4 controversies on nuclear power

François Lévêque,

Professor of economics at Mines ParisTech

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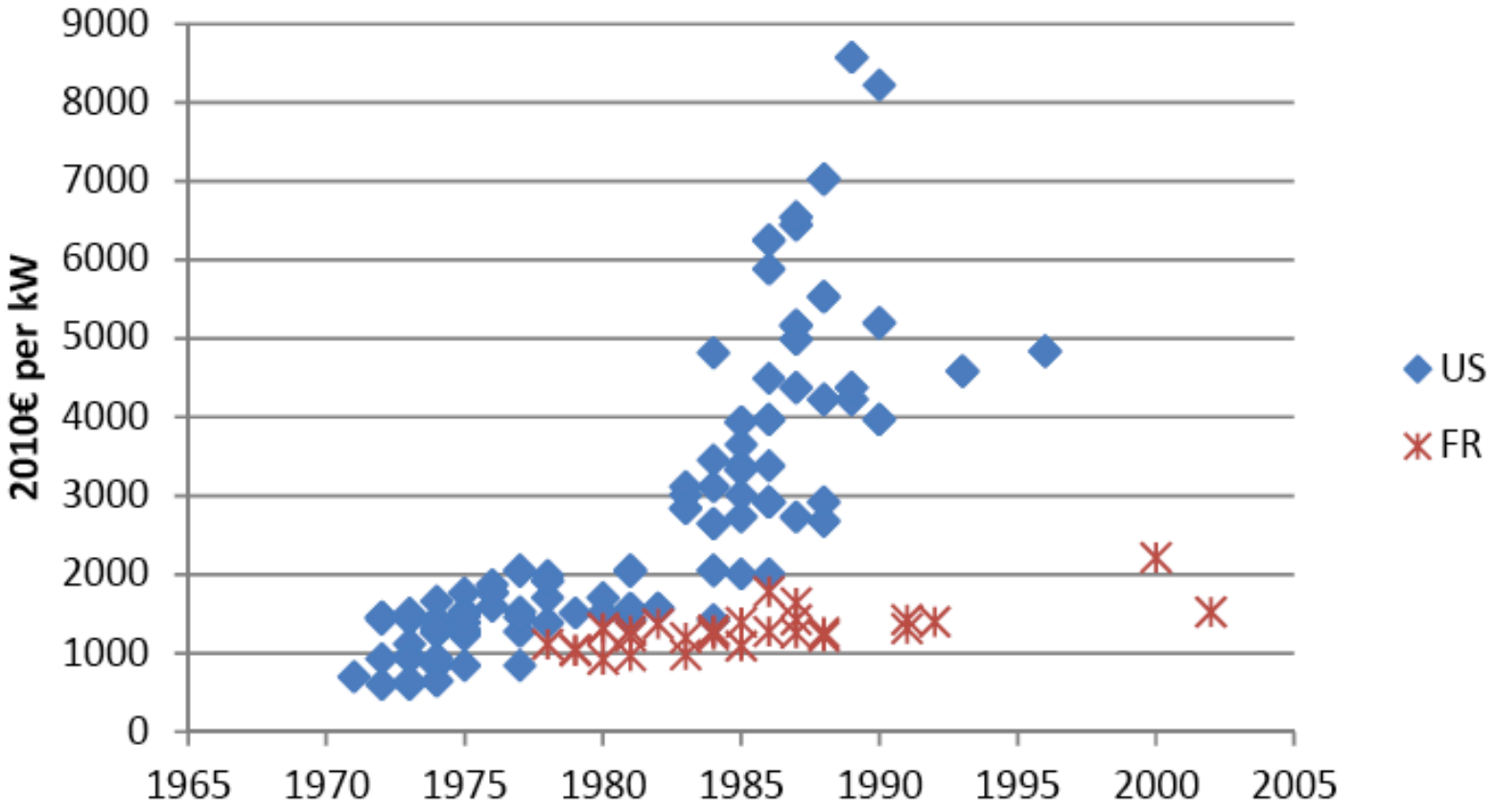
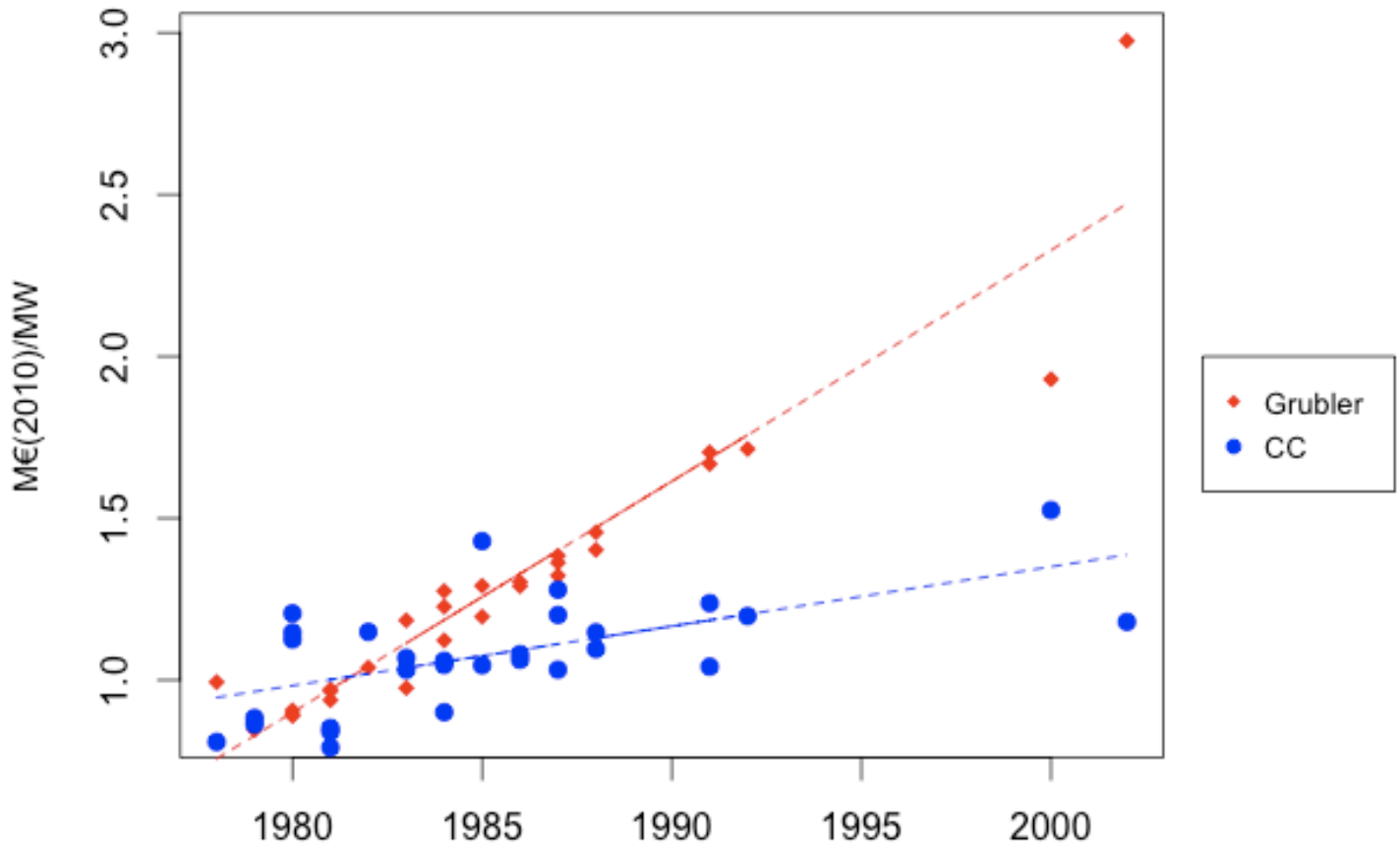
Introduction

