

## *Banking: Crises and Regulation*

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*Spring 2017*

### *Historical example: International banking and the Knights Templar*

An interesting early example of international banking is given by the Knights Templar. The main objective of this knights order was to provide protection for Christian pilgrims making their perilous journey to the holy lands, and its members were sworn to poverty similar to monks. Now you can imagine that during the Middle Ages, travelling from Europe to the Near East was a large undertaking, and carrying around a lot of cash to pay for accommodation and food was not safe. The Knights Templar therefore came up with an ingenious idea; a pilgrim could deposit cash at one of the order's churches and in return they would receive a letter of credit.<sup>1</sup> Using this letter of credit they could withdraw money at other churches of the order along the route to Jerusalem. The order was very successful in their undertaking and created a vast network across Europe. They even served as money lenders to kings who needed capital to finance their wars. For example, the English crown jewels were stored at Templar Church in London in the 1200s serving as collateral on a loan the King had made.

<sup>1</sup> During the Tang dynasty in China there was something similar.

### *Banks*

Over the centuries banks have evolved as financial intermediaries to the complex system of finance that we have now. The basics of banking are pretty straightforward and we will focus on two types of banking that are relevant to today's financial system.

1. Clearing house banks
2. Fractional reserve banking

But first let's zero in on why financial intermediaries such as banks are useful. There are a couple of reasons for this.

1. Pooling savings
  - Many savers deposit small amounts
  - Someone needing a big loan can go to a bank rather than searching for a saver who happens to have the right amount
2. Risk diversification

- Savers lending to a single borrower face idiosyncratic risk: if the borrower fails to pay back, they lose all their money
- A bank can lend to many borrowers and pass safe return to the saver

### 3. Maturity transformation

- Savers want to have access to their savings whenever they want
- This is inconvenient for a single borrower
- Banks are in better position to make these long-term loans

### 4. Information processing

- Banks can specialize in screening borrowers, processing and sharing information, and in writing sophisticated debt contracts<sup>2</sup>

<sup>2</sup> Although in the previous lecture we found out that credit rationing could occur.

### *Clearing house banks*

Suppose that one business day the following transactions occur

- Bank A's depositors have their accounts credited with €10 million from Bank B's depositors
- Bank B's depositors will be credited with €9 million from Bank A's depositors

To keep the books balanced one could deploy couriers transferring the money between the banks, €19 million. However, this is risky as money can be lost or the courier can get robbed. To solve these issue people came up with the concept of a clearing house bank which settles the accounts. How does this work?

- At the end of the day the clearing house will order the transfer of €1 million from Bank B to Bank A
- More efficiently you can deduct the €1 million from the ledger entry for Bank B's account and add it to Bank A's
- All deposits still fully backed by the cash in the vaults

These clearing house banks were the forerunners of today's central banks.<sup>3</sup>

<sup>3</sup> The earliest example of this type of bank was the Wisselbank in Amsterdam.

### *Fractional reserve banking*

Most of the time only a small fraction of a bank's total deposits will be demanded on any given time. Consider in our example that Bank

"most" being an important qualifier here.

B, despite having €10 million in claims against it, only needs to transfer €1 million at the end of the day. This means that not all the cash has to be in the vault in order to back up the deposits; some of it can be used for loans while keeping some cash reserves to deal with day-today demand. This practise is called fractional reserve banking. In the wake of the Great Recession, the practice of fractional reserve banking has received some criticism due to the fact that the depositor's money might actually not be at the bank. Nonetheless, there are some important advantages with regard to fractional reserves

It is called fractional reserve banking because they only keep a fraction of the money you've deposited with them on reserve in case people come to withdraw their money.

#### 1. Saves depository money

- Banks can charge interest on loans
- Without this interest income fees for depositors would be higher if the bank would to make a profit

#### 2. Banks serve as an intermediary

- Between those that have money and those that need to borrow money
- This is a crucial aspect of the modern economy

Nonetheless, there are indeed also an important disadvantage of fractional reserve banking which has the potential for instability

- Banks are supposed to have assets greater than liabilities owed to non-investors<sup>4</sup>
- It could be the case that the bank makes loans to borrowers who default
- When customers suspect that the bank does not have the assets to pay back money they might want to have their money back
- This could lead to a run on the bank: many depositors want their money back.
- Many banks are unable to cope with bank runs

<sup>4</sup> i.e. have positive bank capital.

