

Experimental Economics

- **Markets, aggregation and strategic environment**
 - Double-Auction Markets
 - Players with zero-intelligence
 - Robustness to low marginal incentives
 - Asset Markets
 - Bubbles and crashes
 - Strategic environment
 - Strategic complements and substitutes

Double Auction

- **The double auction:**
 - Both buyers and sellers can post prices at which to buy/sell
 - Buyers attributed marginal values
 - Profit per trade: $\pi = MV - p$
 - Sellers attributed marginal costs
 - Profit per trade: $\pi = p - MC$
 - Information:
 - Players only know their own marginal values/cost
 - During trading:
 - Highest bids
 - Lowest asks
 - Trading prices

Double Auction: Example

Buyers' values:

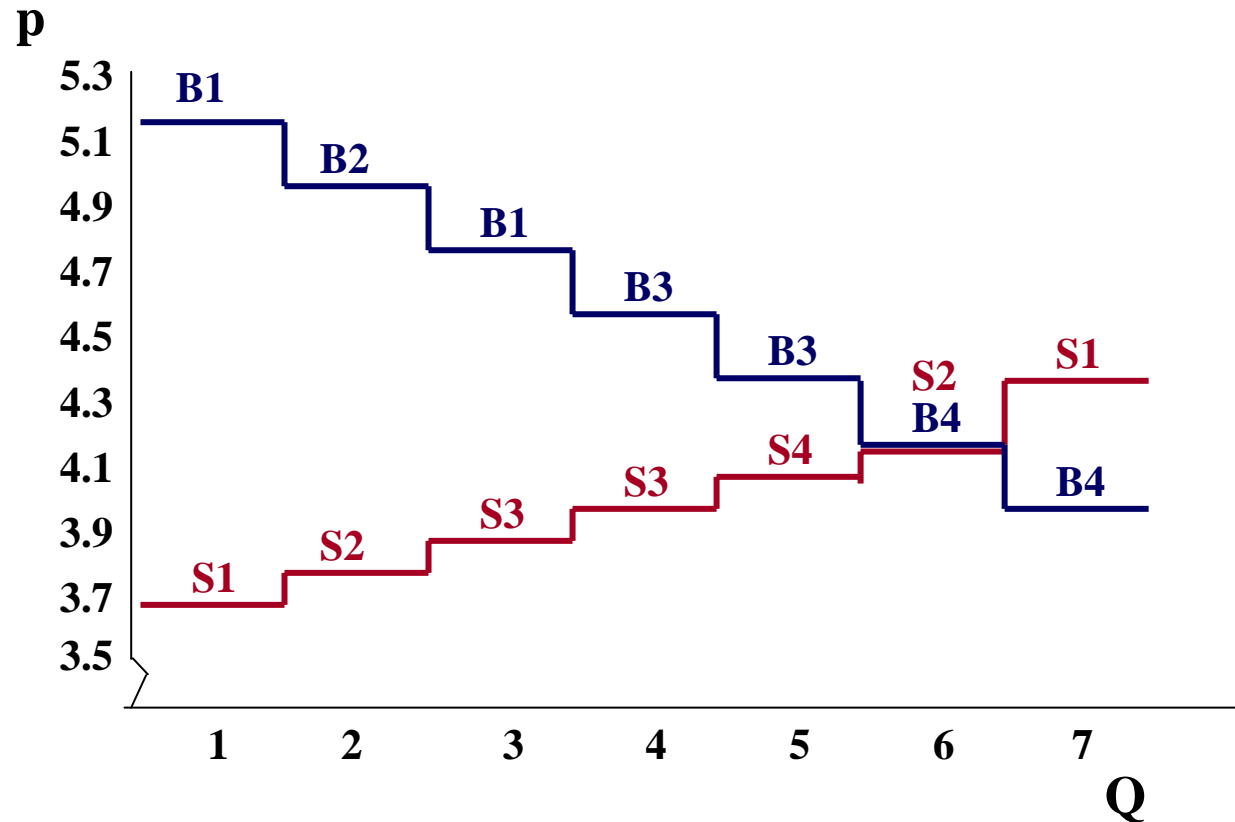
Buyer	unit1	unit2
B1	5.2	4.8
B2	5.0	---
B3	4.6	4.4
B4	4.2	4.0

Sellers' costs:

Seller	unit1	unit2
S1	3.7	4.4
S2	3.8	4.2
S3	3.9	4.0
S4	4.1	---

Aggregate Demand and Supply:

