Manipulation and (mis)trust in prediction markets

Financial Fraud, Misconduct and Market Manipulation Conference @ Lancaster

September 13, 2024

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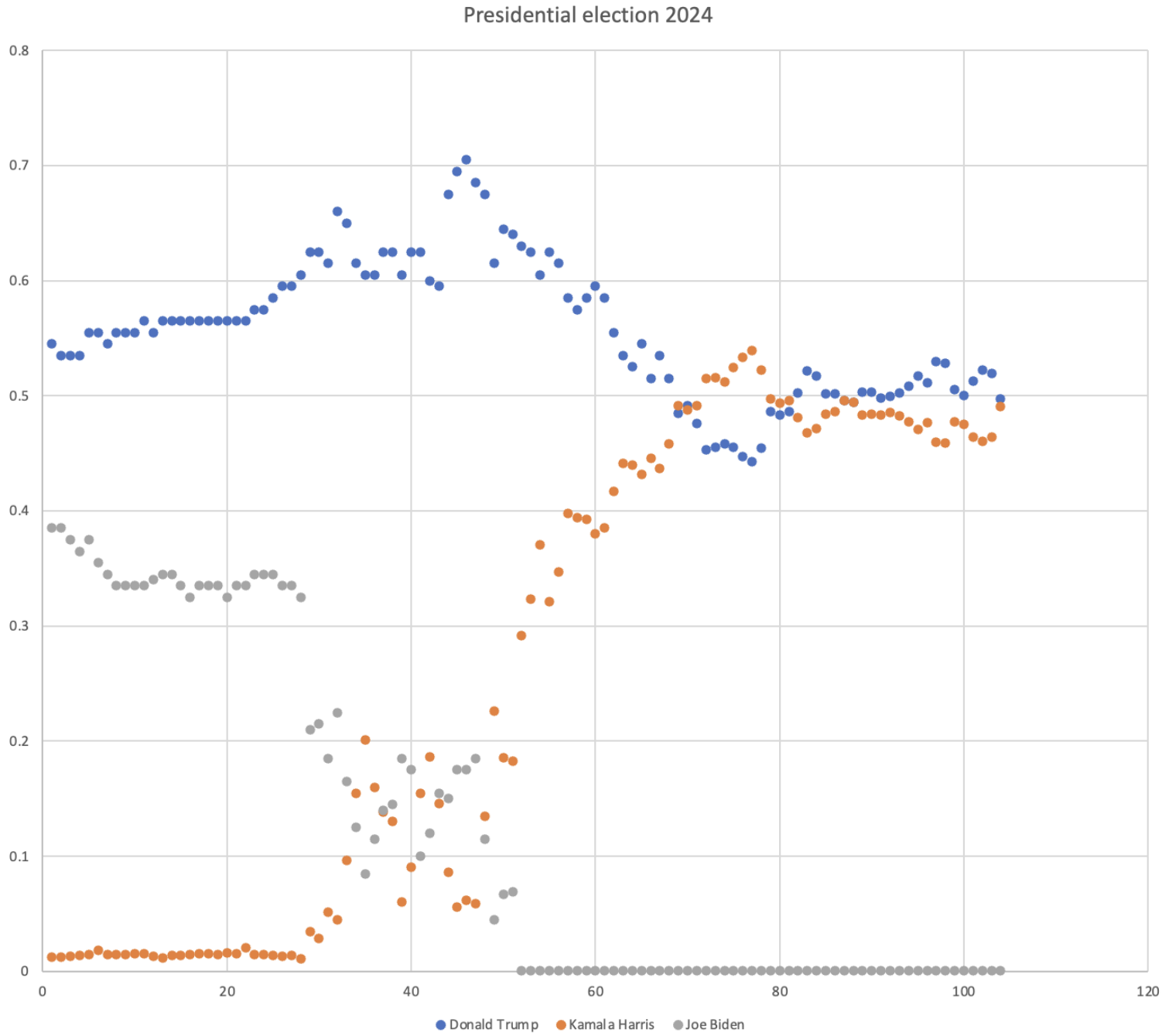
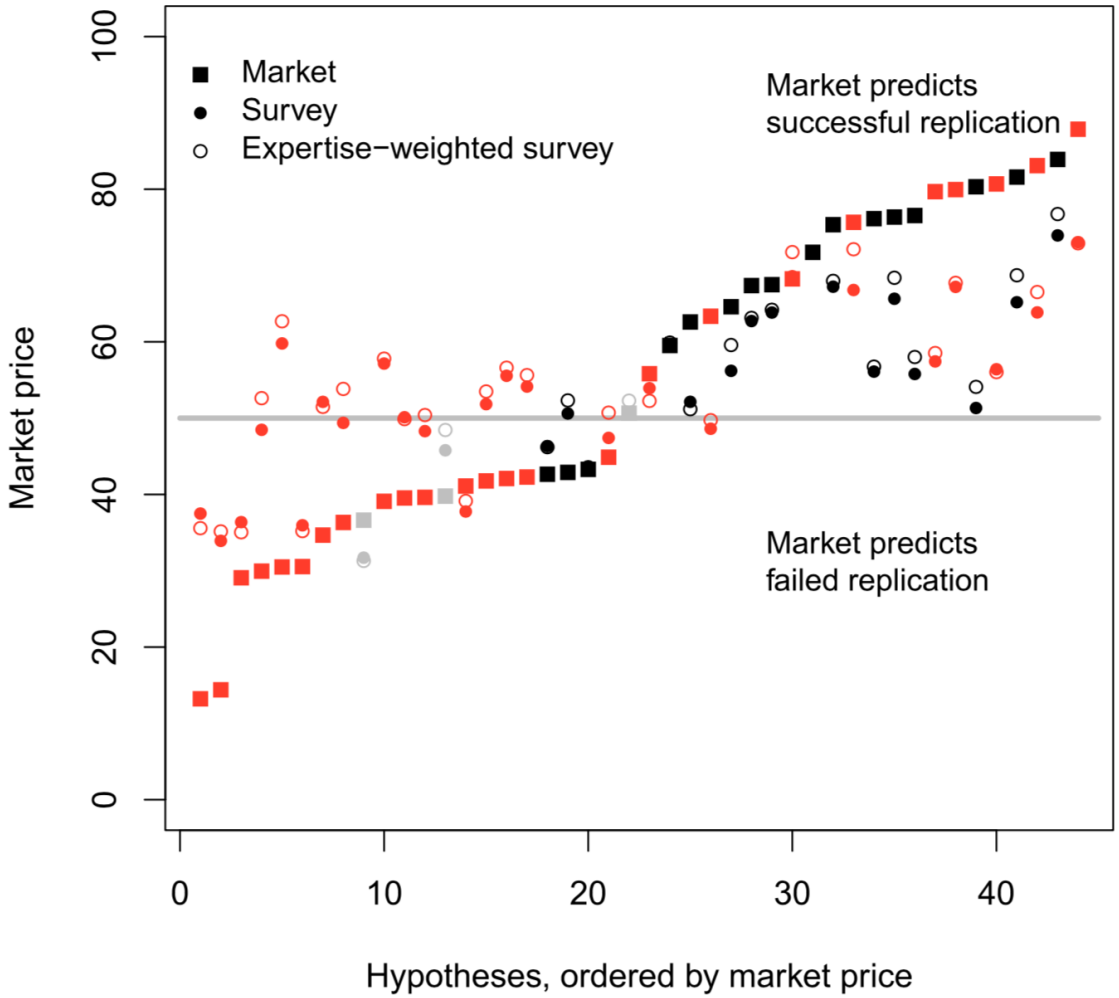
  - Used in organisation as forecasting tools (e.g., Chen and Plott, 2002; Gillen, Plott and Shum, 2017).


Presidential election 2024
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0
20
40
60
80
100
120
Donald Trump
Kamala Harris
Joe Biden

Replication of psychology research (Dreber et. al, 2015).



- Black = Successful replication
- Red = Failed replication

Lab experiments find that markets "can be" good at aggregating information when traders only care about their market payoffs (e.g., Choo, Kaplan, and Zultan, 2019; Forsythe and Lundholm, 1990; Plott and Sunder, 1988).

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Prediction markets are promising tools to guide policy or organisation decision making.

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Our Objective:

Study how manipulators can affect information aggregation properties of market and influence policy makers' decisions.

