Dynamic Seller Strategies in an Auction Marketplace

Joan Morris, Peter Ree, Pattie Maes
MIT Media Lab

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Question

- In a dynamic marketplace, where buyers bid on products, and
- Sellers have agents (*pricebots*) making automated decisions to accept or reject bids,

How does a seller develop and evaluate pricebot strategies?

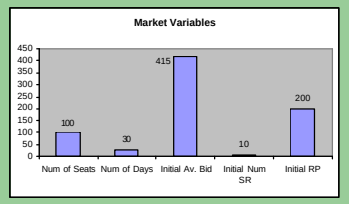
Answer

- Use market simulator as evaluation tool
- Develop a specific market scenario for evaluation
- Implement seller strategies and compare results

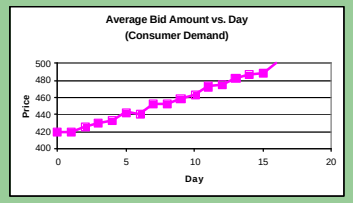
The Market Simulator

INPUTS

Market variables



Consumer behavior

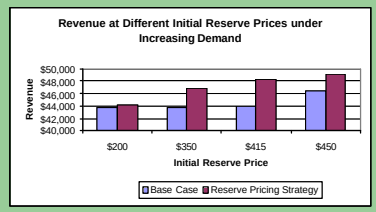


Seller strategies

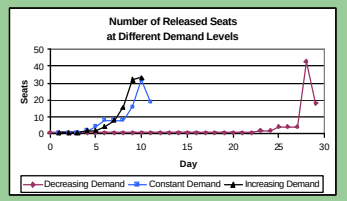
Simulation

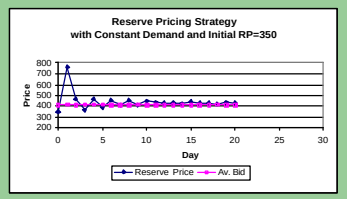
OUTPUTS

Revenue results



Market behavior



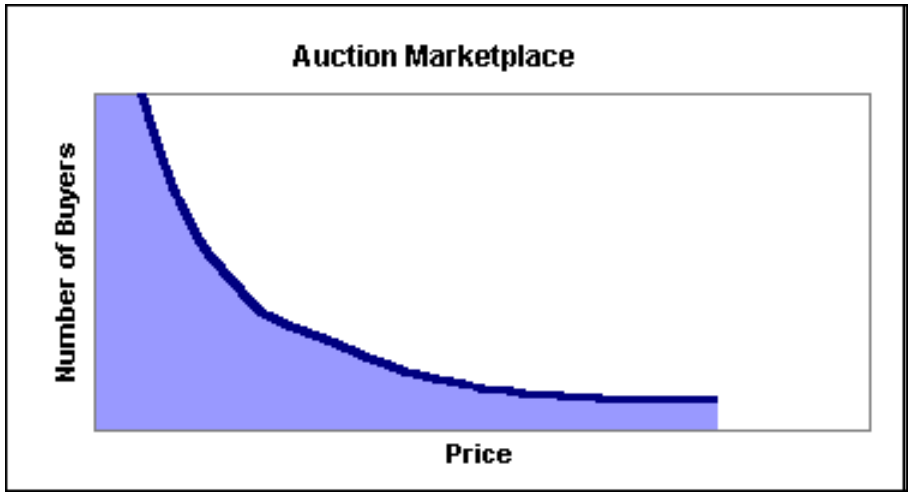


The Market Scenario

- Auction selling airline tickets
- Finite goods, finite time, changing perceived value
- One seller, many buyers
- Reverse, sealed-bid, discriminatory auction
- 30 days to sell 100 seats, seller settles bids at the end of each day

