

# Insurance, Beliefs and Affects: Using psychophysic paradigm to explore insurance behaviors facing catastrophic risk

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# Outline

- 1 Decision with Emotion and Catastrophic Risk
- 2 Field Experiment on Flood Risk
- 3 Psychophysics Experiment on Insurance Choices
- 4 Conclusion and Future Research

# Catastrophic Risk

Catastrophic risks are low-probability events with widespread and possibly irreversible consequences.

- Type of risks that challenge classical decision theory model...
- ... and are not well taking into account by individuals

An example: "the Pill experiment" (Chanel and Chichilnisky, 2012)

- Choose to swallow one pill among one billion with only one lethal pill for \$222.000.
- An half of subjects answer "No" meaning that according to E.U they value their life to more than \$ 220 trillion ( $220.000/10^{-9}$ )
- Classical valuation of life (price to reduce probability of death) value life around \$1.7 - 7 million (Beattie et al., 1998)

⇒ This instability of preferences facing LPHE could be due to emotional aspects of this kind of decision?

# Decision and Emotion

Emotions are out of classical decision theory framework.

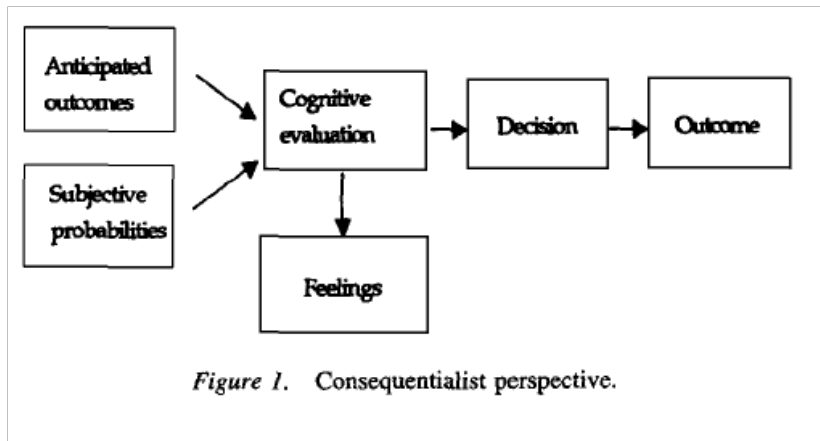
But biological and behavioral evidence that emotions affect decision:

- Change the evaluation of outcomes
- Change the process of decision
- Provide energy to support decisions
- Help reminiscence of similar situations to make decision
- Memorize the events to update future decisions and actions

⇒ How to take into account these emotional aspects into decision making?

⇒ Loewenstein et al. (2001); Loewenstein (2004): *Risk as feelings*

# Emotions are just a consequences of decision.



*Figure 1. Consequentialist perspective.*

# Anticipated emotions affect decision.

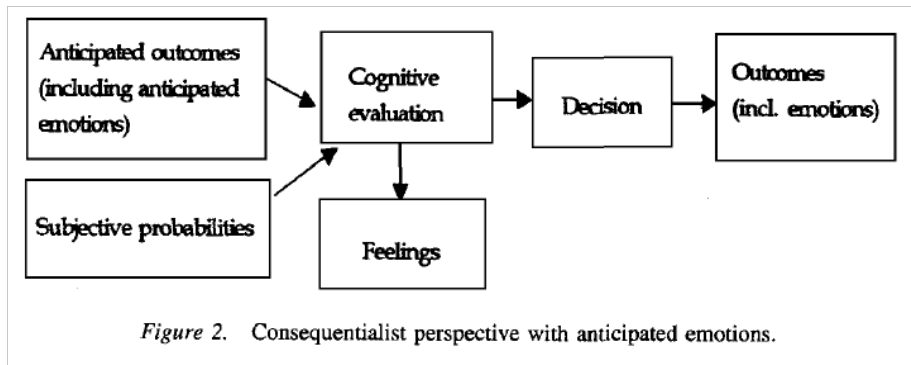


Figure 2. Consequentialist perspective with anticipated emotions.

