



Introducing BEES

Banks, Enterprises and the Economy Simulation

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Agent Based Modeling for Banking and Finance

Torino, 9-11 February 2009



What is BEES

- An engine for the study of the economic system and of the role played by its actors:
 - Consumers
 - Enterprises
 - Banks
 - Central banks
 - Governments.
- The fulcrum of the model are banks, their intermediation function and their **choices** in terms of **business** and **risk positioning**.
- The intent is to put real life in the model, and to bring the model to real life.



Topics

BEES

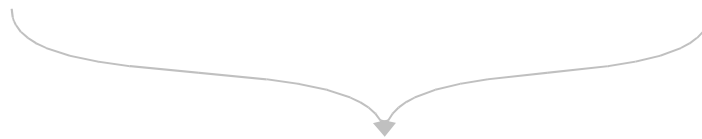
Banks Enterprises and the
Economy Simulation

Banks Market Capitalization



TSR and its Drivers

Capital Requirements



Market Attractiveness, Profitability and Risk Exposure



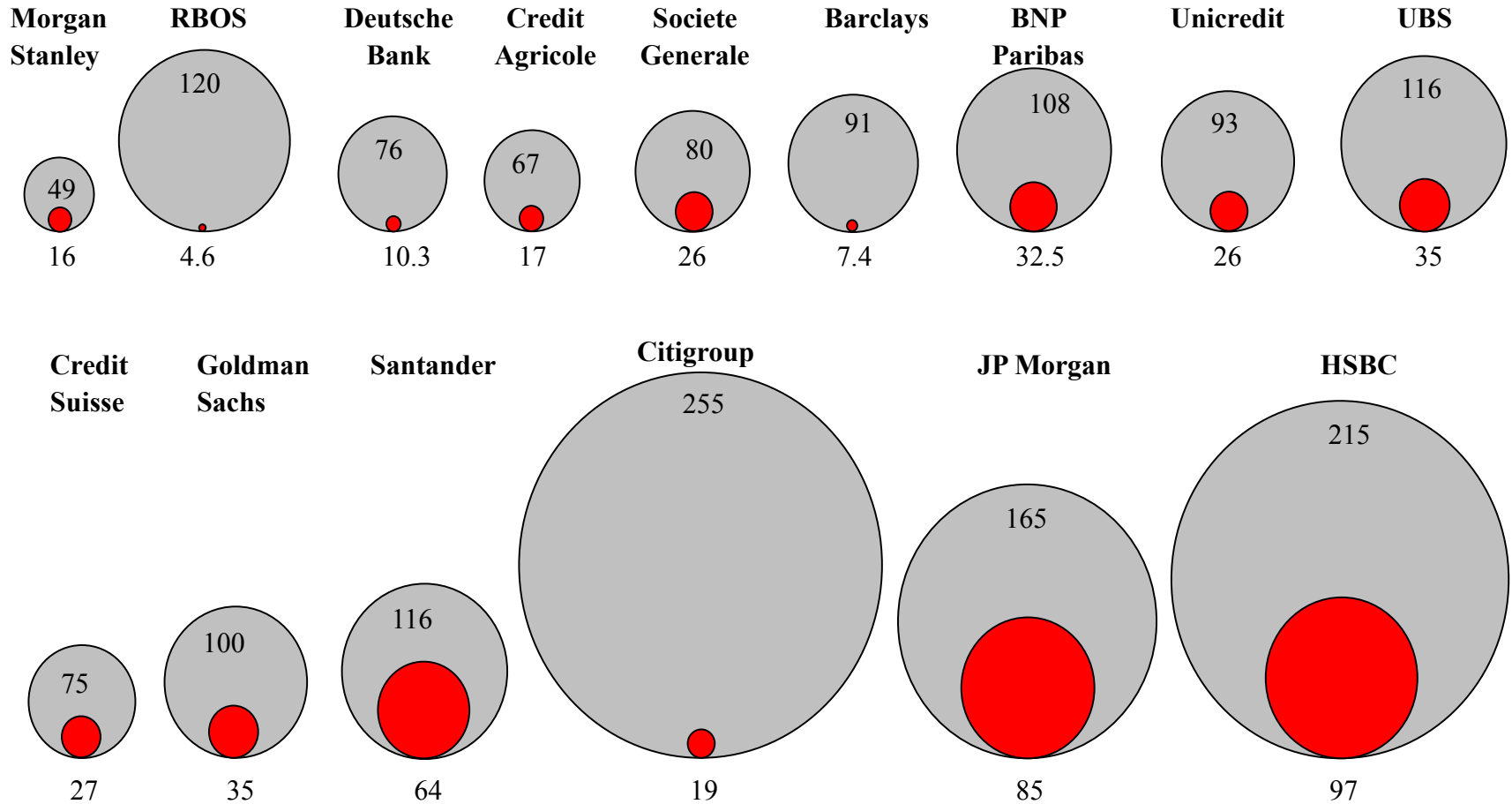
The Model Framework

- Endogenous Characteristics
- Use and Future Developments

Changes in Market Capitalization can be fundamental for stakeholders...