- marginal values give demand function
- marginal costs give supply function

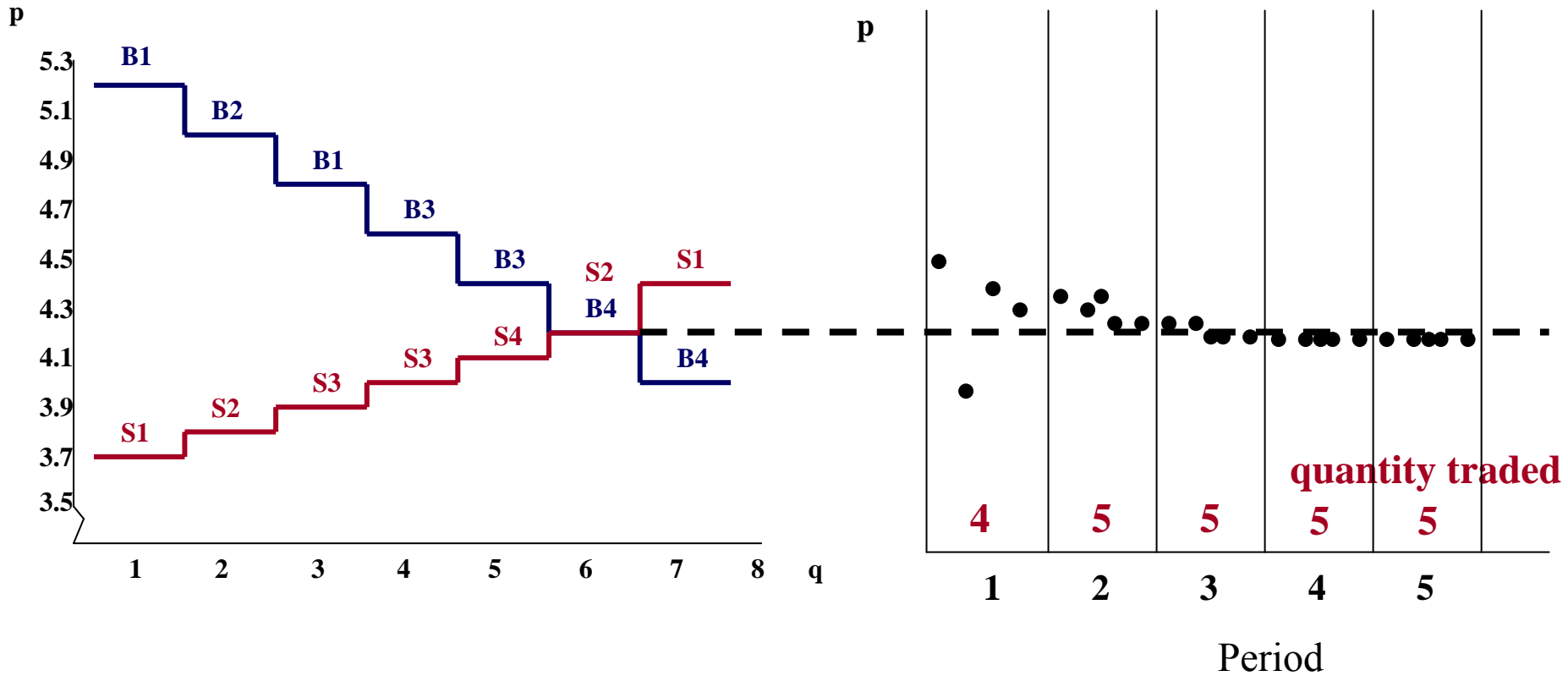


Double Auction

- **Typical procedures**
 - Sequence of trading periods
 - Each period lasts preset time (e.g. 2 min)
 - In each period there are new units to buy/sell
 - Units do not carry over periods
 - Buyers buy high value units first
 - Sellers sell low cost units first
 - Subjects can accept the bid/ask or place new one
 - No unprofitable trades allowed
- **Typically, subjects do not know why certain prices evolve**

Double Auction

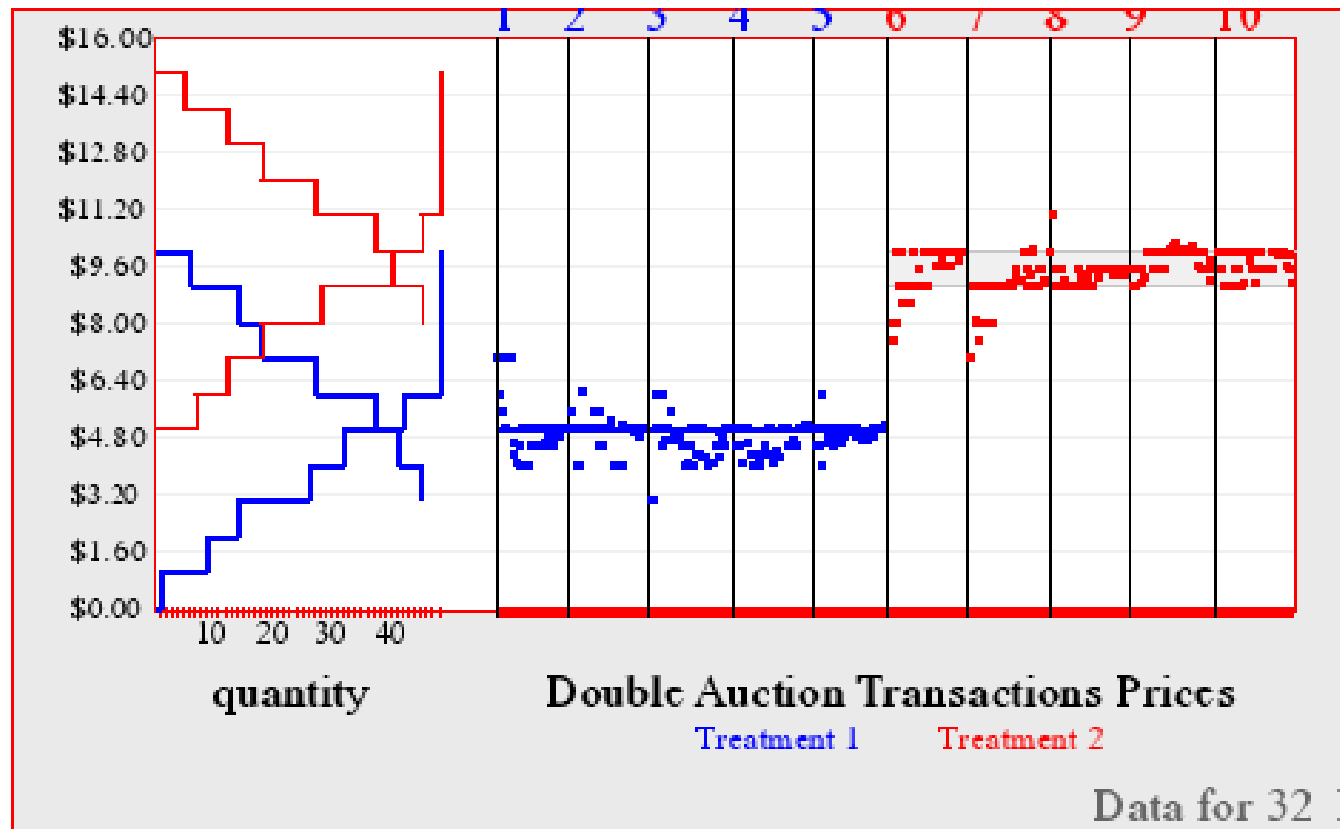
Typical Experimental Results (>2 sellers)



Double Auction

Typical Experimental Results

Adjustment to shocks

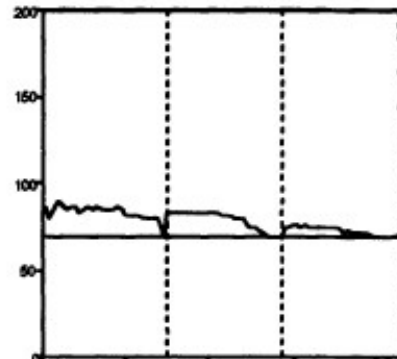
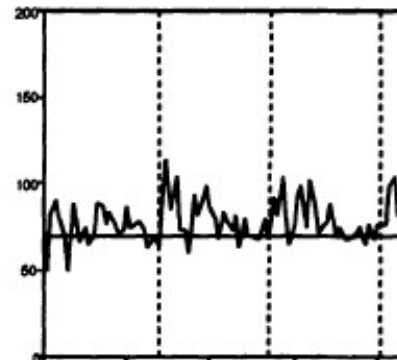
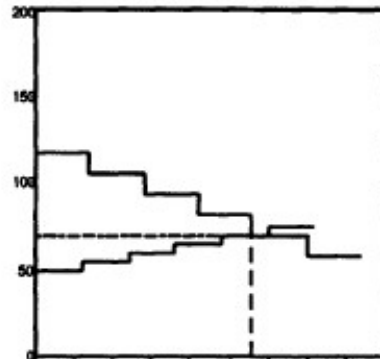
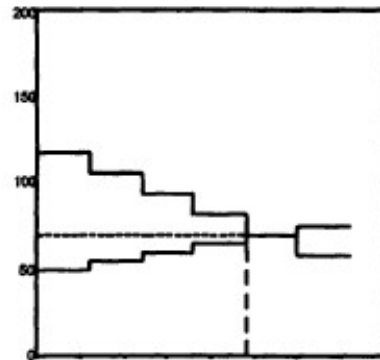


Double Auction

- **Typical Experimental Results**
 - Mean price close to competitive equilibrium
 - Quantity close to competitive equilibrium
 - Efficiency close to 100%
 - Price convergence decreases across trading periods
 - consumer surplus $>$ producer surplus \Rightarrow convergence from above
 - consumer surplus $<$ producer surplus \Rightarrow convergence from below
- **One of the best examples of good prediction by economic theory**
 - But other markets do not work as well

