# Prediction and Antitrust: Prediction Markets

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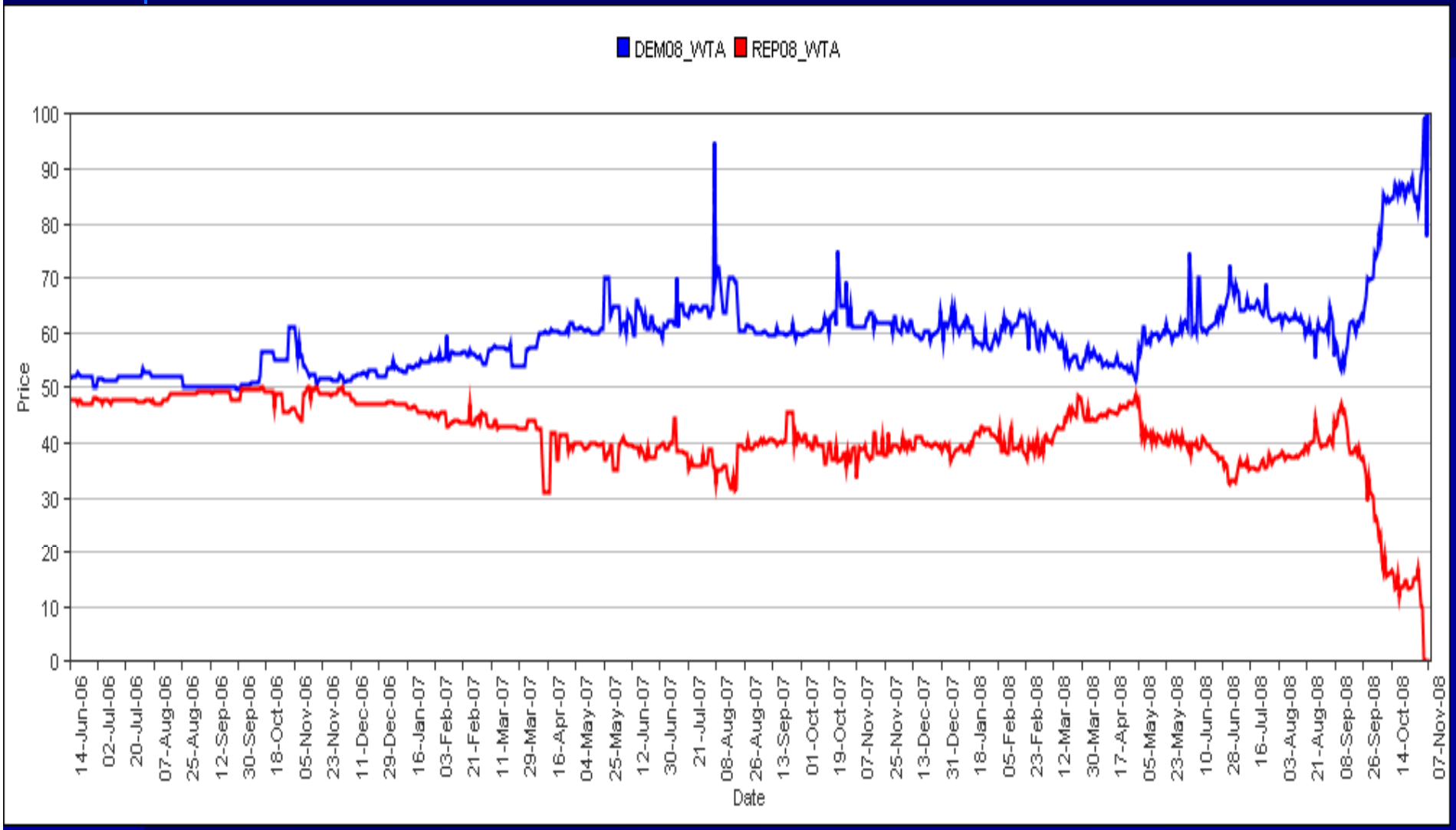
# Goals of project

- Thesis: Prediction markets are the best known way of *incentivizing* and *aggregating* predictions.
- Explain how prediction markets might be used in antitrust in three ways:
  - supporting decisions
  - predicting decisions
  - assessing decisions

# Prediction markets: The traditional design

- Traders can buy and sell shares whose payoff depends on some future event.
- Iowa Electronic Markets
  - Winner Take All market: Winning candidate's share pays off $1
  - Vote share market: Republican & Democratic shares pay off in proportion to fraction of two-party vote

# 2008 Winner-take-all



# Continuous double auction

- “Bid” queue contains offers to buy shares
- “Ask” queue contains offers to sell shares
- If trader enters an order to buy, it will either be:
  - matched based on most attractive offer on ask queue
  - or added to the bid queue
- Midpoint of bid and ask queues generally considered to be the instantaneous market forecast

