E C O N O M I C S B U L L E T I N

Bargaining under ambiguity: some experimental evidence

Hammad Siddiqi
Lahore University of Management Sciences

Abstract

This paper investigates the price behavior in an experimental market in which participants are only aware of their own private values and do not possess information about the demand and supply curves, hence face ambiguity. The paper finds that when demand is flatter (more elastic) than the supply curve in price−quantity space then price approaches equilibrium from below, that is, all trades initially occur below the equilibrium price. However, if demand is steeper (less elastic) than supply, then the equilibrium price is reached from above. A simple rationale for this result is that in the first round of trading, participants tend to split the surplus from trading evenly among themselves since they are unaware of the equilibrium price. However, in subsequent rounds price quickly converges to the equilibrium as the equilibrium is discovered through repeated interactions.

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1. Introduction

Suppose the market for an asset opens for the first time, an example is the first issue of shares by a firm going public, the initial public offering (IPO). Such an asset is likely to be the most informationally opaque and consequently very hard to value since no historical information about its price is available. Can anything useful be learned from the equilibrium price discovery process of such an asset? We explore this question through an experiment and find that there may be a pattern. This paper investigates the equilibrium price discovery process in an experimental market, in which participants are only aware of their own private values and do not possess information about the shapes of demand and supply curves, hence face ambiguity. The paper finds that when demand curve is flatter than the supply curve in price-quantity space then price approaches equilibrium from below, that is, trades initially occur below the equilibrium price. In other words, if the demand is more elastic than the supply, then the equilibrium price is reached from below. However, if the demand is less elastic than the supply, then the equilibrium price is approached from above.

The result may have implications for the IPO under-pricing puzzle. The typical way of going public is by initial public offering (IPO) of shares to investors. Ibbotson (1975) and Logue (1973) were among the first writers to document that IPOs tend to be underpriced. They document that the share price jumps substantially on the first day of trading. LJungqvist (2005) writes that in the US, underpricing has averaged 21% in the 90s, and 40% in the 4 years since 2000. IPO underpricing has interested financial economists for decades. The literature on IPO underpricing is extensive. See Ritter and Welsch (2002), Ritter (2003), and Ljungvist (2005) for surveys of research on IPO underpricing. Is it possible that IPO underpricing is due to the demand for new issue being more elastic than the supply of new issue? Here, we do not replicate the institutional arrangements associated with an IPO. Rather, we are interested in a general situation where the market for an asset or a commodity opens for the first time; each person only knows his private value or private cost, and trading occurs through an open auction.

2. Experimental Design

The experiment was conducted at Stevens Lab at Northern Illinois University. Participants were undergraduate students at Northern Illinois University. The experiment was announced through email. Each participant was randomly assigned a role as a buyer or a seller and was seated at a terminal. Instructions were explained and a quiz was taken. The experiment began once all questions were answered correctly by everybody. The computer screen facing each participant initially showed the assigned role (either a buyer or a seller) and corresponding private value if buyer or private cost if seller. The screen also reminded each participant about their goal for the experiment, which was to make as much money as possible by buying low if buyer and selling high if seller. The gain for each buyer was the difference between his private value and the price paid by the buyer. The gain for each seller was the difference between the selling price and his private cost.[1] In each round of trading, each trader was allowed to buy a maximum of one unit if buyer or sell a maximum of one unit if seller. Participants submitted bids and asking prices

[1] Each participant was paid his/her average gain from all the rounds.

electronically, and watched the progress in real time. That is, they observed all bids, asks, and successful trades. Participants also had access to a chat screen through which they could chat with each other. Every message posted on the screen was visible to all participants. There were 2 experiment variations and 4 rounds in each variation. Each round of trading lasted for exactly 2 minutes. If a participant didn't succeed in completing the transaction in 2 minutes than a gain of 0 was recorded for him/her. In variation 1, demand was more elastic than the supply (figure 1a), and in variation 2, demand was less elastic than the supply (figure 2a). The experiment was conducted over 2 days. On day 1, variation 1 was conducted and on day 2 variation 2 was conducted. There were 48 participants in variation 1 and 46 participants in variation 2. There were no repeat participants. The participants were equally split between buyers and sellers.

