



Pitfalls of Insuring Production Risk

A Case Study on some Wind Power Auctions in France

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Feed-in-Tariffs and Auctions for Renewables

Support Mechanism: **Feed-in-Tariff** contracts awarded through **auctions**

- *Feed-in-Tariffs*: Fixed price paid to eligible renewable producers
- *Auctions*: Eligible producers/power plant projects asking for the lowest price are selected by the auctioneer



Contingent Auctions

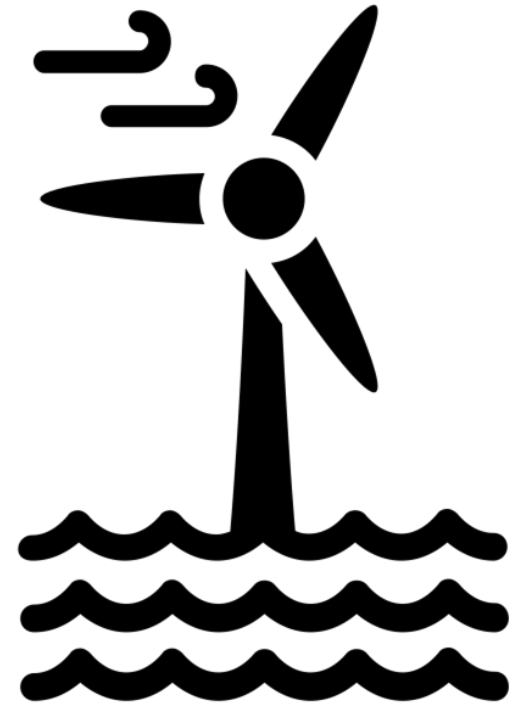
Auctions in which the payment made to/by the bidder (*power plant's revenue*) depend on future events (*amount of electricity produced*) which can be seen as an exogenous risk by the bidder (*weather variability, misestimation of wind resource*)

Some takeaways from the literature

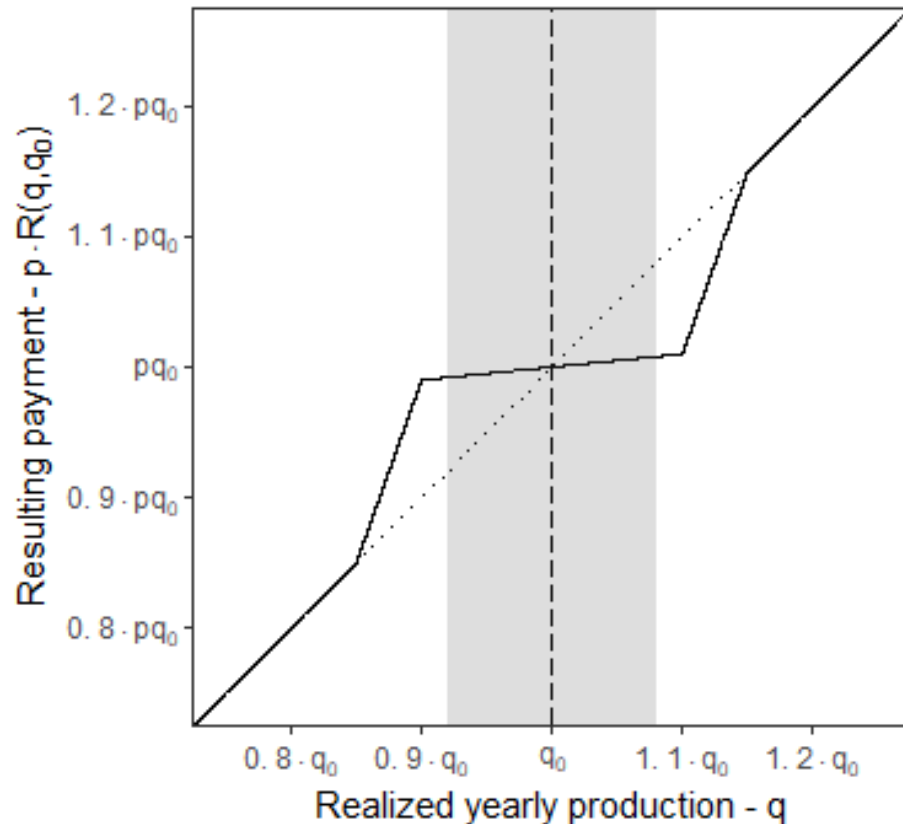
- The **existence of risk premiums**: risk-averse bidders increase their bids to compensate for a greater exogenous risk
- Appropriate **contract design** may **limit the risk the winning firms bear**, and in the end **help develop renewable electricity at a lower cost**