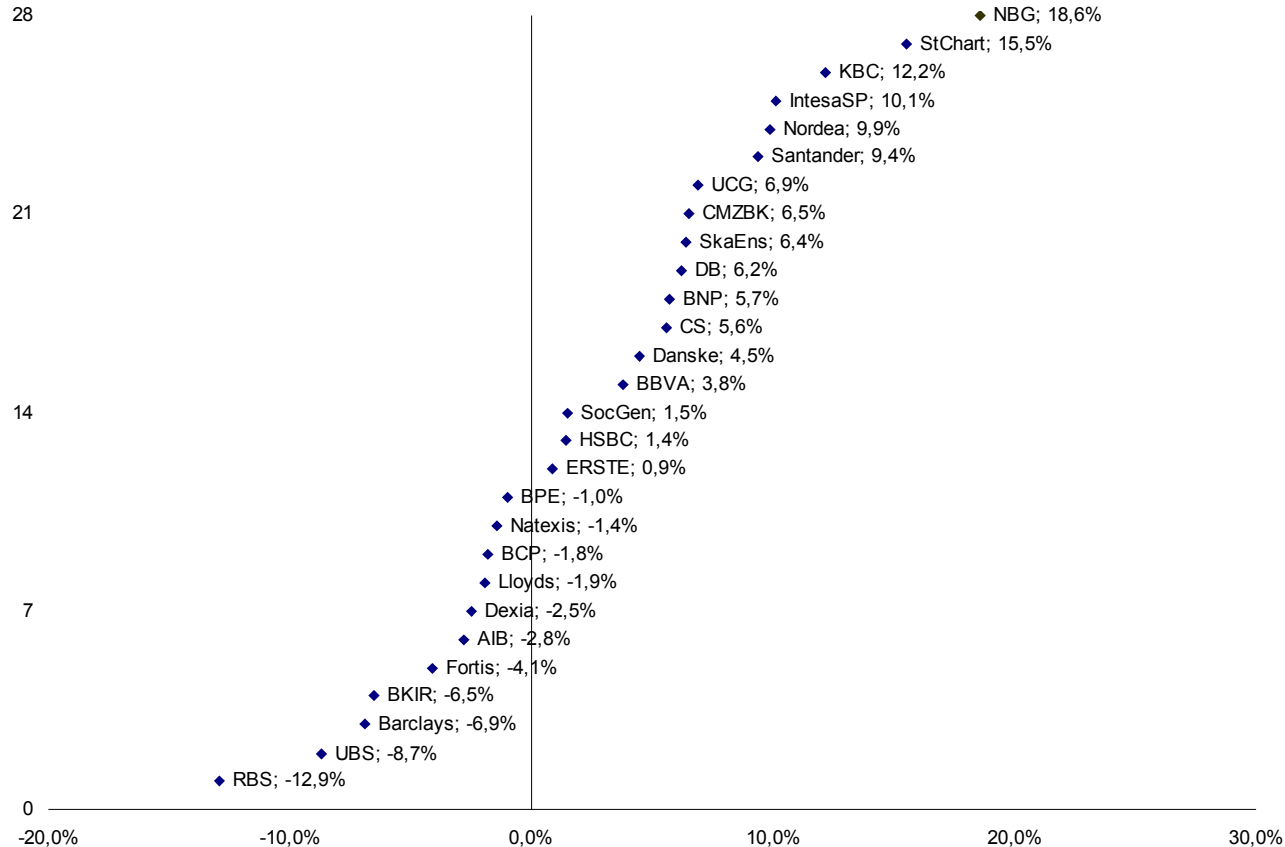
- Market Value as of January 20th 2009, \$Bn
- Market Value as of Q2 2007, \$Bn





...as well represented by the Total Shareholder Return (TSR)

3yr TSR ranking (2005 -2007)



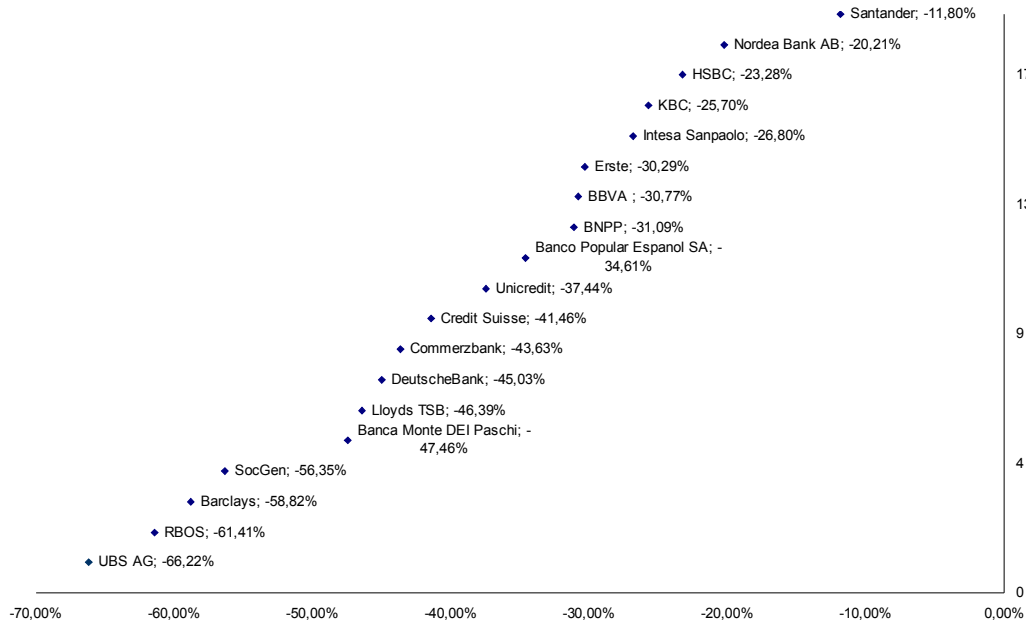
The TSR signifies the market performance in terms of stock price variation and dividend yield

$$TSR = \left(\frac{(p_{t+1} - p_t) + div_{t+1}}{p_t} \right)$$

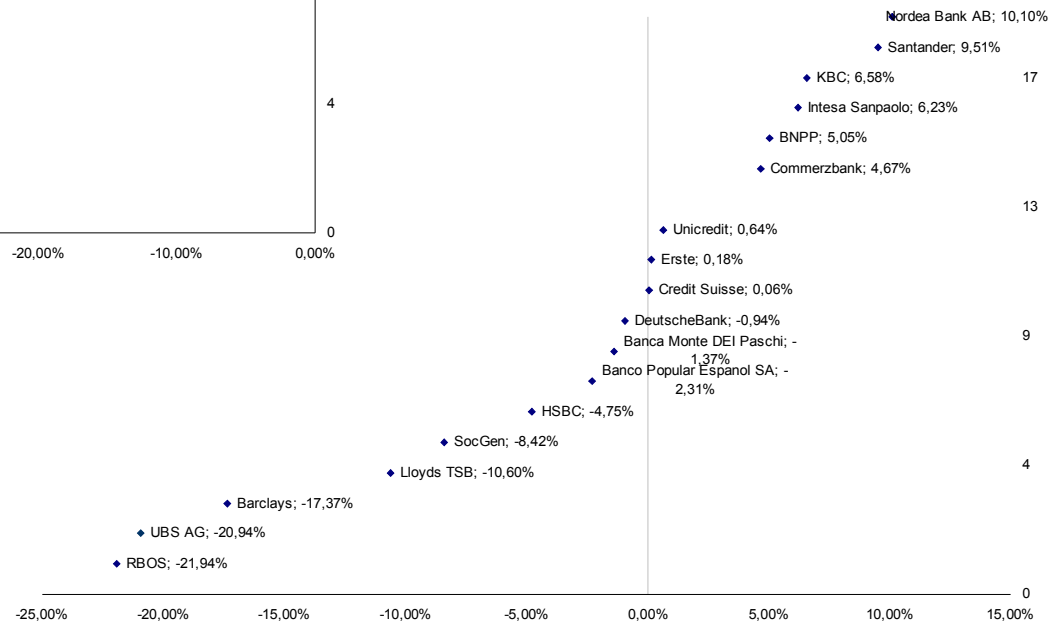


(after the shock...)