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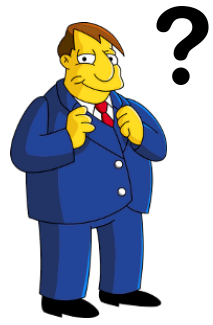

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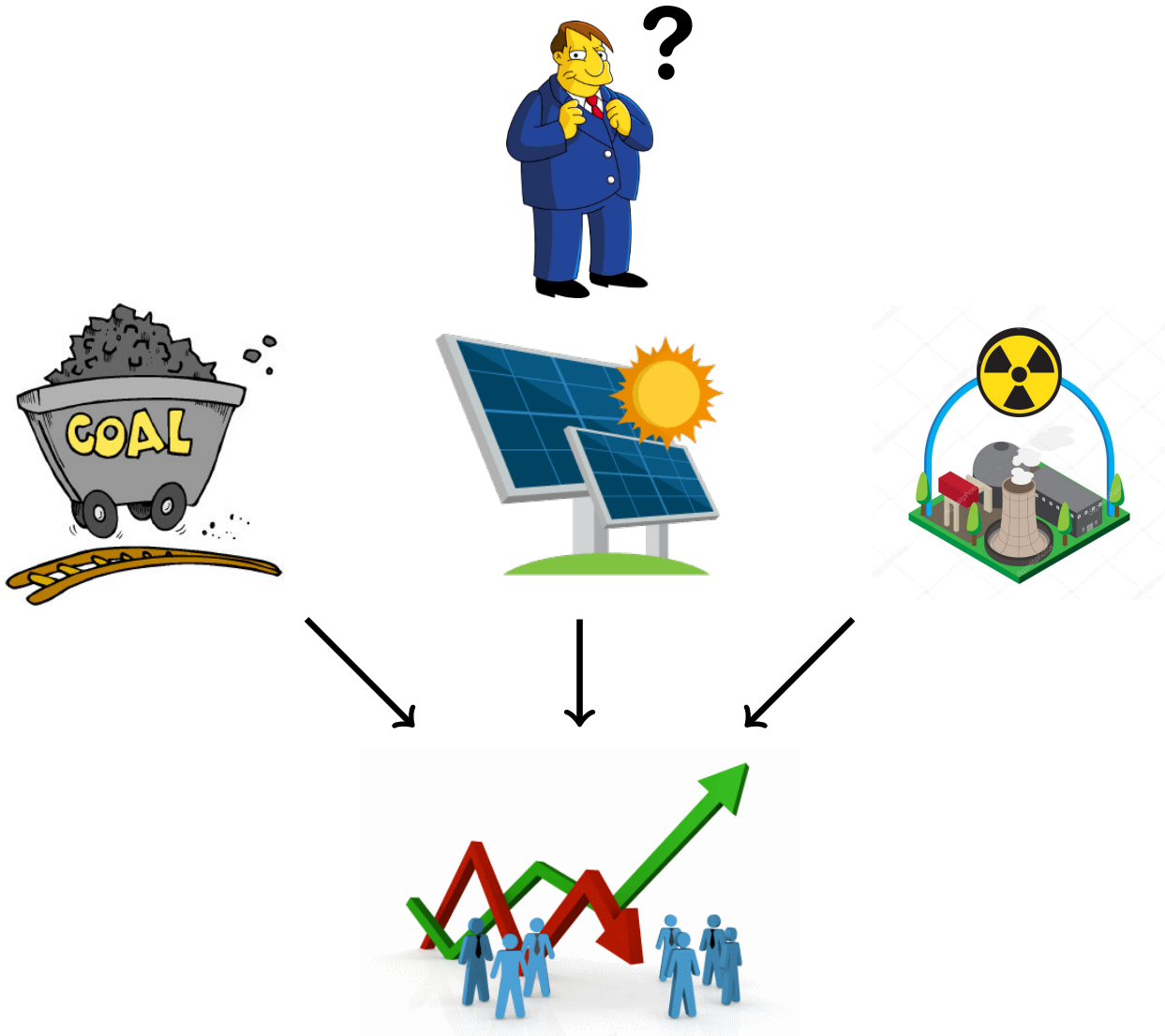

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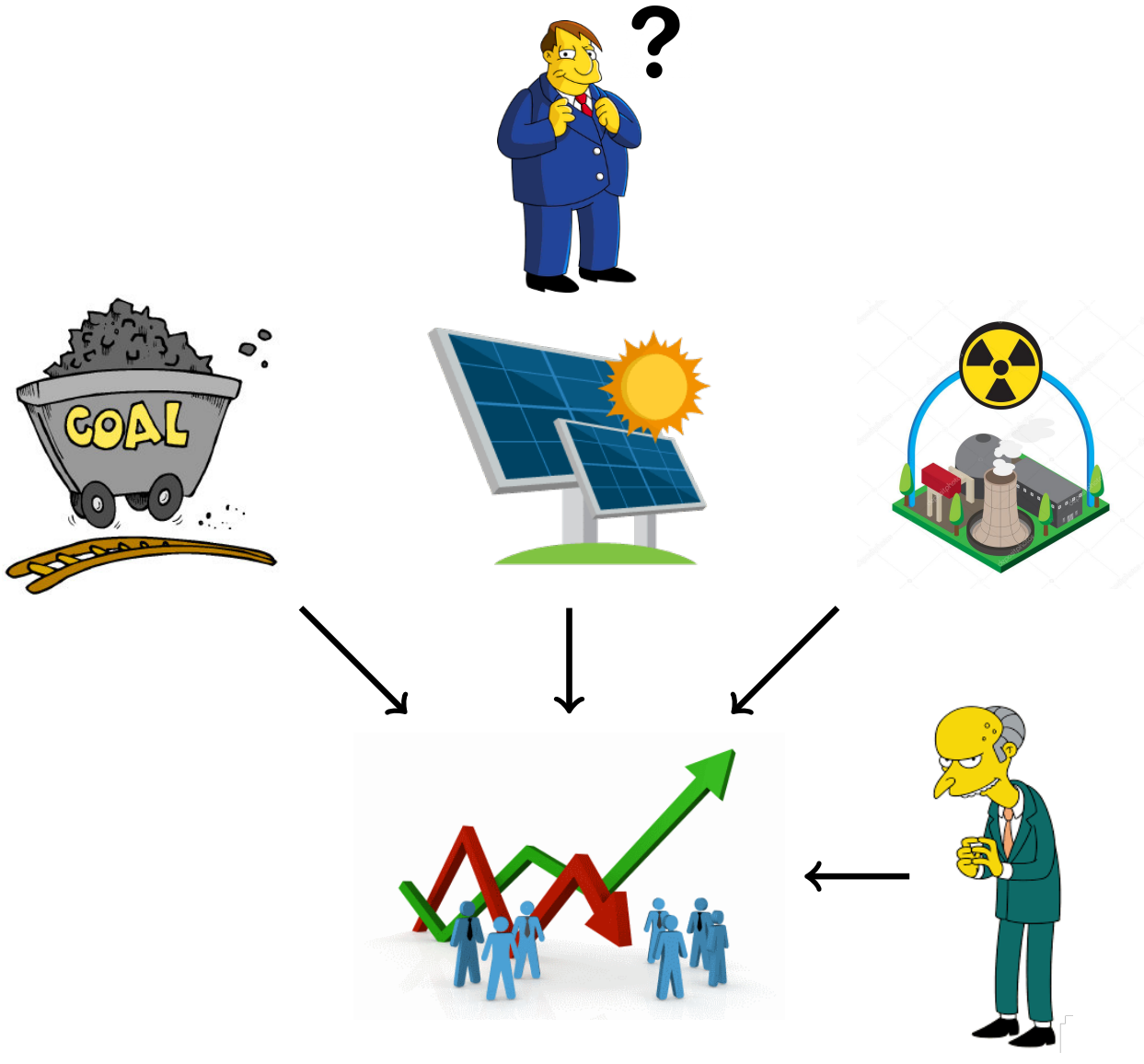

Terror futures

Print edition

A bet too far

Futures markets meet two formidable foes: terrorists and politicians

Jul 31st 2003

PREDICTING terrorism is a devilishly hard business. So it is perhaps no surprise that America's government should cast about for unorthodox ways to guess when the bad guys might strike next. One of the most eclectic routes that the Pentagon chose, creating an online futures market to enable punters to place bets on the odds, say, of a bioterrorism attack or the assassination of the king of Jordan, created a furore when Democratic senators got wind of it. The plan was cancelled on July 29th by the defence under-secretary, Paul Wolfowitz. (The Economist Intelligence Unit, a sister company of *The Economist*, supplied economic and political data to the plan's developer.)

AP

Ne faites pas vos jeux, Mr Wolfowitz

Related literature

Very hard to identify manipulation in the field!

