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HANDOUTS

FINANCIAL MANAGEMENT AND FINANCIAL MARKETS

-SECOND PARTIAL-

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FINANCIAL MARKETS

Credit risk management map and a first insight into default risk

The **objective of a company** is to rise as much as funds (in order to finance all the projects) for the lowest possible cost -> in order to do so, companies have to understand what are all the comprehensive activities done by banks in order to evaluate entities -> we have to take the perspective of both *CFO* (Chief Financial Officer, for the companies) and the *CRO/CLO* (Credit Risk Officer/Credit Loan Officer, for the banks).

The **definition of a banking** is collecting deposits in order to provide loans and other financial instruments in order to gain from the marginal interest (the interest the company has to pay to deposit needs to be lower than the interest received by giving loans) -> the **essence of banking** is the profitable management of credit risk, as this is the *main risk the bank* faces when it decides to lend money. Lending is based on 2 products:

- *Money* -> you have to provide money to the counterparty
- *Information* -> after and before lending money you receive information to assess credit worthiness (the ability of the counterparty to repay loan)

In order to do so, a bank faces the *goal dilemma* (which is the dilemma regarding which should be the goal the bank has to face and what should be the best combination of instruments in order to achieve it), and banks have to respect and comply with according to current regulation:

- *Capital* -> in order to perform a specific banking activity (and face a specific risk) you need a certain amount of capital
- *Risk* -> in order to perform a specific activity, the company has to face a specific level of risk
- *Liquidity* -> sufficient amount of liquidity both according to the regulation
- *Profitability* -> particularly relevant for shareholders

Let's assume the objective of a bank is the profitability measured by ROE -> because it is calculated as NI/Equity, we have to operate on these two components:

- In order to increase ROE, we could *reduce equity*, but the bank has to *complain with regulation* that requires minimum levels of equity in order to operate
- In order to increase ROE, *increase the NI* -> we can do it by conducting new activities that increase the NI but usually means assuming a *higher level of risk* -> according to regulation, you must *increase equity and cash* for protecting the bank from potential bankruptcy

➔ It is not easy to adjust the parameters, and risk management is one of the most important components

Let's consider an example:

- Innovatech: A promising but unrecognized technology startup seeks a €1 million loan to launch a new product. High growth potential, but also a high risk of failure.
- SolidSteel: An established manufacturing company with stable but low profits seeks €1 million to modernize a plant. Low risk, but also a low return for the bank.

You're the bank. Who would you lend money to? And why? The first option is more suitable for venture capital financing (so financing with equity and not with debt) and the second is more for banks, as it is a safer and more risk-adverse

In a world without risk, so in a world where with our rating system we are 100% capable of discriminating good borrowers from bad borrowers, it is more difficult for a bank to justify an interest rate, as according to the simple rule "more risk = more return", if there is no risk there is neither going to be any return -> Banks job isn't to avoid risks, but to *measure* (so understand what is the risk the companies are facing), *price* (according to the level of risk we have to understand the level of interest), and *manage* them correctly (if we manage it incorrectly, we'll have problems on the cost of capital).

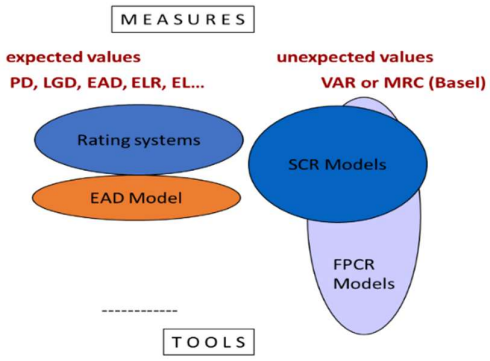
A we said before, the level of risk influence also the *capital structure* the company has to comply with. The BS of a bank is composed of assets (which includes both the PPE owned by the company and the loans that they have given) on one side and Debt (which is composed of the deposits the bank has received, the bonds they have issued…) + Equity on the other side. Regulators affirms that the level of equity should not just reflect the level of asset, but also the *Risk Weighted Asset* (for each asset, there is a different level of risk, that depends also by the type of company, as a loan given to a Innovatech is different than a loan given to SolidSteel). So, if for example the asset is 100€, we have to calculate the RWA (which is not necessarily 100€) and then we establish the level of Equity according to regulation.

What is **credit risk**? The possibility of a loss resulting from a borrower's or counterparty's *failure to repay a loan or meet contractual obligations* -> you can suffer a loss in case of *default* but also in case of a *downgrade from rating agencies* (which can be caused by both internal and external factors) -> effective management is crucial for *profitability* and *solvency* (as a bank there is the serious risk that can cause a bank run because of a lack of trust, which can have a domino effect on the other banks).

There are **several risks the company faces** -> *default risk* (so the risk that the counterparty goes default and is not able to pay back its loan), *severity risk* (what happens in case of default and what is the loss given the default -> you can reduce this risk thanks to the introduction of collaterals, which can be a real estate, but the fluctuations that can occur in the value implies that our loan might be not fully covered), *exposure risk* (even though we have a loan, and therefore we know the characteristics, the exposure at the moment of default is the amount of the loan that I will lose in case of default, which should be lower than the exposure of today. In case a company has a line of credit that is used only partially, the exposure connected to the default is higher as the company will probably use the entire line of credit), *migration risk* (risk of a downgrade, which cause company losing money because they have to pay an higher interest for receiving money), *spread risk* (the risk that the difference between the level of risk of two assets will increase, as the volatility connected to lower grade assets is higher and requires a higher cost of debt), *concentration risk* (we are in a logic of portfolio, and if a bank has all the exposure in a single sector, it won't benefit the reduction of benefit derived from diversification).

In order to measure the credit risk, we have two logics:

- **Default mode** -> you assume you are exposed to a risk only in case of a default (it considers only the default, severity and exposure risks) -> we use the *Simplified Credit Risk Model (SCR model)* in order to identify the level of equity
- **Mark to market** -> you are exposed to a risk in case of a default and considering also the other risks -> *Full Portfolio Credit Risk Model*, based on *Value At Risk* (which identifies the ideal amount of equity that is capable of protecting the bank from the credit risk, the economic



capital) and *Minimum Required Capital* (defined by Basel, which is an authority composed of the most relevant financial authorities from the different states of the world that defines what it is expected from bank, the regulatory capital) -> the role of authorities is establishing a level of regulatory capital that is as close as possible to the economic capital.

Credit losses can be viewed from two perspectives (the two «legs» of credit risk management):

- *Expected Values*: The *average loss we anticipate over a given period for a portfolio* -> predictable and recurring on the long run
- *Unexpected Values*: The *potential variability or volatility of losses around the expected average* -> represents the risk of larger-than-average losses within a given time horizon

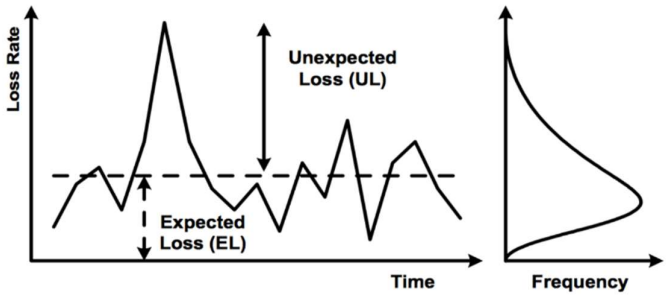
Expected Loss -> The average loss expected from a credit exposure or portfolio. Impacts on Financial Statements:

- Lead to setting *Credit Loss Provisions*.
- Recorded as an *Expense* on the Income Statement.
- *Reduce the net value of assets* (loans) on the Balance Sheet via an allowance account.

➔ Considered a cost of doing business

Unexpected Loss -> Losses that exceed the expected loss level due to adverse or unexpected events (e.g., a recession causing higher-than-average defaults), which depends on the time horizon of the bank -> represents the «tail risk». Impact on Financial Statements:

- lead to setting *Equity Capital requirements*.
- Purpose: Establish the level of equity needed to absorb losses that go beyond provisions and ensure the bank's solvency. Equity holders bear this risk.



If you want to draw the EL vs UL, you can see from the graph that in case there is a variable level of loss the average is going to be the *Expected Loss*. If we stay there, the *provisions* we make for the Expected loss *are going to be enough*. But, if on the other side, we are moving to the peaks (so the maximum loss the company can face within its activity with a reasonable confidence level) -> if we are not protected, the unexpected loss should be covered with capital -> if it does not have enough capital, the company goes bankrupt. If we see the distribution of the losses, it is possible to see how the majority of the losses the company reasonably expects to face are at the level of the EL, while the losses connected to the UL have lower probability to happen and lay on the ties of the distribution.

Expected Loss: measures

In the **default-mode «DM» approach**, that is assuming losses only derive from default events. To calculate **Expected Loss (EL)**, we need 3 measures:

- *PD (Probability of Default)*: The *likelihood that a borrower will default within a specific time horizon* (e.g., 1 year). (0% to 100%) -> we use the rating, coming from rating agencies or internally defined
- *LGD (Loss Given Default)*: The *proportion of the exposure that is lost if a default occurs* (after accounting for recovery). (0% to 100%) -> It is a level of risk not just associated with the characteristics of the borrower but also associated with the characteristics of the loan, such as the guarantees (which can change over time).

➔ If we consider only these two factors, we have the *expected loss rate*

- *EAD (Exposure at Default)*: The *outstanding amount of the credit exposure at the time a default occurs.* (Monetary value)

$$EL = PD * LGD * EAD$$

Let's assume we have an AA company (so it is rated), which gives a PD =0.01. The loss in case of default is 50% (as it is protected) and the line of credit of 100€ -> EL = 0.5€ -> you don't want to exceed this EL, but for example the rating moves to BBB, which moves the PD = 0.03 -> the bank, who doesn't want to move from the EL can increase collateral, can reduce the exposure or both of them.

Unexpected Loss:

- *Measures*:
  - VaR (Value at Risk): Estimates the *maximum potential loss over a given time horizon at a specific confidence level* (e.g., 99.9% VaR over 1 year) -> the closest definition of the economic capital
  - MRC (Minimum Required Capital): *Regulatory capital determined by frameworks* like Basel I, II, III, and following, *based on risk-weighted assets*, incorporating unexpected loss concepts.
- *Tools*:
  - Credit Risk Models (also known as VaR Models or Portfolio Models):
    - *Simplified Credit Risk models (SCR)*: Often focuses on stand-alone risk -> usually consider the default risk model.
    - *Full Portfolio Credit Risk models (FPCR)*: Considers portfolio effects, including concentration and correlation -> we want to consider a mark to market exposure, and we want to consider the
  - Regulatory Rules (Basel): Provide methods and parameters for calculating MRC

All 6 credit risks can be viewed from both perspectives, except concentration risk:

- Expected values (Provisions): Driven by the average outcomes of Default, Severity, Exposure, Migration, Spread risks.
- Unexpected values (Capital): Driven by the variability of Default, Severity, Exposure, Migration, spread risks, plus Concentration Risk (which is inherently a portfolio effect related to how an exposure correlate with others in the portfolio).

Different approaches define *how credit losses are recognized*:

- Default-Mode approach (DM): A credit *loss only occurs when a borrower officially defaults*.
- Mark-To-Market approach (MTM): A credit loss *can occur due to any decline in the market value of the credit exposure, even if no default has happened* (e.g., due to rating downgrade or spread widening).

Default-Mode Models (typically Simplified Credit Risk models - SCR): Focus on risks directly linked to the default event: Default Risk (PD), Severity Risk (LGD), Exposure Risk (EAD)

Full Portfolio Credit Risk Models (FPCR): Can be either DM or MTM.

- DM FPCR Models: *Cover Default, Severity, Exposure risks plus Concentration Risk*.
- MTM FPCR Models: *Cover Default, Severity, Exposure, Concentration risks plus Migration Risk and Spread Risk* (covering all six risks).

The first major MTM FPCR model was JP Morgan Credit Metrics, developed in the late 1990s. Significance: Marked a shift towards more sophisticated portfolio-wide risk measurement, including migration effects and spread risk. Still used by sophisticated banks for complex portfolios. Simpler methods or regulatory approaches are used elsewhere.

Default risk: measuring PD

Let's focus now on the first key risk: Default Risk. How do lenders measure the Probability of Default (PD) for a borrower? Using **Rating Systems** that produce borrowers' or issuers' ratings. This is because usually establishing the PD is a preliminary activity the company has to do before asking for a collateral to the borrower. **Assignment of the rating** (which precedes the determination of the credit risk) -> discriminate the different borrowers and demonstrate it over time. How do we do it? The PD that we measure after the classification are in line with your classification, which means that the average PD we have calculated for AAA companies is lower than the average PD calculated for AA companies.

How many classes a rating system should have in the *ideal world*? 2, *good or bad*, but it means that there is 0 risk, and we are 100% to affirm if the risk connected to a company is 0% and 100% -> in reality there is a big grey area, and within the grey area we can allocate the different companies to the rating classes -> we have to classify the company in a rating class, we take the average of companies belonging to the classes that are survived over a period of time (at least 5 years) -> the remaining percentage is the Probability of Default of that rating class. We have to consider that each bank has its own rating system, which means that the PD calculated by different banks for the same rating class can be different.

There is **no situation where the rating is perfect**, so we always have to consider a level of error. As S&P says, «*rating is, in the end, an opinion*». Ratings are categorical ordinal measures of risk (e.g., AAA, AA, ..., CCC, D). Two key processes in rating systems:

- *Rating Assignment (Risk Differentiation)*: The process of assigning a borrower to a rating class based on various factors (financials, industry, management, etc.). The output of this process is a graded opinion (a rank-ordered classification, a rating)
- *Rating Quantification (Rating Calibration)*: The process of associating a cardinal probability of default (a number between 0 and 1) to each rating class, typically over a specific time horizon (e.g., 1-year PD for BBB) -> if I know a company belongs to AAA rating, I can identify the PD associated with that company. This is a standard procedure both in rating companies and banks, but what changes are the procedures:
    - Rating companies make their evaluation based on more judgmental and qualitative information
    - Banks make their evaluation based on more statistical models and quantitative information

Quantifying PD via historical data -> The most common method for rating quantification is using empirical historical evidence, which requires the company an history of rating procedures already completed -> this problem, connected with the complex licences that a company need in order to be authorized to conduct this work. PD is typically estimated as the *long-run historical average of default rates for each rating class* -> by having this average, we can compare to the actual number of companies that have defaulted and make a judgement regarding the accuracy in the evaluation process conducted by the company. Basel II regulation:

- 447. PD estimates must be a long-run average of one-year default rates for borrowers in the grade
- 461. Banks must use information and techniques that take appropriate account of the long-run experience when estimating the average PD for each rating grade
- 463. Irrespective of whether a bank is using external, internal, or pooled data sources, or a combination of the three, for its PD estimation, the length of the underlying historical observation period used must be at least five years for at least one source. If the available observation period spans a longer period for any source, and this data are relevant and material, this longer period must be used.

➔ We have to look at longer periods in the past in order to understand what are the probabilities that the company would default in 1 year

Calculation of the **Default Rate (DR)**:

- The *denominator* should consist of the number of non-defaulted obligors observed at the beginning of the one-year observation period with any credit obligation. In this context a credit obligation refers to any amount of principal, interest and fees as well as to any off-balance sheet items including guarantees
- The *numerator* should include all obligors considered in the denominator with at least one default event during the one-year observation period.

By computing the DR for the different rating classes during a long period of time, we can obtain the PD for that class by computing the average during years -> it is possible to notice how by decreasing the rating class it is possible to notice *higher levels of DR* and *higher levels of volatility*.

Analysing historical default rates reveals key properties of rating systems:

a) **Discriminatory Power (Risk Differentiation Capability)**:
   a. Does a *better rating always mean a lower default rate*?
   b. Look row-wise (across years for a given rating): *are default rates monotonically ordered*?
   c. *Property*: *Ex-post default rates should monotonically increase as ratings worsen*.
   d. *Observation*: This property *is rarely achieved in a single year* but consistently achieved for long-term averages.

b) **Good Calibration (Goodness-of-Fit)**:
   a. *How close are the observed annual default rates to the expected PD* (the long-term average, assumed as expected default frequency, that is EDF or PD)?
   b. Look column-wise (annual rates vs. long-term average for a rating): *are annual rates close enough to the long- term average of the considered class*?
   c. *Observation*: There is *wide variability of annual default rates around the long-term average*. This variability increases for worse rating classes (higher standard deviation). This is why ratings are at the hearth of VaR models calculations: the worse the rating class, the higher the variability of default rates and also of all others risk measures, the higher is VaR. In Basel regulations, for banks using approaches based on internal ratings, the MRC is calculated by a risk-weighting formula that takes 1-year PDs as inputs. Therefore, also MRC is strictly depending on ratings

Implications for back-testing ratings -> Based on the observations:

- *Ex ante (prediction)*: Each borrower in a rating class has the same PD (a probability).
- *Ex post (outcome)*: For a single borrower, the outcome is binary (0 for non-default, 1 for default).

➔ Implication: You cannot back-test a rating system on single cases, we can verify considering a portfolio. The outcome will always differ from the probability prediction. You must back-test on groups (classes) of borrowers and over sufficient time periods to see if actual rates align with predicted PDs on average

Suppose an investor uses the BBB 1-year PD (0.19% from Table long-term average) to make a one-year investment decision in BBB bonds issued by a given issuer. Implication: This investor will never achieve a 0.19% default rate outcome. The issuer either defaults (100% default rate) or does not default (0% default rate). To experience a default rate approximating the PD (0.19%), the investor needs to meet two requirements:

- Diversify: Buy bonds from many different BBB issuers.
- Repeat: Make these diversified investments year after year.

Why PD is a «true number» for financial institutions?

- *Banks and other institutional investors* (funds, insurers):
  - Naturally finance plenty of borrowers (diversification).
  - Are in the business year after year (repetition).
- They *physiologically meet the requirements for the law of large numbers to apply*.
- For them, *expected values* (like PD) are *statistically «true numbers» over the long run*.
- This is why *accounting rules link provisions to EL and regulations use PDs for capital requirements.*

Ratings performance & validation -> The reliability of rating systems is continuously assessed by:

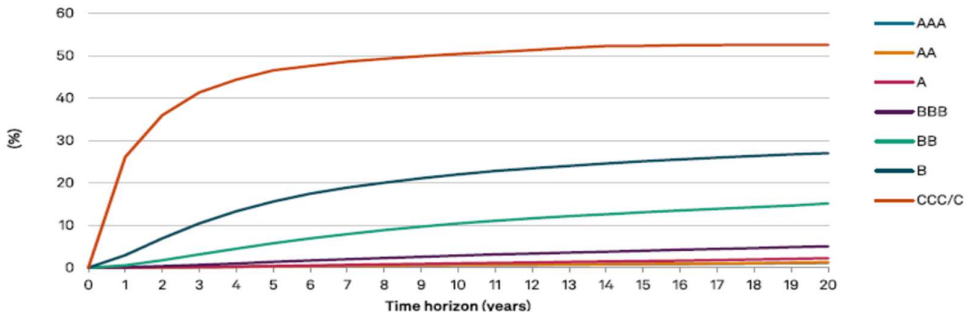
- *Rating Agencies* (publish studies)
- *Investors & Banks* (use ratings for their investment decisions)
- *Supervisory Authorities* (authorize internal/external ratings under Basel) -> if you are a supervisor, you should authorise primarily the bank to use its own rating system.

The key tool for assessment is Back-testing: Comparing predictions (ratings/PDs) with actual outcomes (defaults).

Validation assessment 1: discriminatory power over time

Check if riskier ratings consistently show higher cumulative default rates over longer time horizons (e.g., 2-year, 5-year, 10-year cumulative defaults). It is possible to notice how all the rating classes have the same structure, and it follows the principle that companies belonging to higher classes have lower risk of default considering all the time horizons.

Global corporate average cumulative default rates by rating (1981-2024), S&P Global



Validation assessment 2: good calibration over time -> Assess how close the observed cumulative default rates for various time horizons are to the average cumulative default rates (which represent the expected probability of defaulting within that horizon) -> Similar to the 1-year case, this involves *checking the variability of actual cumulative rates around the long-term average* for each horizon and rating class. -> Small variability = high goodness-of-fit for that horizon/class.

Validation assessment 3: ratings stability (migration matrices, which is something demonstrating a stability over a period of time, this is the good instrument) -> Assess how frequently ratings change. Useful for investors with medium-term horizons. Key Observations:

- *Default Probability*: The percentages in the 'D' (Default) column increase as the initial rating worsens.
- *Stability*: High percentages along the diagonal (staying in the same class) indicate reasonable stability, because it means that the majority of the companies have remained in the same rating that was previously assigned (like it is possible to notice from the following tables). Stability highly depends on the time-horizon we are considering, as it is much probable that a

company would remain in the same rating within one year than in 5y (even though it would mean we have conducted a good evaluation)

- *Adjacent Migrations*: Migrations are more frequent to adjacent rating classes than to distant ones.

Table 1.2 – One-year Global corporate average transition rates 1981-2024 (%)

From/to	AAA	AA	A	BBB	BB	B	CCC/C	D	NR
AAA	87.28	8.92	0.51	0.03	0.10	0.03	0.05	0.00	3.08
AA	0.45	87.74	7.50	0.44	0.05	0.06	0.02	0.02	3.74
A	0.02	1.48	89.42	4.64	0.23	0.10	0.01	0.05	4.04
BBB	0.00	0.07	3.05	87.33	3.21	0.40	0.09	0.14	5.71
BB	0.01	0.02	0.10	4.44	78.89	6.25	0.50	0.56	9.23
B	0.00	0.02	0.06	0.14	4.47	75.18	4.79	2.93	12.41
CCC/C	0.00	0.00	0.07	0.13	0.40	13.18	45.07	26.12	15.03

Table 1.3 – Seven-year Global corporate average transition rates 1981-2024 (%)

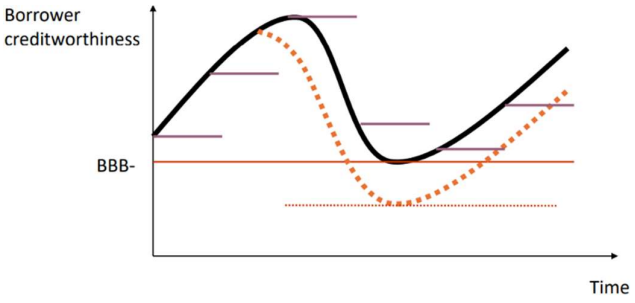
From/to	AAA	AA	A	BBB	BB	B	CCC/C	D	NR
AAA	38.53	32.69	6.77	1.50	0.23	0.18	0.10	0.49	19.49
AA	1.37	42.89	27.08	4.30	0.65	0.33	0.03	0.47	22.90
A	0.06	4.83	50.61	15.56	2.05	0.64	0.11	0.71	25.43
BBB	0.03	0.43	10.83	46.69	7.03	1.96	0.30	2.15	30.58
BB	0.00	0.06	1.07	12.25	26.17	9.59	0.90	8.50	41.46
B	0.00	0.01	0.23	1.55	8.07	17.42	2.02	20.23	50.46
CCC/C	0.00	0.00	0.20	0.81	3.13	6.93	2.10	48.83	38.01

➔ Assessing the migration as it influences the level of credit risk.

Rating philosophy: Point-in-Time vs. Through-the-Cycle

How should ratings reflect the economic cycle? Two main philosophies:

- *Point-in-Time (PIT):* Aims to assess a borrower's current creditworthiness, incorporating both structural and cyclical factors -> you take a picture of the level of risk today, which reflects the *firm-specific factors* and *business-related factors*
- *Through-the-Cycle (TTC, usually used by rating agents)*: Aims to assess a borrower's creditworthiness over a longer-term perspective, focusing on structural risk and resilience through the entire economic cycle (often based on stressed scenarios and «bottom-of-the-cycle» situation).



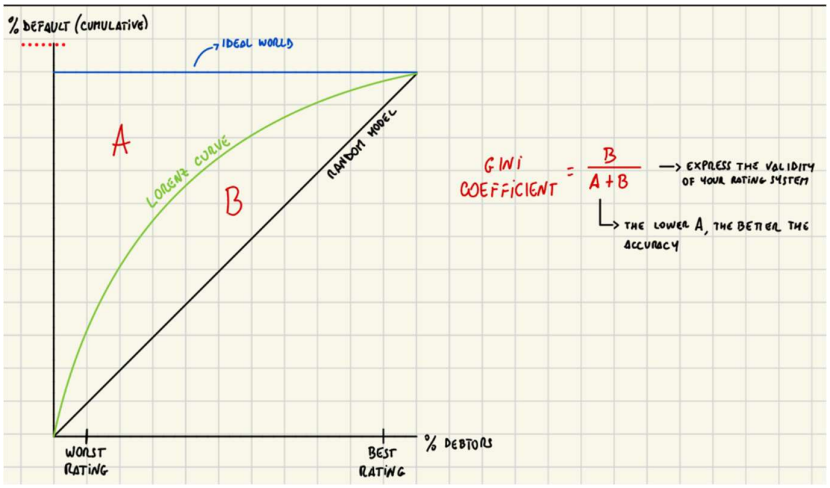
➔ The only way to change the rating is when analysing stress testing the worst-case scenario that creates is different from the level we had before

Characteristics of PIT vs. TTC ratings:

- *Point-in-Time (PIT)*:
  - Focus: Current creditworthiness.
  - Responsiveness (good calibration): High (changes with the economy/firm), as after 1 year the level of risk is close to the one measured.
  - Stability: Lower (more frequent rating migrations).
- *Through-the-Cycle (TTC)*:
  - Focus: Structural risk over the economic cycle
  - Responsiveness (good calibration): Low (stable across the cycle).
  - Stability: Higher (fewer rating migrations).

	Point-in-Time (PIT) Ratings	Through-the-Cycle (TTC) Ratings
Strength	High responsiveness to current risk, leading to potentially better goodness-of-fit in a specific year.	High stability over time, strong long-term discriminatory power.
Weakness	Lower stability; ratings change frequently.	Actual default rates in a given year can diverge significantly from the associated Probability of Default (PD), leading to weaker goodness-of-fit in that specific year (but better over the cycle).

Agencies and internal ratings. Judgement-based and statistical-based ratings



The Lorenz curve and the Gini coefficient are needed for the home-assignment the professor gave us: valuate the quality of the credit ratings provided.

Rating systems are fundamental to assess the risk of an asset, so they are strictly related to Weighted risk assets and so to the level of capital a financial institution is required to have.

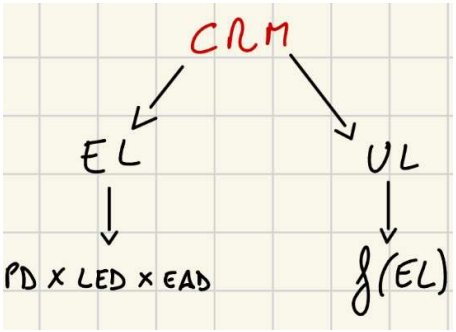
Why are credit ratings important in finance?

- *Capital markets*: Inform investors, facilitate bond issuance, syndicated loans.
- *Risk Management*: Credit Risk quantification.
    - Risk appetite framework: you cannot exceed a level of risk corresponding to x%. Why does the bank define more classes of risk (which correspond to a % of risk each) than the ones they need (e.g. the bank cannot go over than class 6, but defines 10 classes of risk)?

In case of a new borrower, you don't want to exceed the risk related to class 6. If the new borrower is beyond class 6, you cannot accept that borrower.

- *Lending decisions*: Guide credit decisions, pricing, portfolio management. They are driven by the quantification of risk as disclosed by the risk appetite framework
- *Cost of capital*: For borrowing entities. For a firm is not only about having debt, but also how much. Even if debt is cheaper than equity, if you get too much exposed-on debt you increase your risk, and so the credit rating worsens and you will probably pay more interests on debt -> problem of optimal capital structure, which reflects in WACC.
- *Banking Regulation* (like Basel framework) -> they have the purpose of defining how the banks have to measure risk, in order to define how much regulatory capital set. The core of Basel I *is credit risk*. According to it, the *minimum required capital is 8% of Risk Weighted Assets*. How to measure the Risk Weighted Assets?
    - Basel I: nature of borrowers

- Basel II: two possibilities:
  - *standardised approach*: the way you measure RWA is not only based on the nature of the borrower, but also on probability of default. According to the different rating classes you adjust the risk -> rely on external rating agencies (CAIs= Credit Assessment Institutions)
  - *Internal rated based approach*: each bank defines its own rating system validated by the supervisor and then you use these measures to compute the expected loss and the unexpected loss



Types of credit ratings: by producer

Common distinction based on who produces the rating:

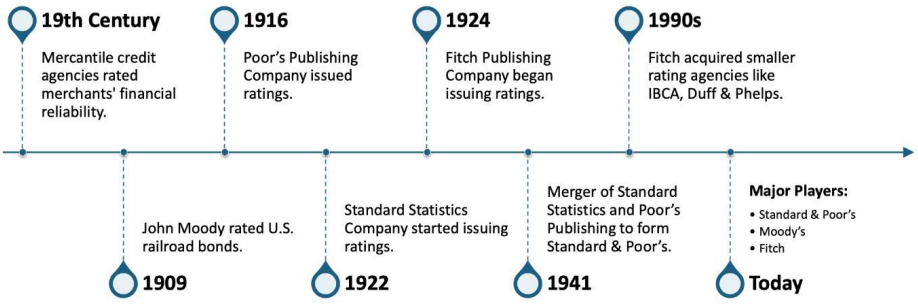
- *Agencies' Ratings* (e.g., S&P, Moody's, Fitch)
- *Internal Ratings* (Produced by banks)
- *Market-Implied Ratings* (Derived from market data)

These types often differ in their Rating Philosophy / Time Horizon:

- *Agencies*: Typically, TTC (Through-the-Cycle)
- *Internal*: Tend to have a high degree of PIT-ness (they are more Point-in-Time)
- *Market-Implied*: Very PIT oriented

Agencies' ratings

They have a long history, as it is possible to notice from the following timeline and are significant for capital markets (bonds, syndicated loans). They have historical evidence of *predictive power*, which resulted in *accumulated experience*. They have methodologies codified over time and access to issuers' internal info. They can conduct a *solicited rating* (requested and paid for by the entity being rated, involving active participation and the provision of private data to the rating agency) or an *unsolicited rating* (issued by a rating agency without a specific request from the entity, using only public data, and the entity does not pay a fee or necessarily participate in the process). *Reputation* is key for credibility, as the reputational factor should *help financial institution to avoid bad behaviour* (e.g. Arthur Andersen). Role in Basel II (ECAI recognition) for banks using the Standardize Approach. There are always the 3 same rating agencies on multinational scale, while on a regional scale there are many more.