# Emotions are a second process of decision.

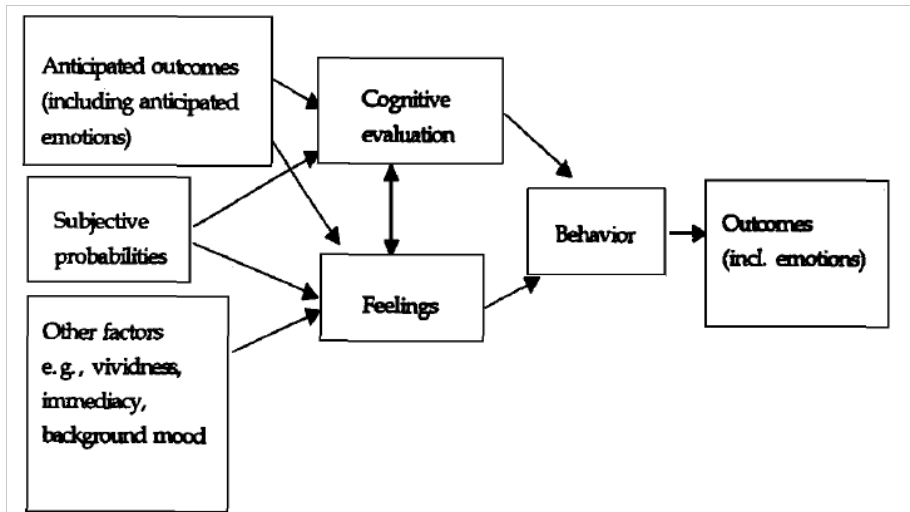


Figure 3. Risk-as-feelings perspective.

# Dataset

Objective: try to identify the impacts of emotions in the decision process facing catastrophic risk.

Two datasets on catastrophic risk:

- Field experiment on flood risk
  - ⇒ Estimate the impact of an emotional past-experience on WTP to reduce the risk.
- Psychophysics experiment on LPHE
  - ⇒ Introduce an emotion in a well-controlled experiment.
  - ⇒ Identify the importance of the *low probability* and the *high event* in a LPHE setting.



# Design of the Survey

Survey on four populations in South of France

- Recent flood (Draguignan, 2010)
- Past flood (Vaison la Romaine, 1992)
- Potential flood risk
- Any flood risk

Different blocs of questions:

- Demographic questions
- Psychological questions (BFI, control, risky behaviors...)
- Preferences under risk and intertemporal choices
- Past emotional experience and PTSD
- Anticipation and WTP for protection and insurance against catastrophic risks

# Predictions

- Past experience affects subjective beliefs, insurance choices and preferences.
- Difficulty to anticipate emotional aspects of a disasters without past experience.

⇒ In a catastrophic risk framework, emotions impact decisions but this kind of emotions is hardly anticipated without past experience.

# Effects of recent or past experience and being at risk

Elicit subjective beliefs and WTP for insurance and protection against flood and storm.

	Subjective probability of flood	Level of anticipated negative emotion in case of flood	WTP			
			Flood		Storm	
			Insurance	Protection	Insurance	Protection
Recent Exp. (n = 34)	>0**	>0***	>0**	>0***	>0*	>0**
Past. Exp. (n = 22)	=	<0***	=	=	=	=
Risk No Exp (n = 50)	=	=	=	=	=	=

Reference : No Risk of flood (n = 28)

- Effect of recent experience but no effect of past experience.
- No effect of living in a potential risky zone.

# The effect of post-trauma disorder (PTSD) and a score of severity in flood experience

Scoring a PTSD index for each individual and an index of negative experience for flood victims.

	Subjective probability of flood	Level of anticipated negative emotion in case of flood	WTP			
			Flood		Storm	
			Insurance	Protection	Insurance	Protection
PSTD	>0**	>0*	=	=	=	=
Flood severity	=	=	=	=	=	=

- PTSD affects anticipations but not WTP.
- Flood severity is non influential.

# The effect of anticipated emotion

Scoring anticipated negative emotions that will be felt in case of disaster.