- A political party explicitly asked supporters to manipulate a prediction market (Hansen, Schmidt, and Strobel, 2004).
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There are a few studies: Hanson, Oprea and Porter (2006) and Veiga and Vorsatz (2009,2010), Deck, Lin and Porten (2013)

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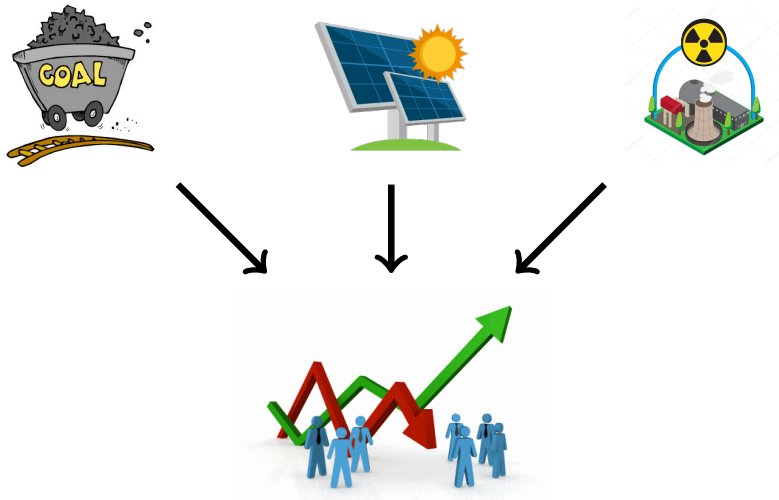
- The policy decision affects all traders.
  $\Rightarrow$ Traders have explicit incentives to counter manipulation attempts.
- We manipulate common knowledge regarding the existence of manipulators.

Experimental design

Market stage



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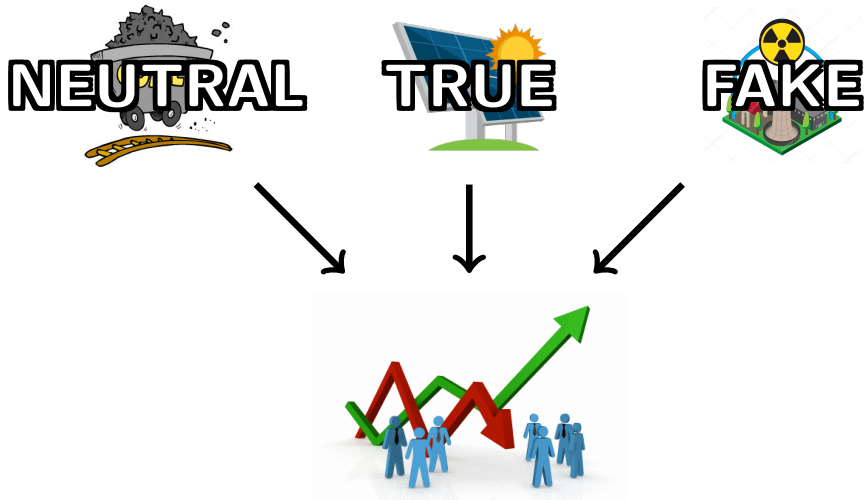

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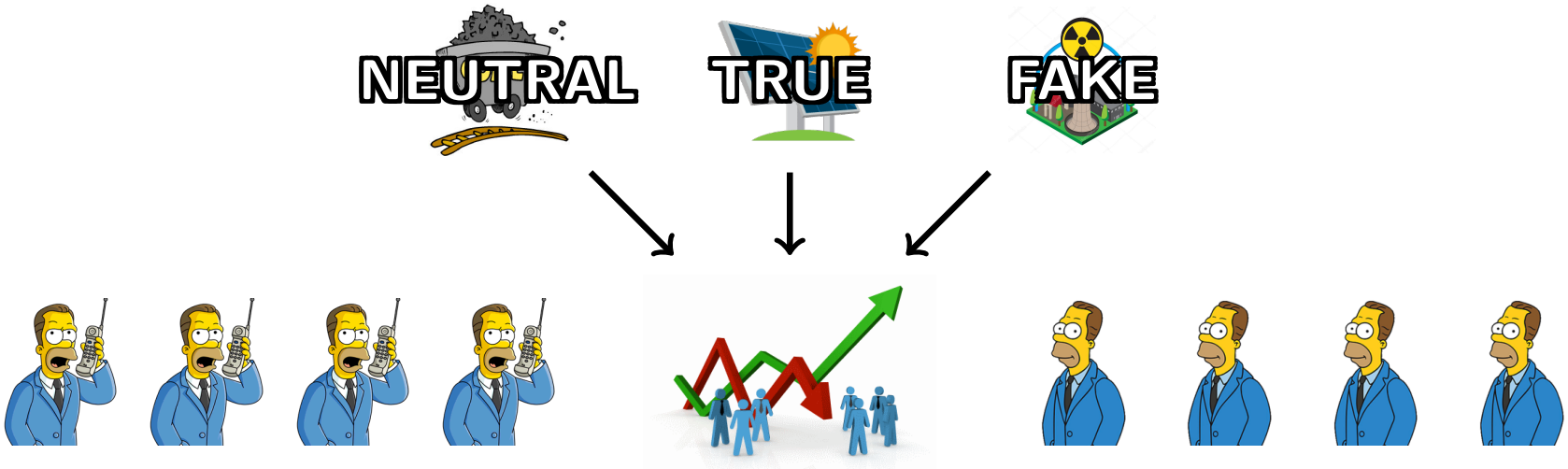

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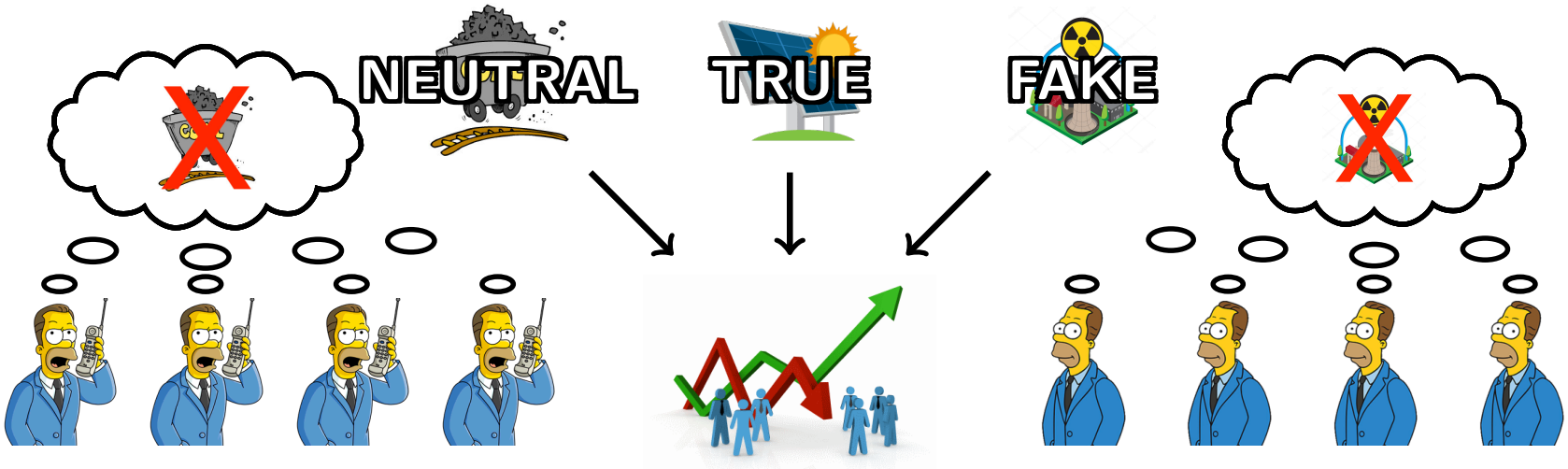