Internal ratings (banks)

Developed from the mid-1990s, developed not only for regulatory purposes, but to better manage risk. Strong boost *from Basel II capital adequacy regulation* (Internal Ratings-Based approaches - IRB). Used by banks for their own *lending decisions, pricing, and capital calculation*. Tend to have a higher PIT component (reflecting current conditions, behavioural data) than agencies' ratings. *Ratio*: for large

corporates bank can rely on rating agencies, but what happens for SMEs? They will *probably not be rated*, so to *recognise their level of risk* you can use internal rating systems. This is also because of natural for financing SMEs: proximity advantage, access to detailed information, cost recovery through loan margins. Confidential to the bank. Every bank *has its own internal rating system* -> there is no sense in the comparison of the classification you receive from each bank.

Market-implied ratings

Start spreading in the 1990s. These ratings are derived by transforming market data, such as *credit spreads* (interest on the security vs risk free rate -> the spread reflects the probability of default), *CDS spreads* (Credit Default Swap premium that you pay. Sort of insurance against default of an entity. The higher is the probability of default the higher is the premium you pay) and *equity prices* (correlation on market data to measure the probability of default), into an indicator of default risk. The process of converting market data into a rating relies heavily on assumptions that supplement the underlying calculations, and they use relatively simple models. They are very oriented to Point-in-Time (PIT) (reflect current market sentiment and liquidity conditions) -> can be volatile (low stability over time).

Types of credit ratings: by dimension

There are **2 dimensions** to consider:

1. *Obligor/Issuer Rating*:
    a. Assesses the *debtor's creditworthiness*.
    b. *Focuses on the Probability of Default (PD)* of the entity.
    c. *Allows comparison* between different debtors.
2. *Operation/Issue/Facility Rating*:
    a. Also assesses the *risk of a specific debt instrument or loan*.
    b. Also *considers specific features* (seniority, collateral, guarantees).
    c. Also *depends on the expected Loss Given Default (LGD)*.

Measures the Expected Loss (EL) for a specific facility of a given borrower ($EL = PD \times LGD$).

Note: We will primarily focus on Issuer/Borrower ratings.

Rating processes

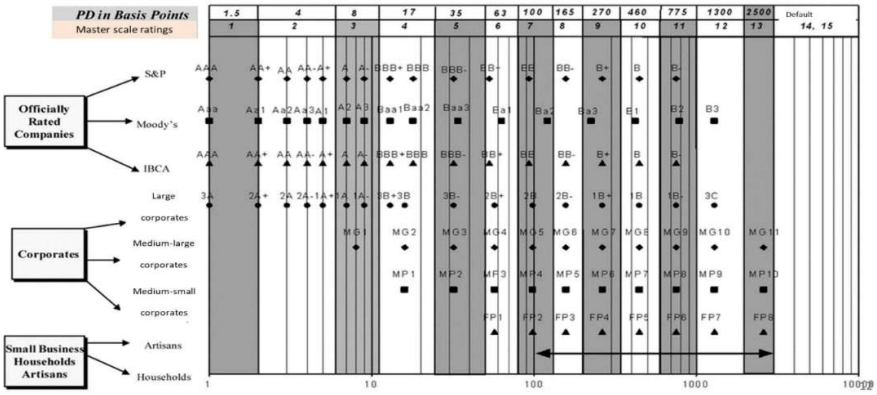
1. Assignment Process (risk differentiation):
    a. *Gathers information, uses tools/methodologies*.
    b. Output: An *ordinal indicator of risk* (the rating class or score) -> provides a rank of credit risks.
2. Quantification/Calibration Process:
    a. *Associates a cardinal measure of risk to each ordinal rating class*.
    b. Output: A number representing the level of risk.

Rating dimensions & processes matrix

Dimensions / Processes	Issuer/Borrower	Issue/Facility
Assignment (output: ordinal indicators of risk)	Issuer/Borrower ratings	Issue/Facility ratings
Quantification/Calibration (output: cardinal measures of risk)	Ex ante: probabilities of default Ex post: default rates	Ex ante: expected loss rates Ex post: loss rates

Comparing ratings across different systems

An illustrative example of master scale for a bank



Rating assignment: methodologies

The process of assigning ratings differs significantly (2 extremes):

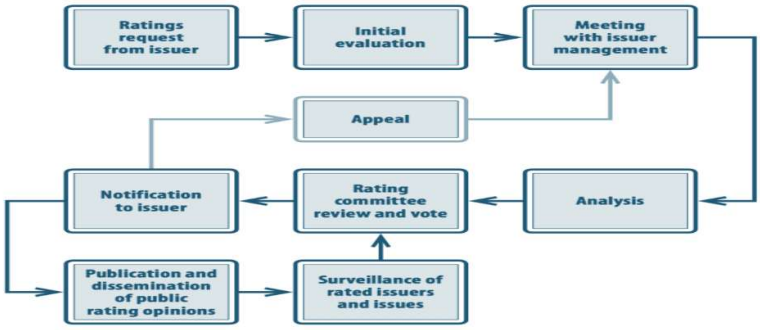
- **Judgment-Based** (Principles-Based): Primarily used by Agencies. Relies on expert opinion, qualitative & quantitative analysis, committee decisions. There are big limits: *high degree of subjectivity, biases*, etc. But using a judgemental approach you can take into account qualitative information.
    - E.g.: warehouse full of products and dust: long period problem in selling products. This can negatively affect the situation of the company, and so the rating.
    - E.g.: quality of the management of the company: you can assess it by benchmarking the company with similar ones. You have to value their expertise and knowledge of the company/business
- **Statistical Based**: Primarily used by Banks for internal ratings. Relies on statistical models interpreting historical quantitative data.

➔ In the reality many banks use a mix of the two approaches.

Judgment-based approach

Not mechanical (as S&P managers "a rating is, in the end, an opinion."). It is a complex process: *preliminary analysis*, *meetings* (with issuer), *analyst presentation, rating committee discussion & vote*. *Wide range of info*: *Objective/Subjective, Quantitative/Qualitative, Historical/Forward-Looking*. Includes sector analysis, competitive analysis, management quality. Quantitative inputs (financial ratios) inform, but don't rigidly determine the rating. *Surveillance process*: Ongoing monitoring, annual reviews, triggers for action (CreditWatch, Outlook change, Rating change).

Example: Standard & Poor's analyst-driven rating process



An analysis is requested, and the credit agency does a research based on public available information. Then you meet the management.

To balance these factors, agencies can use a matrix:

BR **FR**	**1**	**2**	**3**	**…**
1	AAA	BBB	CCC	…
2	BBB	CCC	…	
3	CCC	…		
…	…			

Possible causes of ratings failure and their balance

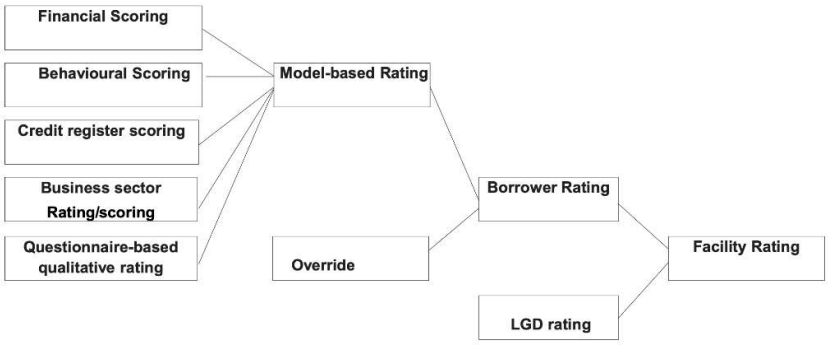
- *Information risk* -> the *data provided by the institutions whose products are being rated inaccurate* (e.g. Posteltaliane IPO: close to 1000 pages of disclosure, but the longer the disclosure the less you are actually disclosing).
- *Analytical constraints* -> *rating agencies may rely on already issued rating reports* in order to overcome the lack of human resources working for the rating process
- *Revenue bias* -> the issuer of the product being rated may be *inclined to pay additional fees to the rating agency in order to receive a more favourable rating*
- *Other incentive problems* -> *conflict of interests arising from other services offered* (e.g. risk management)

- *Rating Agency Reputation* -> it is the only asset to justify investors demand ratings and issuers pay for them

Statistical-based approach

Primarily rely on statistical models, which interpret *historical quantitative data* about the borrower. Inputs are *financial statements*, *internal behavioural data*, *credit bureau, credit register*. For retail/simple segments, this often is the *final rating* (no override). Increasingly enriched by new data (internet, satellite data and level of pollution) and methods (ML/AI) - (regulatory caution about 'black boxes').

A typical architecture of internal ratings



Statistical models: data inputs

Financial Scoring: Firms' Financial Ratios (e.g., from financial statements)

Behavioural Scoring: Internal Behavioural Information (account balances, facility usage, payments); relationship between the bank and the company

External Information (credit bureau reports, payment arrears notifications):

- E.g. a company increases the number of banks it has relationships with exponentially -> it means it is probably *desperate for cash*, and *if it had no problems with the other banks, it would have asked them*. But it instead went to other banks, so it is probably riskier, because the previous banks are not financing the company. If, instead, the number of banks decreases exponentially, it means many *banks are exiting a relationship with the firm*, so probably the company is not reliable anymore.

Centralised Credit Registers: Credit Register's Behavioural Data (borrower's relationships with other banks, e.g. Centrale dei Rischi di Banca d'Italia) -> you can look if one of the companies has problems with other banks!

Business Sector rating/scoring

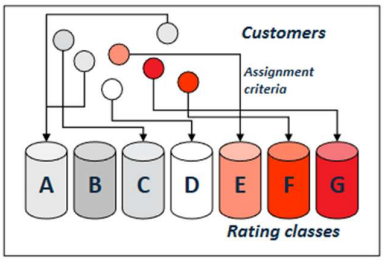
Questionnaire-based qualitative rating: Qualitative Assessments (if coded/structured)

Then you put all the variables according to their statistical significance in the model jointly with override -> the bank adjusts the scoring *based on other factors*. There is a high risk of manipulation of the ratings, so the overrides are strictly regulated. The changes should be justified, and the outcomes should be monitored over-time. The key risk is a manipulation in risk, so a manipulation in weighted risk assets, which mean less capital, so more loans and riskier, so a higher probability of default!

Statistical models: modular architecture

- *Different data sources have different properties* (frequency, consistency, objectivity).
- Models often *built as separate 'modules' for different data sources*.
- *Module outputs* (scores/ratings*) integrated by a 'second level model'*.

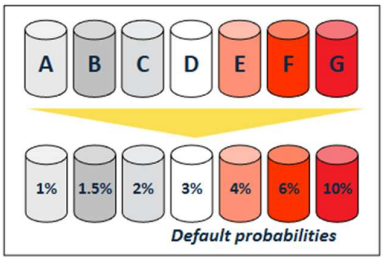
Advantages of Modules: Facilitates maintenance, allows re-calculation of specific modules, clearer customer profile view, ensures contribution of different areas, handles missing data for some modules, allows specialized modelling techniques.



Default risk: from customers to ratings, from ratings to PDs

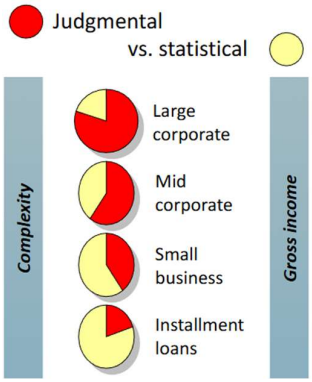
The PD-rating process can be seen as 2-stage process:

- in the rating assignment phase, customers are assigned to a set of ordered rating classes, or buckets
- In the rating quantification phase, a value of the PD must be estimated for each rating class (when the model is built or re-calibrated)



From customers to ratings: the rating assignment phase

This has already been tackled by most large banks. This is usually managed by a mix of statistical algorithms (e.g., discriminant scoring) and human-based procedures, with the latter focusing on qualitative aspects which cannot be objectively measured. The balance between automated and labour-intensive techniques varies according to the borrower's complexity and the loan's gross contribution.

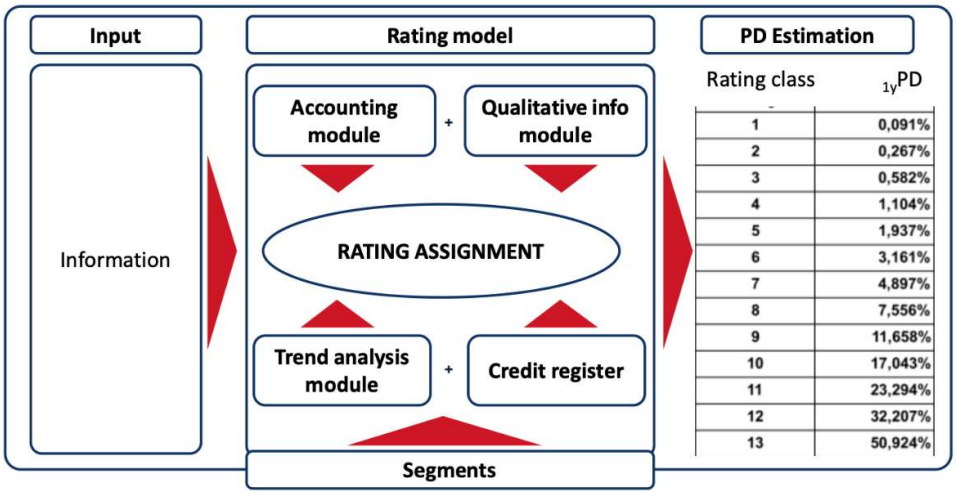


The architecture of a rating system

In order to build a rating system, there are several questions we have to ask:

- What historical data to consider when collecting the dataset for estimating and validating the model (perimeter of borrowers' type, time horizon, default definition used…)?
- What (explanatory) variables to consider?
- What weights to select for each of them?

The architecture of an internal rating systems for the estimation of the PD of a real bank

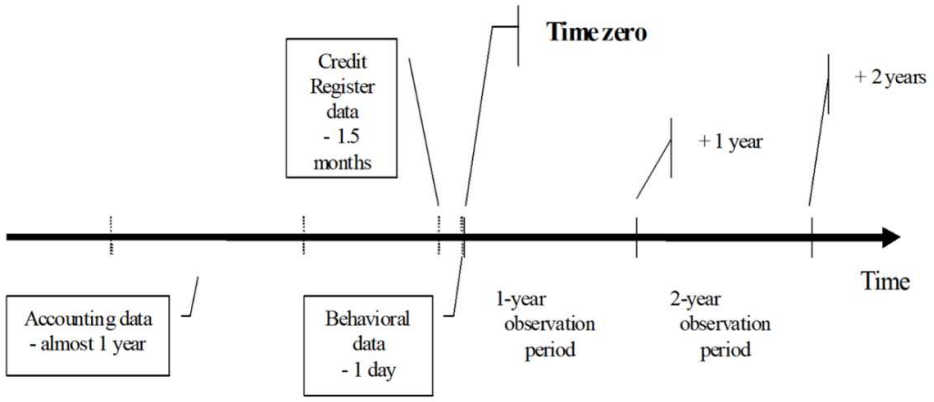


This is the rating system used by a real listed bank. The *quality of information* is *essential to the proper running of this system*. The minimum wight is usually given to the qualitative module, not because it is less important, but to *reduce the risk of subjectivity*. The outcome is the classification of the company in one of the 13 classes the company identifies

Statistical model estimation process

Goal: Build a model that links historical data at a point in time (said "time zero") to the outcome (Default/Performing) in a subsequent period. *Start* with a *dataset of borrowers*, including those who defaulted and those who performed, where the potential explanatory variables are the *data available before the outcome is known* and the Dependent Variable is the *outcome* (0 for performing, 1 for defaulted). *Techniques*: *Statistical procedures* (Stepwise selection for variables, Linear Discriminant Analysis / Logistic Regression for weights). *Aim*: Develop a model (e.g., $Z = a_1 \cdot X_1 + a_2 \cdot X_2 + ...$) that best discriminates between defaults and non-defaults. These are "*Reduced-Form Models*". Z is the borrower's score, a1 a2 … are the parameters, X1 X2 … are the explanatory variables.

Model estimation: defining the time frame



You want to obtain the probability of default at one year, but to obtain it you need data also on the following years. On the left of *time zero* (the theoretical point in the past when assessment is made), you see how much old the different kind of data must be (their level of update) in order to be reliable. *Data Collection*: Collect all information available at Time Zero (accounting, behavioural, credit register, considering data lags) -> potential explanatory variables. *Observation Period*: *Time interval after Time Zero where the outcome* (Default/Performing) is *observed* -> target time horizon.

➔ Model links data available at Time Zero to Observation Period outcome.

Time frame decisions & time-stratification

Common Observation Period for PD estimation is of 1 year. *Longer horizons* for the observation period led to more forward-looking models, but predictive power may decrease. The importance of different types of explanatory variables changes (behavioural data decrease their relevance the longer the observation period).

➔ Regulatory Expectation (Basel II §414, ECB Guide 2024): Ratings assignment should target «a longer time horizon» (e.g., 2-3 years according to ECB), whereas the needed PD quantification horizon is 1-year.

The *time-frame link* (Time Zero data to Observation Period outcome) must be consistent for all borrowers in the dataset. Time-Stratification means *using different Time Zeros for different borrowers* in the dataset which decreases the dependence on a single calendar year / specific economic cycle stage, smoothing the model's relation to the cycle.

Statistical models: minimizing errors

Models are not perfect, as they make errors in classification. The goal of estimation is to identify variables and weights that minimize both Type I (which means predicting a good performing entity thanks to the model while in reality it is a defaulting company) and Type II errors (where we predict the company to be a bad investment while in reality, they are a good company).

Actual status / Model prediction	Good (Performing)	Bad (Defaulted)
Good (performing)	Correct classifications of Good borrowers	Type I Error
Bad (defaulting)	Type II Error	Correct classifications of Bad borrowers

These errors have different costs for the bank:

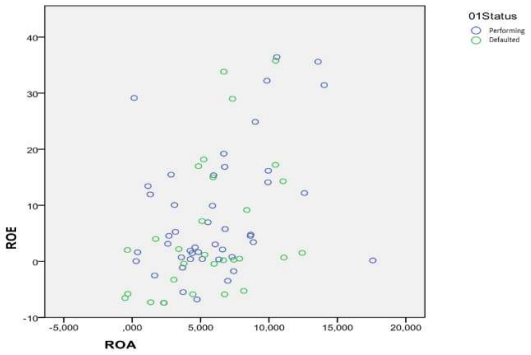
- *Cost of Type I Error (False Positive)*: The *loan is granted*, but the *borrower defaults*. Cost is the expected average Loss Given Default (LGD) on these defaulted loans. This is typically the most expensive error per occurrence.
- *Cost of Type II Error (False Negative)*: The *loan is rejected*, but the *borrower would have performed*. Cost is the expected average interest margin not earned. This is a missed profitable opportunity (an opportunity cost).

➔ Models are estimated to **minimize error number**, but credit policy uses the model with awareness of error costs.

Statistical model: example with 2 variables

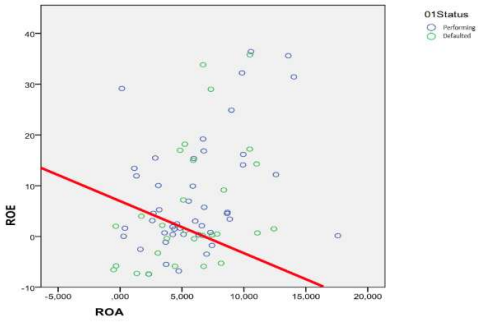
For the sake of simplicity let's assume they have already been chosen:

- Find a way to best separate performing from defaulting firms using these variables.
- Model takes form: $Z = a \times ROE + b \times ROA$



Statistical model: finding the optimal cut-off

- Choosing weights 'a' and 'b' and a cut-off score Z* means *defining a line that divides the plane*. The line separates good borrowers from bad borrowers
- *Equation of the line*: $ROE = \frac{Z^*}{a} - \frac{b}{a} \times ROA$
- Model estimation finds the optimal 'a', 'b', and Z* to position this line to minimize misclassifications (Type I and Type II errors).
- Shows how variables interact (e.g., low ROE okay if ROA high enough). It's a multivariate model.

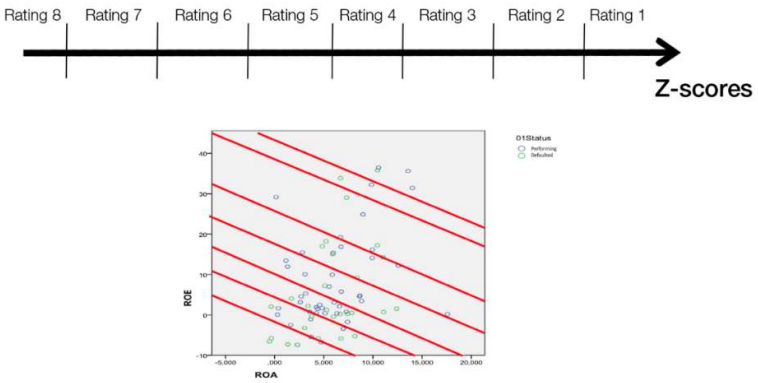


From scores to rating classes

If the *goal* is not just *Accept/Reject*, but assigning an ordinal Rating Class, we need to set multiple cut-off values (Z_1^*, Z_2^*, Z_3^*...) instead of just one (Z^*). *Each cut-off* represents a *new straight line* having a different intercept (Z^*/a) but same angular coefficient (b/a), and therefore parallel to the original straight line

➔ Higher score -> Higher predicted quality -> Lower expected default rate.

Rating classes as bands



You define different z scores associated with different levels of ratings, since it can be difficult to define only one line that tells you “Good” or “bad”. In this way you have many levels for the goodness of the borrowers

Altman Z-Score model (1968)

$$Z = 1.2 * X_1 + 1.4 * X_2 + 3.3 * X_3 + 0.6 * X_4 + 1.0 * X_5$$

where the *X* are explanatory variables:

- X_1 = Working capital / Total assets
- X_2 = Retained earnings / Total assets
- X_3 = Earnings before interest and taxes (EBIT) / Total assets
- X_4 = Market value of equity / Book value of total liabilities
- X_5 = Sales / Total assets
- ➔ Z* value (cut-off point): 2.365

This value is *empirically defined*.

Example: AlphaCorp

Financial Data (as of December 31, 2024) -> Let’s assume the following financial data for AlphaCorp (all values in millions of EUR):

- Current Assets: €150
- Current Liabilities: €70
- Total Assets: €500
- Retained Earnings: €100
- EBIT: €60
- Market Value of Equity: €300
- Total Liabilities (Book Value): €250
- Sales: €400

Example

Step-by-Step Calculation

- Calculate X_1 (Working capital / Total assets) -> Working Capital = Current Assets - Current Liabilities = €150 - €70 = €80 -> X_1=80/500=0.16
- Calculate X2 (Retained earnings / Total assets) -> X_2=100/500=0.20
- Calculate X3 (EBIT / Total assets) -> X_3=60/500=0.12
- Calculate X4 (Market value of equity / Book value of total liabilities) -> X_4=300/250=1.20
- Calculate X5 (Sales / Total assets) -> X_5 =400/500=0.80

Example

Calculate the Z-score

$$Z = (1.2 \cdot 0.16) + (1.4 \cdot 0.20) + (3.3 \cdot 0.12) + (0.6 \cdot 1.20) + (1.0 \cdot 0.80)$$

$$Z = 0.192 + 0.28 + 0.396 + 0.72 + 0.80$$

$$Z = 2.388$$

➔ As Z > Z* (2.388 > 2.365) the company is predicted as **performing!**

However, the same Altman suggested to use a «grey zone approach» -> *Zones of discrimination*:

- Z > 2.99 -> *"safe" zone*
- 1.81 < Z < 2.99 -> *"grey" zone*
- Z < 1.81 -> *"distress" zone*

Interpretation: 1.81<2.388<2.99 => «Grey» zone

The problem with this model is that it has lot of biases. Once it was used more, now less. The model is more suitable for listed companies, where you have more information.

Conclusion for AlphaCorp -> While AlphaCorp is not currently in the «distress» zone, its Z-score indicates that its financial health is in an uncertain state. Investors and creditors should *exercise caution* and *conduct further in-depth analysis of the company's financial performance*, liquidity, and debt management. Management should review their strategies to improve profitability, liquidity, and overall financial stability.

The role of qualitative factors

Statistical models primarily use quantitative data. However, crucial aspects of creditworthiness are qualitative:

- *Business Risk*: Industry trends, competitive position, market outlook.
- *Financial Risk*: Ability to withstand stress (beyond ratios), group affiliations.
- *Management Quality*: Experience, competence, cohesion, succession planning.

These factors are hard to capture perfectly in quantitative models.

Example of qualitative items in credit analysis

Corporate Structure***
- date of incorporation of the company (or of a significant merger and / or acquisition),
- relationships with parent company / subsidiaries,

Core business***
- markets in which the company operates, their stages in the "business life cycle" and type of competition;
- competitive position of the company, strength and weaknesses;
- nature of competitive advantage (cost / differentiation, dominant / defendable),
- years the company operates in the current core business,
- growth forecast,
- quality of the references in the marketplace,

Strategy ***
- strategic plans,
- business plans,
- stage of implementation of plans,
- proportion of assets / investments not strategically linked to the company's core business,
- extraordinary transactions (revaluations, mergers, transfers of business divisions, demerger of business) and their objective,

Quality of management***
- degree of involvement in the ownership,
- management's knowledge, experience, qualifications and competences (in relation to competitors),
- dependence on key figures,
- presence of a dominant entrepreneur / investor,

Other risks***
- operating risks,
- geographical concentration,
- level of business diversification,
- liquidity of inventories,
- quality of client base,
- share of total revenues generated by most relevant customers,
- dependence on some company's suppliers,
- legal and / or environmental risks,

Sustainability of financial position***
- off-balance sheet positions,
- sustainability of critical dead-lines with internal / external sources and contingency plans,
- liquidity risk, potential loss in receivables of one or more major customers, potential need to accelerate the payment of the most important suppliers,
- exposure to financial market risks,

Quality of information provided by the company and timing in the documentation released***
- information submitted on company's results and projections,
- auditors' assessment on the quality of budgetary information,
- past litigations.

Incorporating qualitative factors: judgment-based override

Process: Credit analysts propose adjustments to the model-based rating based on expert judgment about qualitative or non-modelled information. Requires approval by a specialized unit (e.g., "Rating Desk"). Effectiveness depends on analyst expertise and consistency -> useful for unique or recent events not in historical data (like the CEO example in the exercise).

Judgment overrides: risks & regulation

Risk: Overrides can be systematically misused to artificially improve ratings.

- Driven by commercial pressures (sales targets).

- To reduce capital requirements or provisioning.
- Undermines system integrity and comparability.

Regulatory Requirements (Basel II §417, §428):

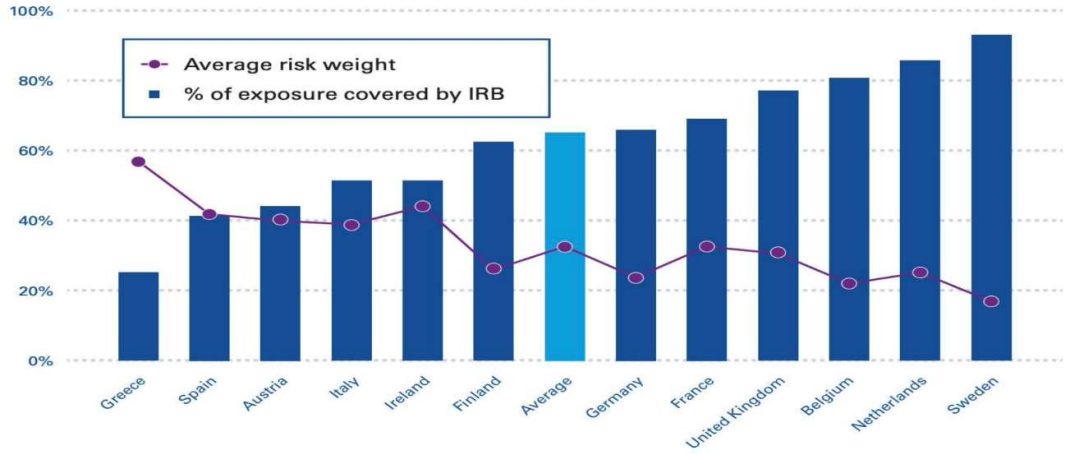
- Human judgment/oversight necessary, models also permissible.
- Clear rules for overrides: situations, extent, who approves.
- MUST identify and separately track overrides.
- MUST monitor their performance.