Therefore, fractional-reserve banking systems are subject to occasional periods of instability.

### *Bank balance sheets*

The assets and liabilities of a bank are listed on its balance sheet.

- liabilities show the sources of the bank's funds
- assets show the uses of the funds

Maturity mismatch is a standard feature of banking. People who supply funds want to have it available for return at shorter terms than the people who the bank lends the money to. In the past government imposed regulations to limit maturity mismatch but these have been lifted over the years. Most banks are vulnerable to situations where large amount of liabilities have to be paid back over a short time period.

## 1. Assets

	Total	Loans to euro area residents			Holdings of debt securities issued by euro area residents			Holdings of equity and non-MFI investment fund shares	External assets	Fixed assets	Remaining assets
		Total	General government	Other euro area residents	Total	General government	Other euro area residents				
	1	2	3	4	5	6	7	8	9	10	11
Outstanding amounts											
2015	25,853.1	11,737.6	1,110.2	10,627.4	4,024.5	2,728.2	1,296.3	779.3	5,034.5	212.7	4,062.1
2016	26,689.0	11,853.6	1,079.6	10,774.0	4,604.6	3,229.4	1,375.2	783.2	5,213.3	203.1	4,018.0
2016 Q3	26,990.4	11,855.5	1,098.8	10,756.7	4,516.1	3,156.1	1,359.9	776.5	5,269.7	210.1	4,349.3
2016 Q4	26,689.0	11,853.6	1,079.6	10,774.0	4,604.6	3,229.4	1,375.2	783.2	5,213.3	203.1	4,018.0
2016 Nov.	27,170.3	11,922.0	1,089.1	10,833.0	4,607.1	3,223.1	1,384.0	772.1	5,455.8	208.6	4,191.3
2016 Dec.	26,689.0	11,853.6	1,079.6	10,774.0	4,604.6	3,229.4	1,375.2	783.2	5,213.3	203.1	4,018.0
2017 Jan.	26,778.4	11,876.5	1,097.5	10,779.0	4,660.2	3,268.0	1,401.2	786.4	5,381.0	201.8	3,849.8
2017 Feb. <sup>(*)</sup>	27,032.5	11,885.5	1,076.4	10,809.1	4,717.1	3,312.6	1,404.4	789.0	5,486.8	200.9	3,939.6

## 2. Liabilities

	Total	Currency in circulation	Deposits of central government	Deposits of other general government/ other euro area residents	Money market fund shares <sup>(*)</sup>	Debt securities issued <sup>(*)</sup>	Capital and reserves	External liabilities	Remaining liabilities	Excess of inter-MFI liabilities over inter-MFI assets
	1	2	3	4	5	6	7	8	9	10
Outstanding amounts										
2015	25,853.1	1,048.9	227.4	11,533.9	465.2	2,318.6	2,548.7	3,662.8	4,096.8	-49.3
2016	26,689.0	1,087.3	252.4	11,907.1	506.3	2,228.3	2,659.2	4,053.7	4,032.6	-37.9
2016 Q3	26,990.4	1,066.5	297.4	11,779.8	486.9	2,220.0	2,697.8	4,087.2	4,400.4	-45.5
2016 Q4	26,689.0	1,087.3	252.4	11,907.1	506.3	2,228.3	2,659.2	4,053.7	4,032.6	-37.9
2016 Nov.	27,170.3	1,071.1	300.4	11,847.2	512.3	2,238.9	2,662.7	4,336.2	4,256.4	-54.8
2016 Dec.	26,689.0	1,087.3	252.4	11,907.1	506.3	2,228.3	2,659.2	4,053.7	4,032.6	-37.9
2017 Jan.	26,778.4	1,075.4	316.2	11,879.4	519.6	2,215.8	2,644.7	4,258.2	3,882.1	-13.1
2017 Feb. <sup>(*)</sup>	27,032.5	1,078.4	298.4	11,894.8	514.2	2,225.3	2,696.3	4,386.9	3,958.0	-19.7

Figure 1: Aggregated balance sheet of the Euro area monetary financial institutions (MFI), amount in billions. Source: European Central Bank

## Banking crises and their consequences

Banks make a profit by charging higher interest rates on loans than they pay out on deposits. There are some risks however.