- A book divided in 4 parts
  - Estimating the costs of nuclear power: points of references, sources of uncertainties
  - The risk of major nuclear accidents: calculation and perception of probabilities
  - Safety regulation: an analysis of the American, French and Japanese cases
  - National policies and international governance
- A positive economic approach
  - Understanding phenomena and assessing effects
- A twofold wager
  - A non partisan book could be worthwhile for readers
  - Casting light on uncertainties is a good way to make better decisions
- Let’s see 4 controversies for illustration

Cost escalation: France v. USA (Controversy 1)



Cost escalation in France has been much lower

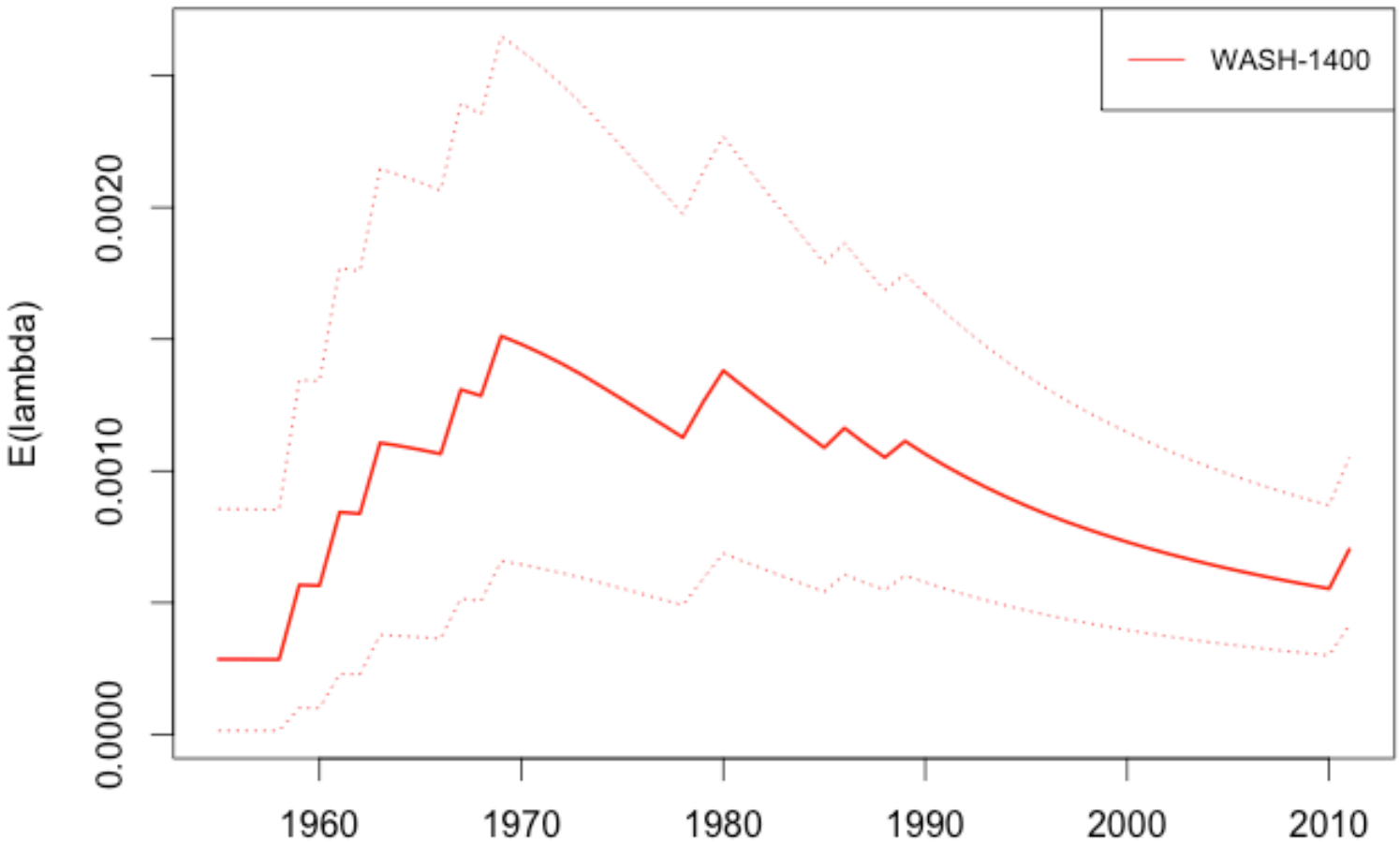


Main drivers of the nuclear cost escalation in France