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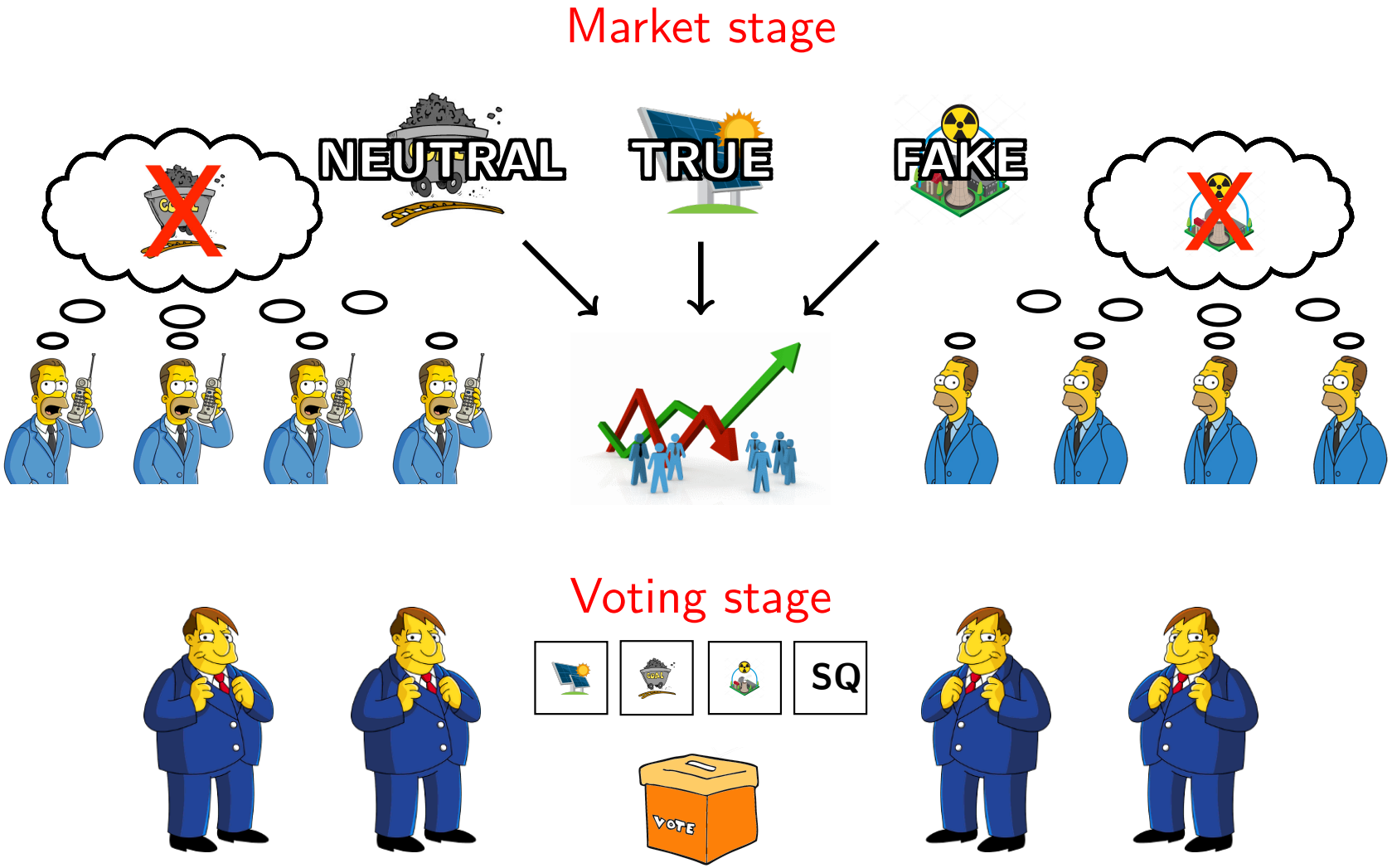

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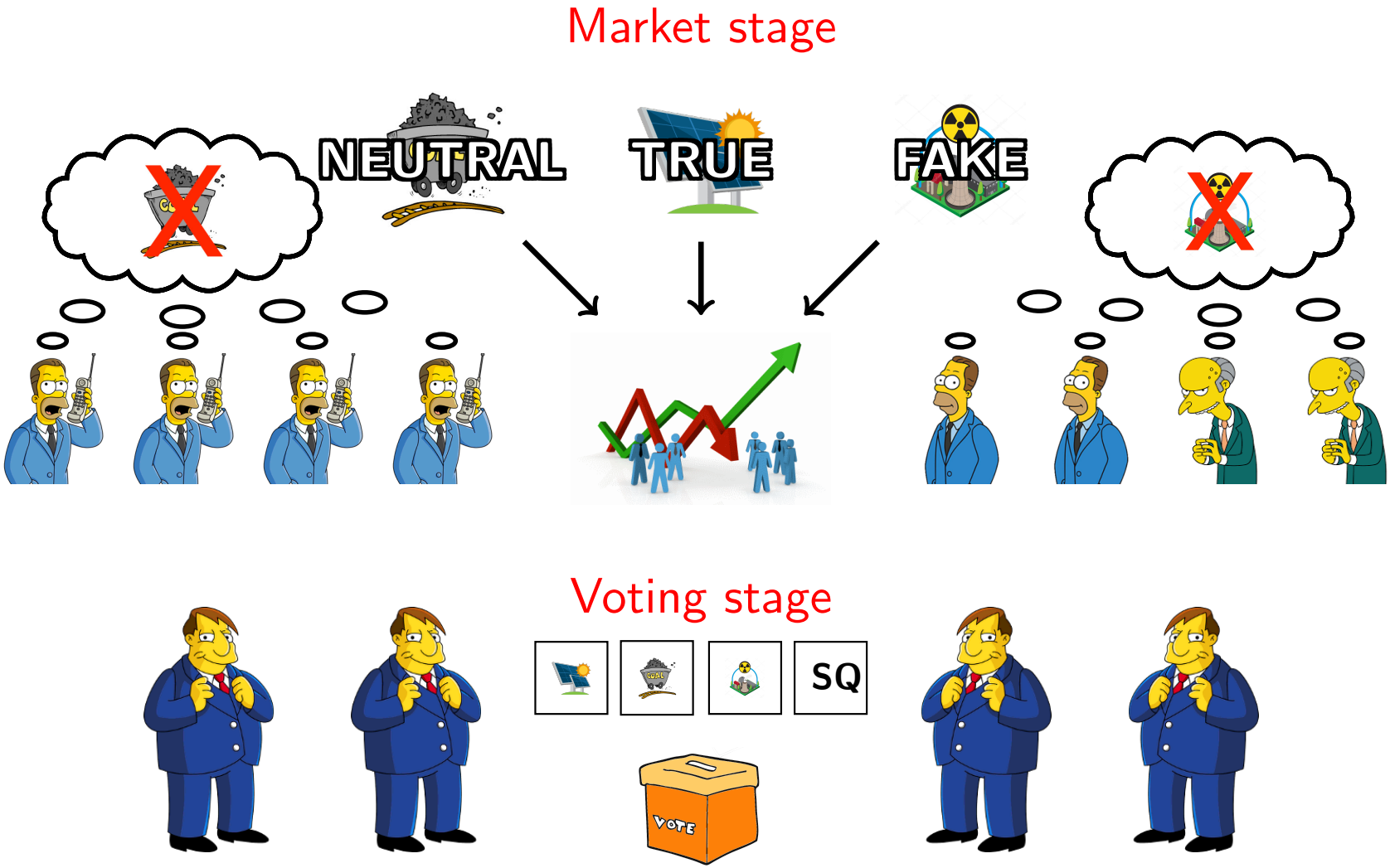

Manipulators

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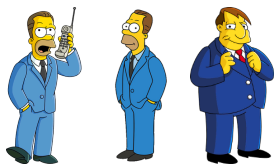
The other traders in Group I and all traders in Group II are Blue traders.
Blue traders. are always of Type-A.
The Red traders are equally likely to be Type-A or Type-B (manipulators), determined independently at the beginning of each round.

Preferences over polices



Type-A traders, policy makers

Project	Payoff from project
SQ	100
TRUE	400
Otherwise	-400

Type-B traders

Project	Payoff from proje
SQ	100
FAKE	1000
Otherwise	-400

Payoffs

Policy makers:

$$\pi = 650 + \textit{Payoff from project}.$$

Traders:

$$\pi = 400 + \textit{Market cash} + 10x\,\textit{Correct assets} + \textit{Payoff from project}.$$

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- Red traders are either Type-A (Not manipulators) or Type-B (Manipulators), within groups.
- This is either common knowledge (CK) or private information (NCK), between groups.
- We had seven markets in each treatment.

Theory (static equilibrium)

	Security prices			Implemented policy
	True	Fake	Neutral	
Equilibria				
Prior Information Equilibrium (PIE)	5	2.5	2.5	True policy
Fully Revealing Equilibrium (FRE)	10	0	0	True policy
Non-Revealing Equilibrium (NRE)	5^+	5^+	0	Status quo

All traders value the True asset at 5.
An equal number of traders value the Fake and the Neutral assets at 0 and at 5.

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Prices are fully revealing.

All traders value the True asset at 10 and the others at 0.

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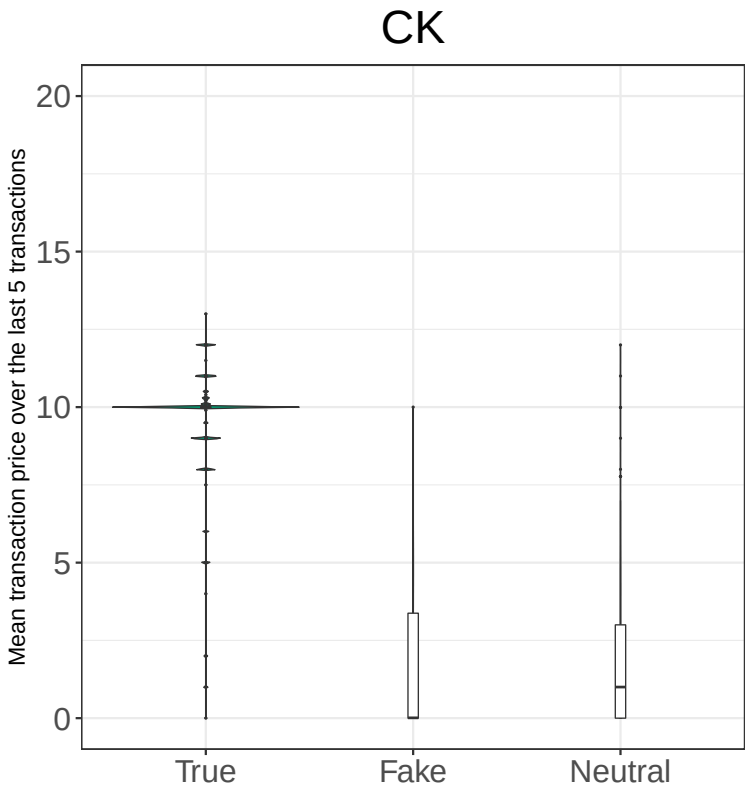
Manipulators mirror the behavior of the traders in their group.