French Offshore Wind Auctions

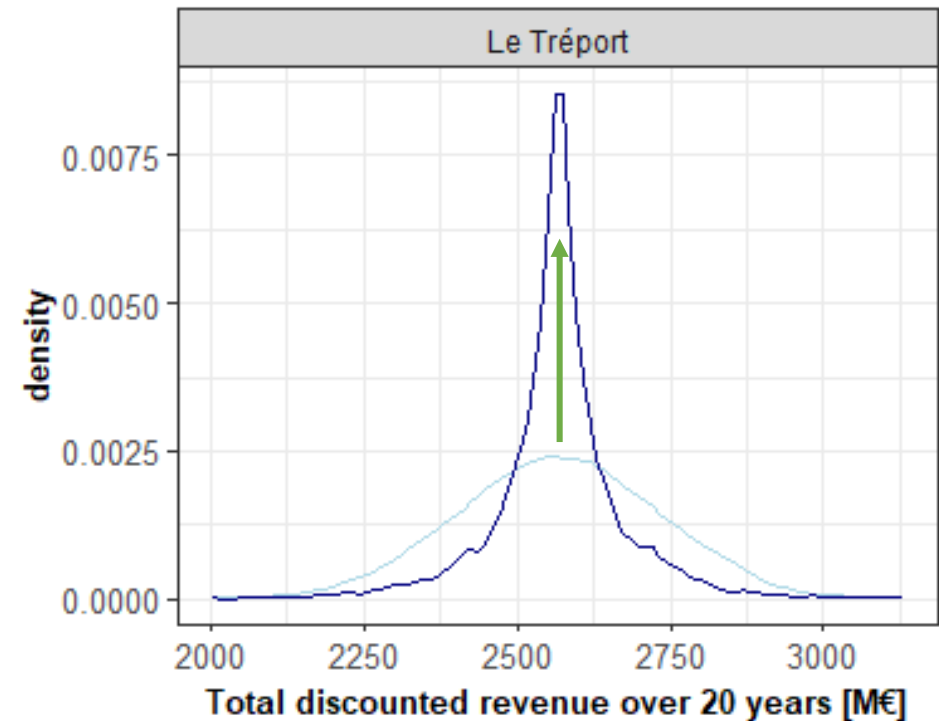
- In 2011 and 2013, France auctioned away 6 offshore wind sites
- Winning firms were to benefit from Feed-in-Tariff contracts
- Insurance against production risk was provided through a **modified "payment rule"** lowering payment variability around a reference production:
 - Bidders were asked to **self-report their expected yearly production** (or equivalently their average capacity factor)
 - **Yearly payments vary very little** as long as actual yearly production falls **within +/- 10% of the stated expected production**



