

Differences in Beliefs, Incentives and Bubbles

Augustin Landier (TSE)



Beliefs and Economics

- **Standard:**
Common priors & asymmetric information
- **Differences in priors:**
Agree to disagree
Where do differences in beliefs come from?
- **Beliefs dynamics**
 - Bayesian vs. non-bayesian
 - Agents might overweight certain signals



Beliefs and Economics

- **Standard:**
Common priors & asymmetric information
- **Differences in priors:**
Agree to disagree → "Motive for trading"
Where do differences in beliefs come from?
"No trade theorem"
- **Beliefs dynamics**
 - Bayesian vs. non-bayesian
 - Agents might overweight certain signals



Beliefs and Economics

- **Standard:**
Common priors & asymmetric information
- **Differences in priors:**
Agree to disagree
Where do differences in beliefs come from?
Remark: Goldman & Paulson, Magnetar
- **Beliefs dynamics**
 - Bayesian vs. non-bayesian
 - Agents might overweight certain signals



Applications of differences in beliefs

- Political Economy
 - Ideology: what is the best system? Do financial markets self-regulate? Etc.
- Finance
 - Corporate decisions/Investment
 - Incentives
 - Contracts
 - Organizations
 - Deliberation of small groups
 - Groupthink
 - Asset prices: trade, bubbles



Road Map

- Psychology Background
- From 1 individual to collective aspects
 - 1 individual
 - 2 individuals (principal-agent)
 - Groups (groupthink)
- Link with financial crisis



Psychology

- **Optimism vs. Overconfidence**
 - Above average effect
 - Overestimating certainty
- **Self-serving beliefs**
 - Cognitive dissonance
 - Base-rate neglect, heuristics
 - Self-attribution
 - Skill or luck / superstars
- **Confirmatory bias** (beliefs are sticky)
- Evolutionary selected?
 - commitment

The brain's failures in information processing

- Immune system of the self
 - Realists are clinically depressed
- Limited ability to deal with probabilities
 - Baye's rule is a recent discovery (18th century)

Exemple of Heuristics: Categorization Bias

- Heads or tail:
 - What sequence is most probable?
 - HHHH TTTT or TTHH THTH
- "*Linda is 31 years old, she was a bright student and holds a PhD in sociology. She was active as a student union leader while doing her graduate studies*".
 - Probability("Linda works as a banker")?
 - Probability("Linda works as a banker at a bank specialized in micro-credit")?

Exemple 2: Conditional probabilities

- Medical test
 - 1% of population has disease
 - Test :

TEST	+	-
sick	99%	1%
Healthy	1%	99%
 - You test positive after being randomly selected
 - P(you are sick)?

Exemple 2: Conditional probabilities

- Medical test
 - 1% of population has disease
 - Test :

TEST	+	-
sick	99%	1%
Healthy	1%	99%
 - You test positive after being randomly selected
 - P(you are sick) = 50%
 - Bayes (1763)

Biases: Base-rate neglect (Non-Bayesian belief formation)

- **Conditioning probabilities=weighting different signals**
 - Skill vs. luck
 - "super star effects": example hedge funds
 - Example of ideology:
 - People overweight
 - National history and Family history
- **Remark:**
 - endogeneity pb is a form of Bayesian mistake
 - Over-inference from correlation

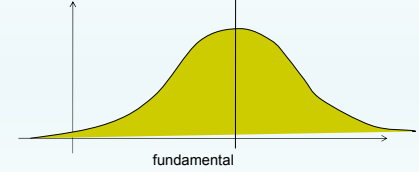
Economics

- We self-select into activities
→ amplification of initial mistakes
 - N activities.
 - Observe noisy signal: $S_i = V_i + \epsilon_i$.
- $S_1 < \dots < S_N$. → Pick activity N
Assume believe: $E(V_N) = S_N$
Instead of $E(V_N) = S_N - E(\epsilon_N | S_N = \max S_i)$

Implications?

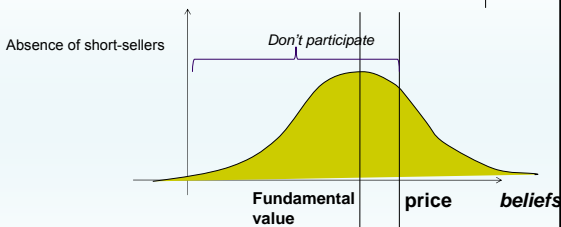
Winner's curse

- Signal on common value: $S_i = V + \epsilon_i$.



