

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

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joint work with:

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(Telefonica)



BASED ON A
TRUE STORY

Checking from SPAIN:

- Hotel I*****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)?



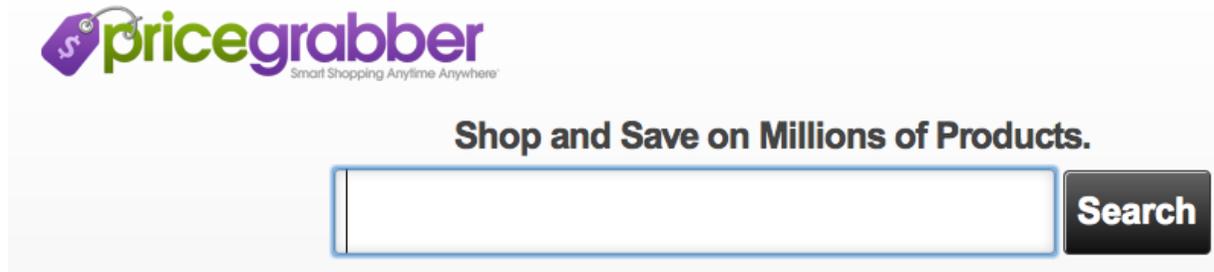
- Situation where two consumers are charged differently for the same product
- Based on how much are they willing to pay (reservation price)



Fixed prices is a “recent” thing



Could E-commerce backfire for customers?



We shop millions of products to find the best one for you at today's lowest price



electronics computers home & garden clothing & accessories health & beauty jewelry video games sports see more

Pricewatch® est. 1995

Street Price Search Engine

Compare millions of prices from the most trusted stores and auctions!

Could E-commerce backfire for customers?

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

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Revised version, July 27, 2003

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?

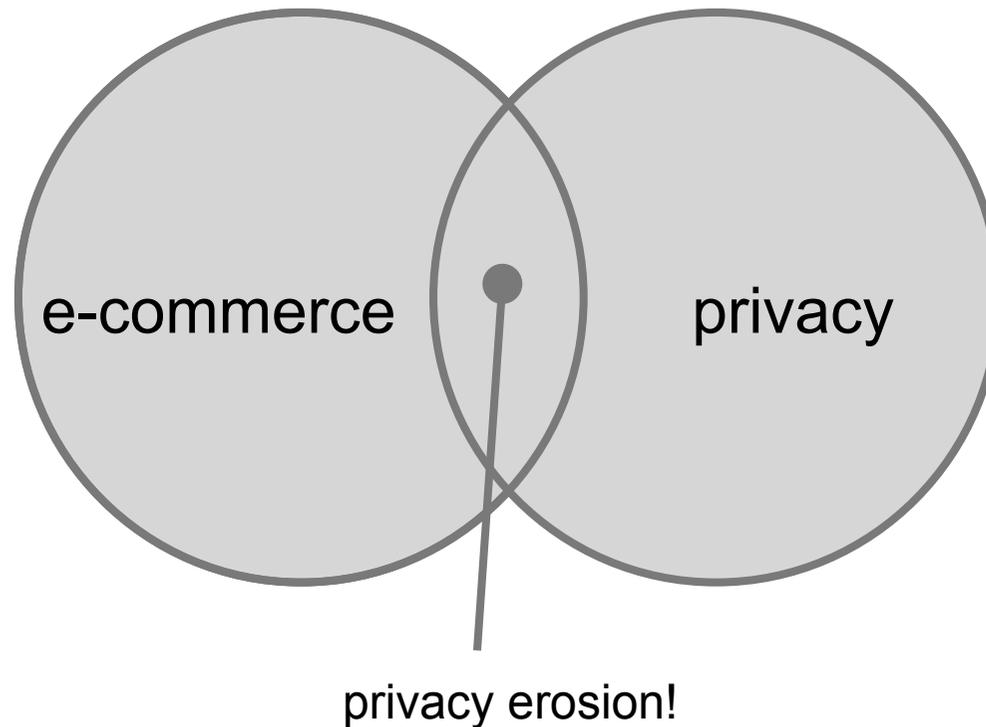


Robinson–Patman Act

From Wikipedia, the free encyclopedia

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](#)^(?))) 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

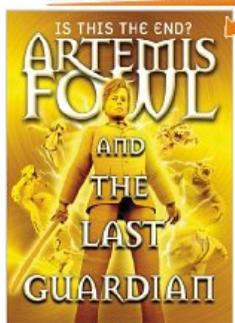
e-commerce dwarfs online advertising



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

Seems so ...

