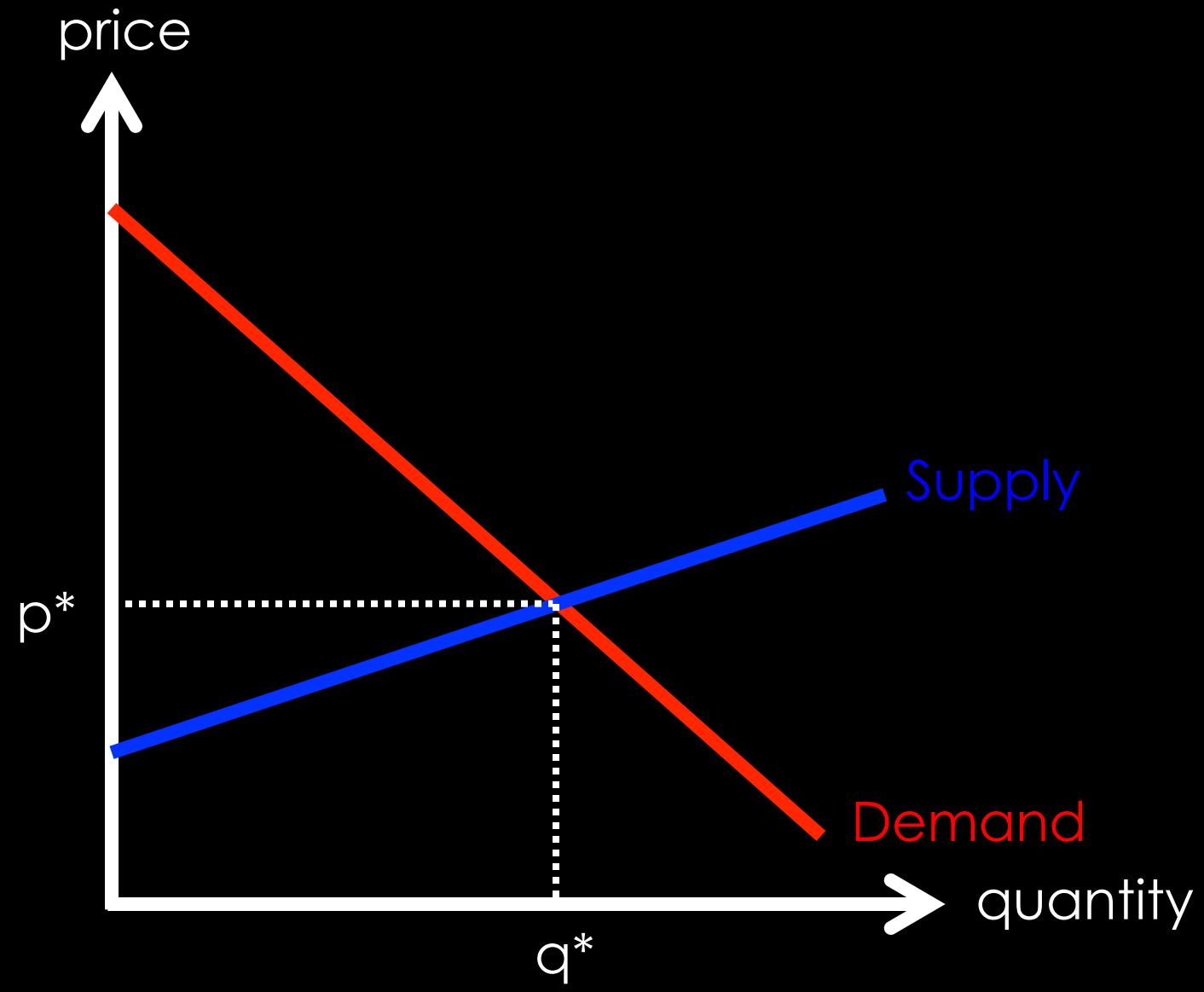
5.1 Introduction
5.2 Chamberlin Market
5.3 Double auction
5.4 Robustness of double auction
5.5 Posted offer markets
    Comparison with double auction
    Response to shocks

LECTURE 5: EXPERIMENTAL MARKETS

Aims

- Be familiar with the functioning of different experimental market institutions.
- Be familiar with the key results and outcomes of experimental market institutions


price
Supply
p*
Demand
quantity
q*

Competitive markets

- Assumptions
  - Agents are rational and selfish utility/profit maximisers
  - A homogeneous well defined good is produced and traded
  - There are numerous firms and consumers
  - Agents are price takers (auctioneer)
- These assumptions can be seriously questioned
  - People are boundedly rational
  - People often have interdependent utility functions
  - There are many markets with only few firms
  - In most markets there is no auctioneer but agents set prices

