Parallels between Theory-Based Experiments in Political Science and Economics

Thomas Palfrey
Caltech

ESA
Tucson, AZ
11 11 11

Traditional View of Differences between Economics and Political Science

- Private vs. Public Decision Making
- Markets vs. Politics
- Money vs. Votes
- Transferable Utility vs. Non-transferable Utility
- Producers/Consumers vs. Candidates/Voters
- International Trade vs. International Relations

Parallel theoretical foundations

- The basic model of individual decision making is *homo economicus*
  - Bayes' rule
  - Selfish optimization
- The basic approach to predicting outcomes is based on equilibrium or stability.
  - The **core** as a predictive solution concept in competitive environments
  - Subgame perfect **Nash equilibrium** as a non-cooperative solution for games in extensive form.
  - Allows one to compare the effects of changing institutions (game forms)
- Can layer onto this basic approach nonstandard 'behavioral assumptions' for either political or economic models:
  - Disequilibrium approaches (e.g., level-k, adaptive learning)
  - Soft optimization (e.g., QRE)
  - Judgment fallacies (e.g., base-rate neglect, cursed equilibrium)
  - Social Preferences (e.g., altruism or inequality aversion, reciprocity)

Parallel Phenomena

- Auctions, markets, and voting institutions
  - Vote trading, logrolling, all pay auctions
- Competition
  - Candidates, Parties, Firms, Workers
- Monopoly and market power
  - Agenda control, dictatorship
- Information aggregation and rational expectations equilibrium
  - Polls, bandwagons
- Bargaining and compromise
  - Government formation, legislative bargaining, international conflict
- Public goods and free riding
  - Voter turnout, political participation, collective action
- Adverse selection in auctions and voting
  - Strategic voting and abstention, swing voter's curse
- Mechanism Design
  - Comparative politics, voting rules, organizations

Today's focus: Vote Trading

Two papers:

"Competitive Equilibrium in Markets for Votes" with Alessandra Casella and Aniol Llorente-Saguer

"Vote Trading With and Without Party Leaders" with Alessandra Casella and Sébastien Turban.

The two papers demonstrate how auction and market models of economic exchange can be applied in a natural way to study political exchange.

Part of a larger research program on mechanism design in the context of political institutions.

Competitive Equilibrium in Markets for Votes

Alessandra Casella, Columbia University, NBER
Aniol Llorente-Saguer, Max Planck Institute, Bonn
Thomas R. Palfrey, Caltech

ESA Tucson Lecture
November 11, 2011

- Majority Rule is widely used.
  - Robustness to different informational settings.
  - May's Theorem (May, 1952)
  - However... it **fails** to take into consideration **intensities**.

- Majority Rule is widely used.
  - Robustness to different informational settings.
  - May's Theorem (May, 1952)
  - However... it **fails** to take into consideration **intensities**.

- Example:
  - Max, Major, and Eve need to decide on a binary issue.

	Alternative M	Alternative E
Max	10	0
Major	12	0
Eve	0	30

- Majority Rule is widely used.
  - Robustness to different informational settings.
  - May's Theorem (May, 1952)
  - However... it **fails** to take into consideration **intensities**.

- Example:
  - Max, Major, and Eve need to decide on a binary issue.

	Alternative M	Alternative E
Max	10	0
Major	12	0
Eve	0	30

  - Majority rule outcome: M

- Majority Rule is widely used.
  - Robustness to different informational settings.
  - May's Theorem (May, 1952)
  - However... it **fails** to take into consideration **intensities**.

- Example:
  - Max, Major, and Eve need to decide on a binary issue.

	Alternative M	Alternative E
Max	10	0
Major	12	0
Eve	0	30

  - Majority rule outcome: M
  - Efficient outcome: E

- Possible solution... **vote markets?**
  - Buchanan and Tullock, 1962, Coleman, 1966, Haefele, 1971, Mueller, 1973, ...

- Distinction between:
  - logrolling (pure exchange)
  - **spot trading for money.**
- A **single** binary decision, made by majority rule.
- A **competitive market** for votes.
- Ignoring ethical concerns.

Conflicting claims:

1. A market for votes increases efficiency by expressing intensity.
2. Externalities might make a votes market inefficient.

But there is a prior issue one must address first:

- **What is the competitive equilibrium in a market for votes?**
- **How does one apply general equilibrium theory to a model of political exchange?**

A SIMPLE EXAMPLE

	Alternative M	Alternative E
Max	10	0
Major	12	0
Eve	0	30

	Alternative M	Alternative E
Max	10	0
Major	12	0
Eve	0	30

Existence Problem!

1. $p > 0$ and one voter has 3 votes. One vote is redundant. Excess supply.
2. $p > 0$ and one voter has 2 votes. One vote is worthless. Excess supply.
3. $p > 0$ and all have 1 vote. Either excess demand or supply.
4. $p = 0$. Excess demand.

There is no general model of decentralized vote markets for which a competitive equilibrium exists. These are pathological environments!

- Votes are indivisible.

There is no general model of decentralized vote markets for which a competitive equilibrium exists. These are pathological environments!

- Votes are indivisible.
- Externalities: Value of a vote depends on others' holdings

There is no general model of decentralized vote markets for which a competitive equilibrium exists. These are pathological environments!

- Votes are indivisible.
- Externalities: Value of a vote depends on others' holdings
- Public Goods

There is no general model of decentralized vote markets for which a competitive equilibrium exists. These are pathological environments!

- Votes are indivisible.
- Externalities: Value of a vote depends on others' holdings
- Public Goods
- No intrinsic value

There is no general model of decentralized vote markets for which a competitive equilibrium exists. These are pathological environments!

- Votes are indivisible.
- Externalities: Value of a vote depends on others' holdings
- Public Goods
- No intrinsic value
- Payoffs are discontinuous: Votes are worthless unless pivotal

There is no general model of decentralized vote markets for which a competitive equilibrium exists. These are pathological environments!

- Votes are indivisible.
- Externalities: Value of a vote depends on others' holdings
- Public Goods
- No intrinsic value
- Payoffs are discontinuous: Votes are worthless unless pivotal
- If one individual is pivotal then others are as well

There is no general model of decentralized vote markets for which a competitive equilibrium exists. These are pathological environments!

- Votes are indivisible.
- Externalities: Value of a vote depends on others' holdings
- Public Goods
- No intrinsic value
- Payoffs are discontinuous: Votes are worthless unless pivotal
- If one individual is pivotal then others are as well
- Non-satiation is violated

In this paper, we:

- Propose the concept of **Ex Ante Competitive Equilibrium.**
- Apply it to a vote market.
- Prove existence.
- Characterize the equilibrium properties
- Test the equilibrium concept in a lab experiment.

The Environment

- A committee of N (odd) voters, deciding between two alternatives, A and B.

The Environment

- A committee of N (odd) voters, deciding between two alternatives, A and B.
- Each voter prefers A with probability $\frac{1}{2}$ and is endowed with 1 indivisible vote.

The Environment

- A committee of N (odd) voters, deciding between two alternatives, A and B.
- Each voter prefers A with probability $\frac{1}{2}$ and is endowed with 1 indivisible vote.
- Voter i attributes value $v_i \in [0, 1]$ to his preferred alternative.

The Environment

- A committee of N (odd) voters, deciding between two alternatives, A and B.
- Each voter prefers A with probability $\frac{1}{2}$ and is endowed with 1 indivisible vote.
- Voter i attributes value $v_i \in [0, 1]$ to his preferred alternative.
- v_i is privately known

The Decision Procedure

- Two stages:
  1. Voters can buy votes from each other using the numeraire
  2. Voters cast their votes, if any, for their preferred alternative

The Decision Procedure

- Two stages:
  1. Voters can buy votes from each other using the numeraire
  2. Voters cast their votes, if any, for their preferred alternative
- The decision is taken according to the majority of votes cast

The Decision Procedure

- Two stages:
  1. Voters can buy votes from each other using the numeraire
  2. Voters cast their votes, if any, for their preferred alternative
- The decision is taken according to the majority of votes cast
- Ties are resolved by a coin flip

Preferences and Demands

- Each voter's net demand for votes belongs to the set $S_i = \{ s \in \mathbb{Z} | \, s \geq -1 \}$
- The set of feasible *mixed* demands of voter i is the set of probability measures on S_i, denoted Σ_i

Preferences and Demands

- Each voter's net demand for votes belongs to the set $S_i = \{ s \in \mathbb{Z} | \, s \geq -1 \}$
- The set of feasible *mixed* demands of voter i is the set of probability measures on S_i, denoted Σ_i
- A rationing rule $\Re$ maps voters' demands to a feasible allocation of votes $X = \left\{ x \in \mathbb{Z}_+^n \middle| \sum x_i = N, x_i \geq 0 \right\}$.

Preferences and Demands

- Each voter's net demand for votes belongs to the set $S_i = \{ s \in \mathbb{Z} | \, s \geq -1 \}$
- The set of feasible *mixed* demands of voter i is the set of probability measures on S_i, denoted Σ_i
- A rationing rule $\Re$ maps voters' demands to a feasible allocation of votes $X = \left\{ x \in \mathbb{Z}_+^n \middle| \sum x_i = N, x_i \geq 0 \right\}$.
- Ex post utility equals: $u_i = v_i l_w - (x_i - 1) \, p$
- $U_i \left(\sigma, \Re, p \right)$ is ex ante utility, given p, an action profile σ, and the rationing rule $\Re$.

The Equilibrium: Definition

- The set of demands σ^* and price p^* constitute an **Ex Ante Competitive Equilibrium** relative to rationing rule $\Re$ if:

  1. **Expected** utility maximization: For each agent i, σ_i^* satisfies

$$\sigma_i^* \in \underset{\sigma_i \in \Sigma_i}{\arg Max} U_i \left(\sigma_i, \sigma_{-i}^*, \Re, p^*\right)$$

The Equilibrium: Definition

- The set of demands σ^* and price p^* constitute an **Ex Ante Competitive Equilibrium** relative to rationing rule $\Re$ if:

  1. **Expected** utility maximization: For each agent i, σ_i^* satisfies

  $$\sigma_i^* \in \underset{\sigma_i \in \Sigma_i}{\arg Max} U_i \left(\sigma_i, \sigma_{-i}^*, \Re, p^*\right)$$

  2. **Expected** market clearing: In expectation, the market clears:

  $$\sum_{s \in S} q_{\sigma^*}(s) \sum_{i=1}^{n} s_i = 0$$

Proposition 1

- For all n and $\{v_1, ..., v_n\}$ there exists an Ex Ante Vote-Trading Equilibrium with positive trade where
  - Voters 1 to $n-2$ offer to sell their vote with probability 1;
  - Voters $n-1$ and n demand $\frac{n-1}{2}$ votes with probabilities γ_{n-1} and γ_n respectively, and offer their vote otherwise.

The paper considers one commonly-used rationing rule (all-or-nothing), but one can use other rules with similar results.

Equilibrium Properties

1. The only actions that in equilibrium are selected with positive probability are either -1 or $\frac{n-1}{2}$.
2. Any votes market outcome where trade occurs always results in dictatorship.
3. Rationing occurs with probability 1.

Return to simplified example, where sides are known. Similar equilibrium properties.

	Alternative M	Alternative E
Max	10	0
Major	12	0
Eve	0	30

What is the ex ante equilibrium?

Return to simplified example, where sides are known. Similar equilibrium properties.

	Alternative M	Alternative E
Max	10	0
Major	12	0
Eve	0	30

What is the ex ante equilibrium?

1. $p = v2/2 = 12/2 = 6$

Return to simplified example, where sides are known. Similar equilibrium properties.

	Alternative M	Alternative E
Max	10	0
Major	12	0
Eve	0	30

What is the ex ante equilibrium?

1. $p = v2/2 = 12/2 = 6$
2. Max's demand: $= -1$ (supply one vote)

Return to simplified example, where sides are known. Similar equilibrium properties.