3. Results

Figure 1a shows the demand and supply curves used in variation 1.[2] The equilibrium price is $50 and the demand is relatively more elastic than the supply. Figure 1b shows the concluded transactions in each round. As can be seen for the figure, all the concluded transaction in the 1st round are below the equilibrium price. In subsequent rounds, price gradually converges to the equilibrium and by 4th round most transactions occur at the equilibrium price. Figure1c clearly shows that the equilibrium price has been reached from below. Note that the average price at which transactions are concluded rises in each round, as figure 1d shows. In the 1st round, the average transaction price is $41.59 and the average transaction price by the 4th round is $50.25 indicating that the convergence to the equilibrium is rapid.

In variation 2, the demand is less elastic than the supply. As figures 2b, 2c, and 2d show, the equilibrium is reached from above and the average price at which transactions are concluded falls with each round.

There is a clear pattern linking respective demand and supply elasticities with whether the equilibrium price is reached from below or above.

4. Conclusion

Apart from implications for the IPO underpricing puzzle, the result is very interesting in its own right. Intuitively, without any knowledge about the actual demand and supply curves, participants trade in such a way so as to split the gains from trade evenly. As an example, suppose the buyer value is $60 and the seller cost is $20. Without knowing the equilibrium price, the participants initially tend to agree around $40, a 50-50 split, which seems fair. However, as they learn, price converges to the equilibrium. So, there is underpricing and overpricing depending on relative demand and supply elasticities. It would be interesting to investigate what happens to the extent of underpricing or overpricing as the demand and supply elasticity difference is increased. This is the subject of future research.

[2] Buyer values arranged in descending order gives the demand curve and seller costs arranged in ascending order gives the supply curve.

References

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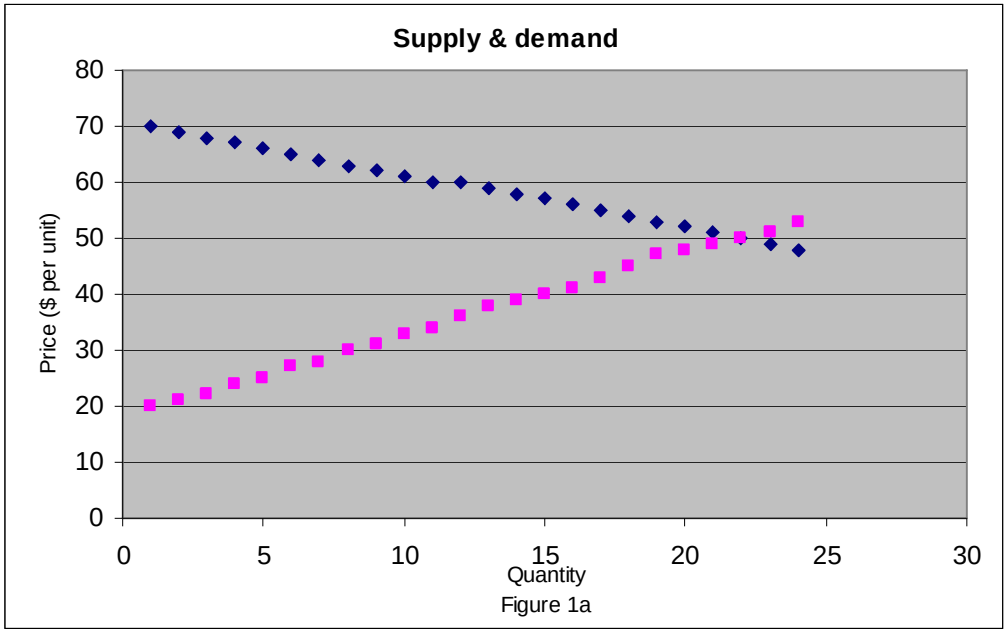


