SYMPOSIUM

Market Design, Manipulation, and Accuracy in Political Prediction Markets: Lessons from the Iowa Electronic Markets

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The Iowa Electronic Markets (IEM) are real-money, Internet-based futures markets where contract prices reveal information about events such as elections.[1] The IEM traded two contract sets for the 2012 US presidential election: (1) "vote-share" contracts that predicted popular vote-shares taken by the two major party candidates and (2) "winner-takes-all" contracts that predicted who would take the majority of this vote.[2]

The vote-share market contained two contracts: UDEM12_VS, paying $1 times the Democratic share of the two-party popular vote, and UREP12_VS, paying $1 times the Republican vote-share. A "unit portfolio" (one of each contract) always paid $1. This structure results in prices that reflect traders' expectations about vote shares and, therefore, forecast vote shares.

The winner-takes-all market contained two contracts: DEM12_WTA, paying $1 if the Democrat received more than 50% of the two-party popular vote, and REP12_WTA, paying $1 if the Republican received more than 50%. Again, the "unit portfolio" always paid $1. This structure means prices should reflect traders' expectations about who wins (in this sense) and, therefore, forecast winning probabilities.

Vote-share markets forecast something directly observable: actual vote shares. In contrast, winner-take-all markets forecast probabilities of events occurring. We can only observe whether events occur, not the true underlying probabilities. As a result, accuracy is typically measured using vote-share markets. The IEM has proven remarkably accurate. In contemporaneous comparisons to 964 national polls, the IEM was closer to the eventual election outcome 74% of the time (Berg, Nelson, and Rietz 2008). Figure 1 updates Berg, Forsythe, Nelson, and Rietz (2008) through the 2012 US presidential election, showing the Election-Eve forecasts and actual outcomes for all vote-share and similar IEM markets. The average absolute forecast error for US presidential elections is 1.13 percentage points. The errors for other US elections and foreign elections are 3.35 and 2.12 percentage points, respectively.

MANIPULATION

We discuss the possibility that deliberate market manipulation may affect accuracy and two IEM design features that discourage manipulation.

What is Manipulation?

Because prices are forecasts, effective price manipulation may affect the forecasting performance of prediction markets. Section 9(a)(2) of the 1934 Securities and Exchange Act (Securities and Exchange Commission 1934) defines price manipulation as: "To effect, alone or with 1 or more other persons, a series of transactions…raising or depressing the price of (a) security, for the purpose of inducing the purchase or sale of such security by others." This assumes that the manipulator unfairly profits by misleading other market participants. For example, a "pump and dump" strategy may involve disseminating false information about a stock and, possibly, driving up prices with a few strategic trades, to profit by selling the stock at artificially high prices. The manipulator's motivations and the direction he or she would want to move prices are clear.

This financial market intuition does not transfer easily to political prediction markets where manipulation is more involved than "hyping" a candidate or submitting a large trade that temporarily affects prices. In general, political prediction market manipulation is framed as influencing the election outcome. To be effective, the manipulator would have to know how price movements would affect the election outcome and then sustain artificial price levels.

Does Manipulation Have Predictable Effects?

In prediction markets, traders' profit motives encourage accurate price forecasts. Suppose a trader in the last election (correctly) believed that Obama would take 51.2% of the two-party popular vote, but observed a UDEM12_VS (Obama) price of $0.480. The trader could profit by $0.512-$0.480=$0.032 per contract by buying Obama contracts and holding them through the election. This would drive up the price, making it more accurate if expectations are correct. Research shows that price setting traders are relatively unbiased (e.g., Oliven and Rietz 2004). The causal relationship is that expectations about voter actions drive prices that forecast voter actions.