Double Auction

- **Zero-intelligence traders** Gode & Sunder 1993
 - Compare human traders to zero-intelligence traders
 - Zero-intelligence traders:
 - Post random prices to buy/sell
 - Buy at random prices as long as trade is profitable

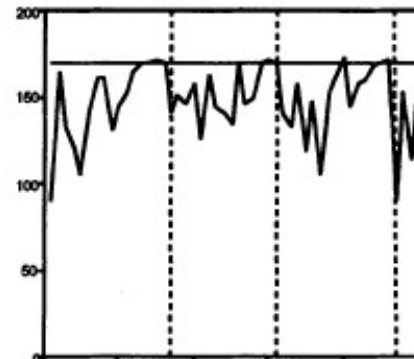
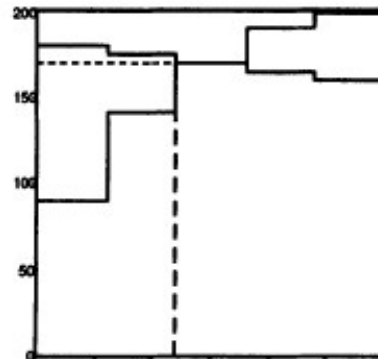


computer

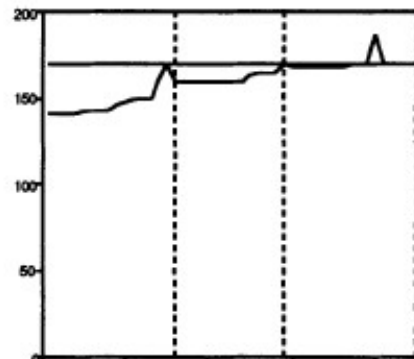
human

Double Auction

- **Zero-intelligence traders** Gode & Sunder 1993
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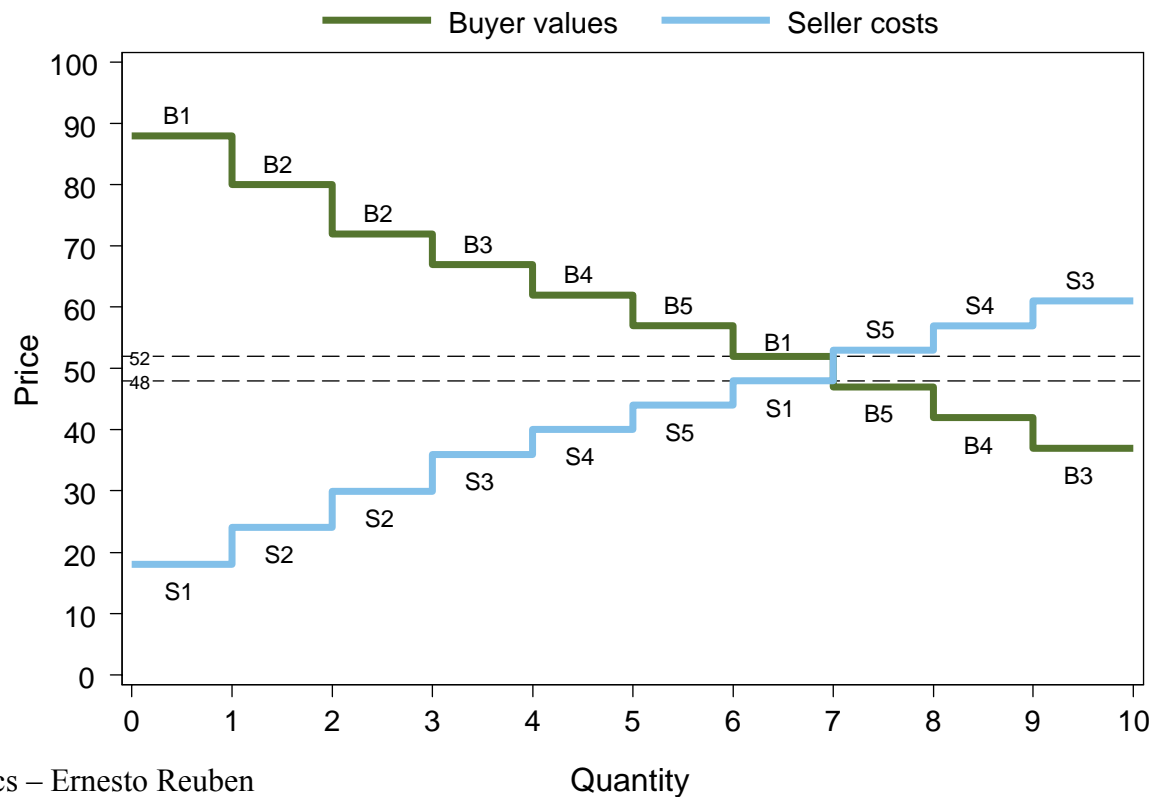
computer



human

Double Auction

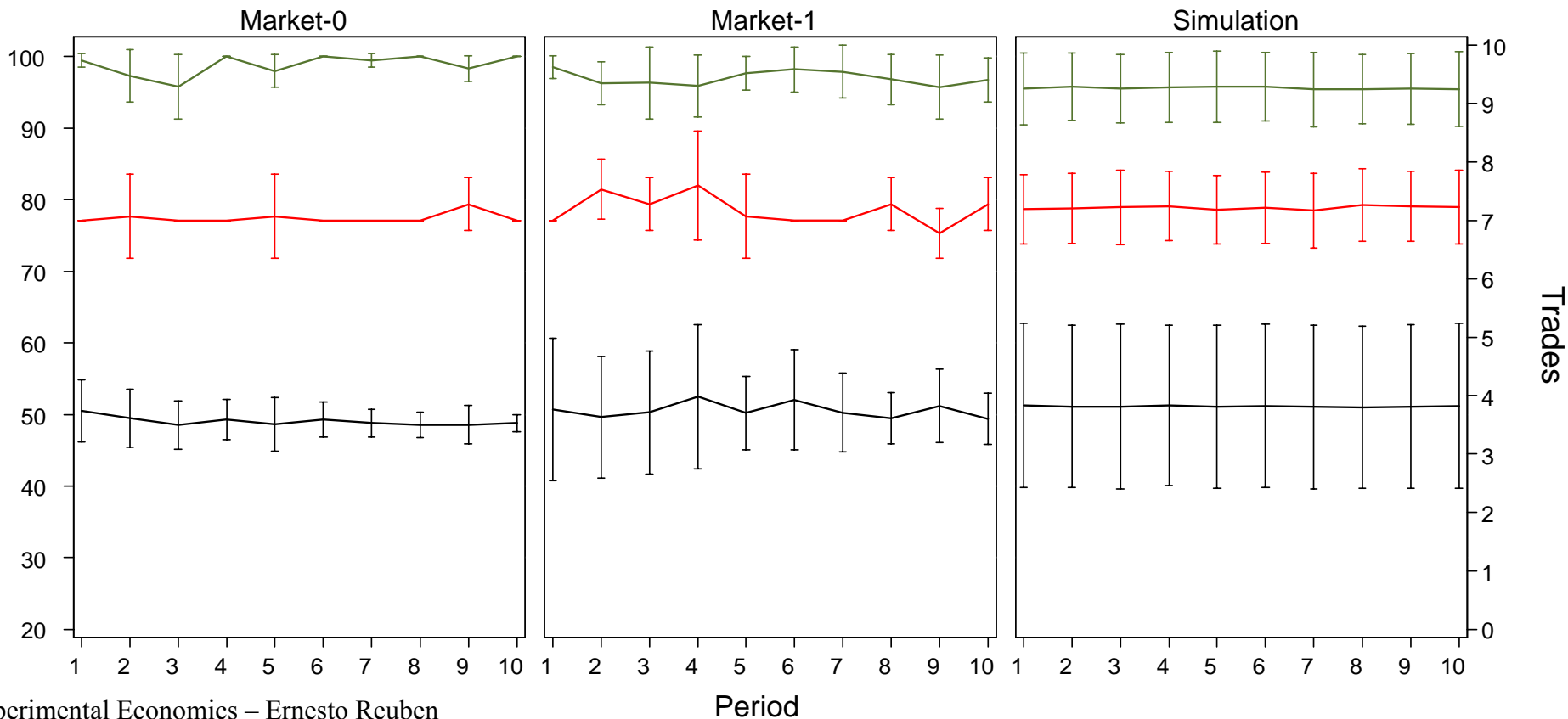
- **Market performance under high taxation** Großer & Reuben 2009
 - The effect of high taxes on double-auction markets
 - 2 treatments
 - Normal double-auction market
 - Double-auction market with a redistributive tax of 100%