According to econometric studies (Escobar and Leveque, 2012)

- The scale-up is the main driver of the increase in the costs. Building larger reactors took more time and they turn out to be more expensive
- The cost of labor is also one important driver of the construction costs, it grew faster than the price index used to homogenize the cost data
- There is no evidence of learning effects at the industry level. However we found positive learning effects at the palier and type level
- Safety concerns also took part in the cost escalation. The reactors with better performance in terms of safety indicators were also more expensive

Major accidents: observed frequencies versus calculated frequencies (Controversy 2)



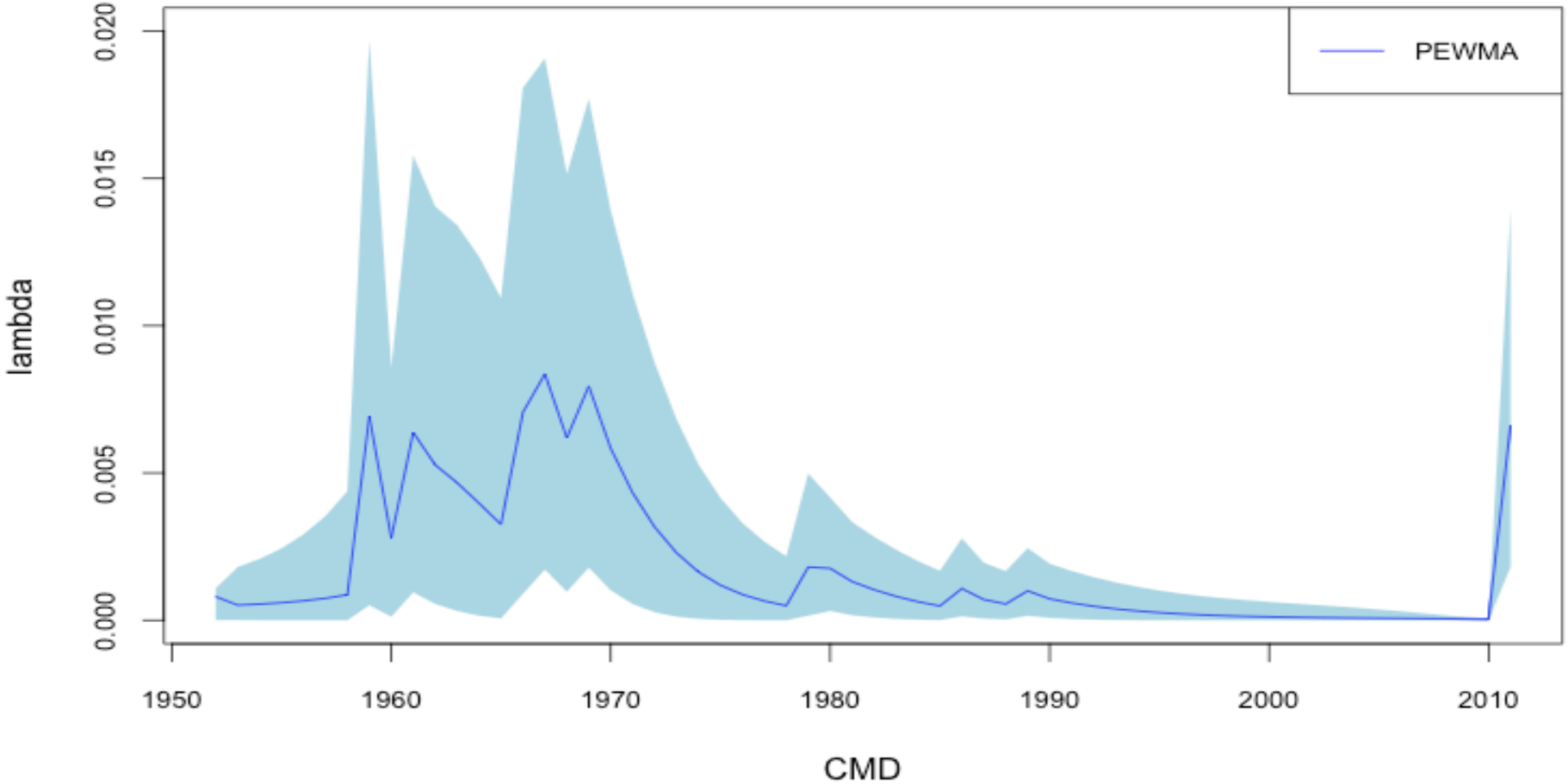
Bayesian Poisson Gamma model, Escobar-Rangel and Lévêque, *Safety Science, (*2014)