- Borrowers don't pay back loans
- Sometimes bad investments are made in stocks and bonds
- Other assets invested in lose much of their value

These risks might lead to a situation where the bank has negative equity capital<sup>5</sup> This might trigger a bank run when it is suspected that the bank is insolvent, where depositors fear that they might not get their money bank. Some recent examples of bank runs include

- 2001 in Argentina during the economic crisis (1999-2002)
- 2007 Northern Rock in the UK, first advanced economy bank run since the 1930s
- 2009 there was a bank run on the DSB bank in the Netherlands, which was caused by a single man.
- 2015 a bank run occurred in Greece after the banks had a two week holiday
- 2015 saw failure of the two biggest banks in Cyprus

A couple of things happen during a bank run.

1. Banks starts paying off depositors selling off most liquid assets<sup>6</sup>
2. Subsequently the bank has to sell non-liquid assets, which are not easily turned into cash<sup>7</sup>

<sup>5</sup> I.e. the assets go below what it owes to depositors and bond-holders.

<sup>6</sup> Cash, excess reserves at the central bank, government debt securities

<sup>7</sup> Long-term customer loans, property assets. Note that selling non-liquid assets quickly (fire sale) often requires having to sell these assets at a lower price than normal.

Bank runs are often triggered by the, assumed, insolvency of the bank, which will make the bank even more insolvent. Since a bank run can be triggered by just rumours, banks and governments are always quick to declare that the banks are fully solvent. The main concern of a bank run is not the fate of a single bank but mainly the risk of contagion. A single bank failing can be inconvenient, but poses in itself not a major problem but it does put other banks under pressure which can cause more serious problems. Now for depositors banks probably look the same, and the failing of one bank can lead to doubts about the banking system as a whole. Bank failures therefore often come in batches, making the whole system unstable.

### *Credit implications of a bank run*

A main consequence of a banking crisis is that it usually leads to severe restrictions on the availability of credit, both for firms and households. We can examine what happens during a banking crisis using a stylised balance sheet.

Assets (use of funds)	Liabilities (source of funds)
Loans	Deposits
Securities	Other borrowings
Cash and reserves	Equity capital

Table 1: Stylised bank balance sheet

By definition we have

$$\begin{aligned} \text{Loans} = & \text{Deposits} + \text{Other Borrowings} + \text{Equity Capital} \\ & - \text{Cash and reserves} - \text{Securities} \end{aligned}$$

A banking crisis likely leads to a credit squeeze, due to the movement in the factors in the equation above leading to a lower quantity of loans. Let's have a look at how these factors are affected

#### 1. Loans

- Hard for bank to call in loans
- When loan is paid off, bank will keep funds as cash, reserves, or invest in securities
- Or pay off deposit outflows or maturing bond liabilities
- Don't make new loans

#### 2. Deposits

- Customers prefer to keep cash at home

- Banks will have less funds to loan
3. Other borrowings
    - Bond markets/other fund providers likely reluctant to lend to banks, worrying they might fail
  4. Cash and reserves
    - Large amounts of cash and reserves will be kept on balance sheet
    - Needed to survive a potential bank run
  5. Securities
    - Banks will prefer to shift towards securities that can be quickly sold to raise cash

The result is a credit crunch which is caused both by the behaviour of both the bank and its customers. As such, the bank will no longer be in a position to lend to borrowers and financial intermediation breaks down. This can have adverse macroeconomic effects as financial intermediation is crucial for certain economic activities, and a banking crisis can lead to a severe recession, as the recent financial crisis has illustrated.

The modern banking system has a number of additional features that make current crises more difficult to deal with than in the past.

- Non-deposit funding
  - Deposit insurance tend to reduce risk of bank runs
  - Many banks obtain substantial non-deposit funding via bond markets or inter-bank money markets
  - These fund providers are more prone to run compared to sticky depositors
- Interbank linkages
  - Failure of one bank can lead to the failure of other banks
- Financial assets and negative feedbacks
  - Many banks have large financial asset holdings
  - The valuation of which are determined by the markets
  - During a crisis a negative feedback loop can occur involving banks selling assets, which tend to decline in value reducing the solvency of banks

For example, sectors such as construction and consumer durables suffer particularly; without credit access, business and consumer confidence suffer which has negative impacts.

