Finance & Economics Club

GAME THEORY

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About The Project

This project involves Games devised by based on the fudamental concepts of Game theory and auction theory

"The purpose of studying economics is not to acquire a set of ready-made answers to economics questions,but to learn how to avoid being deveiced by economists"

-Joan Robinson

WHAT IS AN AUCTION ?

An auction is a sales event wherein potential buyers place competitive bids on assets or services either in an open or closed format.

Types Discussed here

1. *Highest Unique Bid*
2. *Dutch Auction*

THEORY

Highest Unique Bid

This type of auction requires bidders to place bids that are global unique bids. That is, for a bid to be eligible to win no other bidder can have made a bid for the same amount. Bidders are generally able to place multiple bids and the number of current bids at each amount is typically kept secret.

The bid that is the highest and unmatched when the auction closes is the winning bid

THEORY

Dutch Auction

Dutch auctions are a competitive alternative to a traditional auction, in which customers make bids of increasing value until nobody is willing to bid higher.

A Dutch auction initially offers an item at a price in excess of the amount the seller expects to receive. The price lowers in steps until a bidder accepts the current price. That bidder wins the auction and pays that price for the item.

AUCTION THEORY

In all games, we have players who selfishly maximize their payoffs using all the available information. They choose their best responses to other player's strategies.

Any game starts with rules. Rules of the game include players, strategies available for each player, payoffs for all possible combinations of strategies of all players.

Asymmetric information adds one more element: each player can be of more than one type and each player’s type is his private information.

MATHEMATICS

- HIGHEST UNIQUE BID

We assume risk-neutrality and denote the set of identical bidders by $I = \{1,2,\ldots,n\}$. All bidders have the common set of strategies $B = \{1,2,3,\ldots\} \cup \{so\}$ where "*so*" stands for the decision to stay out. Each bidder independently chooses her strategy $b_i \in B$. We let $\mathbf{b} = (b_i, \mathbf{b}_{-i})$ denote a pure-strategy profile of all bidders, where $\mathbf{b}_{-i} = (b_1,\ldots,b_{i-1},b_{i+1},\ldots,b_n)$ is a pure-strategy profile of all but bidder i.

Players who enter the auction by choosing a single bid incur a fixed, non-refundable entry fee of c (c>0). The winner receives the prize v (v>c) and pays her winning bid. Losers get nothing. Thus, bidder i's payoff function is given by

$$u_i(b_i, \mathbf{b}_{-i}) = \begin{cases} v - b_i - c & \text{if } b_i \text{ is the lowest (highest) unique bid in the LUBA (HUBA) game} \\ -c & \text{if } b_i \text{ is not the lowest (highest) unique bid in the LUBA (HUBA) game} \\ 0 & \text{if bidder } i \text{ stays out} \end{cases}$$