	Subjective probability of flood	WTP			
		Flood		Storm	
		Insurance	Protection	Insurance	Protection
Anticipated emotion	=	=	=	=	=

- Anticipated emotions have no significant impact.

# Preliminary Results

- Positive effect of recent experience on WTP.
- At, this stage, no clear evidence on the role of affects and emotions.

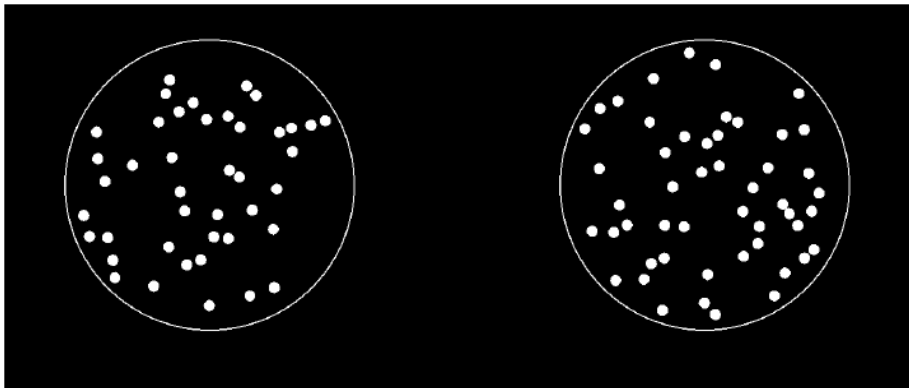
# Motivation

Our main objective is to induce some emotions in a well-controlled experiment.

- Use a psychophysical task that allows to control the performances of subjects and predict their subjective beliefs.
- Use a loss framing and house money effect to induce emotions.
- Use LPHE events with real incentives

⇒ Analyze the impacts of emotions and LPHE on insurance choices, subjective beliefs, level of worry and accuracy.

# Perceptual task



- Subjects have to identify the circle with the most of dots
- Time of visualization  $< 1s$
- Individual calibration of difficulty



# Signal Detection Theory

Advantages of using a psychophysic task:

- Control of individual performance
- Measure of accuracy for confidence i.e. metacognitive abilities
  - Calibration: Distance between the mean predicted success rate and the actual one: over/under confidence
  - Discrimination: Capacity of individuals to make a distinction between the probability of occurrence of two events: Area Under ROC
- Important quantity and quality of data
- Automatic task
- Prediction of confidence by SDT models

# Design of the Experiment

Two tasks:

- Subjects accumulate their own reward by performing the task 30 times  
⇒ Affects induced by ownership (*House money effect* - Thaler and Johnson, 1990)
- Subjects play bingo bets on their own accuracy in the task  
⇒ Decision under risk with framings effects and insurance

Timeline of bingo periods:

- Learn the characteristics (gain-loss, goal, stake)
- Elicitation of worry about the bet (0-9 scale)
- Elicitation of subjective beliefs  
⇒ Probability Matching mechanism **Beliefs**
- Elicitation of insurance coverage  
⇒ BDM mechanism **Insurance**
- Perform the 5 trials with elicitation of confidence trials-by-trials
- No feedback

# Treatment Effects

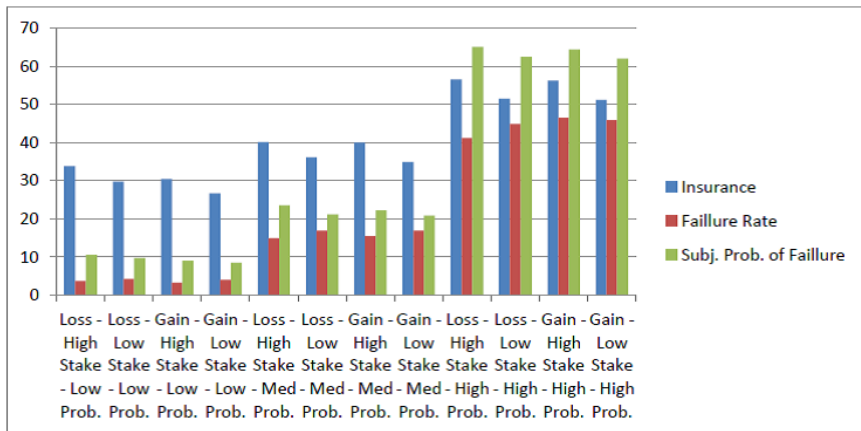
Variations of the bingo bets:

