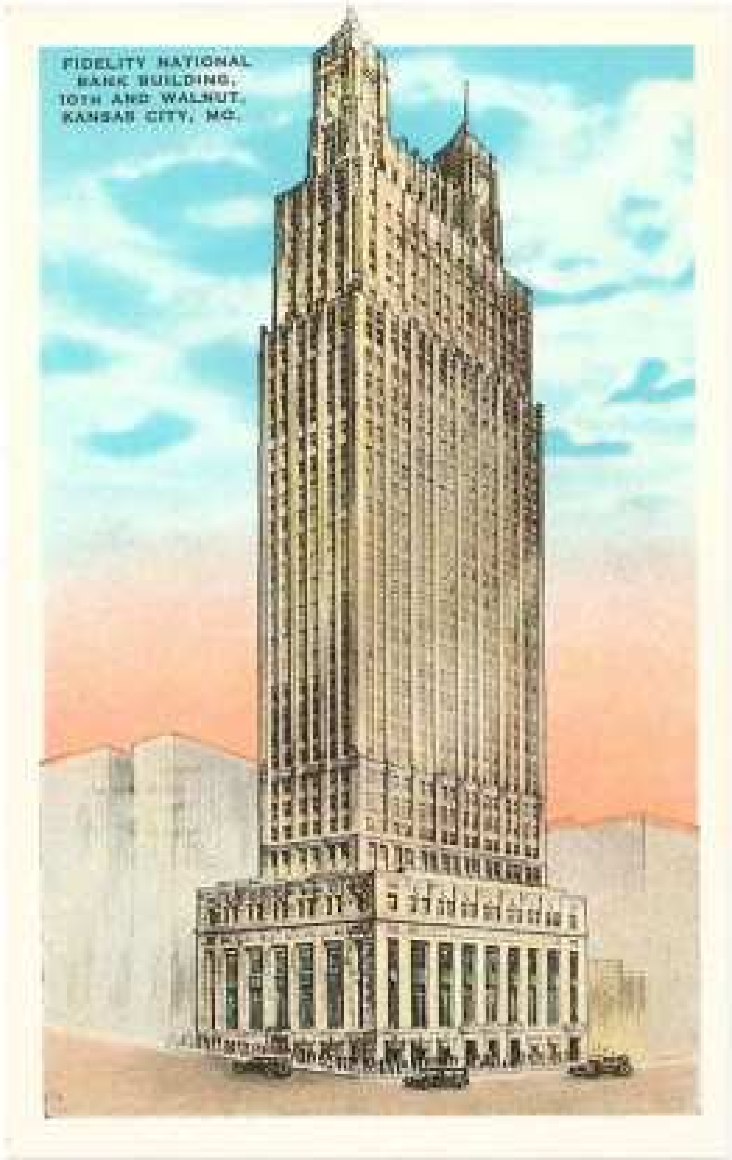

An Agent Based Model of the Credit Process

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Agenda

Our Framework: The Bank as an Organization

Commercial Banking: the Credit Process

Dealing with a Complex System

The Bank as an Organization

- Focus on universal banks, financial services companies engaged in several businesses

- commercial bank activity, devoted to serve customers through loans, mortgages and deposit
- investment bank, interested in mergers, acquisitions, and capital markets
- corporate center: services (accountability, logistic, IT, HR), governance

The Bank as an Organization

Board of Directors

Commercial Bank Division	**Investment Bank Division**	**Corporate Center**
Retail SMEs Middle corporate …	Investment Banking Merchant banking Bancassurance Structured finance M&A Advisory …	General Mgnt Planning/Development Risk Mgnt Cost & Accounting Control Human Resources Investor Relations Treasury …
Segmentation	Instrument	Governance

Banks, firms, and credit

- The aim of this ABM model is to analyze the lending process and the relationship that takes place between banks and firms, both depicted in the perspective of complex systems.