French Payment Rule with truthful bidders



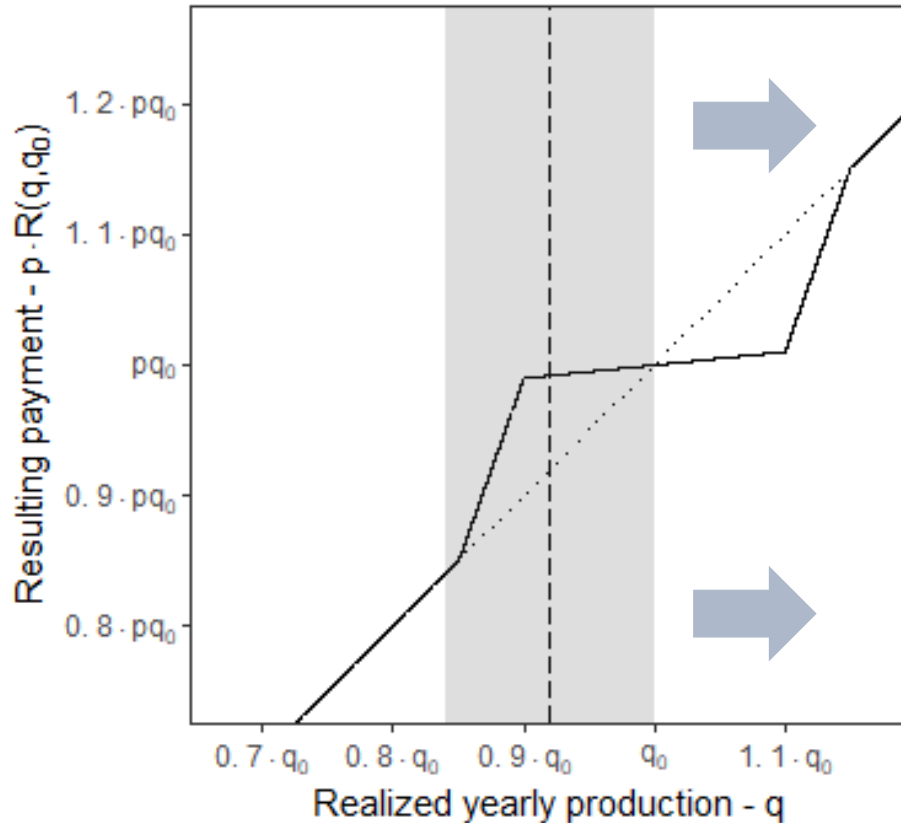
Payment Rule used for French Offshore Wind Power Auctions in 2011 and 2013



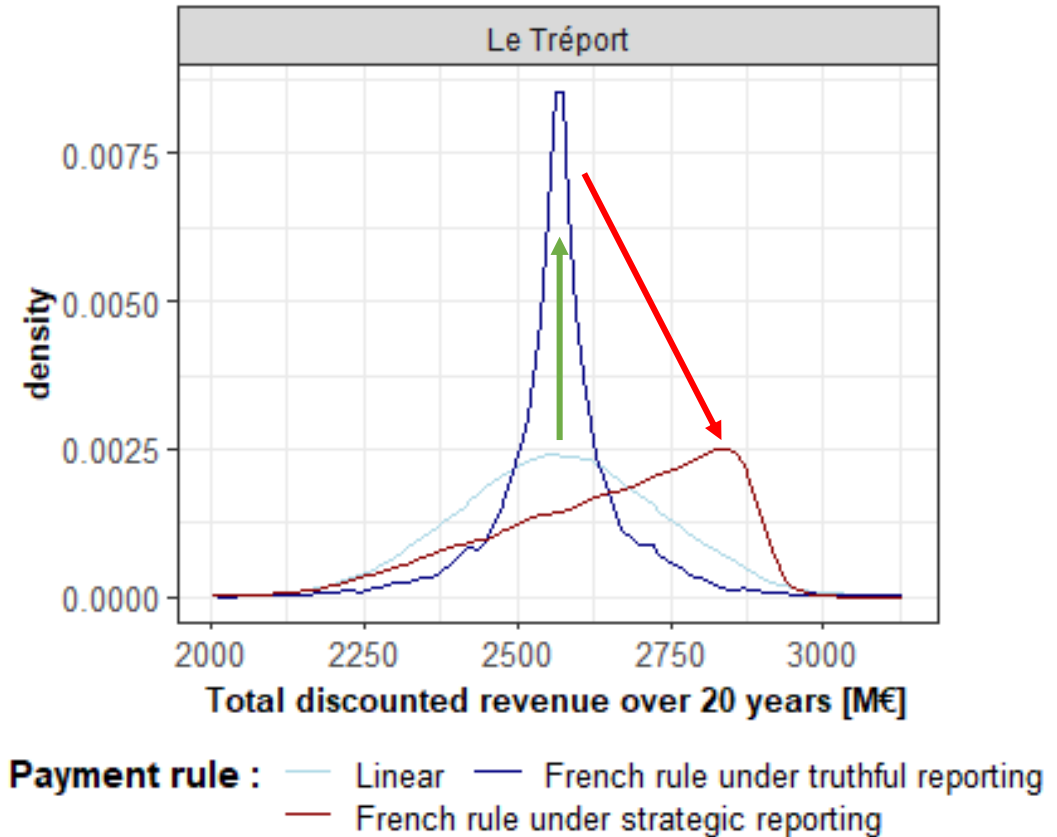
Payment rule : — Linear — French rule under truthful reporting