- $E(V) = S_i$...but $E(V|win) < S_i$!!
 - $E(V|win) = S_i - E(\epsilon_i | \epsilon_i = \max(\epsilon_j))$

Remark: Miller's effect on stock-market



Q=Supply of shares=Demand of shares

With short-sellers, supply of shares endogenous!

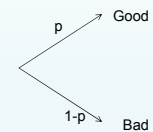
Part II 2 AGENTS

Questions

- In principal-agent setting, how do differences in beliefs affect
 - Incentives ?
 - Optimal financial contracting ?
 - Performance ?
 - Adverse selection ?

Optimism and motivation: ambiguous link

- Complements → more effort
Max $pU(e) + (1-p)U(0) - C(e)$



- Substitute → less effort
Max $pU(1) + (1-p)U(e) - C(e)$

Ex: precautionary effort

First remarks on incentivizing optimists



- Intuitions:
 - Cheaper to make them invest in success
 - Cheaper to pay: "pay with dreams"
- But...
 - More costly to make them "manage risk"
 - Precautionary effort
 - More costly to make them scale down project
 - Adaptation/liquidation

"Too Motivated?" Van den Steen 2004



- If agents have "wrong model of the firm", incentives are harmful
 - flat compensation (akin to multitasking)
- More so for agents under authority
 - Clash between authority and incentives if principal and agent have different beliefs
- Homogeneity of beliefs makes things easier
 - Corporate culture

CEO overconfidence



- Heaton (2001)
 - Over confidence gives both pecking order and free cash-flow. *Why?*
- when a CEO is overconfident about his strategy,
 - outside finance looks very expensive to him.
 - Some negative NPV investments look attractive
- Landier-Thesmar (2004)
 - Link with debt maturity

Motivation



- **Optimism** – rather than willingness to take risks – documented bias among entrepreneurs (e.g. Pinfeld [2001])
- **Private Equity Puzzle** (Moskovitz-Jorgensen)
 - Abnormally low risk-adjusted returns of entrepreneurial investment
- **Source?**

Is It Worth the Effort ?



- Puts natural structure on „Private Benefits“.
- Helps thinking about „Entrepreneurial Effort“:
 - Multitask: Initial idea (t=0) vs. Adaptation (t=1)
- **Explains contractual anomalies:**
 - VC contracts contingencies driven by both **external** and internal risk (Kaplan & Stromberg).
 - CEOs paid for luck (Bertrand&Mullainathan)

Outline:



- **Simple model, a la Aghion-Bolton**
 - Optimal debt contracts with realists and optimists (Short-term vs. Long-term)
 - Separating Equilibrium
- **Empirical tests**
 - Predicting optimism from characteristics
 - Capital Structure, optimism and performance
 - Robustness

Model

- **Risk-averse** entrepreneur
- 3 periods:
 - t=0: entrepreneur raises I from a *competitive market*, does effort e .
 - t=1: Intermediate cash-flow R_1 and strategy
 - $R_1 = R$ or 0 ,
 - strategy choice, *growth* or *safe*.
 - t=2: final payoff R_2

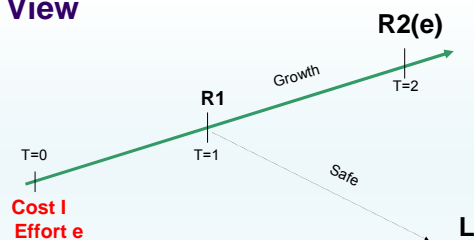
Initial Beliefs about Project

- Projects: **Good** or **Bad**
 - **Good** ↔ growth strategy works
 - **Bad** ↔ growth strategy does not work
- Strategy: **Growth** or **Safe**
 - **Growth** yields $R(e)$ or 0
 - **Safe** yields $L < R(e)$ always
- Beliefs: **Optimist** or **Realist**
 - **Optimist**: project is good with proba 1
→ extreme assumption but inessential
 - **Realist**: project is good with proba $\frac{1}{2}$