Fukushima Daiichi: a strong or a small risk revision to make ? (Controversy 3)

How does the Fukushima-Daiichi accident change our prediction of accident? (8 observations of core-meltdown, even minimal, before Fukushima-Daiichi , 11 after)

Model	$\hat{\lambda}_{2010}$	$\hat{\lambda}_{2011}$	Δ
MLE Poisson	6.175e-04	6.66e-04	0.0790
Bayesian Poisson-Gamma	4.069e-04	4.39e-04	0.0809
Poisson with time trend	9.691e-06	3.20e-05	2.303
PEWMA	4.420e-05	1.95e-03	43.216

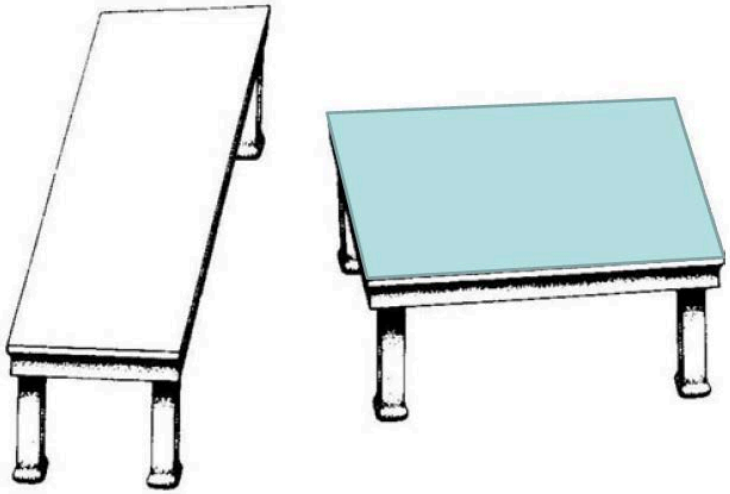
A strong Fukushima Daiichi effect?



Poisson Exponentially Weighted Moving Average (paramètre d'indépendance : 0,82)

Basing public decision on probabilities as calculated by experts or as perceived by laymen? (Controversy 4)