Firm's Revenue distribution with a standard contract and with the French payment rule

French Payment Rule with strategic bidders



Payment Rule used for French Offshore Wind Power Auctions in 2011 and 2013



Firm's Revenue distribution with a standard contract and with the French payment rule

Overview

- 1 Introduction: Why insure renewables against production risk?
- 2 A Model of Production Insuring Payment Rules
- 3 Consequences for the French Offshore Wind Auctions
- 4 Can we improve Production Insuring Payment Rules ?
- 5 Conclusion

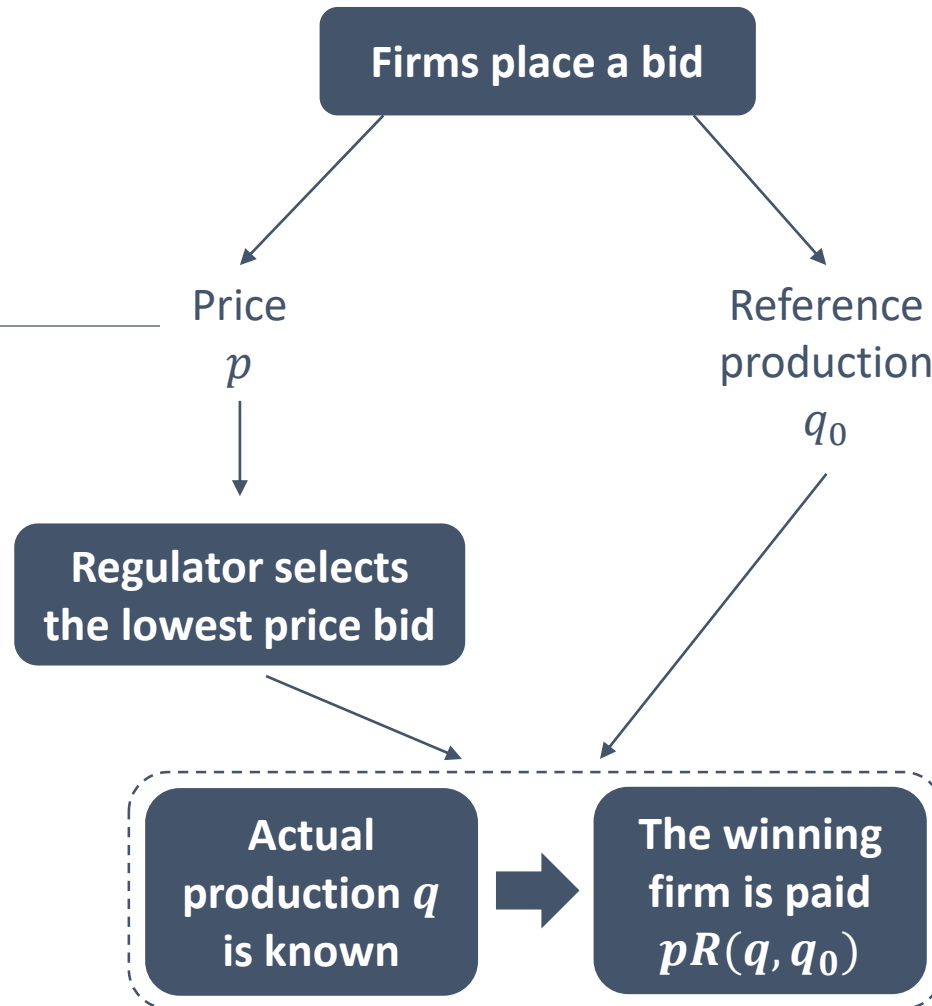
The Auction Game

Hypothesis: Symmetry in cost and risk aversion



Price bid is determined by **zero-profit conditions**

...except in case of **asymmetry regarding strategic behavior**
(some truthful and some strategic)



Bidders are either...