The causal logic underlying prediction market manipulation goes the opposite direction: market prices drive voter actions, affecting them in predictable ways (e.g., Rhode and Strumpf 2008). Thus, the tail (the relatively few IEM traders) wags the

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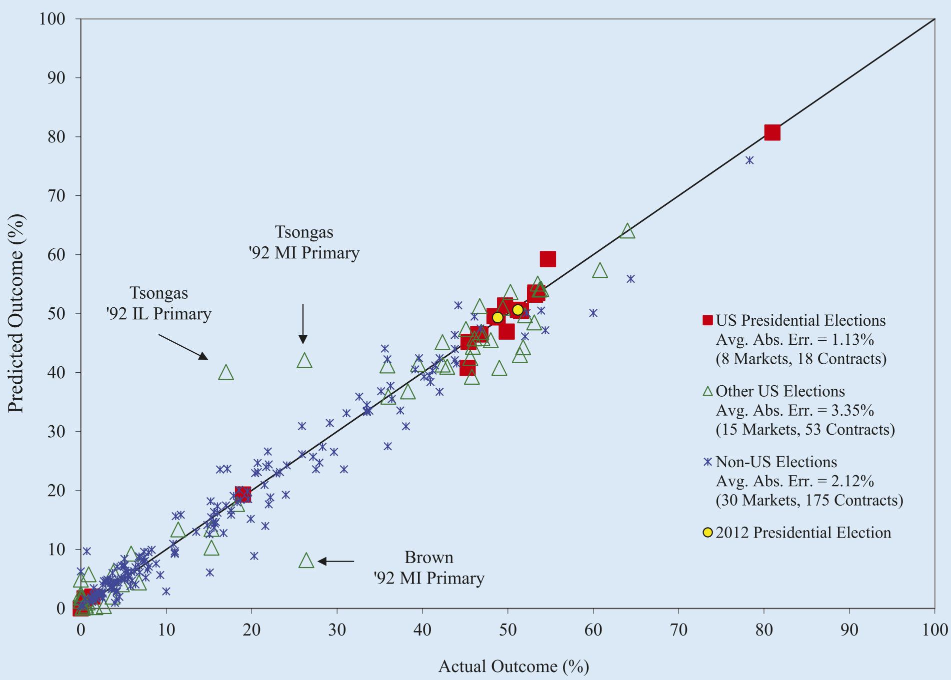
Figure 1

IEM Predicted versus Actual Outcomes for Vote-Share and Seat-Share Political Markets (Berg, Nelson, and Rietz 2008, updated through the 2012 US presidential election)



dog (the electorate).[3] The typical argument is that higher market prices increase that candidate's votes: a market-based "bandwagon" effect.[4] However, there is a long, unresolved debate on "bandwagon" and "underdog" effects in elections (starting with Simon (1954)). Bandwagon effect proponents argue that when voters expect a candidate to do better they are more likely to vote for that candidate. Underdog effect proponents argue the opposite: either supporters of a candidate expected to do well become complacent, failing to turn out, or supporters of a candidate expected to do poorly rally around the candidate.

Similar uncertainty holds true for close races. Relative to a 51%/49% lead, does a 52%/48% lead encourage or discourage turnout and, if so, for which candidate? Thus, it is unclear how "manipulating" markets affects eventual election outcomes, if at all.

This debate has a direct correlate in prediction markets. In the IEM 1996 US Presidential Vote-share Market, Clinton led Dole by substantial margins (up to 18.7 percentage points). Could this large forecast difference affect turnout? If so, would Dole voters give up and not turn out, benefiting Clinton, or would complacency lead to low Clinton voter turnout, benefiting Dole? Similar uncertainty holds true for close races. Relative to a 51%/49% lead, does a 52%/48% lead encourage or discourage turnout and, if so, for which candidate? Thus, it is unclear how "manipulating" markets affects eventual election outcomes, if at all.

Is Manipulation Possible?

Rhode and Strumpf (2008) state: "We find little evidence that political stock markets can be systematically manipulated beyond short time periods." Discussing attempts to change prices through large trades, Berg and Rietz (2006) state: "Evidence suggests, however, that prices recover quickly after large trades that do not correspond to actual changes in the prospects of candidates." Looking at the long run, they argue that "the fact that IEM prices appear to be accurate suggests that they are not manipulated successfully."[5] Two design features make long-run IEM manipulation challenging: account limits and unit portfolios.