	Alternative M	Alternative E
Max	10	0
Major	12	0
Eve	0	30

What is the ex ante equilibrium?

1. $p = v2/2 = 12/2 = 6$
2. Max's demand: $= -1$ (supply one vote)
3. Eve's demand: $= 1$ (demand one vote)

Return to simplified example, where sides are known. Similar equilibrium properties.

	Alternative M	Alternative E
Max	10	0
Major	12	0
Eve	0	30

What is the ex ante equilibrium?

1. $p = v2/2 = 12/2 = 6$
2. Max's demand: $= -1$ (supply one vote)
3. Eve's demand: $= 1$ (demand one vote)
4. Major's demand: mix equally between -1 and 1

For most parameters, only the second highest valuation voter mixes.

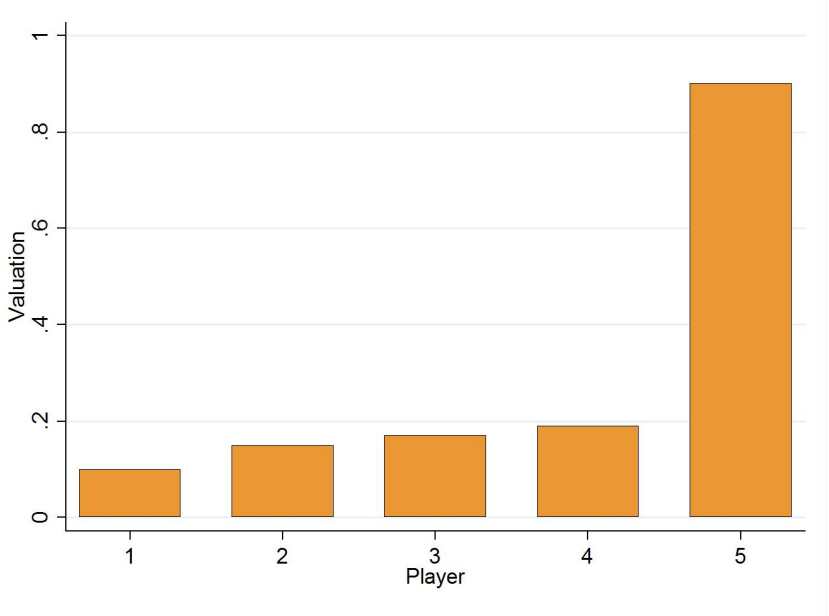
For most parameters, only the second highest valuation voter mixes.

- For all n, there exists a finite threshold $\mu_n \geq 1$ such that if $v_n > \mu_n v_{n-1}$, then
  - $\gamma_{n-1} = \frac{n-1}{n+1}$
  - $\gamma_n = 1$
  - $p = \frac{v_{n-1}}{n+1}$.
- The parameters used in the experiment fullfill $v_n > \mu_n v_{n-1}$.

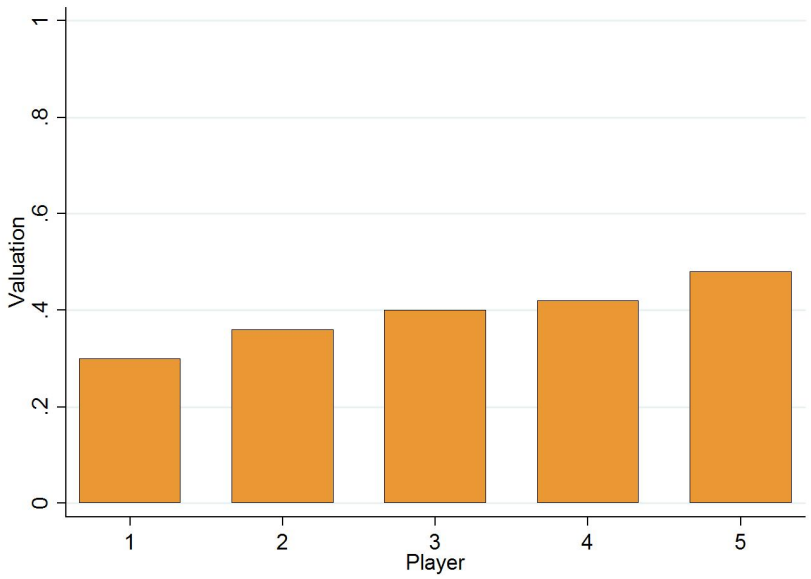
- How do vote markets compare to Majority Rule?

- How do vote markets compare to Majority Rule?
- Purely utilitarian welfare perspective
  - Assigning decision power to one voter with highest valuation can be welfare improving.

- How do vote markets compare to Majority Rule?
- Purely utilitarian welfare perspective
  - Assigning decision power to one voter with highest valuation can be welfare improving.



- How do markets compare to Majority Rule?
- From a purely utilitarian welfare perspective
  - Assigning decision power to one voter with highest valuation can be welfare improving.
  - Ignoring the will of all but highest valuation is unlikely to be desirable.



Proposition 2

- For any sequence of well-behaved distributions F_n, there exists $\overline{n}$ such that if $n > \overline{n}$, $W_{MR} > W_{VM}$.

- How can we test the theory?
- In the field...
  - We don't know the preferences of voters/legislators
  - Cannot directly control for other confounding factors such as budget constraints, influence of third parties, ...
  - Illegal in many settings, so hard to find data
  - One promising possibility: Voting shares of firms are bought and sold in financial markets.
- In the lab instead...
  - We control for preferences
  - Avoid confounding factors

- Experiments were conducted at Caltech (SSEL)
- Interactions among subjects were computerized (Multistage)
- "Naive subjects". No subject participated in more than one session.

- Experiments were conducted at Caltech (SSEL)
- Interactions among subjects were computerized (Multistage)
- "Naive subjects". No subject participated in more than one session.
- 8 sessions were run in total, 4 with $N = 5$ and 4 with $N = 9$.

- Subjects were randomly assigned to be in favor of X or Y
- They were assigned privately known valuations $v_i \in (0, 1000]$
- All subjects were endowed with one vote.
- Continuous multiunit open book market.

Standard Trading Mechanism: Multiple-Unit Open-Book Computerized Double Auction

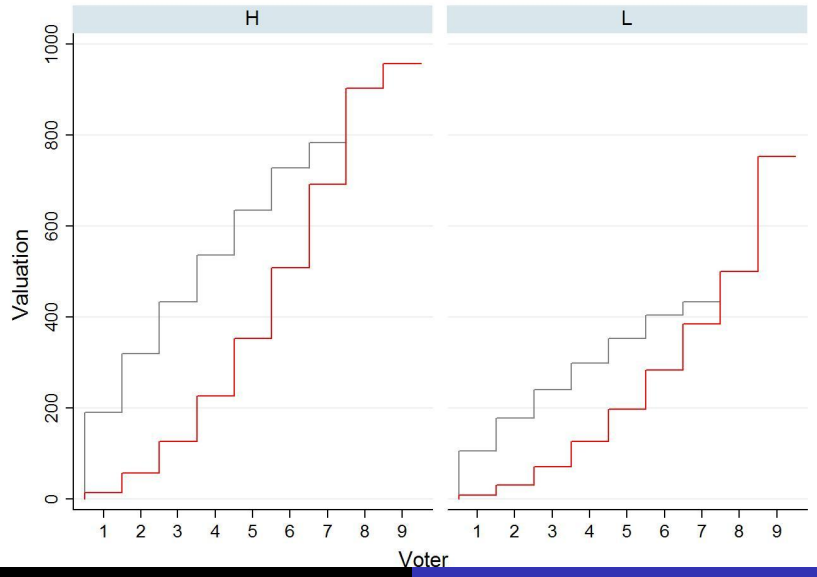
- Orders (bids or offers) allowed at any time, for one or multiple votes.
- New orders did not cancel outstanding orders. But orders could be canceled at any time.
- Computer screens showed and updated (i) outstanding orders; (ii) the number of votes held by each subject.
- Initial loan of 10,000 points. Cash holdings were updated and no purchase with negative balance was allowed.
- Subjects could not short-sell votes.

Standard Trading Mechanism: Multiple-Unit Open-Book Computerized Double Auction

- Orders (bids or offers) allowed at any time, for one or multiple votes.
- New orders did not cancel outstanding orders. But orders could be canceled at any time.
- Computer screens showed and updated (i) outstanding orders; (ii) the number of votes held by each subject.
- Initial loan of 10,000 points. Cash holdings were updated and no purchase with negative balance was allowed.
- Subjects could not short-sell votes.
- 2 minute trading stage (continuous double auction)
- After the trade stage, committee decision by majority rule.

Parameters and design:

- Each committee traded in four different markets in different sequences
- Each market was repeated five times
- 2 x 2 set of valuations: $\{High, Low\} \times \{Top, Bottom\}$
- $\{High, Low\}$ refers to value of v_{n-1}
- $\{Top, Bottom\}$ refers to skewed up or down (same v_{n-1})



Design of sessions

	Match			
Session	1	2	3	4
1	HT	LB	HB	LT
2	LT	HB	LB	HT
3	HB	LT	HT	LB
4	LB	HT	LT	HB

- Four sessions with $n = 5$, four sessions with $n = 9 \Longrightarrow 56$ subjects.
- Caltech undergraduates; June 2009.
- Average length: 75 minutes, average payoff: \$29.