- Truthful: $q_0 = \bar{q}$
- Strategic: $q_0^*(p) = \text{Argmax}_{q_0} \Pi(p, q_0)$

Main takeaways from the model

Under “Production Insuring Payment Rules”:

- Strategic bidders are incentivized to **overstate their expected production**
- Such payment rules always result in **lower prices** than under a linear payment rule
 - *If bidders are truthful*, due to **lower risk premiums**
 - *If bidders are strategic*, due to their expected revenue being artificially inflated by the insurance mechanism: **lower prices are deceptive, expected payment will not necessarily be lower**
- *In case of asymmetry regarding strategic behavior*, strategic bidders are allowed to win the auction **while capturing a positive rent**

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A Proxy of the Risk faced by Offshore Wind Bidders

Objective: Estimate the French regulator's losses magnitude

Method: Simulate a firm's best response in the auction given...

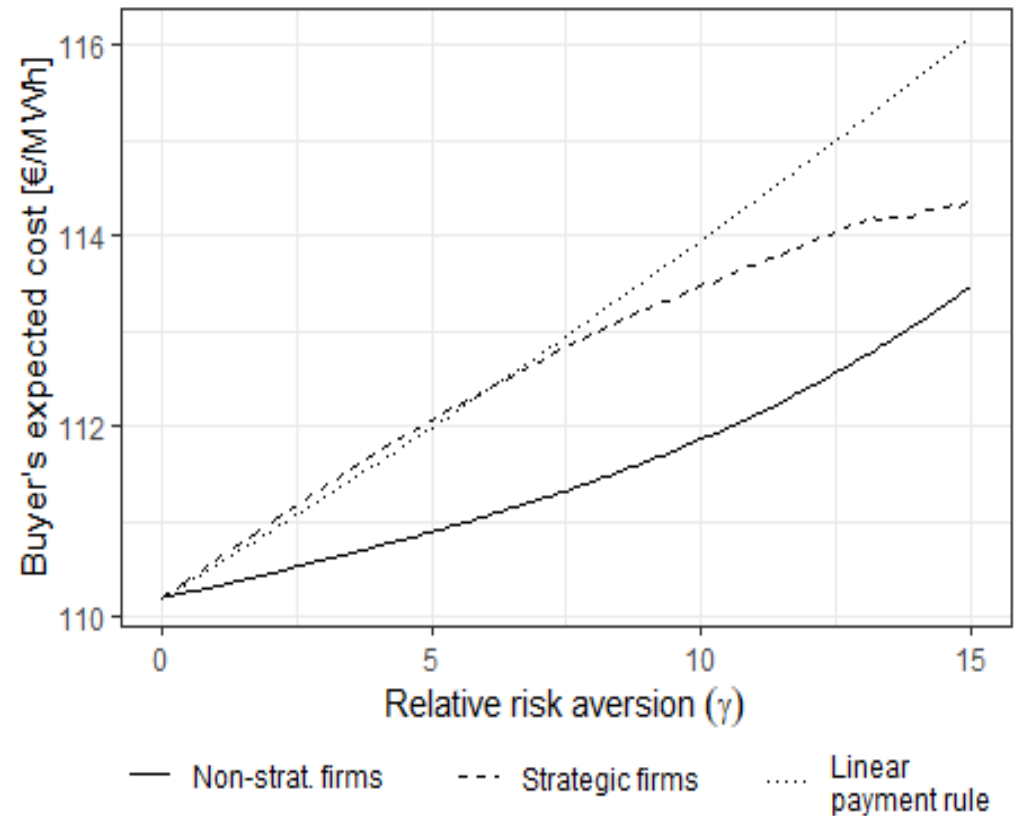
- Feed-in-Tariff contracts following the actual French rule for a **duration of 20 years** and assuming an **interest rate $r = 5.7\%$**
- Firms' risk aversion following a **CRRA utility function** of parameter γ
- A proxy for **risk distribution** including:
 - **Weather risk:** Wind production simulation based on historical weather data for each site, recombined at the quarter level to get a large sample of yearly production
 - **Misestimation risk:** A normal noise whose spread accounts for a 5% mean absolute error, in line with common estimation mistakes made until recently

Impact on the Buyer's Expected Cost

Considering a standard risk aversion ($\gamma = 1$),
Simulation for 5 offshore wind sites