1yr TSR ranking (2h07 – 2h08)



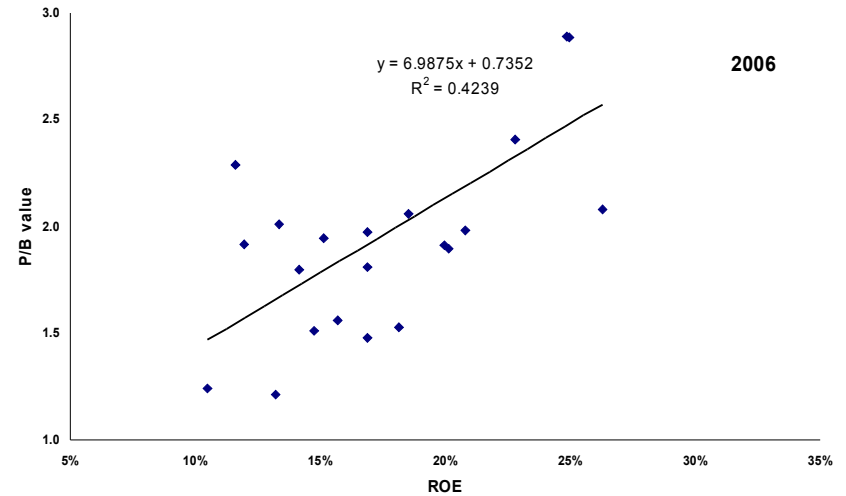
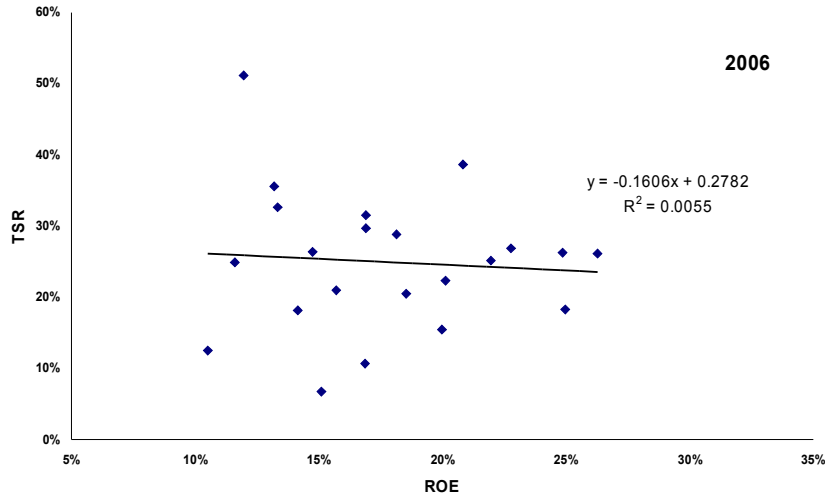
3yr TSR ranking (2h05 – 2h08)



Market, being not perfect, were unable to determine and evaluate adequately risk inside banks: the change in valuation after the crisis shows what is the value incorporating higher risk expectations, according to the failures that took place in the last 6 months.



TSR drivers: how can we endogenously affect market value?



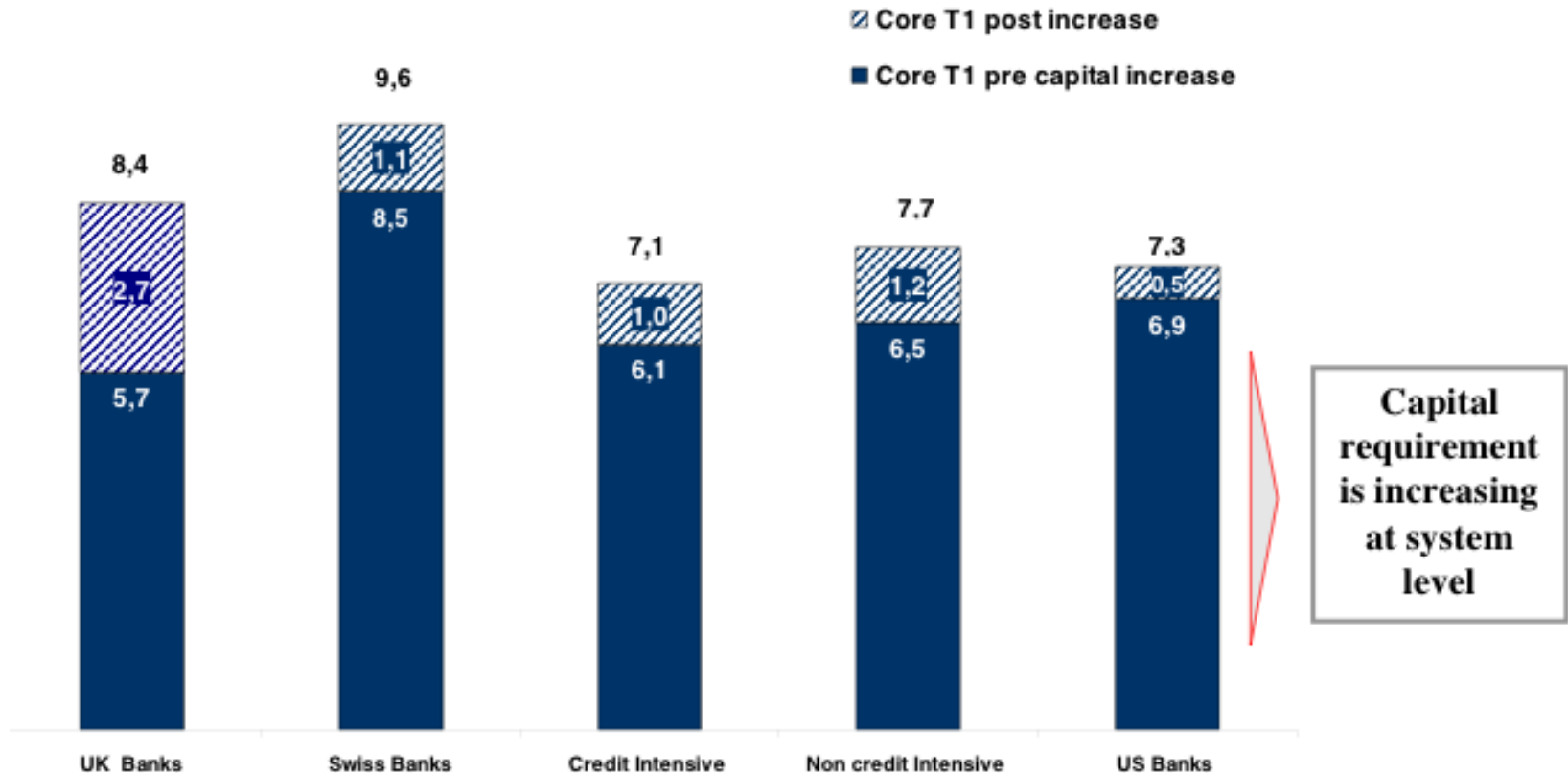
Explained variable		ROE	Δ ROE	Organic equity growth	ROE volatility	Relative size	Sectoral specialisation	Country	Lagged adjustment
Excess market return (yearly)	Explained variance	16%	7%	10%	< 1%	11%	< 1%	< 1%	< 1%
	Sign of relation	-	+	+	n.m.	-	n.m.	n.m.	n.m.
P/B value	Explained variance	52%	< 1%	n.a.	< 1%	2%	< 1%	< 1%	26%
	Sign of relation	+	n.m.	n.a.	n.m.	-	n.m.	n.m.	+