These additional complications produced a range of new government interventions during the global financial crisis, many of which have been expensive for taxpayers.

### *Incentive problems in banking*

Another issue in modern banking is the image of bankers which has changed from risk-averse moneylenders to risk-loving gamblers. The incentives of the bank management can lead them to take risks that sometimes end up getting the banks into trouble such as

1. High leverage<sup>8</sup>
2. Many risky investments
3. Too much short-term non-deposit funding
4. Are too big

<sup>8</sup> Little equity capital relative to assets

### *Example: Running a bank*

To illustrate the risks emerging from the incentives of the bank management let's examine what running a bank looks like. Imagine that an investment group decides to start a bank with a starting capital of €10 million and to get things off the ground they do the following

- Spend €1 million on a retail branch network
- Offer 1% interest rate on deposits which attracts €50 million in deposits
- Use €50 million to make loans at an interest rate of 5%
- Keep €9 million in cash and reserves

The balance sheet will look like this

All figures in million €.

Assets (use of funds)		Liabilities (source of funds)	
Loans	50	Deposits	50
Branch network building	1	Equity capital	10
Cash and reserves	9		
Total	60		60

Table 2: Balance sheet

Like in any other business there are revenues and costs.

- Revenues
  1. Interest income from your loans: 5% of your €50 million
  2. Fees charged: €1 million
- Costs
  1. Interest on deposits: €0.5 million

Revenues		Costs	
Interest income	2.5	Interest paid	0.5
Fees	1	Running costs	1.5
Total	3.5		2

Table 3: Income statement

## 2. Running costs: €1.5 million

The bank's income statement will look like

Given this initial success, we are now going to try and expand the business, the following steps are taken

- €0.5 million is paid back to investors in dividends
- €1 million is used to make more loans
- €20 million is issued in debt securities to raise funds to make additional loans

Meaning that the balance sheet will now look like this

Since the bank got an investment of €10 million and made a profit of €1.5 million giving a Return on Equity of 15%.

Assets (use of funds)		Liabilities (source of funds)	
Loans	71	Deposits	50
Branch network building	1	Equity capital	11
Cash and reserves	9	Debt securities	20
Total	81		81

Table 4: Balance sheet after expanding the business

The goal of bank is to expand, but there is one small problem: some people don't pay back their loans. Suppose that of the €21 million that used for new loans €5 million went to a slightly narcissistic real estate developer who went bankrupt. This will have the following effect on the bank's balance sheet

Assets (use of funds)		Liabilities (source of funds)	
Loans	66	Deposits	50
Branch network building	1	Equity capital	6
Cash and reserves	9	Debt securities	20
Total	76		6

Table 5: Balance sheet after expanding the business

Can see that the assets exceed deposits and debts by only €6 million. There are a couple of points worth mentioning here.



1. Equity capital is risky; one bad loan removes a fair chunk
2. Investors will get paid dividends when there is a profit, but they are the first to lose money when there is a bad loan
3. Depositors and debt-holders have first claim to getting their money back

The main lesson here is that the bank needs to be very cautious in assessing the credit risk of a loan.

*Example: Comparing two banks of different size*

Having established some of the risks faced by a bank, we now move on to analyse how size matters in this respect. Again, suppose that a bank starts with an equity capital of €10 million does the following

- Pays 2% on deposits
- Charges 3% on loans
- Has a 10% of deposits reserve requirements

We will consider two cases here in terms of raising funds

1. Conservative (table 6)
  - €90 million is raised in deposits
2. Aggressive (table 7)
  - €90 million is raised in deposits
  - €100 million borrowed from international money markets<sup>9</sup>

<sup>9</sup> At a 2% interest rate.