Double Auction

- **Market performance under high taxation** Großer & Reuben 2009
 - Mean behavior is very similar but the 100% tax adds a little noise (but less than zero-intelligence traders)

— Traded prices — Number of trades — Market efficiency



Double Auction

- **Market performance under high taxation** Großer & Reuben 2009
 - Mean behavior is very similar but the 100% tax adds a little noise (but less than zero-intelligence traders)

Treatment	Mean Price	Std Dev Price	Mean Quantity	Std Dev Quantity	Mean Welfare	Std Dev Welfare
Market-0	49.05	2.83	7.04	0.19	98.84	1.42
Market-100	50.57	6.73	7.19	0.40	97.01	3.43
Simulation	51.15	11.40	7.22	0.61	95.61	4.94

Double Auction

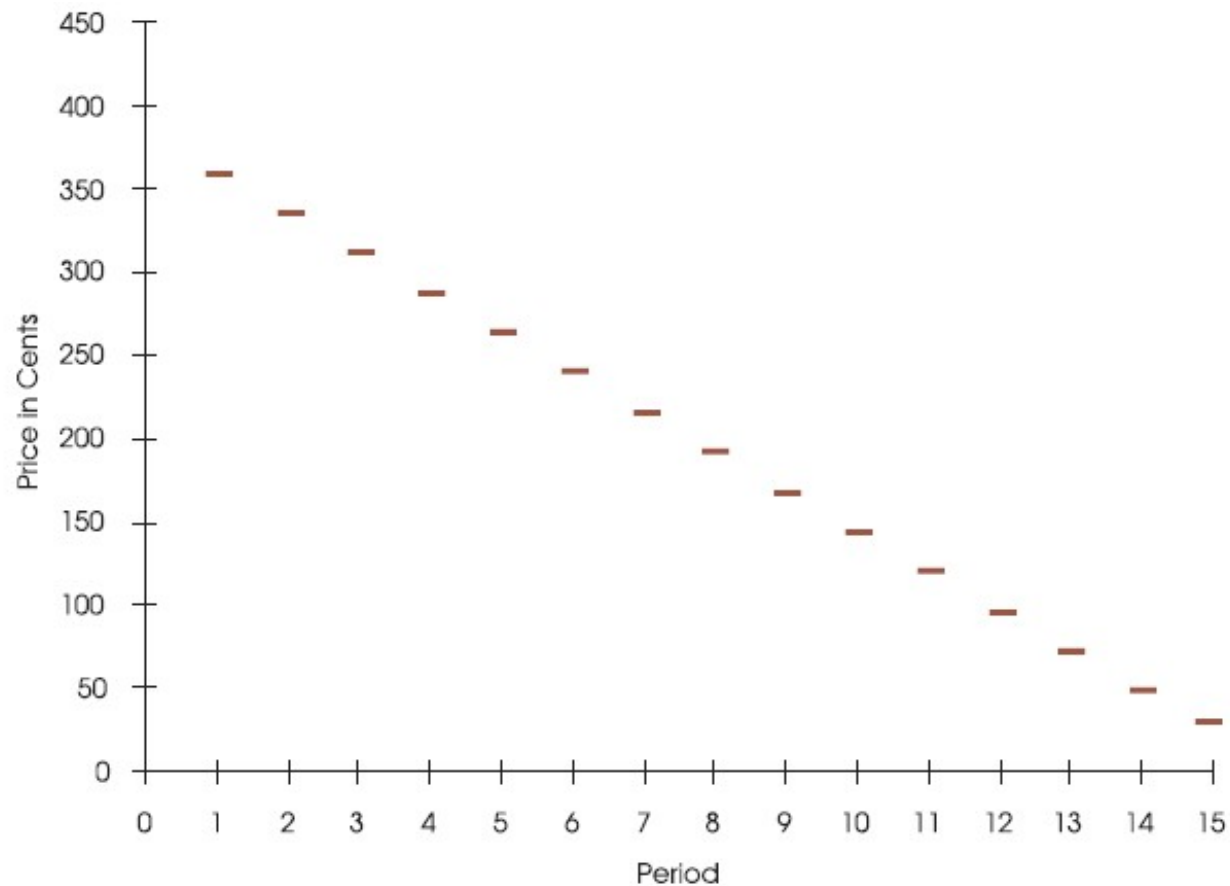
- **Summary**
 - Double auction gives results which are very close to economic theory
 - Predicts price and quantity sold
 - Robust to shocks of demand and supply
 - Due to competitiveness of the institution
 - Hard to say anything about the rationality of players
 - Zero-intelligence players perform almost as well
 - Markets with 100% redistributive taxes perform almost as well too.
- Its also a great teaching tool!