Account limits

Individual IEM accounts are restricted to a $500 investment, with the restriction re-imposed each election cycle. This limits the size of individual traders relative to the market. In 2000, when Rhode and Strumpf (2008) report attempting to manipulate the market through random "large" orders, there were hundreds of active traders, more than 500,000 contracts traded, and $210,633 invested by traders with market access. A $500 account is extremely small relative to that market. Berg and Rietz (2006) report that Rhode and Strumpf's "large" orders were not actually large. Dozens of different traders submitted hundreds of orders that were larger than Rhode and Strumpf's. Thus, the size of the market and typical order sizes effectively undermine successful manipulation.

Unit portfolios

IEM "unit portfolios" make manipulation difficult. Consider the 2012 US presidential election. In many prediction markets (e.g., InTrade), the Obama and Romney markets were entirely separate, with bid and ask information displayed on separate screens and no

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Table 1

Arbitrage Free, Symmetric Bids and Asks

PANEL A: DISPLAYED INFORMATION

CONTRACT	BID	ASK
DEM12_WTA	$0.510	$0.520
REP12_WTA	$0.480	$0.490

PANEL B: ADDITIONAL INFORMATION

CONTRACT	BID	ASK	SYNTHETIC BID (1-CROSS ASK)	SYNTHETIC ASK (1-CROSS BID)
DEM12_WTA	$0.510	$0.520	$0.510	$0.520
REP12_WTA	$0.480	$0.490	$0.480	$0.490
Total	$0.990	$1.010	$0.990	$1.010

risk-free way to exploit inconsistent pricing directly.[6] In contrast, the IEM traded contracts for both candidates in a single market that included a risk-free method to exploit inconsistent pricing.

In the 2012 IEM winner-takes-all market, each contract (DEM12_WTA and REP12_WTA, representing Obama and Romney) paid off $1 if its candidate took the majority of the two-party popular vote. Traders could buy unit portfolios (one of each contract) from other traders at the sum of asks any time in one transaction. Similarly, they could sell unit portfolios at the sum of bids in one transaction. Traders could also trade unit portfolios directly with the exchange any time for $1. This creates an infinitely elastic portfolio supply and demand. It also creates an arbitrage relationship between bids and asks for the contracts that makes manipulation particularly difficult.

Table 1 shows a typical bid and ask configuration. Traders sell at bids and buy at asks (they see the information shown in panel A). Panel B contains additional information to show how unit portfolios make manipulation difficult. Traders can buy a unit portfolio from the exchange for $1 and sell at the sum of bids any time. Similarly, traders can buy at the sum of asks and sell to the exchange for $1. There are two ways to buy a contract: directly at the ask, or indirectly at the "synthetic ask." For instance, the direct purchase cost of an Obama contract is $0.52, the ask. The indirect cost reflects buying the portfolio for $1 and selling the Romney contract at the bid, a net cost of $1-$0.48=$0.52. We label this the Obama "synthetic ask." Similarly, there are two ways to sell an Obama contract: directly at the bid ($0.51), or indirectly by buying Romney at the ask and selling the unit portfolio for $1 (net price = $1-$0.49=$0.51). Here, the direct and synthetic prices for any given transaction equal each other.

Now consider a manipulator who wants to drive up Obama prices. In separate markets, all the manipulator needs to do is submit a higher bid for Obama or buy Obama until the ask moves. Unit portfolios complicate this. Suppose the manipulator bids up Obama shares to $0.53 and tries to sustain it by leaving a $0.53 bid in the queue. This creates an arbitrage opportunity. Any other trader could recognize a pure arbitrage profit of $0.53+$0.48-$1.00=$0.01 by buying the unit portfolio for $1 and selling at the sum of asks. There is an infinite supply of $1 portfolios and IEM data show that, when arbitrage violations arise, traders exploit them. Similar dynamics hold if a trader creates arbitrage opportunities by bidding up the other candidate or bidding down either candidate (so the sum of asks is less than $1). The manipulated prices do not stand long against the onslaught of arbitrageurs (Oliven and Rietz 2004).