Assets (use of funds)		Liabilities (source of funds)	
Loans	91	Deposits	90
Cash and reserves	9	Equity capital	10
Total	100		100

Table 6: Balance sheet starting with €100 million

Assets (use of funds)		Liabilities (source of funds)	
Loans	191	Deposits	90
Cash and reserves	9	Equity capital	10
		Borrowings	100
Total	200		200

Table 7: Balance sheet starting with €200 million

Using a more conservative approach in fund raising the profits of the bank will be

$$\begin{aligned}\Pi &= 3\% * 91 - 2\% * 90 \\ &= 2.73 - 1.8 = 0.93\end{aligned}$$

$$\text{Return on Equity} = 9.3\%$$

With a more aggressive approach, where the bank borrows money on the international market, the profits will be

$$\begin{aligned}\Pi &= 3\% * 191 - 2\% * 190 \\ &= 5.73 - 3.82 = 1.91\end{aligned}$$

$$\text{Return on Equity} = 19.1\%$$

Important to note is that the larger bank has a capital to assets ratio which is lower while the profits are higher, and thus also has a higher return to equity. The capital-asset ratio is often discussed in reversed terms as the assets-capital ratio which is called the leverage ratio. For the two banks we have leverage ratios of

1. 10 for the smaller bank: equity capital was 10% of total assets
2. 20 for the larger bank: equity capital was 5% of total assets

Main takeaway here is that it is not in the self-interest of the bankers to maintain sufficient capital levels to protect against losses as higher credit and liquidity risk means higher bank profits. There are two sets of incentives to consider here

#### 1. Investors

- People differ in the amount of risk they are willing to accept
- Shareholders of highly-leveraged banks be willing to lose all their money in the prospect of high returns most of the time
- By the time things go pear-shaped they may have made a decent enough return from all the dividends

#### 2. Bank management

- There are strong incentives for the management to take on high leverage, even when investors are risk averse
- E.g. profit-linked bonuses, which means that they want to maximise profit today
- When a bank blows up they don't have to pay back bonuses

Highly-leveraged banks make larger profits, but they also take on more risks. It has more credit risk since loans could go bad, and there is more liquidity risk as funds from the international money market could dry up.

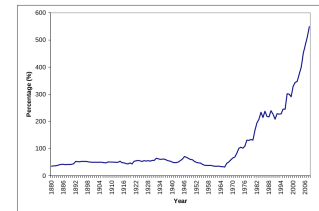
### *Too big to fail*

In terms of systemic risk a bank may be perceived to be too big to fail because its failure could bring down the whole financial system. This provides incentives for banks to grow larger as the larger they get the higher the probability that the state will intervene when things go wrong. An interesting paper on this topic is "Banking on the state" by Alessandri and Haldane (2009). They document how

- The banking sector has grown in size relative to the economy
- Banks have become more leveraged and less liquid
- Have engaged in more risky trading activities

Although profits are privatised, losses are public.

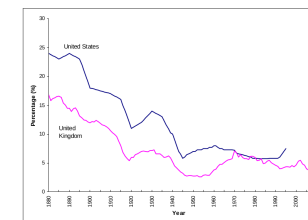
Chart 1: UK banking sector assets as % of GDP



Source: Sheppard, D. K. (1971) and Bank of England.

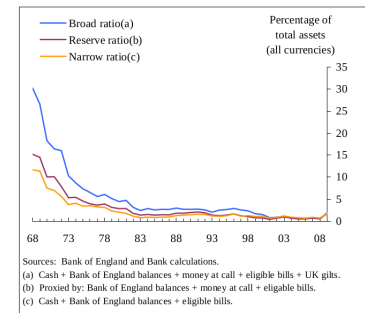
Note: The definition of UK banking sector assets used in the series is broader after 1966, but using a narrower definition throughout gives the same growth profile.

Chart 2: Capital ratios for UK and US banks



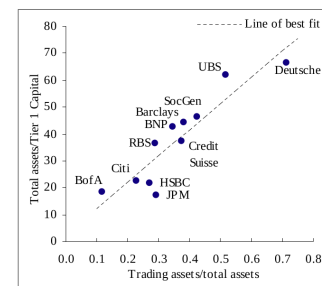
Source: US: Berger, A. Herring, R and Szegö, G (1999). UK: Sheppard, D.K (1971), BBA, published accounts and Bank of England calculations.

Chart 3: Sterling liquid assets relative to total assets



Sources: Bank of England and Bank calculations.  
(a) Cash + Bank of England balances + money at call + eligible bills + UK gilts.  
(b) Proxied by: Bank of England balances + money at call + eligible bills.  
(c) Cash + Bank of England balances + eligible bills.

