

*Financial System*

# Types of risks incurred by financial institutions

Luigi Vena

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# Agenda

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*Credit Risk*

*Liquidity Risk*

*Interest Rate Risk*

*Market Risk*

*Exchange Rate Risk*

*Operational Risk*

# Credit Risk

- Each borrower is expected to give back the principal of the loan and to make interest payments on their promised dates
- However, almost no borrower is risk-free; that is to say, its probability of default (PD) is greater than 0
- Should a borrower default, both the principal loaned and the promised interests are at risk

**Definition:** *credit risk is the risk that the promised cash flows from loans and securites held by financial institutions may not be paid in full*

# Origins of credit risk

- The relationship between lender and borrower is characterized by the presence of information asymmetries
- Asymmetries arise because FIs (lenders) do not know enough about the counterparties (borrowers)
- For example, a borrower who takes out a loan usually has better information on the risk-return profile of the investments for which the funds are earmarked than the lender does
- A key role of FIs involves **screening** and **monitoring** loan applicants to ensure that only the most creditworthy loans are funded

# Credit risk: an example

Consider a FI with the following balance sheet

Assets		Liabilites	
Cash	20m	Deposits	90m
Gross loans	80m	Equity (net worth)	10m
Total	100m	Total	100m

Suppose that the manager recognizes that 5m of its loans is unlikely to be repaid

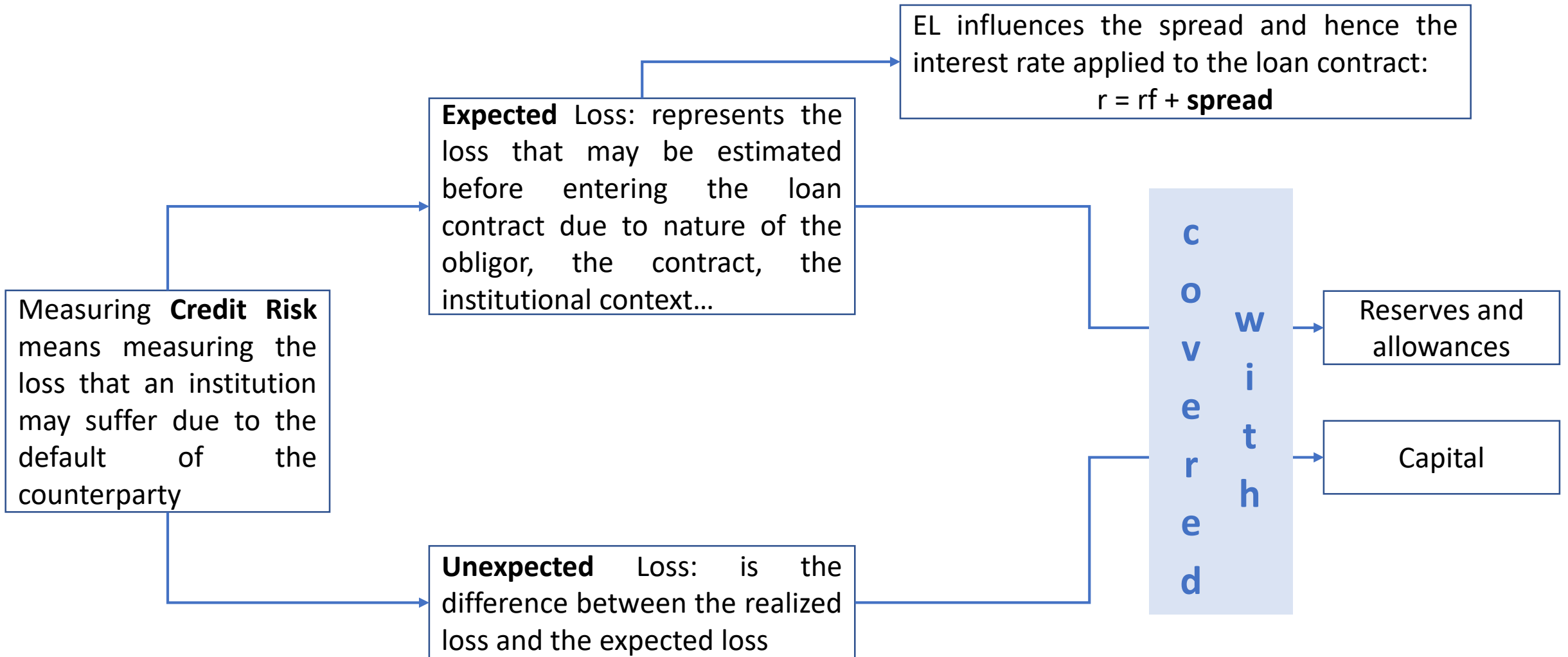
Executive must charge off the value of loans, and the economic loss must be charged off against shareholders. That is, both sides shrink by the amount of the loss