Results

No manipulators: transaction prices



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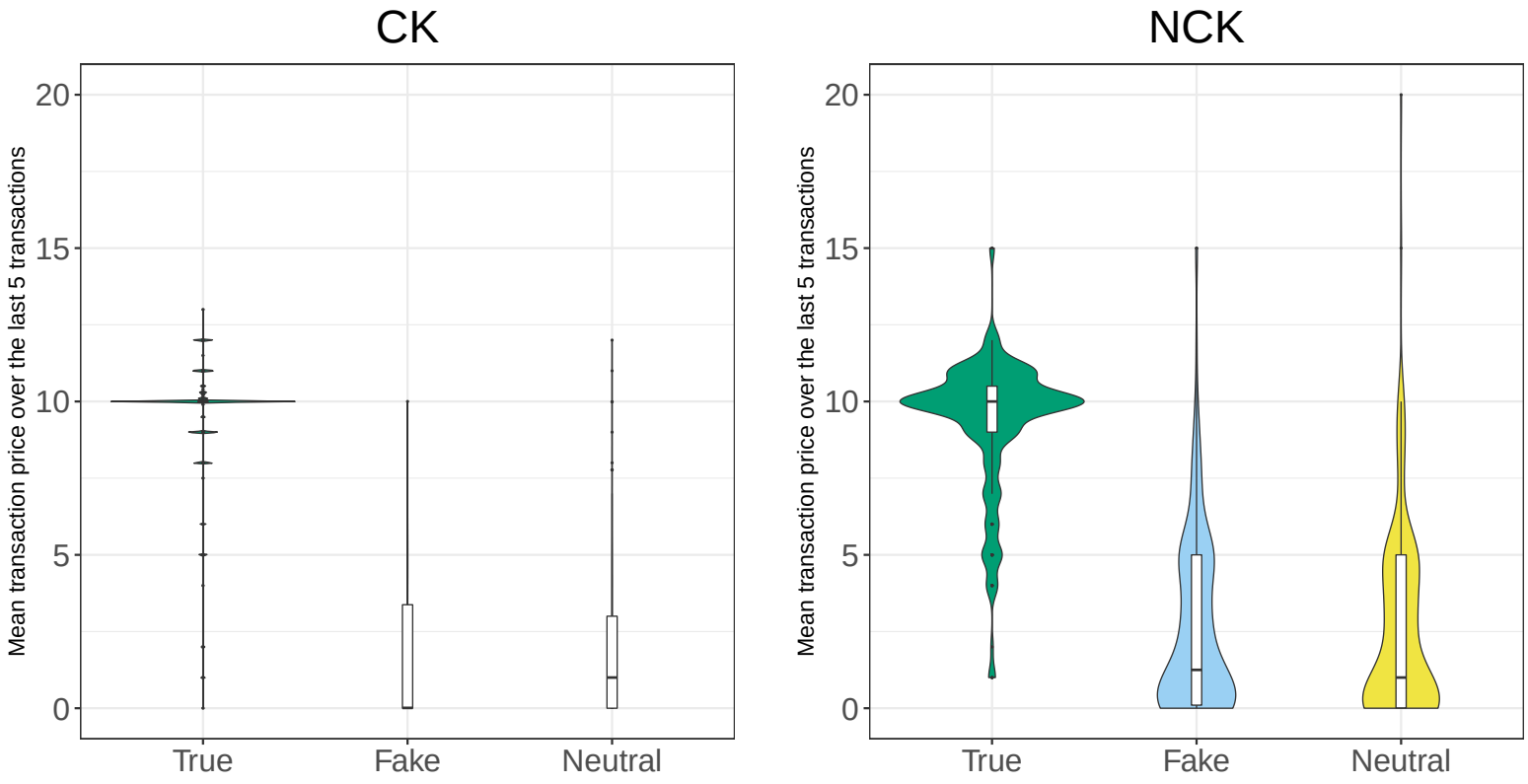
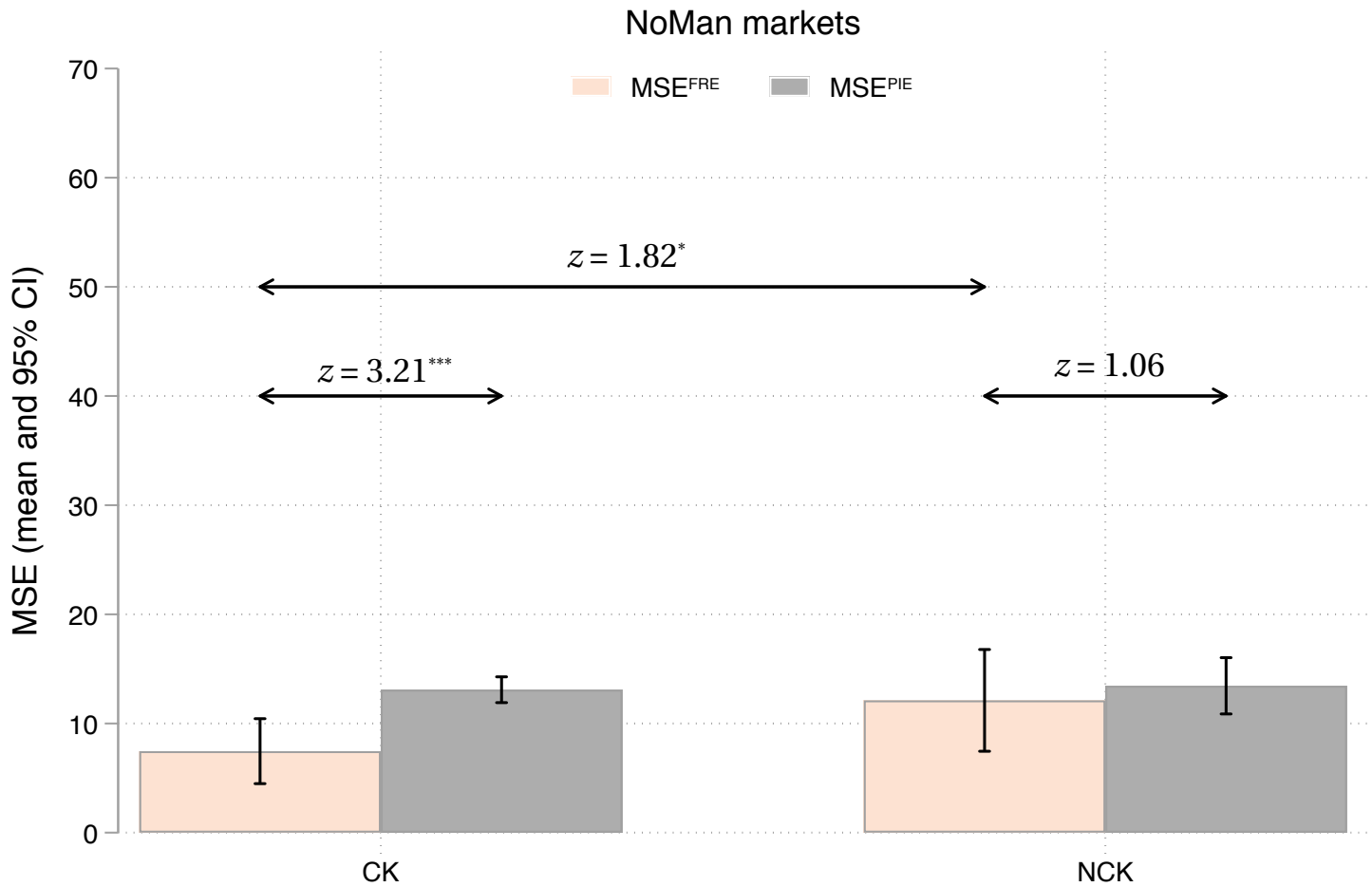