Chart 8: LCFIs' trading portfolios and financial leverage – 2007



Sources: Published accounts and Bank calculations

### *Capital adequacy rules*

Due to the incentive structure banks will tend to be over-leveraged when no good regulation is in place. So in order to discourage banks from having assets too large relative to the amount of capital, regulators have used capital adequacy rules to ensure that banks have enough room to absorb losses when things go pear shaped, in order for the claims of depositors and senior bond-holders to be honoured. The capital adequacy requirements as they have been set out in the 1988 Basel Accord apply internationally. The Basel approach identifies two types of loss-absorbing classes of liabilities

1. Tier 1 capital: equity capital and highly subordinated bonds
2. Tier 2 capital: other subordinated bonds

Regulatory capital is the sum of these two types of capital and minimum requirements are set for how much of this capital a financial institution must have. When a bank has riskier assets, more regulatory capital is required, where the capital requirement is set as a fraction of the Risk Weighted Assets (RWA).

1. Total regulatory capital had to be a minimum of 8% of RWA
2. At least 50% of regulatory capital has to be Tier One capital
3. Tier One capital has to be at least 50% common equity

A shortcoming of the first Basel accord was that the risk weights were not representative of the actual risk being taken. Therefore, after many years of planning Basel II was implemented in 2004. The most important differences with regard to the original Basel accord include

- Larger selection of risk buckets; using ratings agencies risk assessments to better assess the risk of various types of assets
- Option of using an in-house Internal Ratings Based (IRB) approach to assessing the riskiness of assets
- Basel II assumed mortgages to be less risky
- Better public disclosure of financial account information

The original approach assigned risk weights of 0%, 10%, 20%, 50%, or 100% to different asset classes.

Example: suppose that a bank has €100 in cash (zero risk weight), €300 in bonds (20% risk weight), and €600 in mortgages (50% risk weight). In this case the bank has total assets of €1000 and risk-weighted assets equal €360, meaning that the bank requires regulatory capital at a minimum of  $8\% \times 360 = 28.8$

### Value at risk

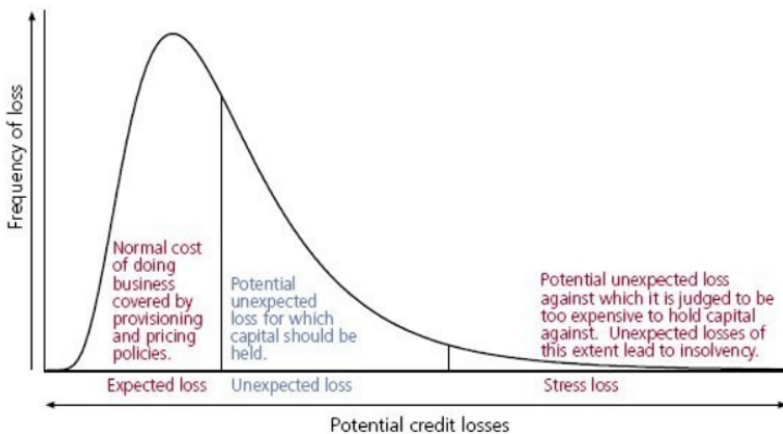


Figure 2: Illustration of distribution Value at Risk

A measure for the level of risk of the investments of a bank is the Value at Risk. The VaR estimates how much a bank could lose under normal market conditions using a statistical distribution of the bank's credit losses (illustrated in figure 2)

- Expected loss is the average of the distribution
  - Banks should deal with these by writing down part of their loans each year as loan loss provision
  - i.e. valuing assets at less than their current book value in anticipation of future losses
- Right hand side line (stress loss) is the extreme tail of the distribution
  - 1% tail is commonly used
  - e.g. at a weekly VaR of €50 million, there is 1% chance that your portfolio will lose more than €50 million over the course of a week

Using the IRB approach as set out by Basel II, banks are required to have a minimum level of regulatory capital equal to some multiple of the unexpected losses indicated by the VaR.<sup>10</sup>

<sup>10</sup> Usually by a factor of three.

$$\text{Capital required} = 3 * \text{VaR}$$

The Basel regulations also require banks to have capital equal to at least 8% of risk weighted assets. The VaR can be used to calculate the value of risk weighted assets as

$$\text{RWA} = \frac{3 * \text{VaR}}{0.08}$$

Some additional adjustments need to be made to arrive at the final RWA figure

1. An upward adjustment for market risk<sup>11</sup>
2. An adjustment for operational risk<sup>12</sup>

The VaR approach sounds straightforward enough, but there is a caveat with implementing it. For instance, the VaR figure is usually determined by using a distribution of past returns of the assets held. There are two issues with this approach.<sup>13</sup>

1. Estimation sample
  - True distribution is not known, can only be estimated from historical data
  - Banks mainly rely on using returns from recent years
2. Tail risk
  - Financial markets generate extreme losses more often than predicted by a normal distribution
  - Fat tails are not properly accounted for

<sup>11</sup> "...pertaining to interest rate related instruments, equities, foreign exchange risk and commodities risk."

