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Ultimatum game bargaining in a partially directed search market

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ABSTRACT

We investigate a partially directed search and bargaining market with a laboratory experiment. First, sellers post intervals of possible surplus splits (i.e. the payoffs that would result from posting possible prices) that direct buyers to approach them. Second, after matching occurs, final surpluses are determined by ultimatum game bargaining. We investigate the interaction between bargaining and competition in the preliminary search stage, with a focus on how preferences for fair bargaining outcomes affect search. The main results confirm that behavior in the ultimatum game is consistent with preferences for fair outcomes, and the main effect on search is to drive up the posted buyer surplus lower bounds above the competitive equilibrium towards more equal surplus splits. Our main treatment variable is the number of buyers in the market, and when the number of buyers is increased, lower bounds and ultimatum offers to buyers decrease. This is consistent with fairness perceptions being influenced by competition.

1. Introduction

Many markets operate in two stages. First, buyers search for a seller to purchase from. Second, they bargain with the seller over the price. In the goods market, this is common for expensive durable goods such as homes, cars, etc. It is also common on online marketplaces such as Craigslist. Many labor markets operate this way too. A well-established fact about bargaining is that the participants' concerns for fairness may impact the outcome.[1] We investigate whether fairness still matters when bargaining occurs after search, and once we show that it does, what effects it has on the search stage.

Our search model is directed search as introduced by Burdett et al. (2001) (hereafter BSW)[2] generalized to allow sellers to post an interval of possible buyer surpluses.[3] We call this partially directed search, because sellers post only partial information (an interval of possible surpluses) rather than the precise information posted in BSW (an exact surplus).[4] Buyers observe the posted possible surpluses and then decide which seller to approach. Sellers have 1 unit of the good (which is

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[1] Fairness in bargaining refers to agents that consider their own payoff as well as the division of surplus where, usually, more equal divisions are preferred to more unequal divisions (inequality aversion). Formal models include Fehr and Schmidt (1999) and Bolton and Ockenfels (2000).

[2] Other similar early models of directed search include Peters (1991), Montgomery (1991), and Moen (1997).

[3] In most market games, sellers post prices. In the ultimatum game (see below) or the labor market, sellers usually post buyer surpluses. Of course, this is just framing as one can easily be calculated from the other. Hereafter, we borrow the terminology from the ultimatum game.

[4] We generalize directed search by allowing sellers to post partial information. Another literature has generalized directed search by allowing sellers to post the mechanism they will use to sell their object (see Albrecht et al., 2014 for a recent example).

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of no value to them) and buyers have unit demand. This supply and demand structure captures the examples listed above, but our main reason to choose it is that it implies theoretical tradeoffs for both sides of the market. Sellers want to keep as much surplus for themselves as possible, but know this may deter buyers from approaching. Buyers want to approach sellers who they think will offer the most surplus, but know that such sellers may be more congested with buyers. This induces competition on both sides of the market which is the focus of our analysis.[5] Specifically, the effects for search we alluded to at the end of the first paragraph are the effects on this competition, and we investigate a number of questions related to them. For example, do sellers post large intervals with the expectation that the final surpluses will be reasonably equal, or do they post narrow (or possibly even degenerate) intervals that guarantee reasonably equal surpluses? And if they post large intervals, do the posted intervals determine a norm for what surpluses are considered reasonably equal or is it just the total value of the good? The answers to these questions, and others, are of course tied to buyer search behavior, because sellers compete to attract buyers.

The bargaining protocol we implement is ultimatum game bargaining with sellers proposing to buyers. While the actual bargaining structure in many markets is less rigid (in the sense that buyers may be able to make counteroffers), the environment is already quite complex and we think the ultimatum game is the simplest way to identify the basic effects of bargaining on search competition. Additionally, the ultimatum game has perhaps the starkest divergence of behavior and theory due the theoretical prediction being extremely unequal.[6] Therefore, there is a good chance to see behavior in the search stage that also diverges from theory and in ways that are interpretable through fairness.[7] Finally, this protocol is directly comparable to standard directed search where there can only be one offer and so only one (meaningful) round of bargaining.

We analyze results of a laboratory experiment on the following partially directed search and bargaining game. First, sellers post an interval range of possible buyer surpluses. Then, buyers view the ranges and select one seller to approach. A buyer is matched to the seller they approach if they are the only buyer who approaches them, or one of the approaching buyers is randomly selected to match if multiple buyers approach the seller. Second, each matched seller makes an offer from the range they have posted, and this offer is accepted or rejected by the buyer. This final stage is the ultimatum game constrained to the interval of possible divisions posted by the seller.[8] It is important to note that the equilibrium outcomes of partially directed search are identical to those of standard directed search. This is because the seller will offer the lower bound of their posted interval, so both sides theoretically view the lower bound as the final offer. We can therefore use the equilibrium predictions of directed search as a baseline prediction, and then compare differences to this prediction to examine fairness effects.

In all treatments, there are two sellers and our main treatment variable is the number of buyers in the market. In one treatment, there are three buyers, and the theoretically predicted surplus for matched sellers is 72.7 and matched buyers is 27.3, which fairly closely coincides with the usual offers in the ultimatum game. In the second treatment, there are five buyers and the theoretically predicted surplus for matched sellers is 91.23 and matched buyers is 8.77, which is far more unequal. We also consider standard directed search where sellers must post an exact offer, although buyers still have the option to reject the offer after they match with the seller. These baseline treatments allow us to understand the effects of offering partial information as opposed to exact information.

Our results confirm that offers are well above the predicted equilibrium, particularly in the treatment with five buyers. This is true in the baseline treatments too, which suggests that just having the power to reject the final offer increases buyer surplus. We also find that, on average, sellers post fairly large intervals. The lower bounds are in fact very close to offers, suggesting that theory predicts well in this subgame and that fair offers are set relative to total value and not the endogenously selected intervals. The upper bounds are quite large, which we interpret as slight evidence of sellers attempting to trick buyers into thinking larger upper bounds signal larger offers although it also may be due to larger upper bounds just not driving away buyers.

We also see some treatment effects which imply that the competition is not completely eroded by concerns for fairness. Offers are lower and buyers are willing to accept lower offers when there are more buyers. We interpret this as the competitive context affecting the norm for what a fair ultimatum offer is. In particular, more competition among buyers drives down the perceptions of what constitutes a fair offer.

Finally, we also investigate efficiency and find that the markets are reasonably (constrained) efficient, because buyers approach strategies turn out to be close to random (for complicated, but interesting, reasons we detail below), which is the constrained efficient strategy, and they rarely end up rejecting offers.

[5] Alternatively, in random search models, there is only competition among sellers, because buyers do not actively search (see Mortensen, 2005).

[6] The proposer in an ultimatum game should offer nothing to the responder (or perhaps a penny to make the best response strict) and the responder should accept because receiving something is better than nothing. Experiments have shown that offers are usually intermediate, averaging around 30–40% of the endowment, and in fact when offers are small, below about 20% of the endowment, responders routinely reject them (see, for example, Camerer and Thaler, 1995).

[7] More generally, the effects of bargaining outcomes on search go back to pioneering search theory. Diamond (1982) and Pissarides (1985) look at the effects for the number of vacancies posted in labor markets while Mortensen (1982) looks at the effects for how hard agents search when search is costly. Investigating these other kinds of links in the presence of concerns for fairness would be interesting future work.

[8] Constraints such as this are occasionally referred to in the literature as a mini-ultimatum game. For an example, see Falk et al. (2003).