Monetizing Information: Competition in Online Markets

Alok Gupta
Carlson School Professor of IDSc
What’s this about...

> Economics based design and management of systems

- Business Processes
- Technology and Infrastructure
  - As a driver
  - As a support mechanism
- Mechanisms
  - B2C
  - B2B
Rationale Belief...

Online Prices Should converge, resulting in little or no price dispersion!
### Why is This Important?

<table>
<thead>
<tr>
<th>Product Category</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clothing and accessories</td>
<td>67%</td>
</tr>
<tr>
<td>Books/Magazines</td>
<td>67%</td>
</tr>
<tr>
<td>Music/DVD/Video</td>
<td>65%</td>
</tr>
<tr>
<td>Computer HD or SW</td>
<td>55%</td>
</tr>
<tr>
<td>Toys, Video games</td>
<td>50%</td>
</tr>
<tr>
<td>Consumer Electronics</td>
<td>48%</td>
</tr>
<tr>
<td>Tickets (movies, concerts, theatre)</td>
<td>43%</td>
</tr>
<tr>
<td>Gifts and Collectables</td>
<td>42%</td>
</tr>
<tr>
<td>Health &amp; beauty items</td>
<td>38%</td>
</tr>
<tr>
<td>Gift Card/Certificates</td>
<td>38%</td>
</tr>
<tr>
<td>Furniture, home &amp; garden</td>
<td>29%</td>
</tr>
<tr>
<td>Pet supplies</td>
<td>26%</td>
</tr>
<tr>
<td>Sporting goods</td>
<td>23%</td>
</tr>
<tr>
<td>Jewelry/watches</td>
<td>22%</td>
</tr>
<tr>
<td>Food</td>
<td>22%</td>
</tr>
<tr>
<td>Other</td>
<td>9%</td>
</tr>
</tbody>
</table>

Source: DoubleClick (www.performics.com)
Theory and Reality

**Theory**

- Individuals can easily search the price information and everything else being equal price should converge (Bakos, 1997)
- The “law of one price” is no law at all (Varian, 1980)
  - Firms use randomization strategy
    - Making it difficult for individuals to search

**Reality**

- Greater than 50% price dispersion exists due to
  - Retailer heterogeneity
    - Branding
    - Awareness
    - Trust
  (Brynjolfsson and Smith, 2000)
- Price dispersion persists over time, though
  - Number of firms decline
  - The range of prices tightens
  (Baye et. al., 2002)
Is Price the Most Important Factor?

FEATURES BRINGING SHOPPERS BACK TO A WEB SITE

<table>
<thead>
<tr>
<th>Top Box</th>
<th>Top-2 Boxes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Free/Flat Shipping</td>
<td>Free/Flat Shipping</td>
</tr>
<tr>
<td>Privacy Policies/Guar</td>
<td>Privacy Policies/Guar</td>
</tr>
<tr>
<td>Order Tracking</td>
<td>Order Tracking</td>
</tr>
<tr>
<td>Rebates/Coupons</td>
<td>Rebates/Coupons</td>
</tr>
<tr>
<td>Online Outlet</td>
<td>Online Outlet</td>
</tr>
<tr>
<td>Customer Reviews</td>
<td>Customer Reviews</td>
</tr>
<tr>
<td>Comparison Capabilities</td>
<td>Comparison Capabilities</td>
</tr>
<tr>
<td>Price/Product Alerts</td>
<td>Price/Product Alerts</td>
</tr>
<tr>
<td>Live Help</td>
<td>Live Help</td>
</tr>
</tbody>
</table>

Fulfillment Process

Product Information

Source: DoubleClick (www.performics.com)
Small Business Patterns

How often do you use search engines to do each of the following for your business?
(Rate on a Scale of 1-5 where 5 means "very frequently" and 1 means "not at all frequently") (N=292)

- To read other customer/user reviews: 18.8%
- To read a professional/expert review: 20.9%
- To make a purchase: 37.7%
- To find a place to purchase: 40.1%
- To get more info from the specific manufacturer or service website: 43.8%
- To compare prices: 45.2%
- To get more information about my options: 46.6%

Source: DoubleClick (www.performics.com)
How frequently do you discover new/relevant products/services for your business that you weren't aware of, but learned as a result of your searches?

- Often/Almost Always: 18.8%
- Sometimes: 31.5%
- Rarely/Never: 49.7%
- 50.3%
Competing with Information!
Information...

> Is the competitive tool for the Internet
  > Facilitation (google, froogle, BizRate, etc.)
  > Organization (Amazon, Yahoo Pipes, mashups…)
  > Derivation (DoubleClick, Google Analytics, etc.)
  > Transparency and monetization
  > • Understand consumers’ needs
    Usage patterns
    Importance/Valuation
My Contention

> Web based commerce will evolve to competition based on “information transparency.”
> Firms need to compete by developing focused information revelation strategies and appropriately pricing their product.

