Crowd-assisted Search for Price Discrimination in E-Commerce: First results

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joint work with:

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BASED ON A TRUE STORY
Checking from SPAIN:

-- Hotel [****k
-- on H***s.com

... was quoted 150e / night

Checking from Sweden:

-- at the same time
-- for the same hotel
-- on the same web site
-- for the same days
-- and the same room

... was quoted 120e / night
Could it be Price Discrimination (PD)?

- Situation where two consumers are charged differently for the same product
- Based on how much are they willing to pay (reservation price)
Fixed prices is a “recent” thing
Could E-commerce backfire for customers?
Could E-commerce backfire for customers?

Privacy, Economics, and Price Discrimination on the Internet
[Extended Abstract]

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Abstract. The rapid erosion of privacy poses numerous puzzles. Why is it occurring, and why do people care about it? This paper proposes an explanation for many of these puzzles in terms of the increasing importance of price discrimination. Privacy appears to be declining largely in order to facilitate differential pricing, which offers greater social and economic gains than auctions or shopping
PD & E-commerce: A *match made in heaven*

(or somewhere else?)

- Shopping history
  - Retailer knows consumer's preferences
- Browsing history
  - Tracking cookies
- Geographic Location
- Customer's behaviour on web page
  - Going directly to an airfare ticket vs. looking around for cheaper offer at other dates
- Origin URL
  - Customer entering a shop from price aggregator might be more price-sensitive
- ... every piece of information that gives a hint about customer's behaviour
Would e-retailers do such a thing?

Robinson–Patman Act

The Robinson–Patman Act of 1936 (or Anti-Price Discrimination Act, Pub. L. No. 74-692, 49 Stat. 1526 (codified at 15 U.S.C. § 13 et seq)) is a United States federal law that prohibits anticompetitive practices by producers, specifically price discrimination. It grew out of practices in which chain stores were allowed to purchase goods at lower
e-commerce dwarfs online advertising

- e-commerce market in 2012 > $1,000,000,000,000,000
- 10 x larger than online advertising ($100bn)

privacy erosion!
Detecting price and search discrimination on the Internet

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ABSTRACT
Price discrimination, setting the price of a given product for each customer individually according to his valuation for information is being used increasingly to drive targeted advertising.
Another hypothesis put forward for the wide-scale...

Seems so ...
Exclusive leather wallet for men

TL140814

€ 41,87

Dimension
10.5 x 9 x 1.5 cm

Colour: Brown

- Polished calf-skin leather
- 3 compartments

Discount: -12%

Price: € 41,87

please select colour:

- Add to cart

Exclusive leather wallet for men

TL140814

€ 38,06

Dimension
10.5 x 9 x 1.5 cm

Colour: Brown

- Polished calf-skin leather
- 3 compartments

Discount: -20%

Price: € 38,06

please select colour:

- Add to cart
Too many questions, too few answers
Limitations of our initial platform

1. Needs (at least) one price extraction template per web-site.

2. No clue as to where we should start the search from.
Next step - crowdsourcing

Pictograms:
- Computer from The Noun Project
- Shopping Cart designed by Phil Goodwin from The Noun Project
- User designed by Steffen Halme from The Noun Project
- User designed by Luis Prado from The Noun Project

Real consumers

Monitoring server

Different systems / locations / profiles

Interesting retailers
$sheriff
Detecting Price Discrimination

1. Select price

<table>
<thead>
<tr>
<th>Availability: In Stock</th>
</tr>
</thead>
<tbody>
<tr>
<td>Price: $200.50</td>
</tr>
<tr>
<td>Ex Tax: $90.00</td>
</tr>
<tr>
<td>Price in reward points: 400</td>
</tr>
<tr>
<td>10 or more $105.40</td>
</tr>
<tr>
<td>20 or more $93.48</td>
</tr>
</tbody>
</table>

2. Check it

3. Examine differences

| S, Safari, Spain | $189.00 |
| Firefox, Spain | $189.00 |
| m, Liège | $155.99 |
| São Paulo | $189.00 |
| q, Tampere | $189.00 |
| any, Berlin | $201.50 |
Initial results

• 340 beta users for a couple of months  [No *death by success* please]

• Pointed us to 20 retailers with price variations

• We monitored 100 products from each one of these retailers
  
o  Repeated the crawling every day

  o  For one week
Which retailers?
Which products?
Which countries?

(b) www.amazon.com
Which states?

(a) www.homedepot.com
More complex policies seem to exist

Websites Vary Prices, Deals Based on Users’ Information

By JENNIFER VALENTINO-DEVRIES, JEREMY SINGER-VINE and ASHKAN SOLTANI
December 24, 2012

It was the same Swingline stapler, on the same Staples.com [SPLS +1.53%] website. But for Kim Wamble, the price was $15.79, while the price on Trude Frizzell’s screen, just a few miles away, was $14.29.

A key difference: where Staples seemed to think they were located.

A Wall Street Journal investigation found that the Staples Inc. website displays different prices to people after estimating their locations. More than that, Staples appeared to consider the person’s distance from a rival brick-and-mortar store, either OfficeMax Inc. or Office Depot Inc. [ODP -2.12%]. If rival stores were within 20 miles or so, Staples.com usually showed a discounted price.
What types of pricing policies do we see?

[MULTIPLICATIVE]

(a) www.digitalrev.com
What types of pricing policies do we see?

[MULTIPLICATIVE with an ADDITIVE TERM]

(b) www.energie.it
What about personal information?

- Cookie history
- Previous purchases
- Other public profile info (FB, LinkedIn)

Figure 10: The impact of login on the price of Kindle ebooks at www.amazon.com
Hard to demonstrate PD based on Personal info

• Our measurement servers have a clean history → location is the diff factor

• Real uses however get prices that depend also on their profile
  o E.g., cookie history

• Cookie history
  o Has higher “dimensionality” than Location
  o Difficult to gather (would users trust a service and hand it over?)
Ongoing work

• PD related
  o Revive and scale up $heriff
  o Make it go viral
  o Use it to collect a larger dataset

• Advertising related
  o How much targeting is going on?
  o Is Do-Not-Track being respected
  o Can we demonstrate profile trading between ad networks?
Moonshots!
Our moonshot...
The Data Neutrality Lab (DLAB)
D-LAB Objectives

- Detect and expose Data Privacy online leakage
  - Develop the tools to help Users and Regulators
  - Provide the infrastructure for running measurements and storing dataset
  - Fund research groups
  - Organize events and disseminate results

- Tragedy of the commons vs. Sustainable Personal Data use
  - Resources exploited ruthlessly lead to extinction (e.g. buffalos in US Midwest).
  - Once we loved real TV but Ad Breaks broke the experience. Will privacy leakage break Internet advertising ($1B per annum) or e-commerce ($1T per annum).
  - For a “Data Trading Economy” to flourish but remain sustainable, data-handling transparency is paramount.

- Community-led effort to defend a common-good goal
  - The Data Transparency debate needs strong push, equal to the Net neutrality debate.
  - The Internet was built by a community and has to be safeguarded by a community
Stay tuned ...
Thank you -- Questions?

- Sheriff extension available at
  
  http://pdexperiment.cba.upc.edu

- Publications