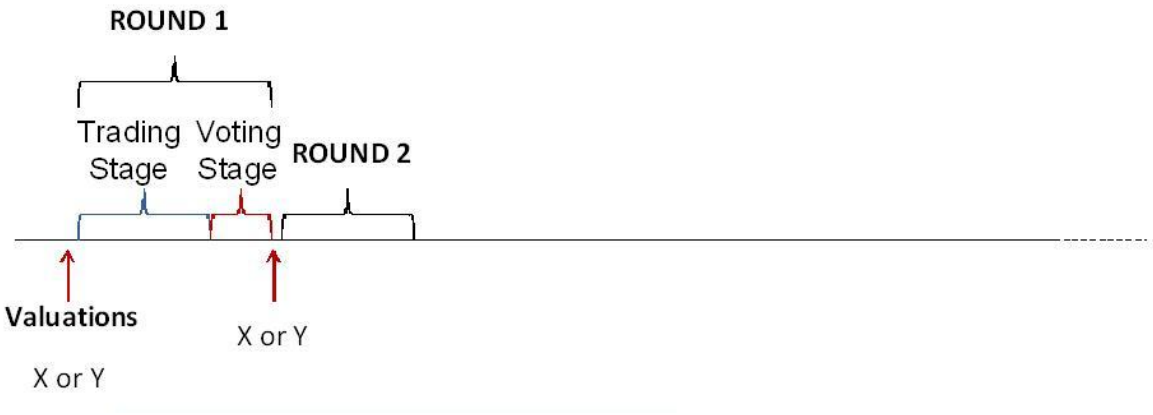

Valuations
X or Y

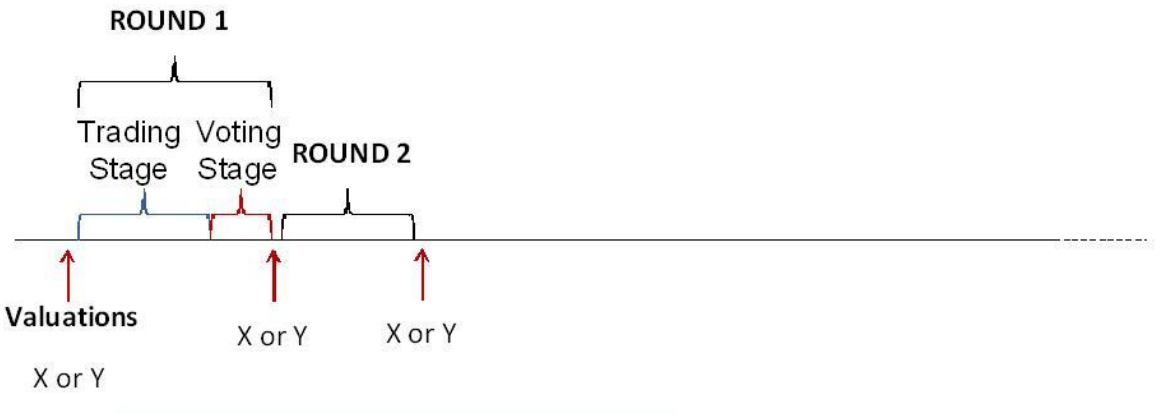

Trading
Stage
Valuations
X or Y

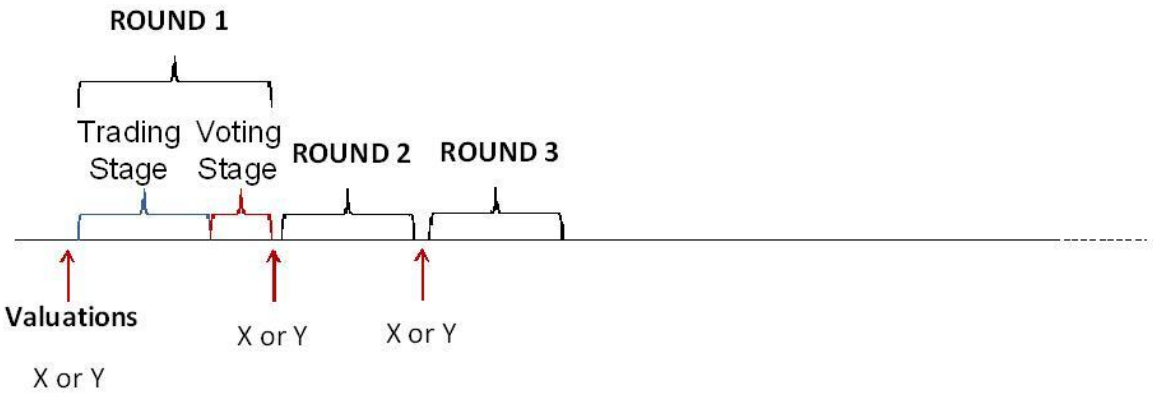

Trading Stage
Voting Stage
Valuations
X or Y

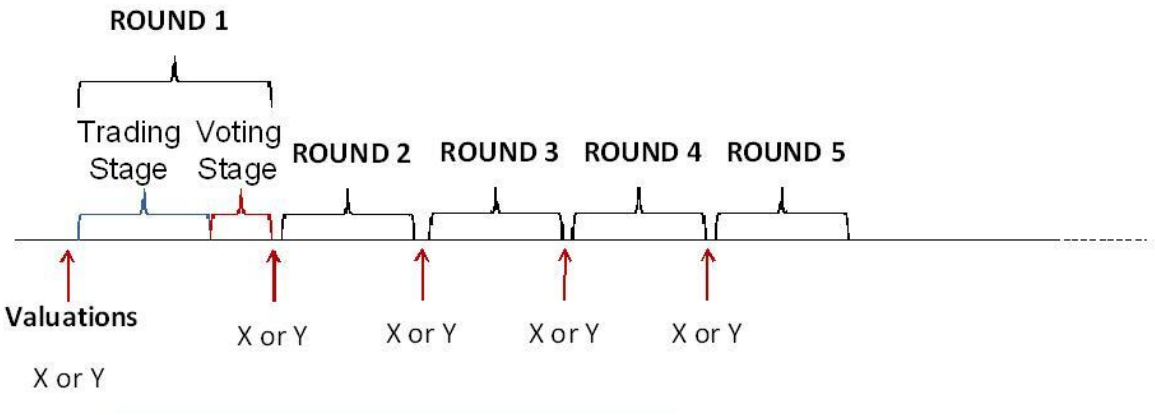

ROUND 1
Trading Stage
Voting Stage
Valuations
X or Y

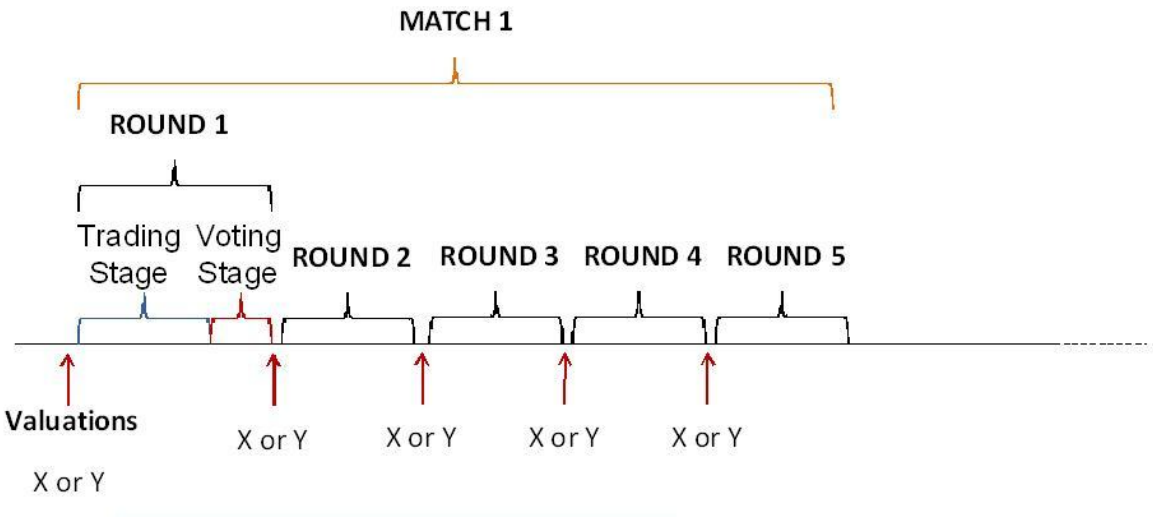

ROUND 1
Trading Stage
Voting Stage
Valuations
X or Y
X or Y

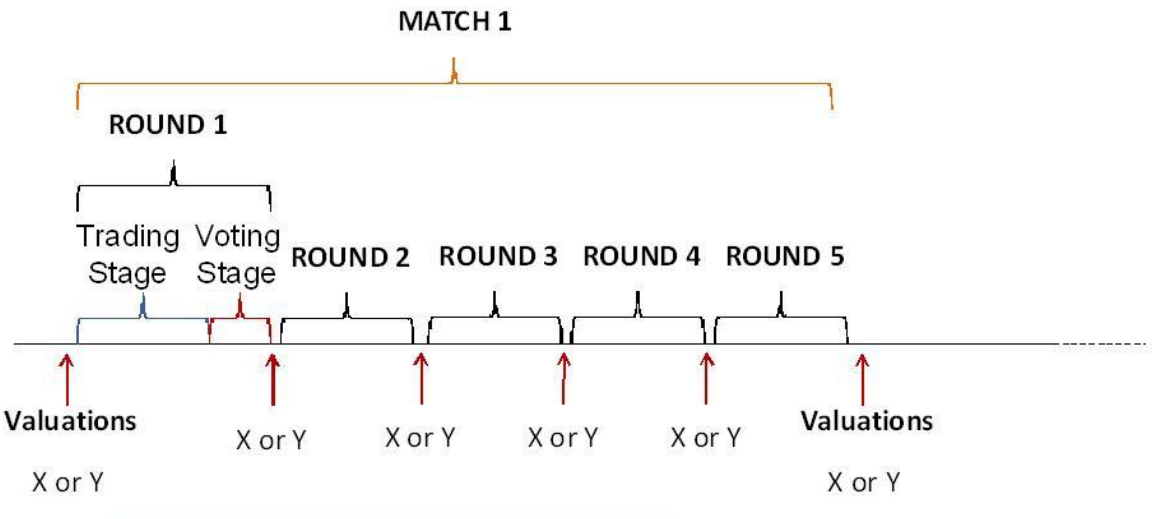

ROUND 1
Trading Stage
Voting Stage
ROUND 2
Valuations
X or Y
X or Y

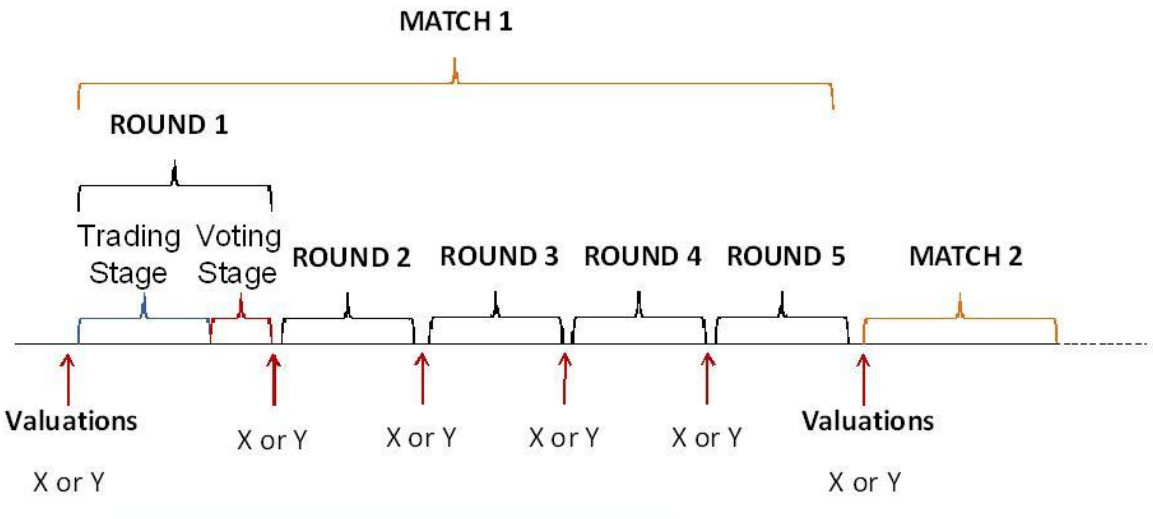

ROUND 1
Trading Stage
Voting Stage
ROUND 2
Valuations
X or Y
X or Y
X or Y

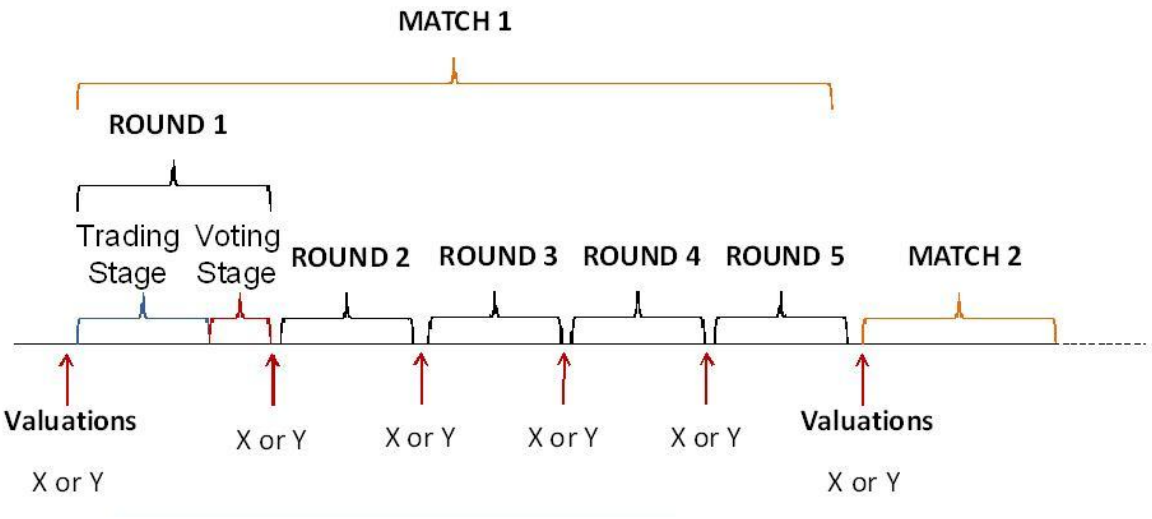

ROUND 1
Trading Stage
Voting Stage
ROUND 2
ROUND 3
Valuations
X or Y
X or Y
X or Y