Guidelines for handling overrides are crucial

Incorporating qualitative factors: method 2-qualitative module (statistical)

Qualitative information collected via structured questionnaires (e.g., by relationship managers). Answers are codified into *ordinal* or *nominal data* and are used as input for a statistical model within a dedicated qualitative module. Requires *large historical datasets* of codified qualitative data for estimation. Benefits: Structured documentation, potential for future statistical validation.

Proportion of credit risk exposures under the IRB approach and average credit risk weight



Internal Rating systems are the most used in Europe nowadays.

Future trends in credit rating

Big Data: Availability of vast, new datasets. Artificial Intelligence (AI) & Machine Learning (ML):

- New tools for analysis and synthesis.
- Potential for incorporating unconventional data (e.g., sentiment from text).
- More complex algorithms.

Regulatory Perspective: Current caution regarding complex "black box" models for capital adequacy purposes. Validation challenges. Anticipation that these innovations will gain recognition over time.

Other concepts, measures and tools of credit risks

Firstly, let's analyse the main concepts that arise from the report "S&P Global, 2025: Default, Transition, and Recovery: 2024 Annual Global Corporate Default and Rating Transition Study":

- The models that have been developed by S&P are closer to the optimal model (so the model that is capable of identify with a 100% accuracy if a borrower is good or bad) than the random model (generated by tossing a coin), so we have a *good discriminatory power* -> we expect this from one of the major rating agency
- The performance of the model is different from *geography* and *industry*, as there are sectors/local areas that are riskier
- The performance of the model depends by the *time horizon* -> the best performance is 1y time horizon (82,8%) vs the performance at 7y time horizon (69,2%) -> despite the percentage is lower, we still have a good discriminatory power (as the percentage is above 50%)

Corporate Gini coefficients by region, 1981-2024

	--Time horizon--			
	One-year	Three-year	Five-year	Seven-year
Global				
Weighted average	82.86	75.11	71.72	69.22
Average	85.65	78.73	74.66	71.68
Standard deviation	(5.33)	(4.94)	(5.19)	(5.16)

- What about the classification between speculative and investment grade? 96,9% of defaults refer to *speculative* grades
- Gini index correlates with defaults rates -> when we have a recession, we have an increase in the overall risk of the economy = we have an increase in the probability of default, both for good and bad borrowers

➔ Overall, we can say that ratings are accurate according to Gini index, and the rating produced in this report by S&P (as well as the ones produced by other rating companies) can be trusted -> the discriminatory power of the classification systems used by these companies represents the competitive advantage of rating companies. In addition, from the regulator's perspective, it is possible to use and trust these ratings in order to determine the regulatory capital for the different companies.

In the previous chapters we have said that *banks cannot avoid risk*, but they have to know the risk they assume in order to *price properly* and *manage the risk*. Managing it means *monitoring the performance of the counterparty we have installed a relationship* in order to control the level of the risk so the bank can intervene (review the line of credit, maintain a constant EL)-> in the worst case, there would be the problem of recover from the default of the counterparty by using the several guarantees and collaterals. We said that the two components of credit risk are:

- *EL* -> we referred to it as the cost of doing business, and we said that banks are *covered by provisions*
- *UL* -> the variability around the mean of the losses, represented by the EL. Because of this, we have said that it is a function of the EL (f(EL)), and that it is *covered by capital*, defined using different tools. In particular, we have to make a distinction between:
    - Economic capital, which is measured by models such as the VaR (Value at Risk)
    - Minimum required capital/Regulatory capital -> the minimum capital companies need to have in order to face a specific level of risk, usually by using as a parameter the RWA

When we talk about **credit risk models**, it is a different concept from credit risk management, as they are the models that allow the banks to estimate the economic capital -> they are strictly related to the concept of economic capital. The main characteristic is how they account for defaults:

- *Default Mode* -> you recognise the loss only when the counterparty defaults -> *PD, LGD, EAD*
- *Mark to Market* -> you recognise the loss not only with the default but also with a worsening of rating -> *PD, LGD, EAD, Migration risk* (the risk a bank would face a downgrade in its rating), *Spread Risk*

(the risk the difference between the risk-free rate and the return of the company will increase -> during the 2008 financial crisis there has been an increase in these spreads)

There are 2 important models:

- *Simplified credit risk models* -> DM
- *Full Portfolio Credit risk model* -> *can be used booth for DM* (in this case you include the concentration risk, which means there is a lack of diversification by the company) *and MTM* (all the risks are considered)

In the second lecture we focused on Probability of Default (PD) -> it is connected to the mechanism related to the rating process:

- *Assignment* -> there are 2 philosophies, *Point in Time* (you estimate the risk of the company in a specific moment, which can be different from the one we picture one month later) or *Through the Cycle* -> *methodology* can be *judgemental* (so based on the judgement of experts that consider both qualitative and quantitative data -> generally used by rating agencies) and *statistical* (typically used by banks, they are entirely based on quantitative data, such as the Altman Z score model, which are updated every year no matter what is the explanatory power of a certain variable) -> they are *useful just to discriminate if a company is a good or a bad company*
- *Quantification* -> you want to quantify the percentage of default
- *Validation* -> it is about the discriminatory power, the good calibration and about the stability of measures -> they are important because if you want to use an internal rating, you have to demonstrate to supervisors the good of their rating system.

EL is the loss expected over a period of time, and it is important to calculate it accurately as the UL is a function of the EL. For a *single exposure* (simplified, so a single product such as a single loan): EL = PD × LGD × EAD -> We need to understand LGD & EAD more deeply.

Severity risk: Loss Given Default (LGD)

Definition: the amount lost if default occurs.

$$LGD = 1 - RR, where\ RR\ is\ the\ Recovery\ Rate$$

Recovery Rate is a function of the *Recovery Amount* and *Recovery costs*. *Why important?* Recovery varies hugely (*collateral* (banks analyse the assets to pledge for giving the loan. They have also to monitor the value of the asset in order to understand how it influences the LGD), *guarantees* (there is a third party that guarantee against the case of default of the company, with who the bank has no direct relationship with), *legal process* (procedures of recover, which can be internal for the bank or at legal court in case of bankruptcy)). We can estimate LGD using 2 approaches:

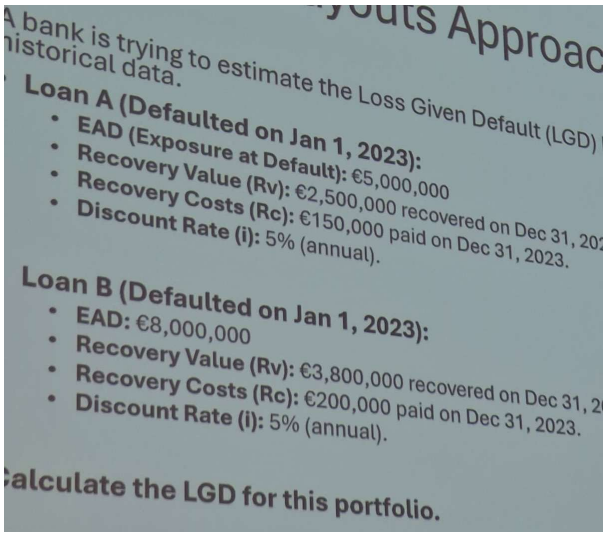
- *Actual payouts approach*
- *Market price approach*

Actual pay-outs approach

$$LGD = \frac{Loss}{EAD} = 1 - RR = 1 - \frac{PV\ of\ Net\ Recovery}{EAD} = 1 - \frac{\sum_t (\frac{RV_t}{(1+i)^t} - \frac{RC_t}{(1+i)^t})}{EAD}$$

Key Inputs for Estimation are *Recovery Value (RV), Recovery Costs (RC), Timing (t), Time Value of Money* (i, as recovering 1€ today is different from recovering 1€ in the future. It can be estimated using the rate you can apply to a new loan) and *Exposure at Default (EAD)* -> we essentially compare the money we actually lose with the exposure at the time of default.

Example:



Solution (considering we have a 1-year time horizon):

$$Total\ EAD = 5{,}000{,}000€ + 8{,}000{,}000€ = 13{,}000{,}000€$$

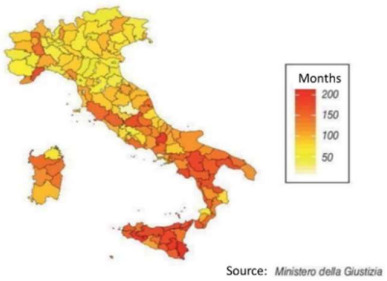
$$LGD_A = 1 - \frac{\frac{2{,}500{,}000}{1+0.05} - \frac{150{,}000}{1+0.05}}{5{,}000{,}000} = 55.24\%$$

$$LGD_B = 1 - \frac{\frac{3{,}800{,}000}{1+0.05} - \frac{200{,}000}{1+0.05}}{8{,}000{,}000} = 57.14\%$$

If we want to identify the total LGD of the bank, we can calculate it as a normal average, but it is better to calculate it with a weighted average using the EAD:

$$LGD = 55.24\% * \frac{5{,}000{,}000}{13{,}000{,}000} + 57{,}14\% * \frac{8{,}000{,}000}{13{,}000{,}000} = 56{,}42\%$$

Usually, the efficiency of recovery depends on the single bank, as they usually have their own recovery departments that have to manage the collaterals and the guarantees. LGD can also depend on the *efficiency of legal courts* -> let's consider the following map showing the average month to execute a bankruptcy procedure in different Italian courts (2014-2017). We can notice that even at the best performing courts, we still talk about 50 months, which is more than 4 years. At a systemic level, because we know that UL is a function of EL, and LGD influences EL, improving the level of efficiency of courts can reduce the need for capital of the different banks.



Market price approach

LGD is estimated by looking at the market prices of similar bonds that defaulted in the past (so you need bonds), usually observed one month after the default. This delay allows the *immediate price volatility caused by the default event to subside,* leading to a more considered market valuation that better reflects recovery expectations -> it enters *subjectivity*, as we have to define what is a comparable bond (in terms of geographical area, in terms of seniority, in terms of sector…). The average LGD of comparable bonds then used as the ex-ante estimate for currently traded bonds, to evaluate the potential loss in case of default.

$$LGD = 1 - RR = 1 - \frac{Market\ value\ (1\ month\ post - default)}{Nominal\ Value}$$

Expected Loss Rate (ELR)

Once both the *Probability of Default (PD)* and the *Loss Given Default (LGD)* are estimated, the Expected Loss Rate (ELR) for a *specific exposure* can be calculated simply as:

$$ELR_{ij} = PD_i * LGD_{ij}$$

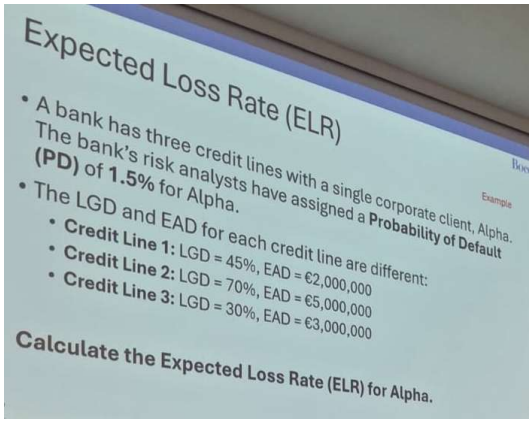
Where *i* refers to the obligor i and *j* refers to the specific credit line of obligor i -> a borrower can have different lines of credit or financial instruments.

Expected Loss Rate (ELR) - debtor with different credit lines with the bank

If obligor i has m different credit lines with the bank, the *overall expected loss rate* (ELR_i) across all m lines is a *weighted average of the individual ELRs*. The weights are determined by the *relative size of each credit line's Exposure at Default (EAD_{ij}) compared to the total EAD* of obligor i (EAD_i) with the bank. Thus, the formula becomes:

$$ELR_i = PD_i * \sum_{j=1}^{m} (LGD_{ij} * \frac{EAD_{ij}}{EAD_i})$$

Example:



Solution:

$$ELR = 1{,}5\% * \left(45\% * \frac{2{,}000{,}000}{10{,}000{,}000} + 70\% * \frac{5{,}000{,}000}{10{,}000{,}000} + 30\% * \frac{3{,}000{,}000}{10{,}000{,}000}\right) = 0{,}795\%$$

Turning to the bank's overall portfolio, the *expected loss rate of a portfolio of exposures* to n borrowers is:

$$ELR_p = \sum_{i=1}^{n} (ELR_i * \frac{EAD_i}{\sum_{i=1}^{n} EAD_i})$$

Similarly, in an ex-post perspective, the *loss rate of a portfolio (LR_p)* that includes n borrowers is:

$$LR_p = \sum_{i=1}^{n} (LR_i * \frac{EAD_i}{\sum_{i=1}^{n} EAD_i})$$

➔ In order to understand if we made a good prediction and calibration, we have to make a comparison between the expected loss rate and the actual loss rate (which is what you find after a period of time).

Exposure risk - Exposure at Default (EAD)

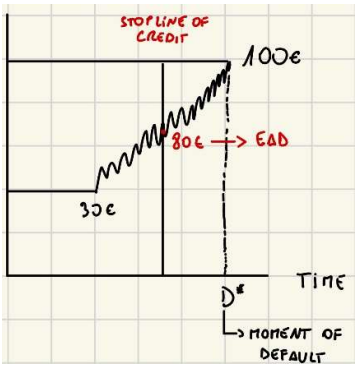
Why can't we simply say that EAD is our current level of exposure? Because we have to look at the behaviour of the client. **Definition**: The *outstanding amount at the moment of default* -> Often not the current exposure! Why estimate? Borrower behaviour changes as default approaches. *Estimation*:

- Using the Exposure Multiplier (Em) -> **EAD = Em × Ec,** where Ec is the *Current Exposure*
- Em is estimated using historical data -> First of all, a *bank calculates the Em for each of the loans* that have gone into default in the past:

$$Em = \frac{Actual\ EAD}{_{-1y}Ec}$$

where $_{-1y}$Ec is the *Exposure that was current one year before the default*. Then, a bank defines *clusters of similar loans* (same facility type, similar size, …) and hence calculates the *average Em for each cluster of loans*.

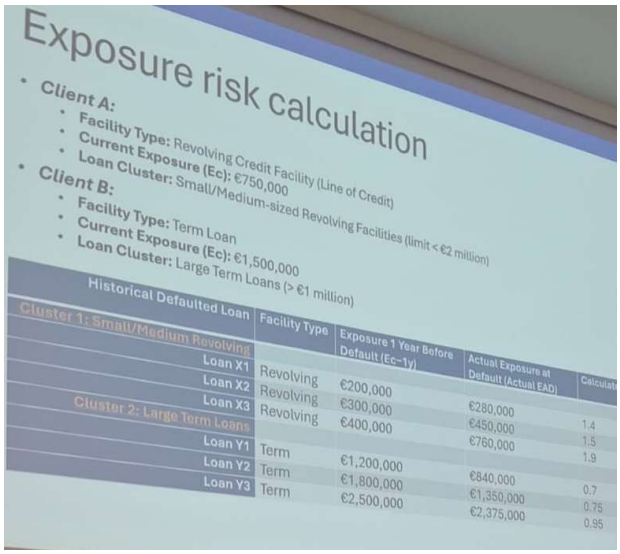
Let's suppose there is a client who has a line of credit of 100€, of which he's just using 30€. We can expect that the client will use the entire amount of the line of credit, but thanks to the internal monitoring system of the bank it is possible to see how the client used the line of credit in the past, the efficiency of the monitoring system and the level of collaterals -> you can stop the usage of the line of credit before the default (let's say at 80€), which will become our Exposure At Default -> Comparing Ec and EAD we can estimate our Em.



EAD behaviour:

- *Discretionary Facilities* (Credit Lines, Cards -> expected in cases of discretionary lines of credit):
  - Borrowers draw down before default.
  - Typically, Em > 1
  - EAD > Current Exposure
- Amortizing Loans (Mortgages, Term Loans):
  - Scheduled repayments reduce principal before default occurs.
  - Typically, Em < 1
  - EAD < Current Exposure

Example:



Solution:

The Em values are calculated by comparing the Actual Exposure at Default and Exposure 1y Before Default (for example, for Loan X1 280,000/200,000 = 1,4).

Once we have calculated all the Em for the same clusters of loans, we can compute the average Em that will be applied to the Ec in order to identify the EAD.

"Revolving" type:

$$Average\ Em = \frac{1{,}4 + 1{,}5 + 1{,}9}{3} = 1{,}6$$

$$EAD = 750{,}000€ * 1{,}6 = 1{,}200{,}000€$$

"Term" type:

$$Average\ Em = \frac{0{,}7 + 0{,}75 + 0{,}95}{3} = 0{,}8$$

$$EAD = 1{,}500{,}000€ * 0{,}8 = 1{,}200{,}000€$$

Expected Loss (EL)

Now we can move on to **estimating the expected loss in value (EL)** for a given borrower i having m credit lines with the bank. In formula terms

$$EL_i = PD_i * \sum_{j=1}^{m} (LGD_{ij} * EAD_{ij})$$

For a portfolio of n borrowers, we expect that the **Expected Loss** is the sum of the Expected Losses of all customers:

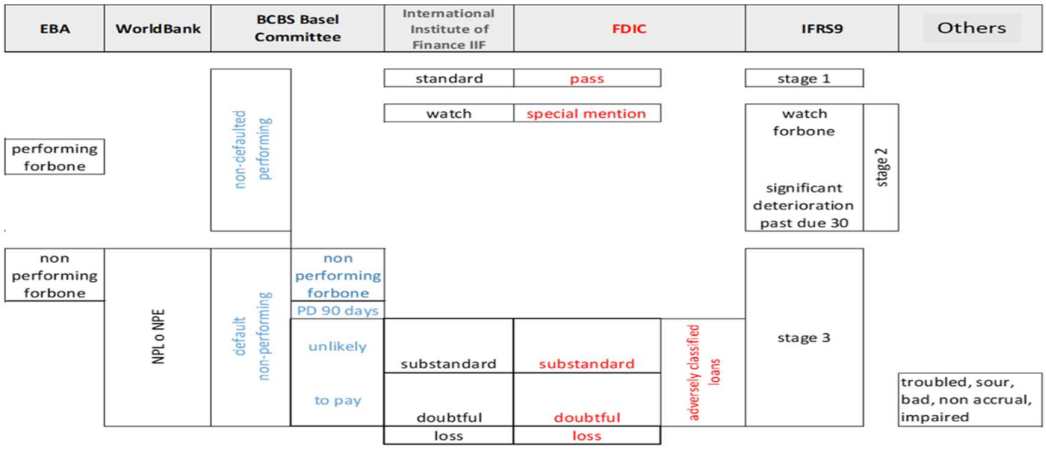
$$EL_p = \sum_{i=1}^{n} EL_i$$

Interpretation: EL is an expected cost, *covered by provisions* in the financial statement of banks. Similarly, from an ex-post perspective, the **portfolio loss (L_p)** is simply the sum of the actual losses incurred on the individual exposures (L_i):

$$L_p = \sum_{i=1}^{n} L_i$$

Default definition

We have always talked about default as a certain event that is used to calculate the EL and UL, but we haven't defined it yet. As it is possible to see from this table, there are multiple definitions of default according to the different regulators, which usually make a distinction between "performing loans" and "non-performing loans" -> we are going to focus on the definition of Basel Committee.



Traditional definition of default (Focused on «bad loans») -> the bank evaluates that the borrower will not pay back the loan in full, *without considering forced execution of collaterals and guaranties*.

Basel II DoD -> it includes two additional definitions of default together with the traditional one:

- *Unlikely to pay* (unlikely to meet the obligations with the bank) -> you can predict it knowing the characteristics of the borrower -> *there are some factors/events by which you can affirm the customer will not be able to pay back 100% of the loan*
- *Past due 90 days* -> if you have a borrower who is not able to pay one of his instalments and after 90 days they haven't paid, if the payment surpasses a certain threshold should be considered in default

What is the impact of Basel II DoD on PD, LGD and EAD measures? Captures a wider spectrum of credit deterioration increasing the objectivity of the definition, because Past due 90 days derives from a pure observation of data, whereas UTP are more judgmental and can be more easily differently interpreted by banks and their supervisors all over the world.

Unexpected Loss (UL)

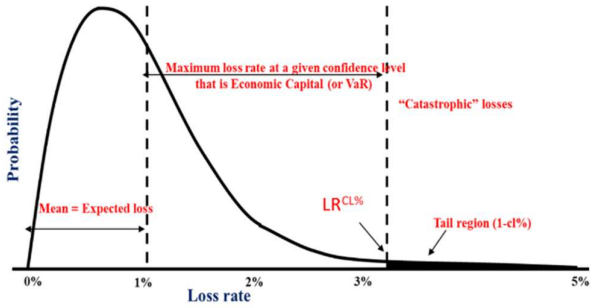
Once you have the EL, you can **calculate the UL**, which is the variability around the average that requires risk capital to be calculated. Differently from market risk you cannot use the standard deviation, and distribution of losses are *highly skewed*:

- Lots of outcomes near zero loss on the left side of the distribution.
- A long tail of potentially high losses on the right side of the distribution.

➔ Instead σ is a symmetric measure; it doesn't focus on the critical "bad" tail.

Value at risk approach -> Estimates the maximum loss expected at a given confidence level over a set horizon, excluding EL (*Net VaR*) (Example: 1-year VaR at 99.9% Confidence). Confidence Level, for example at level 99.9%, means *there's a 99.9% probability that actual losses will NOT exceed EL + VaR*, which means the capital we have collected is more than enough. Conversely, 0.1% (in the example) is the probability that losses will exceed EL + VaR and you cannot quantify how much.

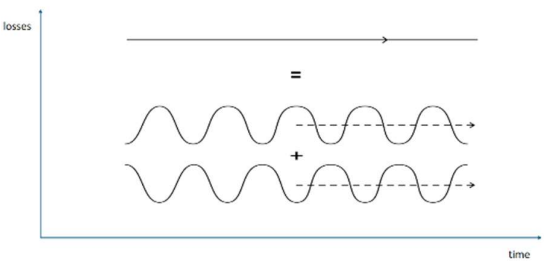
VaR = Economic Capital needed to absorb unexpected losses. *Bank Solvency*: If A*ctual Loss > [EL (Provisions) + VaR (Capital)]*, the bank faces distress/failure. The *confidence level* reflects the *bank's target Probability of Default* (due to credit losses) (e.g., 99.9% VaR -> 0.1% chance of losses exceeding capital buffer). Cost of this capital impacts loan pricing & banks' performance (RAPMs).



The graph shows the distribution of the loss rate (which shows us why we cannot use the standard deviation). By computing the Expected Loss, we are able to cover the high majority of loans given by the bank. For the coverage of the Unexpected Loss, the value depends by the value of confidence level chosen by the bank.

Portfolio effects: VaR is not additive!

We have to remind that EL is additive (in fact, as we have seen before, the expected loss for a portfolio is the sum of the expected losses of the single elements, $EL_p = \sum EL_i$). On the other hand, UL (VaR) is NOT additive -> *the Value at Risk of portfolio (VaR_p) can be lower than the sum of the Stand-Alone Value at risks ($\sum_{i=1}^{n} VaR_i^{SA}$).* Why does it happen? *Diversification* -> the key is the Correlation between losses on individual exposures. So, for example, let's suppose that there are two businesses, one produce ice cream and the other umbrella -> in case there is a rainy day, the losses generated from the ice cream business is compensated by the profit from the umbrellas, in particular because these two businesses are



not correlated between them -> if diversification is not conducted with accuracy, the VaR required for that company will be higher and, therefore, the level of capital required by regulators. This is the so-called **concentration risk** -> Risk arising from a sub-optimally diversified portfolio. Exposures are highly correlated (e.g., same industry, region, risk factor).

➔ *High concentration → Higher portfolio VaR → More capital required*

Marginal VaR -> difference with a portfolio without the new exposure and the portfolio with it. Stand-alone risk of a loan is a less useful measure of risk. What matters is the incremental risk a loan adds to the existing portfolio.

$$Marginal\ VaR: VaR_i^M = VaR_{p+i} - VaR_p$$

➔ Generally, $VaR_i^M < VaR_i^{SA}$ due to diversification benefit within the portfolio

Variability of outcomes regards not only losses as a whole, but also their components such as the variability of default rates, variability of loss given default rates and variability of exposure multipliers and EADs.

Credit Risk Models (CRM) - VaR Models

Purpose: Estimate probability distributions of credit outcomes → Calculate VaR:

- SCRM (Simplified models) -> only for the Default Mode, which allows to calculate stand-alone VaR -> Do NOT account for correlations.
- FPCRM (Full Portfolio models) -> Calculate portfolio & marginal VaR -> INCORPORATE correlations. It can be either Default Mode or Mark-to-Market.

➔ CRM vs. Ratings: CRM yield UL (VaR); Ratings yield EL inputs (PD, LGD estimates).

Mark-to-Market (MTM): loss without default

Default Mode assumes loss only happens on default. With the MTM value changes based on market perception, even if the exposure is still performing -> New Risk Profiles:

- *Migration Risk*
- *Spread Risk*

Migration risk -> Loss in value due to a downgrade in credit rating. Mechanism:

- *Downgrade* → Market requires higher credit spread.
- *Fixed contractual cash flows* (bond/loan) → Price must fall to offer higher yield.

Relevant to any Asset Valuation (but easily observable only on traded assets such as bonds): Price = PV of Cash Flows discounted at Yield (risk- free + spread -> the change in rating changes the spread and therefore the Asset Valuation)

$$P = \sum_{k=1}^{N} \frac{C}{(1+r)^k} + \frac{FV}{(1+r)^N}$$

Spread risk -> Loss in value due to a generalized increase in market-required credit spreads, even if own rating is unchanged -> *often happens during market stress*. Mechanism: Higher market «price of risk» → Market demands higher spread for all risk levels → Prices fall for existing instruments contractually bound to lower returns.

Why MTM?

- Captures risks (Migration, Spread) Default Mode misses.
- Provides a more dynamic view of value changes.
- Highly relevant for marketable credit instruments (bonds, securitized loans). But, as all loans can be securitized, it is actually relevant for almost all asset classes.
- Useful for internal decision-making, even if accounting is not strict MTM for loans.

The most relevant drawback of the MTM model is the pro-cyclicality. Mechanism:

- Economic Downturn → Credit Risk ↑
- MTM Approach → Asset Values ↓ (due to Migration/Spread risk)
- Bank Capital ↓ (based on asset values)
- Reduced Lending Capacity
- Worsens the Economic Cycle ↻

Ratings: a common input, used differently

Both Default Mode and MTM rely on individual credit ratings:

- *Default Mode (SCRM/FPCRM)* -> The probability distributions of default risk and severity risk show higher variability the higher their averages (that is the higher PDs and LGDs are, that is the worse borrower ratings and severity ratings are) -> Used to estimate default-driven UL.
- *Mark-to-Market (MTM-FPCRM)* -> Ratings also used to derive Migration Matrices & Credit Spread Curves. Used to estimate value-change-driven UL (including default).

Credit selection

If we want to understand what is behind the generation of cash, we have to understand what generates the profitability, and so the strategy and the sustainability of the business model.

Cash flow is vital for day-to-day operations and debt servicing, but if the company is not profitable, it is not possible to generate the cash. Profitability drives *sustainable cash flow* (usually considering a medium-long term horizon), *builds equity, and ensures long-term viability* -> without profit, *cash is temporary*, as it eventually runs out. For banks, understanding future profitability is key to prudent lending -> looking at the *current profitability* (usually by looking at the ROE) is different from *assessing the future profitability*, which requires some *assumptions*. These assumptions are present in the business plan shown by the company for receiving the loan, but we should not rely too much on them, as the *information might be inflated* -> it needs to challenge the information presented by managers. This can be done by *comparing the values of competitors*, but you need *a cluster of different companies,* and you *have to know the industry,* if the company has a competitive advantage (which can justify the higher level of profitability shown by the company in its business plan) -> it is a complex operation, as there is a subjectivity for defining what is a competitor and whether it belongs to a specific industry (which is a group of companies doing the same product for the same market -> this can be redefined if we consider the technology, which is important in order to identify our comparables).

Setting the standards: EBA LOM, 2020 «**Final Report on the European Banking Authority Guidelines on Loan Origination and Monitoring**»:

- *Core Objective*: Ensure robust & prudent credit risk management by institutions.
- *The Big Picture*: Not just about current numbers, but a 360° business analysis.
    - Integrates *financial & qualitative profiles* (such as the business model, which requires experience to analyse. This is because not always the company has a long history that can help us to analyse the company, like it happens with start-ups).
    - Forward-looking: *Medium- to long-term horizon* (3-5 years).
    - Profitability is Cornerstone: For *business sustainability & borrower creditworthiness* -> when we take a loan, it has an impact on the cost of debt and then the cost of the future debt we might arise, as well as the sustainability of the debt and the creditworthiness.

Following the intense and widespread critique by the financial industry of EBA-LOM 1999 draft, EBA has separated requirements for these two macro-segments of banking lending -> Art. 2 of Commission

Recommendation of 6 May 2003 concerning the **definition of micro, small (MS)** and **medium-sized and large enterprises (MSL)** states that:

1. The category of *micro, small and medium-sized enterprises (SMEs)* is made up of enterprises which *employ < 250 persons*, and which have an *annual turnover < EUR 50 million*, and/or an *annual balance sheet total < EUR 43 million*.
2. Within the SME category, a *small enterprise* is defined as an enterprise which *employs < 50 persons* and whose *annual turnover and/or annual balance sheet total < EUR 10 million*.
3. Within the SME category, a *microenterprise* is defined as an enterprise which *employs < 10 persons* and whose *annual turnover and/or annual balance sheet total < EUR 2 million*.

The final EBA-LOM, however, have many identical paragraphs for the two macrosegments, and even when requirements are different, they are only minimal differences!