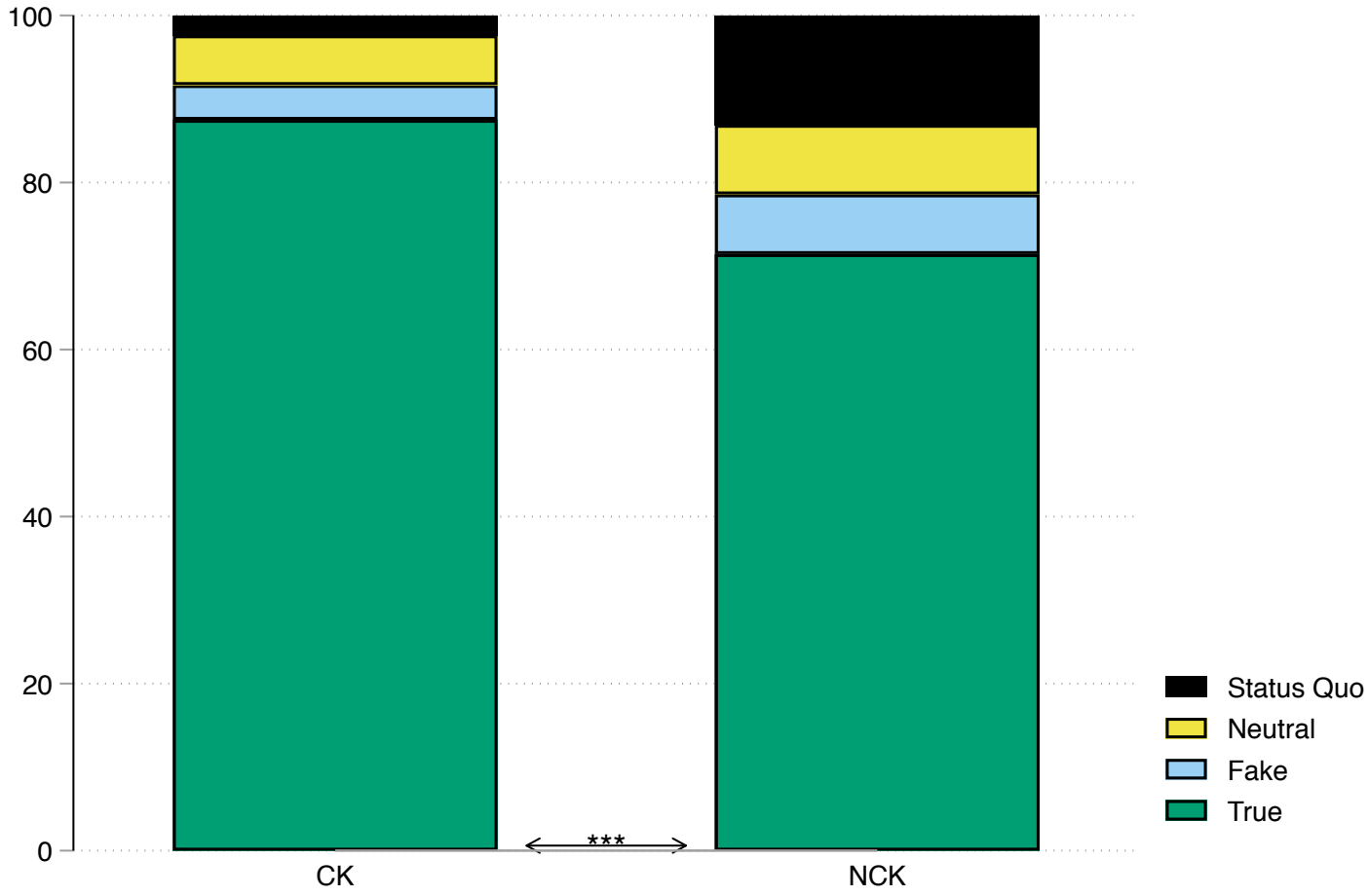
Equilibrium predictions: no manipulators

Focus on transactions in the last five transaction of the market.

- MSE^{PIE}: mean square deviations of prices from the PIE.
- MSE^{FRE}: mean square deviations of prices from the FRE.



No manipulators: voting



Results

Result 1

If it is common knowledge that there are no manipulators in the market, Arrow-Debreu markets are successful at aggregating diverse and partial information about the true state into prices and facilitating optimal policy making.

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Result 2

Mere suspicion of manipulation – even when there is none – impedes information aggregation and optimal policy making.