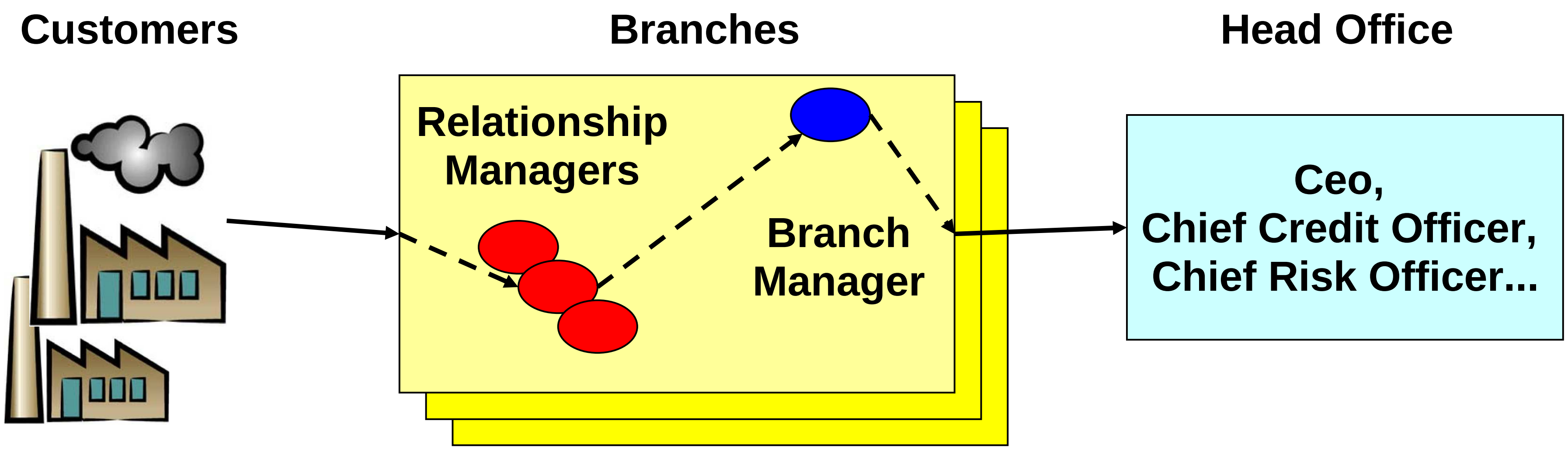
- Commercial Banks offer permanents credit lines to firms for their activities, supporting the financial management of both current activities and long term investments.

- The bank decision whether to give or not the financial support depends on the evaluation of the credit capacity: in this work we focus our attention on this micro level

The Credit Process

- The credit process is based upon a risk selection, through which the banker analyzes the enterprise and its capability to refund the loan at maturity: characteristics such as profitability, patrimonial structure and equilibrium, indebtness, are evaluated and concurr to define the amount of credit that will be granted.
- From an aggregate point of view, are relevant
  - the structure of the bank,
  - the risk aversion of the banker,
  - and the targeted credit quality
- Commercial policies and the market positioning are strongly affected and driven by these variables

The Model Framework



Banks are strongly hierarchical structures, with a main head office, and many branches that develope their action directly on the territory. According to this hierarchy, people decision power varies depending on their position and role in the organization.

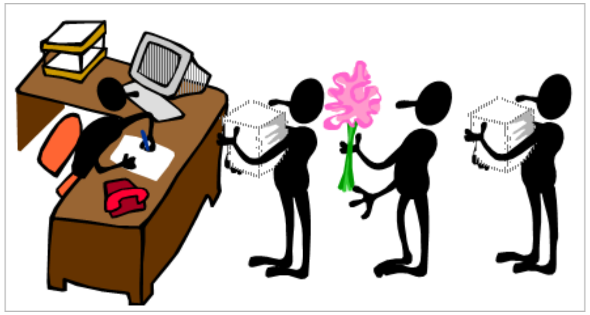
The higher the amount of the credit line and of the riskiness of the operation, higher the position in the hierarchy of the person that will have to decide for the granting. The proposal will then move from the account manager, to the branch manager, to any of the superior levels until the main head office.