<i>Linear Contract</i>	Risk premium vary between 0.29 - 0.36 %
<i>French Rule with truthful bidders</i>	The risk premium is divided by half
<i>French Rule with strategic bidders</i>	These gains are lost
<i>French Rule with only one strategic bidder (worst scenario)</i>	The strategic bidder captures a rent 15 times larger than the potential gain if all firms were truthful

Simulation for Courseulles Site (Normandy)

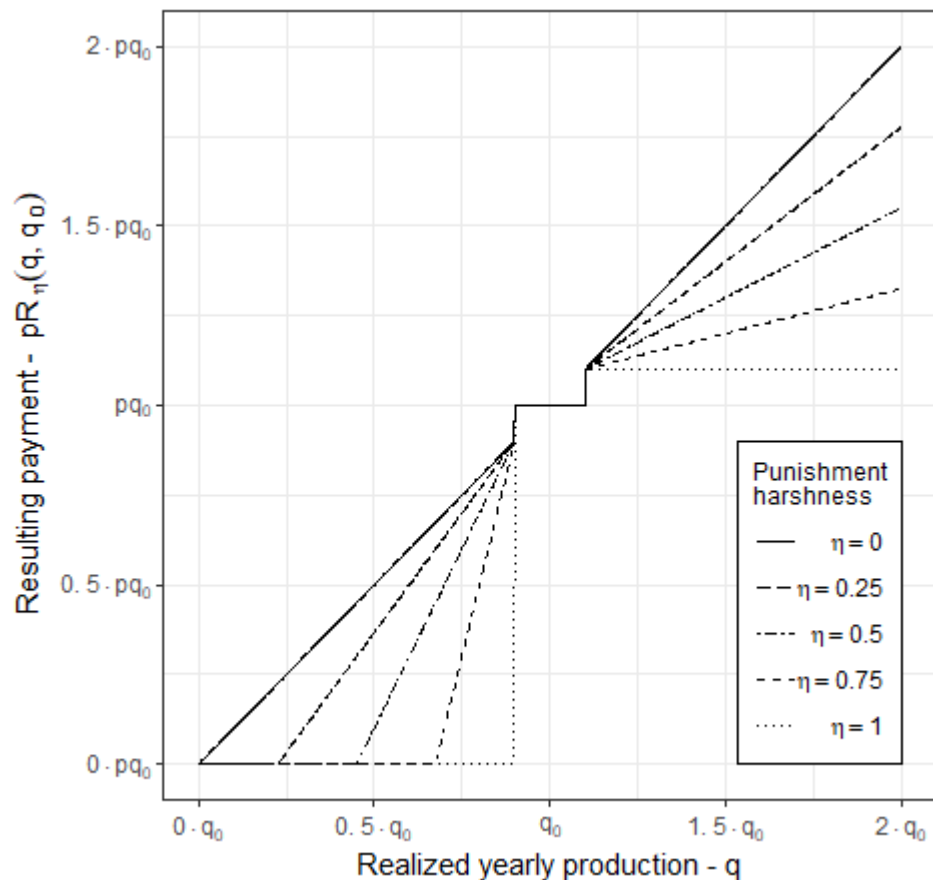


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Limiting Strategic Behavior with “Punishments”

New class of payment rules parameterized by (w, η) , with payment depending on production being...