- Gain / Loss: subjects can win / lose their previous rewards  
⇒ Affect induced by loss aversion (De Martino et al, 2006)
- Goal: subjects have to reach 2, 3 or 4 success over 5 (probability of failure: 3, 10 or 40%)  
⇒ Risky choices under low probabilities
- Stakes: bet for €20 or €200  
⇒ Risky choices for high consequences

# Payment Scheme

- 5€ for participation
- 1 periods of randomly selected (1/20 at a stake of €200)
- Accumulation of confidence points at the rate 1 point = 10 cents (could be negative)

# Insurance Behaviors



- Over-coverage regarding failure rate and subjective probability of failure.
- The worst case is LPHE.

# Worry as a Measure of Feeling

Individual levels of worry (normalized) could be explained by the experimental frames i.e. the experimental setting could induce emotions.

	Beliefs	Goal	Stake	Loss
Worry	<0***	>0***	>0***	>0***

- The level of worry is linked to beliefs, objective information and anticipated emotions.
- As a measure of feeling we will use a pure worry i.e. the residual of the regression.

# Insurance Choice

		Insurance
Decision weights	Subj. prob. of success	<0***
	Stake	>0***
	Goal	>0***
Preferences	R.A	>0*
	L.A	<0***
	Impatience	<0***
Metacognitive abilities	Discrimination	<0***
	Calibration	=
Frames	Loss	>0**
Feelings	Worry	>0***

- As expected decision weights and preferences affect insurance behaviors.
- Metacognitive ability (discrimination measured by ROC area) is linked positively to better insurance coverage.
- Anticipated emotions (loss frame) and immediate emotions (worry) play a role in the decision process.

# Subjective Beliefs

		Subj. prob. of success
Decision weights	Stake	<0***
	Goal	>0***
Preferences	R.A	=
	L.A	>0***
	Impatience	=
Metacognitive abilities	Discrimination	>0***
Frames	Loss	<0**
Feelings	Worry	<0***

- Subjective beliefs of success are linked to decision weights and metacognitive abilities but independent of preferences.
- Subjective beliefs are affected by the emotions.



# Two processes of decision: cognition and emotion

		Insurance with worry	Insurance without worry
Decision weights	Subj. prob. of success	-0.18***	-0.33***
	Stake	0.033**	0.031***
	Goal	0.06***	0.056*
Preferences	R.A	>0**	=
	L.A	<0***	=
	Impatience	=	<0***
Metacognitive abilities	Discrimination	=	<0***
	Calibration	>0***	<0***
Frames	Loss	>0***	=
Feelings	Worry	=	=

- The determinants of insurance seems to change in presence of emotions
- Preferences and anticipated emotions vs. metacognitive abilities.
- More importance of decision weights without worry.

# Financial performance of the subject

For each bingo, we compute the expected performance.

		Expected performance
Preferences	R.A	<0***
	L.A	>0***
	Impatience	>0***
Metacognitive abilities	Discrimination	>0***
	Calibration	<0***
Frames	Loss	<0*
Feelings	Worry	<0***