<sup>12</sup> "...inadequate or failed internal processes, people and systems or from external events."

<sup>13</sup> VaR is also open to gaming by bank staff as this [New York Times](#) article discusses.

### *Macroprudential regulation*

Capital adequacy rules are intended to keep the banking system stable, but they can have the unintended consequence of worsening recessions by causing credit crunches. Consider a bank starting to incur serious losses on its loans and expecting to go below its Basel-consistent capital ratio. There are two courses of action that the bank could take

1. Raise more equity capital by selling shares to private investors
  - Would dilute the claim on future dividends of the current owners
  - With current management it is unlikely that they get a good price for the extra shares
2. Maintain the equity capital at its current level and instead reduce risk-weighted assets
  - Reduce assets; bank uses incoming loan payments to pay off liabilities instead of issuing new loans
  - Take less risk; invest new funds in government bonds rather than potentially risky customer loans

### *Systemic risk*

Interbank markets make it easier for banks to cope with reserve requirements

- by lending and borrowing short-term funds
- allowing banks with lots of deposits but without good loan opportunities to lend to banks with good loan opportunities but limited deposits

Interbank lending certainly provides some advantages, keeping the whole banking system oiled, but at the same time it also has the potential to make the whole system unstable. Consider a scenario where there are three banks (A,B,C) each with an equity capital of €10 million<sup>14</sup>

1. Bank A borrows €25 million from bank B
2. Bank B borrows €15 million from bank C
3. Bank A loses €35 million in loans, wiping out equity capital
4. A becomes insolvent → B loses €25 million
5. B becomes insolvent → cannot pay C
6. C becomes insolvent and has no equity capital left

<sup>14</sup> Note that this example is not entirely realistic as the amount of capital lost by the first bank is greater than the total amount of capital in the system.

The insolvency of one bank (A) brings down the whole banking system. This is known as systemic risk. Besides the vulnerabilities caused by interbank lending, there is another mechanism through which one bank in trouble can cause trouble for the whole system. Consider the following scenario

1. A bank in trouble starts selling liquid assets to pay off depositors/lenders
2. Bank's fire sale places downward pressure on asset prices
3. Other banks need to mark down value of their assets, due to regulation
4. Fire sale reduces equity capital → increasing risk other banks

These examples illustrate how the failure of a single bank poses a risk for the whole financial system causing instability either through

1. Contagion; through interbank lending
2. Spillovers; through asset sales

The point of capital rules is to keep individual financial institutions solvent, these rules are called prudential regulation: They are there to maintain stability by encouraging prudence. However, rules put in place to encourage each institution to be prudent can lead to the whole financial system becoming unstable. Consider this in relation with the business cycle:

1. During boom times asset prices increase, loans are paid back and this increases equity for banks
2. Equity increase allows banks to expand their operation acquiring new assets
3. With lots of demand, liquidity is not an issue and asset boom continues
4. Boom turn into busts however and eventually the cycles plays out and a recession arrives
5. Banks will worry about capital requirement and sell off assets
6. Asset sales drive down prices, eroding equity across the system.

One shortcoming in terms of regulation is that the capital adequacy rules are not adjusted to the fluctuations in the business cycle. This leads to the situation where banks can increase their leverage during the boom stages, yet the regulatory capital ratio doesn't show that they are taking big risks. To deal with this behaviour using regulation would require that during the boom period a banks needs to have higher capital ratios (lower leverage) and during recession the capital ratio could be lowered (higher leverage) to prevent fire sales.

An increase in asset prices induces financial institutions to borrow in order to buy more assets, while a decrease in asset prices triggers the selling of assets. With liquidity and fire sale effect this can lead to a downward spiral.