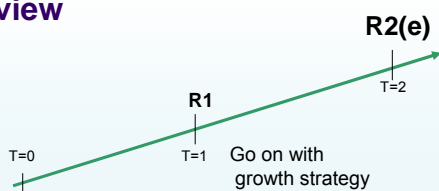
Intermediate cash-flow=Signal

- R_1 = correlated to project's type:
 - $P(R_1=R|\text{good project})=1$
 - $P(R_1=R|\text{bad project})=p$
- So, $R_1=0 \rightarrow$ bad project
- Bayesian updating:
 - Realists: $P(\text{type=good}|R_1=1)=1/(1+p) > .5$
 - Optimists: $P(\text{type=good}|R_1=0)=1$

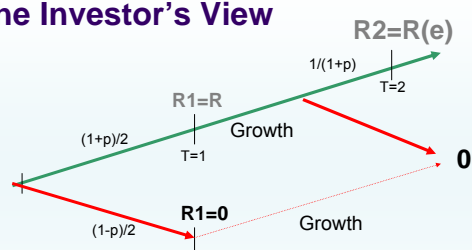
Business Plan: the Optimistic View



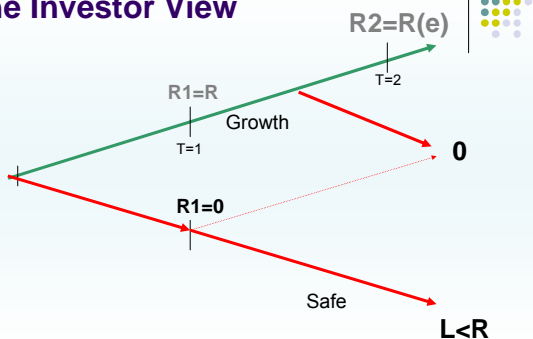
Business Plan: the optimistic view



Business Plan: The Investor's View



Business Plan: The Investor View



Debt Contracts

- Assume no contingent contracts.
- **Short-term debt:** repayment at $t=1$
→ investor gets control and ownership in bad state.
- **Long-term debt:** no repayment before $t=2$.

Results

- Short-term debt optimal with optimists.
- Long-term debt optimal with realists.
- Both types *self-select* in the right contract.
 - Beliefs don't have to be observable
- Optimists have higher propensity to invest own wealth

Short-term debt: 'Paying with Dreams'

- **Entrepreneur believes $R1=0$ will not happen**
→ Willing to sell control + ownership on this state
- **Investor can impose safe strategy in bad state**
→ Can leave even more upside to entrepreneur.

Cash-flow allocation *amplifies external risk*

The Value of Long Term Debt For Realists

- **Insurance**
→ Entrepreneur gets something in bad state
(and wouldn't with ST debt)

Self Selection

- In equilibrium: revelation constraints are *not* binding
- optimists refuse long term debt because they find risk premium too high
- Realists refuse short term debt because they want insurance + transferring control worthless
→ Equilibrium is **separating**

'Theoretical Robustness'

- For an optimist perspective, losing control has a cost (inefficient action taken in bad state): R-L.
- This effect is dominated if:
 - Signal sufficiently informative
 - Entrepreneur sufficiently optimistic.

Data

- Merge 2 sources:
 - SINE Survey, 1994-97 and 1998-2001
≈ 30 000 entrepreneurs for both waves.
 - Entrepreneur's characteristics and expectations
 - Administrative accounting data (sales > \$100 000)
 - Focus on pure creation → 23 000 firms only
- Can compare expectations to ex-post data: Detailed accounting information every year

Initial Firm's characteristics

	Sole Proprietors		Corporations	
	Small	Big	Small	Big
Employment (number of employees)	0.4	2.5	0.2	5.1
Fixed assets (thousands euros)	17	52	22	73
Total Sales (thousands euros)	117	245	90	458
Observations	11,007	12,179	17,263	5,923
Equity / (debt + equity)	0.74	0.65	0.72	0.58
Observations	4,324	11,685	10,828	5,181
(Equity + Inside Debt) / (Debt + Equity)	0.80	0.76	0.82	0.76
Short term bank loans / Bank loans	0.44	0.46	0.49	0.44
Credit lines / Bank loans	0.34	0.36	0.38	0.34
Observations	250	2,750	1,168	1,832

Financial Contracting with Optimists: Testing the Theory

- **Empirical strategy**
 - Estimating **bias in expectation**
 - Use it as a measure of systematic bias / check consistency
- $$\Delta = E_s(\tilde{Y}|I) - \tilde{Y}$$
- $$= \underbrace{E(\tilde{Y}|I) - \tilde{Y}}_{\text{rational error } \varepsilon} + \underbrace{E_s(\tilde{Y}|I) - E(\tilde{Y}|I)}_{\text{bias } b}$$
- **Main Prediction tested**
 - Cross section correlation with capital structure

Which individual characteristics are likely to affect Optimism?