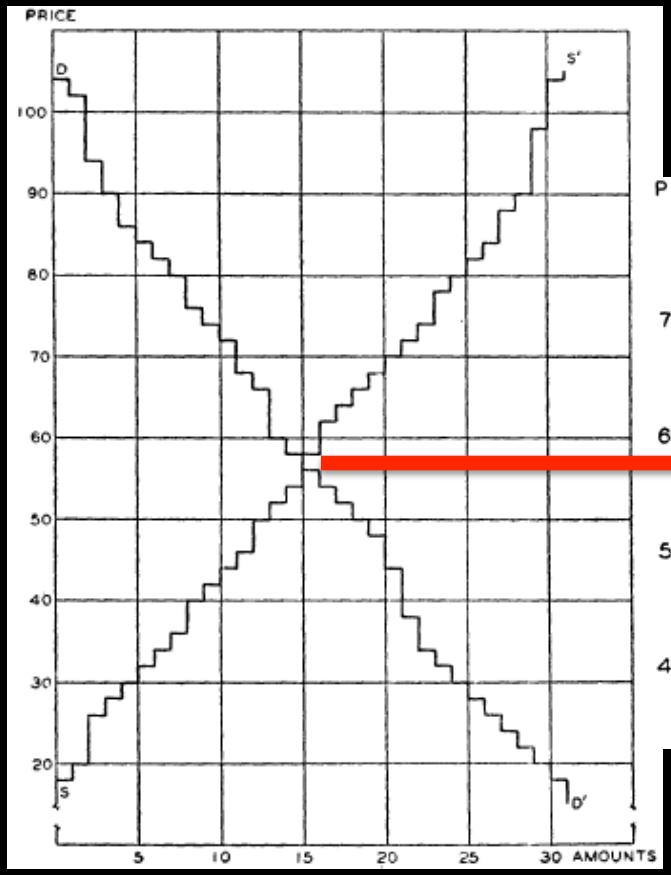
Questions

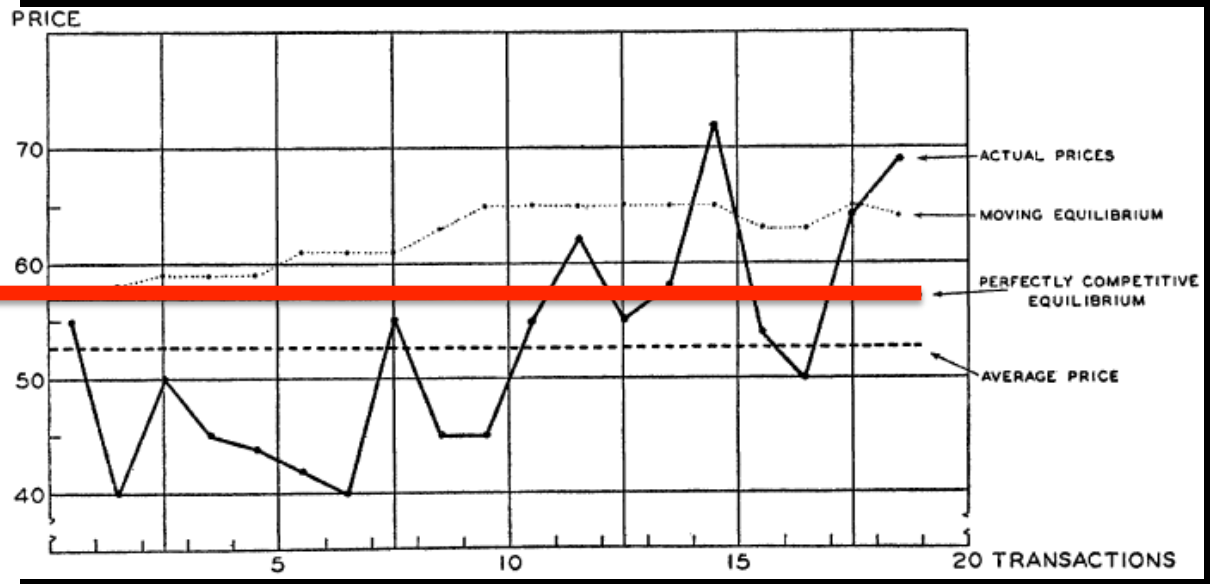
- Do these deviations from the assumptions constitute negligible frictions or do they seriously challenge the predictive power of the competitive market model?
  - Answer is very important (e.g., for the first and the second welfare theorem).
- Are there "real" market institution for which the competitive equilibrium is a good predictor of price and quantity outcomes?
- How do different market institutions differ with respect to, e.g., efficiency, convergence etc.?

6.2 Chamberlin ‘s Experiment

- **Chamberlin (1948)** conducted a market experiment in which prices and quantities failed to converge to the competitive equilibrium.
  - Subjects bargained bilaterally.
  - Trading prices were written on the blackboard.
- Chamberlin’ s aim was to refute the competitive model.

Chamberlin market: An example





Chamberlin market: Who trades?

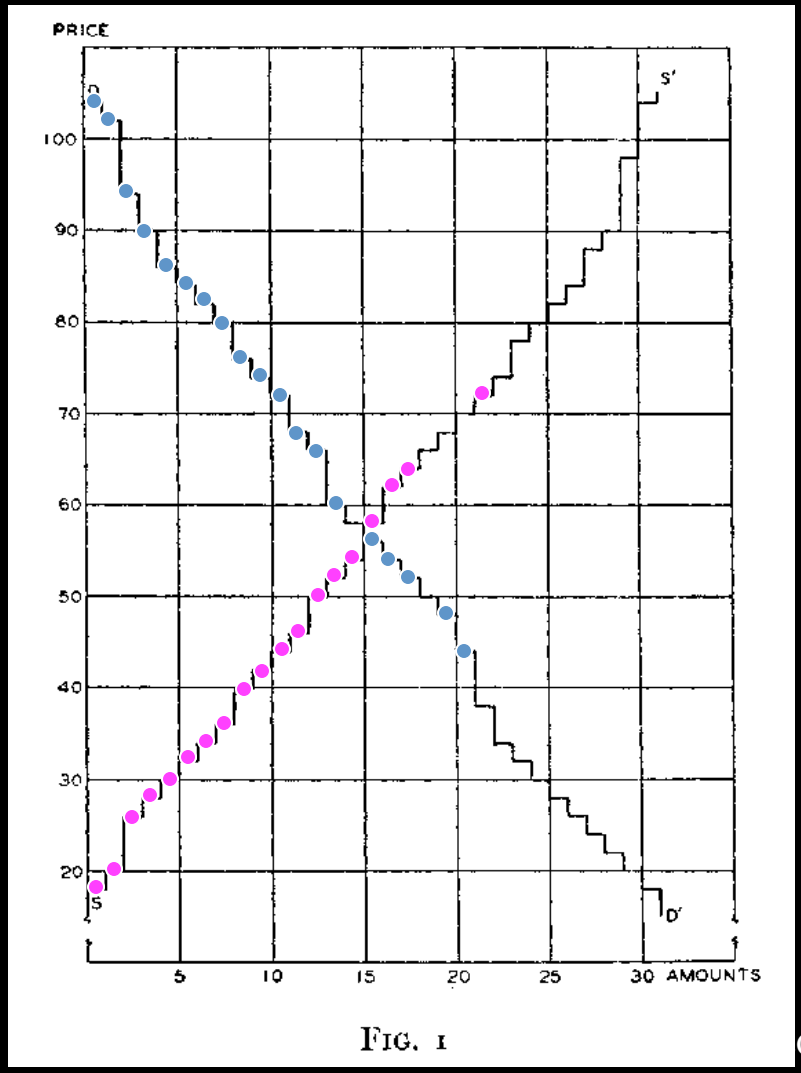


FIG. 1

- Circles denote traders who successfully bargained.
- Conditionally efficient because no further profitable trades were possible.
- Inefficient because many extramarginal traders were successful.

Chamberlin market: conclusion

- Chamberlin concludes that markets do not work in this situation:
- *Perhaps it is the perfect Market which is „strange"; at any rate, the nature of the discrepancies between it and reality deserves study*.

- What was the problem?

6.3 Smith ‘s Experiment

- V. Smith, a former Harvard student changed Chamberlin’s trading institution in the following way:
  - Instead of having subjects circulate and make bilateral deals he used the oral double auction procedure.
  - He also implemented the method of “stationary replication”, which is a sequence of trading days with stationary demand and supply schedules.
- “These two changes seemed to me the appropriate modifications to do a more credible job of rejecting competitive price theory, which after all, was for teaching, not believing...” (Smith 1991, p. 155).

The Double Auction

- Developed by **Vernon Smith** (1962), similar to the Pit Market
- There is a number of buyers and sellers who have **induced** demand and cost, as above
- There is usually **no information** about the cost and values of the **other** traders (private, **incomplete** information)
- Both buyers and sellers can actively offer/bid and accept prices
- All price offers and bids and acceptance decisions are made **public**
- There is an **improvement rule**, that is, bids (offers) must be successively higher (lower)
- "buyer 3 bids $1.20" - "seller 4 asks $1.80" - "seller 3 asks $1.40" - "buyer 2 accepts $1.40" - "seller 2 accepts $1.20"
- Any bids or asking prices remain on the blackboard (or computer screen); when a contract is made, the previous asks and bids are valid again