ROUND 1
Trading Stage
Voting Stage
ROUND 2
ROUND 3
ROUND 4
ROUND 5
Valuations
X or Y
X or Y
X or Y
X or Y
X or Y
X or Y

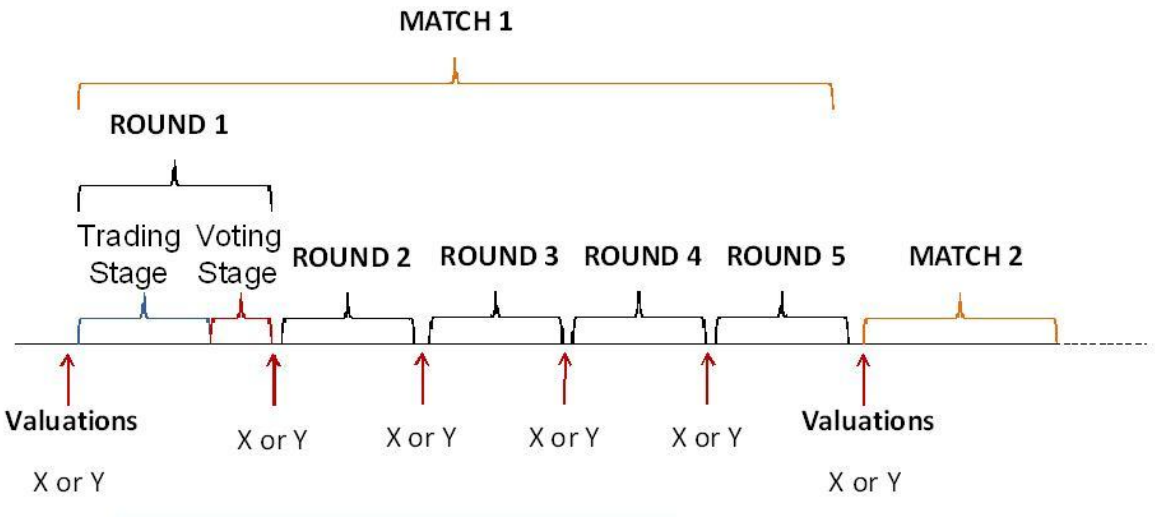

MATCH 1
ROUND 1
Trading Stage
Voting Stage
ROUND 2
ROUND 3
ROUND 4
ROUND 5
Valuations
X or Y
X or Y
X or Y
X or Y
X or Y
X or Y


MATCH 1
ROUND 1
Trading Stage
Voting Stage
ROUND 2
ROUND 3
ROUND 4
ROUND 5
Valuations
X or Y
X or Y
X or Y
X or Y
X or Y
X or Y
Valuations
X or Y

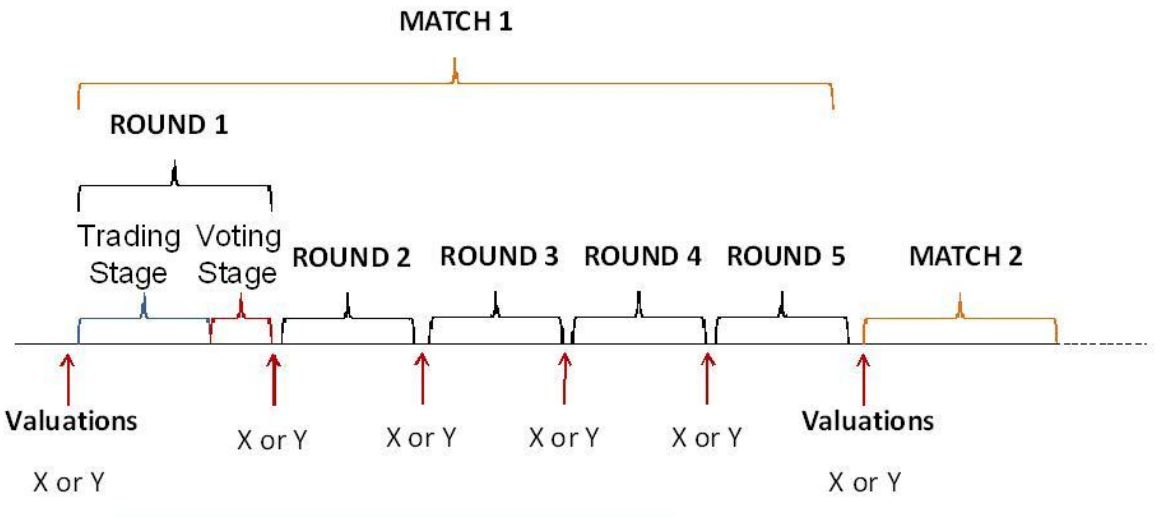

MATCH 1
ROUND 1
Trading Stage
Voting Stage
ROUND 2
ROUND 3
ROUND 4
ROUND 5
MATCH 2
Valuations
X or Y
X or Y
X or Y
X or Y
X or Y
X or Y
Valuations
X or Y



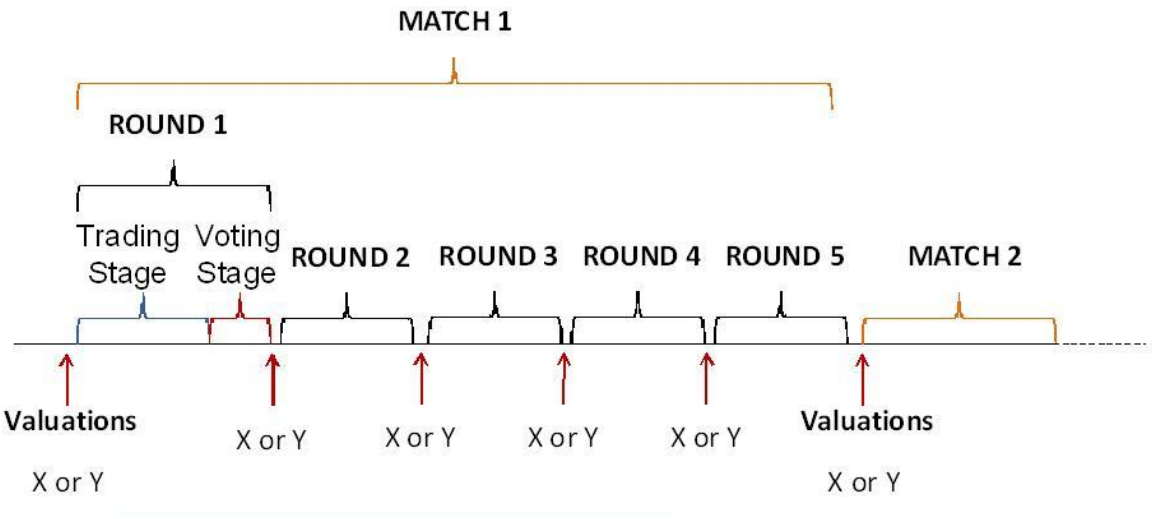
- Committees traded during four different matches



- Committees traded during four different matches
- Each match had different market parameters