“Before, companies guarded and filtered information, now, we are all naked.”

Eugene Polistuk, Former CEO Celestica
An Illustrative Example
Minneapolis, MN (MSP) to Hartford, CT (BDL)

Prices below include all taxes and fees, and are quoted in US dollars. Prices not guaranteed until booked.

Need exact flight times or a specific airline? Find Regular Fares from $560

$369 roundtrip per person

Clearance Fare

<table>
<thead>
<tr>
<th>Departing</th>
<th>Returning</th>
</tr>
</thead>
<tbody>
<tr>
<td>MSP - Minneapolis</td>
<td>BDL - Hartford</td>
</tr>
<tr>
<td>Fri, Jan 27, not a red-eye</td>
<td>Sat, Jan 28, not a red-eye</td>
</tr>
</tbody>
</table>

Minneapolis (MSP) to Hartford (BDL)
0 - 1 Stops

Hotwire Airline Supplier

$560 roundtrip per person

Regular Fare

Regular Fares offer exact flight times and airline names.

View regular fares
Market Transparency Space

Product Transparency vs. Price Transparency

- Expedia
- Travelocity
- Offline
- Hotwire
- Priceline.com
- Orbitz
Timeline

- Oct 2000: Hotwire Launch
- June 2001: Orbitz Launch
- Jan 2005: Travelocity introduces Matrix Display
- April 2005: Hotwire introduces Transparency based fares
- Jan 2006: Priceline introduces Matrix
- June 2006: Priceline introduces transparent fares
- Feb 2007: Hotwire introduces tools to look up historical Prices
Effect of Transparency

- Combined booking data and ticketed price data for 2.15 MM tickets.
  - 46 Origin/Destinations
  - Economy class
  - Offline and online agencies
  - 1 year period: 09/2003-08/2004

**Price Elasticity of Demand**

- Aggregate: 0.83
- Offline: 0.81
- Online Total: 0.93
- Expedia: 1.54
- Travelocity: 1.31
- Hotwire: 1.68
- Online Other: 0.73
Market Transparency Strategy

Case #1: Transparent
Case #2: Distorted
Case #3: Biased
Case #4: Opaque

Inventory
Cost

Information revelation to consumers, competitors, intermediaries, suppliers
Consumable Information, Complex Mechanisms and User Behavior
In March 2008, FCC auctioned 700 MHz band which currently carries on-air television broadcasts; this band will be freed up after February 17, 2009 when all broadcasts will become digital.

Verizon and AT&T won most of the auctions.

These auctions were for various bands (frequencies) and geographical locations.

The process took several auctions; in a given auction, several frequencies over several territories were sold together.

Such auctions are called Combinatorial Auctions.
Transparency in Complex Trading Mechanisms

- Combinatorial Auctions
  - Multiple items (goods) or units are auctioned simultaneously
  - Bids on item combinations are allowed, e.g.,
    - $400 on (TV, DVD player, speaker set)
  - Motivation: complementarity and substitutability
    - Complimentarity -- Such as TV and DVD Player
    - Substitutability – A portable TV v/s DVD player
Original Motivation

> PQT Auctions – iterative multi-unit, no partial fulfillment auctions
  > Bidder bewilderment
    - “I wasn’t in the winner list but ultimately I won without changing my bid…”
    - “What new bid do I place for x units? I bid higher than the highest winning bid but still wasn’t included in the winner’s list…”
Practical applications

- FCC spectrum auctions (McAfee and McMillan 1996; Banks et al. 2003)
- Rights to use railroad tracks (Brewer & Plott 1996)
- Delivery routes (Caplice 1996, Sandholm 2000)
- Airport time slots (Rassenti et al. 1982)
- Procurement of school meals (Epstein et al. 2002)
Complexity of combinatorial auctions

> Challenges:
  > The number of possible packages increases exponentially with number of items
    • Winner determination is NP-hard
    • Participation is cognitively complex

> Earlier solutions
  > Discrete bidding rounds with rules and restrictions
Auction set: \{ A, B, C, D \}

Bids:

1. $50 on \{ A \} \quad \text{WIN: $50 (1)}$
2. $70 on \{ A, B \} \quad \text{WIN: $70 (2)}$
3. $80 on \{ B, C \} \quad \text{WIN: $130 (1, 3)}$
4. $65 on \{ C, D \} \quad \text{WIN: $135 (2, 4)}$
5. $10 on \{ D \} \quad \text{WIN: $140 (1, 3, 5)}$
6. $30 on \{ B \} \quad \text{WIN: $145 (1, 4, 6)}$
Our Focus: Bidder Support

> Questions:
  > Is my bid *currently* winning?
  > Is it *possible* for my bid to win?
  > I want to bid on itemset $X$. How much should I bid to be among the currently winning bids?
  > Which bids are winning right now?
> Facilitate: combinatorial auctions on eBay
Our Approach

Google it!