Click to LOOK INSIDE!



IS THIS THE END?
ARTEMIS FOWL
AND
THE
LAST
GUARDIAN

Artemis Fowl and the Last Guardian [K]
Eoin Colfer (Author)
★★★★☆ (230 customer reviews)

Print List Price: \$18.99

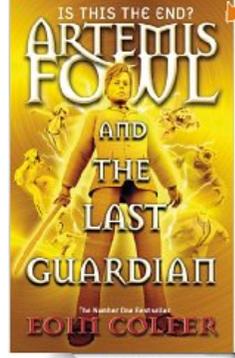
Kindle Price: **\$11.34** includes VAT* & free internet delivery
Whispernet

You Save: \$7.65 (40%)

- Don't have a Kindle? [Get your Kindle here.](#)

Formats	Amazon price	N
Kindle Edition	\$11.34	

Click to LOOK INSIDE!



IS THIS THE END?
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GUARDIAN

Artemis Fowl and the Last Guardian [K]
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★★★★☆ (230 customer reviews)

Digital List Price: ~~\$9.95~~ What's this?

Print List Price: ~~\$18.99~~

Kindle Price: **\$5.89** includes VAT* & free internet delivery
Whispernet

You Save: \$13.10 (69%)

- Don't have a Kindle? [Get your Kindle here.](#)

Formats	Amazon price	N
Kindle Edition	\$5.89	
<input checked="" type="checkbox"/> Hardcover, Deckle Edge	\$10.98	

Eleventh ACM Workshop on Hot Topics in Networks (HotNets-XI)

October 29-30, 2012
Redmond, WA



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

Exclusive leather wallet for men

TL140814

Colour: Brown
[24H SHIPPING!]

- Polished calf-skin leather
- 3 compartments

€ 41,87

Dimension

10.5 x 9 x 1.5 cm cm → inc

kg → lbs



Retail price: ~~€ 47,58~~ Discount: **-12%**

Price: **€ 41,87**

Vat inc.

Customization: 20 characters left

Lucida Calligraphy ^

Lucida Calligraphy ^

Add to Cart

Please select colour:

Shipping to **Spain**, English, EUR (Euro)

Log In | Contact Us | Cart Contents (0)

Exclusive leather wallet for men

TL140814

Colour: Brown
[24H SHIPPING!]

- Polished calf-skin leather
- 3 compartments

€ 38,06

Dimension

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Lucida Calligraphy ^

Lucida Calligraphy ^

Add to Cart

Please select colour:

Too many questions, too few answers

THE WALL STREET JOURNAL. **TECH**

TOP STORIES IN TECH

- 1 of 12  Apple Taps Into Twitter, Buying Topsy
- 2 of 12  Why Everyone Will Totally Read This Col...
- 3 of 12  Samsung Promotes Chairman's Daughter to...