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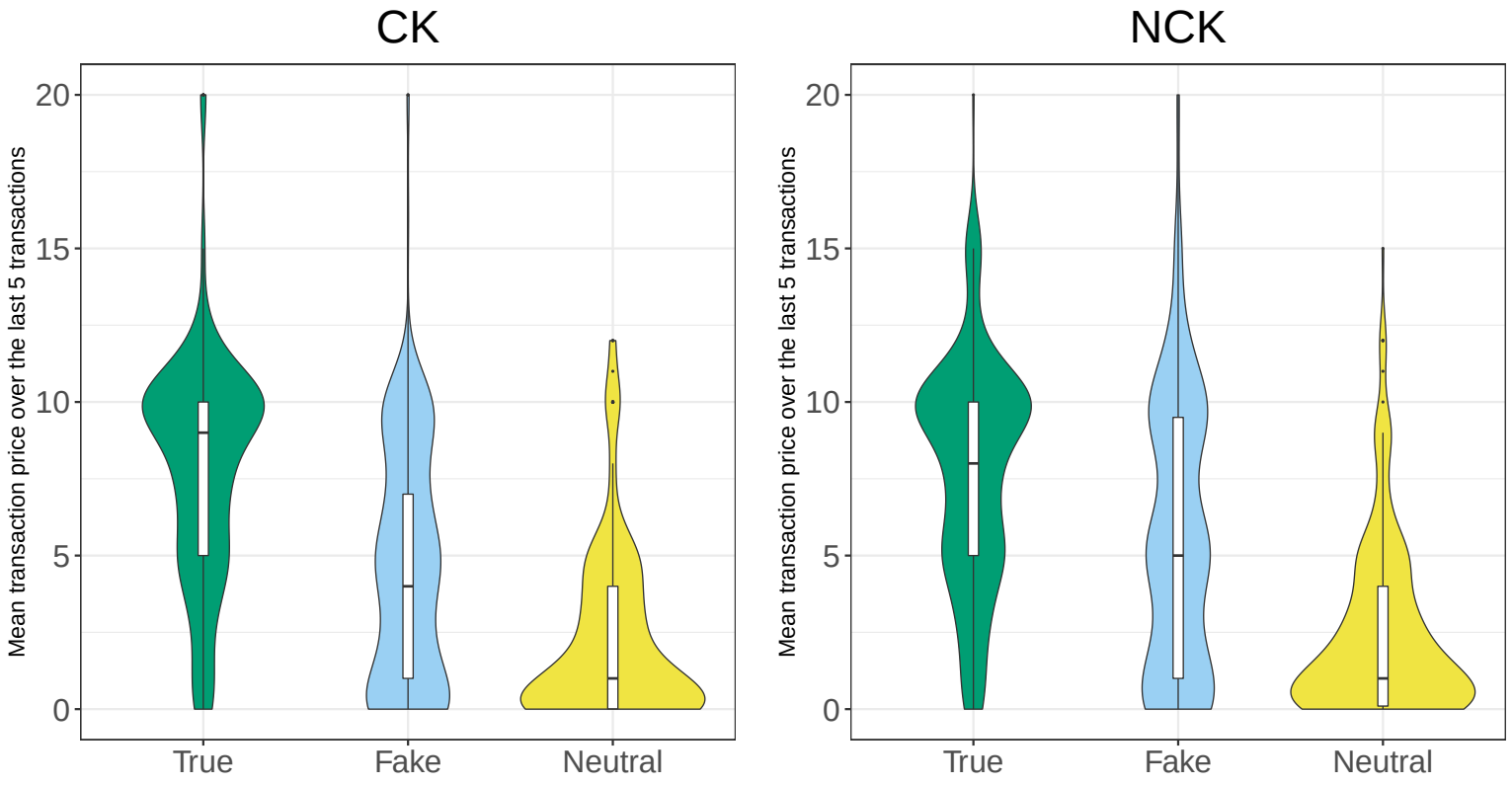
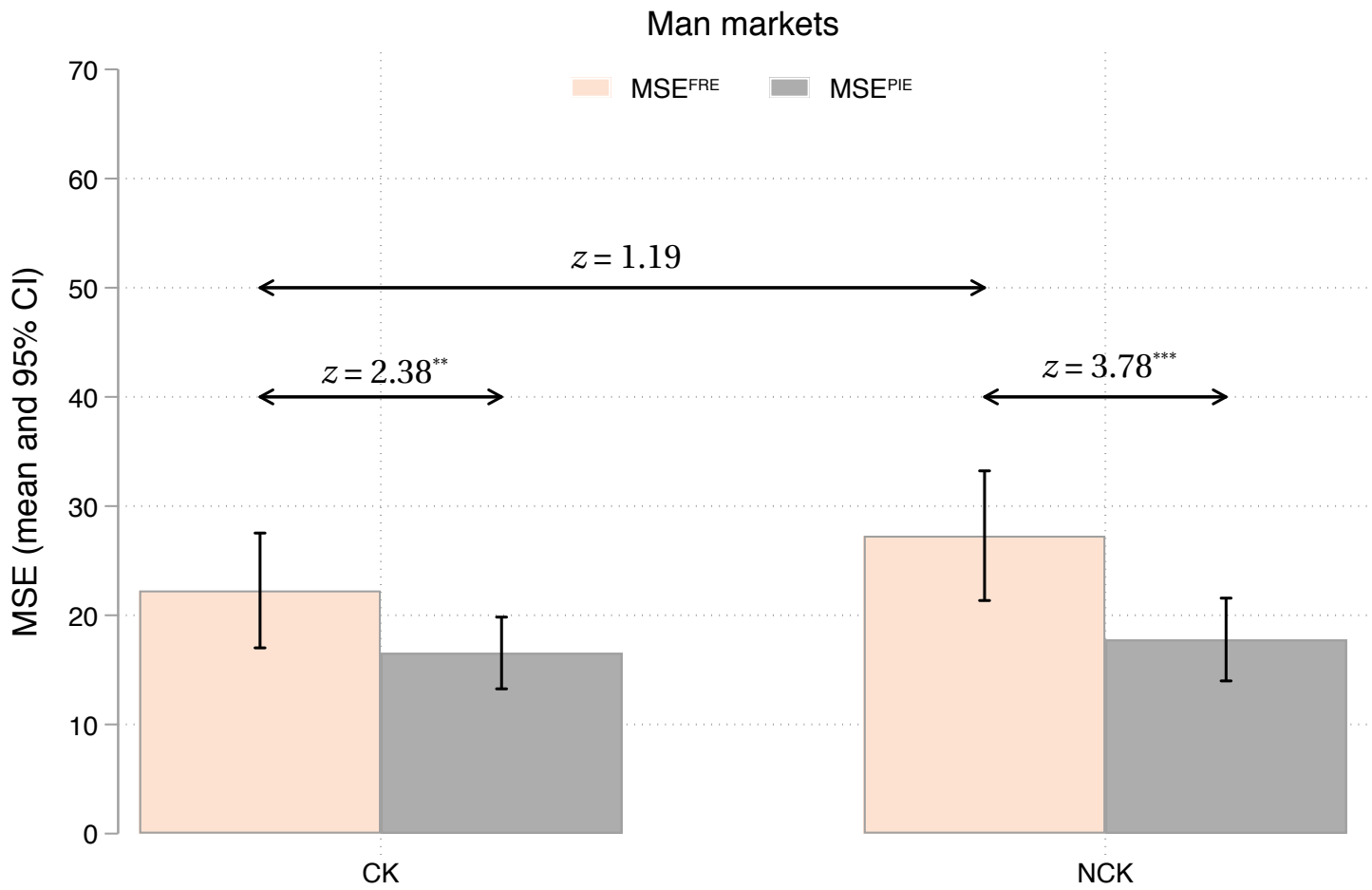
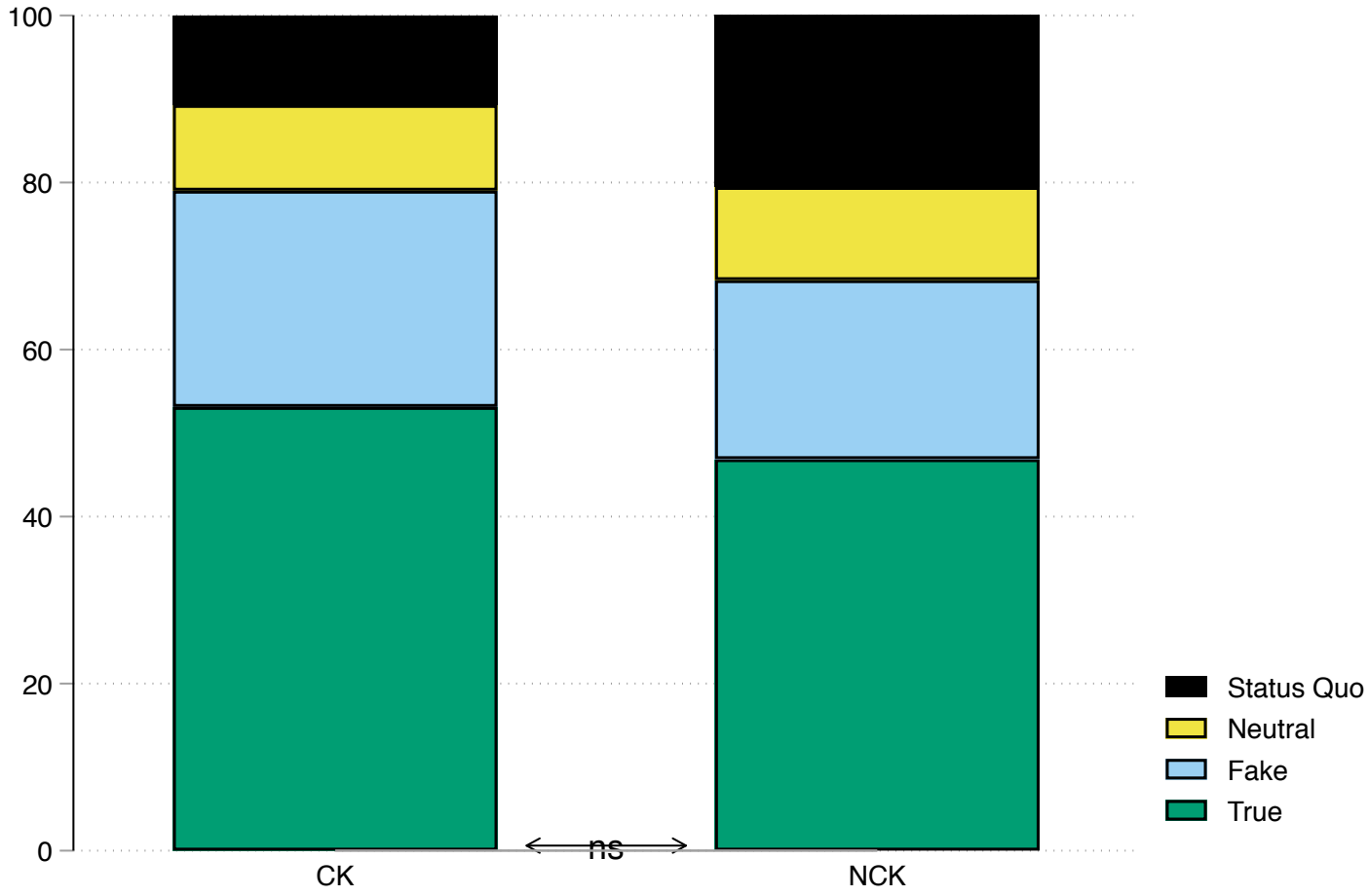


Equilibrium predictions: manipulators



Manipulators: voting



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Result 7

Manipulators are successful in manipulating around 25% of the votes.

Optimal voting

Do voters vote optimally?
We compare the possible payoff conditional on the voter being pivotal:

- Based on actual votes.
- Based on the following strategy:
  Vote for the policy associated with the highest observed price if the ratio of the second to the first price is less than α, and for the Status Quo otherwise. That is,

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$\Rightarrow$ Note that $\alpha = 1$ implies always voting based on the highest price (unless tied), and $\alpha = 0$ implies always voting for the status quo.