Figure 1a

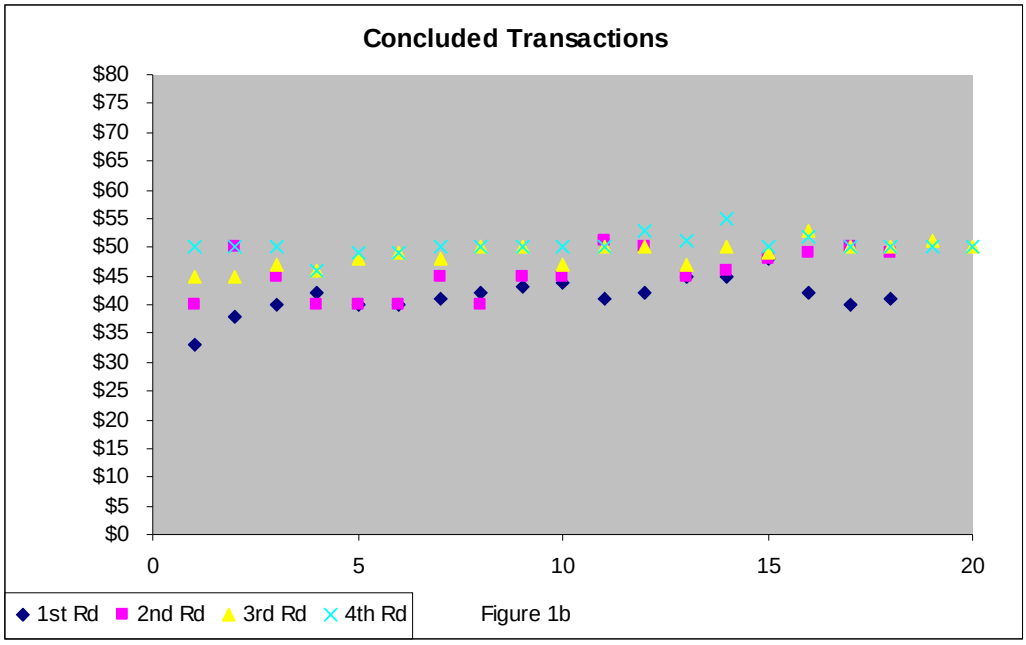
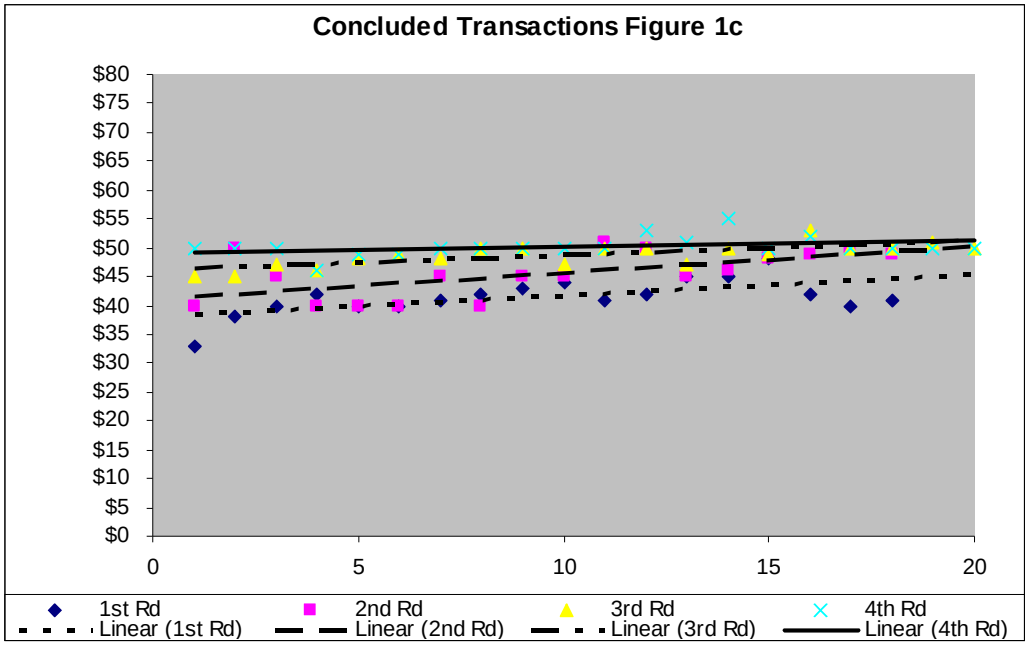