EBA LOM: key directives for assessment:

- *Comprehensive Information* (you need a lot of information): Business model, corporate structure (governance, see how the company is managed…), business plans with financial projections. (§86, §90, for both MS and MSL)
- *Realistic Projections*: Banks must assess and even make their own projections if borrower data is unreliable. (§129 MS, §151 MSL).
- *Future Profitability*: What a retained earnings impact equity. (§152 for both MS and MSL)

Stress testing & early warnings

Stress Testing (§131 MS, §156-158 MSL): Assess repayment capacity under some events that can impact negatively company's profitability (such as a decline in revenues or operational loss or managerial problem). For MSL enterprises, a detailed list of factors to stress is provided by EBA-LOM:

- *Idiosyncratic Events*: Decline in revenues/profit, operational loss, management problems, supplier failure, reputational damage, liquidity outflow.
- *Market Events*: Macro downturn, sector downturn, interest rate shocks (e.g., +200 bps!).

Early Warning Indicators (EWIs, indicators that tells us in advice that there are some problems so the bank can intervene) (§274): Signals of credit quality deterioration (for both MS and MSL).

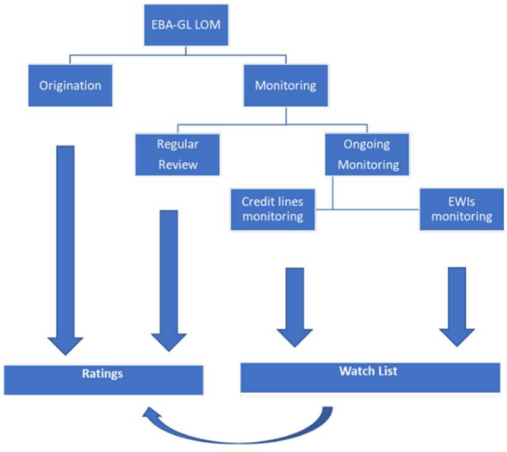
- Examples: Debt increase, turnover drop, narrowing margins, forecast deviation, rating downgrade, covenant breach.
- Watch List (§272): Triggers "alarm-triggered review" – a deep dive similar to origination.

The lifecycle of credit assessment

Origination: Initial assessment, so when we give the loan, we have to *estimate the risk*, using ratings coming from internal rating systems and other sources -> this risk should be compliant to regulation.

Monitoring (after we have given the loan, we have to analyse the risk connected to the company over time, in order to assess the evolution of the probability of default):

- Ongoing: *Behavioural* (so if the usage of the loan is problematic, if the client respects its payment deadlines…) *& Structural* (EWIs, Enterprise Warning Indicators).
- Regular Review: *Periodic (annual) 360° reassessment*.



Watch List: Triggered by EWIs, leads to an "alarm" 360 degrees review, that eventually may change the borrower's rating.

Banks, thanks to capital allocation, can be seen as engines of the whole economic -> banks channel household savings to entrepreneurial initiatives in order to *invest in ventures that generate the "highest economic value" (with lowest risk)*. This drives national GDP growth, even with constant financial resources. The key is to prioritize profitable enterprises with sustainable and predictable earnings = lower default probability.

$$Savings -> Bank -> Productive\ Business -> GDP\ Growth$$

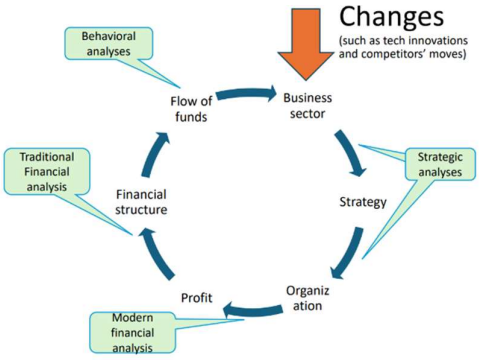
Two paths in lending policies, different outcomes:

- *Asset-Based Lending* (when there is no trust in the accounting systems, you protect your exposures with collaterals and guarantees) -> in this case, the company gives some collateral (mortgages, pledges) for covering the loan -> it requires an existing strong balance sheet.
    - Why appealing? Reduces operational costs of credit analysis (easier to evaluate existing assets).
    - Problem: Can hinder efficient allocation (does not ensure resources go to the most productive ventures) and the efficiency of the protection depends by the stability of the price of the collateral.
- *Cash-Flow Lending* (EBA LOM Approach) -> it is based on the future profitability of the company and its sustainable earnings potential, usually for a medium-long period or at least for the same maturity of the debt. Why superior? Directs funds to economically viable businesses.
    - Benefit: Aligns with efficient resource allocation and long-term economic growth.
    - Problem: it is not easy to assess the future profitability of the company; it requires several assumptions.

Why cash-flow lending wins:

- *Asset-Based Risks*:
    - Client Portfolio Erosion: Defaults (even with recovery) mean losing clients, forcing to replace them with potentially marginal borrowers.
    - Capital Erosion: High equity at origination doesn't guarantee resilience; operational losses can quickly wipe it out.
- *Cash-Flow Lending Benefits*:
    - Forward-Looking: Addresses fundamental business health.
    - Focus on Sustainability: Lending to firms whose viability depends on operating income.

The starting point is going to be the business sector, as it is the environment where we are going to operate and the one that is more subjective to changes from external factors. The aim of the company is to develop a strategy that allow it to operate within the business sector, even though the strategy continuously change and updated.



Once we have defined the good strategy, there are going to be some organizational structure. This is difficult to obtain easily, as there is a natural tendency of human beings to resist the change -> these difficulties are going to be reflected in the financial performance, the level of activity in the bank and its relationship with shareholders.

How companies get into trouble (a logical and chronological sequence)?

- Failure to perceive/interpret changes in competitive environment (not created a new strategy capable of perceiving this changes).
- Inability to innovate strategically (new business model).
- Failure to implement new business model effectively.
- Operational losses: Core operations fail to generate adequate income (ROA < Cost of Debt) -> profitability problems begin here
- Cash deficit & weakened financial structure.

- Creditors tighten lending, distress signals emerge (Credit Registers, credit line usage).

➔ We enter in a **situation of crisis**, which can be of two types:

- *Industrial* -> we have obsolete assets and the product is not accepted -> can lead the company to lose the role of the leader within the market, leading to a financial analysis
- *Financial* -> we have some problems at level of liabilities, such as the high level of debt. At the same time, in case you have good strategy, have a good customer base, you can change the financial structure (for example, restructuring the debt, transform the debt in equity, making payment deadlines longer) and grow again. On the other hand, in case it is not treated properly can install an industrial crisis

Matching risks with analysis

Strategic & Operational Risks:

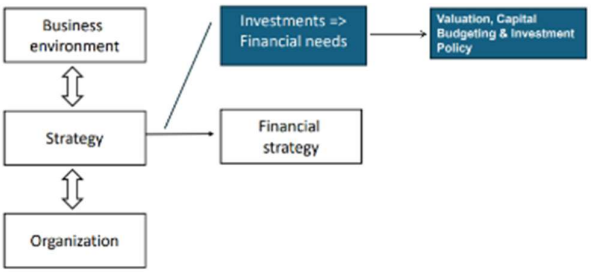
- Root Cause: Inconsistencies between environment, strategy, and operations.
- Manifests in: Operating Margin (Income Statement).
- Analytical Tools: Competitive analysis, business model review, qualitative assessment, modern profitability analysis (quality of earnings assessed via a system of financial ratios examined together with strategic analysis).

Financial Risk:

- Root Cause: Weak balance sheet, mismatches in financial characteristics.
- Manifests in: Balance Sheet strength, cash flow, debt levels.
- Analytical Tools: Financial structure analysis, traditional ratios analysis (based on ideal values of individual ratios).

➔ There should be a **balance within these risks**, even though it is much easier for a bank to assess the financial risk than the strategic risk, as there are many more instruments

Early detection means identifying strategic/operational issues before they become financial problems. Strategic risk is the first risk the bank should assess, as after that it has to understand if the financial risk is adequate and eventually contribute to risk. In addition, strategic risk is *influenced by the industry* and the *phase of the life cycle* in which the company is present.



What are the characteristics of a good business?

When we assess the characteristics of a good business, we have to analyse it having a medium-long term horizon. The key factor is identifying the **strategy** that we identify by looking at what is the product created, what is the market and how the company wants to assess it (so the organization the company has to build and use in order to produce the product for satisfying the market) -> we have to find a fit.

The first element we have to analyse for assessing the strategy of a company is the business environment. The **business environment** needs to be identified at macroenvironment (using tools like PESTEL analysis -> a change in one of these factors is going to affect multiple industries) and microenvironment (which means analysing the industry, of which we have to define the structure (how many companies operate in the industry, how big they are, how much they are exposed to country risk, how much they are internationalize), life cycle (if you have a new industry, how can you grow?) -> in case a company operates in multiple industries, we'll have to analyse only one of it), competitive forces (Porter's 5 forces)) -> we collect the *opportunities* and *threats* that are common to all companies belonging to the same industry.

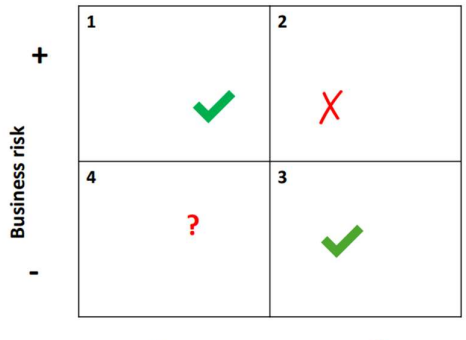
You need to find a **coherence** between strategy, organization and environment -> if we decide to adapt a strategy that allows us to collect the opportunities and face the threats, then you'll have an impact on the company's organization. Another balance we have to find, is between strategy and financial strategy, as in

case we want to make some organizational changes we have to make investments = financial need, which should be covered by the financial strategy -> *Strengths* and *Weaknesses* (firm-specific characteristics)

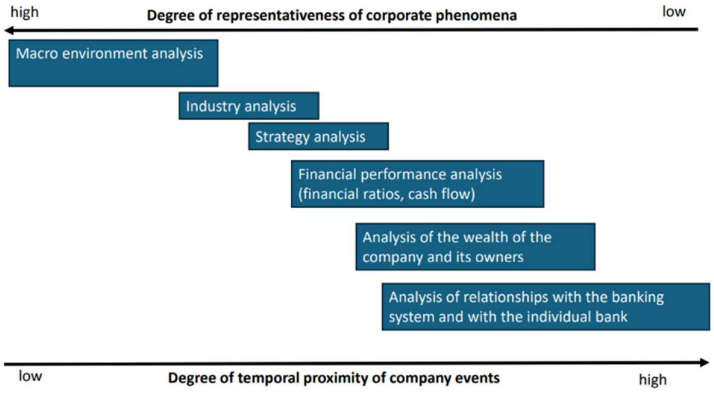
Maximisation of shareholder value:

- Strategic alternatives -> growth of the business (for which we can adopt an internal perspective (organic) or external perspective), increase transparency/clarify business (the lowest is with the conglomerate, for which we apply a conglomerate discount -> in order to reduce it we break down the conglomerate, but we have to consider the pros and cons)
- Financial alternatives -> fund growth (like fund an acquisition) recapitalize (regarding the relationship between D/E, we have to consider the level of them and the correct mix)

SWOT analysis might be just a preliminary analysis conducted by a bank, but in reality what needs to be done is conducting **Business** (which includes country risk, industry risk, competitive position, profitability/Peer group comparisons) and **financial risk** (Accounting, financial governance and policies/risk tolerance, cash flow adequacy, capital structure/asset protection, liquidity/short-term factors) are the risks that need to be *balanced*.



- In case we have a high financial risk (as our financial exposure is very high), then we'll need a low business risk.
- On the other hand, in case there is a high business risk and a low financial risk, the company can allow itself to increase its financial exposure to exploit the leverage.
- The question mark is a situation in which the company is facing a particularly high level of risk aversion, but at the same time they are underutilizing the financial power -> good opportunity for hostile acquisition, in particular if this is done with debt -> we have to be careful this operation does not imply an excessive increase in the financial position.



Credit risk evaluation framework

Let's analyse the two variables:

- The first variable is the *degree of temporal proximity of company events*, such as a default -> if it is high, you know you are close to the default, but you don't know why
- we have to look at the second variable, which indicates why something is happening, but you don't know how

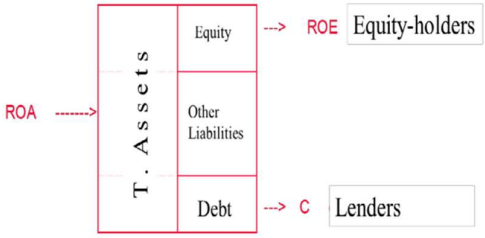
➔ *trade-off* -> the more you are close to know what is happening, the less you know why

(Modern) Financial ratio analysis

Use historical financial statements to *identify strategic choices*, *management policies, and external influences*. **Two Fundamental Principles**:

- Go beyond numbers: Focus on the underlying business dynamics that produced the figures.
- Apply a systemic view: Individual ratios are not analysed in isolation; use a coordinated system of indicators

Starting point -> *financial statement analysis*, in particular by *reclassification of Balance Sheet*.



Key Points: Total Assets (from which we obtain the ROA), Equity (from which we obtain the ROE), Debt, which is classified into:

- Financial debt paying interest (c)

Net sales
+Change in stocks of finished goods and w.i.p.
+Capitalized costs
VALUE OF PRODUCTION
- Purchase of raw materials and consumables
+ Change in stocks of raw mat. & consumables
- Cost for services
ADDED VALUE
- Staff costs
- Provisions for employee severance indemnity
GROSS OPERATING INCOME (EBITDA)
- Depreciation of capitalized costs
- Depreciation of tangible fixed assets
- Write-downs on working capital
- Provisions for liabilities and charges
+ Capitalization of intangible assets
- Depreciation of intangible assets
NET OPERATING INCOME (EBIT)
+/- Other (non-operating non-financial) revenues & charges
CURRENT INCOME BEFORE FINANCIAL P&L
+ Financial income
- Losses on and write-downs of financial assets
CURRENT INCOME BEFORE INTEREST EXPENSES (CIBIE)
- Interest and other financial expenses
CURRENT INCOME
+/- Gains (losses) on disposal of non-financial assets
+/- Reduction in write-downs and (W-D of non-financial assets)
+/- Extraordinary income and (charges)
GROSS OF TAX PROFIT
- Corporate income taxes
- Other taxes
NET PROFIT

- Other Liabilities (OL): Non-interest-bearing (e.g., trade payables, which have no direct costs and the only type of cost comes by a missing discount or provisions).

Reclassified Corporate Income Statement

There are several indicators that are interesting for our analysis, such as the *Current Income Before Interest Expenses (CIBIE)* -> current income generated by the company not recognising the contribution of liabilities (= the interests paid to the financing bodies).

After considering the interest expenses we have the *Current Income*, to which we sum/subtract the extraordinary components (in order to obtain the Gross Profit) and taxes (in order to obtain the Net profit)

Even though it is possible to calculate the ROE by comparing Net Income with Equity, it is possible to decompose it in the following way (which includes the impact of liabilities and the impact of some components of the financial statements):

$$ROE = \left[ROA + (ROA - C) * \frac{D}{E} + ROA * \frac{OL}{E}\right] * \frac{GP}{CI} * (1 - T)$$

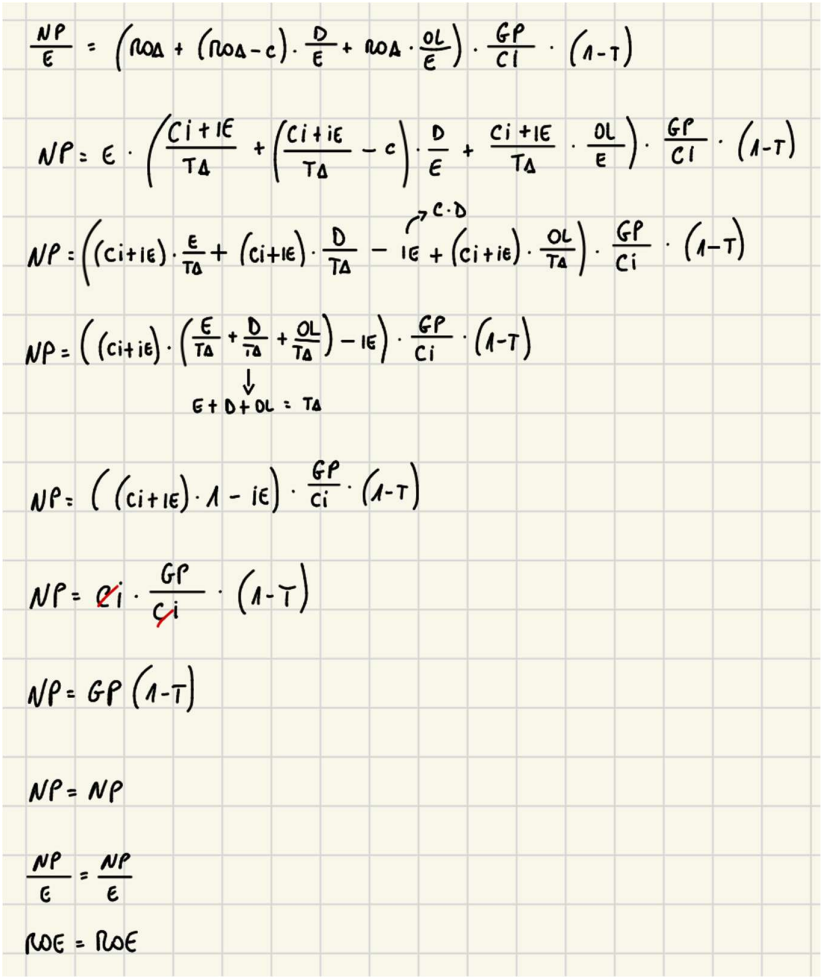
Where:

- *ROE (Return on Equity)*: Net Profit / Equity (Shareholder Profitability).
- *ROA (Return on Assets)*: CIBIE / Total Assets (Return on ALL assets, capital structure independent) -> it is the main indicator of the variation in the Business Risk
- *C (Cost of Debt)*: Interest Expenses / Financial Debt (Average cost of borrowing) -> the difference between ROA and C is called spread and is very important for the effect on the leverage.
- *D/E (Debt-to-Equity Ratio)*: Financial Leverage.
- *OL/E (Other Liabilities to Equity)*: Non-interest-bearing Liabilities Leverage.
- *GP/CI (Gross Profit to Current Income)*: Impact of Extraordinary Items.
- *T (Tax Rate)*: Taxes / Gross Profit.

It is possible to identify the components of the risks faced by the company:

- *Business risk* -> it is assessed by the variability of the ROA
- *Financial risk* -> it is assessed by the variability of C, as it depends by the level of financial leverage (the higher the financial risk = high risk and volatility = worse rating = more cost)

➔ When we have a high level of business risk (so a very volatile ROA) we should have a low financial risk (so a low and stable level of C) in order to have a *positive spread* -> if you have a high volatility for both elements, there is the risk the spread might go below 0



Let's consider this example where two companies have the same ROE

Case	ROE = [ROA + (ROA – C) × D/E] × (1 – T)					
A	17%	20%	20%	6%	1	50%
B	17%	14%	14%	10%	5	50%

Both Case A & B have 17% ROE. Do they carry the same risk for lenders?

Answer: CERTAINLY NOT!

- ROA (20% vs. 14%): B's core business is significantly less profitable.
- Cost of Debt (C) (6% vs. 10%): B faces higher borrowing costs.
- Spread (ROA – C) (14% vs. 4%): B's margin is much narrower (increasing the probability of future ROA<C, all other things being equal).
- Leverage (D/E) (1x vs. 5x): B is highly leveraged. This means:
    - If spread is positive, gains are amplified.
    - If spread turns negative, losses are catastrophically amplified.

➔ Conclusion: High financial leverage amplifies both gains and losses. It amplifies overall risk.

Exercise

You are analysing «Alpha Co.» and «Beta Co.», two companies in the same industry. You have gathered the following summarized financial data for the most recent fiscal year (all figures in € millions):

	Alpha Co.	Beta Corp.
Net Profit (NP)	12	12
Equity (E)	60	40
Current Income Before Interest Exp. (CIBIE)	30	20
Total Assets (TA)	100	100
Interest Expenses (IE)	4	6
Financial Debt (D)	40	60
Other Liabilities (OL)	0	0
Gross of Tax Profit (GP)	15	15
Current Income (CI)	26	14
Taxes	3	3

To do:

- Calculate ROE for both Alpha Co. and Beta Co. What do you notice?
- Calculate all the component ratios for the extended additive ROE formula for both companies (ROA, C, D/E, OL/E, GP/CI, T)
- Apply the extended additive ROE formula for each company and verify it matches your direct ROE calculation (NP/E).
- Based on the component breakdown, which company presents a higher risk from a lender's perspective, and why? Explain your reasoning in detail, connecting to the concepts of profitability and leverage

Solution

Alpha

ROA: ROA=CIBIE/TA=30/100=0.30
C (Cost of Debt): C=IE/D=4/40=0.10
D/E: D/E=D/E=40/60=0.6667 (rounded)
T=Taxes/Gross of Tax Profit=3/15=0.20
1 - T: 1−T=1−0.20=0.80

Applying the Additive ROE Formula
ROE=[ROA+(ROA−C)×D/E+ROA×OL/E]×GP/CI×(1−T)
12/60=[0.30+(0.30−0.10)×0.6667+0.30×0/60]×15/26×(1−0.20)
20% = (30% + 20% x 0.6667) x 57.7% x 80%
ROE for Alpha Co. ≈20%

Beta

ROA: ROA=CIBIE/TA=20/100=0.20
C (Cost of Debt): C=IE/D=6/60=0.10
D/E: D/E=D/E=60/40=1.5
T=Taxes/Gross of Tax Profit=3/15=0.20
1 - T: 1−T=1−0.20=0.80

Applying the Additive ROE Formula
ROE=[ROA+(ROA−C)×D/E+ROA×OL/E]×GP/CI×(1−T)
12/40=[0.20+(0.20−0.10)×1.5+0.20×0/40]×15/14×(1−0.20)
30% = 20% + (10% x 1.5) x 1.07 x 80%
ROE for Beta Co. ≈30%

Which is the riskier company?

- Beta's ROE (≈30%) is 50% higher than Alpha's (≈20%), largely due to Beta's significantly higher financial leverage. However, comparing Gross ROE (= Current Income / Equity) reveals the opposite:
  - Alpha: 43% (=26/60)
  - Beta: 35% (=14/40)
- Alpha has stronger underlying operational performance. Its lower reported ROE was caused by a large, non-recurring negative extraordinary item that needs investigation. Beta's reported ROE was boosted by a small, non-recurring positive item.

Equity approach versus entity approach

How do we evaluate a company's financial health and investment decisions?

- **Shareholders (Equity Approach)**: What's in it for us? How does leverage impact our returns and risk?
- **The Company as a Whole (Entity Approach)**: How do we make capital budgeting decisions? What's the relevant cost of capital to evaluate investment projects? -> we have to make reference to NPV and IRR to assess the worthiness of the project

For example: Alpha has a Debt-to-Equity ratio of 2. Its ROA has historically been stable at 8%, and recently, interest rates increased from 3% to 6%. The spread (ROA – C) used to be +5%, now it is only +2%. Should Alpha maintain its current leverage, increase it, or reduce it?

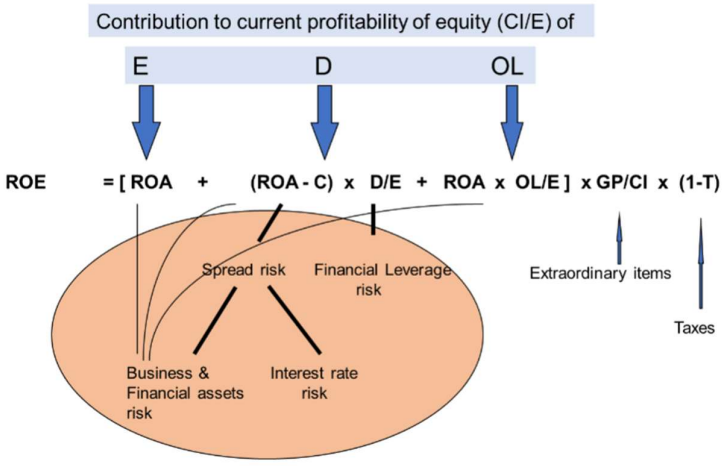
Gross ROE = ROA + (ROA-C) * D/E = 8%+2%*2=12%

D/E increases at 3 -> 8%+2%*3=15% -> in a stationary situation, this is the best alternative, as the ROE increases. But in this case, despite the stability in business risk shown by the stability in ROA, we are in a situation where the environment is changing and we are facing a higher financial risk, so there is the risk that the spread might become negative -> a prudent strategy might be reducing D/E

Equity approach

This approach prioritizes the analysis of profitability from the standpoint of equity holders, with *ROE* serving as the key accounting indicator that summarizes the firm's performance for shareholders. The extended additive ROE formula allows us to connect the overall economic efficiency of the business (viewed from the owner's perspective) to the specific management areas (and their associated risks) that drive it, in particular, to the financial leverage risk. Lenders may use this approach to focus on company profitability. In fact, for the regulatory and management reasons this is the cornerstone of corporate creditworthiness analysis.

Return on Equity (ROE=Net Income/Equity) is the key indicator for shareholders. The Extended Additive ROE formula breaks down ROE to show how profitability, efficiency, and financial leverage drive shareholder returns and helps to assess the economic sustainability of corporate debt.



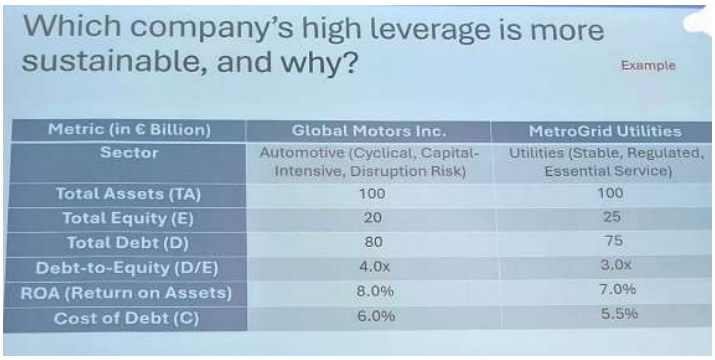
- The volatility of the ROA is an indicator of the Business risk, which is *the consequence of different analysis of the environment*, which has its impacts after a few times (2-3 years). For example, the

financial effects the introduction of competitive product will be reflected -> the volatility of ROA depends by the change in environment and the coherence of the strategy with these changes
- Volatility of the ROA depends by the *stage of the life cycle* -> the ROA volatility of a startup is going to be different from the volatility of a mature company
- If there is a correlation between the increase in the volatility of ROA and the reduction of spread, D/E can be a problem
- If you have a lot of OL means that you are financed by your supplier, but most of the time it means the company is renouncing to discounts

Spread risk factors:

- *Interest Rate Risk (Variability of C)*: Depends on debt structure (fixed vs. floating, short vs. long-term, expected new borrowing in the future, usage of interest rates swaps). Bank's Trade-off: Manage interest rate risk or bear more credit risk.
- *Historical Spread Buffer*: A large, consistent positive spread provides a cushion. Discussion: Why is a historical positive spread important?
- *Correlation Risk (ROA vs. C)*:
    - Positive Correlation (Good): ROA and C move in the same direction (e.g., both rise in an upcycle). Reduces risk.
    - Negative Correlation (Bad): when ROA falls C rises. Increases risk. Risk-adjusted loan pricing increases interest rate risks

➔ Driven by *market's ability to impose risk-adjusted interest rates* (e.g., lower ROA leads to worse credit rating, higher C)



Which company's high leverage is more sustainable and why? Let's evaluate the performance of the CFO and the company for assessing this situation.

	A	B
Company	BR *	*****
	FR *	****
CFO	**	****

Global Motors Inc -> larger spread, but there is a higher volatility, in particular because of the capital-intensive industry in which it operates

MetroGrid Utilities -> it operates in a stable and regulated industry = lower level of volatility

The evaluation given to CFO can be justified mainly because of the Spread -> even though company A has a higher spread compared to company B, the relative level of D/E ratio is much higher and the business risk-> higher risk that the spread might be eroded by financial distresses, which can caused by a rating downgrade following an contraction in profitability.

When is high leverage sustainable? (Equity View)

Any level of financial leverage can be sustainable if the spread (ROA– C) remains positive. What's the probability of the spread (ROA – C) turning negative in the future? High financial leverage is sustainable if spread risk is LOW:

- *Low ROA Variability*
- *Limited Interest Rate Risk* (e.g., fixed-rate debt, stable market rates)
- *Substantial Historical Spread Buffer*
- *Positive, Neutral, or Weakly Negative ROA-C Correlation*

Entity approach

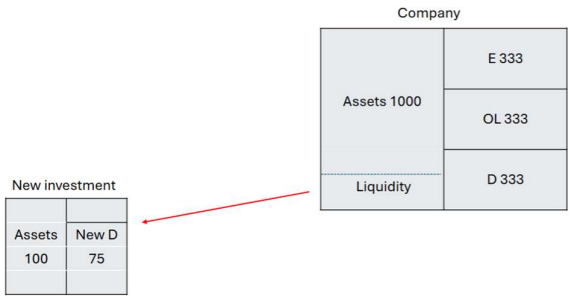
Evaluating the profitability of Investment Projects and Company value. Capital Budgeting: Assessing economic viability of investments by looking at *operating cash flows* (no explicit interest or financial components) and using Internal Rate of Return (IRR) or *Net Present Value (NPV)* as methods. In particular it is necessary to establish the Hurdle Rate which is the minimum acceptable return for an investment (must cover the cost of financial resources used to fund it).

