign OECD

non-

OECD

Risk Weight		Standardised bank risk weights	Sample e	est. FIRB bank ri	sk weigl	nts*Rating
0%	AA- or above	0%		Poland	25%	A2/BBB+
100%	Α	20%		Russia	68%	Baa3/BBB
	BBB	50%		Turkey	141%	-
	BB+ to B-	100%		Bulgaria	100%	B1/BB-
B-	150%	c	zech Republic	24%	Ba1/BBB-	
	unrated	100%		Hungary	24%	A1/A-

A1/A-

\* Inputs: average rating agency values for PD, LGD of 45%, supervisory value for EAD and M of 2.5. (Moody's rating applied if different from S&P)

### Market risk

- Banks are required to have procedures to assess and manage all material market risks. The assessment should be based on VaR modeling and stress testing.
- Example of risk: unexpected change in interest rates.

#### Interest rate change

- A shift in the term structure affects assets and liabilities differently
- Example: Bank balance sheet

The yield curve is flat at 10%.

Short-term Ioans	£40,000,000	Short-term liabilities	£60,000,000
Long-term Ioans	£40,000,000	Long-term liabilities	£10,000,000
Total assets	£80,000,000	Total liabilities	£70,000,000
		Equity	£10,000,000
		Total	£80,000,000

• Suppose the long-term interest rate rises to 12% and the short-term to 16%.

Then each £1 of short-term assets or liabilities decreases in value to £0.9482 and each £1 of long-term assets or liabilities decreases in value to £0.9646.

New balance sheet:

Short-term loans	£37,931,034	Short-term liabilities	£56,896,552
Long-term loans	£38,584,184	Long-term liabilities	£9,646,046
Total assets	£76,515,218	Total liabilities	£66,542,598
		Equity	£9,972,620
		Total	£76,515,218

The market value of equity falls by 0.27%

#### Improvements on Basel I

- Basel II increases risk sensitivity considerably
- Reduces the possibilities to exploit the capital regulation system
- Partially takes into account credit portfolio diversification
- Better incentives for appropriate risk mitigation techniques
- Lower capital requirements levels

### **Cyclical effects**

•Banks and cyclicality:

- Banks lend less during recession, which exacerbates economic downturns
- Banks are more willing to lend during periods of high GDP growth

•Basel II and cyclicality:

 During recessions, credit ratings deteriorate and banks are required to hold more capital, ans lend less

 During expansions, credit ratings improve and banks are required to hold less capital, and lend more

Hence, possible conflict between regulation and economic stability

#### Kashyap and Stein (2004)

- Capital requirements should be such that:
  - 1. Banks engage in positive NPV loans
  - 2. Banks do not default too frequently
- They find that a unique risk curve cannot deliver the first best
- Optimally, there should be several risk curves, for instance 99.9% in normal times and 99.5% during recessions



- They simulate the impact of Basel II on the 1998-2002 period
- Convert firms' ratings into a PD, and map the PD into capital charges
- Result: Large increases in capital requirements during the 1998-2002 period
- The cyclicality depends on the model considered to compute PD

### Problems with existing capital regulation

- Banks and cyclicality:
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  - Banks are more willing to lend during periods of high GDP growth
- •Basel II and cyclicality:
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Hence, possible conflict between regulation and economic stability