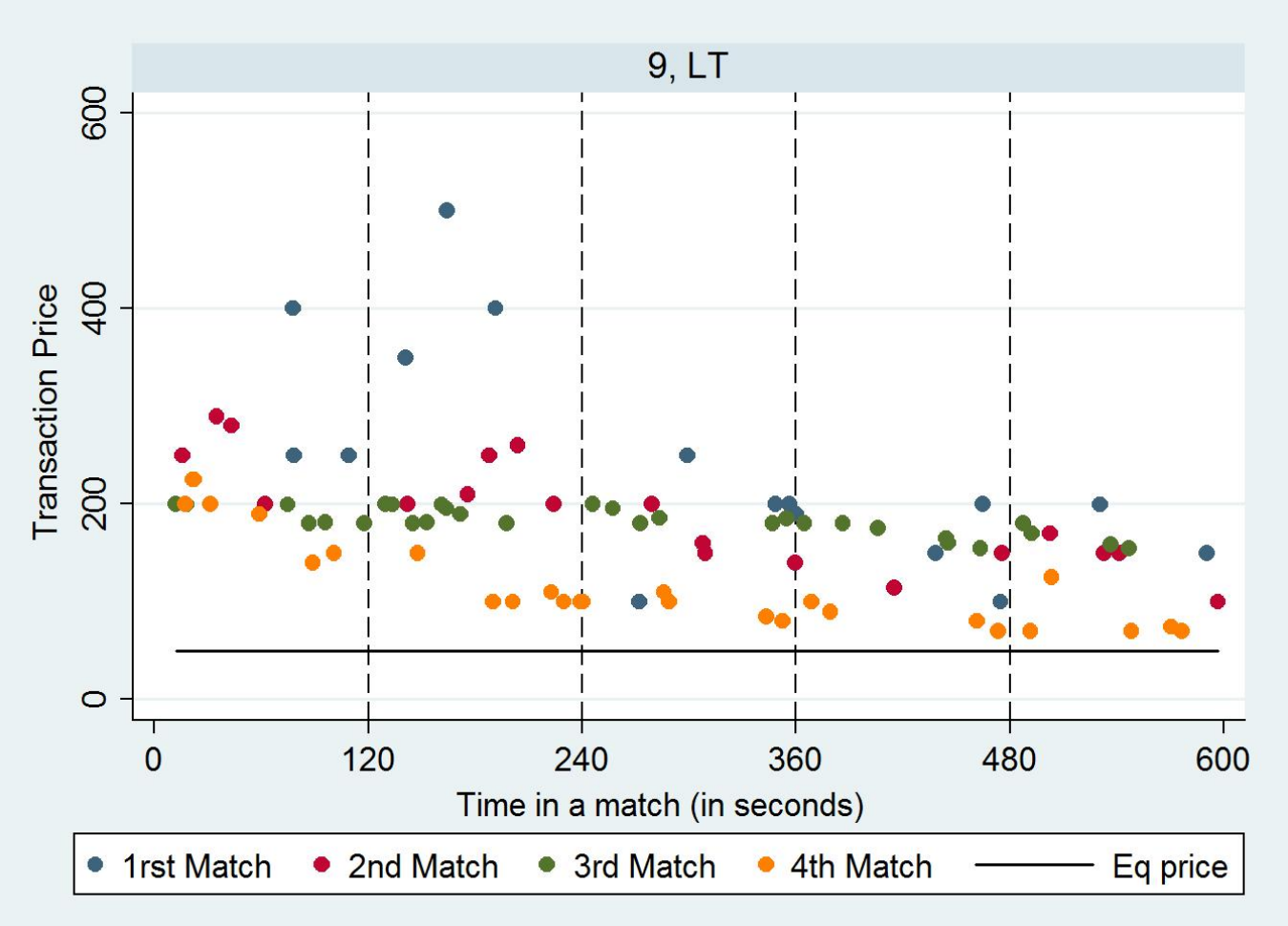


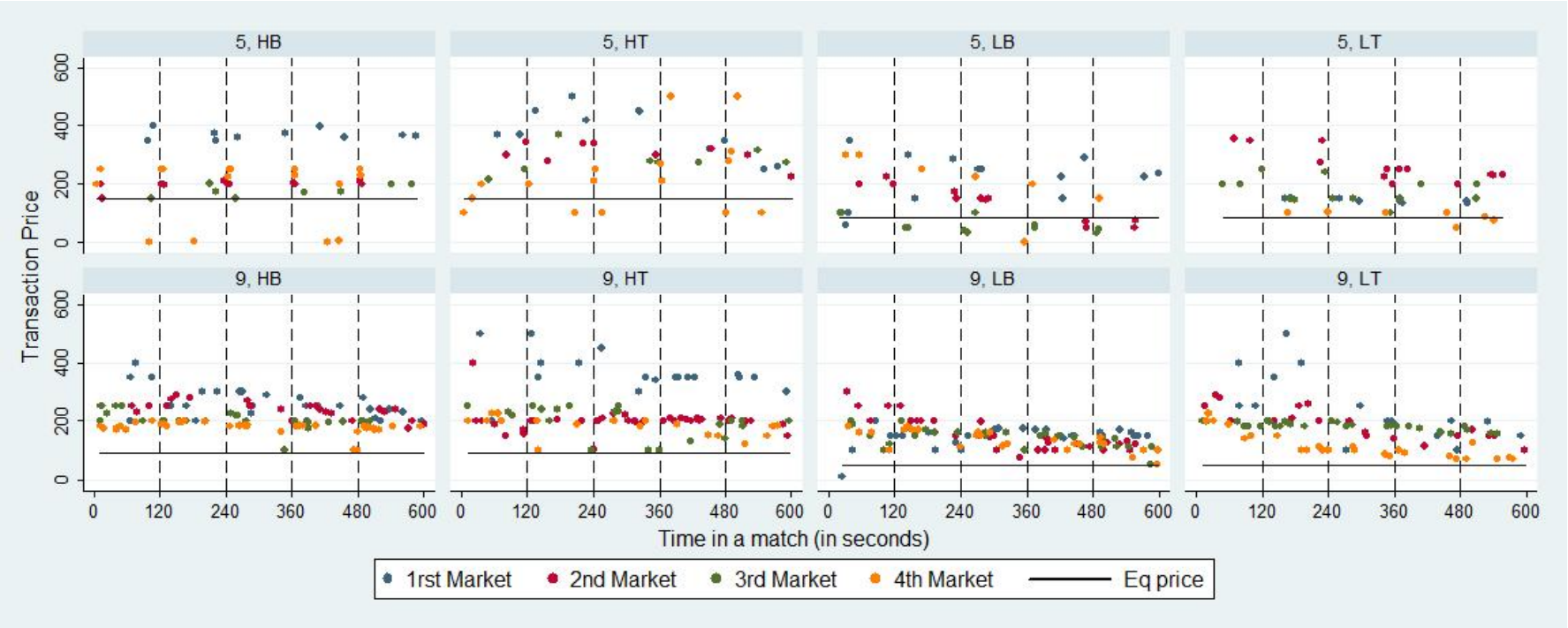
- Committees traded during four different matches
- Each match had different market parameters
- Five replays of each match for convergence



- Committees traded during four different matches
- Each match had different market parameters
- Five replays of each match for convergence
- Values fixed across replays; sides reshuffled

9LT Market. Valuations range from 105 to 753; the equilibrium price is 50.




5, HB
5, HT
5, LB
5, LT
9, HB
9, HT
9, LB
9, LT
Transaction Price
0
200
400
600
0
120
240
360
480
600
Time in a match (in seconds)
1rst Market
2nd Market
3rd Market
4th Market
Eq price

Key findings about pricing:

- Prices generally start above the ex ante equilibrium price.
- Prices decline over time within a match.
- Overpricing declines across matches.
- Convergence toward equilibrium prices from above.

- How to explain high prices?
- Many possibilities.
- We explore one:

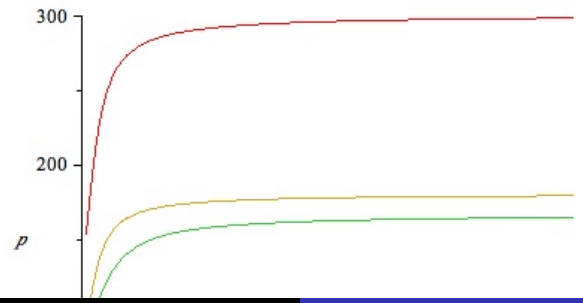
- How to explain high prices?
- Many possibilities.
- We explore one:
- Risk Aversion.

- How to explain high prices?
- Many possibilities.
- We explore one:
- Risk Aversion.

Risk aversion

Proposition

Suppose $u(\cdot) = -e^{-\rho(\cdot)}$ *with* $\rho > 0$, *and* $R1$ *is the rationing rule. Then for all our experimental treatments the set of strategies in Theorem 1 together with the price* $p = \frac{2}{\rho(n+1)} \ln\left(\frac{1}{2} + \frac{1}{2}e^{\rho v_{n-1}}\right)$ *constitute an Ex Ante Vote-Trading Equilibrium.*



- Transaction prices from last match and round

N		HB	HT	LB	LT
5	Last Round Average	240	258	150	81.5
	RN Equilibrium	150.5	150.5	83.5	83.5
	RA Equilibrium	301	301	167	167
9	Last Round Average	176.4	163	102	82
	RN Equilibrium	90.3	90.3	50.1	50.1
	RA Equilibrium	180.6	180.6	100.2	100.2

Testing convergence to equilibrium:

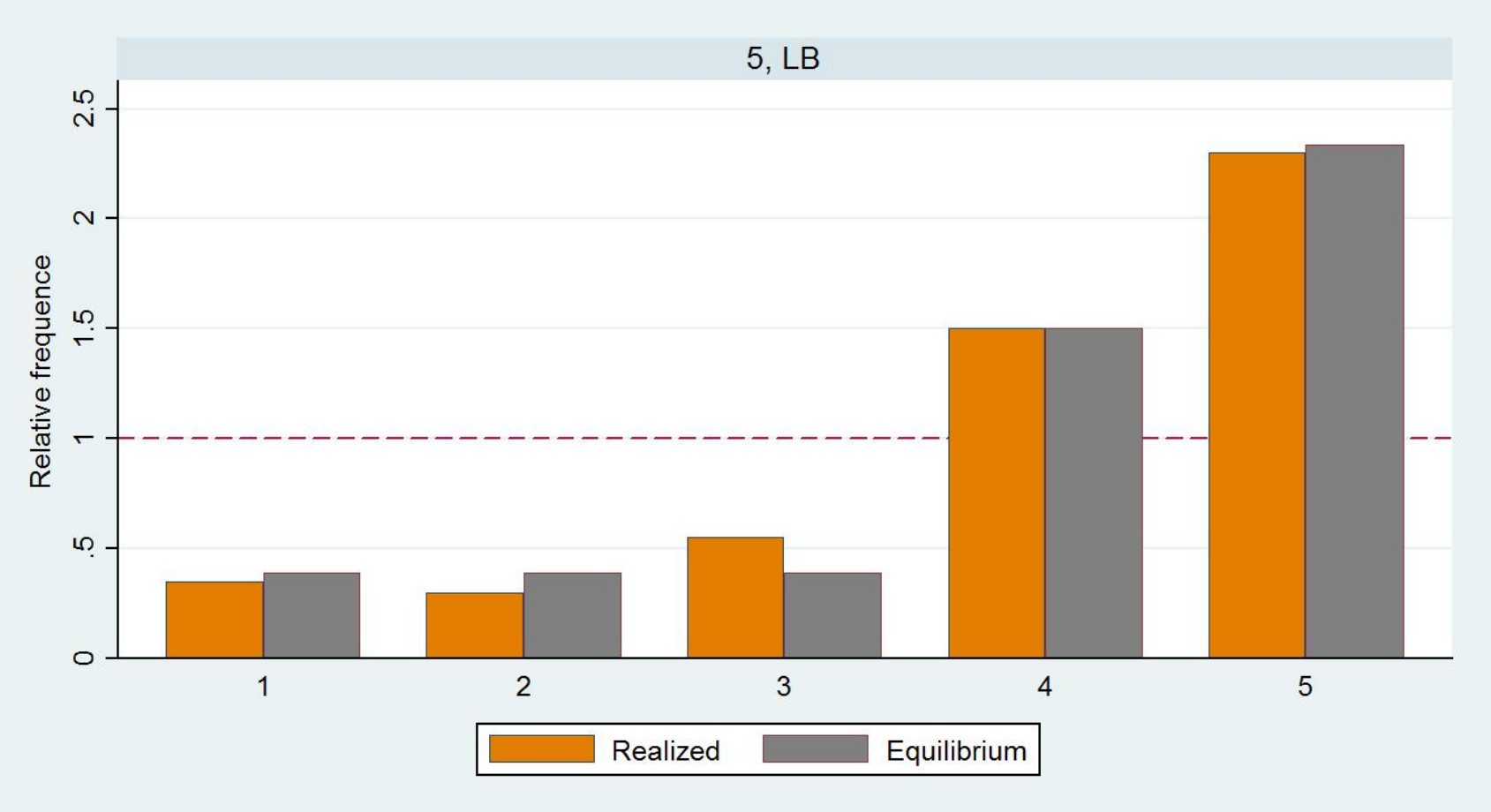
Testing convergence to equilibrium: Asymptotic Regression (a la Noussair-Plott-Riezman)

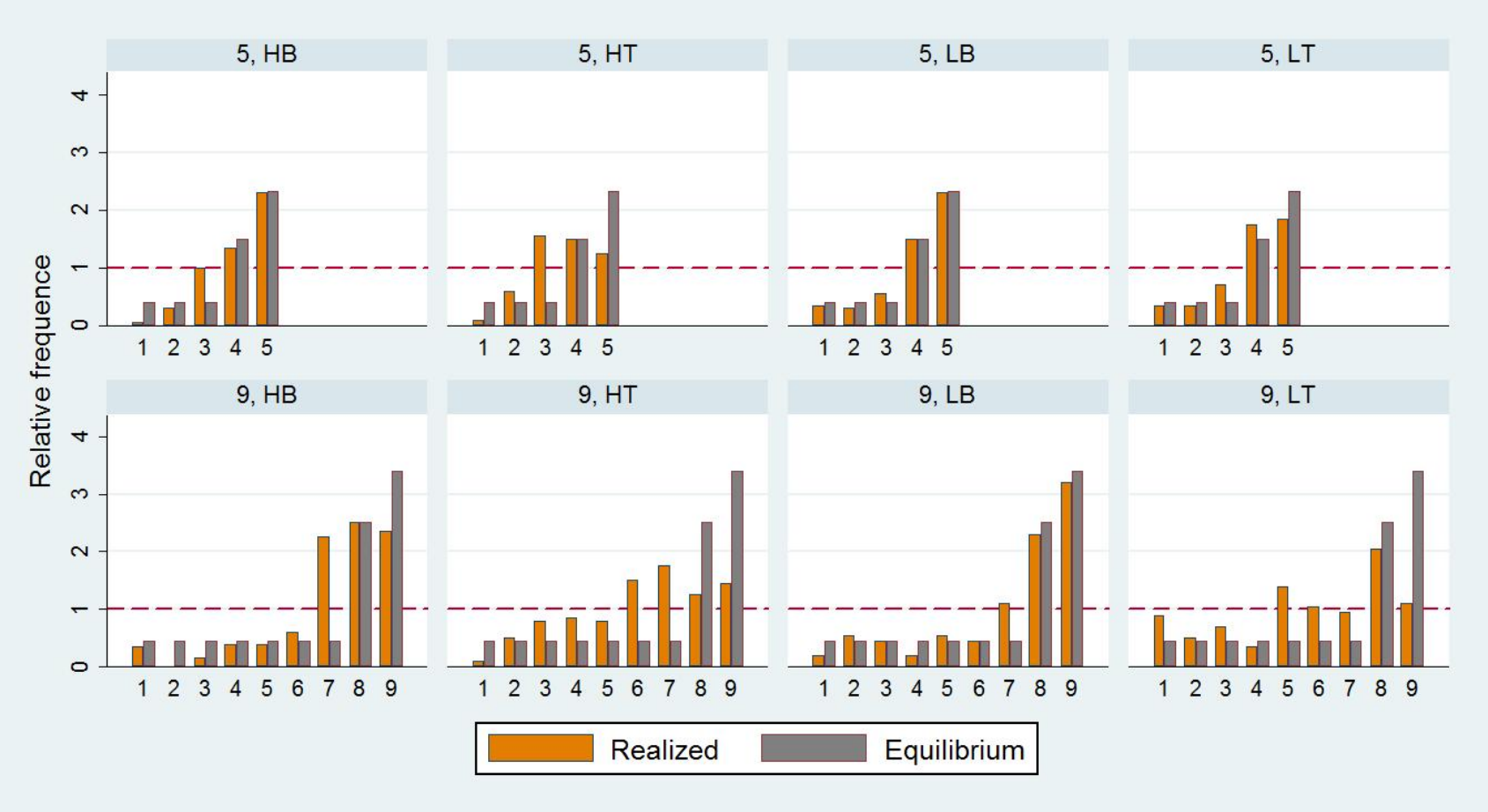
- $p_{Mt} = \alpha_M + \beta_{Mm}(1/t) + \varepsilon_{Mmt}$
- t is the unit of time in the experiment (seconds)
- M is the index for Market
- m is the index for match.
- α_M is the asymptote of price p_M
- constrains each match in a market (each color in the plots) to converge to the same price
- allows convergence path to differ across matches.