Result: Symmetric supply and demand functions

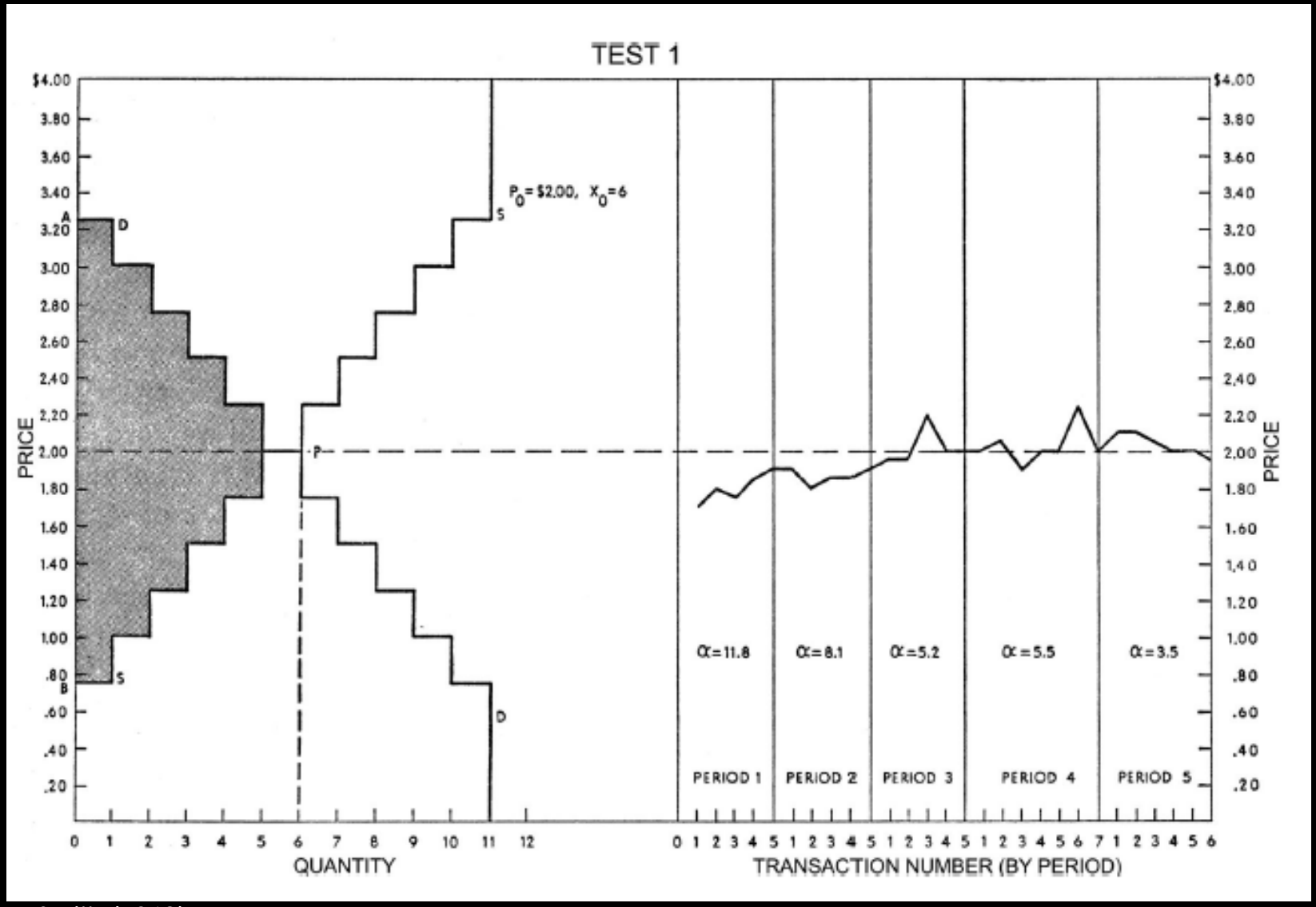
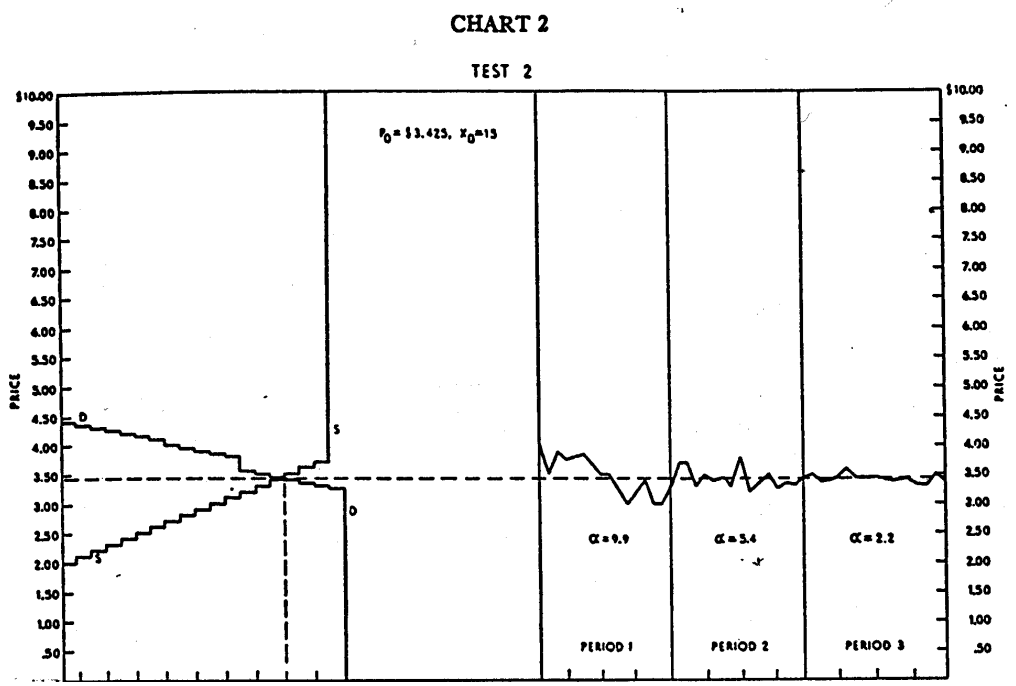
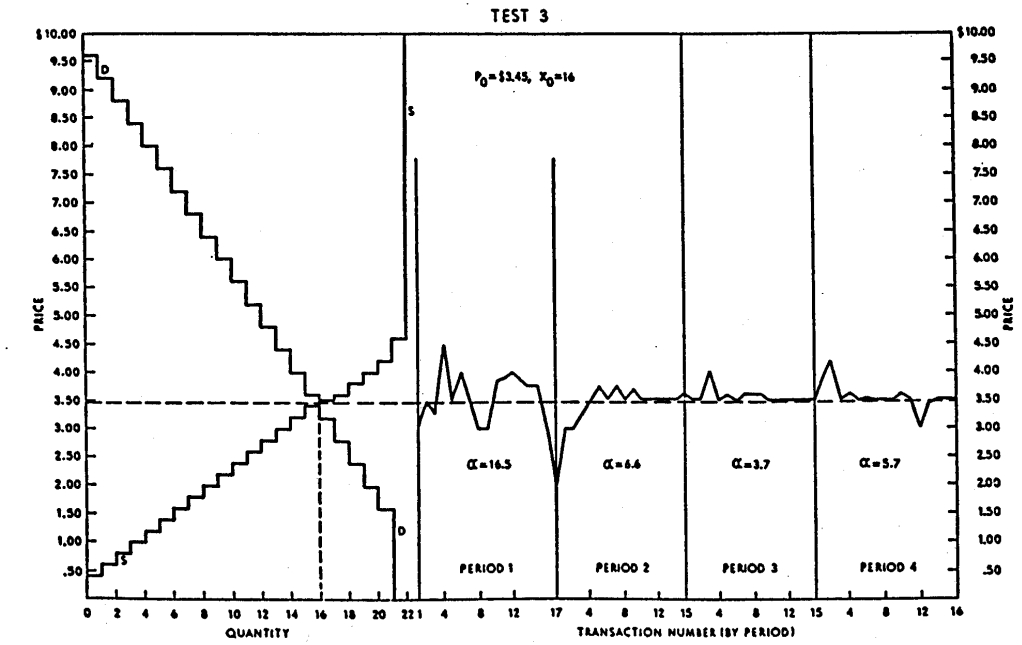


Chart 1: from Smith (1962)