Bubbles and Asset Markets

- **Sell and buy shares with a known expected value:**
 - Uses a double auction but:
 - All players are both buyers and sellers
 - No private values/costs
 - Profits are given by distribution of dividends
 - Each share pays a randomly determined dividend **each** period
 - e.g. $\pi = \$10$ with $p = 0.25$, $\$20$ with $p = 0.5$, and $\$40$ with $p = 0.25$
 - The expected value of a share is common knowledge
 - Shares carry over from one period to the next

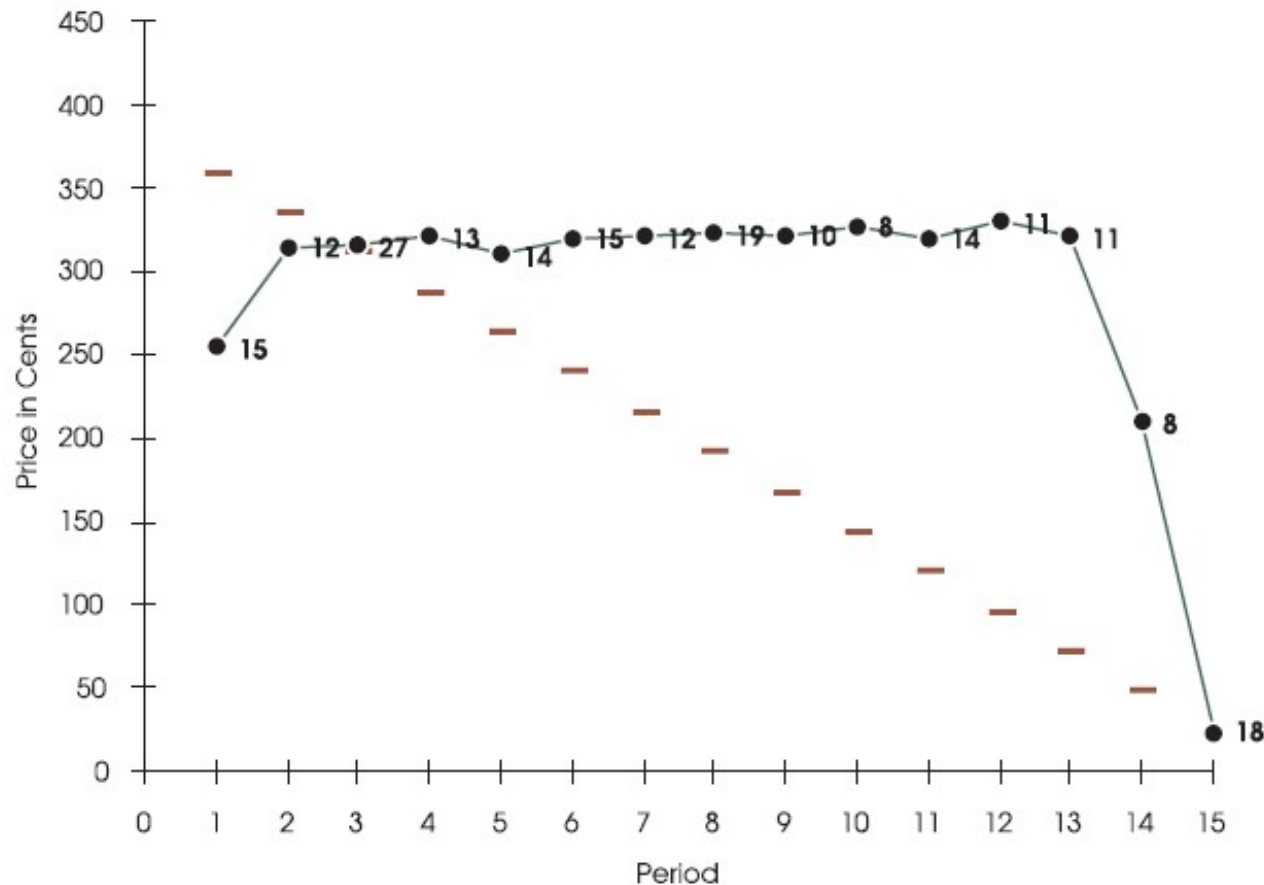
Bubbles and Asset Markets

- **Typical experimental result** Porter & Smith 2003



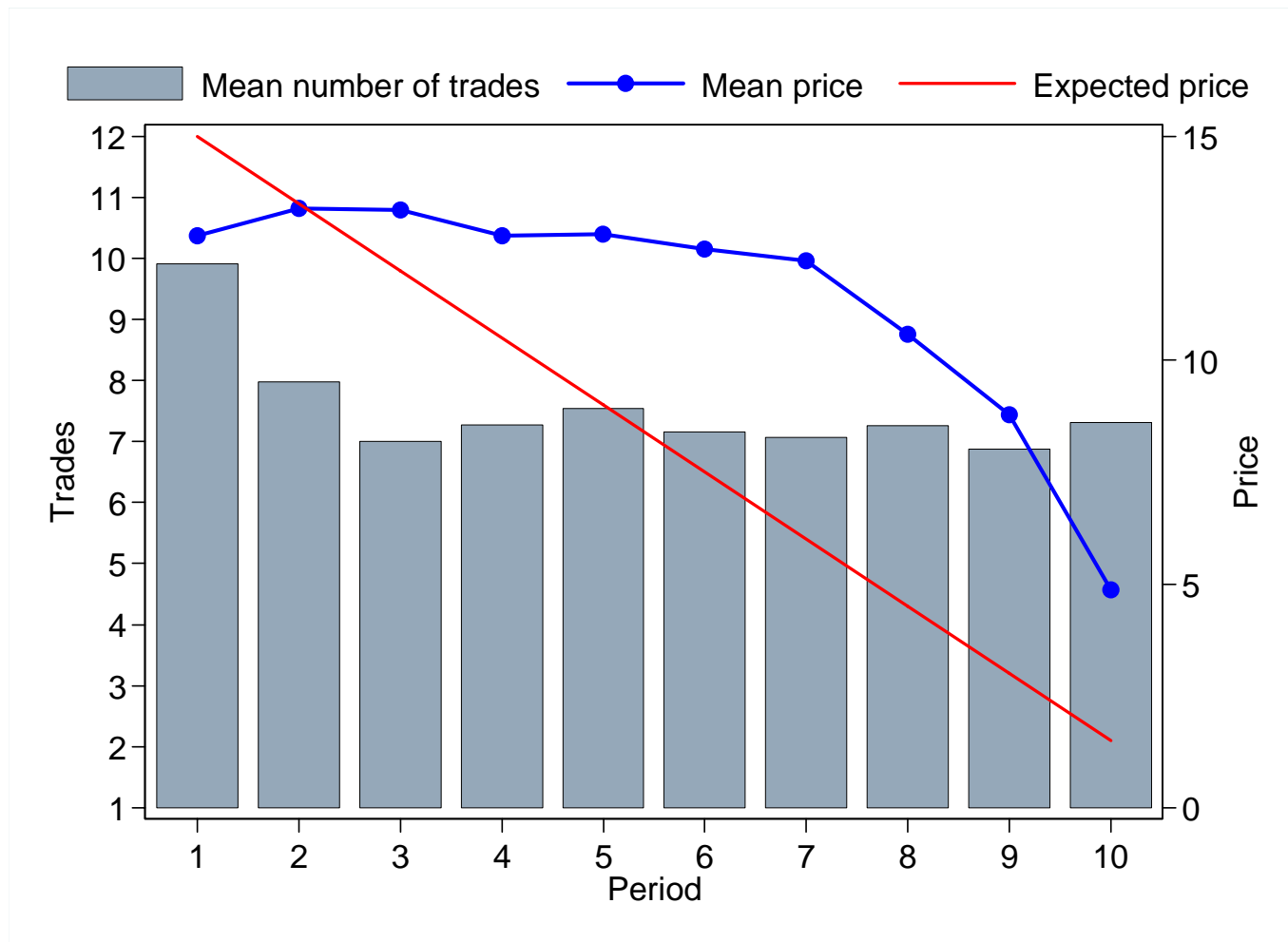
Bubbles and Asset Markets

- **Typical experimental result** Porter & Smith 2003
 - Large deviation from fundamental prices
 - Price bubble that emerges and crashes by the end of the game



Bubbles and Asset Markets

- **Typical experimental result**
 - Occurs even with MBA students of the University of Chicago!