$n = 5$	$\widehat{\alpha}_M$	s.e	95% Conf. Interval	$[\log(p^{rn}), \log(\overline{p})]$	
HT	5.57	0.20	[4.94, 6.20]	[5.01, 5.71]	
HB	5.46	01.6	[4.94, 5.97]	[5.01, 5.71]	N= 178
LT	5.18	0.20	[4.54, 5.82]	[4.42, 5.12]	
LB	4.89	0.29	[3.97, 5.81]	[4.42, 5.12]	
$n = 9$					
HT	5.35	0.11	[5.00, 5.69]	[4.50, 5.20]	
HB	5.35	0.095	[5.05, 5.66]	[4.50, 5.20]	$N = 434$
LT	5.09	0.15	[4.62, 5.57]	[3.91, 4.61]	
LB	4.94	0.04	[4.82, 5.06]	[3.91, 4.61]	

Table: Linear regression of the log of the realized price

- **Average final vote allocations.** Theory vs. Data?




5, HB
5, HT
5, LB
5, LT
9, HB
9, HT
9, LB
9, LT
Relative frequence
0
1
2
3
4
1 2 3 4 5
1 2 3 4 5 6 7 8 9
Realized
Equilibrium

- How frequent is **dictatorship**?

	Market				
n	HB	HT	LB	LT	Average
5	55	45	100	65	66.25
9	25	5	20	0	12.50

- More frequent in B treatments.
- More frequent in with $n = 5$.
- More frequent with experience.
- Note: dictatorship with $n = 9$ means buying 4 votes.

- Ex ante efficiency rates:

		Market			
		LB	LT	HB	HT
N=5	Realized	0,85	0.69	0.85	0.73
	Equilibrium	0.84	0.71	0.78	0.62
	Majority Rule	0.79	0.90	0.83	0.97
N=9	Realized	0.83	0.64	0.80	0.72
	Equilibrium	0.75	0.62	0.70	0.53
	Majority Rule	0.74	0.89	0.79	0.93

- Realized Efficiency $>$ Equilibrium Efficiency.

- Ex ante efficiency rates:

		Market			
		LB	LT	HB	HT
N=5	Realized	0,85	0.69	0.85	0.73
	Equilibrium	0.84	0.71	0.78	0.62
	Majority Rule	0.79	0.90	0.83	0.97
N=9	Realized	0.83	0.64	0.80	0.72
	Equilibrium	0.75	0.62	0.70	0.53
	Majority Rule	0.74	0.89	0.79	0.93

- Realized Efficiency $>$ Equilibrium Efficiency.
- B (T): Realized efficiency $>$ ($<$) Majority Rule efficiency

Conclusions: Theory

- General Equilibrium Analysis can be applied to vote trading
  - Equilibrium Existence Theorem
  - Dictator
  - Inefficiency
  - Comparative statics

Conclusions: Experiments

- Decentralized vote trading
  - Prices converge from above to the competitive equilibrium price range
  - Average vote allocations close to equilibrium
  - Frequent dictators, especially in small committees
  - Inefficiencies can result from too much trading. Externalities
  - Efficiency and comparative statics consistent with general equilibrium theory

Second Study: Partisanship public information. Decentralized trading vs. Party leadership (with Casella and Turban)

- Existence of ex ante competitive equilibrium with decentralized trading with public partisanship
- Need a different model for centralized trading: Bilateral exchange with private values. Bayesian game.

The Environment

- A committee of size n, each individual has one vote.
- Two alternatives, X and Y.
- It is publicly known that M individuals prefer X, $m \leq M$ prefer Y.
- Values $v_i \in [0, 1]$, privately known.
- It is known that v_i is iid $\sim F(v)$ atomless and will full support $[0, 1]$.

The Decision Procedure

- Two stages:
  1. Leaders (C) or individual voters (U) can buy votes from each other using the numeraire;
  2. Leaders (C) or individual voters (U) cast their votes, if any, for their preferred alternative.
- The decision is taken according to the majority of votes cast.
- Ties are resolved by a coin flip.

Coordinated trade:

- The leader internalizes the total value of the group and enforces transfers, if necessary.
- Ex-post utility is given by:

$$u_i^C = \sum_{j \in G_i} v_j I_w - x_i^C p \qquad \text{where } x_i^C \in \{-G_i, ..., G_{-i}\}.$$

- *Uncoordinated trade:*
- Each individual trades independently.
- Ex-post utility is given by:

$$u_i^U = v_i I_w - x_i^U p \text{ where } x_i^U \in \{-1, ..., n-1\}.$$

Mechanism Design Theory: (Myerson and Satterthwaite; Cramton, Gibbons and Klemperer). *Suppose vote trading is coordinated by party leaders. Then an efficient, incentive compatible, and interim individually rational trading mechanism exists if and only if* $M = m$. *If* $M \neq m$, *the optimal mechanism has too little trade: the majority wins too often.*

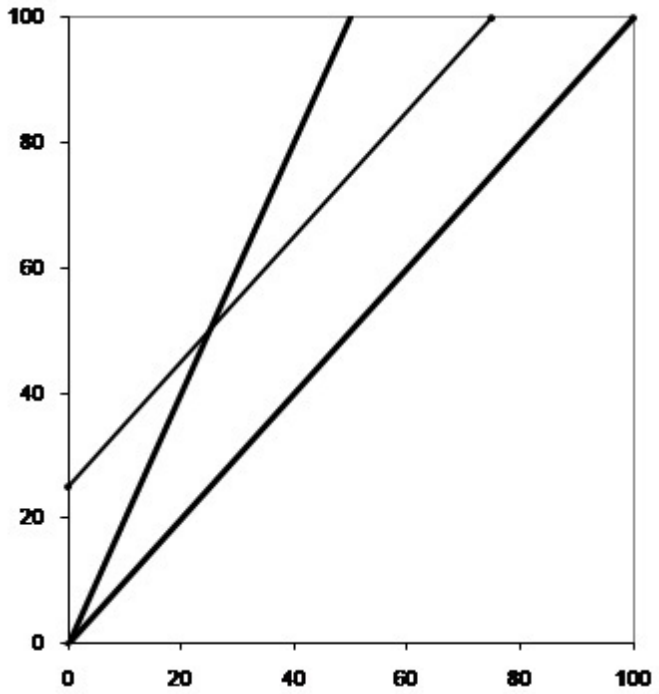
Coordinated trading

1. Two equal-sized groups.

- Each "owns half the decision".
- In the lab. Bid-only continuous open book auction.
- Equivalent to a second-price auction: the winner pays loser the loser's bid.
- $u_i = v_i - b_j$ if $b_i > b_j$
- $u_i = b_i$ if $b_j > b_i$
- Equilibrium bid function: $b_i = \frac{1+2v_i}{6}$
- Efficient, incentive compatible, and interim individually rational.
- Identical to a CGK efficient mechanisms

2. Two unequal-sized groups.

- The majority "owns" the decision (seller). Minority is the buyer.
- In the lab: trade only if $b_m > v_M$.
- Theory: A sealed buyer's bid double auction (Satterthwaite and Williams, 1989).
- $u_s = v_s$ if $b_s > b_b$
- $u_s = b_b$ if $b_s < b_b$
- $u_b = 0$ if $b_s > b_b$
- $u_s = v_b - b_b$ if $b_s < b_b$
- Equilibrium: $b_s = v_s$. $b_b = \frac{v_b}{2}$
- Incentive compatible and interim individually rational.
- Inefficient: trade only if $v_b > 2v_s$.


100
80
60
40
20
0
0
20
40
60
80
100

Decentralized Trade

- Use general equilibrium market model: Ex ante Competitive Equilibrium
- Equilibrium with positive price and positive trade exists under weak assumptions, even when partisanship is known
- Generally results in minority winning too often

Summary

- Coordinated trade with equal groups: fully efficient
- Coordinated trade with unequal groups: the majority wins too often
- ...but superior to voting without vote trading
- Uncoordinated market trade with unequal groups: the minority wins too often
- ...and inferior to voting without vote trading

Experimental Design

- One treatment per session; 25 rounds plus 1 practice round.
- Subjects matched randomly in committees, each choosing between X and Y.
- It was common knowledge that m subjects favored Y and M favored X.
- Values were drawn randomly by the computer from a Uniform on $[1, 100]$.
- Values were private information.
- All subjects had one initial vote and 200 points (to be paid back).
- Any subject could post a bid for a vote.
- The bid appeared on all monitors, together with the bidder's group and a tally of each group's total votes.

Treatments:

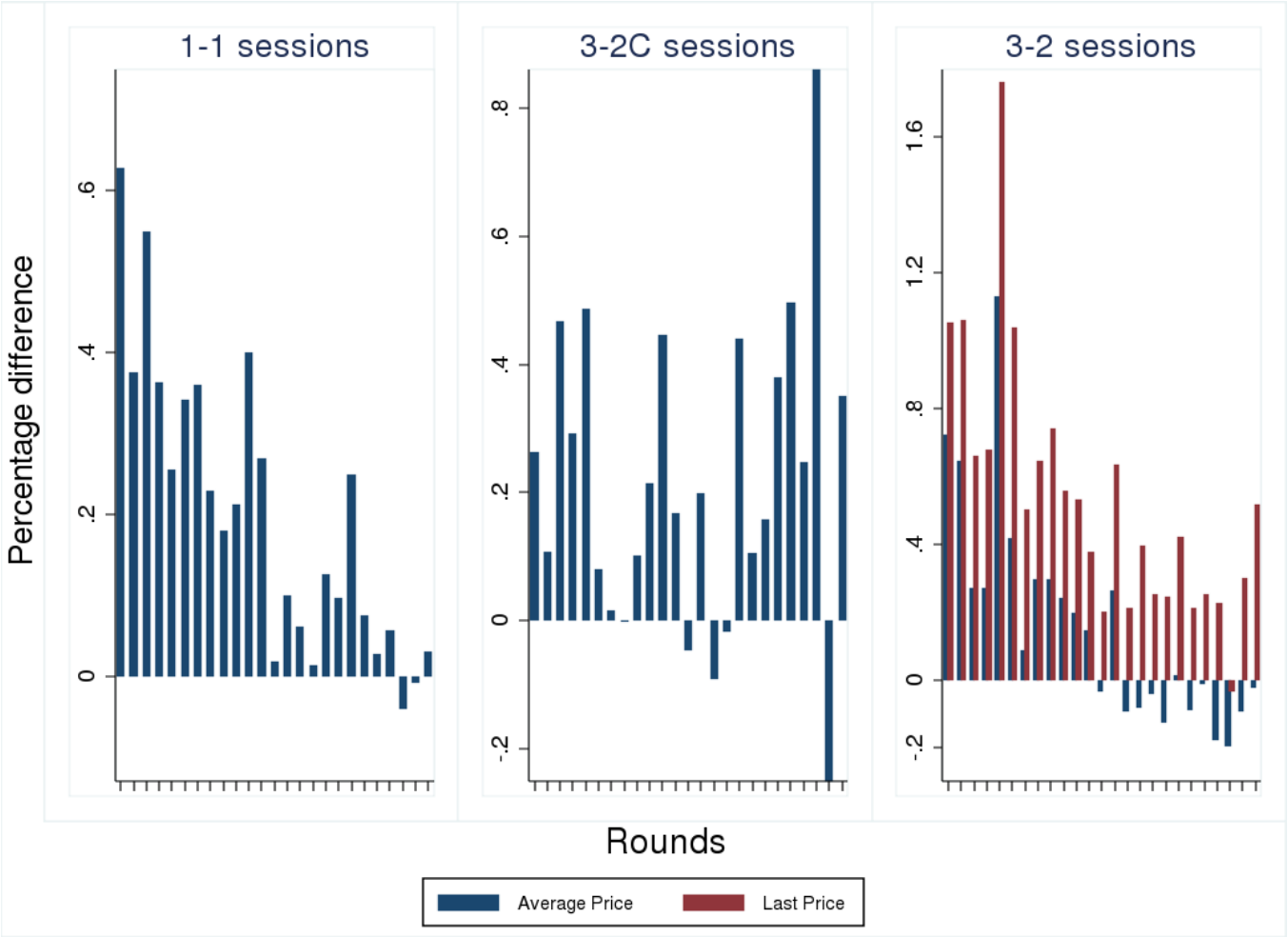
$1,1$ (party leaders) $3,2C$ (party leaders) $3,2$ (decentralized)