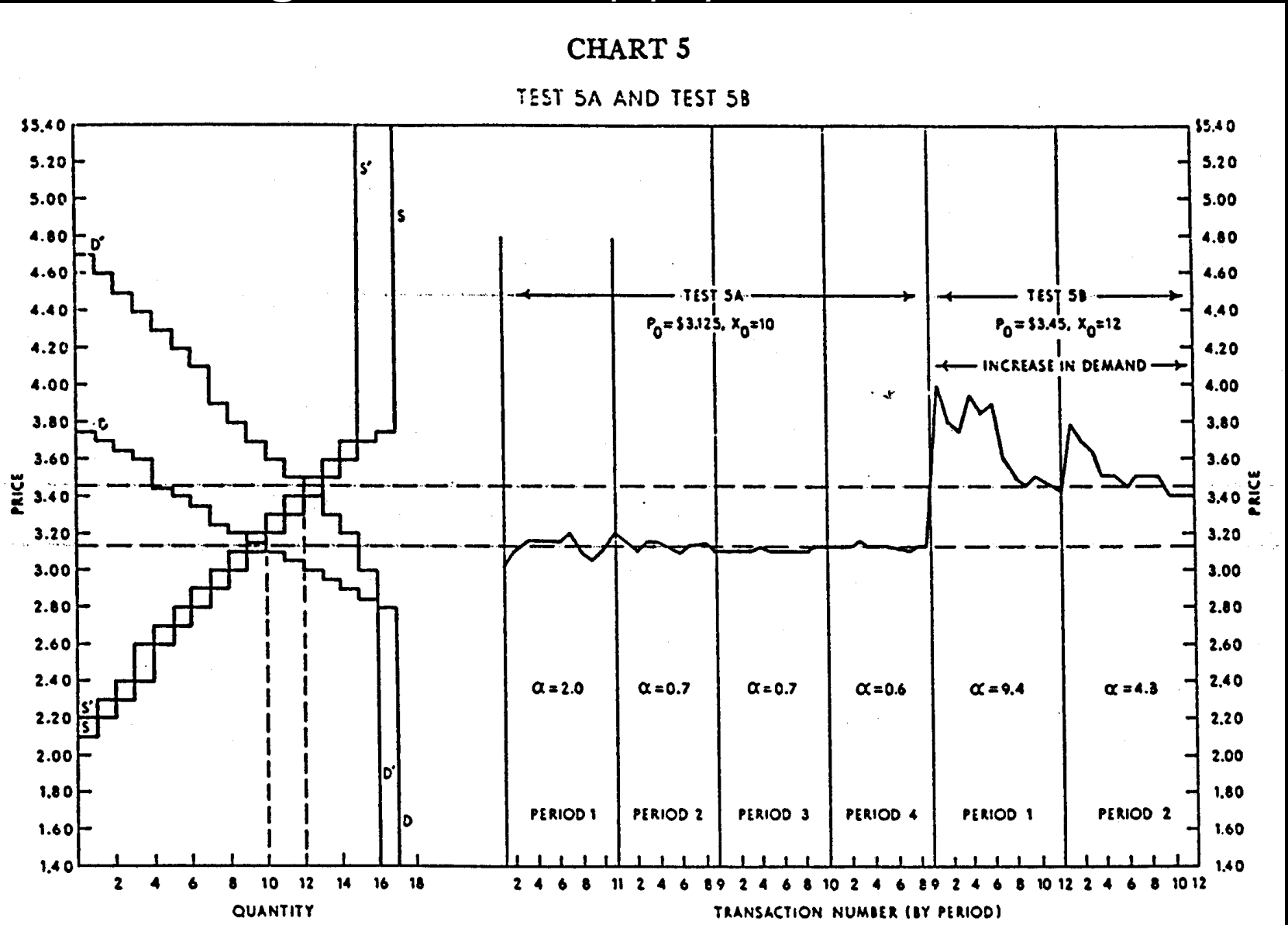


Robustness check I:

flat supply- and demand functions

From: Smith (1962)

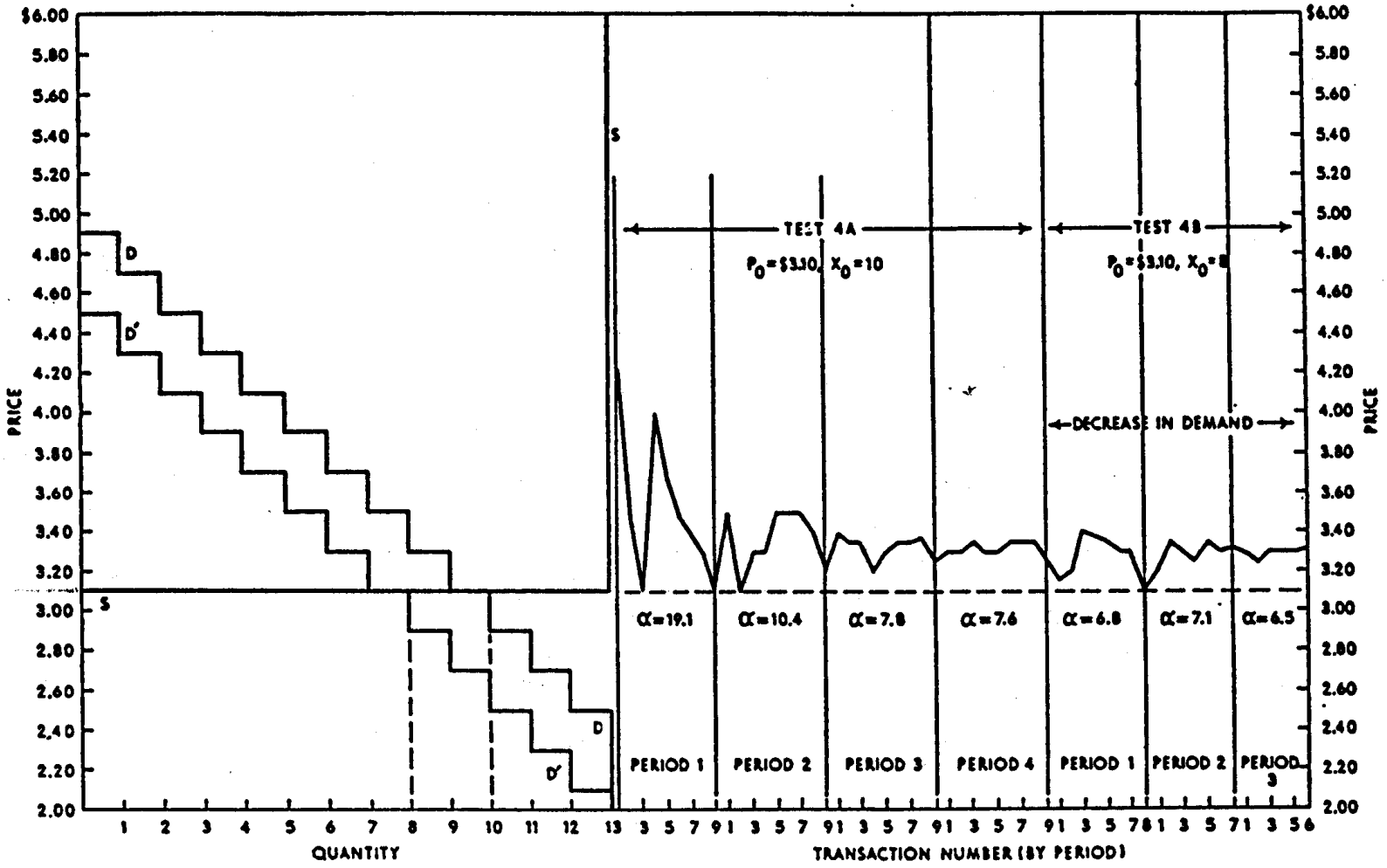
Robustness check II: Changes in the supply- & demand functions