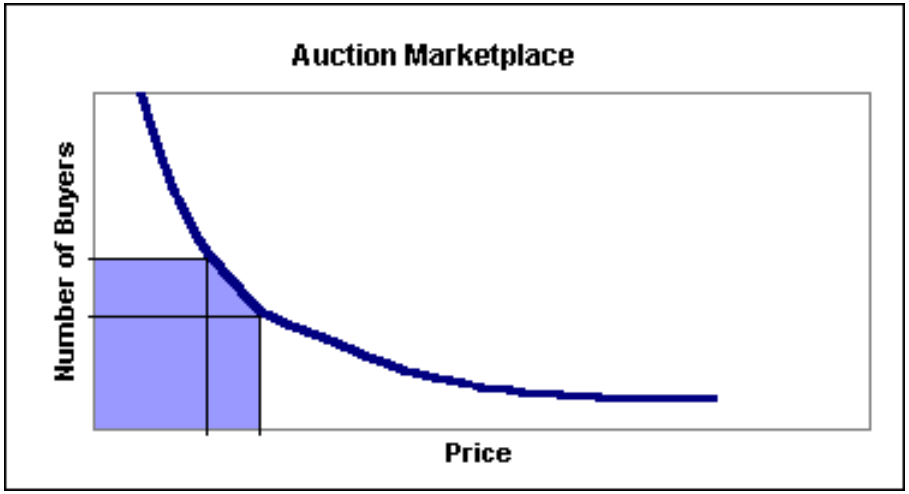
The Market Scenario:
Bid Generation

- Consumers are willing to pay different prices (demand elasticity)
- In a fixed-price marketplace, seller is forced to choose price point
- Auctions can capture demand elasticity



The Market Scenario:
Bid Generation

- Simulator models portion of demand curve
- Bids fall in a normal distribution around an average bid amt
- Num of bids = Demand
- Avg. bid value = Consumer Valuation



The Market Scenario:
A Day in the Life of the Auction…

- At the beginning of the day, the airline releases a certain number of seats at a certain reserve price into the marketplace.
- During the day, buyers send bids to the airline.
- At the end of the day, the airline accepts the bids above the reserve price, up to the number of released seats.
- After winner allocation, the airline chooses the reserve price and the number of seats to release for the next day.

The Seller Strategies

The seller controls two variables each day: reserve price and number of released seats.

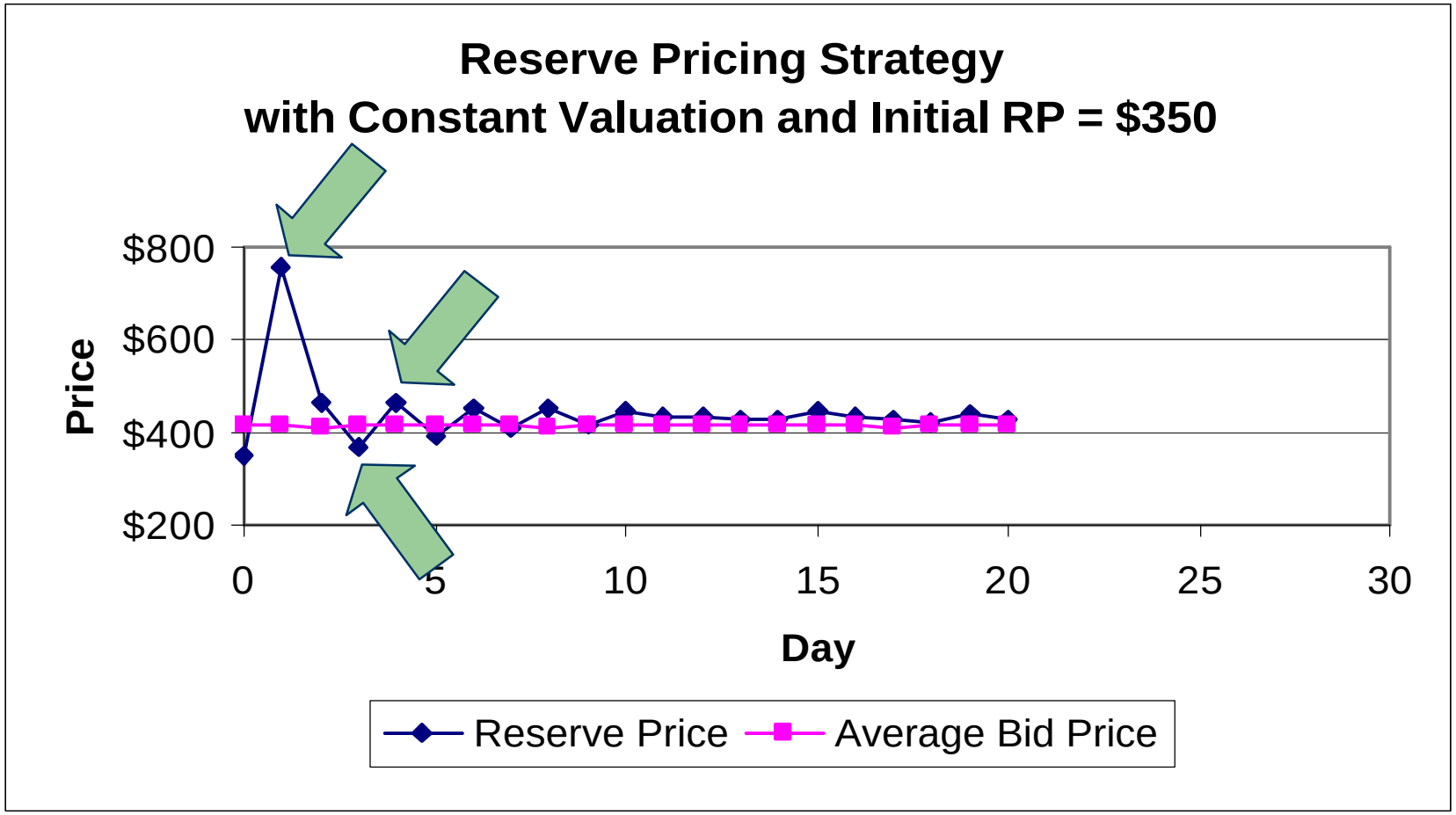
- *Strategy 1:*
  - Change reserve price to control the number of seats sold each day.
- *Strategy 2:*
  - Change the number of seats released each day to control the price at which seats are sold.
- Compared with no strategy
  - No change to either reserve price or the number of seats released each day.