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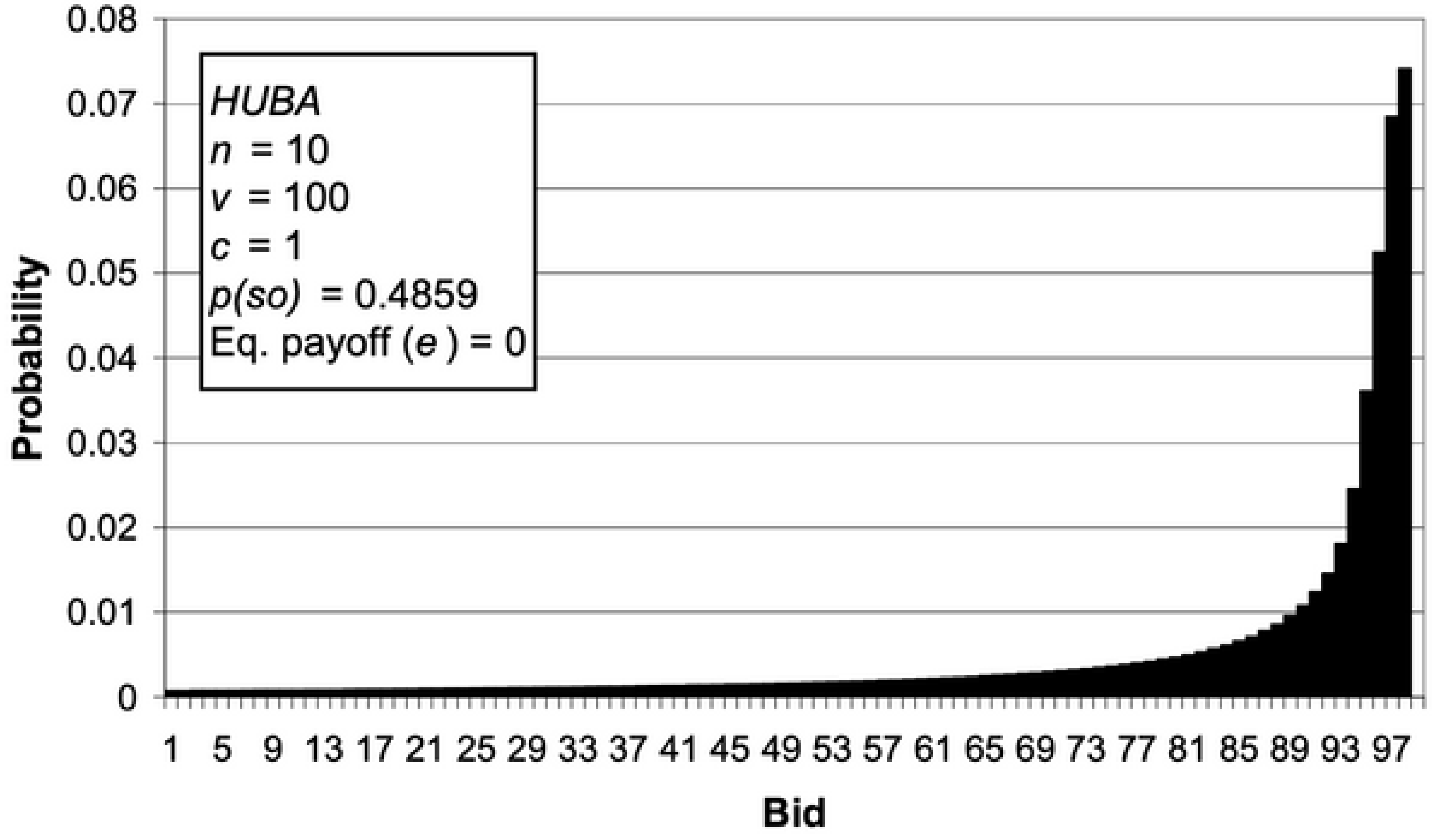
Figure 2: Symmetric mixed-strategy equilibria for the HUBA game for n=10, 30, and 50, v = 100, and c = 1.



MATHEMATICS

- DUTCH AUCTION

Suppose there are $n \geq 2$ potential buyers, denoted by $j = 1, \ldots, n$, who are identical ex-ante. Buyer j valuates the object at v_j, which is only privately observed. As the seller does not observe any of the buyers' valuations, the seller considers v_j, $j = 1, \ldots, n$ as independent draws from the same continuous distribution function F with support $[\underline{v}, \overline{v})$ with $0 \leq \underline{v} < \overline{v} \leq \infty$. The buyers consider the private values of the other buyers as random realizations from F. The equilibrium is a symmetric Bayesian-Nash equilibrium.

For given n and v_0, the optimal bid of a buyer with private value v equals

$$B(v|v_0, n) = v - \int_{v_0}^{v} \left[\frac{F(x)}{F(v)}\right]^{n-1} dx \tag{1}$$

Each bidder participating in the auction thus shades his private value with the amount $\int_{v_0}^{v} (F(x)/F(v))^{n-1} dx$.

GAME 1

Biddathon

Highest Unique Bid

Game Explanation

Considering a best of X(random variable) rounds in a game.The bidder with the most points and money remaining after X rounds wins the game.

Each round will consist of a different item whose points will vary.The player with the highest unique bid will win that round

In case of tie after X rounds,The player with more points will be declared winner

NOTE:All bids will be sealed bids

Collected Data

Please refer to the spreadsheet for More Data

https://docs.google.com/spreadsheets/d/1JZBoi6cIgSt70zJ--
uuzG660W0TLXY1zLtzeo7X_9HQ/edit?usp=sharing

GAME 2

Dutch Roller Coaster

Dutch Auction

Game Explanation

Consider an item X auctioned in a Dutch Auction. The Auctioneer starts the bid from a maximum amount decreasing the bid by certain value every time.The player bids the amount that seems right to the player.

The player with the highest bid wins. In-Case,of a tie between two players, the player who bids first wins.

The player with the most points and most remaining purse wins the game.

Collected Data

Please refer to the spreadsheet for More Data

https://docs.google.com/spreadsheets/d/1JZBoi6cIgSt7OzJ--uuzG66OW0TLXY1zLtzeo7X_9HQ/edit?usp=sharing

BEHAVIORAL ANALYSIS

In Biddathon, players get to decide the bid which creates altogether new strategies in the game. In case of the item with more intrinsic points on it , the Nash equilibrium in the bids of all player shift to the top where as in case of item with low points the Nash equilibrium of the bids of the players remains to a lower figure.

In Dutch Roller Coaster, the player's strategy should be altogether different than game 1. The player should bid on the optimal bid presented by auctioneer.

Thank you!