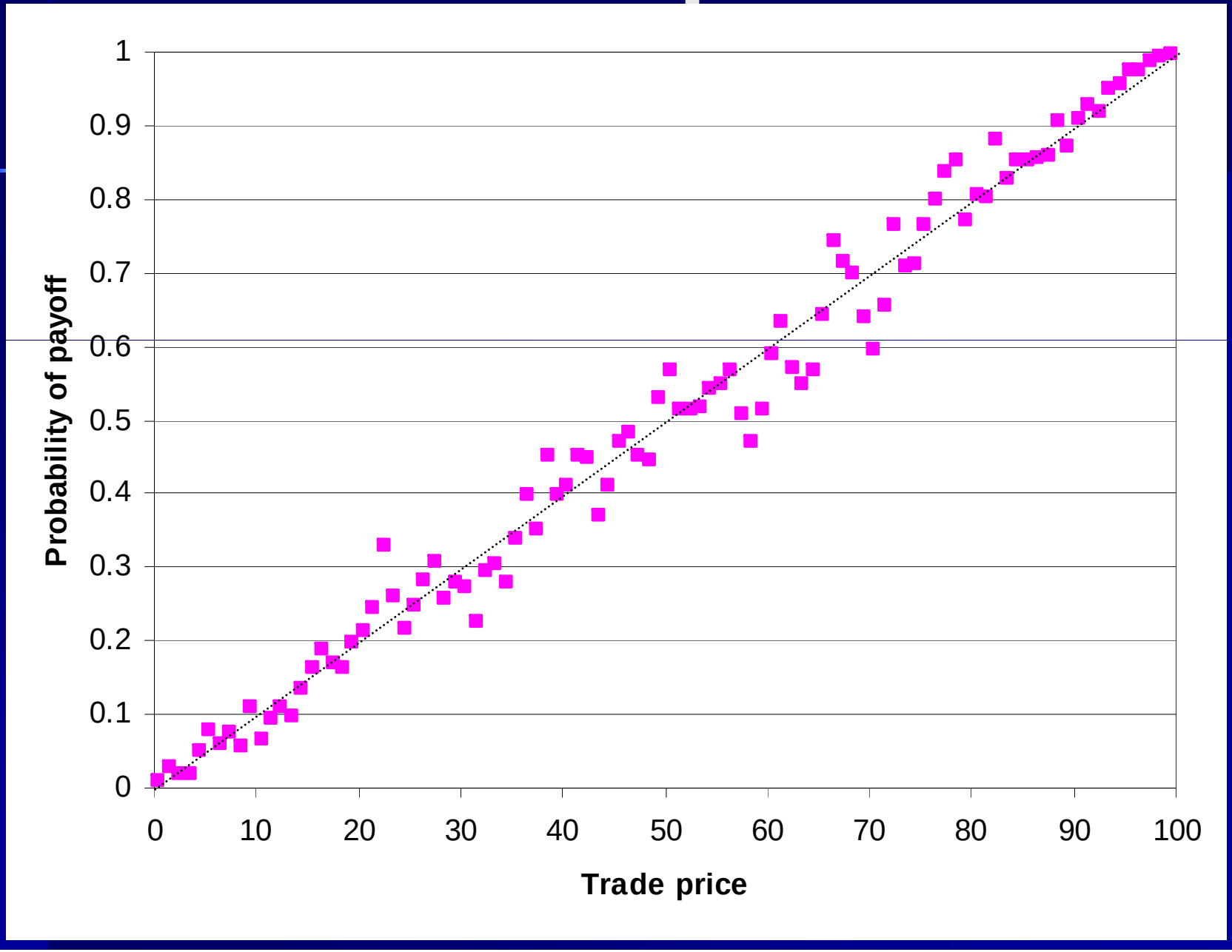
# Continuous double auction

| CONTRACT | BID | ASK | LAST |
|---|---|---|---|
| PRESIDENT.DEM2008 | 55.3 | 57.0 | 55.3 |
| PRESIDENT.REP2008 | 43.0 | 43.1 | 43.0 |
| PRESIDENT.FIELD2008 | 1.7 | 2.5 | 2.0 |

# Market accuracy

- Can’t judge by any single case; must look in aggregate
- Can we interpret prices as probabilities?