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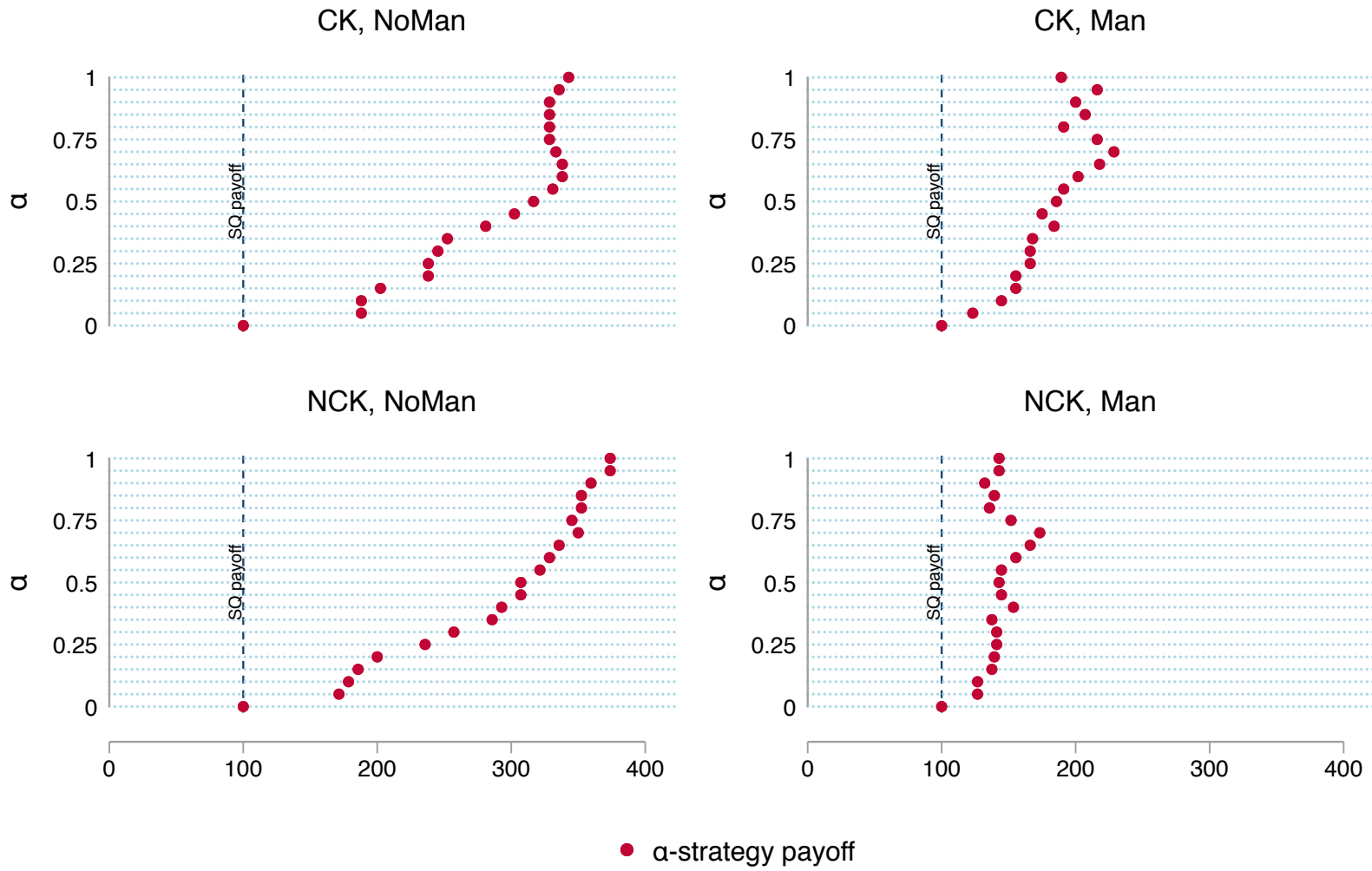

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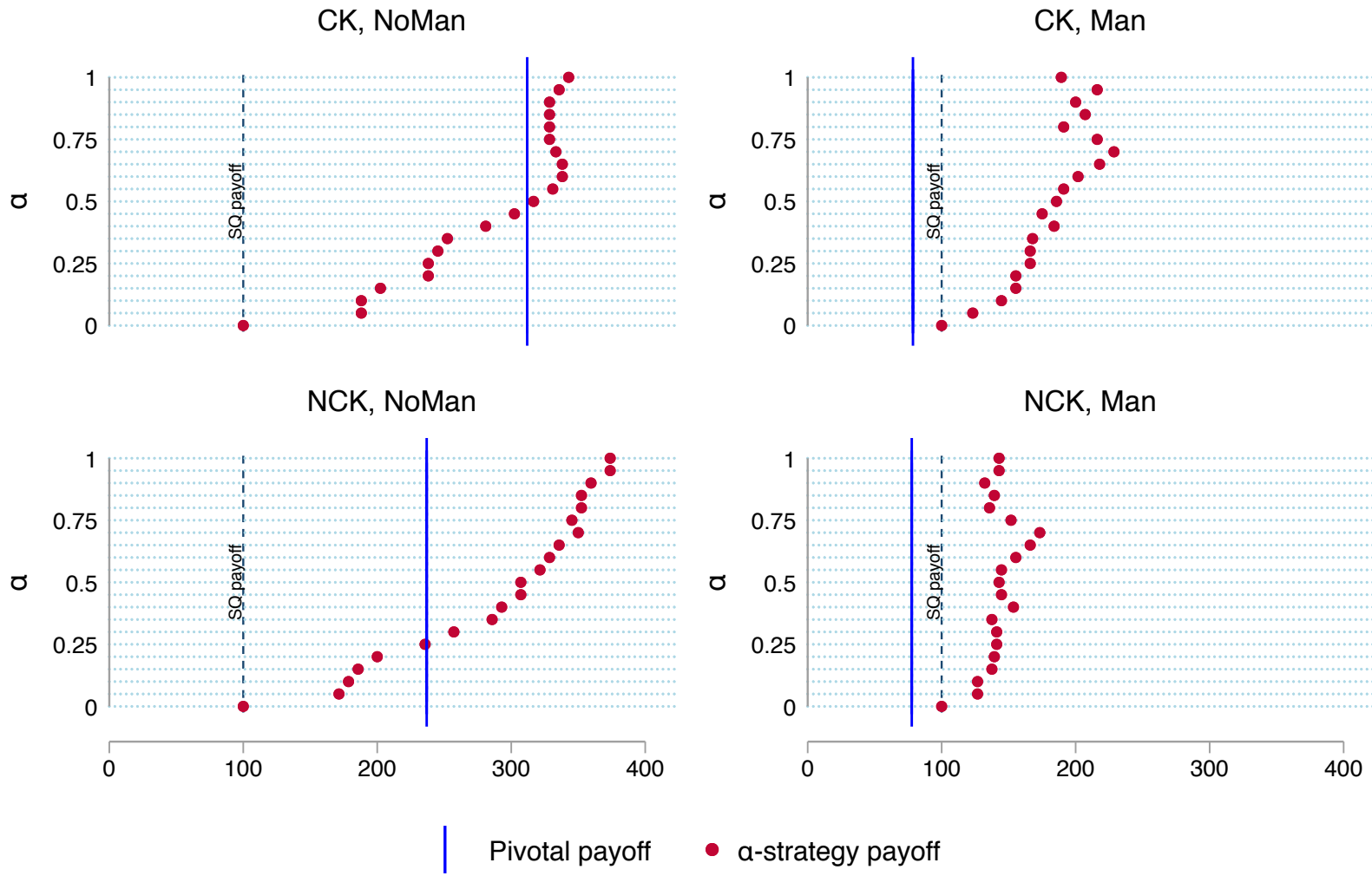

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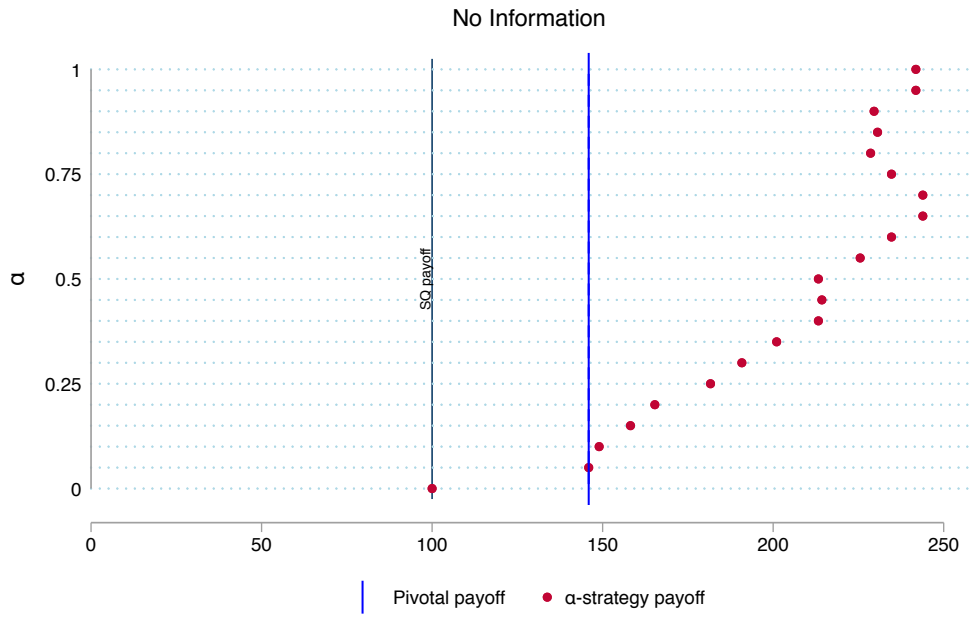

Optimal voting

Result 8

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Result 9

With manipulators, policy makers votes are suboptimal, and lead to worse outcomes than voting for the status quo.

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Mistrust in markets susceptible to manipulation leads to bad policy decisions!

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Thank you for your attention!