Figure 1b


Concluded Transactions Figure 1c
$80
$75
$70
$65
$60
$55
$50
$45
$40
$35
$30
$25
$20
$15
$10
$5
$0
0
5
10
15
20
1st Rd
2nd Rd
3rd Rd
4th Rd
Linear (1st Rd)
Linear (2nd Rd)
Linear (3rd Rd)
Linear (4th Rd)

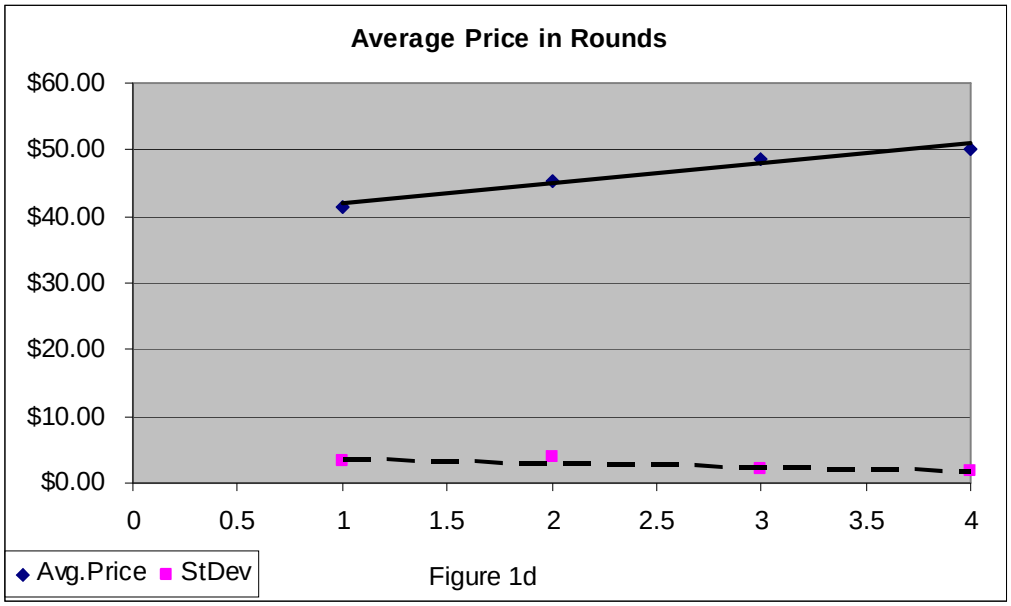

Average Price in Rounds
$60.00
$50.00
$40.00
$30.00
$20.00
$10.00
$0.00
0
0.5
1
1.5
2
2.5
3
3.5
4
Avg.Price
StDev