WHAT THEY KNOW

Websites Vary Prices, Deals Based on Users' Information

Email Print Save 145 Comments    A A

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

Popular Now

ARTICLES

1 **Opinion:**
ObamaCare M

THE WALL STREET JOURNAL. **TECH**

Digits Tech News & Analysis From the WSJ

COMPANIES MOBILE PRIVACY SOCIAL ME

HOT TOPICS: TWITTER'S IPO APPLE'S EVENT WIRELESS SAVINGS CALCULAT

12:59 pm
Jan 10, 2013 UNCATEGORIZED

Want a Deal Online? Pose as a Bargain Shopper

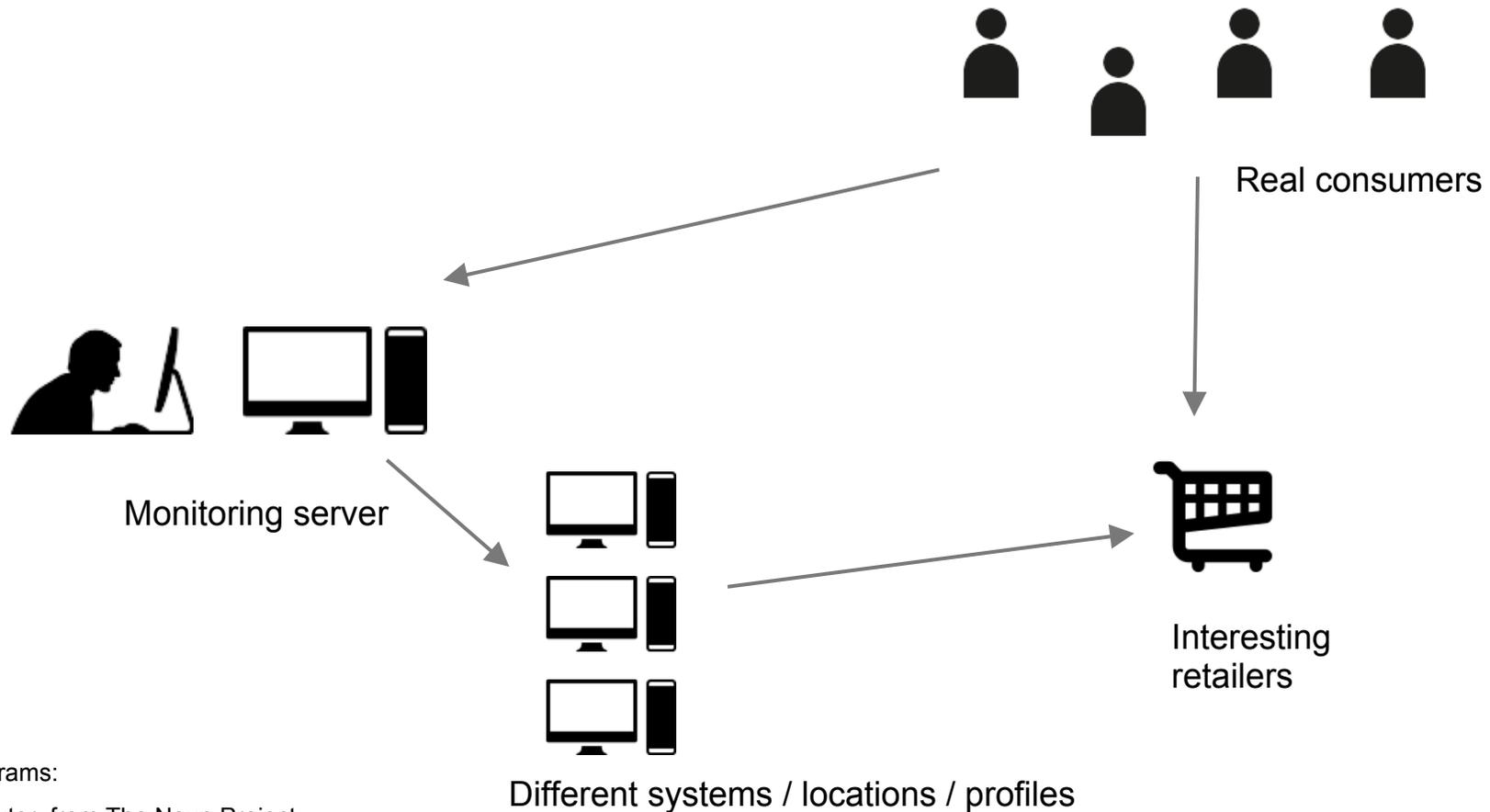


OFFICE OF FAIR TRADING

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



\$heriff

Detecting Price Discrimination

1. Select price

Availability: In Stock

Price: ~~\$200.50~~ \$189.00

Ex Tax: \$90.00

Price in reward points: 400

10 or more \$105.40

20 or more \$92.48

2. Check it

189.00

Check it

3. Examine differences

S, Safari, Spain	\$189.00
Firefox, Spain	\$189.00
m, Liège	\$165.99
São Paulo	\$189.00
d, Tampere	\$189.00
any, Berlin	\$201.50