A Quick Model of Belief Formation

- Entrepreneur has an idea worth: V
- Observes noisy signal: $S = V + \varepsilon$
- Entrepreneur believes: $E(V|S) = S$
and therefore neglects: $E(\varepsilon|S)$
- „Base rate neglect“
- Starts the venture if $S > V_0$
- Over-Optimism Bias: $E(\varepsilon|V + \varepsilon > V_0)$
- Result: **over-optimism** increases with
 - Noisier signal
 - Larger outside option

Which Characteristics ?

- What makes the bias stronger ?
 1. Education, experience = outside option
 2. Expertise = signal more precise
 3. New idea = signal more noisy, forget idea may have been around before

Step 1: Measuring Optimism

- Issue: **get a bias out of expectation errors**

- Expectation errors:

$$\Delta_S = EXPGR - 1_{(\Delta \ln(SALES) > 3\%)}$$

$$\Delta_E = EXP EM - 1_{(\Delta(\text{employment}) > 0)}$$

- Regressed on entrepreneurial observed characteristics

$$\Delta_{S,i} = \beta Z_i + \varepsilon_i$$

$$\Delta_{E,i} = \gamma Z_i + \nu_i$$

Optimism determinants

	Expectation error on "development"			p-value equality
	All	1994	1998	
High school graduate	0.07*** (0.01)	0.06*** (0.01)	0.07*** (0.01)	0.62
College graduate	0.11*** (0.02)	0.10*** (0.02)	0.12*** (0.03)	0.54
Grande école graduate	0.12*** (0.02)	0.10*** (0.04)	0.14*** (0.03)	0.41
Age > 38 years	-0.02 (0.01)	-0.00 (0.02)	-0.03*** (0.01)	0.13
Entrepreneur is male	-0.02* (0.01)	-0.04** (0.02)	-0.01* (0.02)	0.27
Serial entrepreneur	0.08*** (0.01)	0.08*** (0.01)	0.07*** (0.02)	0.64
Experience in industry	-0.05*** (0.01)	-0.06*** (0.01)	-0.04*** (0.01)	0.25
Motive: new idea	0.08*** (0.01)	0.07*** (0.03)	0.09*** (0.01)	0.48
Motive: autonomy	0.03*** (0.01)	0.05*** (0.01)	0.01 (0.01)	0.02**
Real startup	0.18*** (0.01)	0.19*** (0.02)	0.16*** (0.02)	0.29
Year of creation × industry FE	Yes	Yes	Yes	
R ²	0.07	0.06	0.08	
Observations	31,832	14,415	17,417	

Empirical Strategy

- Short-term debt and optimism:

$$STD_i = \Delta_i \beta + X_i \gamma + \varepsilon_i$$

- Robustness:
 - Can use initial expectation error and also expectation error 3 years down the road
 - Almost an instrument

Optimism persists (expectation error 3 years after)

	Expectation error on					
	Employment			"Development"		
	(1)	(2)	(3)	(4)	(5)	(6)
Employment expectation error	-	-	-	0.291*** (0.012)	-	-
Development expectation error	0.197*** (0.015)	-	-	-	-	-
Employment expectation error (Three years after creation)	-	0.056*** (0.012)	0.047*** (0.014)	-	-	0.025*** (0.009)
Development expectation error (Three years after creation)	-	-	0.020** (0.011)	-	0.106*** (0.008)	0.101*** (0.008)
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Year of creation FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry × year of creation FE	Yes	Yes	Yes	Yes	Yes	Yes
R ²	0.06	0.02	0.02	0.10	0.07	0.07
Observations	36,147	13,978	10,891	36,147	10,743	10,743