### *What is Macro-prudential policy?*

So with the knowledge of today, what should be part of good macro-prudential policy? According to a paper by Hanson et al. good policy should include<sup>15</sup>

1. Time-varying capital requirements
  - Higher capital ratios in good times than bad times
  - Retain earnings and build up capital during booms
  - Allow lower ratios in recessions.
2. Higher quality capital
  - Higher requirements for regular common equity to increase immediate loss absorption capacity

<sup>15</sup> ["A Macroprudential Approach to Financial Regulation"](#)

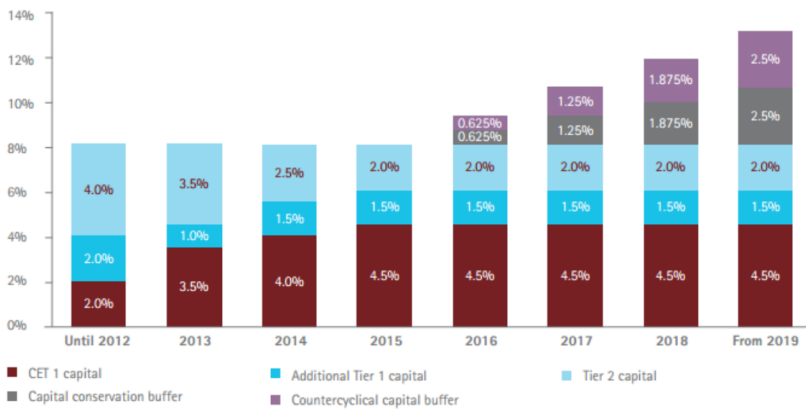
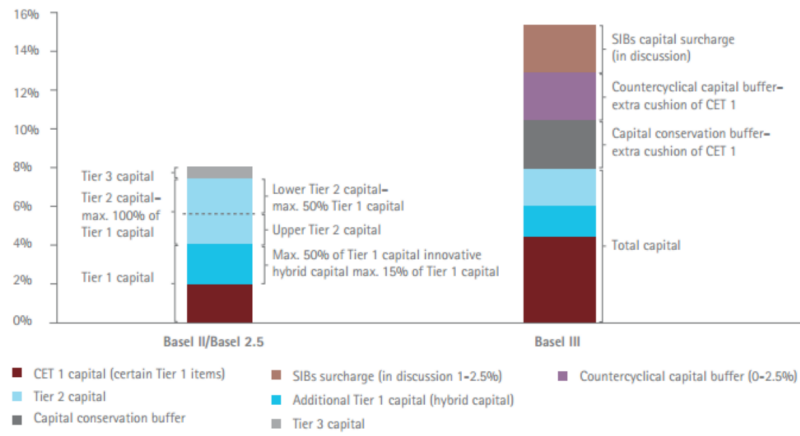


- Less reliance on instruments like preference shares or subordinated debt
3. Prompt corrective action in currency, not ratios
    - Banks below required capital ratios should get back to the target ratios by prompt action
    - Provides incentive to restrict credit
    - Requirements expressed as dollar amounts don't have this drawback.
  4. Contingent capital
    - Encourage banks to issue debt instruments that automatically convert to equity if capital ratios fall below a certain level
  5. Liquidity regulation
    - Discourage excessive use of short-term debt and encourage holding of assets not subject to fire-sale discounts

### *Basel 3 and onwards*

After the financial crisis a new regulatory framework was agreed upon in 2010 (Basel 3) which includes a number of new regulations that are gradually phased in over the years. Specifically

1. A number of adjustment to the common equity requirement
  - 7% in normal times
  - 4.5% minimum allowable common equity requirement in periods of financial/economic stress
  - 0-2.5% cyclical buffer
2. Stricter definitions of capital
  - Requiring more deductions for things like pension fund shortfalls
3. Maximum leverage ratio: limit on ratio of unweighted assets to capital
  - Addresses some of problem due to over-reliance on risk modeling



There are also some other new regulations

- Liquidity reforms
  - Basel 3 introduced liquidity coverage ratio so that banks can survive 30 days in stress scenario when funding is withdrawn
- Too big to fail
  - Committee identified 28 global systematically important banks
  - Proposes higher Tier One capital ratios for these banks (1-2.5%)
- Structural reforms
  - Some countries impose limits on how much risky financial trading a deposit-taking bank can do
  - Some calls for separating investment from consumer banking