As a consequence, varying the structure of the hierarchy and the distribution of powers through the people in it, as well as the characteristics of the individuals involved, will affect the process development and the behaviour of the system

- We describe the firm through the following variables:
  - rating
  - revenues
  - turnover index (revenues / total assets)
  - banking debts (expressed both in absolute value and as a percentage of total assets)
  - suppliers debts “ “
  - risk capital “ “
  - financiable credit “ “

- Our population of firms is based upon statistical distributions that carefully reproduce the main features of the italian market.

The Relationship Manager



Queuing Process

Open Account

Lending Proposal

	Class 1	Class 2	Class 3	Total
	Cash	Mid-long term	Commercial Credit	
Acount Manager	500	500	1000	1000
Branch Manager	1500	1500	3000	3000
Head Office	All	All	All	All

Credit_granted = F(revenues, bank_debt, rating, risk_capital, Total Asset)

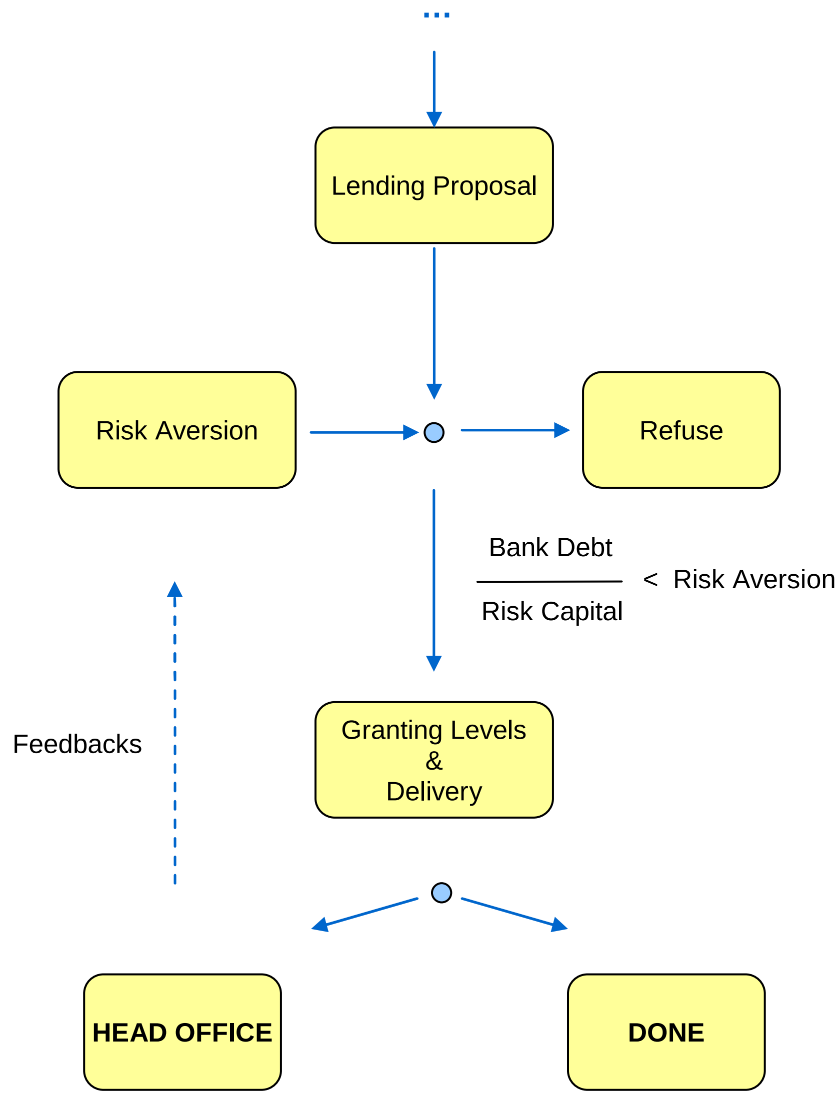
The firm follows the process flow depending on its characteristics. The credit affordability is tested, the account is opened, the amounts of the credit lines are proposed, and the decision power is evaluated on the basis of amounts and risks.