We have to distinguish between:

- **Minor Investments** (Marginal Impact on the financial structure of the firm): Small relative to company size and likely to use the *marginal cost of specific funding sources* (for example, if the return of an investment is 10% and the cost of the debt used to finance this project is 5%, it's convenient). Practical but theoretically flawed: Assumes financial need is static.
- **Major Investments** (Significant Impact on the financial structure of the firm): Large, affects capital structure of the firm. Marginal cost approach is inadequate, and you need to compare the profitability with the overall WACC of the company.

Why marginal cost fails for Major Investments?

- *No One-to-One Matching of Investments & Funding* -> creditors finance the company as a whole, not single projects (which principle is violated in case we use the marginal cost). Projects are funded by the firm's overall financing mix, not just newly raised funds -> Compare project return to forward-looking WACC based on target capital structure.
- *Interdependency Among Financing Sources* -> Current financial decisions affect future funding options -> Raising equity today might improve future credit access and *raising debt today might require getting additional equity tomorrow*. Ignoring these side effects can lead to flawed decisions (e.g., approving low-return projects just because cheap capital is available now).



Initially we might say that because the new debt is 75, the remaining 25 is equity, so D/E = 3. We have to remind that 25€ is financed by 1/3 of D, 1/3 of E and 1/3 of OL -> total debt is 75 + 1/3*25, while the equity is 1/3*25 -> D/E=10.3

Weighted Average Cost of Capital (WACC)

The Go-To for Major Investments & Valuation requires a combination of equity and debt to finance the company as a whole, so we calculate the WACC as fundamental indicator:

$$WACC = K_e * \frac{E}{TA} + K_d * (1 - T)\frac{D}{TA}$$

Forward-looking, Target, Weighted Average Cost of Capital. It reflects a reasonably *appropriate future financial structure* for the company.

- K_e: Cost of Equity (shareholders' required return given the level of risk).
- K_d: Cost of Debt (lenders' required return, net of tax savings -> we have to consider the new financial condition we'll be subjected in case we receive new financing).
- E/TA & D/TA: Weights of equity and debt divided by total assets

➔ Use **Market Values and Target Capital Structure** -> if we want to use the WACC as a threshold for a new project, we have to consider the new capital structure that is going to be implemented in order to do so.

Why use market values for WACC?

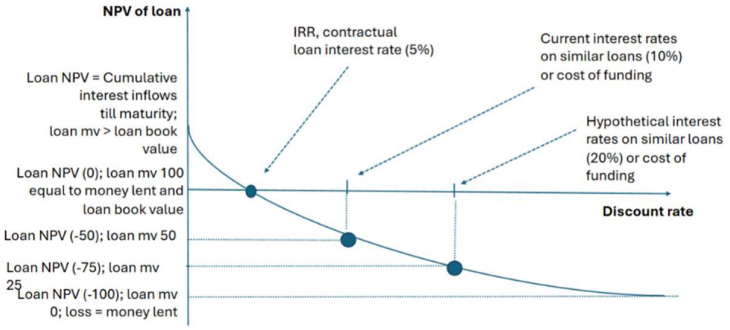
- *Reflect Current Reality*: Market values represent the current investor expectations and perceived risk, incorporating all publicly available information. Book values are historical and don't reflect today's economic reality or future prospects.
- *Forward-Looking Decisions*: WACC is used to evaluate future investments. We need a cost of capital that reflects the actual cost of raising new funds at current market prices, not past accounting figures.
- *True Opportunity Cost*: Market values capture the true opportunity cost of capital. Shareholders' required return and lenders' required interest rates are determined by the market, not by historical book entries.
- *Consistency with Valuation*: Most valuation models (like DCF) deal with future cash flows. Using market-based weights for WACC ensures consistency between the forward-looking nature of the valuation and the discount rate.

Why K_e must be defined considering the *market value* of equity?

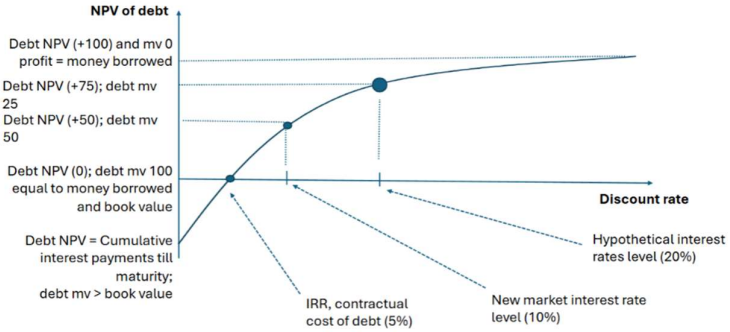
The owner of a company is remunerated via the Net Profit, either it is distributed or not. Modigliani and Miller have demonstrated that in the MM world (and we can say: in the long run, no transaction cost, no information asymmetry…) *dividends + capital gains = NP* because *capital gains are aligned with non-distributed net profits*. Now, assume this relation holds, and suppose the (book value of) equity of a company is 100, the owner can sell the company at 200 (therefore, there is a price-to-book value of 2) and the owner is happy when receiving an annual return of minimum 20%, because there are alternative investments having the same risk of the company that provide 20% return. To make the owner happy, how much the minimum NP must be? 40, because 40/200=20%. The denominator of K_e is the market value of equity, because is the value that can be obtained by selling the company and can be invested in alternative investments that generate 20% return.

Is there a relation between ROE and K_e? The owner has a *target in terms of K_e equal to 20%*. We now know that K_e is calculated on the market value of equity. If you want to specify a target ROE for the company's managers, how much would the target ROE be, in order to be compatible with a K_e of 20% if, as in our example, the price-to-book value is 2? Because the *ROE = K_e * price-to-book value* = 20%*2 = 40%.

Why Kd must be defined considering the market value of debt? When calculating the WACC, suppose you want to use a K_d of 10%, representative of the current market expectations for the cost of debt in the future. However, in the current financial structure of the company, there is a large perpetual debt of 100 (book value) paying a fixed interest rate of 5%, that was obtained years ago when interest rates were lower (we use a perpetual debt in this example to keep things simple, but the same phenomena can be observed for any medium and long term debt). Can you apply a 10% K_d to this debt when you calculate the WACC or you need to make some adjustments? You have to make some adjustments, as you need the current market value of the debt -> 10%.



Let's analyse this from the perspective of the lender. If from the initial situation of 5% we move from a discount rate of 10%, you reduce the value of the loan. Let's assume we are in front of a perpetual debt that pays a coupon of 5%. The initial amount 100. If we discount the coupon of 5€ for 5% we obtain the value of 100, but the discount rate increases at 10%, the value of the loan decreases at 50.

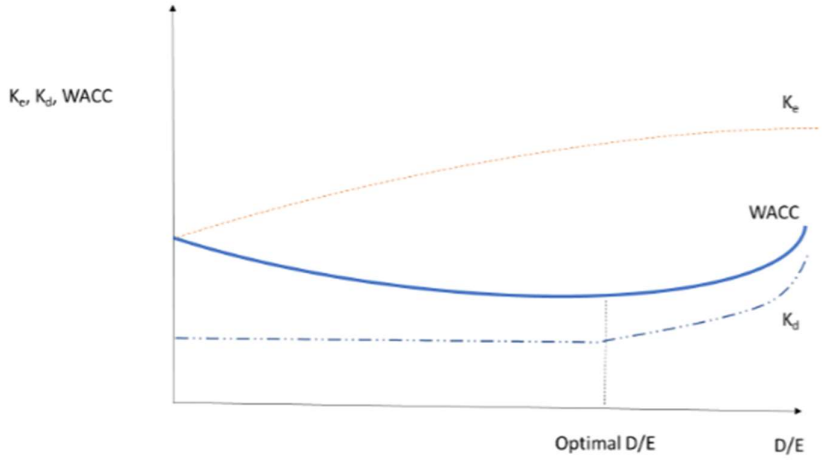


From the perspective of the borrower, we have to consider that the debt we have to show is the one that takes into account the increase in interest rates, which causes the market value of your debt decreases (producing a gain in MTM terms), as

$$P = \sum_{k=1}^{N} \frac{C}{(1+r)^k} + \frac{FV}{(1+r)^N}$$

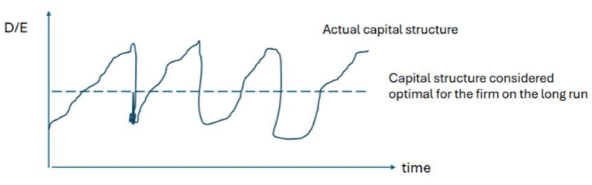
and you can compute the new market price of the debt by simply discounting C and FV using the new market interest rate as r. In the graph, "debt mv" is representing the market value of debt, and "debt NPV" is representing the gains or losses in MTM terms.

The company has to *minimize the WACC* in order to *maximize the Enterprise value*



- K_e: Increases with leverage (shareholders demand more for higher risk). However, the speed of increase (the slope of the curve) decreases because *more and more of the company risk is transferred to debtholders*
- K_d: Stable at first, then rises sharply as default risk becomes apparent.
- WACC: Initially decreases (cheaper debt replaces expensive equity) then rises due to increasing Ke and Kd.

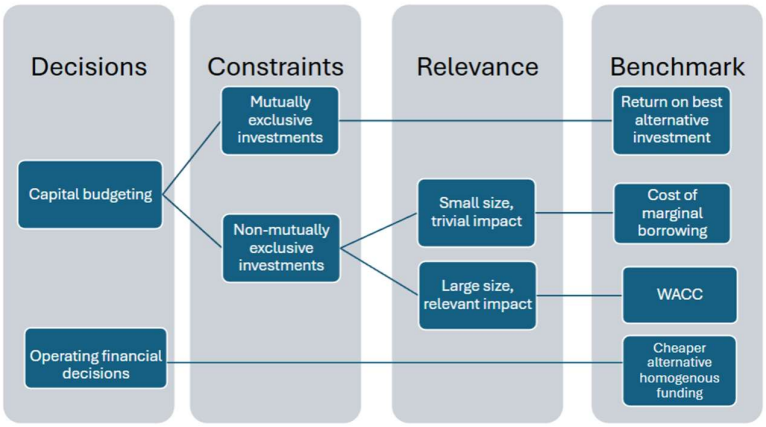
➔ The **Sweet Spot**: There's an optimal Debt-to-Equity ratio where WACC is minimized



The firm's CFO knows she/he cannot deviate from the optimal capital structure *too much* and/or *for too long*. That's why when you are using a unique discount rate in your DCF calculations, it's not necessary to change the discount rate in

order to go after the variegates levels of the D/E ratio that occur in single periods, but you can stick with the one unique D/E ratio related to the optimal capital structure that is CFO's target capital structure for the firm. Therefore, there are two very different types of financial decisions:

- *strategic financing decisions* (setting the optimal capital structure and defining WACC)
- *operating financing decisions* (which funding to choose in any specific moment (equity, s.t. debt, m.l.t. fix rate debt, m.l.t. floating rate debt, leasing, factoring, …)



Equity vs. Entity: different, yet so similar!

$$ROE = \left(ROA + (ROA - c) \cdot \frac{D}{E}\right) \cdot (1-T)$$

$$ROE = \left(ROA \cdot \frac{E}{E} + (ROA - c) \cdot \frac{D}{E}\right) \cdot (1-T)$$

$$ROE = \left(ROA \cdot \frac{E}{E} + ROA \cdot \frac{D}{C} - c \cdot \frac{D}{E}\right) \cdot (1-T)$$

$$ROE = ROA \cdot \frac{TA}{E} \cdot (1-T) - c \cdot \frac{D}{E} \cdot (1-T)$$

$$ROA \cdot \frac{TA}{E} \cdot (1-T) = ROE + c \cdot \frac{D}{E} \cdot (1-T)$$

$$\underbrace{ROA \cdot (1-T)}_{\text{reflects wacc}} = \underbrace{ROE \cdot \frac{E}{TA}}_{\text{reflects } K_e} + \underbrace{c \cdot (1-T) \cdot \frac{D}{TA}}_{\text{reflects } K_d}$$

Example

Gamma considers entering an emerging market with higher political and economic risk. Normally, it uses a WACC of 9% for project evaluation. Should Gamma:

- Increase K_e (using CAPM with higher beta)?
- Allocate more equity capital (lower D/E ratio), thus increasing WACC indirectly?

➔ The only sure thing the company should not do is using 9% for the evaluation of the convenience of the new project, given the new profile of risk.

When evaluating an investment, what if the investment is much riskier than the company's typical projects? Can we still use the company's Weighted Average Cost of Capital (WACC) as the benchmark? The answer is no, not directly:

- *Approach 1* -> If a new investment carries significantly higher risk, you need an **Adjusted WACC**. This adjustment usually means increasing the cost of equity (Ke) in the WACC calculation, because *higher risk* means *shareholders will demand a higher return* to compensate for that extra risk. Models like the Capital Asset Pricing Model (CAPM) can help quantify this increased Ke -> Essentially, you're raising the "hurdle rate" for the project to reflect its unique risk profile.
- *Approach 2* -> This approach, doesn't increase Ke but rather the amount of equity capital needed (therefore reducing the amount of debt and the D/E ratio). Here's how it works:
    - *Riskier investments require more allocated equity (VaR)*: a larger portion of Economic Capital (VaR) is ideally allocated to absorb the higher unexpected losses.
    - *Less debt (1 - VaR) supports the investment*: Consequently, the ideal portion of debt supporting this investment is reduced.
    - Based on this capital allocation (more equity, less debt), the *WACC to be used in the investment evaluation will be higher* (because equity is more expensive than debt), and we are assuming to use more equity and less debt.

➔ Banks, when evaluating loans (that are investments from the point of view of banks) do use this approach to evaluate them from an economic point of view.

Corporate financial analysis and the interaction between financial and operating leverage

Deconstructing ROE was the first level of analysis. Now we move to e **second level of analysis: ROA vs. opROA**:

- *Return on Assets (ROA)*: Measures return from all activities (operating, financial, ancillary) given the return of all the single activities -> $ROA = CIBIE/TA = Current\ Income\ before\ Interest\ Expenses/Total\ Assets$
- *Operating Return on Assets (opROA)*: Focuses on core business profitability (EBIT from Operating Assets only) and relates it with Operating Assets only = excludes financial & ancillary investments/income and assets -> opROA=EBIT/Operating Assets

➔ We expect that the weight of the operating activity is supposed to be high, but we have to verify it. This is because in case the majority of the profitability comes from the operating activity it is bad news. Any difference (level or trend) between opROA and ROA highlights the *impact of non-core activities*. opROA often drives ROA as Operating Assets typically are much larger than financial & ancillary assets, and therefore the weight of opROA prevails on financial & ancillary returns.

Third level of analysis -> Decomposing opROA

$$opROA = ROS * op\ Asset\ Turnover$$

Where:

- **Return on Sales (ROS = EBIT/Sales)** -> How much operating profit (EBIT) is generated per euro of sales
- **Operating Asset Turnover** (Op Asset Turnover = Sales/Operating Assets) -> how many times a company sells its Operating Assets in a year. How efficiently operating assets are used to generate sales.

For example. Two companies, A and B, operating in different consumer markets, both achieve a similar Operating Return on Assets (opROA):

- Company A: Characterized by high Return on Sales (ROS) but a low Operating Asset Turnover (e.g., exclusive inventory, fewer sales per asset) -> *high marginality*, there is a premium price, but it is likely to be a capital-intensive company -> an example is medicine industry.
- Company B: Characterized by a low ROS but a very high Operating Asset Turnover (e.g., high volume, rapid inventory movement) -> *low marginality*, there is not a premium price, but the asset owned by the company are much lower (resulting in the higher level of operating asset turnover -> an example are the supermarkets.

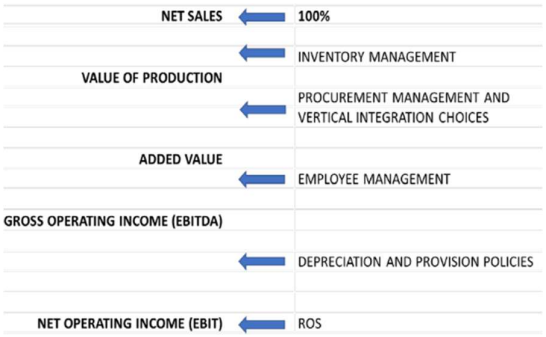
➔ Even though the opROA of the companies are similar, by the components we can understand the business model

Which company's business model might be more vulnerable to a sudden, significant increase in operating costs without a corresponding increase in sales. Why?

Fourth level of analysis (Part A): ROS analysis

ROS = EBIT as a % of Revenues -> Methodology: Analyse the Percentage Income Statement, working UP from EBIT to Sales (100%). In order to do so, the first check is always reviewing Sales Growth Trends! Why? *Fixed cost percentages can change simply due to sales volume shifts*.

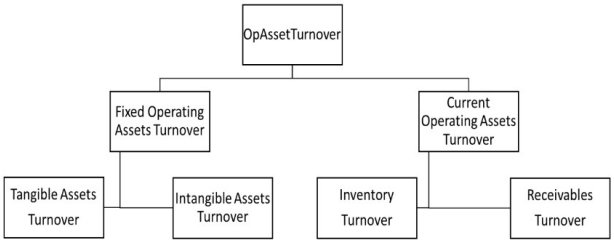
ROS analysis -> uncovering managerial insights:



- *Observe Economic Margins*: Gross Margin, EBITDA Margin, variable costs vs fixed costs etc., so how EBIT is generated and how it is affected -> Where are profits being squeezed or expanded?
- *Impact of External Conditions* (like using the SWOT analysis) -> *Commodity price swings, industry competition, consumer demand shifts*, obviously by *making assumptions* and testing the impact of these assumptions on company profitability.
- *Impact of Management Policies* -> *Pricing strategies, production efficiency, R&D investments, marketing expenses*.

➔ We can analyse the impact of events from the past in the future ROS

Fourth level of analysis (Part B) -> Operating Asset Turnover analysis



We have to assess how efficiently a company uses its operating assets to generate revenue (i.e. sales) -> How often something is sold over 1 year. In order to do so, we analyse turnover of individual components of Operating Assets.

- *Fixed Assets Turnover*: Revenues/Fixed Operating Assets
  - Intangible Assets Turnover: Revenues/Intangibles
  - Tangible Assets Turnover: Revenues/Tangibles
- *Current Operating Assets Turnover*: Revenues/Current Operating Assets
  - Inventory Turnover: Revenues/Inventory
  - Receivables Turnover: Revenues/Accounts Receivables

Turnover, intensity, & period ratios: 3 views for the same phenomena

Ratio Type	What it Tells You
Turnover	How often something is sold in a year.
Intensity	How much of something is needed to generate revenue.
Period	How long a resource is tied up in the business (in days).

Asset	Ratios		
	Turnover	Intensity	Period
Inventory	Sales/Inventory	Inventory/Sales	Inventory/(Sales/360)
Trade Receivables	Sales/Receivables	Receivables/Sales	Receivables/(Sales/360)
Fixed Assets	Sales/FixedAssets	FixedAssets/Sales	FixedAssets/(Sales/360)
Intangible Assets	Sales/Intangibles	Intangibles/Sales	Intangibles/(Sales/360)

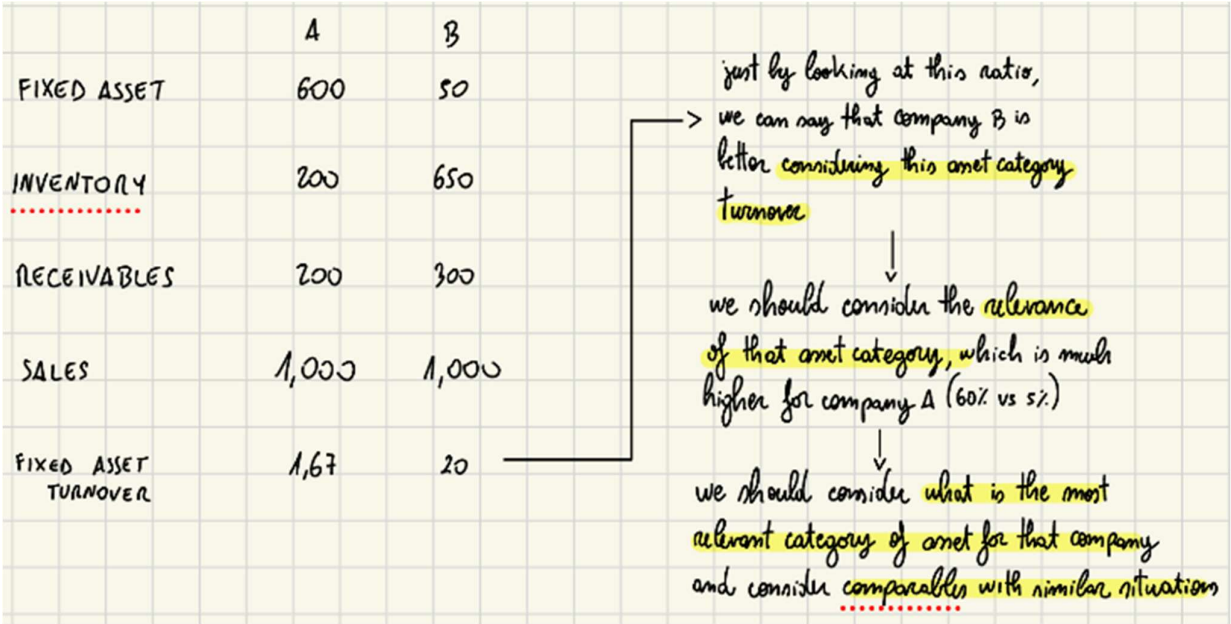
Always consider *turnover ratios* (which is a measure of efficiency that can be applied to every asset) alongside the *percentage breakdown of balance sheet assets* to properly weight their impact. A *single turnover ratio*, in isolation, *might be misleading*. A company might have a very low Fixed Assets Turnover -> sounds bad. However, if Fixed Operating Assets represent only 5% of its total operating assets (e.g., it's a trade company), then the impact of that low turnover on the overall operating efficiency *might be minimal*. Conversely, if inventory makes up 60% of total operating assets, then even a slightly declining Inventory Turnover ratio becomes a major concern because inventory is a large and critical component of their asset base. By looking at the «percentage breakdown of balance sheet assets», you understand the relative importance of each asset category, and you can better assess which turnover ratios are most critical for the company's
overall performance.

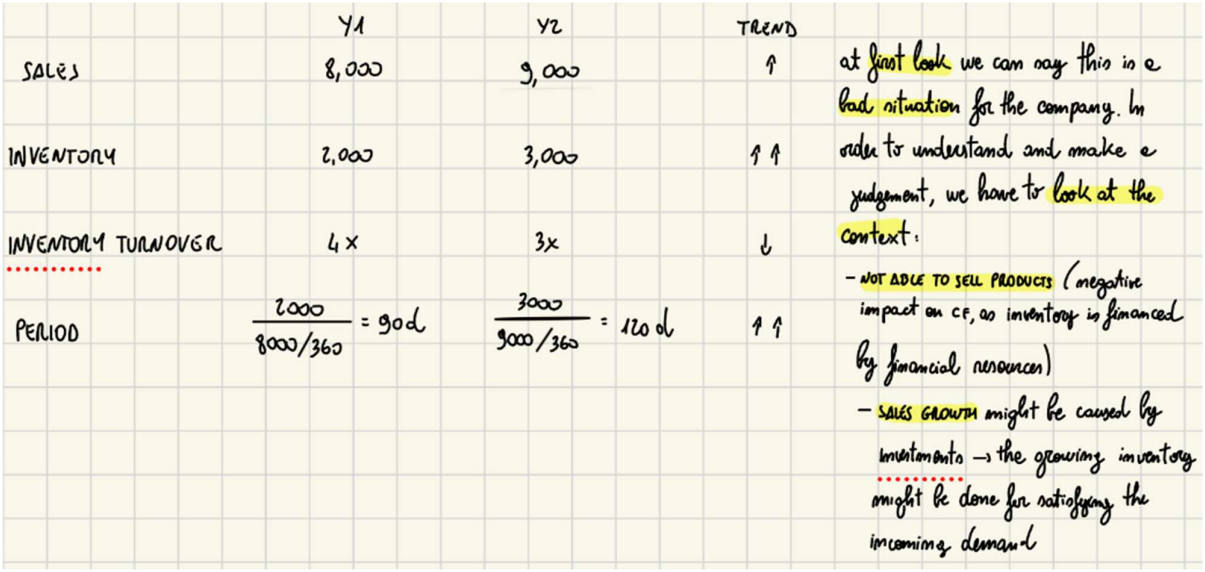
Economic interpretation of turnover trends is not always straightforward -> Trends signal Strengths OR Weaknesses. Example: Declining Inventory Turnover (Higher Inventory intensity, Longer Stock Days):

- *Potential Weakness* -> Can no longer sell effectively (inflexible production against declining sales).
- *Potential Strength/Strategic Shift*:
  - Diversifying product range (more inventory).
  - Expecting significant sales increase (proactive building).
  - Shifting customer base (larger batches for large distribution).
  - Selling to more distant markets (increased transit/safety stock).

➔ Financial data helps, but NON-ACCOUNTING INFORMATION is often essential for confirmation (qualitative information such as the business plan, the information coming from PESTLE analysis…).

Examples





	Y1	Y2	TREND	
SALES	8,000	9,000	↑	at first look we can say this is a bad situation for the company. In order to understand and make a judgement, we have to look at the context:
INVENTORY	2,000	3,000	↑↑	
INVENTORY TURNOVER	4x	3x	↓	
PERIOD	2000 / (8000/360) = 90d	3000 / (9000/360) = 120d	↑↑	- NOT ABLE TO SELL PRODUCTS (negative impact on CF, as inventory is financed by financial resources) - SALES GROWTH might be caused by investments → the growing inventory might be done for satisfying the incoming demand

Leverage: amplifying returns & risks

Leverage: Using fixed costs or borrowed capital to amplify returns -> the Double-Edged Sword = *Higher potential returns, but also significantly higher potential losses*.

Operating Leverage: definitions

$$\sigma_{op} = \frac{\frac{\Delta EBIT}{EBIT}}{\frac{\Delta Sales}{Sales}} = \frac{\Delta\%EBIT}{\Delta\%Sales}$$

- *Traditional Operating Leverage*: *Sensitivity of EBIT* (as it is the IS component for the operating asset) *to a 1% change in Revenue* -> Reflects reliance on fixed operating costs.

$$_T\sigma_{op} = \frac{\frac{\Delta opROA}{opROA}}{\frac{\Delta Sales}{Sales}} = \frac{\Delta\%opROA}{\Delta\%Sales}$$

- «Total» Operating Leverage (Tσ_op): *Sensitivity of opROA to a 1% change in Revenue* -> Considers both fixed operating costs AND fixed operating assets.

➔ You have to look at the industry, compare the results with the competitors, and you have to analyse the components, which are the confront between variable and fixed costs and the presence of fixed assets and variable assets.

Business Sectors tend to be structurally different, but there is also room for **Managerial Discretion**: Companies actively choose their operating leverage through strategic decisions (e.g., vertical integration, outsourcing).

Higher Operating Leverage (more fixed costs) -> Magnifies the change in EBIT for a given change in revenue -> Larger operating profit or loss area beyond/below Break-Even Point (BEP). For a given level of operating leverage, *Risk of Losses depends on revenue variability* (industry, competition) and *distance of current sales from BEP* (historical buffer).

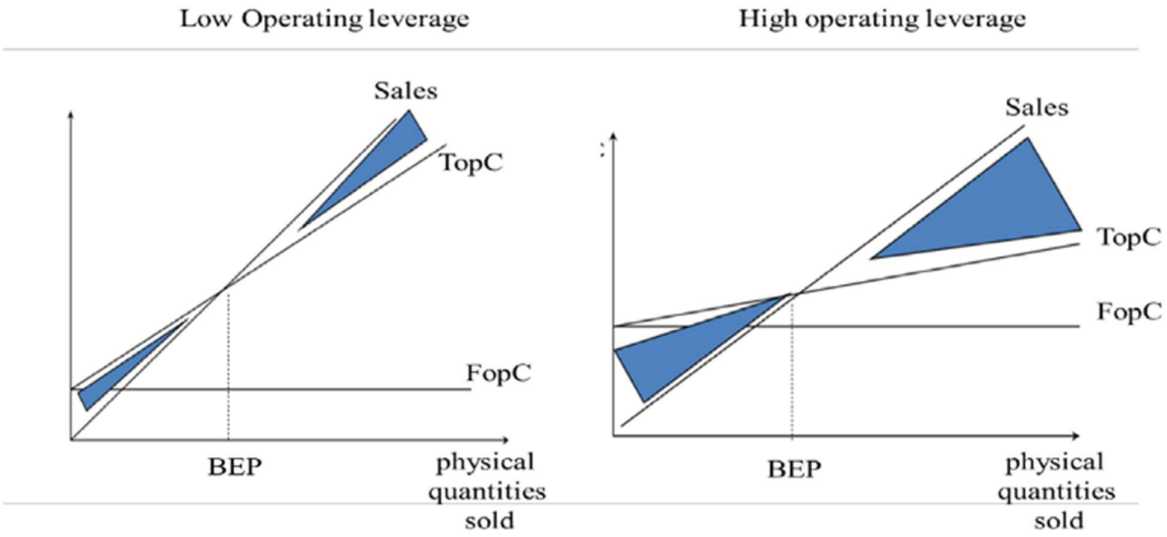
FIAT: from 1980s advantage to 1990s challenges

- 1960s: Sales Growth and High vertical integration -> Car sales were strong; the high operating leverage led to huge profits.
- 1970s: Sales Growth and High vertical integration -> Car sales sank because of the “oil crisis” and oil prices terrific increase. Fiat outsourced many of its productions -> it increased the level of variable costs and the level of flexibility at the expenses of quality.
- 1980s: Growth and Unique Advantage
  - Car sales rebounded, driven by demand for fuel efficiency (e.g., fuel injection, diesel, lightweight plastics).
  - Fiat’s extensive outsourcing seemed risky due to low operating leverage, but yet decided to maintain the outsourcing to several components to a wide range of small companies.