Bubbles and Asset Markets

- **Typical experimental result** Porter & Smith 2003
 - Large deviation from fundamental prices
 - Price bubble that emerges and crashes by the end of the game
 - Robust to:
 - Variance of the dividends distribution
 - Various subjects pools
 - Price change limits
 - Reduced bubble (but not disappearance)
 - Brokerage fees
 - Short-selling
 - Experience

Strategic Environment

- **Strategic complements and substitutes** Fehr & Tyran 2002
 - Why boundedly rational/irrational individuals have a big impact in the asset market game and not in a normal double auction?
 - Nature of strategic interaction:
 - Asset market game:
 - Even if you are rational, if you think prices will go up it pays to buy now to sell later
 - Small number of players who follow prices can cause a bubble
 - Strategic complements
 - Rational players have an incentive to do what other players do
 - Strategic substitutes
 - Rational players have an incentive to do the opposite of what other players do

Strategic Environment

- **Strategic complements and substitutes** Fehr & Tyran 2002
 - A simple pricing game (strategic complements)

selling price	Average price of other firms																													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
1	39	39	20	9	5	3	2	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
2	20	20	39	20	9	5	3	3	2	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
3	9	9	20	39	20	9	5	3	2	2	2	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
4	5	5	9	20	39	20	9	5	3	3	2	2	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
5	3	3	5	9	20	39	20	9	5	3	2	2	2	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	
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10	1	2	2	2	2	3	3	5	9	20	39	20	20	20	9	5	3	2	2	2	2	1	1	1	1	1	1	1	1	
11	1	2	1	2	2	2	2	3	5	9	20	39	39	39	20	9	5	3	2	2	2	2	1	1	1	1	1	1	1	
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22	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	3	5	9	20	20	20	20	20	20
23	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	3	5	9	9	9	9	9	9
24	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	3	5	5	5	5	5	5
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26	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2
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29	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2
30	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

Strategic Environment

- Strategic complements and substitutes Fehr & Tyran 2002
 - A simple pricing game (strategic substitutes)

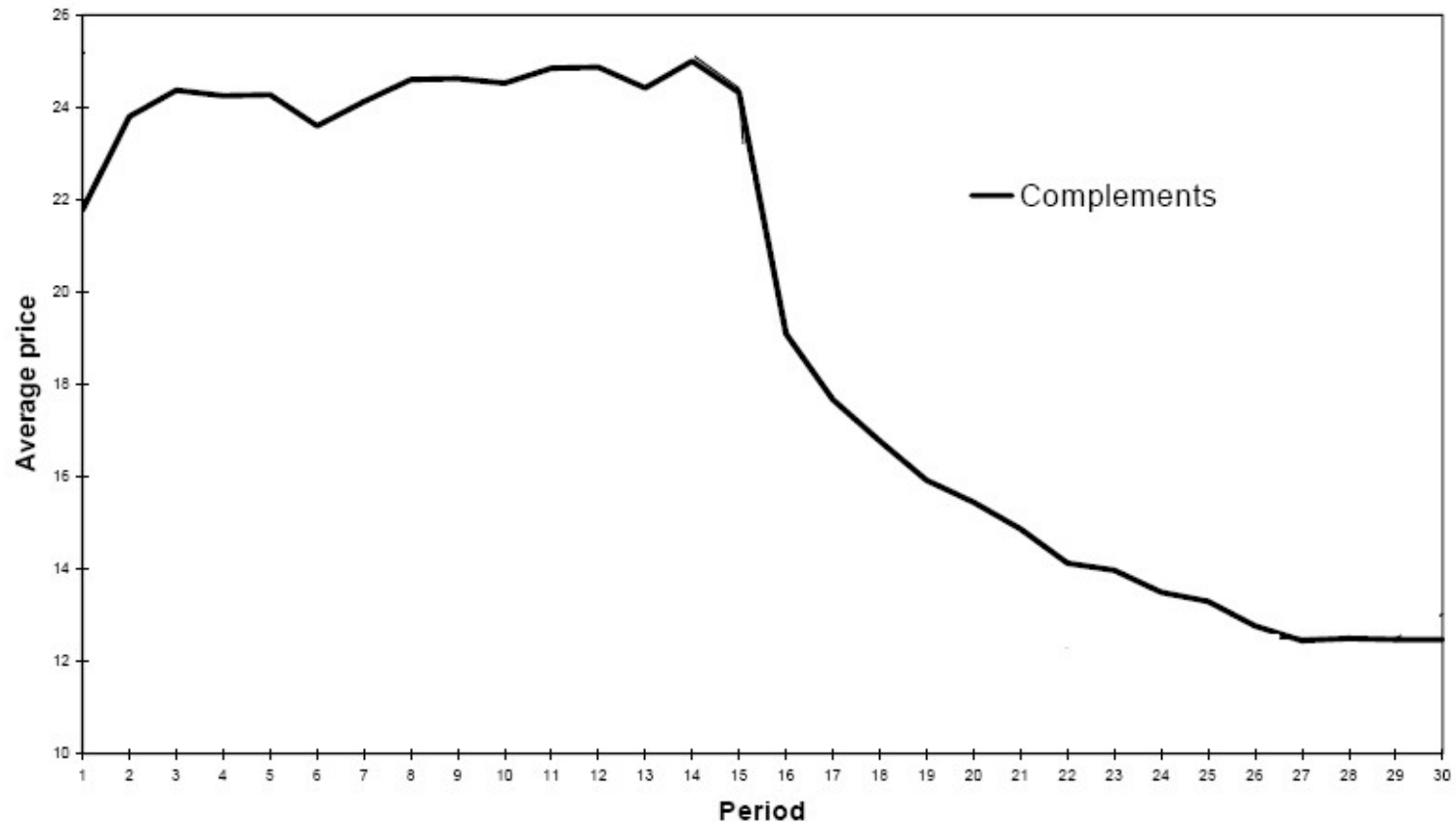
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1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	3	5	9	20	39	39	39	39	39	39	39	39
2	1	1	1	1	1	1	1	1	1	1	2	1	1	2	2	2	2	3	5	9	20	39	20	20	20	20	20	20	20	20
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Strategic Environment

- **Strategic complements and substitutes** Fehr & Tyran 2002
 - Payoffs were altered to induce nominal inertia
 - $\text{Real income} = \text{Nominal income} / \text{Average price of other firms}$
 - Play the game in groups of 4 for 30 periods.
 - In period 15, a nominal shock is introduced (nominal prices are divided by 2)