The Branch Manager

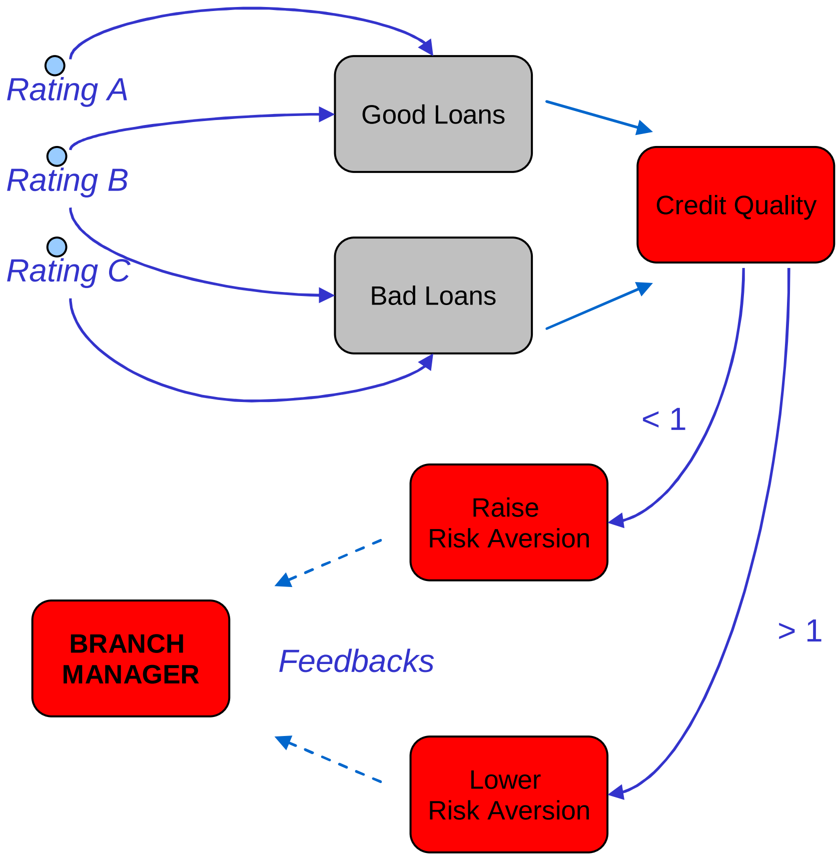
At the middle level we have the branch manager: his behaviour is more connected with the branch results and the incentives that come from the head office.

The branch manager grounds his decision on his risk aversion and compares it with a general value of the solidity of the firm, the risk capital. If the entrepreneur strongly believes in what he is doing, or has until now succeeded, his risk capital will be higher.

The higher the risk capital, the more the chance of having the credit granted by the branch manager. What is more important is that the risk aversion of the branch manager depends also on external factors, namely head office feedbacks.