- Key Advantage: Fiat had monopsony power over small suppliers (you are the only client, so you can set the price of the raw materials), dictating prices and capturing significant margins. This led to high returns with low risk.

- 1990s: Quality Crisis and Strategic Shift -> Fiat faced severe product quality issues (that affected its reputation), forcing its withdrawal from the U.S. market ("*FIAT = Fix It Again Tony*"). Struggled in Europe with the entry of high-quality Japanese automakers. The fragmented supplier network (multiple producers for the same component) undermined quality. Response: Fiat streamlined suppliers (weakening its bargaining power) and re-internalized component design and production, increasing its operating leverage.

Operating Leverage (income statement component): impact on %ΔEBIT



- The line starting from the origin represents *revenues* -> it increases with the quantity sold and has a slope equal to the unit selling price.
- The horizontal line shows *fixed costs*, which do not change with sales volume.
- The *other line that starts where the fixed cost line intersects the vertical axis* represents *total costs*.

These equal fixed costs when nothing is sold and rise as variable costs increase with sales. The *shaded areas* represent either positive EBIT (revenues exceed total operating costs) or negative EBIT (total operating costs exceed revenues).

Traditional measure of the operating leverage is calculated in the following way:

$$\sigma_{op} = \frac{\frac{\Delta EBIT}{EBIT}}{\frac{\Delta Sales}{Sales}} = \frac{\Delta EBIT}{EBIT} \times \frac{Sales}{\Delta Sales} = \frac{(p - VopC)\cdot\Delta Q}{(p - VopC)\cdot Q - FopC} \times \frac{Q\cdot p}{\Delta Q\cdot p} = \frac{(p - VopC)\cdot Q}{(p - VopC)\cdot Q - FopC} = \frac{CM}{EBIT}$$

$$\%\Delta\text{EBIT} = \frac{\Delta EBIT}{EBIT} = \frac{CM}{EBIT} \times \frac{\Delta Sales}{Sales}$$

Operating Leverage (balance sheet component): impact on %ΔopAssets

Assumption:

- Current Operating Assets (Vop Assets): Proportional to revenues.
- Fixed Operating Assets (Fop Assets): Constant regardless of revenue changes

$$\Delta\%opAssets = \frac{VopAssets}{opAssets} \times \Delta\%Sales = \left(1 - \frac{FopAssets}{opAssets}\right) \times \Delta\%Sales$$

Insight:

- A higher share of fixed operating assets leads to LOWER variability in total operating assets for a given sales change.
- This also contributes to opROA sensitivity: EBIT may change significantly, while assets may change little, amplifying the ratio level change

Overall Operating Leverage: impact on %ΔopROA

Combines "Asset Rigidity" and "Cost Rigidity" (consider that CM/EBIT = 1 + FopC/EBIT)

$$\Delta\%opROA \approx \left(\frac{FopC}{EBIT} + \frac{FopAssets}{opAssets}\right) \times \Delta\%Sales$$

$$_T\sigma_{op} \approx \frac{\Delta\%opROA}{\Delta\%Sales} = \left(\frac{FopC}{EBIT} + \frac{FopAssets}{opAssets}\right)$$

Key Takeaway:

- This factor is typically greater than one, acting as a multiplier.
- It amplifies the impact of revenue changes on operating profitability (opROA).
- Practical Use: Benchmarking, peer analysis, monitoring structural development.

Formulas assume constancy assumption in many parameters:

- Fixed costs constant.
- Variable costs % of revenues constant.
- Fixed operating assets constant.
- Variable operating assets % of revenues constant.

The «Gap» is Informative:

- Differences between expected (from formulas) and actual opROA changes (observed on historical data or on projected data via an analytical business plan) signal deviations from the assumptions
- Reveals changes in pricing, efficiency, new investments, credit/inventory policies...

Operating & Financial Leverage interaction

- Higher Operating Leverage = Higher Core Business Risk (greater opROA variability).
- Implication for Financial Leverage: This increased business risk requires a LOWER Debt-to-Equity Ratio to keep overall financial risk (ROE volatility) within acceptable limits.

➔ Principle: The higher the inherent operational risk, the less financial risk a company can afford. E.g., Commercial firms (lower Operating Leverage) often use more debt than Industrial firms (higher Financial Leverage)

Example of a critical moment in borrowing/lending decisions:

- Company AAA invests heavily in internalizing previously outsourced variable costs, financed by significant new debt.
- Operating Leverage ↑: Variable costs → Fixed Costs; Fixed Assets ↑.
- Financial Leverage ↑: New Debt ↑.
- Result: ROE Volatility SIGNIFICANTLY AMPLIFIED! Overall company risk skyrockets.
- Historical financial statements won't reflect the new, higher risk profile

Management's challenge & analyst's role:

- Management: Must make structural decisions (financial mix, cost structure, asset composition) based on medium- to long-term sales & ROA forecasts. Cannot guarantee sales before choosing leverage!
- Analyst: Must critically assess the soundness of these assumptions and strategies.
- Special Case -> Project Financing: Revenue & cost variability can be more accurately estimated, allowing for deliberate leverage balancing

TechFab Spa Example:

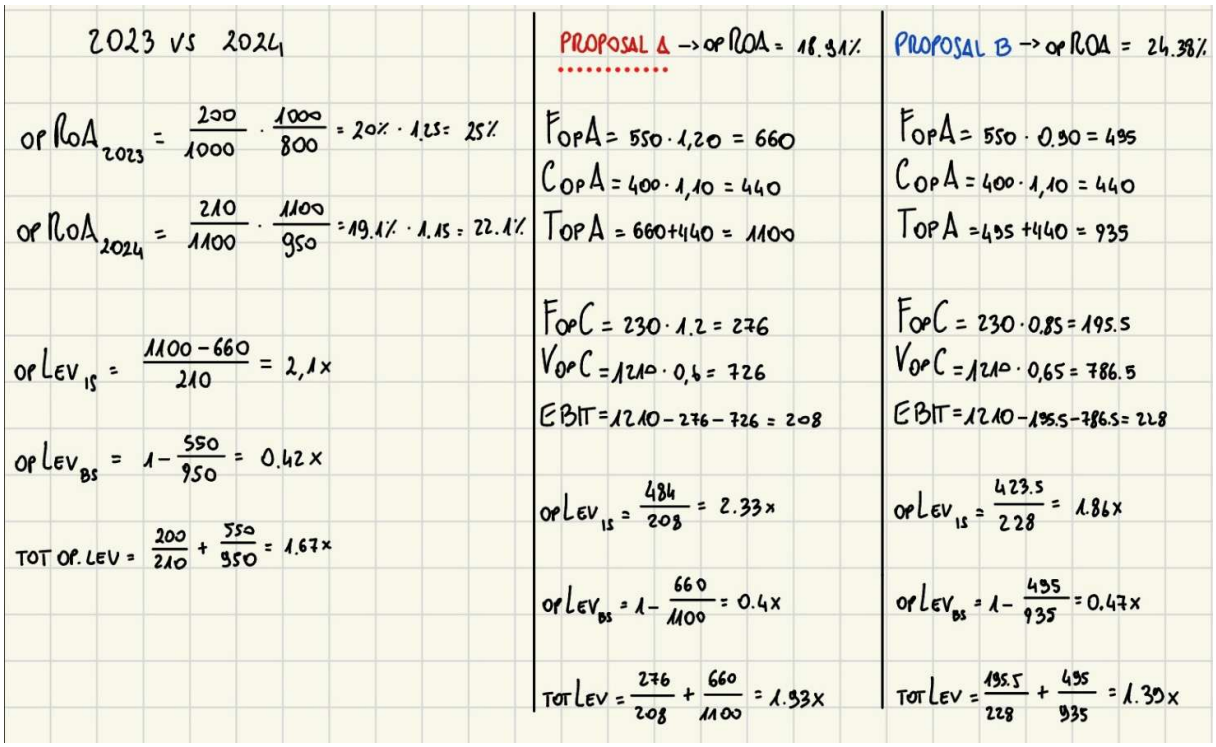
TechFab Spa is a small but successful Italian company that manufactures high-quality components for the consumer electronics industry. The market is becoming increasingly competitive, with new players and constant pressure to lower prices. The company's CEO is concerned because despite a growth in sales, profitability is not improving as expected. While sales grew by 10%, the Operating Return on Assets (opRoA) surprisingly declined. He needs to understand why this happened and decide on the best strategy for the next year. Here is a summary of the key historical financial data:

Data (in € thousands)	*2023*	*2024*
Sales	1,000	1,100
Variable Operating Costs	600	660
Fixed Operating Costs	200	230
EBIT	200	210
Current Operating Assets	300	400
Fixed Operating Assets	500	550
Total Operating Assets	800	950

The CEO has two proposals for the next year (2025), both aiming for a 10% sales growth to €1,210k.

- Proposal A: Invest in new, state-of-the-art machinery to increase in-house production capacity. Therefore, Fixed Operating Costs are expected to increase by 20% from 2024 levels. Fixed Operating Assets are also projected to increase by 20%, while Current Operating Assets will grow in proportion to sales (10%).
- Proposal B: Sell off some older machinery and outsource a portion of production to a third-party supplier. Therefore, Fixed Operating Costs are expected to decrease by 15% from 2024 levels. To compensate for the higher cost of outsourced parts, Variable Operating Costs will increase, representing 65% of sales (up from 60%). Fixed Operating Assets are projected to decrease by 10%, while Current Operating Assets will grow in proportion to sales (10%).

Compare the expected outcomes of both proposals. Which proposal would you recommend to the CEO? Justify your recommendation by discussing the trade-off between projected profitability (opRoA) and the level of operating leverage (risk).



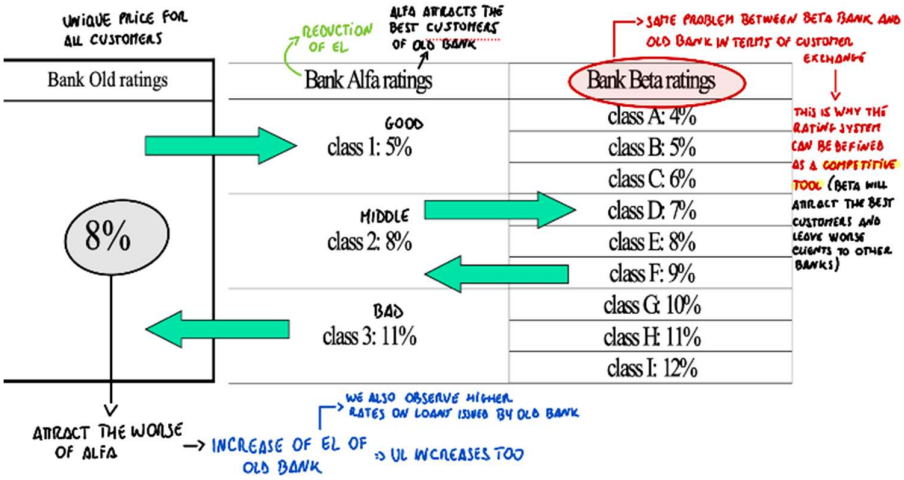
From this analysis, we can affirm that the proposal B seems to be the best alternative as it improves the opROA and improves the operating leverage indicators.

Loan pricing and other applications of credit risk measures

As we said before, the core business of banks is landing money, and the most relevant task is represented by the *risk management*. How do banks manage this risk and decide who to lend to, how much to lend and what interest rate to charge? By measuring Credit Risk, primarily using Credit Ratings.

Rating can be seen as a *competitive tool*:

- **Price Setters** (they can decide the price of a loan): Banks use ratings to differentiate pricing. *Better ratings = Lower rates vs Worse ratings = Higher rates* -> This attracts better clients, leaving riskier, less profitable deals for less sophisticated banks.
- **Price Takers** (when they have to accept the prevailing market rate): Banks must accept market



rates and ratings evaluate if the market rate adequately covers the risk -> *High risk (relative to rate) = Reject loan vs Low risk (relative to rate) = Accept loan*.

Banks without robust rating systems lack accurate risk information. They might price based on *average risk* or *less precise methods* -> good borrowers go to banks that offer better rates based on their low risk while bad borrowers are attracted to banks that underprice their high risk -> Unsophisticated banks end up with a disproportionate share of bad loans and incur significant losses -> *Ratings are a defence against adverse selection*.

Loan pricing (Price Setter)

Let's imagine a bank needs to determines the **interest rate (i_L)** and they have to ensure the **expected return** *covers all costs* and *provides the required profit*. Consider a 1-year loan of 1€ at interest rate i_L

- *Gross repayment due*: $1+ i_L$
- *Expected Repayment* (Net of Expected Loss): $(1+ i_L) \times (1-PD \times LGD)$, where $PD \times LGD$ is the ELR (Expected Loss Rate, which is a percentage value) -> the *higher the ELR, the lower the expected repayment*

As we said before, the **expected repayment must cover**:

- *Principal invested*: 1€
- *Cost of Debt Funding*: Internal Fund Transfer Rate (IFTR) × (1 - Capital Allocation%)
- *Cost of Equity Capital*: Ke × Capital Allocation %
  - Capital Allocation based on risk (VaR or MRC, the additional amount of capital required). Let's use VaR for now.
  - Debt portion is (1−VaR).
- *Operational and Administrative Costs*: C (as a % of loan)

The **risk-adjusted equilibrium formula** -> *Expected Repayment* (which is what you get as a bank out of the amount of money landed, the net reward) = *Principal + Cost of Debt + Cost of Equity + Operational Costs*

$$(1 + i_L) * (1 - PD * LGD) = 1 + IFTR * (1 - VaR) + K_e * VaR + C$$

Solving the equilibrium formula for i_L:

$$i_L = \frac{IFTR * (1 - VaR) + K_e * VaR + C}{(1 - PD * LGD)}$$

This formula shows the minimum interest rate required to cover costs and achieve the target return on equity, adjusted for credit risk. Let's break down its components:

- *Numerator* -> Represents the total costs per €1 of expected repayment. In particular:
  - $PD \times LGD$: *Expected Loss (EL)*
  - $IFTR \times (1-VaR)$: *Cost of Debt Funding*
  - $K_e \times VaR$: *Cost of Equity Capital*
  - C: *Operational Costs*
- *Denominator* $(1-PD \times LGD)$: *Expected proportion of the loan principal that will be repaid* -> if the actual $i < i_L$, then we are not rewarding the risk the bank is taking

Example

- PD = 10% (Borrower Rating: Probability of Default)
- LGD = 40% (Severity Rating: Loss Given Default)
- IFTR = 7% (CFO and Treasury Department)
- VaR = 9% (Credit Risk Models: Value at Risk) -> 1 - VAR = 91%
- K_e = 14% (CEO & Shareholders: Cost of Equity)
- C = 1% (Cost Control Department: Operational Costs)

$$i_L = \frac{IFTR * (1 - VaR) + K_e * VaR + C}{(1 - PD * LGD)}$$

$$i_L = \frac{10\% * 91\% + 14\% * 9\% + 1\%}{(1 - 10\% * 40\%)} = 13.16\%$$

➔ Minimum i_L to be applied for the bank to make a profit out of the loan

How rating influences i_L

As we know, ratings *directly* provide *PD* (borrower rating) and *LGD* (severity rating), but it also *indirectly* influences *VaR* (Economic Capital absorbed, estimated via Value at Risk) or, alternatively, *MRC* (Minimum required regulatory Capital), calculated via the Standardized approach or the Risk Weighting Functions of Basel regulations that take as input PDs and LGDs.

➔ Therefore, a borrower's rating impacts multiple key inputs in the pricing formula.

Why pricing varies (for the same borrower, for the same loan, at the same time)? Even with similar rating systems, different banks may charge different rates due to variations in:

- *PDs and LGDs*: Data and methodologies used to estimate rating models.
- *Cost of bank funding (IFTR)*: types of funding of the bank (retail customers, interbank markets, bond markets …), bank's rating, methodologies to set IFTR (single, multiple for fix/variable interest rates investments, …)
- *Required Return on Equity (Ke)*: governance structure of the bank (cooperative local banks versus banks with equity shares traded in markets without a stable control and vulnerable to M&A).
- *VaR* (stand alone, marginal, bank's loan portfolio diversification, DM/MTM models and their assumptions) or MRC (Std, Firba, Airba banks), and 1-VaR and 1-MRC
- *Operating cost (C)*: cost structure of the bank and methodologies of allocation of common costs (a bank has to disclose how it manages the credit risks and so a company can infer how a bank is really doing and judge whether it is efficient or not)
- *Transitory pricing policies*.

➔ Basel II allows internal models (IRB), fostering diversity and competition rather than standardization in pricing.

RAROC & RAPMs (Price Taker)

In this case, the market sets the interest rate (i_L). The bank must *decide whether to grant the loan or not*. Is the market rate sufficient to cover risk and provide the required return? Need a measure of risk-adjusted profitability.

RAROC (Risk-Adjusted Return on Capital) -> Evaluates the profitability of a transaction or portfolio relative to the economic or regulatory capital required for its risk -> derived by *rearranging the pricing formula to solve for Ke*, which becomes the calculated RAROC for the given i_L.

$$RAROC = \frac{i_L - IFTR * (1 - VaR) - PD * LGD * (1 + i_L) - C}{VaR}$$

Let's understand the components of the RAROC formula:

- *Numerator* -> Represents the *return generated by the loan (i_L) minus*:
  - *Cost of Debt Funding*: IFTR × (1−VaR)
  - *Expected Loss* (on principal and interest): PD × LGD × (1+ i_L)
  - *Operational Costs*: C

➔ Think of this as the "profit" available to compensate equity holders after covering other costs and expected losses ("net profit").

- *Denominator (VaR)*: The economic capital absorbed by the transaction (measure of unexpected loss).

Compare the calculated RAROC for the transaction to the bank's minimum required return on equity (Ke).

- If *RAROC>K_e*: The loan is expected to *generate returns above the minimum required by shareholders -> Value Creation ->Accept the loan* (if other factors permit).

- If *RAROC<K_e*: The loan is *expected to generate returns below the minimum required -> Value Destruction* (in economic terms, even if accounting profitable) -> *Reject the loan*.

Let's consider this example:

- PD = 3% (Borrower Rating: Probability of Default)
- i_L = 5.9%
- LGD = 35% (Severity Rating: Loss Given Default)
- IFTR = 2.1% (CFO and Treasury Department)
- VaR = 14.5% (Credit Risk Models: Value at Risk)
- C = 8% (Cost Control Department: Operational Costs)

$$RAROC = \frac{0.059 - 0.021 * (1 - 0.145) - 0.03 * 0.35 * (1 + 0.059) - 0.08}{0.145} = 15.12\% < K_e$$

➔ Reject the loan -> the loan return on the allocated economic capital (VaR) is insufficient to cover the bank's expected cost of equity (K_e)

Economic Value Added (EVA) -> EVA provides a measure of the total economic value created or destroyed in absolute monetary terms.

$$EVA_{€} = (RAROC - K_e) \times VaR_{€}$$

- If *RAROC* > K_e, EVA is positive (value created)
- If *RAROC* < K_e, EVA is negative (value destroyed).
- If *RAROC* = K_e, EVA is zero (value maintained).

RAROC and *EVA* can also be used ex post (after the loans are granted) as **Risk-Adjusted Performance Measures (RAPMs)**. Used to evaluate the risk-adjusted profitability of *Geographic areas*, *Product lines* (mortgages, cards, etc.), *Customer segments* (SME, Corporate, Retail, etc.) or *Banking divisions* (corporate & investment banking, private banking, consumer credit, leasing & factoring…).

RAPMs are important tools for *capital allocation* (directing capital to the most value-creating activities/segments), *strategic planning* (identifying profitable areas for growth and unprofitable areas to exit or restructure) *and maximizing overall bank value* -> they provide a consistent, risk-adjusted view across diverse activities

Ratings are not just for pricing and performance measurement. They are integrated into various internal decision-making processes, such as *Credit Approval Authority*, *Portfolio monitoring* and *Managing customer relationships*.

Credit approval authority

How large can a loan be to be approved by a specific officer? Traditionally, it is based on Exposure Size (€ amount) -> *simple but ignores risk* (A €1M loan to a high-risk borrower could be riskier than €10M to a low-risk one). Modern approach is based on Risk Metrics derived from ratings (PD, LGD, VaR). Aligns decision authority with the actual risk being taken.

Delegation based on Expected Loss limit (EL*) -> Each officer rank is assigned a maximum Expected Loss (EL*) they can approve for a single transaction or a customer. Because EL=PD×LGD×EAD, to find the maximum Exposure at Default (EAD) for a given borrower/loan: $EAD = \frac{EL^*}{PD \times LGD}$ -> Higher risk (higher PD or LGD) means lower maximum EAD the officer can approve for that EL* limit.

Let's consider this example that compares a low risk with a high risk:

- Low risk:
  - PD = 1%
  - LGD = 30%
  - ELR (PD*LGD) = 0.003
  - EL* Division = 15,000€
- High risk:

- PD = 3%
- LGD = 50%
- ELR (PD*LGD) = 0.015
- EL* Division = 15,000€

What is the acceptable minimum EAD for both?

- Low risk -> 15,000€/0.003 = 5,000,000€
- High risk -> 15,000€/0.015 = 1,000,000€

➔ In presence of low-risk customers, the division can bear a higher exposure at default notwithstanding same limit -> the EL* is the constraint

Delegation based on Unexpected Loss limit (VaR'*, an alternative approach) -> Authority can also be linked to a maximum Gross Value at Risk (VaR'*) for an officer.

$$EAD = \frac{VaR'^{*}}{LR^{CL}}$$

Where LR^{CL} is the *Loss Rate at a given Confidence Level* (derived from credit risk models, incorporates PD, LGD, volatility, and possibly correlation). Similar logic: Higher risk (higher LR^{CL}) means lower maximum EAD for that VaR'* limit.

Let's see an example:

- Low risk borrower:
  - VaR'* = 75,000€
  - $LR^{99.9\%}$=0.5%
  - Maximum EAD = 75,000€/0.005 = 15,000,000€
- High risk borrower:
  - VaR'* = 75,000€
  - $LR^{99.9\%}$=1.5%
  - Maximum EAD = 75,000€/0.015 = 5,000,000€

➔ Same limit of capital absorption, very different maximum exposure

Linking EAD to current exposure -> *EAD (Exposure at Default)* is the potential maximum exposure if default occurs. EAD depends on the *current exposure (Ec)* and the *loan product structure* (e.g., committed lines may have low current exposure but high EAD).

$$EAD = Ec * Em\ (where\ Em\ is\ the\ Exposure\ Multiplier)$$

So, the *maximum current exposure (Ec)* an officer can grant is:

$$Ec = \frac{EAD}{Em}$$

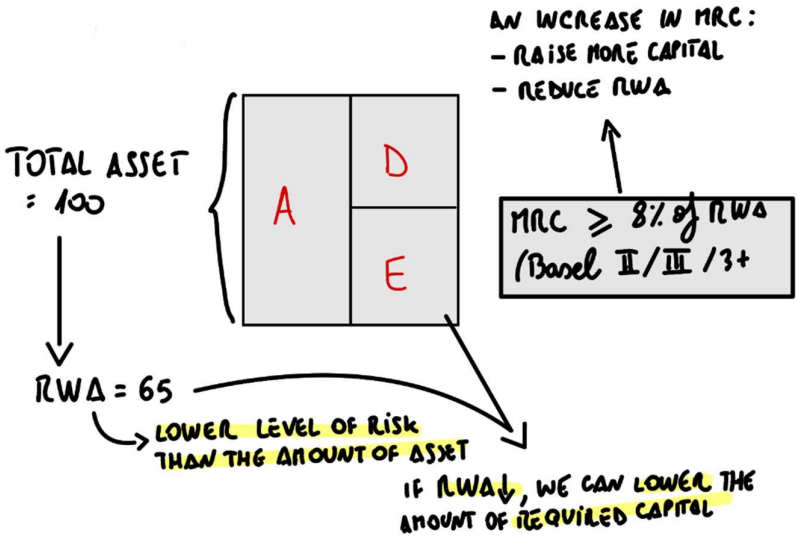
Impact on the credit volume -> *Ratings also affect the total volume of loans a bank can make*. Regulatory capital requirements (Basel II/III/3+):

$$MRC \geq SolvencyCoefficient * \sum RWA$$

Where:

- *MRC* = Minimum Required Capital
- *Solvency Coefficient* (e.g., 8%)
- *RWA* = Risk-Weighted Assets.

Regarding the RWA, we have to consider that:



Under the Internal Ratings-Based (IRB) approach, RWA for a loan is *calculated based on its risk parameters* (PD, LGD, Maturity of the loan), which are driven by internal credit ratings -> **Higher Risk** (Higher PD, LGD, etc.) = **Higher Risk Weight** = **Higher RWA for that loan** = **Higher Minimum Required Capital (MRC)** -> If a bank's capital is fixed in the short term, an *increase in required capital* (due to higher RWA) means the *bank must reduce its total assets* (A) to maintain the capital ratio -> Reducing assets primarily means reducing the volume of loans.

This link creates a procyclical effect. During *economic downturns*:

- *Overall credit risk* (PDs and LGDs) *increases*.
- *Bank RWA increases*.
- *Banks are forced to reduce lending* (credit crunch).

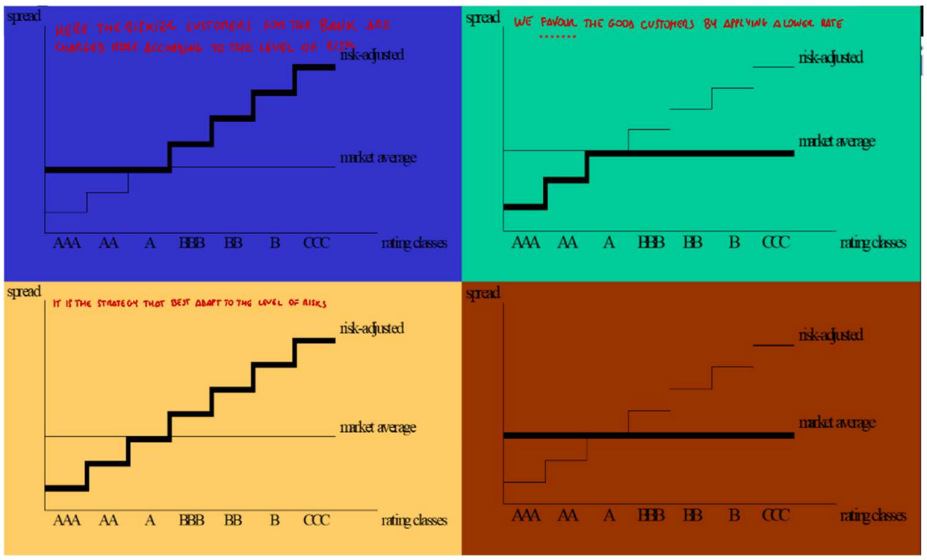
This happens precisely when the economy needs credit, exacerbating the downturn. Basel III introduced measures to mitigate this effect (in particular, the Counter Cyclical Capital Buffer, which is a buffer of 0-2%). When economy is doing well, you are *forced to increase capital in case of downturns*. Banks double the buffer when the economic downturn occur -> this avoids credit crushes during downturns.

Managing customer relationships -> Ratings allow banks to improve the quality of their customer relationships and, therefore, to increase their loan portfolio consistently with their Loan Policy -> transaction banking vs relationship banking:

- The rating system is a good indicator for relationship banking
- This is particularly important when estimating credit risk -> if long-term relationship is in place, the bank might have access to other qualitative information, which is the real competitive advantage in the credit risk management

The implications of different loan pricing policies (example)

Let us suppose that our bank has the technology to apply a correct risk-adjusted pricing, while the majority of other banks (though not all) do not have it (and, because of this, it will apply an interest rate that is equal to the market one). And let us suppose that so far, no bank has practiced risk-adjusted pricing, and we haven't as well. Our bank is considering *four pricing policies* (depicted in the next image, where the thin line indicates the non-risk-sensitive pricing practiced in the past and currently adopted by most other banks, while the thick line represents the policy being considered for evaluation by our bank).



Policy	***Interest margin - €*** (here we have to take in consideration the elasticity of customers' demand: bad customers are less reactive to policy changes compared to goof customers)	***Operating margin - €***	***Loan portfolio size - €*** (it depends by the decisions of customers to leave or remain with the bank)	***RAROC***
Top left	*LI* -> some customers will leave the bank, which will be compensate by the higher interest rates	*SI* -> there is a positive contribution from the interest margin, but there is a strong reduction of provision for expected loss because riskier customers leave	*SD* -> several customers will leave. In addition, if you have a large loan with bad rating, you have a strong incentive to leave	*SI* -> operating profit and interest margin push the numerator to increase. Regarding capital adsorption, because it is a function of risk, we are reducing risk and therefore the leave of capital adsorption
Top right	*LI* -> you attract good customers (which have a higher elasticity) that compensate the interest rate	*LI* -> similarly from before we have a positive boost from the interest margin, but we don't have the same reduction in provision	*SI* -> if you are able to attract a good number of customers, you are able to increase a lot the loan portfolio size	*LI* -> we have a low increase in the amount of the expected loss + low increase in capital adsorption (because you attract more customers)
Bottom left	*LI* -> you attract good customers, but you risk losing bad customers (which prefer banks that apply the red strategy) even though not all of them will leave	*SI* -> you increase the interest margin, but most than anybody you reduce the provisions for expected loss	*?* -> you don't know exactly the size of the portfolio you attract and the one you lose	*I* -> for sure we have an increase, even though we don't know if it is strong or light
Bottom right	*N*	*N*	*N*	*N*

Policy	***ROE***	***Is the policy sustainable on the long run (Y/N)?*** (we have to make our evaluation considering the possibility for competitors to replicate our strategy)	***Nickname for the policy***
Top left	*LI* -> we have an increase in the numerator, but no effect on the accounting equity	*N* -> we are the first mover (which can bring us some advantages in the short run), but because it is not the best policy, there is the risk that other banks might put in practice better policies	*Selective*
Top right	*SI* -> you increase the NI without reducing equity	*N* -> it can bring us some advantages in the short run, but there is the risk that other banks might put in practice the yellow policy	*Expansive*
Bottom left	*I* -> for sure we have an increase, even though we don't know if it is strong or light	*Y*	*Risk adjusted*
Bottom right	*N*	*N*	*Not-risk adjusted*

Corporate financing within the broader context of banking regulations and perceived risks for banks' stability

Why are banks more regulated than other non-financial companies?