Figure 1d

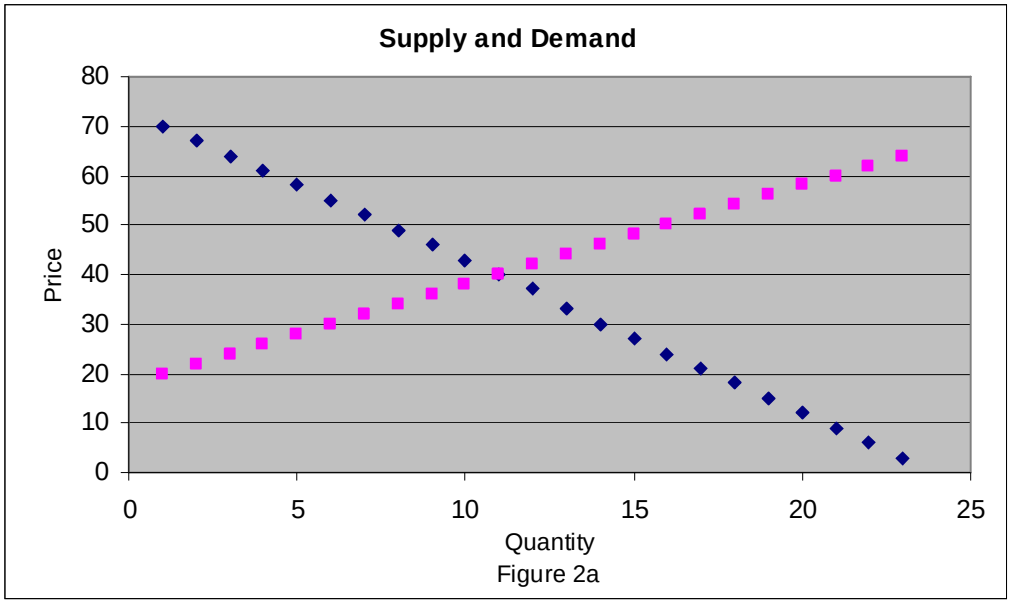


Figure 2a

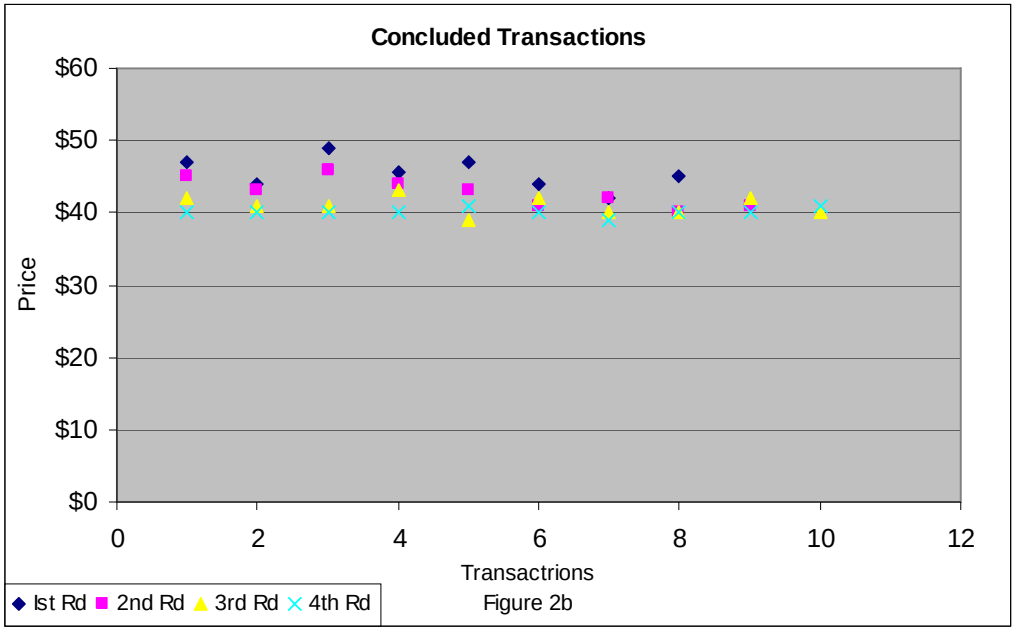
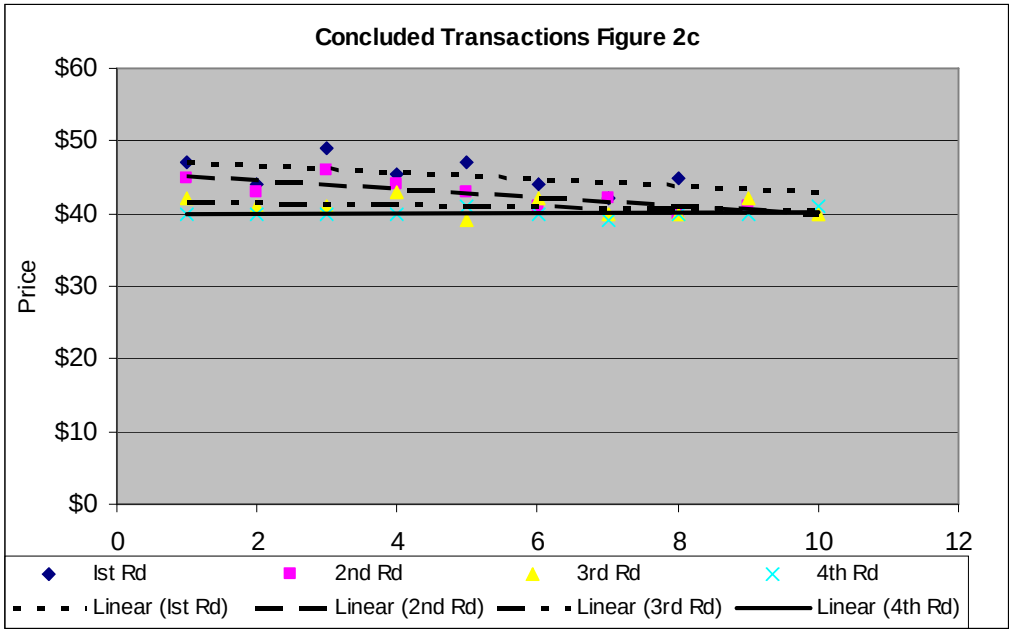
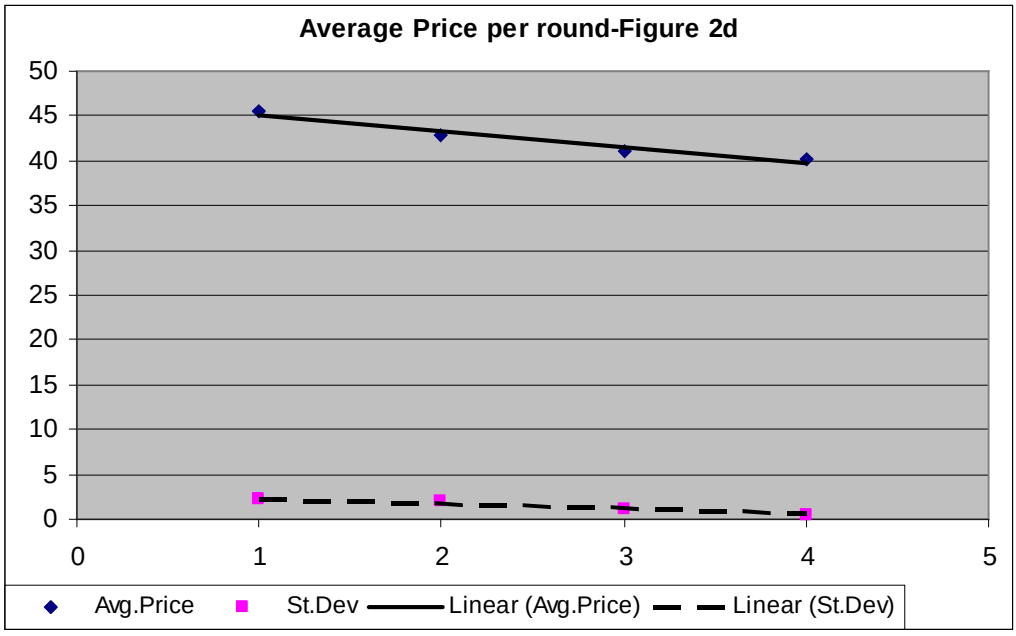


Figure 2b


Concluded Transactions Figure 2c
$60
$50
$40
$30
$20
$10
$0
Price
0
2
4
6
8
10
12
Ist Rd
2nd Rd
3rd Rd
4th Rd
Linear (Ist Rd)
Linear (2nd Rd)
Linear (3rd Rd)
Linear (4th Rd)


Average Price per round-Figure 2d
50
45
40
35
30
25
20
15
10
5
0
0
1
2
3
4
5
Avg.Price
St.Dev
Linear (Avg.Price)
Linear (St.Dev)