Capital Structure and Optimism

	Credit lines/Bank debt					
	All	1994	1998	All	All	All
Expectation error	0.03*** (0.01)	0.04*** (0.01)	0.03** (0.01)	0.03*** (0.01)	0.03*** (0.01)	0.03*** (0.01)
based on "development"	-0.03*** (0.00)	-0.03*** (0.01)	-0.03*** (0.01)	-0.03*** (0.01)	-0.03*** (0.01)	-0.04*** (0.01)
Log (assets ₀)	-0.51*** (0.03)	-0.48*** (0.03)	-0.54*** (0.03)	-0.51*** (0.03)	-0.51*** (0.03)	-0.51*** (0.03)
Tangible assets ₀ /assets ₀	-0.01 (0.01)	-0.03* (0.02)	0.01 (0.02)	-0.01 (0.01)	-0.01 (0.02)	0.02 (0.02)
Real startup	-	-	-	0.14*** (0.03)	0.14*** (0.03)	0.14*** (0.03)
Death in two years	-	-	-	-	-	-
Table 6 regressors included	No	No	No	No	No	Yes
Industry FE × year FE	Yes	Yes	Yes	Yes	Yes	Yes
R ²	0.13	0.13	0.17	0.15	0.18	0.18
Observations	5,474	2,932	2,542	5,474	4,349	4,349

Robustness: can use +3 years expectation error

Dependent variable	Line of credit/bank debt	Line of credit/bank debt
Development expectation error	0.03**	0.02**
Three years after creation	(0.01)	(0.01)
Log (assetso)	-0.01*	-0.03***
	(0.01)	(0.01)
Tangible assetso/assetso	-0.49***	-0.46***
	(0.03)	(0.04)
Real startup	-0.03**	-0.06***
	(0.02)	(0.02)
Table 6 regressors included	No	Yes
Industry \times year of creation FE	Yes	Yes
R ²	0.15	0.17
Observations	3,099	2,576

Conclusion

- Differences in Beliefs matter for optimal contracting.
 - Private benefits: 'Paying with Dreams'.
 - Incentives: Multitasking aspect.
- Data consistent with the view that Optimistic entrepreneurs:
 - Prefer short-term debt ex-ante
 - Are disciplined by short-term debt ex-post

Remark on short-term debt

- Link between ST-debt and bubbles
 - "things will look better tomorrow"

CEO overconfidence: test

- **Psychology:** overconfidence (Malmendier Tate (2004) overconfidence
 - more investment/cash flow sensitivity
 - more pronounced when the firm is equity dependent
- Approach to identify overconfidence
 - *failure to cash in stock options when they are in the money and vested*
 - *holding S.O. until expiration*

Panel B. Percent of "Late Exercisers" Partitioned by Number of Past Late Exercises
Sample: Observations with 67%-in-the-money options (in year five)

Past Late Exercises	% Who Exercise Late	Number of CEOs
0	0.32	487
1	0.64	128
2	0.73	67
3	0.94	32
4	0.79	28
> 4	0.74	23

→ Late exercise = failure to exercise 67% in-the-money stock options during fifth year (start of vesting period)
→ Check for *persistence*

Testing: overconfidence and investment

- Given internal cash flows, overconfident CEOs should over-invest
- Investment regressions
 - interaction term: CF X Overconfidence

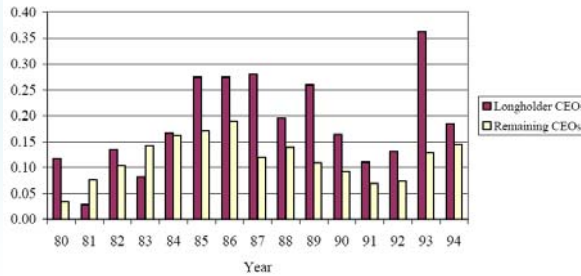
	Baseline Regressions			Late Exercise of 67%-in-the-money Options (in year 5)			
	no fixed effects, no controls	fixed effects, no controls	fixed effects, controls	over-confidence with fixed effects, no controls	over-confidence with fixed effects, controls	standard errors clustered by firm	industry - CF interactions, clustered by firm
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Cash flow	0.2052 (9.73)***	0.6419 (7.19)***	1.6579 (9.85)***	0.6729 (7.56)***	1.7044 (10.20)***	1.7044 (2.99)***	1.2911 (3.22)***
Q	0.0250 (3.04)***	0.0635 (6.54)***	-0.0049 (0.24)	0.0656 (6.79)***	-0.0988 (0.44)	-0.0088 (0.18)	-0.0112 (0.35)
Q*(Cash flow)			0.0521 (2.64)***		0.0648 (3.28)***	0.0648 (0.83)	0.0645 (1.28)
Stock ownership*(Cash flow)			-0.5749 (1.38)		-0.6897 (1.67)*	-0.6897 (0.45)	-1.1138 (0.97)
Vested options*(Cash flow)			-0.4612 (4.15)***		-0.2981 (2.62)***	-0.2981 (1.32)	-0.5015 (2.62)***
Size*(Cash flow)			-0.1713 (8.47)***		-0.1754 (8.77)***	-0.1754 (2.31)**	-0.1433 (2.64)***
Corporate governance*(Cash flow)			0.0363 (2.16)**		0.0441 (2.65)***	0.0441 (1.69)*	0.0597 (2.61)**
holder 67				-0.0551 (1.35)	-0.0495 (1.06)	-0.0495 (1.47)**	-0.0362 (1.27)
holder 67*(Cash flow)				0.1648 (3.39)***	0.2339 (4.70)***	0.2339 (2.59)**	0.1718 (2.20)**
Observations	1058	1058	1058	1058	1058	1058	1056
Adjusted R-squared	0.13	0.56	0.61	0.56	0.62	0.62	0.67