The Head Office

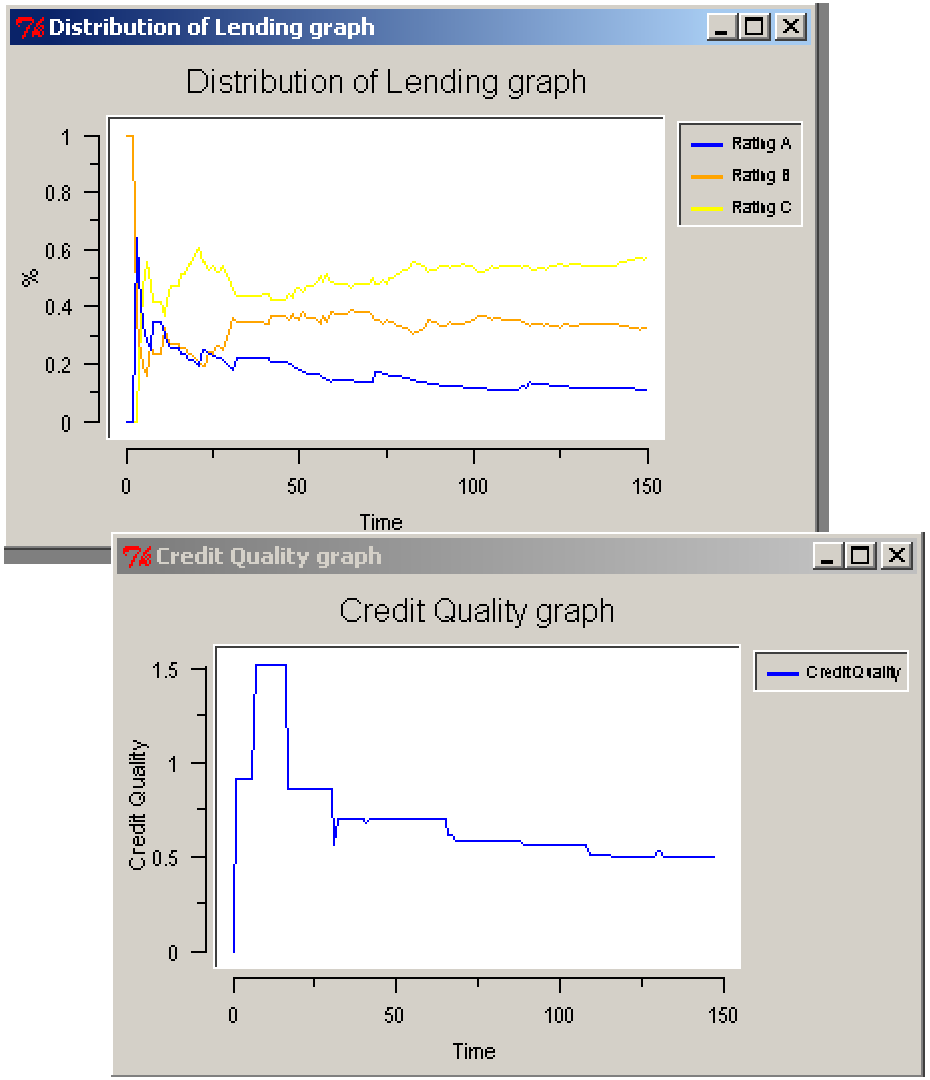


Represents the highest level of the organization. It has to deal with aggregates, which are the outcome of every single action and interaction in the hierarchy below. Its focus is on overall credit quality.

As the overall credit quality lowers, the head office intervenes communicating a higher risk aversion level to the branch manager: this way, less strong and valuable firms would not gain access to credit, and the overall quality will again raise up.

When a satisfying level of quality is gained the head office will lower his branch managers risk aversion, and a new commercial shove will burst.

Output



Credit quality emerges and depends on the operations of the individuals as much as on the interactions among levels of hierarchy. As rules change, credit quality changes.

Graph show the portfolio composition, and the credit quality index. In the simulation large part of firms have a C rating, while good ones, A, are very few.

The behavior of this complex system results from many interactions and feedbacks.

Global behavior is therefore affected by changes in the structure: from the terms in the algorithm at the lower level, to the granting powers, till risk aversion and distribution of firms' characteristics