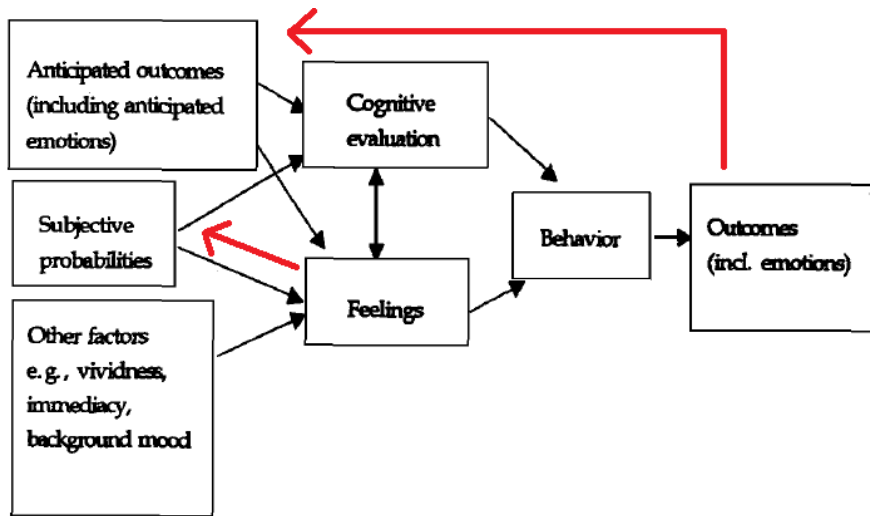
- Negative impact of anticipated emotions (loss frame) and immediate emotions (worry) on financial performance.

# Emotional aspect of metacognitive ability

	Discrimination Task	Discrimination Prediction Bingo
Worry	=	<0**

- Worry doesn't affect the discrimination during the task but affects the prevision of success during the bingo.

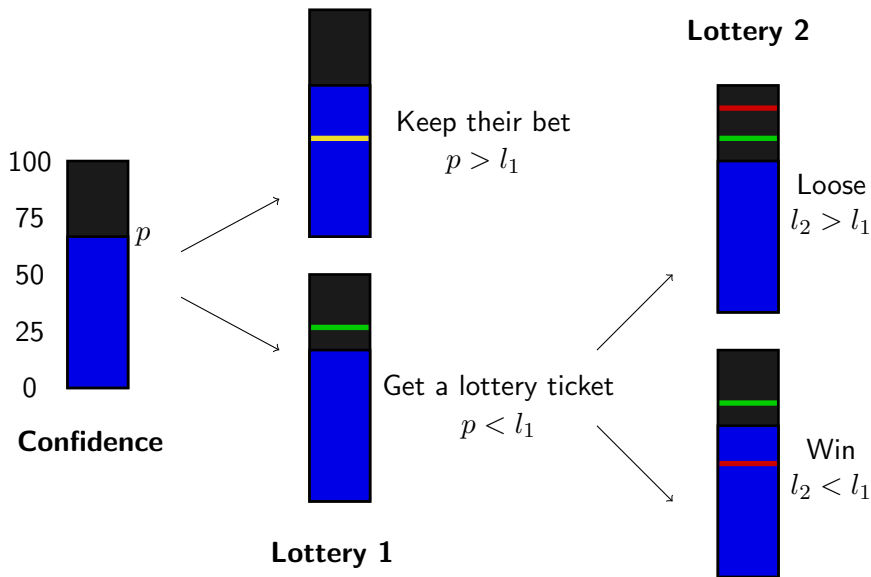
# Feelings as a second process



# Emotions and Decision Processes

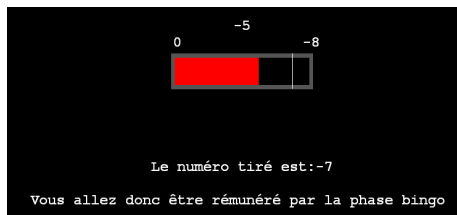
The two experiments give support to the idea that emotions influence the decision making as a second decision process.

- In case of an emotional activation the cognitive process seems to be less influent than the emotional one.
- In terms of modelization, axiomatic approach must allow for these two types of decision processes.  
⇒ Chichilinsky (1996, 2000, 2009) develops an axiomatization with an E.U part (the cognitive one) and an emotional aspect (that have to be precised to be experimentally tested).
- We also have to compute the signal detection models to obtain informations about the speed accuracy trade-off and some predictions about metacognitive abilities.

Probability Matching (HMV - 2011) back

# Insurance Choice back

- Insurance for the bingo phase by certainty equivalent and a BDM mechanism
  - Elicitation of the number of points won for sure
  - Elicitation of the number of points lost for sure
  - A random lottery determines the coverage



⇒ Link between probability of success and coverage rate