chrome web store

Search the store

Home

Popular

You will

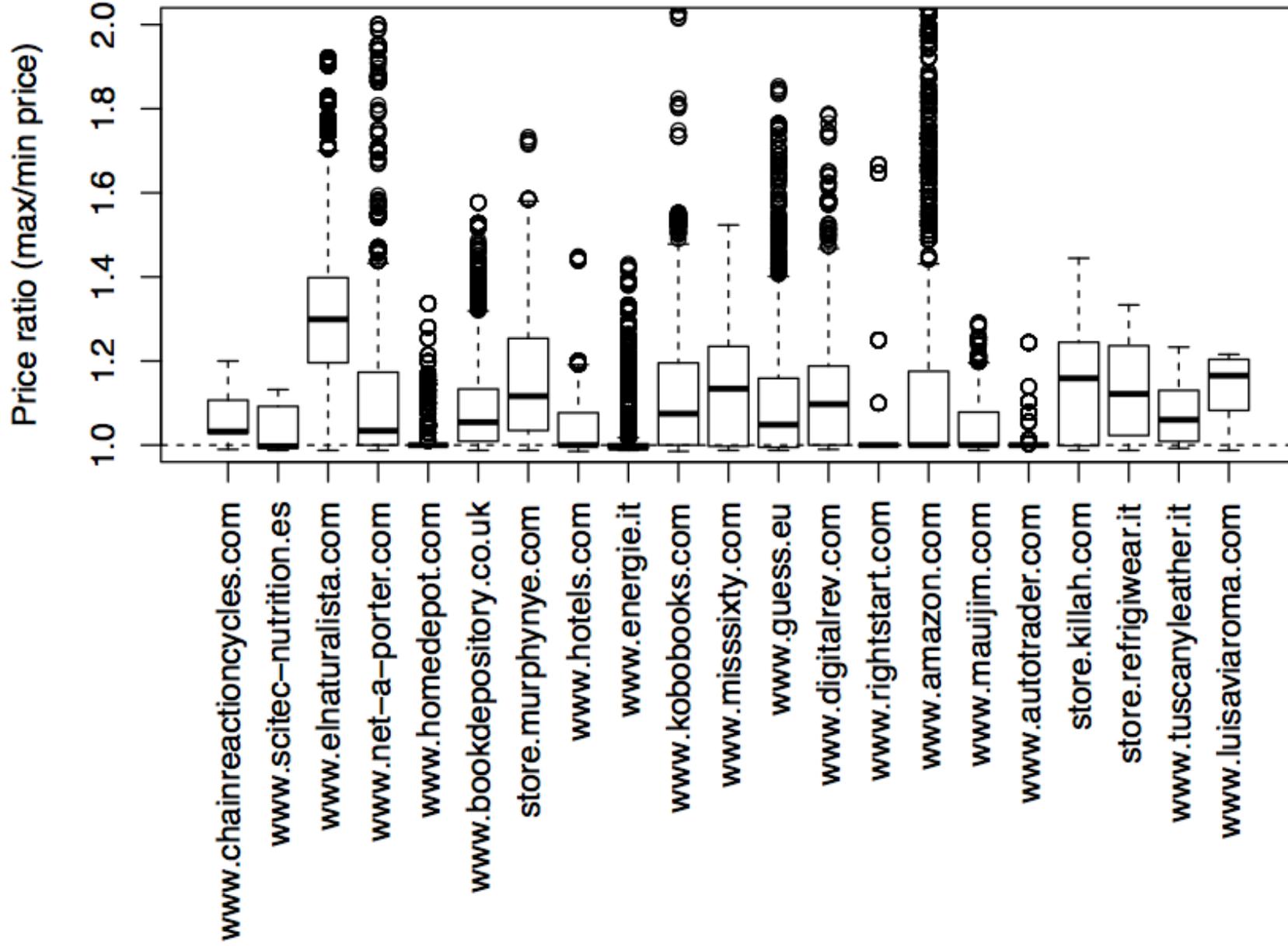
Sheriff

★★★★★ (0) | [Shopping](#) | [from Jakub Mikians](#)