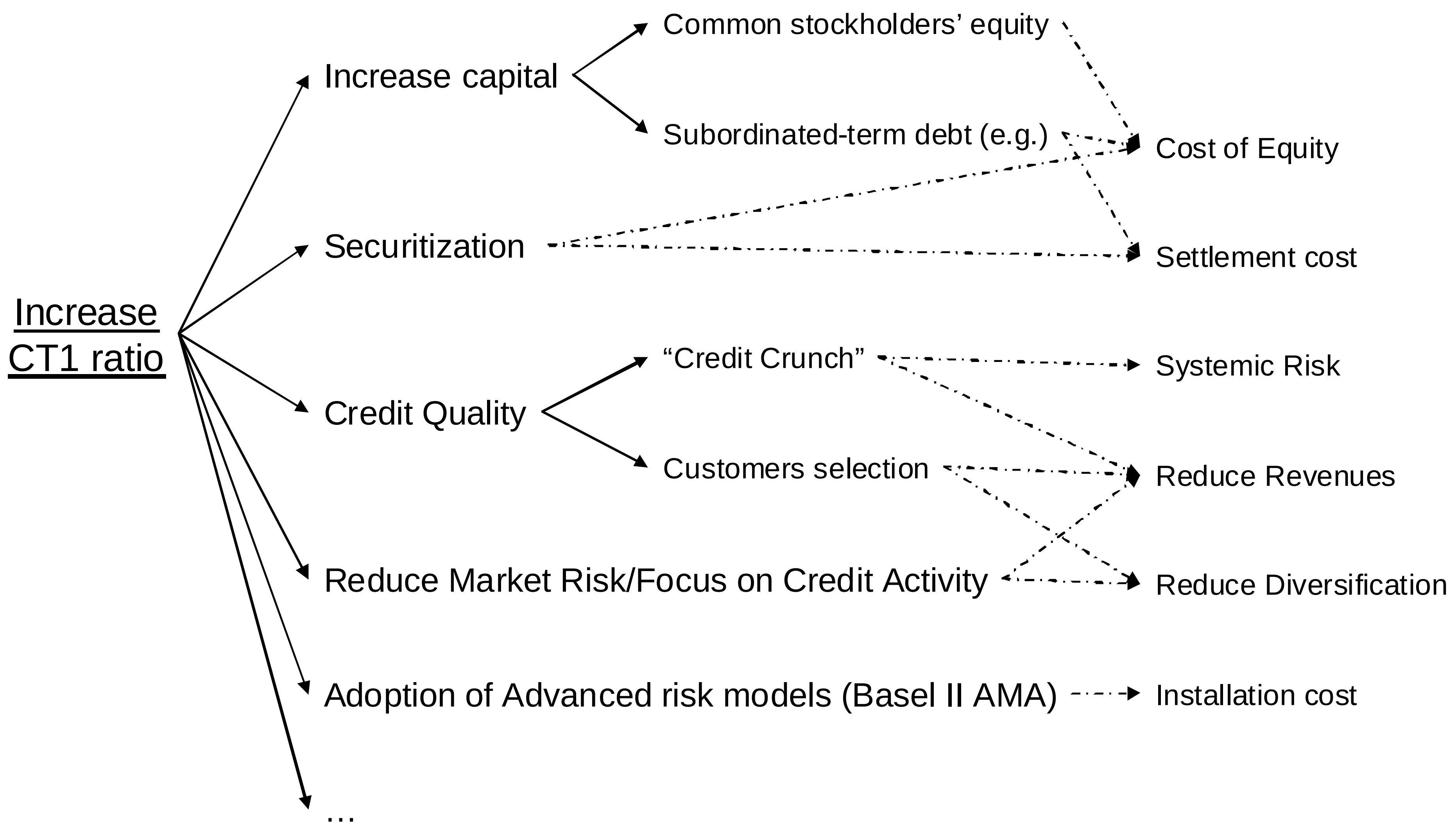
Dealing with a Complex System

- Managers have to deal both with endogeneous and exogenous issues.

- An Example: The crisis of financial market started in mid 2007

- How to increase the bank capital?
  - Which are external constrains?
  - Which are internal constrains?
  - Which BU are involved in the decision?
  - What the chosen instrument implicates?
  - ...

CT1 Ratio


Increase CT1 ratio
Increase capital
Common stockholders' equity
Subordinated-term debt (e.g.)
Securitization
Credit Quality
"Credit Crunch"
Customers selection
Reduce Market Risk/Focus on Credit Activity
Adoption of Advanced risk models (Basel II AMA)
…
Cost of Equity
Settlement cost
Systemic Risk
Reduce Revenues
Reduce Diversification
Installation cost