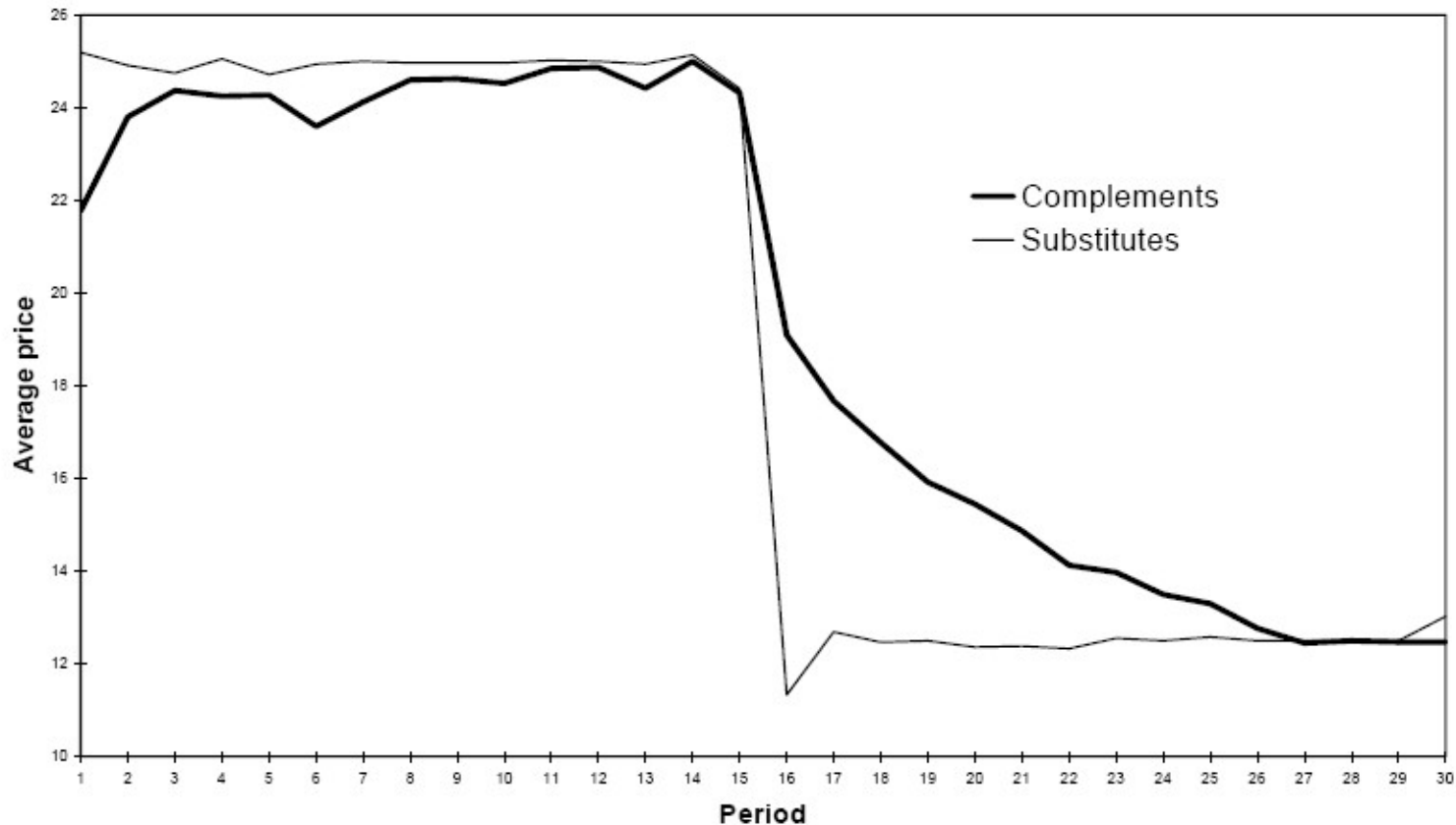
Strategic Environment

- **Strategic complements and substitutes** Fehr & Tyran 2002
 - Results
 - Strategic complements: Gradual adjustment after the shock



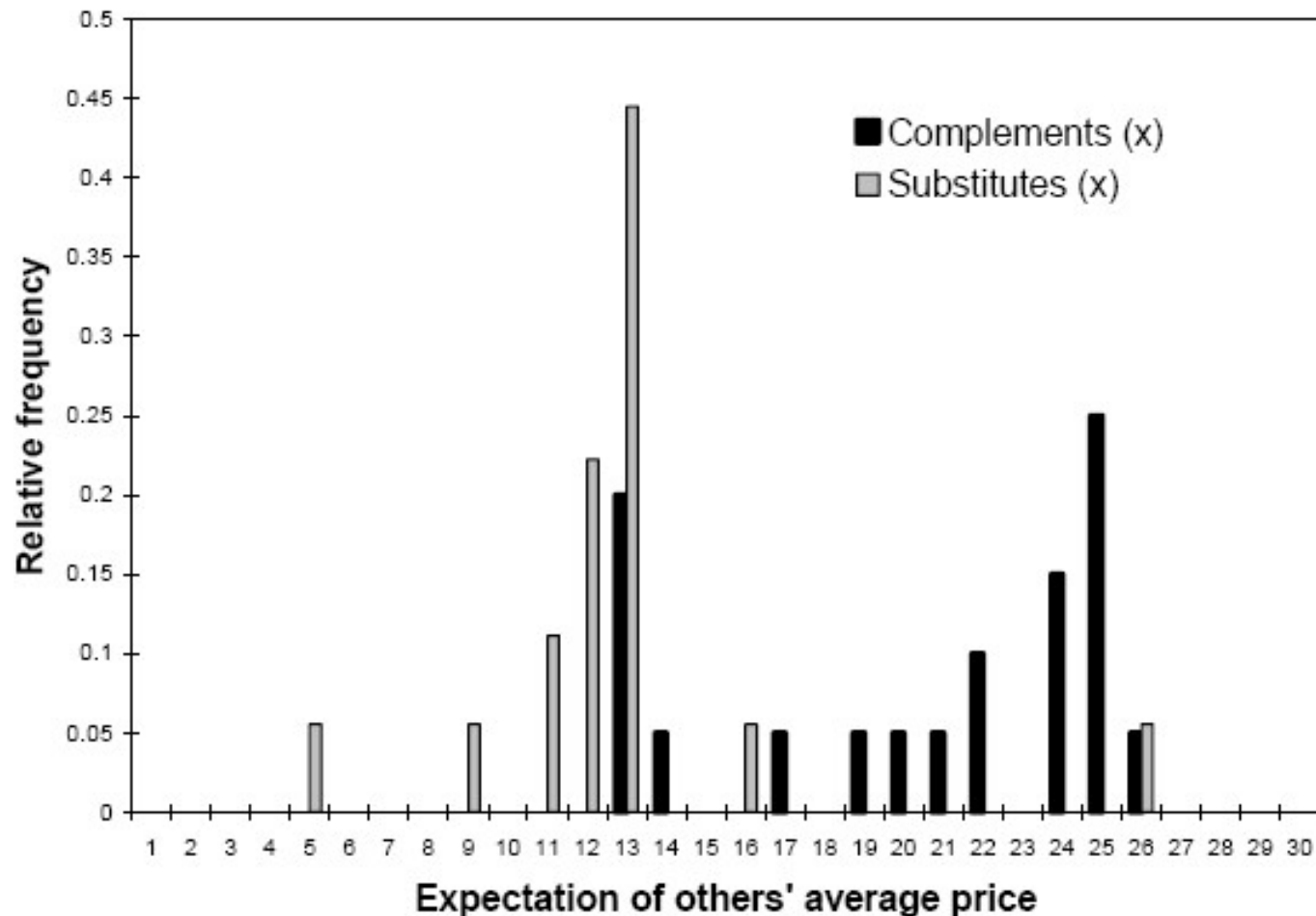
Strategic Environment

- **Strategic complements and substitutes** Fehr & Tyran 2002
 - Results
 - Strategic complements: Gradual adjustment after the shock
 - Strategic substitutes: Immediate adjustment after the shock