Assets		Liabilites	
Cash	20m	Deposits	90m
Gross loans	80m	Equity (net worth)	5m
Less: loan loss	-5		
Total	95m	Total	95m

## Managing credit risk (1/2)

- Many claims issued by FIs are characterised by a limited (known/fixed) return that is expected to occur with a high probability (eg, each period the borrower receive a fixed interest -  $x\%$  of the principal)
- On the other hand, however, FIs bear a large downside risk (loss of principal and promised interest) that is expected to occur with a much smaller probability
- Such a downside risk, namely the credit risk, needs to be managed

# Managing credit risk (2/2)



# Focus on Expected Loss

## EXPECTED LOSS (EL)

Which is the probability that the counterparty defaults?

PD

X

How much of the loan will I lose because of the default of the counterparty?

LGD

X

Which will be the real exposure at the time of default?

EAD

Depends on firm-specific traits: economic and financial structures, type of business....

Depend on loan-specific traits (type of loan, warranties...), recovery costs, recovery procedures...



## Pricing loans

$$r = \frac{cf + PD \cdot LGD + k(ROE - cf) + OC}{1 - PD \cdot LGD}$$

$cf$  is the cost of funding

$k(ROE - cf)$  is the profit margin on capital

$OC$  is the operating cost related to the loan

$PD \cdot LGD$  is the risk premium for default risk

# Managing Credit Risk: an example

- Suppose the following exposure
  - Probability of default: 1%
  - Loss given default: 45%
  - Initial exposure 2000.
- Compute the expected loss (EL), supposing that the counterparty default two-years after taking out the loan, when it has given back already half of the principal
- What about the unexpected loss if the realized loss is 10?
- What if the realized loss is 2?
- What if the realized loss is 4.5?

# Liquidity Risk

- When liability holders demand immediate cash for the financial claims they hold, the debtor should be able to give back the entire amount immediately and economically
- FIs are constantly exposed to liquidity risk in that they borrow money on the short term while they lend money on the mid-long term
- Because of their nature banks are known as maturity-transforming institutions
- To avoid bank runs, banks should be ready to give money to their depositors at any time

**Definition:** *liquidity risk is the risk that a sudden and unexpected increase in liability withdrawals may require to liquidate assets in a very short period of time at low prices*

# Liquidity risk: an example

- Consider a FI with the following balance sheet

Assets		Liabilites	
Cash	10m	Deposits	90m
Gross loans	90m	Equity (net worth)	10m
Total	100m	Total	100m

- Suppose that , because of bad news about the FI, depositors unexpectedly withdraw 15m
- To meet withdrawals the FI uses the 10m in cash and sells assets to raise an additional 5m
- Because of market conditions, however, the FI has to sell 50 cents on the dollar

The FI sells 10m of assets to raise only 5m incurring in a loss of 5m

# Interest Rate Risk

- Along with the liquidity risk, the asset-transforming activity performed by FIs make them exposed to the Interest Rate Risk
- Example:
  - In time 0, a bank borrow money by issuing bonds with maturity  $m$ .
  - At the same time, the bank lend the money borrowed with maturity  $M$ , with  $M > m$ .
  - What does it happen in time  $m$ , when bonds goes to maturity?