Overconfidence & M&A

- Roll's hubris hypothesis
- Tate&Malmendier (2008)
- "overconfident CEOs"
 - Make more acquisitions
 - Especially when internal funds available
 - Tend to overpay
 - Face negative market announcements

Overconfident CEOs do more mergers

Average number of mergers



Part 3: Group Interactions

Bubbles: intuition 1, speculation

- Static starting point: Miller
- Scheinkman-Xiong: dynamic

$$P_t = d_t + \frac{E(P_{t+1} | I_t)}{1+r_t}$$

Speculative term

- Overconfidence on own signals
 - differences in beliefs
 - speculative component of asset values:
 - Option to resell to an optimist
- Symptom: volume+volatility

Empirical evidence (1)

- "Differences of Opinion and the Cross-Section of Stock Returns" Dieter, Malloy, Scherbina, JF 2002.
 - dispersion in analysts' forecasts → lower future returns
- "Short-sale constraints and stock returns", Jones&Lamont, JFE (2002)
 - stocks expensive to short → low subsequent returns

Empirical evidence (2)

- “Breadth of Ownership and stock returns”
Cheng, Hong and Stein, JFE 2002.
 - few long investors → short-sales constraints likely more binding → prices > fundamental.
 - **Reduction in breadth forecasts lower returns**

YES (using mutual fund data)

Bubbles

Application: CEO compensation
Max(fundamental value + speculative value)

Remark: survival of overconfident traders
Max W vs. Max U

Bubbles: Intuition 2: leverage

Intuition 2: (Genakoplos)

Leverage → prices determined by optimists

Low interest rate → more leverage → optimistic valuation → fragility

Securitization extended assets used as collateral → bubble

→ aggregate leverage = risk factor

$$p = \frac{1}{1+r} (P_{\text{moderate}} [v < \bar{v}] E_{\text{moderate}} [v | v < \bar{v}] + P_{\text{moderate}} [v \geq \bar{v}] E_{\text{optimistic}} [v | v \geq \bar{v}])$$

- “When Optimists Need Credit”, Simsek 2010

A short History of Collective Thinking

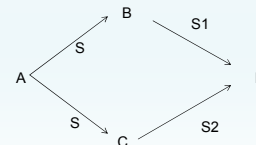
- Pre WW2: Bureaucracy
- Post WW2: small groups of experts
 - Los Alamos, commandos, European commission etc.
- Janis 1972: Groups don't deliberate, they don't think...
 - Invulnerability feeling
 - Overconfidence + undermine outsiders
 - Denial, rationalization
 - Elimination of non-consensual thoughts
 - Examples: Bay of pigs, challenger etc.

Groupthink: Benabou 09

- People interpret reality to feel good
 - But take into account distortions induced on decisions
 - memory
- Strategic interactions in beliefs choice
 - If others' optimism makes them take decisions that are bad for me in the bad state, it increases my incentives to deny reality.
 - Beliefs are contagious!
 - “collective moral hazard”, escalating commitment
 - Relevant for risk-management

Influence

- People overweight redundant signals
- Fake independence



Remark: the role of marketing



- People who sell get biased
 - Cognitive dissonance
- Cannot manage risks properly
- Marketing has taken power in finance...

Conclusion



- Pessimist note
- Optimistic note