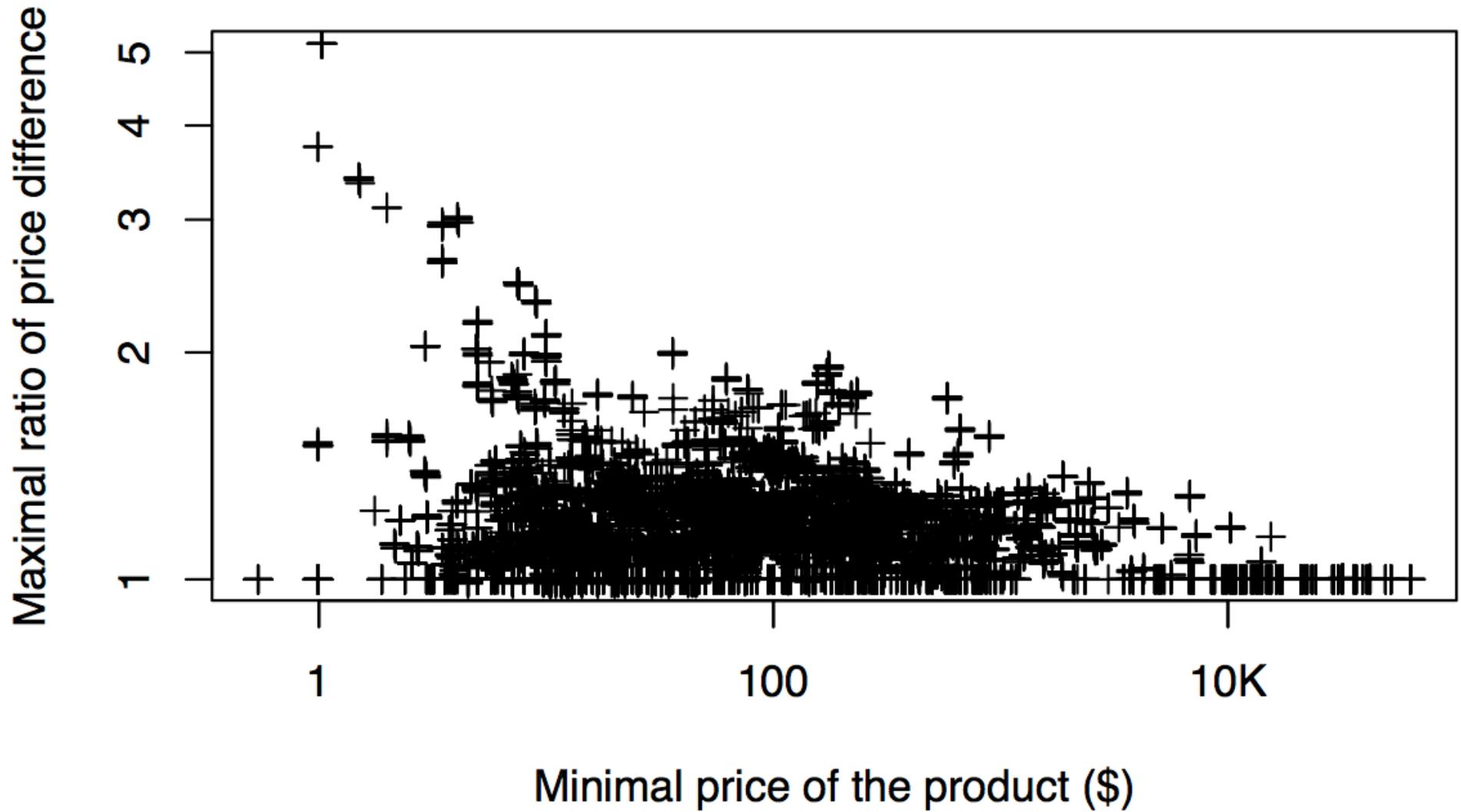
Initial results

- 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
 - Repeated the crawling every day
 - For one week