➔ quick reaction

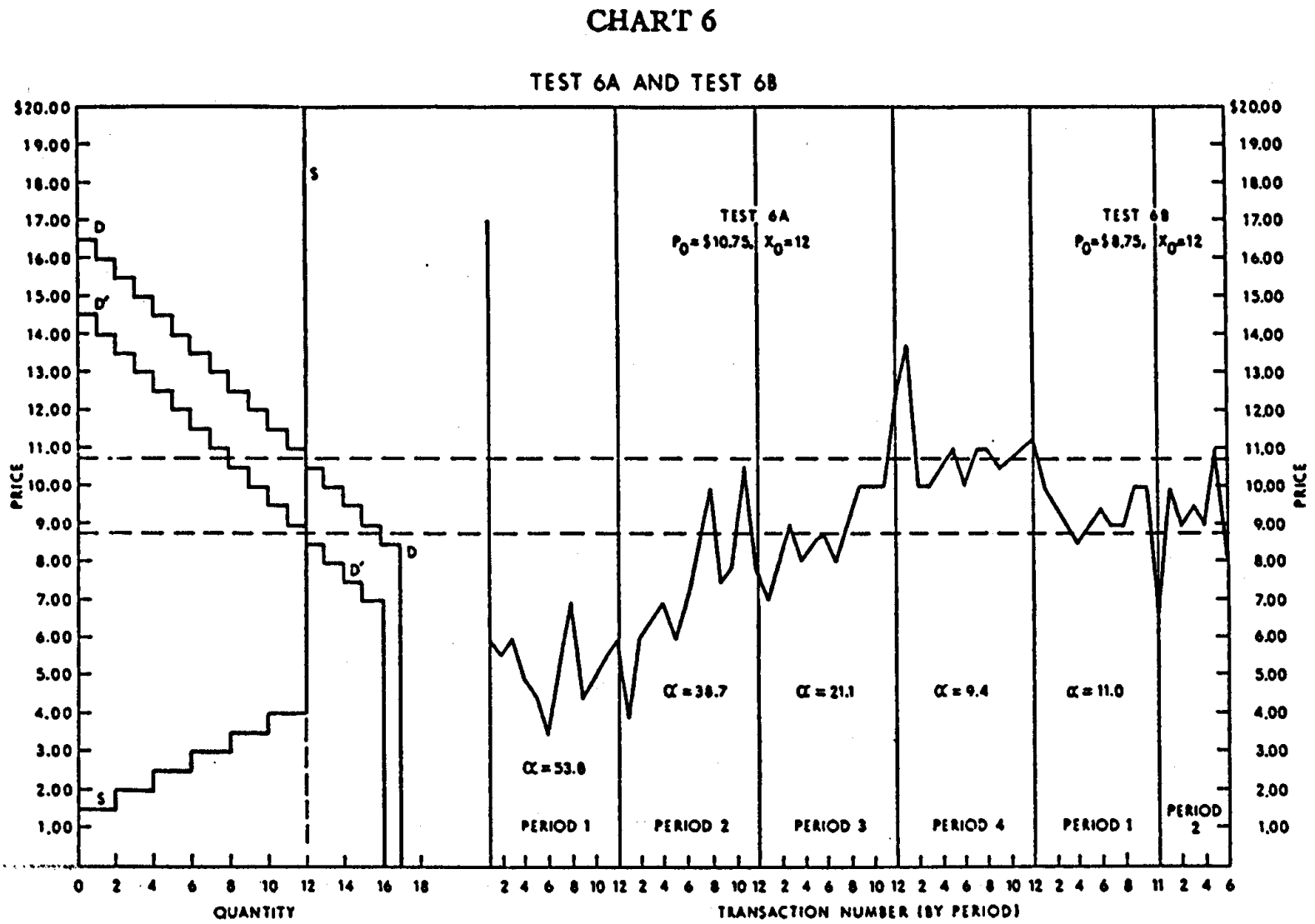
From: Smith(1962)

Robustness check III:
Buyers are on the short side of the market



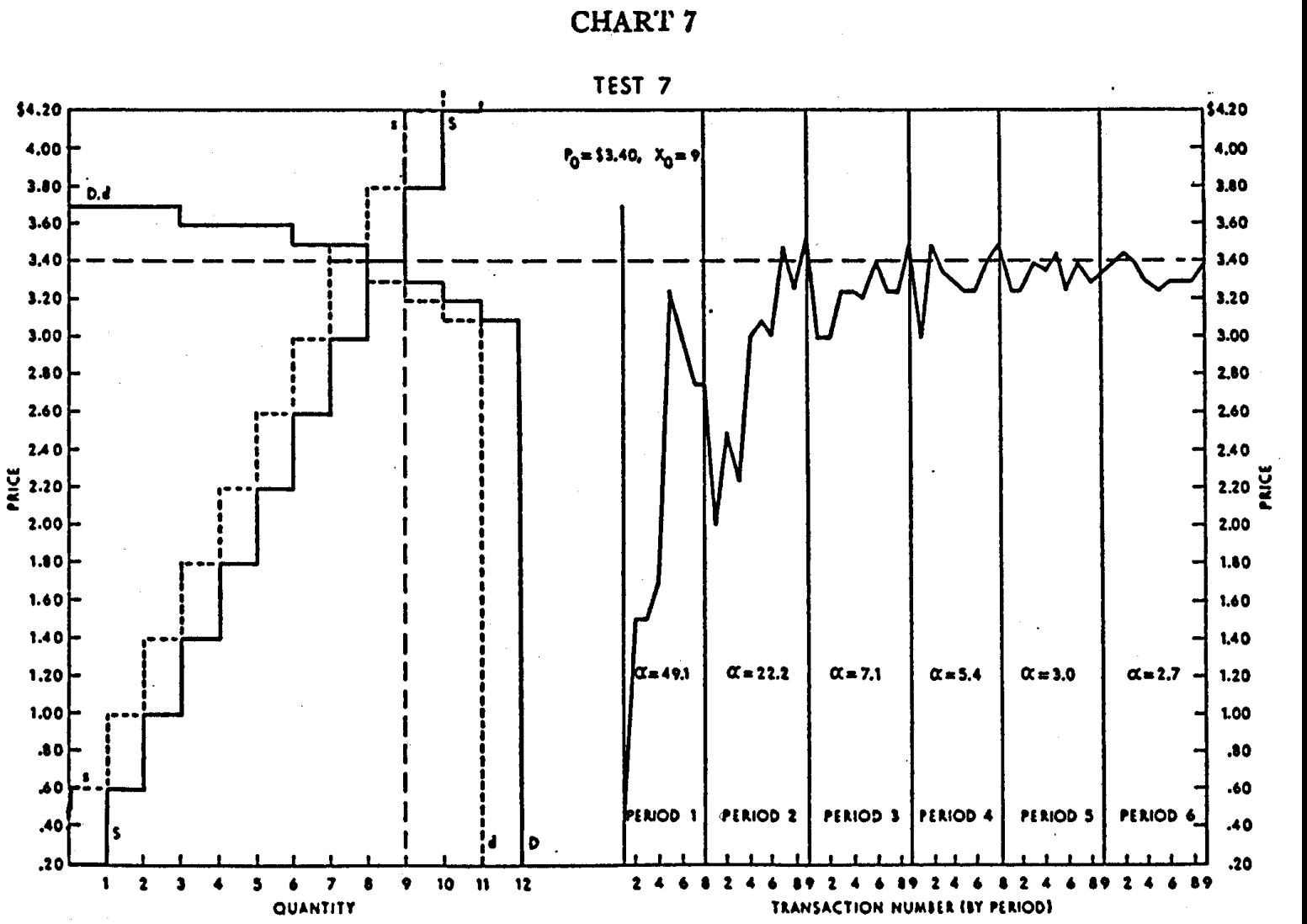
From:
Smith (1962)