2000-2006 timeframe. Sectoral and geographic patterns: limited role in explaining different market performances
 Profitability is by far the most important feature determining both market performance and valuation
 An high ROE is conducive of an high valuation, but at the same time it implies a negative impact on potential TSR



Capital requirement is another fundamental target...

Core T1 ratio, 2007

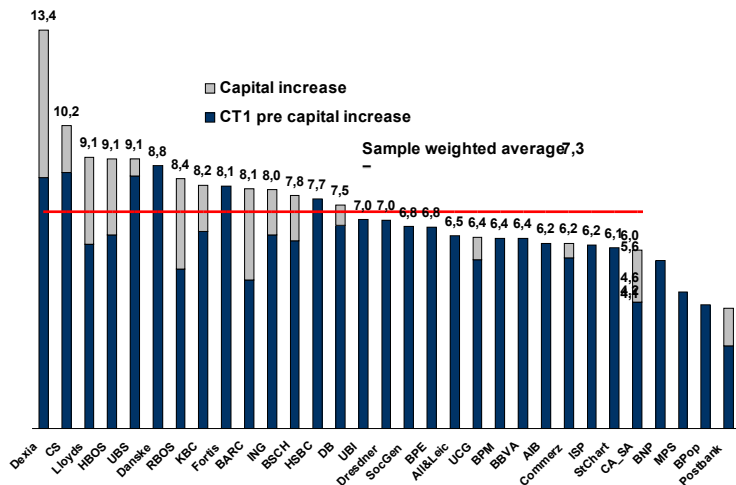


Higher risk means higher capital requirements: banks who did not have adequate capital level had to intervene and raise their equity. As a consequence, being risk not adequately covered by capital, profitability was highly overvalued and previous levels of ROE weren't coherent with the effective risk-return profile of the market. Higher risk means higher capital requirements: banks who did not have adequate capital level had to intervene and raise their equity. Therefore, new profitability levels will be lower.



...differentiated across banks' types and countries

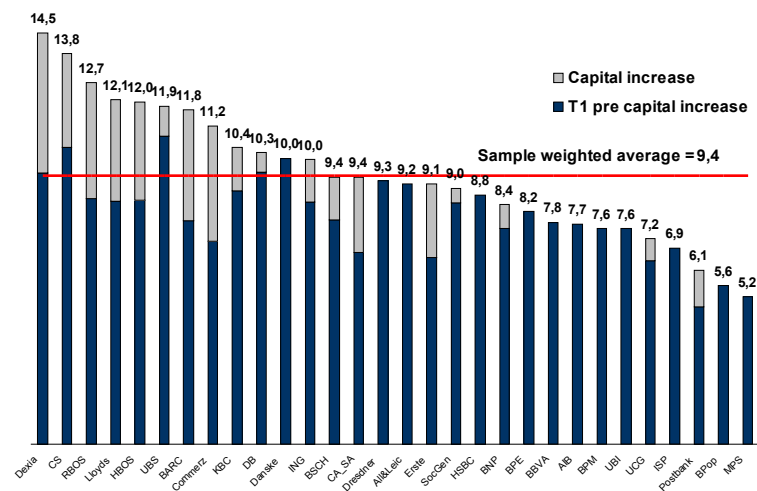
Core Tier 1 Basel II ratios
(actual and estimate after capital increases)



Capital ratios by type of banks'

%	Core Tier 1		Tier 1	
	pre-capital increase	post-capital increase	pre-capital increase	post-capital increase
Credit intensive banks	6,1	7,1	7,8	9,2
Credit intensive, excl. Italian banks	6,3	7,5	8,3	10,1
Non Credit intensive banks	6,5	7,7	8,6	10,2
Total sample	6,3	7,3	8,0	9,4

Tier 1 Basel II ratios
(actual and estimate after capital increases)



Capital ratios by country

	Core Tier 1		Tier 1	
	pre-capital increase	post-capital increase	pre-capital increase	post-capital increase
Italy	5,73	5,96	6,53	6,76
Germany	6,08	6,66	8,26	9,96
Spain	6,39	7,24	7,89	8,75
France	5,58	6,07	7,61	8,70
UK	6,30	8,16	8,53	10,97
Benelux	7,31	8,89	8,90	10,49
Switzerland	8,55	9,62	10,65	12,83

Core Tier 1 Capital: Shareholder's Equity - Intangibles Assets (e.g. Goodwill) - 50% of Participations in Associates and Joint Ventures