Strategy 1: Reserve Pricing

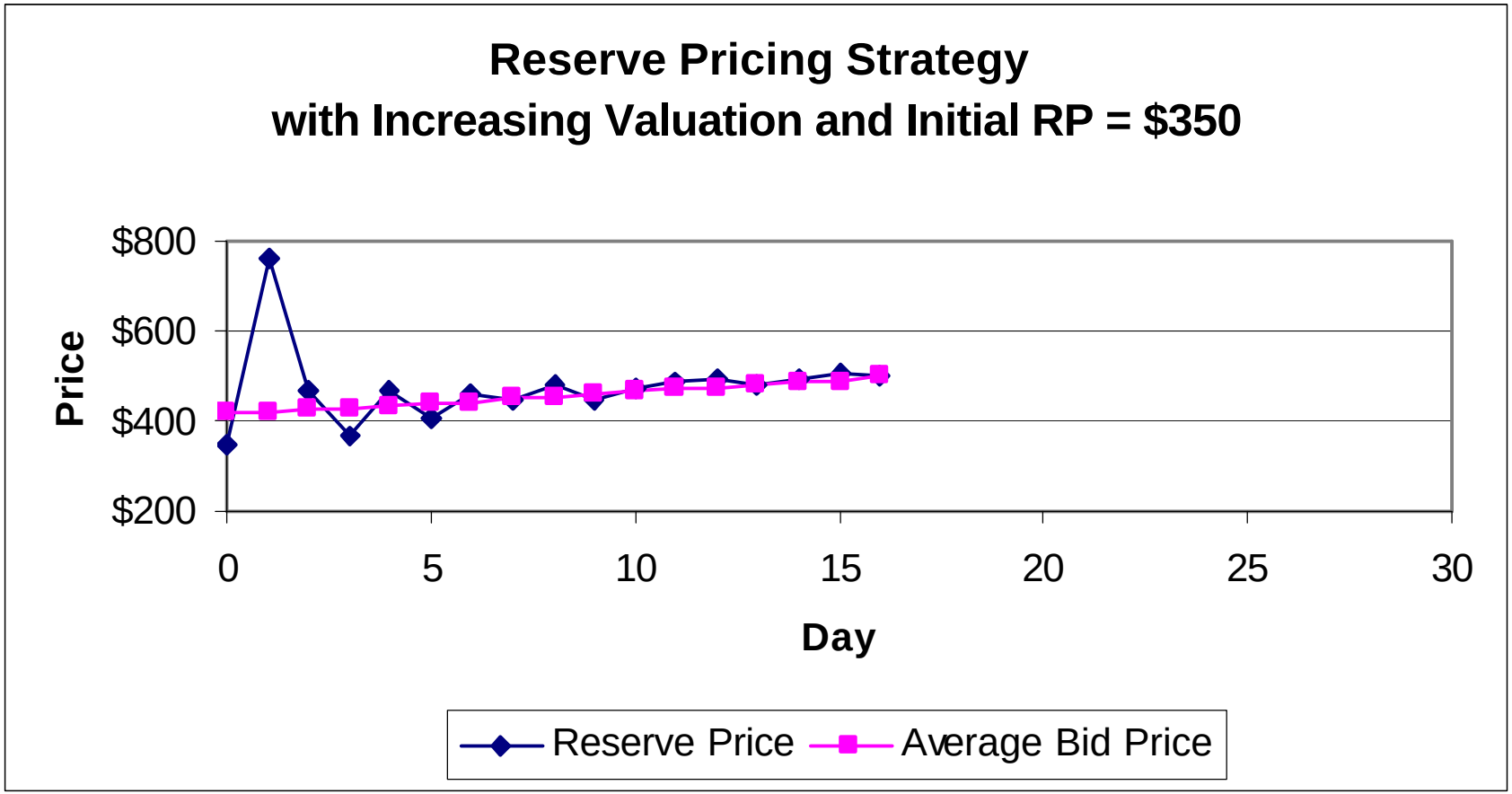
- *Derivative following* strategy.
- Alter the reserve price each day based on how many seats have sold in the auction.
- Goal: To sell all the seats, spread out over the auction.