Robustness check IV: sellers are on the short side of the market I



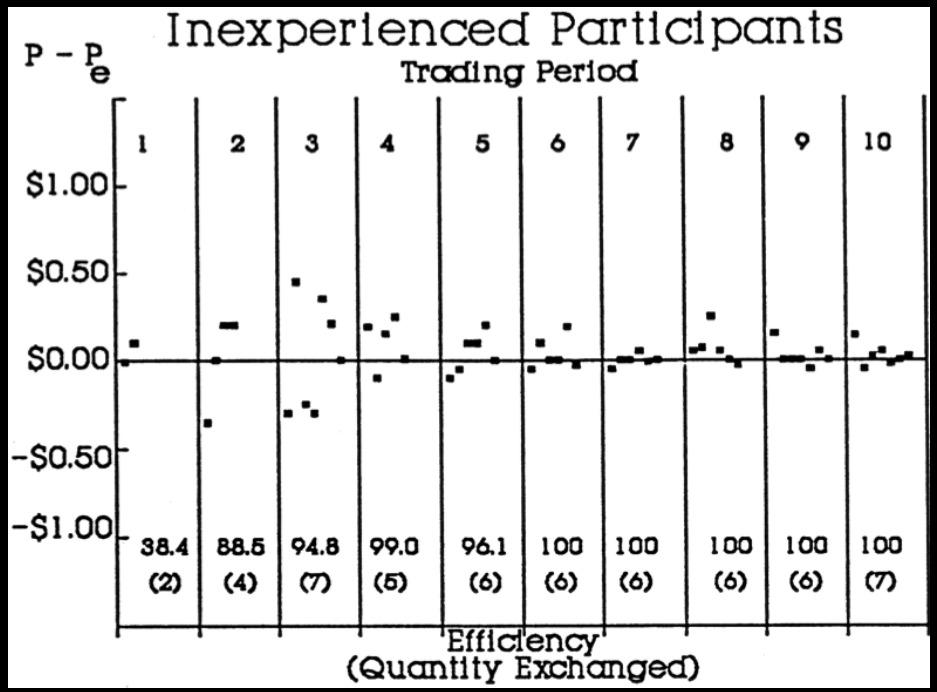
From: Smith (1962)

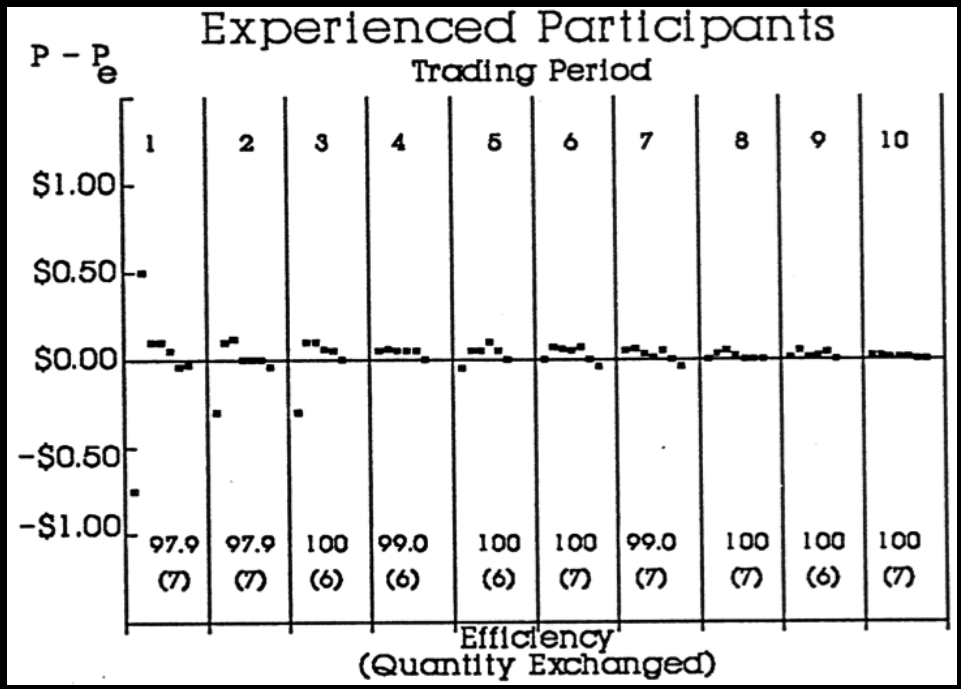
Robustness check V: sellers are on the short side of the market II



From:
Smith (1962)

Robustness check VI: The Effects of Experience





Based on Davis & Holt (1993)

Robustness Check VII: Extreme Earnings Inequality

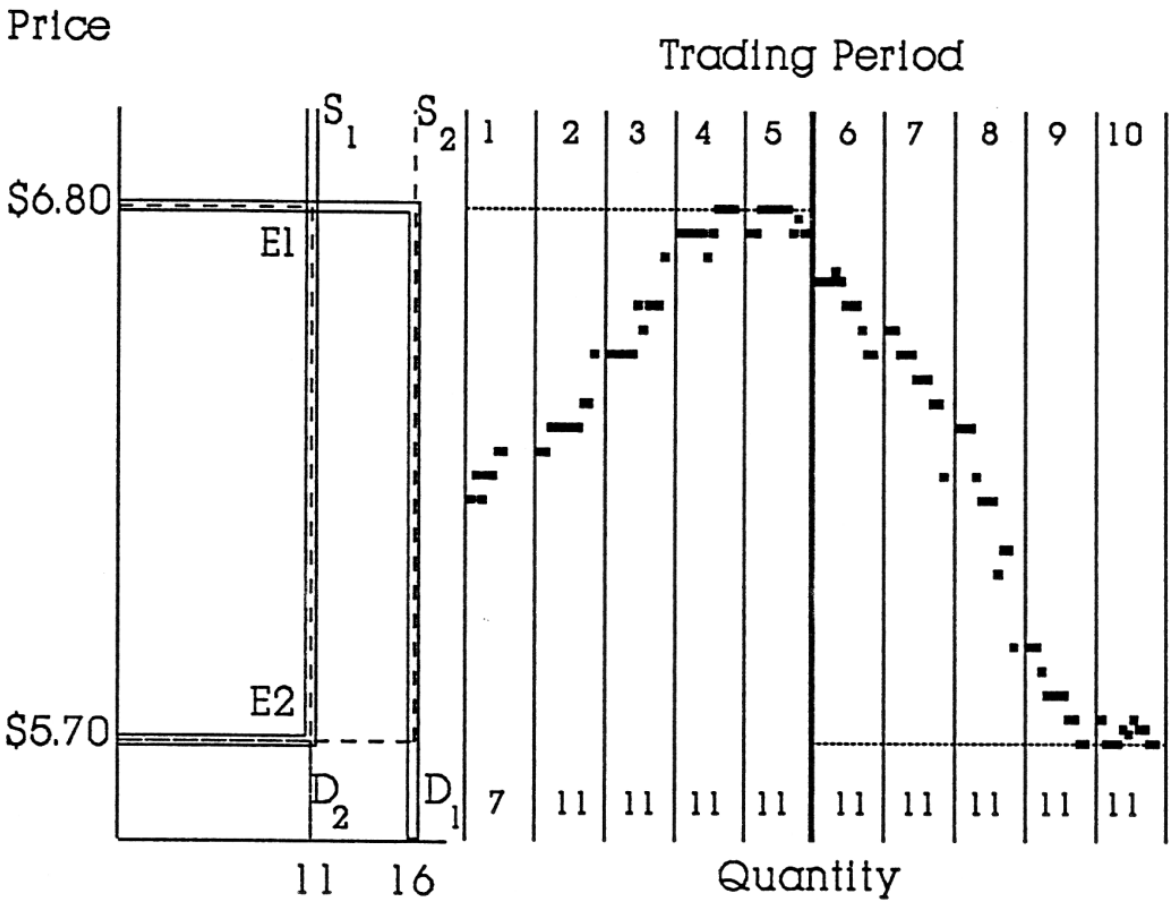


Figure 3.5 Contract Prices for a Box Design: First with Excess Demand, then with Excess Supply (Source: Holt, Langan, and Villamil, 1986)

Robustness Check VIII:

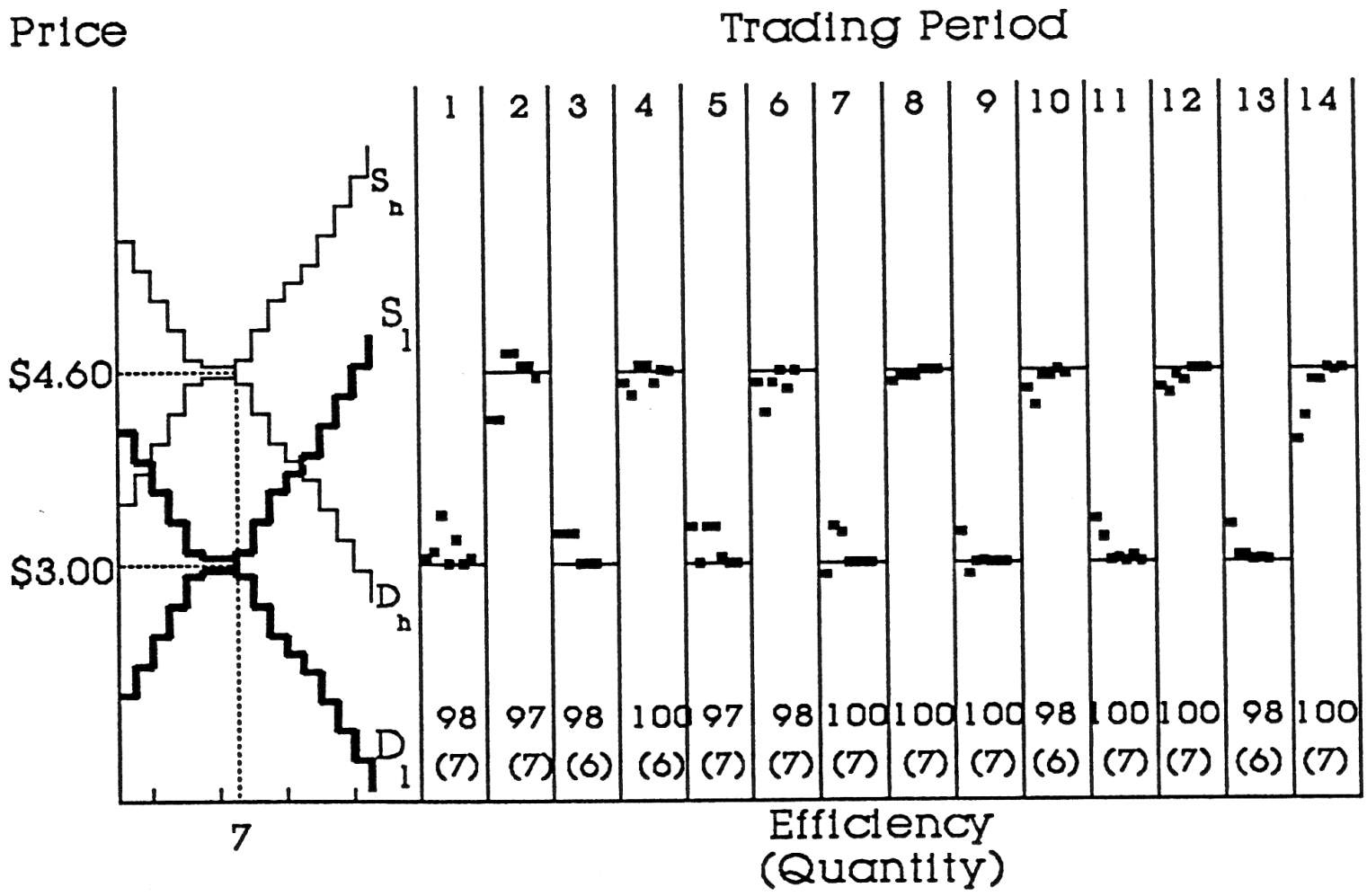


Figure 3.7 Contract Price Sequences with Cycling Supply and Demand
(Source: Williams and Smith, 1984)

Summary I

- Main result:
  - Symmetric supply- and demand functions (Chart 1; Smith 1962)
  - Prices converge, i.e., α declines
- Further findings (less important and robust?)
  - Charts 2/3: better convergence for flat supply- and demand functions (range of offers!)
  - Chart 5: Quick reaction to changes in the supply- and demand functions
  - Charts 4/6/7: division of rents has an impact on the direction of convergence
    - Chart 4: Buyers are on short side, sellers earn almost nothing, prices come "slowly" from above
    - Chart 6/7: Sellers earn relatively high rents, buyers show resistance to pay high prices, convergence from below

Summary

- Relatively quick convergence of prices
  - Without knowledge of supply and demand functions
  - Few traders
  - Inexperienced traders, short time to learn
  - Trade without auctioneer, all traders are price makers and price takers

It can ‘t be true!

“I am still recovering from the shock of the experimental results. The outcome was unbelievably consistent with competitive price theory. ... But the result **can’t** be believed, I thought. It must be an accident, so I will take another class and do a new experiment with different supply and demand schedules.”

(Smith 1991, p. 156)

Summing Up
(Smith, 1991, p. 157)

- In 1960 I wrote up my results and thought that the obvious place to send it was the Journal of Political Economy. It's surely a natural for those Chicago guys, I thought. What have I shown?
- I have shown that with
  - remarkably little learning,
  - strict privacy, and
  - a modest number [of traders],
  - inexperienced traders

  converge rapidly to a competitive equilibrium under the double auction institution mechanism. The market works under much weaker conditions than had traditionally been thought to be necessary.
  - You didn't have to have large numbers.
  - Economic agents do not have to have perfect knowledge of supply and demand.
  - You do not need price-taking behavior - everyone in the double auction is a price maker as much as a price taker.
- A great discovery, right? Not quite, as it turned out. At Chicago they already knew that markets work. Who needs evidence?"

Experimentalists' Policy Advice on Auctions

- Starting with the double auction, experimentalists have developed expertise for **auction design**
- Successful policy advice of experimentalists include the design of
  - environmental permit auctions in the US
  - the 3G Mobile Phone auction in the UK
  - and electricity spot markets in the US
- This success in policy advice of experimental economists can be traced back to these early double auction experiments

Example of a Flawed Experimental Design: Double Auctions - "The Multi Unit Case"

- Early double auctions involved **single-unit** buyers and sellers; they converged to the competitive equilibrium
- Williams (Rev. Econ. Stud., 1973) extended the one-sided auctions to "the **multi-unit** case". He found that markets are **not competitive** any more
- But Williams had **changed the trading institution** at the same time:

  "In my experiments, price offers were posted at the beginning of each period and could not be changed during a trading period"
- Later research found that it is the trading institution that changes the results, not the multi-unit setup
- Lesson from this: never change **two aspects** of the design **at once**! You can only compare across different treatments when you change **one** design feature only. You have to keep everything else **equal**.

Design Issue: 2x2 Treatment Design

- How to design an experiment which cleanly solves the above problem (multi-unit setup versus different trading institution)?
- So-called **2x2 treatment design**
- Old research by Smith was treatment **A**, Williams' **D**
- Only by doing treatments **B** and **C** as well can we find out the real reasons for the change in results
- Comparing **A, B, C** and **D**, it is clear that it was not the multi-unit setting that caused the different result; it was the trading institution

	Double Auction	Williams' new trading institution
single unit	**A** competitive	**B** not competitive
multi unit	**C** competitive	**D** not competitive

6.5 Posted offer markets

- Williams had unintentionally proposed a new and (as it turned out later) very popular trading institution, the **Posted-Offer market**
- Similar to **retail markets:** in contrast to the Double Auction sellers **simultaneously** post prices only **once** per period; haggling is not allowed
- Sellers set a price and fix a **maximum** number of units they intend to sell
- Then buyers shop in a **random** sequence and buy from sellers of their choice
- Posted-Offer markets "tend to have **higher prices than double auction** markets in that adjustment tends to be from above" and **may "not converge at all**" (Charles Plott)