Tier 1 Capital : CT1Capital + Preferred Shares + Hybrid Tier1 instruments

Source: UCG S&BD



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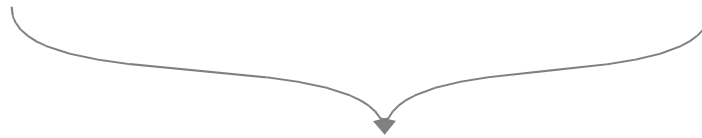
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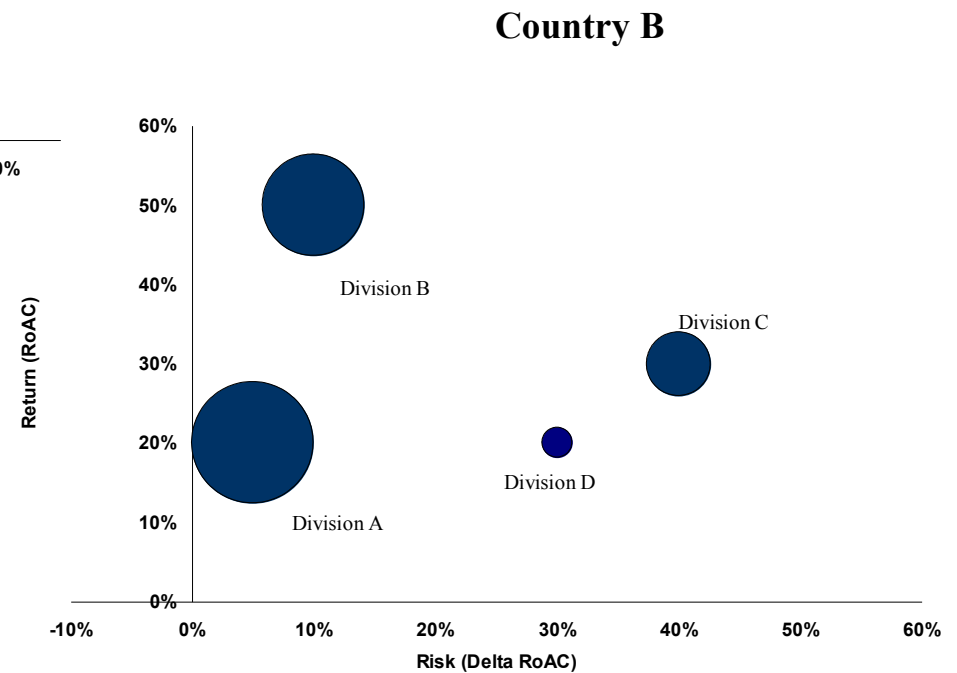
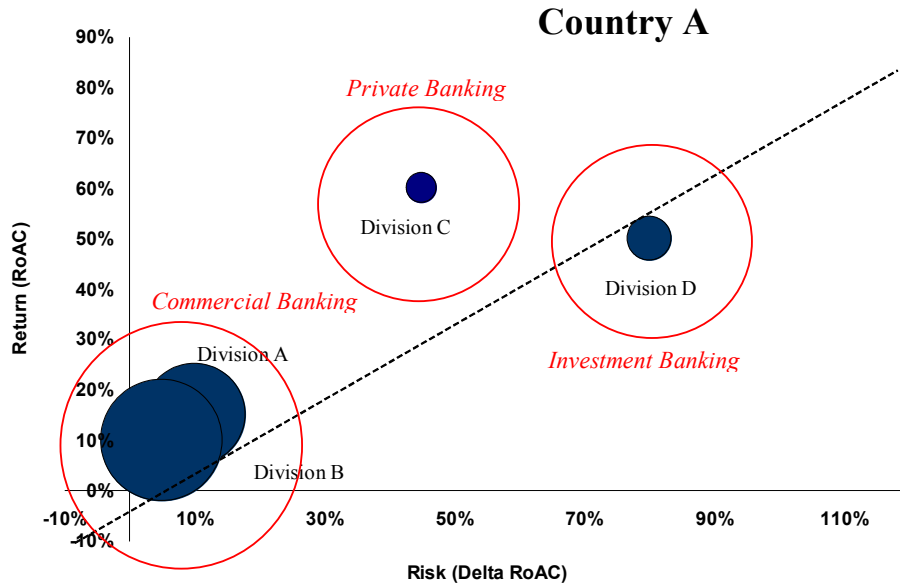
Market attractiveness, profitability and risk exposure...

Business Divisions	GROWTH Net Profit 07-15	PROFITABILITY										TAIL RISK		AC WEIGHT
		Revenues/Volumes*		Cost/Income		Provisions/Volumes		Loans/Deposits		ROAC		Risk Index	Delta ROAC	
		BANK A	SYSTEM	BANK A	SYSTEM	BANK A	SYSTEM	BANK A	SYSTEM	BANK A	SYSTEM			
DIVISION A	10,00%	5,0%	7,0%	...	...	0,50%	0,70%	110,0%	120,0%	15,0%	15,0%	0,40	-10,0%	20,0%
Country A	8,0%	7,0%	4,0%	...	...	0,20%	0,30%	110,0%	100,0%	...	...	...	...	10,0%
Country B	12,0%	3,0%	3,0%	...	...	0,40%	0,50%	120,0%	120,0%	...	...	...	...	10,0%
Country C	10,0%	5,0%	2,2%	...	...	0,35%	0,15%	100,0%	100,0%	...	...	...	...	10,0%
DIVISION B	11,0%	...	...	35,0%	40,0%	...	...	300,0%	300,0%	...	...	0,20	-5,0%	20,0%
Country A	12,0%	...	...	10,0%	15,0%	...	...	500,0%	400,0%	...	...	...	...	...
Country B	10,0%	...	...	15,0%	15,0%	...	...	200,0%	200,0%	...	...	...	...	...
Country C	11,0%	...	...	20,0%	12,0%	...	...	200,0%	200,0%	...	...	...	...	...
...	...	...	...	...	...	...	...	...	...	...	...	...	...	5,0%
...
...
...
...	...	...	...	...	...	...	...	...	...	...	...	...	...	45,0%
...
...
...
...
...	5,0%	...	40,0%	...	70,0%	...	2,00%	...	...	...	...	4,00	-30,0%	15,0%
...	5,0%	...	...	...	...	...	...	...	...	...	...	...	...	15,0%
...	20,0%	...	...	...	...	...	...	...	...	...	...	...	...	25,0%
TOTAL	7,0%	...	...	...	...	...	...	...	...	...	...	...	...	100,0%

For capital allocation is fundamental not only to evaluate volumes and profitability, but also riskiness: therefore we have a three entries matrix. We introduce the concept of “tail risk”: the intent is to go further to the traditional standard volatility and normal distribution measures, and to introduce exceptional conditions volatility, or in other words, *extreme loss*.



...expressing a Risk/Return profile per division and country



Size of the bubbles represents growth of net profit in 2007-2015 timeframe in mn €