- In 1,1 and 3,2C: 2 subjects with opposite preferences.
- In 1,1: one vote each.
- In 3,2C: one subject had 3 votes and one had 2.
- In both cases: each subject value was a random draw from a Uniform over $[1,100]$.

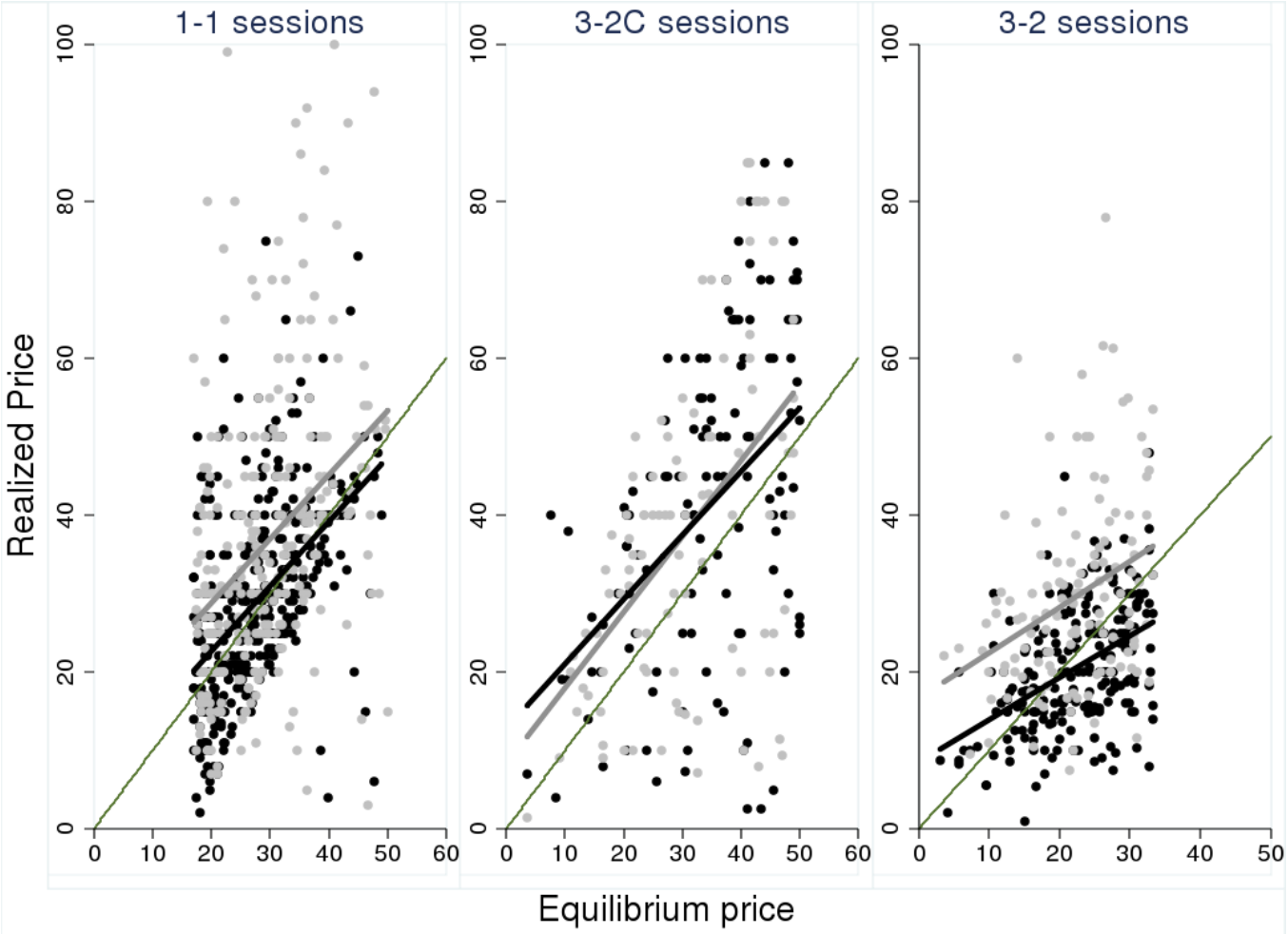
Main Findings:

- Minority wins too much with decentralized trade (3,2); too little with party leaders (3,2C)
- Prices generally above the equilibrium.
- Convergence downward to equilibrium prices except for 3,2C.
- Centralized vote trading leads to efficiency gains.
- Decentralized vote trading leads to efficiency losses.
- More trade in 1,1 (66%) than 3,2C (59%). But less than 100% efficiency.

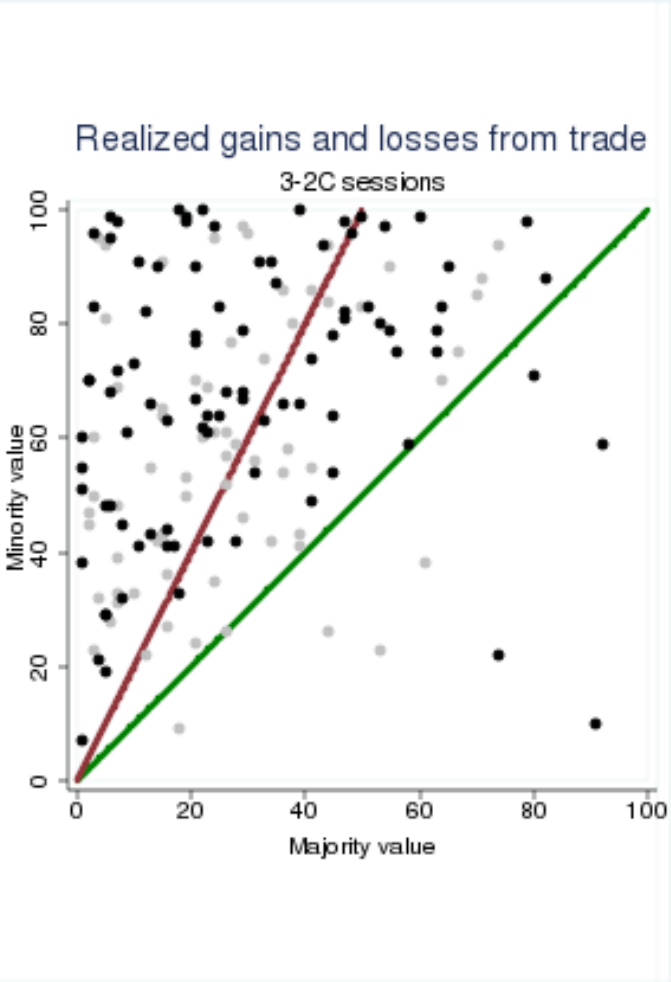
Convergence downward to equilibrium prices except for 3,2C.