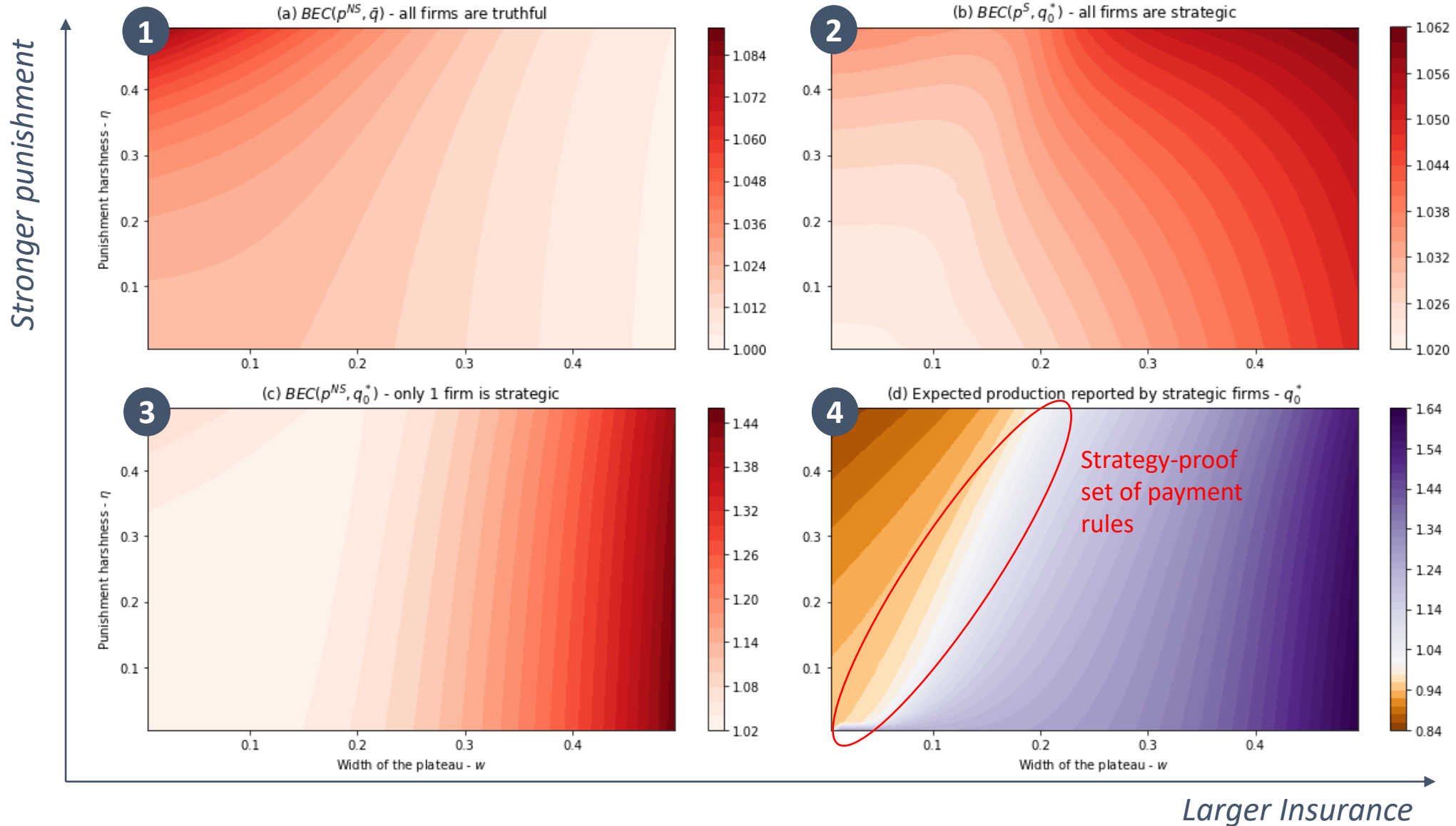
- **Flat within w %** around reported expected production q_0
- **Punished with intensity η** out of this interval

payment increase (resp. decrease) all the more slowly (resp. rapidly) that η is high when above (resp. below) the flat part

Simulation of firms' best response for

- Risk-averse firms with **CRRA ($\gamma = 1$)**
- Production q **normally distributed** with standard deviation equal to 20% of the mean

Auction's outcomes



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Conclusions

Insuring production risk through a “Production Insuring Payment Rule”

➡ Implies strategic behavior through self-reporting of expected production

and then,

➡ Is likely to **fail reducing the risk** faced by firms

➡ May even **increase the cost** for the buyer

Due to

- ➔ An **increased risk** for the winning firm
- ➔ **Rents** captured by the winning firm

Remarks

- Solution ? = Control the reported expected production

(e.g. average capacity factor certified by a third party)

opens the door to...

→ **Manipulation or Corruption** of the third party: sunk costs devoted to modify the reported expected production

→ **Inefficient Selection**: choice of costlier projects, but which have been “lucky” in the determination of their expected production

→ **Incentive to downgrade** the power plant’s technology once insured against low production

(moral hazard equivalent to present information asymmetry issue)

Thank you for your attention