$$RP_{i+1} = RP_i + (RP_i) * \left(\frac{SeatsSold_i}{2 * i * \left(TotalSeats / TotalDays \right)} \right)$$

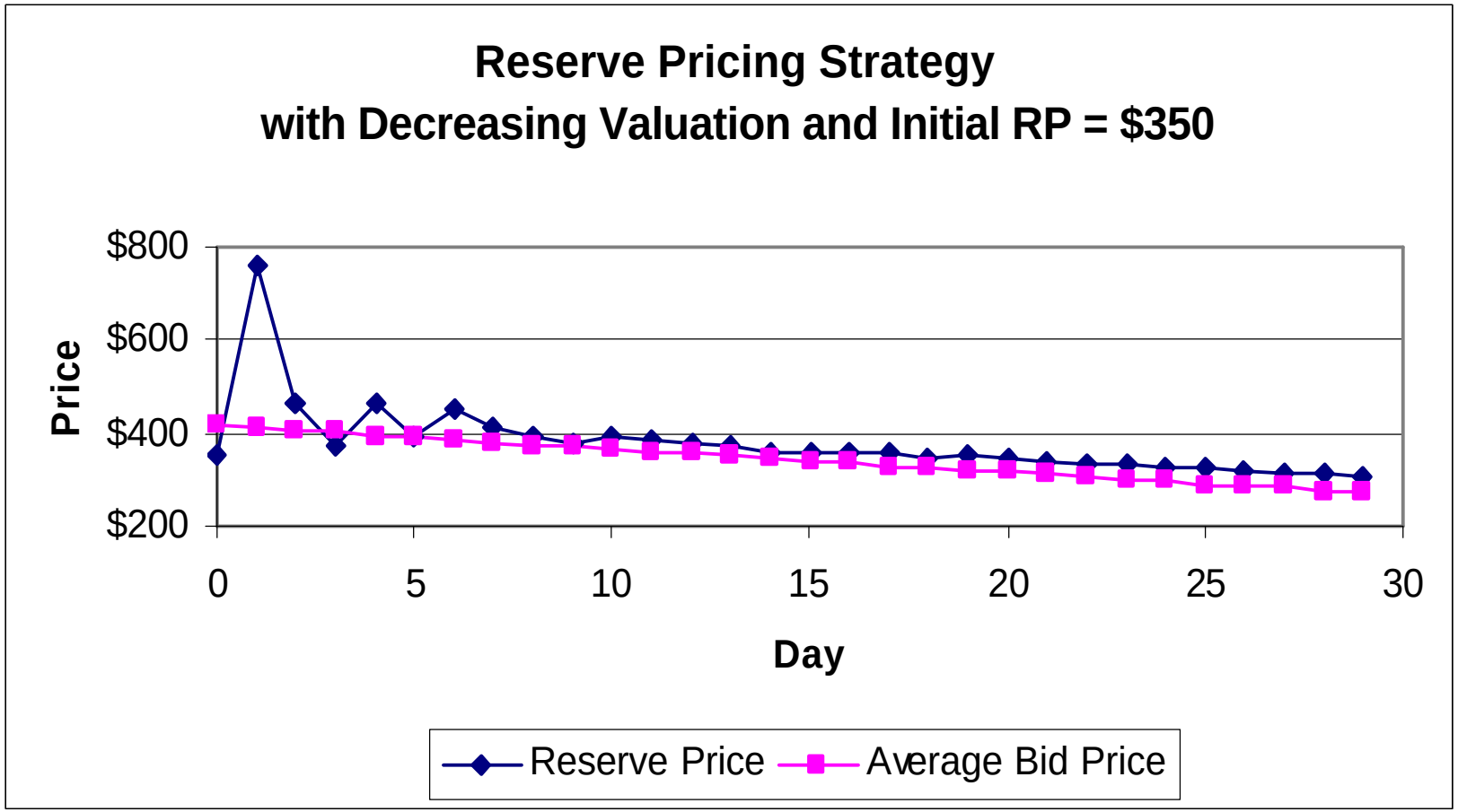
Reserve Pricing Behavior



Reserve Pricing Behavior

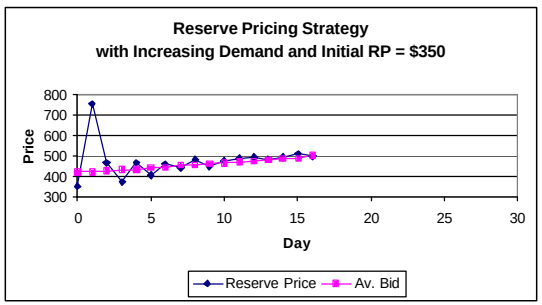


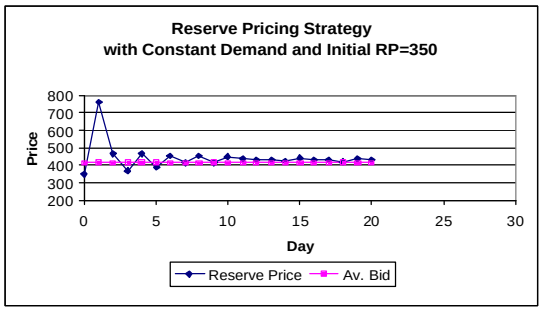
Reserve Pricing Behavior

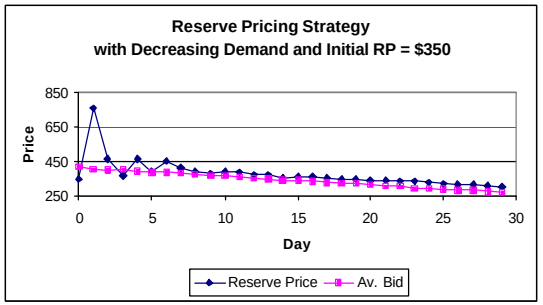


Reserve Pricing Behavior

- After about a period of over and under shooting, the reserve price follows the value of the average bid price.
- Sensitivity to the market's behavior decreases over time.