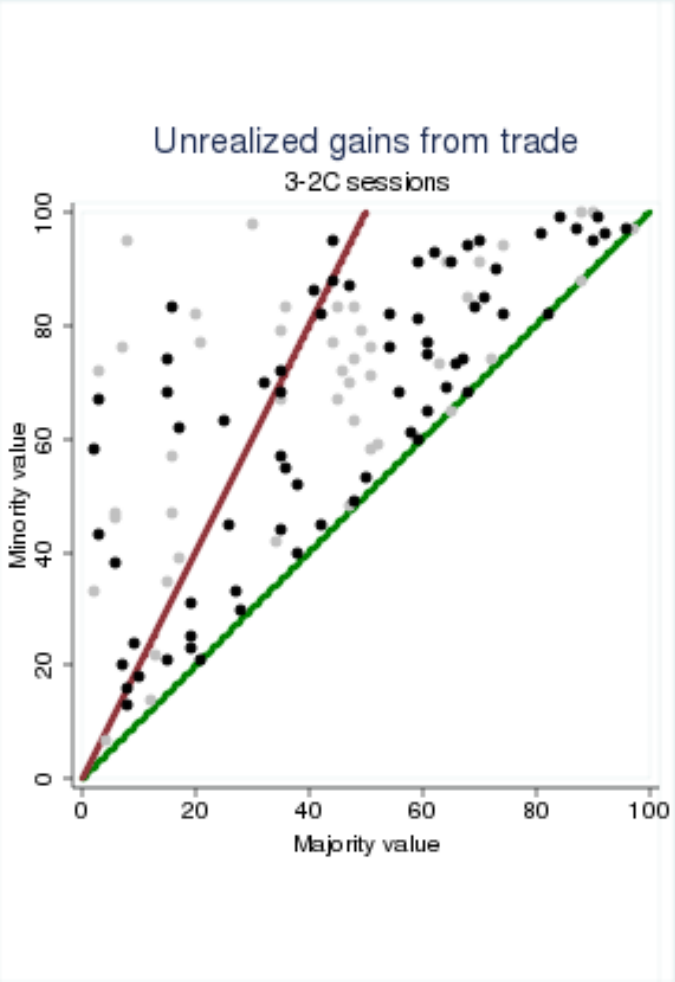


Convergence downward to equilibrium prices except for 3,2C

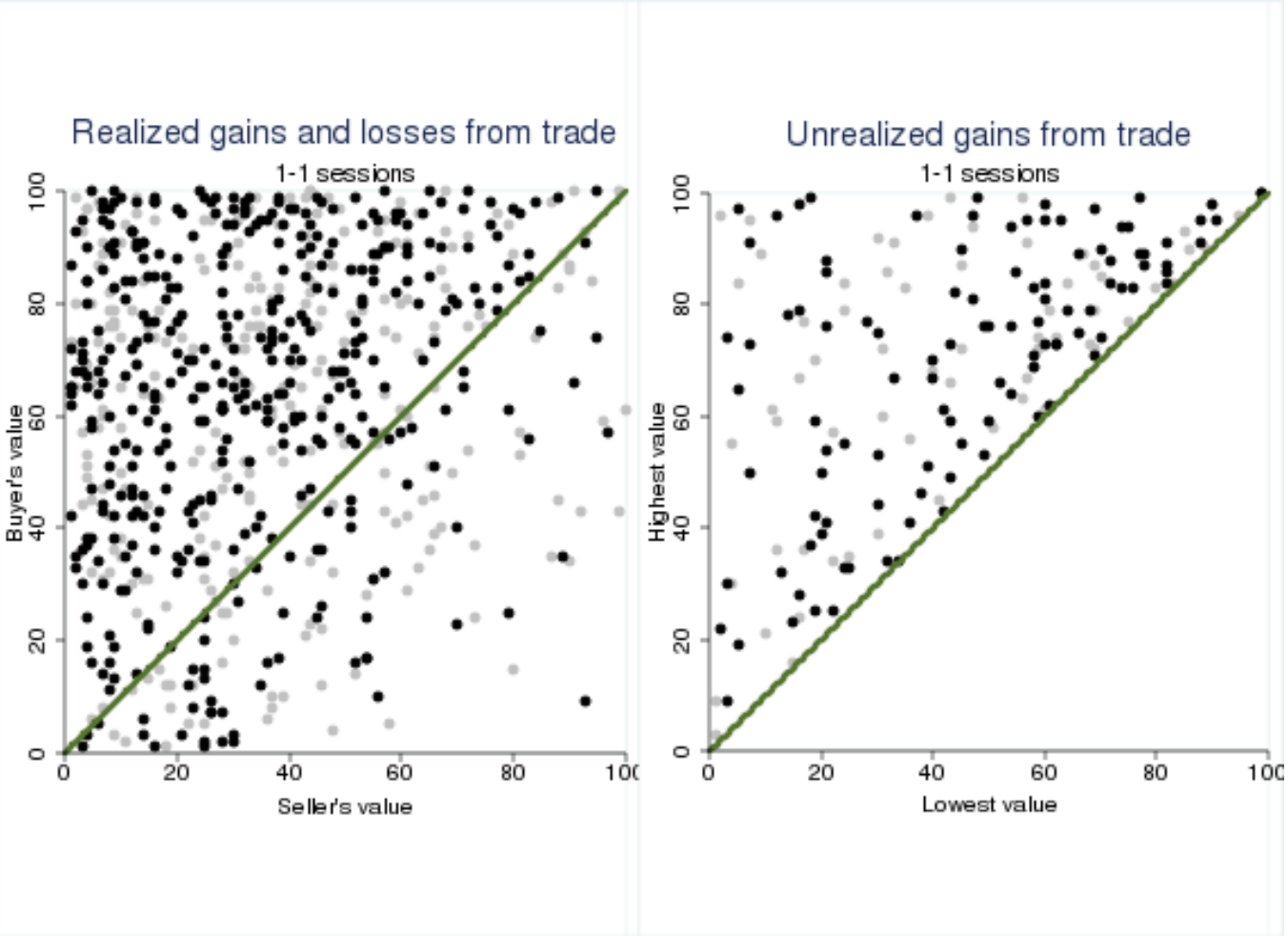


Realized Gains from trade in 3,2C

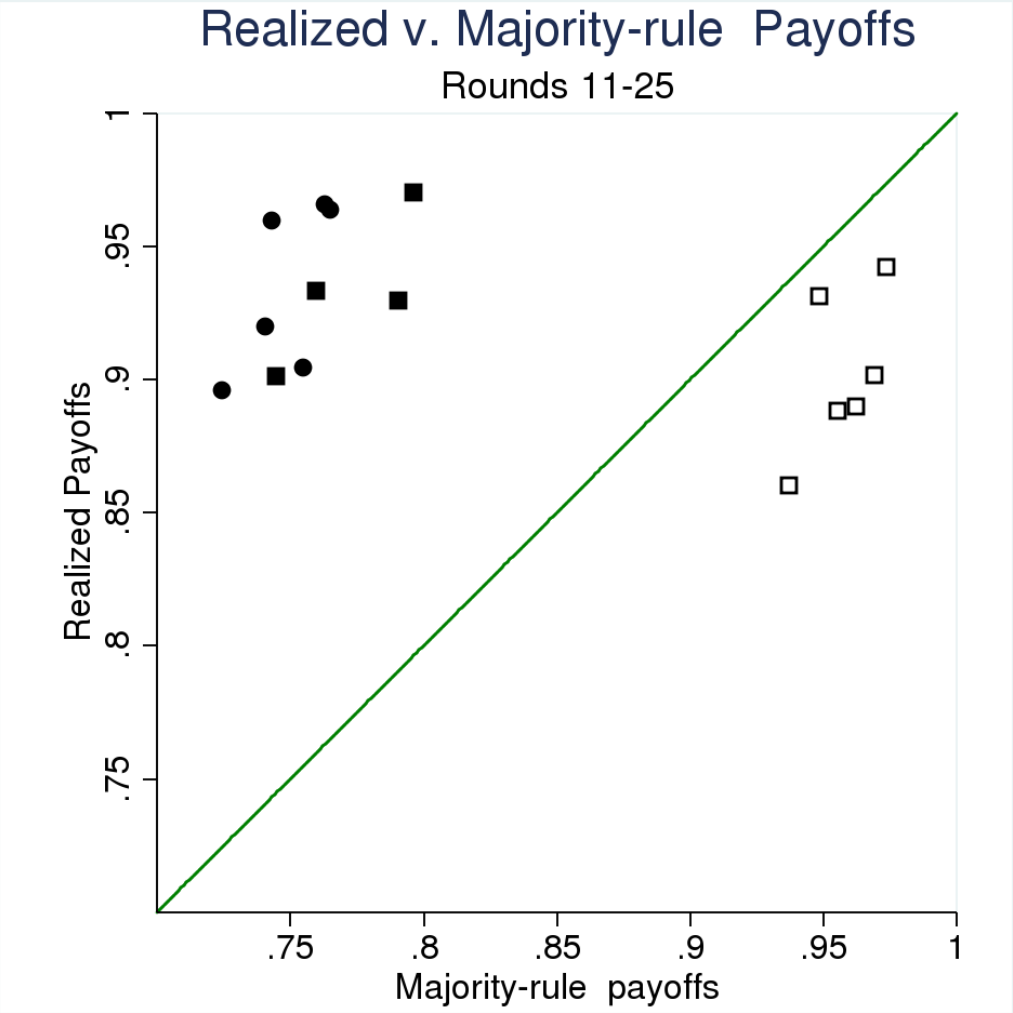




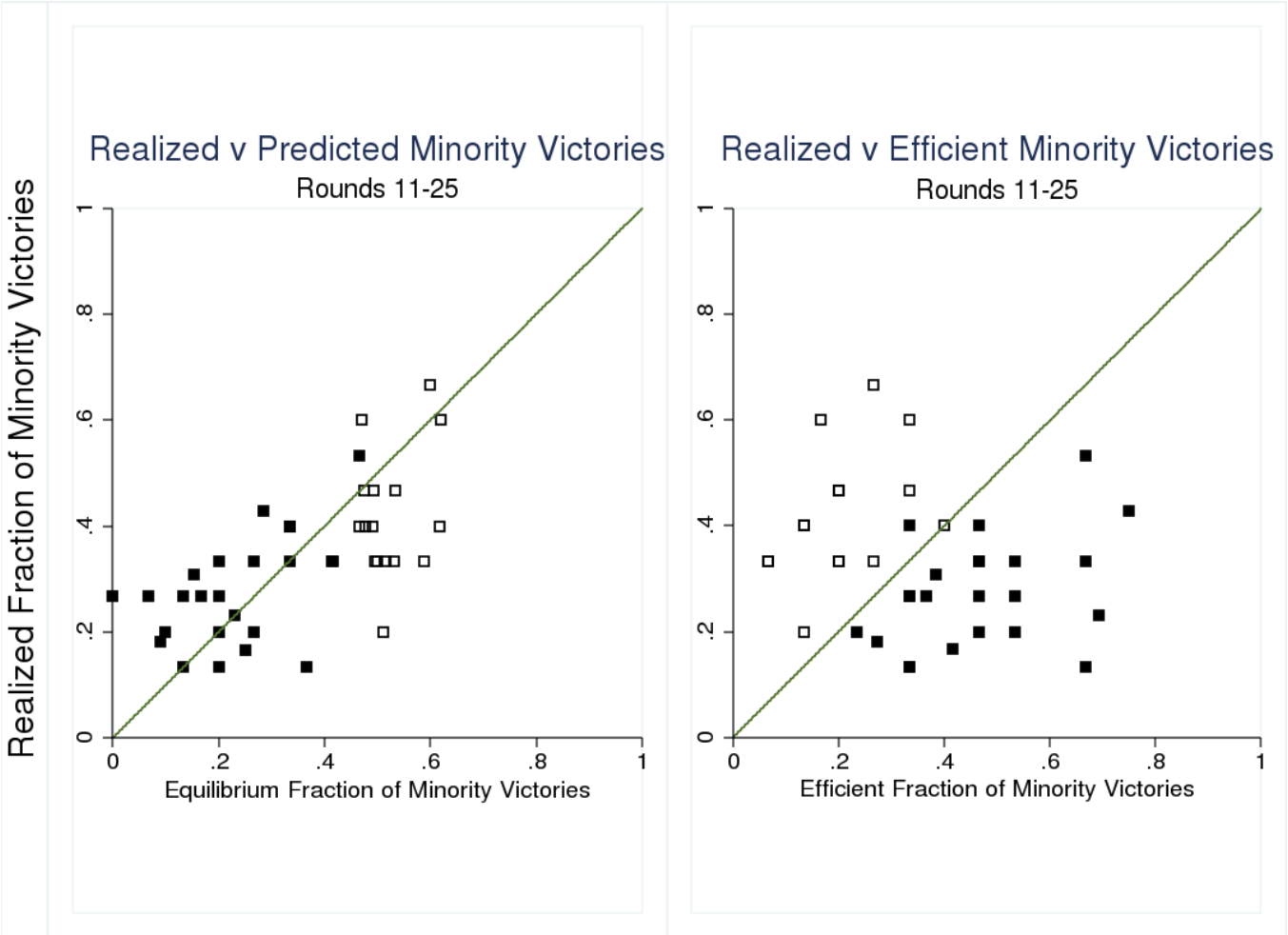
Realized Gains from trade in 1,1



Surplus: Majority Rule vs. Vote Trading



Minority Victories: Decentralized vs. Centralized



Conclusions: Theory

- General Equilibrium Analysis can be applied to vote trading
  - Equilibrium Existence Theorem
  - Dictator
  - Inefficiency
  - Comparative statics

Conclusions: Theory

- General Equilibrium Analysis can be applied to vote trading
  - Equilibrium Existence Theorem
  - Dictator
  - Inefficiency
  - Comparative statics
- Mechanism design theory can be applied to centralized vote trading
  - Results depend on relative size of group
  - Equal size groups: CGK applies: first best possible
  - Unequal size parties: M-S applies: inefficiency unavoidable. Majority wins too often.

Conclusions: Experiments

- Decentralized vote trading
  - Prices converge from above to the competitive equilibrium price range
  - Average vote allocations close to equilibrium
  - Frequent dictators, especially in small committees
  - Inefficiencies can result from too much trading. Externalities
  - Efficiency and comparative statics consistent with general equilibrium theory

Conclusions: Experiments

- Decentralized vote trading
  - Prices converge from above to the competitive equilibrium price range
  - Average vote allocations close to equilibrium
  - Frequent dictators, especially in small committees
  - Inefficiencies can result from too much trading. Externalities
  - Efficiency and comparative statics consistent with general equilibrium theory
- Centralized vote trading beteween party leaders
  - Significant efficiency gains when parties are equal size
  - Smaller, insignificant efficiency gains when parties are unequal in size
  - Inefficiencies result from too little vote trading.

Parallel Phenomena

- Auctions, markets, and voting institutions
  - Vote trading, logrolling, all pay auctions
- Competition
  - Candidates, Parties, Firms, Workers
- Monopoly and market power
  - Agenda control, dictatorship
- Information aggregation and rational expectations equilibrium
  - Polls, bandwagons
- Bargaining and compromise
  - Government formation, legislative bargaining, international conflict
- Public goods and free riding
  - Voter turnout, political participation, collective action
- Adverse selection in auctions and voting
  - Strategic voting and abstention, swing voter's curse
- Mechanism Design
  - Comparative politics, voting rules, organizations