- Banks need deposit for doing their activities, and to collect deposit, you need trust -> for generating trust (which is essential for the good performance of banks and it's beneficial for the economic system as a whole) you need regulations of the banks
- Banks finance economic activity of several players in the economic system (governments, companies, individuals…) -> if there is a *problem in the financial system, there are problems for the whole economy*. In order to avoid it, you need regulation that say what a bank can or cannot do, which can also facilitate an efficient capital allocation from the bank to businesses that can overall generate higher value
- Regulation needed for stability of the bank -> Depending on the size of the firm, it is possible to generate a bigger or a smaller systemic or "domino" effect (the failure of one bank can generate the failure of another bank, which generates the failure of another bank and so on). Why this? *Bank running* -> if all the people come collecting the deposits, even if your bank is considered a safe place, you're incentivised to collect deposit too -> if all customers come at the same moment to collect deposit, there is a mismatch of maturity (this is because usually banks collect money from deposit, which is a short-term source, to finance loans and mortgages, which is a long-term source) because the bank does not have the liquidity to satisfy all the requests.

Evaluating banking system performance

Key Dimensions:

1. *Stability*
2. *Operational efficiency*
3. *Allocative efficiency*
4. *Effectiveness as a monetary policy transmission mechanism*

Stability

Stability aims at preserving the existence of the bank = absence or limitation of bank crises.

- *Indicators*: *Number of failures, assets of failed banks, depositor losses*.
- *Challenges*: *Special resolution regimes, deposit insurance, supervisory efforts to avoid public awareness*.

➔ Trade-off: Often competes with operational efficiency. You can generate operational efficiency with low levels of net interest rate margin

Operational efficiency

Ability to reduce operating costs and manage risks with minimal losses. Measurement: *Net Interest Margin (NIM)* per unit of financial assets. If you operate with a low NIM, it means that *you pay a high rate to the depositors*, which will eventually increase the number of depositors that are essential for the operations of the bank. At the same time, it means that we have *low interest in loans*, because we have lower operating costs -> drivers:

- *X-efficiency*: Innovating management practices (e.g., IT systems or a good organization).
- *Economies of Scale*: Increasing operations size (M&A).

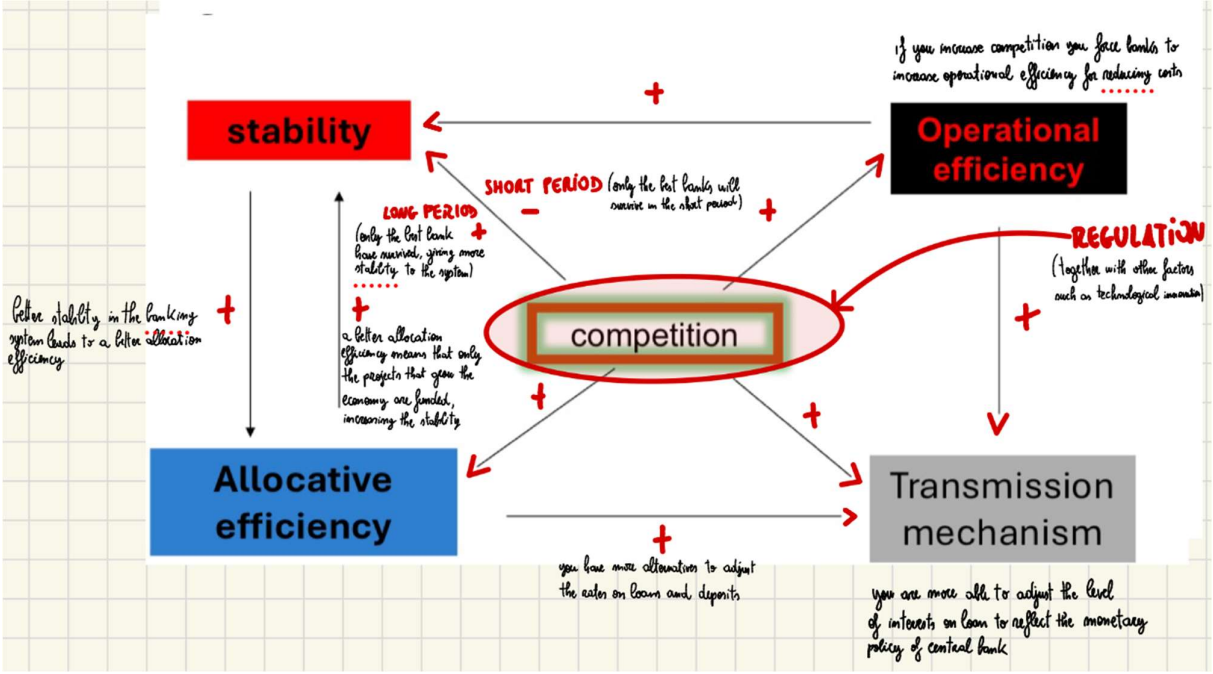
Benefits of low NIM (which is sustainable for the existence of the bank): *Lower lending rates* (boosts investment), *higher deposit rates* (promotes saving) → *stronger GDP growth*. Trade-off: Higher competition → lower NIM → harder for less efficient banks to survive.

Allocative efficiency

Channelling resources to business initiatives with the best risk-return balance -> it is the ability for banks *to discriminate bad borrowers from good borrowers* (so, borrowers that have good projects that can generate value inside the economy), because a *bank has limited financial resources*. Directs funds to borrowers most likely to generate income and least likely to default -> Crucial role for banks, especially when financial markets are short-term oriented. This does not mean avoiding risk, and how banks assess credit risk is fundamental for the efficiency of the bank. For this purpose, competition can enhance credit assessment, but excessive competition may lead to simplification/automation.

Effectiveness as a monetary policy transmission mechanism

Ability to quickly and effectively transmit central bank monetary policy (e.g., interest rate changes) to the real economy actors (for example, in case the ECB decides to reduce the rate for deposits done by commercial banks, this will manifest itself in a reduction in interest rates applied by commercial banks to consumers) -> i*f you are not efficient and you don't have a stable financial system*, central banks might find some difficulties to transmit their monetary policies (making it less effective for reaching its objectives). Competition reduces banks' ability to manipulate rates (e.g., delaying lending rate reductions), making monetary policy more effective.



Evolution of Regulatory Approaches

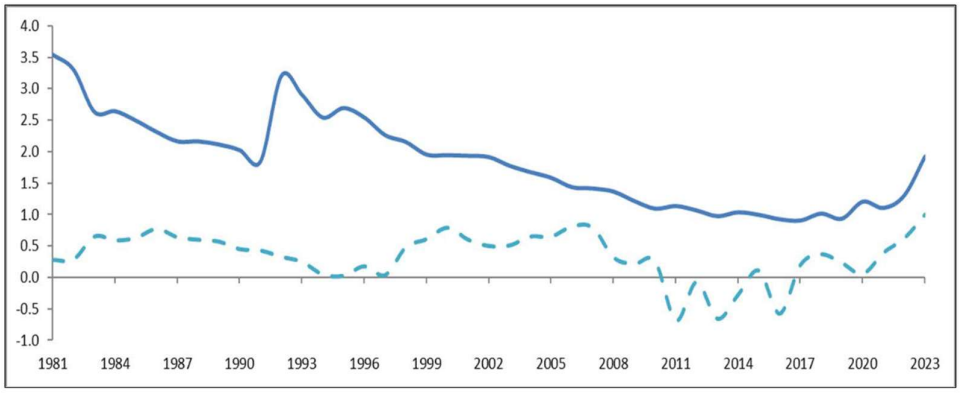
Post-Great Depression (1929-30): Structural Supervision -> The philosophy at that time saw banking as a public-interest activity, and because of this the objectives were the *deposit protection* and *financial system stability*. In order to achieve these goals, *rigid system architecture* have been built, there was a *restricted operational scope*, and a *limited competition*. Example: Glass-Steagall Act (1932) in the US -> *separation of commercial & investment banking* -> if you give loans, you are not allowed to issue corporate bonds or any other financial instrument. In addition, within the commercial banks there is a distinction between banks that are allowed to give loans according to the time maturity (if you are a bank that only gives short-term loans, you are not allowed to give loans with a long-term maturity) -> the authorization given to conduct a specific activity depends by the capability of the bank to contribute to the economic system, and in case you wanted to change your activity you needed a special authorization.

➔ Structural regulation and supervision of banks (you affirm who can operate and what they can do)

Mid-1980s: Shift to Deregulation & Prudential Supervision (you apply the same rule to all companies at global effect in order to reduce arbitrage opportunities) -> the need for a change in regulation is given by the *slower economic growth in Western economies* (outside of the oil crises of 60s-70s). In order to realized it, governments have built an overly stable, less competitive banking systems hindered growth (high NIM → low savings, low investment). Means:

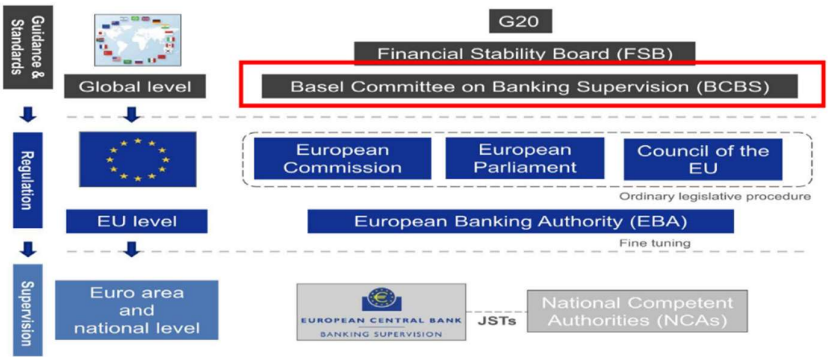
- *Increasing competition* (eliminating structural constraints, e.g., allowing universal banking).
- *Privatization of nationalized banks*.
- *Massive deregulation*
- *Moving from a structural regulation to a prudential regulation* (so you want to regulate the behaviour of banks, applying the same rules to all banks, just to avoid arbitrage)

➔ Outcome: Greater freedom for banks, push for products and processes innovations, but new requirements (e.g., minimum capital).



Evolution of Net Interest Margin and Earnings of Italian banks

The international dimension of rulemaking and supervision



G20 and **FSB** are two bodies that aim at giving general bases, but the **BCBS** is a body that is a global standard setting in particular when it is about the minimum level of capital that banks need to maintain in order to assume a specific level of risk in the asset of the bank.

At EU level we *have 3 bodies* (European Commission, European Parliament and the Council of the EU) that have the legislative power and set the general legislation and implement the standards set at global level -> they define guidelines, they don't define rules. The operational arm is the *European Banking Authorities* that takes the guidelines of the legislative bodies into more fine tuning.

NCAs are in charge of verifying if the banks actually implement the regulations and the guidelines -> in case this does not happen, there are several methods by which authorities can ask for a change, such as a change in the BoD. At this level, we have to make a distinction between *significant banks* (there is a list of more than 100 banks according to the size of the asset, which are under the direct supervision of the ECB) and *not-significant banks* (which are controlled by the NCAs). In addition, the ECB can create *Joint Supervisory Teams (JSTs)* with people coming from other central banks or other financial authorities for controlling specific cases, in order to increase the quality of control and the supervision.

Basel Committee on Banking Supervision

The **Basel Committee** (established in 1975, hosted at the Bank for International Settlements located in Basel) is the primary global standard-setter for the prudential regulation of banks and provides a forum for cooperation on banking supervisory matters. It is composed of the *authorities* such as *supervisors and central banks of the countries represented* (originally of the G20, now of all the countries). Its mandate is to strengthen the regulation, supervision and practices of banks worldwide with the purpose of *enhancing financial stability* and *avoid arbitrage between countries* (for example, in case for the same activity and the same amount of asset, the required capital is lower in a country than in another one, there is a situation of arbitrage that the Basel Committee works to eliminate by setting the same requirements at global level).

The first international prudential framework: Basel I (1988)

Issued by Basel Committee on Banking Supervision and the key Principle is that banks must maintain a Minimum Required Capital (MRC) -> **Requirement**: *MRC of 8% of Risk-Weighted Assets (RWAs)*.

$$MRC = 8\% * \sum_{i=1}^{4} RW_i * A_i$$

Where:

- RW_i: *Standardized Risk Weight* (0%, 20%, 50%, 100%) applied to the specific category of asset (so not the total amount of assets).
- A_i: *Asset Category* (e.g., cash, government bonds, corporate loans) -> Asset Classification: Based on asset liquidity, borrower nature, country of residence -> each has a specific level of risk, so to each one is attributed a risk weight.

➔ It is very easy to apply, but you cannot really discriminate between the specific level of the counterparties

Limitations of Basel I:

- *Overly Broad Counterparty Categories*: Encouraged riskier lending within each RW class. Penalized highly reliable borrowers.
- *Underestimated Risk*: Capital requirements globally underestimated for riskier segments.
- *Static Requirements*: Ignored increased risk during economic downturns (procyclicality concern).
- *Ignored Key Risk Factors*: Loan maturity, collateral value had little effect on risk weights.
- *Ignored Diversification Benefits*: Crucial in risk management but not recognized.
- *Limited Recognition of New Products and Management Tools*: Credit derivatives (emerging at the time) not fully recognized for risk mitigation.
- *Consequences*: Lack of transparency in bank solvency, price distortions, reduced credit access, weak incentives for improving credit risk management.

A revised framework: Basel II (2004)

Pillar 1 -> minimum capital requirements measured in an objective way considering credit risk, market risk and operational risk

- *Credit Risk*:
  - Standardized Approach (refinement of Basel I -> also in this case the minimum required capital is determined by a percentage of the RWA, but there are additional factors that help us to identify in a more accurate way the RW): Uses external ratings (ECAIs), recognizes guarantees, differentiates segments -> as a consequence, we don't have just broad categories (such as governments), but more specific ones (government AAA, government AA…).
  - Internal Rating Based Approaches (define the risk rates using their own internal rating systems):
    - *Foundation IRB (FIRB):* Banks estimate, using internal data, Probability of Default (PD), whereas LGD, M and EAD are set by the regulation.
    - *Advanced IRB (AIRB)*: Banks use internal data to estimate PD, Loss Given Default (LGD), Exposure at Default (EAD) and Maturity (M) of individual loans.

➔ There is a high incentive to move from a standardized approach to the IRBA, because regulators gave the possibility to have a lower MCR for the same exposure if they chose an IRB approach (as it is more precise) -> after the introduction of Basel II, none of the biggest banks in Italy used the first method. Most of them decided to use the AIRB.

- *Market Risk*: Allows use of internal VaR models.
- *Operational Risk*: Newly introduced (Basic Indicator, Standardized, Advanced Measurement)

Pillar 2: Supervisory Review Process (SReP) -> If in the Pillar 1 is more objective (because it considers only those 3 objective measurements), the measure is more subjective (as it considers all the residual risks, such as the operational risk or the reputational risk). Regarding the process, it starts from *banks assessing their own capital needs* (ICAAP, Internal Capital Adequacy Assessing Process). You as a bank conduct a self-review of the characteristics of the bank that can influence the level of the risk of the bank. *Supervisors, starting from the ICAAP, evaluate all the assets and may impose add-ons*.

➔ As a consequence, there is an increase in the capital requirement, but it is subjective because it depends by the interest of the regulator

Pillar 3: Market Discipline -> you disclose information about how you manage the risk/capital/governance, so people can decide which is the best bank in the market at doing so and decide which is the best one for financing their operations -> it is not very effective, because if there are just few companies looking at the information, it loses its purpose. It is not a requirement, but it is an incentive for customers to obtain information about how the bank manage their activities -> it increases transparency in order to increase the level of trust.

Basel II: Key Shifts

- From Uniformity to a Merit- Based Approach:
  - *Risk Measurement*: Banks could choose from a menu of options, including their own internal risk models (there is an incentive for banks to develop their own internal rating system, as it requires less capital), moving away from a single standardized method.
  - *Supervision*: A shift to differentiated oversight, rewarding banks with sophisticated risk management.
- Increased Risk Sensitivity:
  - *Granular Risk Weights*: Replaced broad, fixed risk weights with more precise, risk-sensitive measures (Example: Corporate loan risk weights now range from 14% to 238%, reflecting actual risk, instead of a flat 100% with Basel I).
- Market Discipline & Convergence:
  - *Borrower Rewards*: Better-rated borrowers benefited from lower interest rates.
  - *Convergence*: Introduced a strict, consistent definition of default (DoD) across all banks and countries to ensure comparability.

The 2007-08 financial crisis: Basel II's problems

A Blurring of Boundaries:

- *Commercial & Investment Banking*: Securitization blurred the lines, weakening banks' credit rigor.
- *Credit & Liquidity Risk*: Securitization made liquidity highly dependent on fragile market sentiment.

The Web of Interconnectedness:

- *Banks & Insurers*: AIG's collapse showed how banks offloaded risk to insurers.
- *Banks & Markets*: Loans securitization, fair value accounting and internal models created a dangerous interdependence.
- *Sovereigns & Banks*: A "doom loop" emerged, where a bank crisis could lead to a sovereign crisis, and vice-versa.

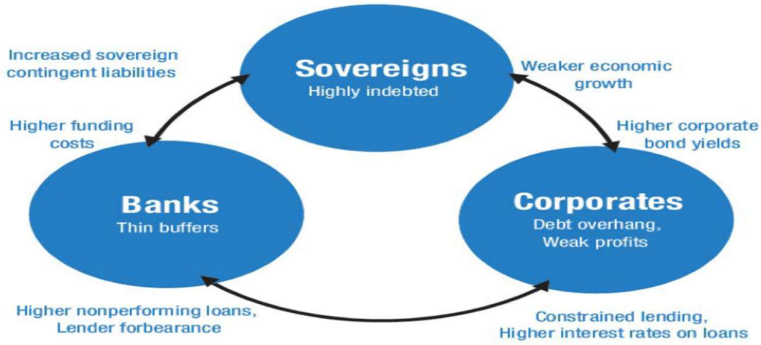
Key Issues:

- *Procyclicality*: Basel regulation and IAS39 (the new accounting standards fair value oriented) amplified economic booms and busts -> the origin of the crisis was not the Basal II, but the bad behaviour and strategy implemented by banks. Because there was a crisis, the overall level of risk in the economic system and, therefore, in the assets of the bank increased. But a higher level of RWA means a higher level of capital required, which reduces the availability of resources the bank can give in a moment where the real economy really needed it.
- *Global Contagion*: Problems spread globally (e.g., U.S. subprime crisis → global markets) due to originate to sell strategy, financial and credit derivatives, loans securitization in the financial markets, as well as to the globalization of real economies.

In order to better comprehend the reasons behind the crisis, we have to take in consideration financial intermediation models:

- *Originate to Hold* -> Lenders make loans with the intention of holding them through maturity and conducting the constant verification of the riskiness of the customer/loan, as it is present in our BS
- *Originate to Distribute* -> Lenders make loans and transform them in assets with the intention of selling them to other institutions and/or investors -> the convenience is that you can transfer to the

market an illiquid, untradable asset and, therefore, the risk in exchange of new liquidity for making new loans. In addition, by transferring these loans to the market the bank had lower level of asset = lower level of RWA = lower level of MRC, which allowed to save capital that could have been used for making new loans. Banks had very low incentives to conduct a correct credit analysis and monitor the level of risk. As a consequence, there is an incentive to increase the number of customers, that led to the creation of NINJA loans (No Income, No Job, No Asset, as collateral, customers)



A global regulatory framework for more resilient banks: Basel III (2010-2011)

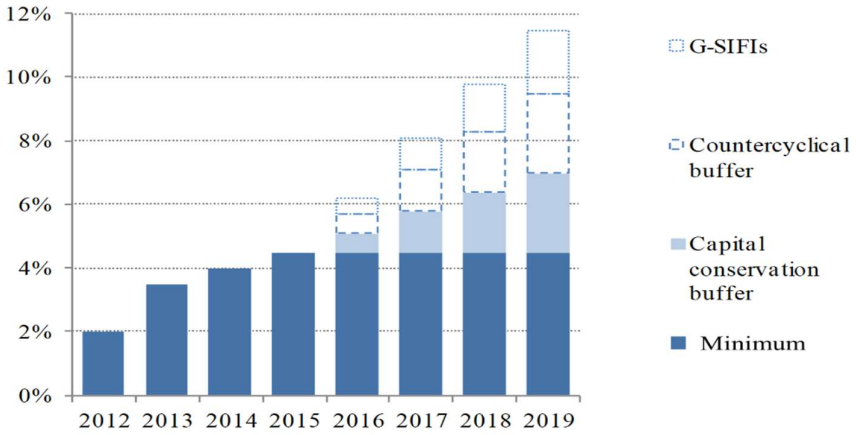
The mandate for this new regulation has been the G-20 and the Financial Stability Board. It is improper to talk in this case about a completely new regulation, as the structure of Basel II is still valid. Instead, we have to see Basel III as an implementation of the previous regulation.

a) *Strengthening Capitalization*: With the Originate to Distribute model that have been introduced during the crises; by transferring these risky securities in exchange of liquidity the bank reduces the level of capital required.
   a. Enhancing Capital Quality: *Higher common equity & Tier 1* (these are high quality financial instruments, such as convertible bonds) ratios (4.5% to 6%). *Eliminate hybrid instruments, Tier 3 capital. Capital Conservation Buffer* (2.5% of RWA) -> Additional common equity buffer above minimums, which limits dividends/bonuses until met.
   b. Strengthening Risk Coverage: *Increased capital for trading book, complex securitizations, counterparty risk* (derivatives, repos). Incentives for OTC derivatives to regulated markets.
   c. Managing Procyclicality:
      i. *IFRS 9 (Expected Loss)*: Accounting standard shift from "incurred loss" to "expected loss."
      ii. *Countercyclical Capital Buffer* (0-2.5% of common equity Tier 1, the level depends by national discretion): it is a buffer meant to face the procyclicality. Links capital to macro-financial situation identified by the aggregate credit supply -> You have to increase the buffer in case the economy is going well (and the level of risk is low), which will be used when the economy will go down
   d. Leverage Ratio: *Capital to total assets* (not risk-weighted) should be at least 3%. Helps reduce deleveraging, mitigates model risks.

b) *Liquidity Risk Management* (Crisis showed even well-capitalized banks faced liquidity issues):
   a. Liquidity Coverage Ratio (LCR): Banks must hold enough high-quality liquid assets (HQLA) in order to protect the bank from a crisis for a 30-day stress scenario (that you have to define).
   b. Net Stable Funding Ratio (NSFR): Encourages stable funding sources over a one-year horizon.

➔ Additional capital requirements for *Systemically Important Financial Institutions* (in case the bank is particularly important for the amount of asset that it holds, so that it is possible for it to generate a significant domino effect and harm the whole economy, then it will be required an additional amount of capital)

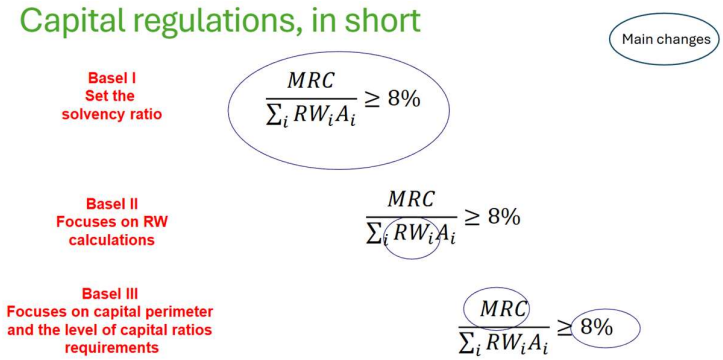
Basel III capital requirements added up, during the phase-in stage of the regulation:



Basel III: Early approach

Market & supervisory push -> with an early adoption, *markets incentivized banks to comply ahead of schedule, pushing them to raise capital and tighten credit standards*. G-SIBs: Globally Systemically Important Banks faced an additional capital buffer (1-2.5% of RWA), acknowledging their systemic risk.

Overall impact -> *Less impact on individual risk weightings/bank-enterprise dynamics*. Impact on Credit Supply: Basel III had a significant impact on the total volume of credit, by increasing capital requirements and limiting less expensive forms of capital.



The problem is that the world today is much more complex, as there are several small crises.

- Uncertainty -> you don't know the type of result you can obtain, and you don't know the probability
- Risk -> it is known the type of result and what is the probability

In an uncertain world, having a strict regulation is not something efficient.

Finalising post-crisis reforms (Dec 2017): Basel 3+ (Basel 4 / Basel 3 Endgame) ->

Implementation: Started Jan 1, 2023; fully phased-in over 5+ years. 6 Areas:

1. Standardized Approach for Credit Risk: Recalibrated RWs for ECAIs, more risk- sensitive for real estate (e.g., Loan-to-Value).
2. Internal Ratings-Based (IRB) Approach for Credit Risk:
    a. Restrictions: Advanced IRB no longer allowed for banks, FIs, large corporates (>€500M revenue).
    b. Minimum PD/LGD thresholds introduced.
    c. Goal: Reduce RWA variability across banks/systems.
3. Credit Valuation Adjustment (CVA) Risk: New capital requirements for counterparty credit risk on non-credit transactions (derivatives). Simplified approach for smaller banks.
4. Operational Risk: Single new standardized approach replaces all existing methods.

5. Output Floor: Minimum capital for internal models set at 72.5% of the amount calculated using standardized approaches. Limits RWA density variability. You have a limit in the application of internal rating approach -> limiting the benefits of IRBA
6. Leverage Ratio Buffer for G-SIBs: Additional Tier 1 capital buffer above 3% ratio.

European Legislation: "Banking Package" (June 2024) → Capital Requirements Directive (CRD VI, it is more about supervision, it is not implemented directly in the states), Capital Requirements Regulation (CRR III, it regulates the capital requirements of banks, which are the actors).

Final thoughts: what leads what? Regulation, bank management, and financial markets

The spark: Mid-1980s deregulation disrupted the «petrified forest» of banking. Regulators' role: Largely reactive to the rapid pace of change. Growing Complexity: Interconnections - banking, insurance, shadow banking, markets. Critique of over-regulation: complex regulations may be suboptimal for crises -> simple rules might be better, as each crisis is different. Impact on bank management: New regulations force banks to innovate, find flexibilities, and deliver products cost-effectively. Implications for corporate CFOs: Essential to understand regulatory constraints on credit supply (from banks and capital markets) for effective, lower-cost capital access.

The current trend towards sector consolidation

The European banking system is undergoing a profound transformation driven by three converging forces.

1. Regulatory Evolution
    a. Stricter Capital Requirements: Banks must hold more capital to ensure stability.
    b. Enhanced Governance: New rules demand stronger internal controls and oversight.
    c. Intensified Supervision: Authorities like the ECB are increasing scrutiny.
2. Technological Innovation -> The rise of Fintech and other new technologies (such as AI) is forcing banks to modernize and invest heavily to remain competitive.
3. Structural Profitability Pressure
    a. Low interest rates and fierce competition are squeezing bank margins.
    b. High costs from regulation and technology investments further reduce profitability.

➔ The key turning point has been the «normalization» of non-consensual operations, such as hostile takeovers. This shift is accelerating the drive toward industry consolidation, pushing smaller or less efficient banks to merge with larger, more stable institutions to survive. This process is creating stronger, more resilient banking groups within Europe

Conclusion

Relation between regulation and ratings

As previously discussed, internal **credit ratings were already widely used before Basel II** by the most sophisticated banks as powerful tools for bank management and competitiveness. They also indirectly affected other banks through **adverse selection** effects. The relationship between ratings and regulation has evolved over time. It was initially **productive under Basel II**, later became **contradictory** (with developments such as EBA Guidelines on Loan Origination and supervisory practices), and more recently appears potentially **dangerous** under Basel 3+ and CRR3.

The reasons why the relationship between Basel II regulation and ratings is extremely productive are:

- **First reason: incentives to improve risk management tools** -> Basel II avoids the adverse selection effects of Basel I by allowing the use of external ratings under the Standardised Approach

and by granting lower capital requirements to IRB banks, encouraging the development of internal rating systems. Further incentives come from Pillar 2, as banks lacking adequate internal risk tools may face additional capital requirements (Add-ons) imposed by supervisors.