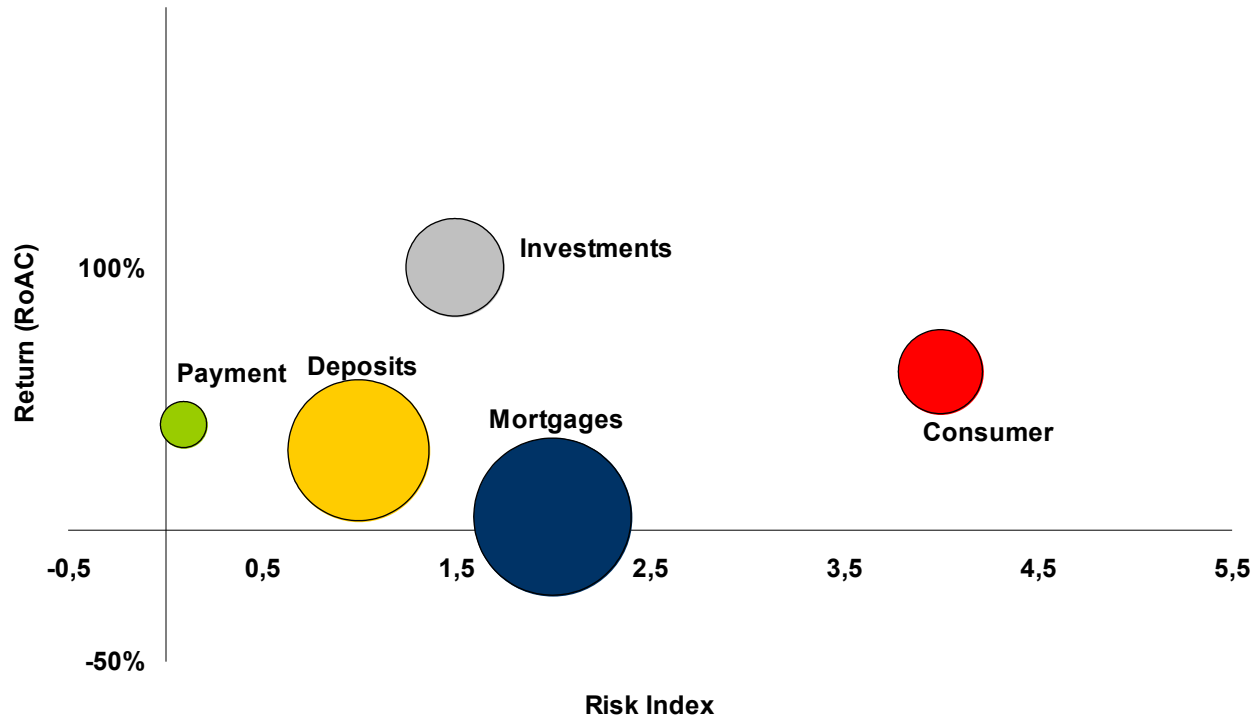
...by division and kind of product...

RETAIL DIVISION	GROWTH Net Profit 07-15	PROFITABILITY								TAIL RISK		AC WEIGHT
		Revenues/Volumes*		Cost/Income		Provisions/Volumes		ROAC		Risk Index	DeIta ROAC	
		BANK A	SYSTEM	BANK A	SYSTEM	BANK A	SYSTEM	BANK A	SYSTEM			
Financial Liabilities
Consumer Finance
<i>Personal Loans Excl Prof</i>
<i>Professionals</i>
<i>Credit Cards</i>
<i>Overdrafts</i>
Mortgages
Financial Assets
Payments
<i>Transactions</i>
<i>Debit cards</i>
<i>Credit Cards</i>
Deposits
Investments
<i>Mutual Funds Distribution</i>
Insurance
TOTAL

Figures are illustrative



Business division: risk return profile by product and country



Country A, Country B...

Size of the bubbles represents growth of net profit in 2007-2015 timeframe in mn €

Source: UCG S&BD



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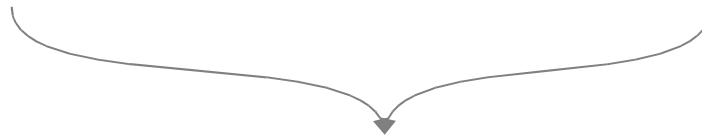
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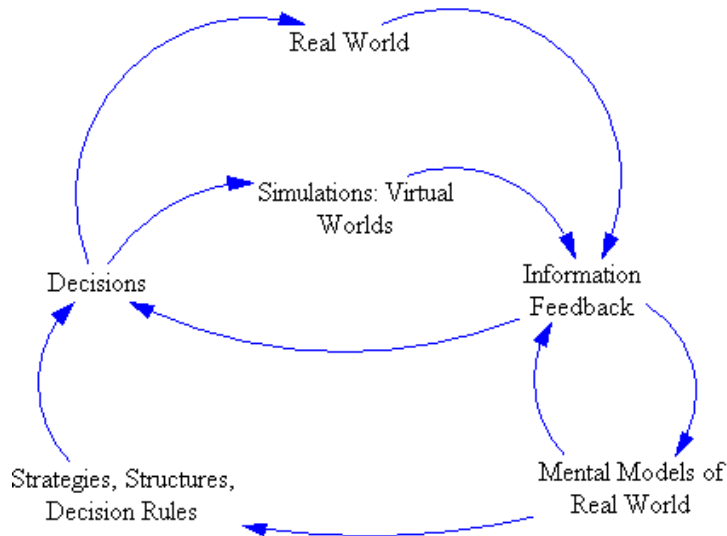
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Simulations of Real World...

- Strategies, structures and decision rules used in the real world can be represented and tested in the virtual world of the model: feedbacks alter our mental models and lead to the design of new strategies, new structures and new decision rules.
- Bounded rationality (Simon, 1947). Knowledge, information, environment and alternatives represent the decision premises, the units by which we analyse decision making. Knowledge on consequences is always incomplete. Only a few of all the possible alternatives is in the minds of individuals.
- We need cooperation: institutions and organisations are conceived as models of collective behaviour that influence individuals (Arrow, 1974). The aim of organisation is that of design an environment such as that the individual in his choices could get as much closer to rationality as possible