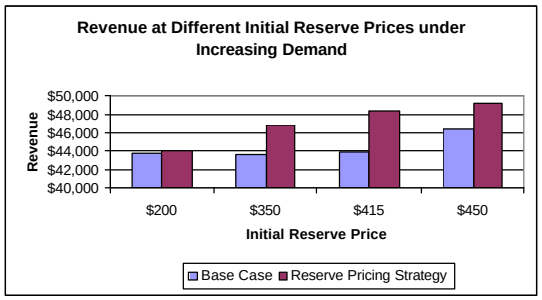


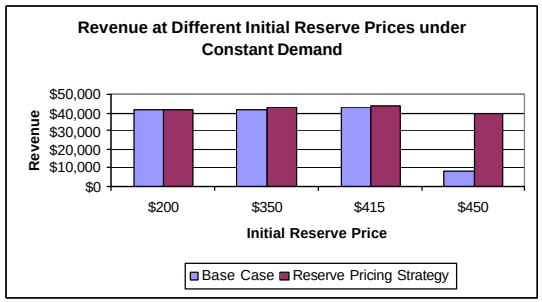


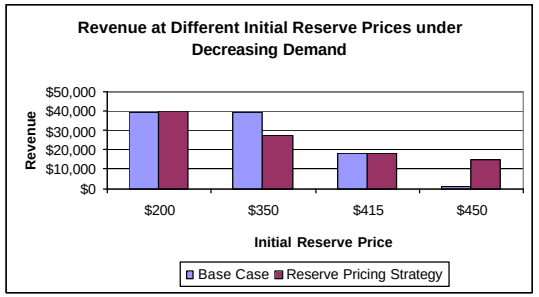


Reserve Pricing Revenue

- Reserve pricing strategy ( ) increased revenue above the no-strategy case ( ).
- Each day, the seller only sold seats to the upper half of the bid distribution.