Strategic Environment

- **Strategic complements and substitutes** Fehr & Tyran 2002
 - Results
 - Subjects expectations are the driving force for the speed of adjustment



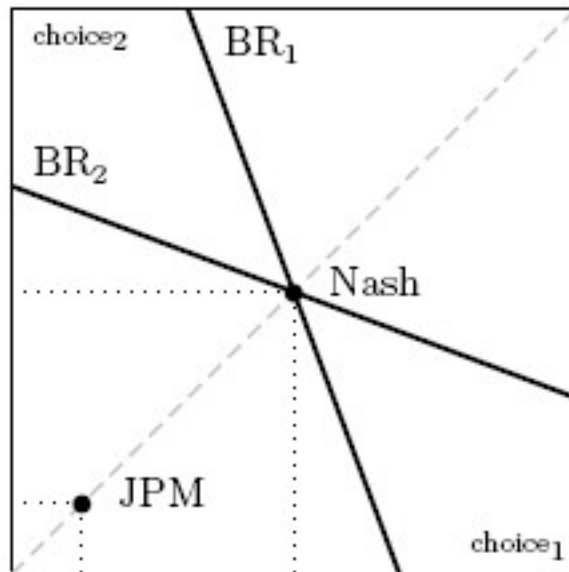
Strategic Environment

- **Strategic complements and substitutes** Potters & Suetens 2008

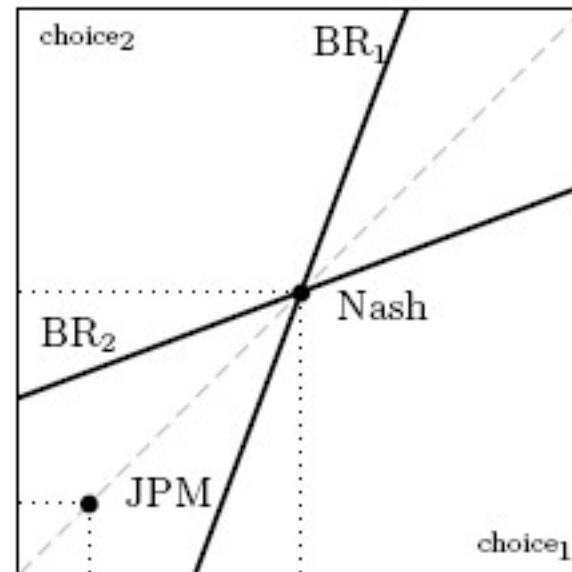
- **Another example**
 - Price competition (strategic complements)
 - If you lower your price I also lower mine
 - Quantity competition (strategic substitutes)
 - If you lower your quantity I increase mine

Strategic Environment

- **Strategic complements and substitutes** Potters & Suetens 2008
- Study the ease of collusion under the two strategic environments
 - Keeping the same:
 - Nash equilibrium choice and payoff
 - Joint-payoff-maximizing choice and payoff
 - Optimal defection payoff
 - Absolute values of the slopes of the best response functions



(a) SUBSTneg



(b) COMPLneg

Strategic Environment

- **Strategic complements and substitutes** Boone et al. 2008

Complements

	0	1	2	3	4	5	6
0	6	6	6	24	28	45	65
1	6	10	10	25	40	45	65
2	10	24	30	34	40	54	90
3	3	10	34	40	48	54	90
4	2	3	30	34	45	71	100
5	1	2	17	32	40	56	75
6	1	1	15	15	15	45	65

Substitutes

	0	1	2	3	4	5	6
0	6	6	6	24	28	45	65
1	6	10	10	25	40	54	75
2	6	10	30	34	40	71	100
3	6	10	34	40	48	56	90
4	10	24	30	34	45	56	90
5	3	10	15	32	40	56	75
6	1	1	15	30	30	45	65

Strategic Environment

- **Strategic complements and substitutes** Potters & Suetens 2008
 - Results
 - Considerably more collusion under quantity competition

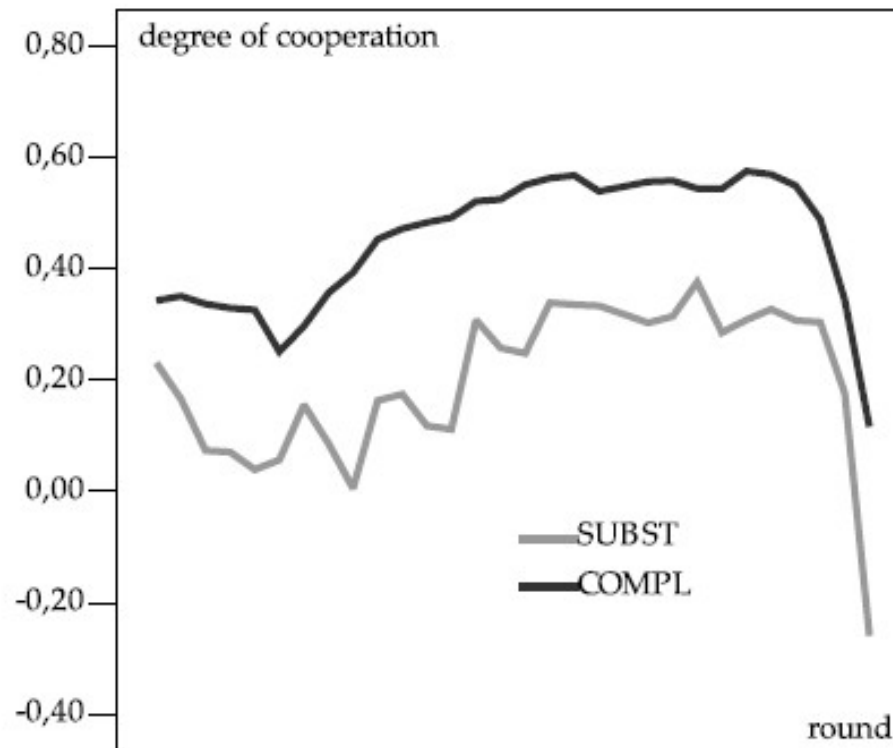


Figure 2: Average degree of cooperation

Strategic Environment

- **Strategic complements and substitutes** Boone et al. 2008
 - Results
 - Face-to-face contact boosts cooperation only for substitutes.