# 2005 MLB Tradesports



# Why use prediction markets to support decisions?

- Antitrust example
  - In assessing merger of XM and Sirius, one question was whether streaming music from cellphones would be a viable competitor.
  - Simple market: What percentage of music listening will be streamed on a cell phone in 2015?
- Objectivity
  - Eliminates cheap talk
- Incentives
  - May encourage search for or production of information
  - Draws those most confident of ability to make accurate predictions

# Market manipulation

- If markets affect policy, people will try to manipulate them.
- Literature indicates that attempts at manipulation
  - have short-run effects
  - but in the long term improve overall market accuracy by providing more profit potential.
- Manipulation can be successful on a particular contract only to the extent that someone's bluffing actual succeeds in fooling others.
- If I offer to bet $100 that the temperature will rise 5 degrees in 10 minutes, I might succeed in misleading others – but only because it is rational to place some epistemic weight on such offers.

# Subsidized markets

- Existing markets are mostly unsubsidized, making them zero sum games. That may work fine for predicting baseball scores or movie returns.
- For some applications (esp. boring ones like antitrust), subsidies may be necessary, and there are a variety of approaches to providing them.

# Overcoming low liquidity

- Many say that only some prediction markets will have sufficient liquidity to allow meaningful probability generation.
  - But subsidies can attract liquidity.
  - Moreover, automated market maker mechanisms provide another tool, allowing individuals to “trade” without finding someone to trade against
  - In effect, the house will enter into trades based on current prediction.
- In many real applications, we want a single expert or a handful of people to do a very careful analysis, but with strong financial incentives to get it right. Markets with automated market makers can find **wisdom in crowds**, not just wisdom of crowds.

# The market scoring rule

- Subsidized markets can increase participation and research incentives.
- Scoring rule: A formula for paying someone based on accuracy of prediction
  - Strictly proper scoring rule: Gives incentives to make accurate probability estimates
- Market scoring rule
  - Allows sequential predictions
  - Anyone can become new predictor by agreeing to pay off prior predictor according to scoring rule
  - Payment is based on degree to which one improves the prediction
  - Mathematically equivalent to an automated market maker, so it can look like a continuous double auction to the user

# Deliberative prediction market

- We might want to use a prediction market not just to generate a number, but to generate a *discussion*.
- Reward depends on degree to which one's movement of the market "sticks"
  - If previous prediction is 6, and I announce 8, but about a week later it is 7, then I break even.
  - Last predictor is rewarded based on a scoring rule
- Gives incentive to convince other market participants

# Predicting antitrust decisions

- Agency or court still makes ultimate decision.
- But market provides a numeric assessment and gives incentives for public to make arguments and expose the flaws in others' arguments.
- Sometimes, it might help decisionmakers to look at what others expect them to do.

# Why use prediction markets to predict decisions?

- If pool of decisionmakers is expected to be relatively good, then prediction itself will be of a good decision.
- Decisionmaker benefits from:
  - Numeric prediction
  - Arguments (in deliberative market)
- Public benefits by reputationally constraining decisionmaker, identifying arbitrary and idiosyncratic decisionmaking.

# Assessing decisions: Conditional markets

- Probably the most useful potential application in antitrust.
- Antitrust example: If this merger is approved, what will a basket of goods cost? What if the merger isn't approved?
- Predict B given A
- Simplest approach: Unwinding (cancel contracts corresponding to contingency that doesn't occur).

# Normative prediction markets

- Limitation of conditional markets
  - We must construct ex ante a measure that we think will be a proxy for the social consequences of the merger. What if this is not possible, for example because it is difficult to know what the goods and services even will be?
- Normative market
  - Forecast an assessment to be prepared in 10 years by someone in FTC about what, in retrospect, the net social benefits (costs) were or would have been to approving the merger.
- Benefits
  - Nonideological assessments
  - Improved manageability of vague standards

# The State of Prediction Markets

- State of prediction markets: Fairly primitive. Little use of automated market makers, conditional markets, or normative markets. Very little use of prediction markets in legal contexts.
- Even with further use, ultimately a prediction market is just a tool for determining what the apparently most informed, confident person thinks. This view is presumably influenced by the views and arguments of others, but prediction markets do not divide predictive tasks or encourage specialization in different types of analysis, all of which might be relevant to a particular prediction.
- Can prediction markets do more? That is, can a prediction market break down a predictive task instead of treating it as an atomic whole?

# The Future? A prediction web

- Sketch: Interconnected web of markets.
  - Some nodes are defined based on other nodes, with weights set by markets; “leaf nodes” are also markets.
  - E.g., might assess present discounted value of Fortune 500 corporations. All of these depend indirectly (some more than others) on future economic conditions, which may depend on factors like what legislation passes. Meanwhile, a number of corporations’ success might correlate (in some cases inversely) on the success of a particular product, which in turn might depend on a number of factors.
  - Change in one node automatically propagates to others. The goal is to create genuine wisdom of crowds, where we can produce predictions based on more factors than any one person could understand.
  - Long-term potential to revolutionize a field like antitrust by modeling its logic rather than just aggregating conclusions by people applying it.