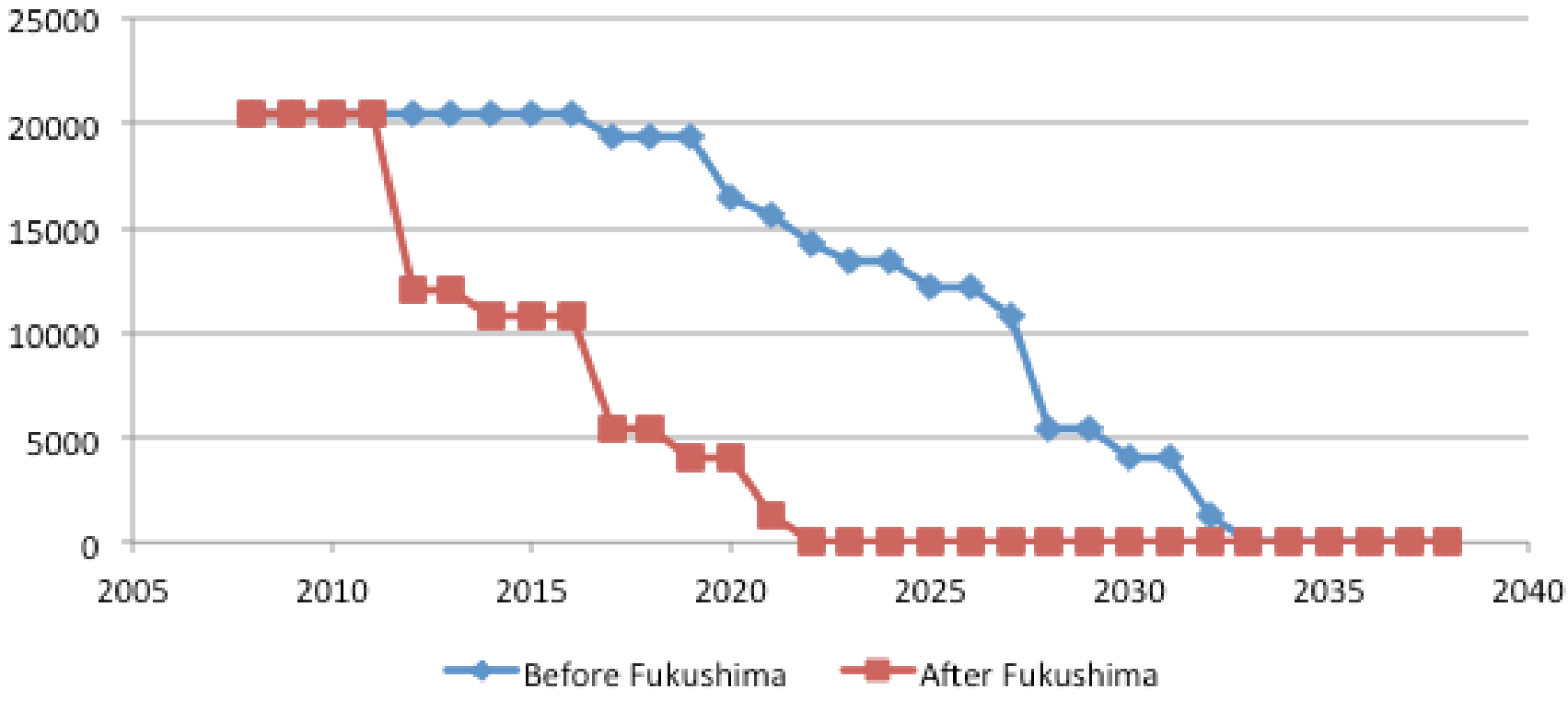
- Experimental psychology studies (e.g., D. Kahneman, 2011) show that our perception of probabilities is biased
- For instance, the probability of a 0,0001 loss is perceived lower than a probability of 1/10.000 (the so-called denominator neglect heuristic)



Biases of perception are all unfavorable to nuclear technology

- Nuclear accident is a
  - Rare event, hence perceived probability is overestimated
  - Ambiguous event, hence our minds select on the highest value of probability and damages
  - Dread event, hence we neglect the denominator and focus on the event itself which leaves a strong footprint
- Consequently,
  - Demand for overinvesting in nuclear safety
  - Distorted choice between alternative power technologies (coal or hydro are perceived less dangerous whereas deaths due to coal or hydro have been higher)
- Do we have to take into consideration in estimating the nuclear social cost, the expected cost of accident or the perceived cost of accident?

The German nuclear phasing-out



The post Fukushima-Daiichi acceleration of the phasing-out results in about € billion 50 loss (Keppler, 2012)

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