

In on-line auctions (particularly e-bay auction in this paper), three formats appear, which are listed below (Behaviors depicted here could only happen in the posted duration).

- Regular auction: The bidders could bid the item as long as his bidding price is higher than the reserve price. The highest bidder wins the bid **at the end** of the posted duration.
- Fixed-price listing: A bidder could win the item **at any time** if he is willing to bid the item at the fixed-price.
- Buy-it-now (BIN) auction: **At any time**, a bidder could **instantly** win the item if he is willing to pay the “buy-it-now” price to the item, but if no one exercises the BIN option, it reduces to a regular auction.

In both theoretical and empirical aspects, we would like to ask: what is the driving force which urges sellers to choose different types of auction? Furthermore, does this driving force provide us with an angle to analyze the determination of the optimal reserve price? If so, is the suggested optimal price pattern in tune with the intuition and empirically testable?

Traditionally, expected revenue is the core of the analysis in the auction; however, in analyzing new types of auctions (i.e., on-line auction) some other factors **might** play a key role in modeling the auction. We therefore have to choose some new features into consideration not only to make the model more realistic but also to help explain the observed pattern.

In this paper, time patience (the discount factor δ) is the key. It determines the classification of the three types of sellers who separately choose different auction formats. The authors set up a two-stage model, where the bidders could use the BIN option in the first stage, and in the second stage, a second price auction with reserve price is held. The relationship between buy-it-now price, **B**, the reserve price, **r**, and \tilde{v} , the threshold value of valuation (whenever a bidder values the item higher than \tilde{v} , he would call a BIN option) provide an intuitive way for classification. In a seller's strategy,

- If **B=r (which means the seller could only accept one bidding price)**, the auction is a fixed-price setting.
- If the seller's strategy is to set **B as greater than the BIN price for the buyer possessing highest value for the item**, the auction reduces to a regular auction since no buyer would in effect exercise the BIN option in any circumstances.
- If the seller set the BIN price in the middle of the two stated above, the auction is a BIN auction.

By mainly solving for the Lagrangian established by maximizing the expected revenue, the results are as follows.

- The most patient guy ($\delta=1$) would choose the regular auction with the least optimal reserve price across three formats of auction. The intuition is that since he is willing to wait most, the quick return (the BIN option) is not so attractive to him
- The second patient (whose discount factor falls between 1 and lower bound) guy chooses the BIN auction.
- The least patient guy chooses the fixed-price listing.