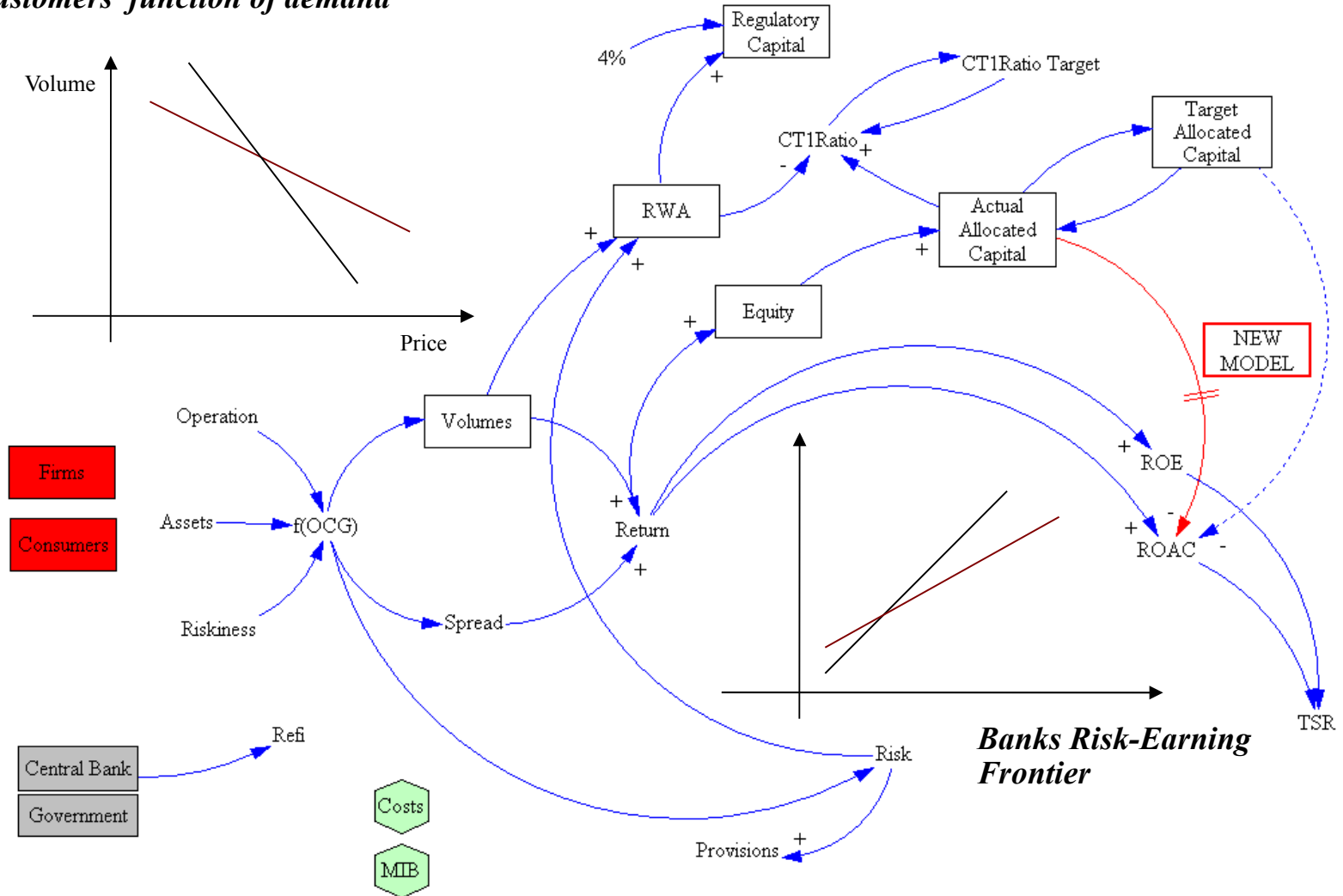


- “The knowledge that economic actors possess and do not possess, the computations that economic actors can make and cannot make must not enter economic theory as ad hoc assumptions. They must be shaped and tested by the sharpest empirical methods we can devise.” (Simon , 1997)



...and the BEES Framework

Customers' function of demand





About the Framework...

- Customers look for credit in order to fulfil their needs: each customer is characterised by a riskiness, and has to sustain a cost for his debts.
- On principle the remuneration that the bank asks should be proportional to the risk it bears: therefore a bank should be able to define a risk-earning frontier, both on its customers and on its assets.
- A decision making process based on this simple trade-off should be highly suitable, but is not always carried out. One of the main aims of the model is to endogenously determine the curve of demand of customers, and the risk earning frontier.
- In our perspective, the frontier is the main instrument for analysing the relationship among the actors in the model, and for depicting their behaviour. Depending on exogenous and endogenous conditions the bank would decide how to shape its portfolio: the profile chosen should be coherent with the risk appetite of its stake-holders as well as the capability of the bank to perform well in a specific sector.
- According with this frontier, the bank decides how to allocate its capital: or in other words, where and how to grow. And as a consequence, how to relate with the market.
- Competition among banks, the market reaction and institutions intervention complete a framework that in its evolution can fit different kinds of analysis.
- Since for capital allocation it becomes fundamental to evaluate volumes, prices and risk at the same time, in the framework presented BEES' aim is to carry out an endogenous and empirical analysis on the three fundamental sides of the problem creating a risk-earning frontier that could enhance decision making processes.



BEES Characteristics: Customers, Banks, and the Environment

- Consumers: Households, Consumer Finance, Richness, Riskiness
- Firms: OCG, Equity, Debt, Revenues, Risk
- Customers in need of financing look for a random proposal, or the best proposal, that the credit market is able to offer
- What can Banks Do?
 - Define Volumes and Price of their credit offer
 - Carry on the risk selection process
 - Define the risk frontier they have to manage
 - Decide where and how to grow
- What About Competition?
 - Different banks make different offers on volumes and prices
 - These differences depend on their actual and prospective positioning on the risk-earning frontier
 - The Market reacts to changes in bank positioning, by choosing the one that better fits its needs
- What about Institutions?
 - The Central bank by changing the Refi affects the economy
 - Governments interventions will be implemented soon



BEES Itself

The screenshot shows the BEES NetLogo interface. The title bar reads "BEES.09 - NetLogo {C:\Documents and Settings\ui41628\Desktop\NetLogo\Banking with NetLogo}". The menu bar includes File, Edit, Tools, Zoom, Tabs, and Help. The interface is divided into several sections:

- Control Panel:** Contains buttons for "setup" and "go", a "view updates" checkbox, a "normal speed" slider, a "continuous" dropdown menu, and a "Settings..." button.
- Sliders:** Four sliders control the number of agents: "Nbank" (value 3), "Nfirms" (value 56), "Nconsumers" (value 48), and "refi" (value 3).
- Revenues Graph:** A line graph titled "Revenues" showing a linear increase from 0 to 86.6 over 28.8 ticks.
- 3D View:** A 3D window showing a top-down view of the simulation environment with various colored agents (green, red, white) and buildings (blue, red, white). The window title is "ticks: 0" and "3D".
- Command Center:** A text area at the bottom showing the following commands and results:

```
observer> (patch 4 13): (firm 4)
(patch -4 -13): (firm 4)
(firm 4): false
observer>
```



Using and Developing BEES

- BEES is thought as Analysis and Decision Making tool
- Future Developments and possible Usages of the BEES engine:
 - Banks will be differentiated : governance, business mix, risk appetite...
 - All variables will depend on empirically grounded minded-processes
 - Investment Banking
 - Costs structure
 - Firms and consumers will interact
 - There will be an interbank market
- Comparison with actual methodologies and ABM for Optimal Capital Allocation will be the first workbench for the BEES engine
 - Marginal Allocated Capital:
 - The function of demand problem
- But also:
 - Density of branches in the territory
 - Leverage, Assets and Liabilities
 - Incentives policy
- With, an horizon given by:
 - What should the bank be in the long term? And what its role?
 - A bank, in its inter-mediation function, stimulating and growing along with the economic environment: a long term perspective....

$$AC_{optimal} = \left[\frac{ROAC - \text{marginal } ROAC}{\frac{\delta ROAC}{\delta RWA}} + 1 \right] \times AC_{start}$$