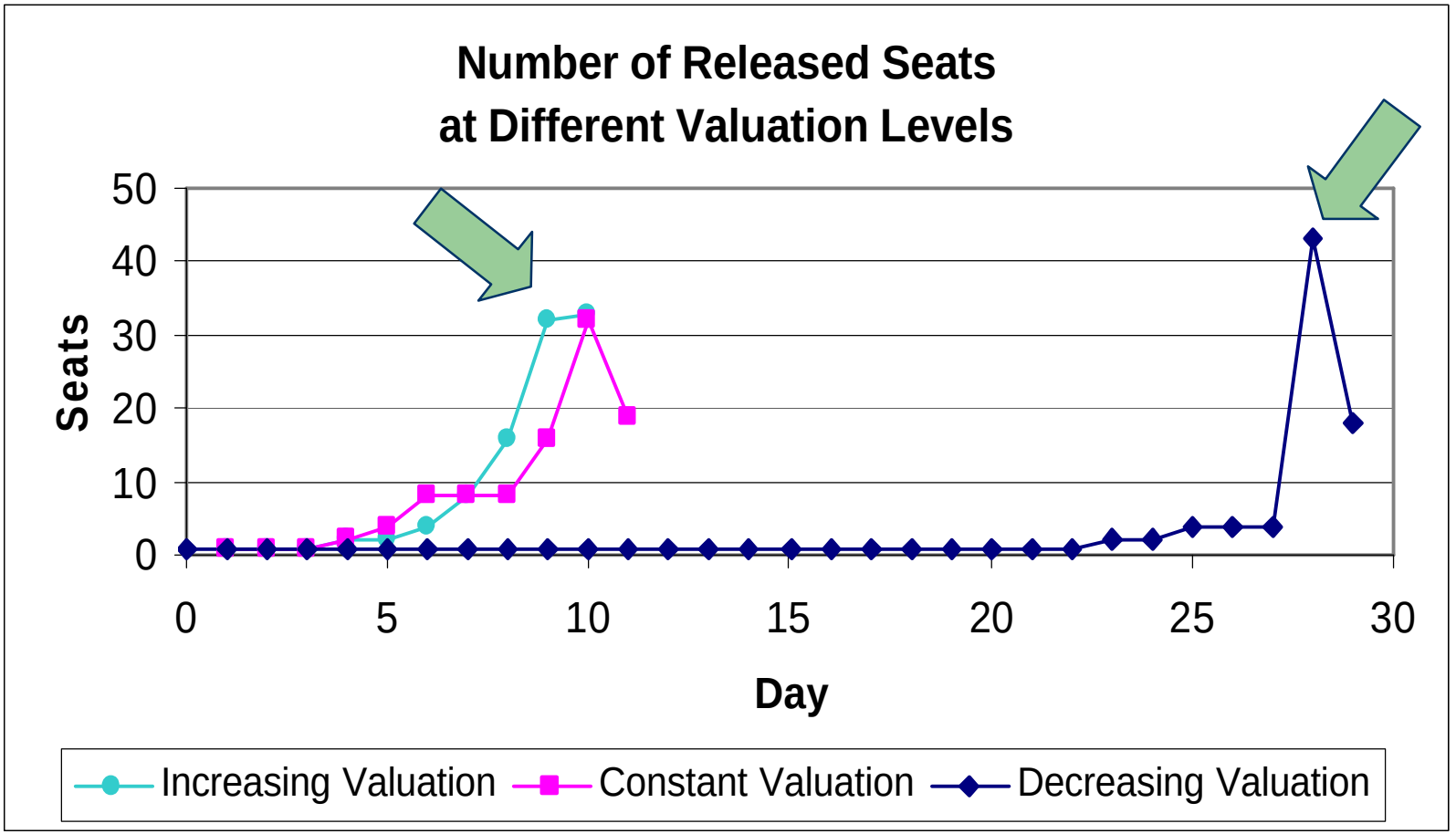


Strategy 2: Seat Releasing

- *Myopically optimal* strategy.
- Alter the number of seats released each day based on the consumer valuation level.
- Goal: Sell more seats at relatively higher valuation levels.

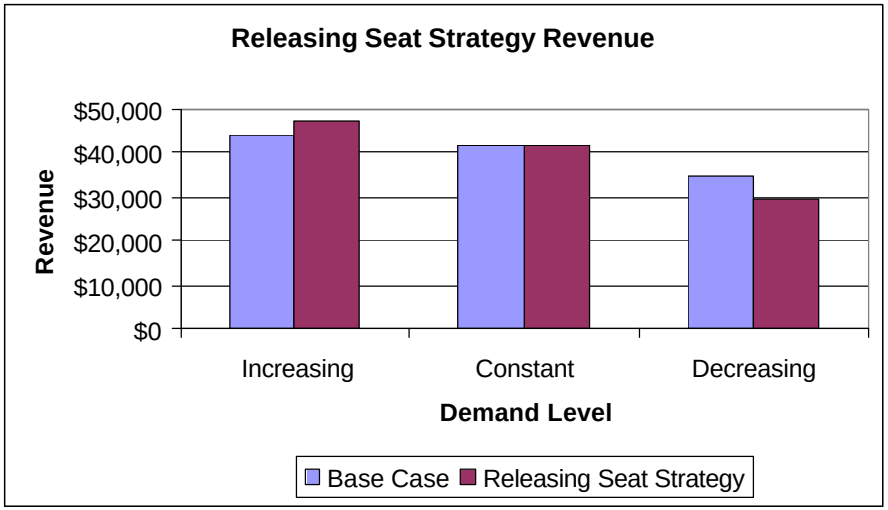
$$SR_{i+1} = SR_i + SR_i * \left(\frac{Bid\,\mathrm{Pr}\,ice_i - Bid\,\mathrm{Pr}\,ice_{i-1}}{Bid\,\mathrm{Pr}\,ice_i} \right)$$

Seat Releasing Behavior



Seat Releasing Revenue

- Tracking consumer valuation ( ) did not significantly increase revenue over no-strategy case ( )
- Most of the seats were sold when valuation was at a relative low point



Strategy Conclusions

- Reserve pricing strategy
  - Reserve price followed the average bid price, capturing higher half of distribution
  - Increased revenue over the no-strategy case
- Seat releasing strategy
  - Algorithm for interpreting valuation levels was overly simplified
  - Did not significantly increase revenue

General Conclusions

- This initial study looked at whether or not this method of evaluation was feasible.
- By using a simulator and working with a specific market scenario, we were able to develop and evaluate strategies.
- Strategies produced non-intuitive results. Observing simulated market behavior gave insight into auction strategies.
- Non-deterministic strategies can be evaluated in this method.

Future Work

- Develop more successful **strategies**
- More complex model of **consumer behavior**
- Multiple **sellers and auction mechanisms**, testing strategies against one another
- **Other markets**: perishable goods, event tickets, natural resources (ex: gas), broadband access

For more information…

Software Agents Group

MIT Media Lab

joanie@media.mit.edu

pree@media.mit.edu

pattie@media.mit.edu

http://agents.www.media.mit.edu/groups/agents/