Prices and Efficiency in a Posted Offer Market

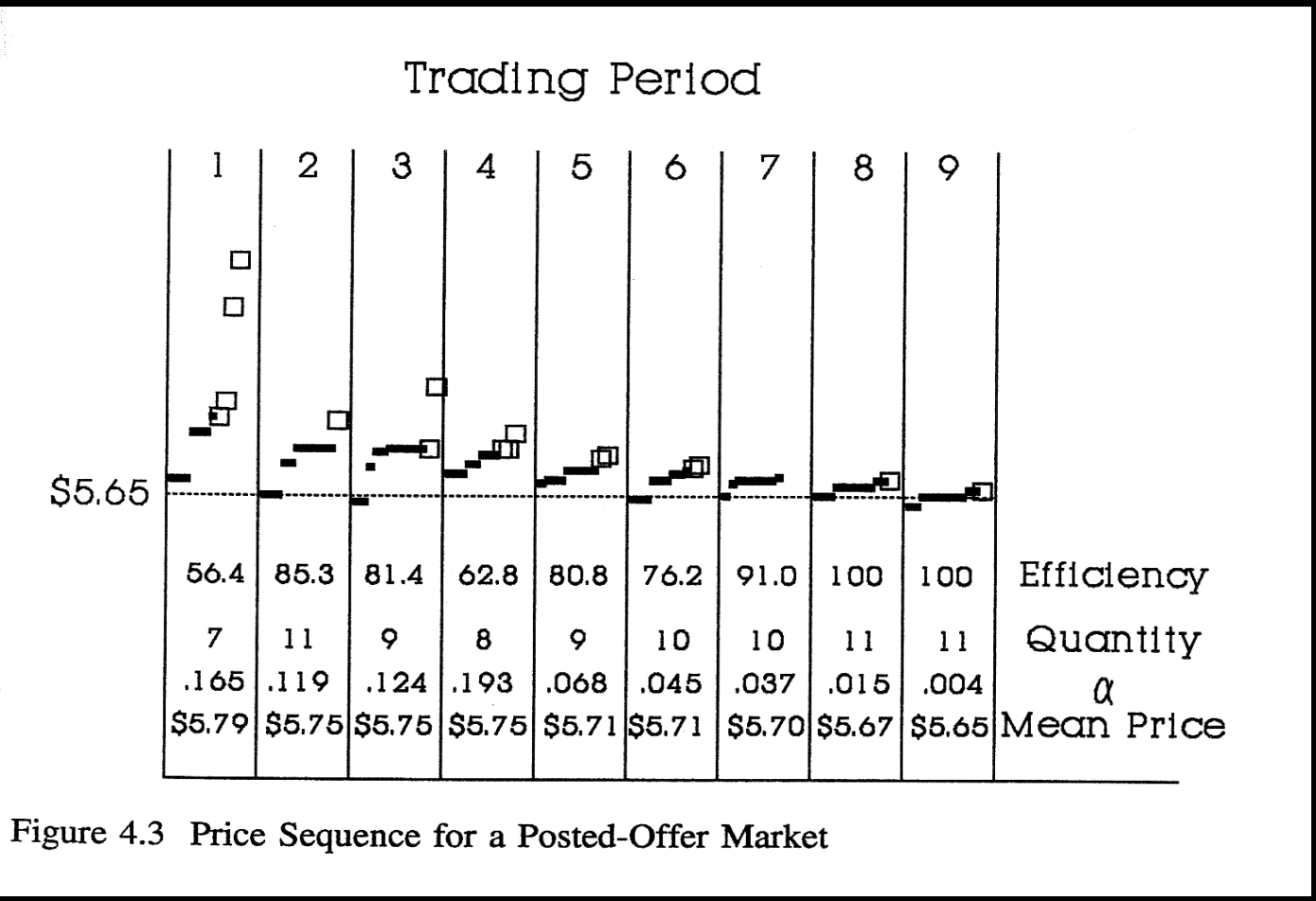


Figure 4.3 Price Sequence for a Posted-Offer Market

From Davis & Holt 1993:

- Solid dots: contract prices
- Empty boxes: nonaccepted price offers
- Results
  - Slow convergence
  - Convergence from above
  - Initially efficiency very low

Responsiveness of Double Auction and Posted Offer Markets to Demand Shocks

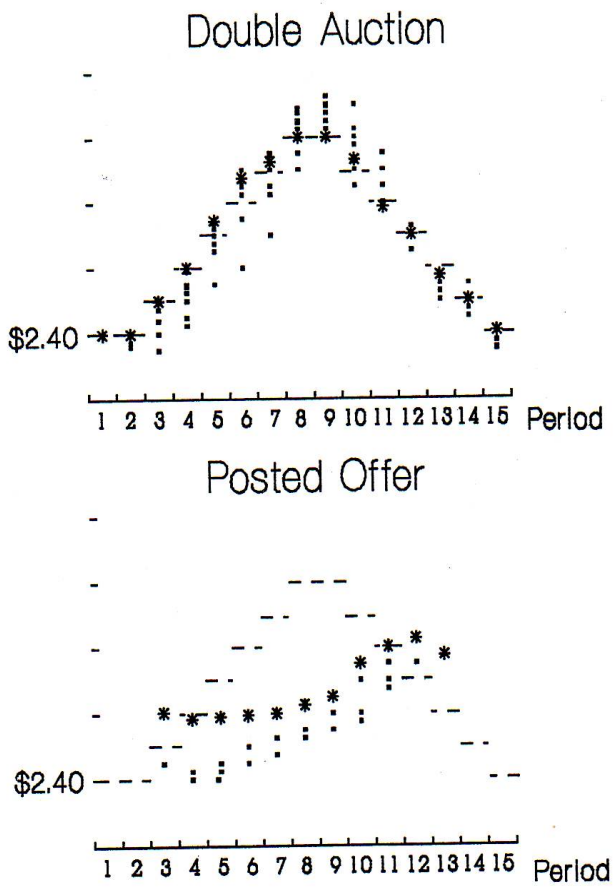


Figure 4.7 Double-Auction and Posted-Offer Contract Prices in a Design with Regular Demand Shifts (Source: Davis, Harrison and Williams, 1991) Key: contract prices: ·, Final contract prices: *, Equilibrium Price: --.

- Demand increases until period 8 and falls from Period 9 onwards.
- Results double auction
  - Initially, most prices in the DA are below CE. After the negative shock they are above CE.
  - Closing prices in the DA track CE very well.
- Results posted offer market
  - In the PO-market actual prices bear no resemblance to the CE-prices. They still rise when demand is already falling creating zero trades in period 13 and 14 (stagflation).

Conclusion

- Different market institutions can be set up in the lab:
  - Double auction.
  - Single sides auction (not discussed).
  - Posted offer market.
- In the double auction market equilibrium is a good predictor for the number of trades as well as for the closing price.
- In the posted offer market, convergence to market equilibrium is much slower.

Problem Set

1. Double auctions assume that the demand and cost parameters remain constant all the time. In reality, cost and demand shocks (changes) often occur. What would be the appropriate experimental design to analyse demand changes in a double auction experiment?
2. Experimental economists want to contribute to the efficient design of pension schemes. The experiment involves the consumption choices over time where the players' death occurs at a random point. Can this be done in the lab?
3. Someone questions the relevance of double auction results. "People in the real world rarely trade in this manner. Therefore, I do not believe more strongly in the concept of competitive equilibrium than before." Comment on this objection.
4. Rearrange the Pit Market cost schedule in the lecture notes such that you start with the highest cost value and end with the lowest. How many units can be traded? How many prices are possible? How can welfare change?

Problem Set

5. Suppose you wanted to do the above experiment by Williams. In addition to analysing single unit versus multiple units and double auction versus posted-offer rule, you want to analyse single seller (monopoly) versus multiple seller (competition). What would be the appropriate treatment design? How many additional treatments would you have to do?
6. Why is the Double Auction not a game? Write down a Posted-Offer markets as an extensive form game.
7. Calculate the (mixed strategy) Nash equilibrium for the above posted-offer market. What is the Nash profit of the sellers? What is the Nash equilibrium distribution?
8. Someone argues: "The mixed strategy Nash equilibrium is far too difficult to compute even for a trained economists to be of any relevance for experimental research". Discuss.