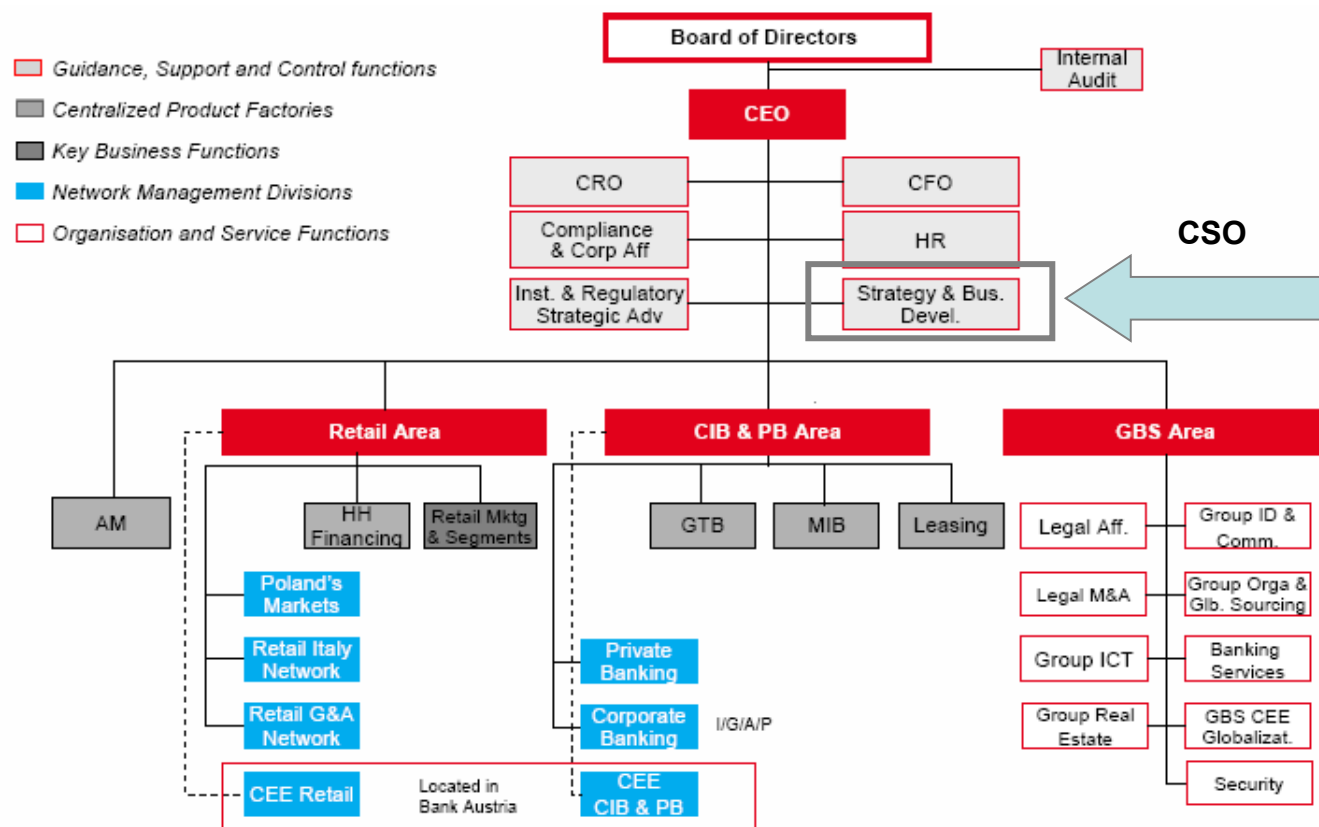
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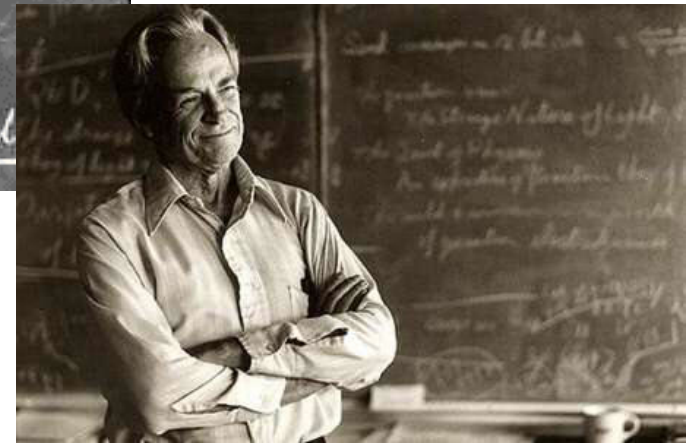
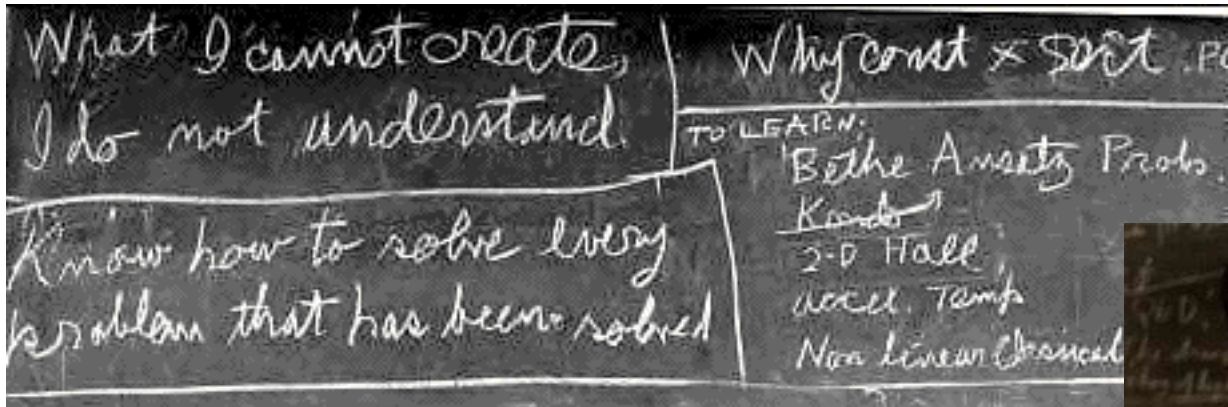
...and acknowledgments

- Francesco Giordano, Unicredit Chief Strategic Officer
- Andrea di Biasio, Head of Strategic Capital Allocation





In the end... why models?



Richard Feynman's Blackboard at the time of his death,
as reported in Stephen Hawking's "The Universe in a Nutshell", 2002

Any Questions?



Thank You!

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