**Definition:** *Interest rate risk is the risk incurred by FIs when the maturities of their assets and liabilities are mismatched and interest rates are volatile*

## Interest rate risk

- **Refinancing risk:** is the risk that the cost of reborrowing funds increases because of an upward shift in interest rates, reducing the income of the FI
- **Reinvestment risk:** is the risk that the returns on funds to be reinvested decrease because of a downward shift in interest rates, reducing the income of FIs
- **Price risk:** is the risk that the price of the security will change when interest rates change. For this reason, it is also known as market price uncertainty

# Managing interest rate risk

- Interest rate risk originates from the mismatching between liabilities and assets
- Thus, to reduce exposure to interest rate risk, a FI can reduce such an existing mismatching
- Indeed, perfect matching means that assets and liabilities go to maturity in the same period. Should it happen, interest rates on assets and liabilities are negotiated in the same time, preserving the spread between them.
- On the opposite, i.e. in case of mismatching, only the interest rate on assets (or that on liabilities) is re-negotiated exposing the FI to the interest rate risk, namely the reduction of interest margin.

# Interest rate risk: an example

- Suppose the following FI:
  - Investments (assets) are entirely financed with debt (liabilities), i.e. there is no equity
  - Investments have a 10y maturity and return a fixed rate of 5%
  - Funds are borrowed for 3y and cost 1%
- Is the FI exposed to interest rate risk?
- What if interest rates shift upward?
- What if interest rates shift downward?
- Is being exposed to such a risk good or bad? Is it necessary?



# Market risk

- The asset side of financial institutions is composed of diverse financial instruments: loans, short term investments, equity instruments, debt instruments, financial derivatives...
- Shares, bonds, and derivatives may be held by financial institutions only for trading purposes. That is, FIs buy/sell these instruments in the short term to obtain positive profits due to changes in market prices
- Of course, sometimes the opposite situation may occur: FIs suffer losses because of change in asset prices
- **Definition:** *market risk is the risk incurred in trading assets and liabilities due to changes in market conditions*

# Exchange rate risk

- What is an exchange rate?
- What is the exchange rate risk:
  - Suppose that a FI wants to invest in time  $T$ , €100 in US T-bill; the market price of T-bill is \$115 and the exchange rate  $\text{€}/\text{USD} = 1.15$ .
  - Suppose that time  $T+1$  the price of the T-bill is still \$115 but the exchange rate is 1.20. Which is the value of the investment in Euro?

**Definition:** *the exchange rate risk is the risk that exchange rate changes can affect the value of a FI's assets and liabilities denominated in foreign currencies*

# Exchange rate risk: an example

EUR/USD (EURUSD=X) [Add to watchlist](#)

CCY - CCY Delayed Price. Currency in USD

**1.123** +0.0008 (+0.07%)

As of 9:16AM GMT. Market open.

Indicators Comparison Events Date Range 1D 5D 1M 3M 6M YTD 1Y 2Y 5Y **Max** Interval 1W Line Draw



# Exchange rate risk: an example

- Suppose the following investments
  - US 10Y ZCB  $\rightarrow r = 2\%$
  - EUROPEAN 10Y ZCB  $\rightarrow r = 5\%$
- Suppose that US bonds are as risky as European bonds
- Under the perspective of a US investor, which one would you prefer?

# Exchange rate risk: an example

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  - US 10Y ZCB  $\rightarrow r = 2\%$
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- Suppose that US bonds are as risky as European bonds
- Under the perspective of a US investor, which one would you prefer?
- Suppose that the EUR/USD exchange rate varies as shown in the previous slide
- Suppose that you invested in 2008...which is the actual return of the two investments?

# Operational Risk

- Most of the operations and actions executed by FIs rely on/ are executed thanks to a technological infrastructure
- A malfunctioning in the technological architecture may result in losses for FIs
- Also, a loss may occur because of a natural calamity (e.g. earthquakes and floods)

**Definition:** *operational risk is the risk of loss resulting from inadequate or failed internal processes, people, and systems or from external events*