- **Second reason: internal ratings as competitive management tools ->** Basel II recognises internal ratings as competitive management tools and as the final synthesis of creditworthiness assessment, capable of incorporating all relevant information. Recognizing the internal rating system developed autonomously by each bank as competitive tool incentivize continuous improvement to make more timely and accurate credit decisions. However, the regulation requires that the same *systems used for credit decisions* are also *used for capital calculation* (the use test). So, Basel II explicitly rejects the idea of a regulatory rating system, as this would encourage banks to manipulate ratings to minimise capital requirements rather than improve credit decisions. Instead, banks are rewarded for producing more accurate and forward-looking ratings. Two corollaries follow from this approach:
    - the rating represents the final synthesis of creditworthiness assessment. It must therefore include all information considered in the lending decision, including quantitative and qualitative information. Basel II explicitly confirms this principle, allowing the use of statistical models but specifying the rating must consider all relevant information, including information outside the model.
    - banks must be free to choose how ratings are assigned. Basel II is neutral with respect to rating assignment methods and imposes strict requirements only on the downstream calibration phase, i.e. on the quantification of risk parameters such as PD, LGD, and EAD. Statistical models and mechanical credit scoring systems are allowed but are neither mandatory nor sufficient on their own, as they typically rely on a limited subset of information.
- **Third reason: clarity on the role and time horizon of ratings** -> Basel II states that ratings must be updated at least annually and are tools used primarily in granting and review processes, not for continuous credit monitoring. Basel II and subsequent ECB guidance clarify that the time horizon for assigning ratings should be longer than one year, typically *two to three years*, in order to capture forward-looking risk and expected changes in economic conditions. At the same time, the probability of default (PD) associated with ratings must refer to a one-year horizon, as this PD is the input used in regulatory capital calculations.

In essence, regulation clearly distinguishes between:

- the rating assignment phase, which should adopt a longer-term perspective and relies on judgemental analysis,
- the risk quantification phase, where PDs are estimated over a one-year horizon and used to determine risk weights and regulatory capital.

Contradictions in Basel II leading to future problems

On the one hand, Basel II requires ratings to be *forward-looking*, *stable over time*, and *based on non-short time horizons*, in order to ensure good risk differentiation among borrowers. On the other hand, the regulation requires ratings to produce probability of default (PD) estimates that are *close to the actual default rates* observed over a one-year horizon, which is necessary for accurate capital quantification.

These two objectives *cannot be fully achieved with a single type of rating* and therefore require ratings of different nature:

- The **first objective** (stability and forward-looking assessment) is achieved through *Through-the-Cycle (TTC) ratings*. TTC ratings are *relatively stable over time* because they assess borrowers' creditworthiness across the entire economic cycle. As a result, borrowers' rating classes tend to change little when economic conditions improve or worsen. PDs associated with TTC ratings are typically based on *long-term historical default data*. However, when these PDs are compared with actual default rates observed in specific future periods, the realized default rates often show high variability. This implies a weak relationship between TTC ratings and short-term realized default rates.

- The **second objective** (accurate calibration of default probabilities) is achieved *through Point-in-Time (PIT) ratings*. PIT ratings are more sensitive to current economic conditions and therefore produce PDs that are closer to realized default rates over short horizons. However, this comes at the cost of higher volatility and lower stability of ratings over time.

➔ In conclusion, regulation requires ratings to satisfy both TTC and PIT properties, even though these properties are inherently conflicting. This contradiction generates several problems in practice.

Alignments and contradictions

The consistency of EBA LoM with Basel II -> In many respects, the EBA LoM (2020) is consistent with the principles of Basel II. Ongoing monitoring under the EBA framework *does not imply continuous re-rating of exposures*. Instead, the outcome of monitoring activities is the possible inclusion of a credit position in a watchlist, meaning that it is *flagged for future periodic review*, rather than being subject to immediate re-assessment. The "periodic review" process requires banks to review and update internal ratings or credit scoring systems, in line with Basel II. In this respect, the EBA LoM:

- *aligns with the long-term orientation* of ratings required by Basel II
- *promotes allocative efficiency in the banking sector*, allowing banks to direct resources toward deserving medium-term entrepreneurial projects whose returns may not be observable in the short term
- *is consistent with the interests of individual banks*, for both technical and strategic reasons.

The contradictions of EBA LoM with Basel II -> despite this alignment, the EBA LoM also introduces *significant contradictions* with Basel II regarding the role of internal ratings.

- The *first contradiction* concerns the *purpose of ratings*. According to EBA LoM, internal ratings become one of several indicators used in ongoing monitoring, specifically as an early warning signal of credit quality deterioration. A *downgrade* (actual or expected) of the *internal rating is treated as an indicator that may lead to placing the exposure on a watchlist* and potentially revising the rating later. This approach implies that *internal ratings are autonomous signals*, used within monitoring processes, rather than being the final outcome of credit assessment. This creates a short-circuit between processes and contradicts Basel II, which views ratings as the final synthesis of creditworthiness.
- The *second contradiction* concerns the *scope of information included in ratings*. The EBA LoM specifies that, in assessing creditworthiness, banks should separately analyse:
    - the client's financial position and credit risk
    - the business model, organisation, and strategy
    - the internal rating or credit score
    - all financial commitments and exposures
    - the structure of the transaction and guarantees

This structure implies that the *rating no longer incorporates all relevant information* but becomes just one element among others. As a result:

- *ratings no longer include all information used to assess borrowers or transactions*
- ratings are *no longer the final summary of creditworthiness* for credit decisions
- rating *assignment becomes separated from loan underwriting decisions*, recreating the split that Basel II explicitly sought to avoid.

The EBA LoM, credit pricing, and ratings: a managerial trap? Chapter 6 of the EBA LoM addresses credit pricing, a topic that directly *affects banks' managerial autonomy* due to the risk of adverse selection. Supervisors aim to ensure that credit risk is properly priced, as mispricing can undermine financial stability. The EBA LoM requires banks to differentiate prices based on *client type* and *credit quality*. For consumers, micro-enterprises, and small enterprises, pricing should be based mainly on portfolio and product loss experience, whereas for medium and large enterprises, pricing should be more closely linked to the individual transaction and loan. This reflects how markets typically operate and is partly constrained by legal requirements preventing price discrimination among retail clients. However, the problem arises because banks face risk-adjusted economic losses when lending to higher-risk clients if pricing is too standardised.

Banks therefore have a strong incentive to use adequate internal rating and scoring systems to guide accept/reject decisions and identify transactions that generate superior risk-adjusted returns. When such systems are used, performance indicators such as EVA, RORAC, RAROC, RORWA, and ROTA can effectively signal which clients or transactions to accept. If banks were to adopt a minimalist interpretation of the EBA LoM (especially in consumer, micro-enterprise, and small business lending) and treat ratings or scoring systems as non-essential competitive tools, they would expose themselves to a high risk of adverse selection.

Contradictions with Basel II in supervisory practices

A **first contradiction** with Basel II emerges from the convergence of interests between banks and supervisory authorities, which has led to an *increasing identification of internal ratings with statistical-based assignment systems*. This represents a departure from the Basel II framework. Banks have seen advantages in this convergence in terms of *process standardisation, cost reduction, and time savings*. Supervisory authorities, in turn, have considered statistical models useful for preserving the objectivity and comparability of evaluations. As a result, supervisory validation of rating systems has increasingly required that internal ratings be based on robust statistical models and effectively used in management.

A **second contradiction** arises during the validation of internal models. Supervisory authorities agreed to validate models that violated Basel II, by allowing a one-year target horizon *not only in the quantification phase* but also in the *rating assignment phase*. A one-year horizon allows banks to *include more internal behavioural data*, increasing the *statistical discriminatory power* of the model and facilitating supervisory validation. However, when the target horizon is limited to one year, the information that becomes most relevant is mainly short-term behavioural data, while financial statement information plays a reduced role and *strategic and qualitative information becomes marginal*. As a result, the model increasingly resembles an early warning tool rather than a comprehensive creditworthiness assessment -> contradiction when the same tool is used both for credit granting/review and for ongoing monitoring. The two processes have different objectives, as clearly stated by both Basel II and the EBA LoM. In addition, the restrictive attitude of supervisory authorities toward the use of overrides, further limited the role of judgemental analysis.

A **third contradiction** is that to prevent influence from parties with conflicting incentives, *supervisory practices have increasingly pushed toward separating responsibilities*. This has led to two main consequences:

- banks establish a Credit Risk Management function responsible for the final rating decision, separate from the Credit Department responsible for loan underwriting
- discrepancies may arise between the underwriter's assessment of a borrower's creditworthiness and the assigned internal rating.

As a result, the informational content of the rating may no longer fully reflect the assessments that supported the original lending decision. This alters the role of ratings and undermines one of the core objectives of Basel II: to base capital adequacy on the **same internal ratings used in credit underwriting**.

The dangerous relationship between ratings and Basel 3+/CRR3

A widespread perception is that Basel 3+ reduces the role of internal ratings. However, this interpretation is misleading and potentially dangerous. From a regulatory perspective, internal ratings remain highly relevant.

- First, evidence from **impact assessments** shows that portfolios treated under the IRB approach continue to benefit from capital savings compared to standardized approaches. Moreover, the absence or weak use of internal ratings can still lead to additional capital requirements under Pillar 2.
- Second, from a **managerial perspective**, internal ratings remain essential to protect banks from adverse selection. Basel 3+ generally increases capital requirements, which raises lending costs and leads banks to pass these costs on to borrowers through higher interest rates. In this context, internal ratings are crucial to correctly differentiate risk and preserve banks' profitability and stability.

Internal ratings are also more informative than external ratings for *non-large corporate borrowers*. External ratings are publicly available and therefore do not provide a competitive informational advantage. Therefore, the idea that Basel 3+ no longer encourages the development and use of internal rating systems is incorrect.

At the same time, Basel 3+ places greater emphasis on external ratings, especially for corporate exposures. This strategy appears particularly aimed at increasing the availability of external ratings for SMEs, given that large corporates are already widely covered by international rating agencies. However, this approach is problematic. While external ratings for SMEs may offer advantages in terms of *cost efficiency*, *use of big data, and disciplinary effects on borrowers*, they also present important drawbacks. They tend to weaken the role of soft information and strategic analysis. Promoting external ratings for SMEs may shifting bank–firm relationships toward a transactional model, where credit is treated as a standardized product. This shift conflicts with the principles of relationship-oriented banking and with the credit assessment logic envisaged by the EBA LoM.

Outlook

Several open questions emerge from the analysis.

Regarding the role of ratings in regulation and supervision, it remains unclear whether current developments reflect a deliberate and coordinated shift by authorities, or rather the outcome of fragmented regulatory approaches without a clear unifying framework.

Another key question concerns the future role of market-based finance, including private debt funds and peer-to-peer lending platforms, in providing credit to firms. It is also uncertain whether these market-based solutions will promote greater transparency or instead accelerate the use of automated credit assessment tools.

Technological developments raise further questions. The rise of AI and GenAI tools may significantly reshape credit assessment, monitoring, and risk management. It is unclear whether these tools will reduce the role of human judgement or instead require new skills and competencies from bank officers.

Ultimately, these trends may lead to a more segmented credit market, with a clearer distinction between transaction-oriented and relationship-oriented models. This segmentation may create new opportunities for lenders and borrowers but also introduce new risks and call for further regulatory adaptation.

Alex Cataldo ARC Ratings 2025 (guest speaker)

What is credit risk? The credit risk is based both on the ability to pay (so the liquidity available to an individual at a specific moment) but also the willingness to pay (so, I defaulted) a financial obligation.

What is a Credit Rating? A rating is an OPINION on the ability and willingness of an Issuer to repay in a timely manner a financial obligation, such as a Bond or Note -> they are not a guarantee, because they are not capable of predicting the future -> credit risk is the input. The receivables are sufficient to reimburse Investors according to the terms of the Offering Circular (typically referring to a final maturity date). As opinions, ratings can change throughout time and others can have different opinions -> the trust component is fundamental. A rating should not be considered a guarantee and do not consider:

- Prepayment risk or market risk which is tied to the fluctuation of interest rates
- Early redemption of a bond or extension risk beyond an expected maturity date (“expected maturity” vs “final maturity”)

The default of an obligation it is not just about the repayment, but we have to look at when we decide to pay, how much etc. This is because several people and institutions limitate their view to the letters associated with the ratings -> you cannot look just at letters; you have to understand what is behind those rating.

There are many ways for assessing credit risk:

- Full expert judgement approach -> we are going to use people that are going to use date to give a rating (ARC Ratings, Moody's Investors Svc)
- Expert system -> people use models to assess the credit risk, but it requires an expert to put the input
- Market implied ratings -> I'm going to look at price, because human being might need time to elaborate information, while if someone buys/sells prices react immediately to this transaction -> the problem is that the market might decide to go against the company which, even though it is a solid company, if there isn't anyone capable of protecting it, it will default
    - Bond market derived
    - CDS Market derived
    - Equity market derived
- Statistical models -> use just financial information to give information

Because of AAA rating, usually it means that the company is safer and they'll pay less money, even though you must diversificate

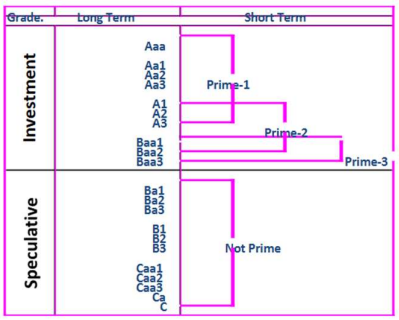
What are the different types of Ratings? Not all ratings in financial markets have the same definition:

- CREDIT RISK (Moody's) = Expected loss = sum (Probability of a loss under different scenarios * estimated severity of loss under these scenarios)
- CREDIT RISK (ARC, S&P, etc) = Probability of Default = (Probability of a loss without considering the amount of this loss)

What is Behind Expected Loss? An expected loss can be determined by weighting the loss -or severity- under each scenario by the probability of such a scenario:

- A Missed scheduled payment of interest or principal composes a loss on the financial instrument (notes or bonds). A probability of such a loss scenario can be determined as well
- Expected loss considers the time horizon in which cash flows pertaining to such an instrument are taken into consideration, which typically takes the form of the final maturity date of the financial instrument.
- At every level in in the rating scale, a maximum assigned level of expected loss corresponds to the notes. For example, a Aaa could correspond to a loss of 0,00550% for a maturity of 10 years.
- Expected loss for the notes that receive a rating, such as Aaa, is independent from the type of issuer: industrial company, bank or Special Purpose Vehicle.

Ratings give investors a global, universal indication to measure the credit risk and a visual representation of it referring to a financial instrument. Comparisons can be made between different issuers or instrument. The foreign currency credit rating of Baa3 or BBB- and allows investors to compare it with similar debt instruments of the same credit rating. John Moody introduced ratings in 1909, when he published the first bond ratings in the Manual of Railroad Securities.



The choice of investment depends obviously by the risk aversion of the individual, but also by the willingness of this person to make money -> a AAA bond, because it is safer, will pay a lower coupon than a BB bond. In addition, the presence of bonds that have worse ratings allow us to build more diversified portfolios.

Moody's Expected Loss table

Rating	1	2	3	4	5	6	7	8	9	10
Aaa	0.00003%	0.00011%	0.00039%	0.00099%	0.00160%	0.00220%	0.00286%	0.00363%	0.00451%	0.00550%
Aa1	0.00031%	0.00165%	0.00550%	0.01155%	0.01705%	0.02310%	0.02970%	0.03685%	0.04510%	0.05500%
Aa2	0.00075%	0.00440%	0.01430%	0.02585%	0.03740%	0.04895%	0.06105%	0.07425%	0.09020%	0.11000%
Aa3	0.00166%	0.01045%	0.03245%	0.05550%	0.07810%	0.10065%	0.12485%	0.14960%	0.17985%	0.22000%
A1	0.00320%	0.02035%	0.06435%	0.10395%	0.14355%	0.18150%	0.22330%	0.26400%	0.31515%	0.38500%
A2	0.00598%	0.03850%	0.12210%	0.18975%	0.25685%	0.32065%	0.39050%	0.45595%	0.54010%	0.66000%
A3	0.02137%	0.08250%	0.19800%	0.29700%	0.40150%	0.50050%	0.61050%	0.71500%	0.83600%	0.99000%
Baa1	0.04950%	0.15400%	0.30800%	0.45650%	0.60500%	0.75350%	0.91850%	1.08350%	1.24850%	1.43000%
Baa2	0.09350%	0.25850%	0.45650%	0.66000%	0.86900%	1.08350%	1.32550%	1.56750%	1.78200%	1.98000%
Baa3	0.23100%	0.57750%	0.94050%	1.30900%	1.67750%	2.03500%	2.38150%	2.73350%	3.06350%	3.35500%
Ba1	0.47850%	1.11100%	1.72150%	2.31000%	2.90400%	3.43750%	3.88300%	4.33950%	4.77950%	5.17000%
Ba2	0.85800%	1.90850%	2.84900%	3.74000%	4.62550%	5.37350%	5.88500%	6.41300%	6.95750%	7.42500%
Ba3	1.54550%	3.03050%	4.32850%	5.38450%	6.52300%	7.41950%	8.04100%	8.64050%	9.19050%	9.71300%
B1	2.57400%	4.60900%	6.36900%	7.61750%	8.86600%	9.83950%	10.52150%	11.12650%	11.68200%	12.21000%
B2	3.93800%	6.41850%	8.55250%	9.97150%	11.39050%	12.45750%	13.20550%	13.83250%	14.42100%	14.96000%
B3	6.39100%	9.13550%	11.56650%	13.22200%	14.87750%	16.06000%	17.05000%	17.91900%	18.57900%	19.19500%
Caa	14.30000%	17.87500%	21.45000%	24.13400%	26.81250%	28.60000%	30.38750%	32.17500%	33.96250%	35.75000%

An example of what is behind Probability of Default:

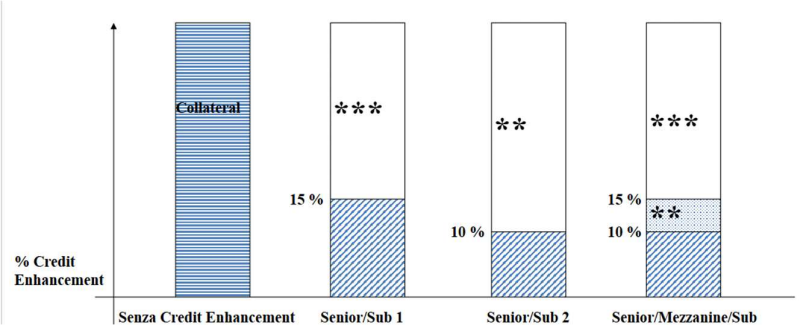
- Characteristics of the Asset:
  - Maturity: 5 years / bullet/ amount: coupon 5%
  - Expected: 0.2% Loss on year 5
  - AA Case: 5x Expected case or 1% on Year 5
- Flows paid without Loss:
  - Years 1 to 4: 100 x 5% = 5 yearly
  - Year 5: 100 x 5% +100 = 105
- Flows paid taking the Loss into account:
  - Year 1 a 4: 100 x 5% = 5 yearly
  - Year 5 EXP: 100 x 5% +100 -100 x 0.2% = 104.8
  - Year 5 Stress:100 x 5% +100 -100 x 1% = 104
- % Default Probability
  - Rating of 100 Issuance: B or below
  - Rating of 99 Issuance: AA

An example of what is behind Expected Loss:

- Characteristics of the Security
  - Maturity: 5 years / bullet/ amount: 100 / coupon 5%
  - Hypnotises: 1% Loss on year 5
- Flows paid without Loss:
  - Years 1 to 4: 100 x 5% = 5 yearly
  - Year 5: 100 x 5% +100 = 105
- Flows paid taking the Loss into account:
  - Year 1 a 4: 100 x 5% = 5 yearly
  - Year 5: 100 x 5% +100 -100 x 1% = 104
  - Net Present Value (Discount rate = 5%) = 99,22
- %Loss = (NPV without Loss - NPV with Loss) / NPV without Loss
  - = (100 -99,22) / 100 = 1% / (1+5%) ^5 = 0,78%
  - => Rating = Baa2 (i.e. Table at 5 years)

Expected Loss calculates the Loss under different scenarios: the Expected Loss is obtained multiplying the loss (the «severity» of loss) times its probability for each scenario. Example (considering the Moody's table of Expected Loss):

Loss at Year 5	Loss	Probability
1,00%	0,78%	5%
0,75%	0,59%	10%
0,50%	0,39%	15%
0,25%	0,20%	30%
0,00%	0,00%	40%
Expected Loss	**0,22%**	
Rating	**A2**	



In a Sr/Mez/Sub structure, Expected Loss rating of the Mezzanine tranche is not « equivalent » to the ** of Default Probability rating, because the severity of loss is more « concentrated » on this tranche: the difference of meaning between EL and DP can explain different phenomena of split ratings on subordinate tranches. For an investor that acquires the Senior and Mezzanine tranche of a Sr/Mez/Sub structure, the DP weighted average rating of its investments is between ** and *** but has the same risk of the Senior tranche in a Senior/Sub 2 (rating **) structure.

The value of Ratings

The benefits of ratings for the issuers:

- It may lead to more favourable loan terms and credit costs, as well as attracting investors
- It may reduce the capital reserve requirements set aside for lending activities by banks using the standardised or external rating-based approach, under Basel II and Basel III
- It may reduce the risk premium demanded by investors through a better understanding of the risks involved
- A rating may reduce the collateral demanded by investors through a better understanding of the risks involved
- It may facilitate de-risking and optimal balance sheet management
- It may enable financial institutions to reduce risk weighted assets, to churn transactions and increase returns
- It potentially opens up and increases the investor pool
- A rating may provide investors with additional "confidence" in an investment

What are the situations in which a rating can be utilized?

When structuring balance sheet usage:

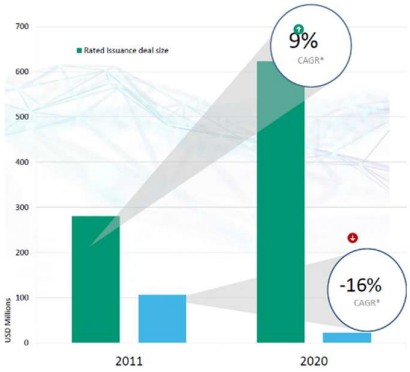
- Direct Lending & Mezzanine -> market for direct lending to mid-size companies is rapidly growing as banks' balance sheet and risk appetite tighten
- Investment in Funds -> active investment in primary and secondary market funds

- Special Situation -> distressed debt and new money investments

How Advisory Partners can work with CRAs:

- Structured Credit -> Credit and distressed loans, corporate receivables, commercial property advice and structuring for funded securitisation
- Debt Advisory -> Covering debt raising, refinancing and restructuring, private placement and acquisition financing
- Alternative projects -> Energy transition and project finance both fund based and single project
- Significant Risk Transfer -> capital advise on RWA and regulatory capital issues

Credit ratings may expand deal size and potential investor base -> In 2011, the average issuance size of a rated transaction1 was 2.68x that of an unrated transaction. In 2020, the rated deal size was 27.5x that of an unrated deal.



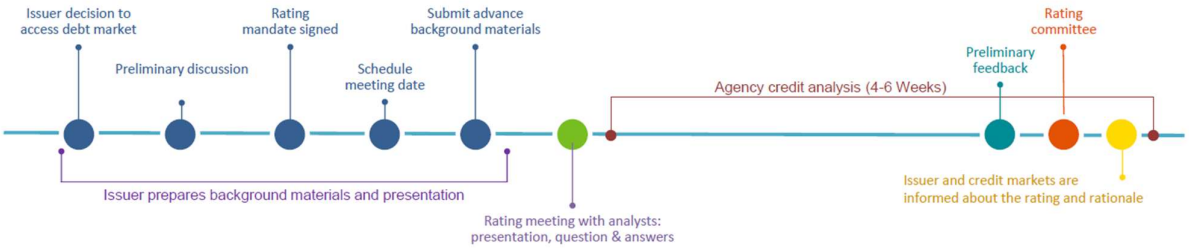
The rating process

ARC Ratings' rating process is based on the following principles:

- Integrity and Objectivity
- Consistency
- Rigour and Accuracy
- Continuity

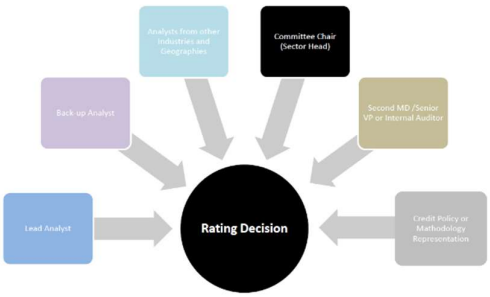
There are 6 Key Stages to an ARC Ratings' rating process:

Indicative Timeline for Typical Rating Process:

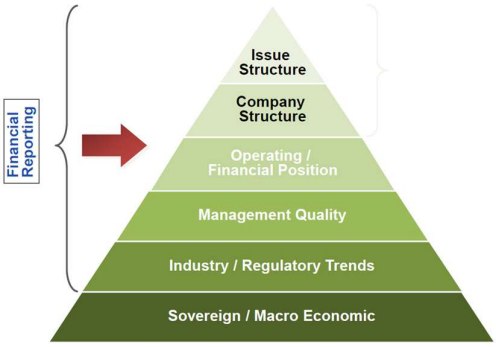


Three Phases to the Initial Rating Process:

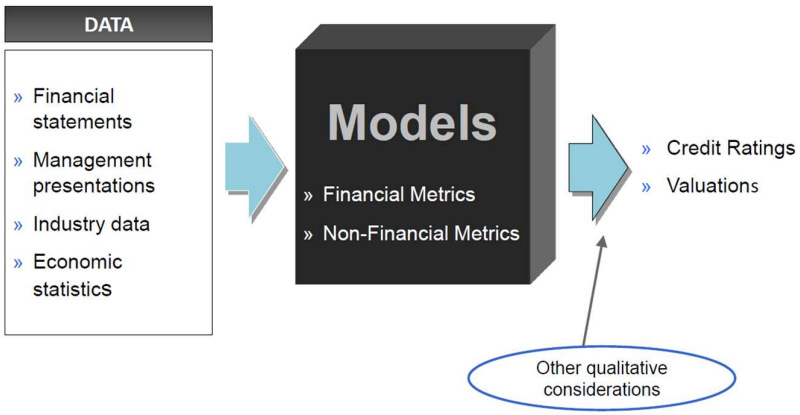
1. INTRODUCTORY PHASE -> Introduction, exchange of information required for rating, management meeting and any follow-up required post meeting
2. INTERMEDIATE PHASE -> Post management meeting and follow-up, the analysts prepare materials for consideration by a Rating Committee
3. FINAL PHASE -> Rating determined by the Rating Committee and rating delivered either through press release available on website and via newswires



Fundament Analysis – Areas of Focus



The Analytic process:



Some other components of the process:

- Adjustments to financial data
- Trend analysis
- Peer comparisons
- Discounted cash flow analysis
- Capital adequacy analysis
- Liquidity analysis
- Stress testing
- *Non-Verbal Clues*
- *The Discussion After the Management Meeting*

EXAMPLE 1: ARC RATINGS CORPORATE FINANCE CREDIT RATING – FRAMEWORK

The following framework is a guideline for the rating analysis. Additional factors may be taken into consideration in the analysis and both a quantitative and qualitative assessment may be made in addition to the framework below. These assumptions will be discussed during the rating panel process.

Different types of risks:

- COUNTRY RISK:
  - What we assess:
    - The country risk of the country where the company is based.
    - The country risk of the main countries where it has activity (as a buyer, a seller or logistics).
  - How:
    - Sovereign Approach + WB Ease of Doing Business / Business Enabling Environment + WB Worldwide Governance Indicators + IMF Indicators.
  - Risk Mitigants:

        - Headquarter in a stable, developed country; diversification of operations/business with access to business partners in multiple markets.
- INDUSTRY RISK
    - What we assess:
        - Cyclicality of the main commodities the company trades; analysis will be focused through the cycle.
        - Competition and barriers to entry in the main commodity markets in which the company operates.
    - How:
        - Analysis of historical and forecast information on prices, volumes traded, product differentiation, market shares, access to the capital market, growth trend and profit margins of each segment, concluded with the scoring to each of the relevant risk factors.
    - Risk Mitigants:
        - Leading player in the market, significant diversification in product and markets, etc.
- BUSINESS RISK
    - What we assess: Ownership, Governance, Market Strategy, Company's market position, Company's product and market mix, Integration level (Backward or forward or both), Level of proprietary trading, Environment & Social
    - How:
        - Analysis of market shares, information on vertical integration, product and market diversification (both historical and forecast), proprietary trading, concluded with the scoring to each of the relevant risk factors.
    - Risk Mitigants:
        - Leading market position, high level of integration, high product diversification, high geographical diversification (both, in terms of purchases and sales), low level of proprietary trading, no compensation incentives that promote risk taking, low level of environment & social issues and steps/initiatives in E&S area.
- FINANCIAL RISK
    - What we assess: Scale, Profitability, Leverage (RMI Adjusted) ***, Liquidity (RMI Adjusted) ***, Use of derivative & exposure, Foreign Exposure
    - How:
        - Analysis of financial information and ratios (property, plant & equipment, Readily Marketable Inventories, EBITDA margin & Oher cash flow based margins (i.e. FCF & FFO Margin, Net Debt/EBITDA, EBITDA/Interest, FFO Interest Coverage), balance sheet liquidity and access to other diversified sources including committed bank lines and funding through access to the capital markets for additional debt or equity, policies for the use of derivatives & amounts of exposure, concluded with scoring of each relevant risk factor.
    - Risk mitigants:
        - Big scale, stability in margins and in line with peers, low leverage, high levels of liquidity available & use of derivatives to limit price risk and with history of successful use.
- OTHER FACTORS
    - What we assess:
        - Parental support
    - How:
        - Analysis of the willingness and capacity of shareholder to provide support in case of need or of requiring the company to provide a significant flow of dividends or group loans. Use of the shareholder rating (if it exists) or internal assessment made by ARC. Can have a positive, neutral or negative impact on the company's rating.
    - Risk mitigants:
        - Shareholder with the willingness (analysis of strategic importance of the company) and capacity to support the company in case of need

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