Instead, suppose that a manipulator only wants to drive up the Obama bid to, say, $0.515. This would create the "asymmetric" bids and asks shown in table 2. If the spreads are

Table 2

Arbitrage Free, Asymmetric Bids and Asks

PANEL A: DISPLAYED INFORMATION

CONTRACT	BID	ASK
DEM12_WTA	$0.515	$0.520
REP12_WTA	$0.480	$0.490

PANEL B: ADDITIONAL INFORMATION

CONTRACT	BID	ASK	SYNTHETIC BID (1-CROSS ASK)	SYNTHETIC ASK (1-CROSS BID)
DEM12_WTA	$0.515	$0.520	$0.510	$0.520
REP12_WTA	$0.480	$0.490	$0.480	$0.485
Total	$0.995	$1.010	$0.990	$1.005

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tight,[7] this creates little price change while creating differences between the bid and synthetic bid for Obama and the ask and synthetic ask for Romney. These differences create price pressures against the manipulator. For Obama sellers, the bid ($0.515) exceeds the synthetic bid ($0.510), so sales will tend to trade against the manipulator's bid. For Romney buyers, the synthetic ask ($0.485) is less than the ask ($0.490). Thus, these traders will also tend to sell against the manipulator's bid. There is no such pressure on the other sides of the market because the synthetic and direct prices are the same.

Unit portfolios do not make manipulation impossible, just difficult. To move Obama's price up, a manipulator cannot simply invest resources to clear out Obama's ask queue (costing $0.52 or more for each unit in the queue) and maintain a higher bid. The manipulator also must clear out Romney's bid queue by buying unit portfolios and selling Romney shares (costing $1-$0.48=$0.52 or more for each unit in the queue) and maintain a lower ask level. This takes a coordinated effort that ties up double the resources (assuming symmetric bid and ask queues).

Combined with account limits, unit portfolios make manipulation particularly challenging. A manipulator who creates an arbitrage opportunity must hold it against completely unconstrained arbitragers. A manipulator who alters bid/ask queues must maintain these bids and asks against the profit motives of hundreds of other traders with hundreds of thousands of dollars.

CONCLUSIONS

If successful, manipulation could affect election prediction market forecasting accuracy. However, the motives for manipulation are not clear. Further, market design features can discourage and counter manipulation. Such features are important for prediction markets to remain viable forecasting tools.

We find little long-run evidence that the IEM can be successfully manipulated—attempts have transitory price effects at best. IEM account limits and unit portfolios make long-run manipulation particularly difficult. Unit portfolios create arbitrage restrictions that counter naïve manipulators. They force sophisticated manipulators to tie up substantial resources while providing other traders convenient ways to counter manipulation. ■

NOTES

1. See http://tippie.uiowa.edu/iem/ (accessed May 30, 2013) and numerous publications (e.g., Berg, Forsythe, Nelson, and Rietz 2008) for additional information.
2. See http://tippie.uiowa.edu/iem/markets/pres12.html (accessed May 30, 2013) for details.
3. Nearly 127 million people voted for the two major-party candidates in the 2012 US presidential election, relative to 197 active traders in the related IEM vote-share market.
4. This argument is in Rhode and Strumpf (2008) and motivates their examples and more general discussion. The exception to this is Hansen, Schmidt, and Strobel (2004) who argue that prices may lead to the "illusion" that it is possible to cast a deciding vote. However, the *directional* link between prices and vote shares remains unclear.
5. Accuracy may also result from extremely effective manipulation. Because Berg, Nelson, and Rietz (2003) document both short- and long-run IEM accuracy, this would require long-run manipulation. It would require other traders' best responses be to change the election outcome rather than trade against manipulation. We think this is unlikely.
6. In the IEM (and similar market), a "bid" is an offer to buy a contract at a specified price. Another trader can sell the contract immediately at this price to the bidder. An "ask" is an offer to sell a contract at a specified price. Another trader can buy the contract immediately at this price from the asker.
7. Spreads are usually tighter than this. For example, the median inside spreads were $0.003 and $0.004 in the 2000 U.S. Presidential Vote Share and Winner-Takes-All markets, respectively.

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