> Analysis of problem complexity revealed that if solutions could be maintained then change in solution due to a new bid can be computed in real-time.

> Designed and mathematically defined some fundamental concepts such as dead & live bids, and sub auctions.

(Adomavicius and Gupta, ISR 2005)
Level of Transparency

> What is appropriate level of transparency that
  > Provides high efficiency
    • To create higher societal wealth
  > Is fair
    • To create incentives for adoption
Real-time Bidder Support Infrastructure – Outcome Feedback

Based on bid classification scheme developed in prior research (Adomavicius & Gupta, 2005)

- Losing bids (dead bids)
- Non-losing bids (live bids)
- Winning
- Non-winning

Bid sequence [bundle; bid] Status after 5 bids

<table>
<thead>
<tr>
<th>Bid</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>[A; $10]</td>
<td>Live and Winning</td>
</tr>
<tr>
<td>[AC; $20]</td>
<td>Dead</td>
</tr>
<tr>
<td>[C; $11]</td>
<td>Live but not Winning</td>
</tr>
<tr>
<td>[BC; $15]</td>
<td>Live and Winning</td>
</tr>
<tr>
<td>[AB; $13]</td>
<td>Live but not Winning</td>
</tr>
</tbody>
</table>

Elapsed Time: 00:01:11
Time since last bid: 00:00:13

The winning bids are in bold red
(The highlighted bids are yours)

Bid History (Reverse chronological)

<table>
<thead>
<tr>
<th>Bid No.</th>
<th>Bid Set</th>
<th>Bid Amount</th>
<th>Bid Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>6.</td>
<td>A</td>
<td>$75.00</td>
<td>00:00:57</td>
</tr>
<tr>
<td>5.</td>
<td>BC</td>
<td>$80.00</td>
<td>00:00:48</td>
</tr>
<tr>
<td>4.</td>
<td>ABC</td>
<td>$140.00</td>
<td>00:00:42</td>
</tr>
<tr>
<td>3.</td>
<td>BC</td>
<td>$80.00</td>
<td>00:00:32</td>
</tr>
<tr>
<td>2.</td>
<td>C</td>
<td>$50.00</td>
<td>00:00:19</td>
</tr>
<tr>
<td>1.</td>
<td>AB</td>
<td>$100.00</td>
<td>00:00:10</td>
</tr>
</tbody>
</table>
Real-time Bidder Support Infrastructure - Process Feedback

Bid sequence:

1. [A; $10] Live and Winning
2. [AC; $20] Dead
3. [C; $11] Live but not Winning
4. [BC; $15] Live and Winning
5. [AB; $13] Live but not winning

Bidding assistance schemes for every potential bid:

- Deadness level (DL)
- Winning level (WL)

Bid History (Reverse chronological):

<table>
<thead>
<tr>
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<th>Bid Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>6.</td>
<td>A</td>
<td>$75.00</td>
<td>00:01:03</td>
</tr>
<tr>
<td>3.</td>
<td>BC</td>
<td>$60.00</td>
<td>00:00:42</td>
</tr>
<tr>
<td>2.</td>
<td>C</td>
<td>$50.00</td>
<td>00:00:29</td>
</tr>
<tr>
<td>1.</td>
<td>AB</td>
<td>$100.00</td>
<td>00:00:14</td>
</tr>
</tbody>
</table>

Elapsed Time: 00:01:44
Time since last bid: 00:00:09

Select lots:

- A $50.00
- B $100.00
- C $50.00
- D $25.00
- E $12.50

Your valuation:

- $50.00

Specify your bid ($):

- (no decimals)

Submit Bid

To at least stand a chance of winning, bid:

- $51.00

To be currently winning, bid:

- $56.00

Live but not winning
Effect of Transparency

> Overall Economic Impact
  > Transparency increases efficiency (or reduces waste) thereby increasing the overall wealth created by the transaction.

> Participant Benefits
  > Auctioneer Benefit
    • Larger with partial transparency
  > Bidder Benefits
    • Larger with complete transparency

> Bidder Behavior
  > Much more closer to typical auctions with complete feedback
  > More strategic behavior with partial transparency
## Likelihood of Acceptance

<table>
<thead>
<tr>
<th></th>
<th>Level 1</th>
<th>Level 2</th>
<th>Level 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Promoters</td>
<td>25%</td>
<td>41%</td>
<td>54%</td>
</tr>
<tr>
<td>Detractors</td>
<td>19%</td>
<td>13%</td>
<td>6%</td>
</tr>
<tr>
<td>NPS</td>
<td>6 points</td>
<td>28 points</td>
<td>48 points</td>
</tr>
</tbody>
</table>
Final Word

> Design of customer-oriented systems need to take economic impact into account

> By understanding its users and controlling the transparency of appropriate information, systems can
  > Provide control over the process/economic activity
  > Control/provision of incentives

> Transparency needs to be explicitly considered in system design
  > Not just provision of data but provision of ‘useful data’
  > Need to understand user behavior