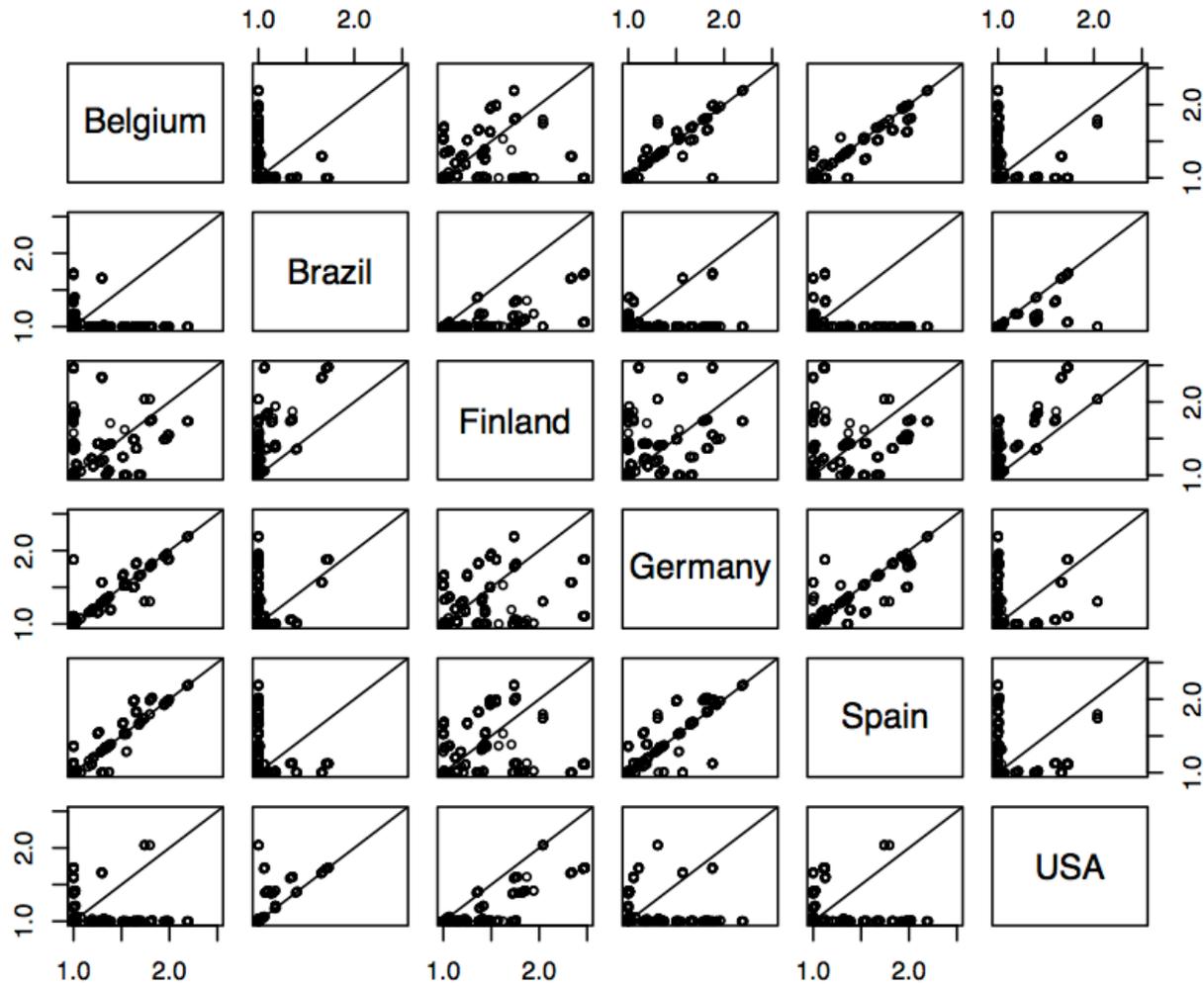
Which retailers?



Which products?

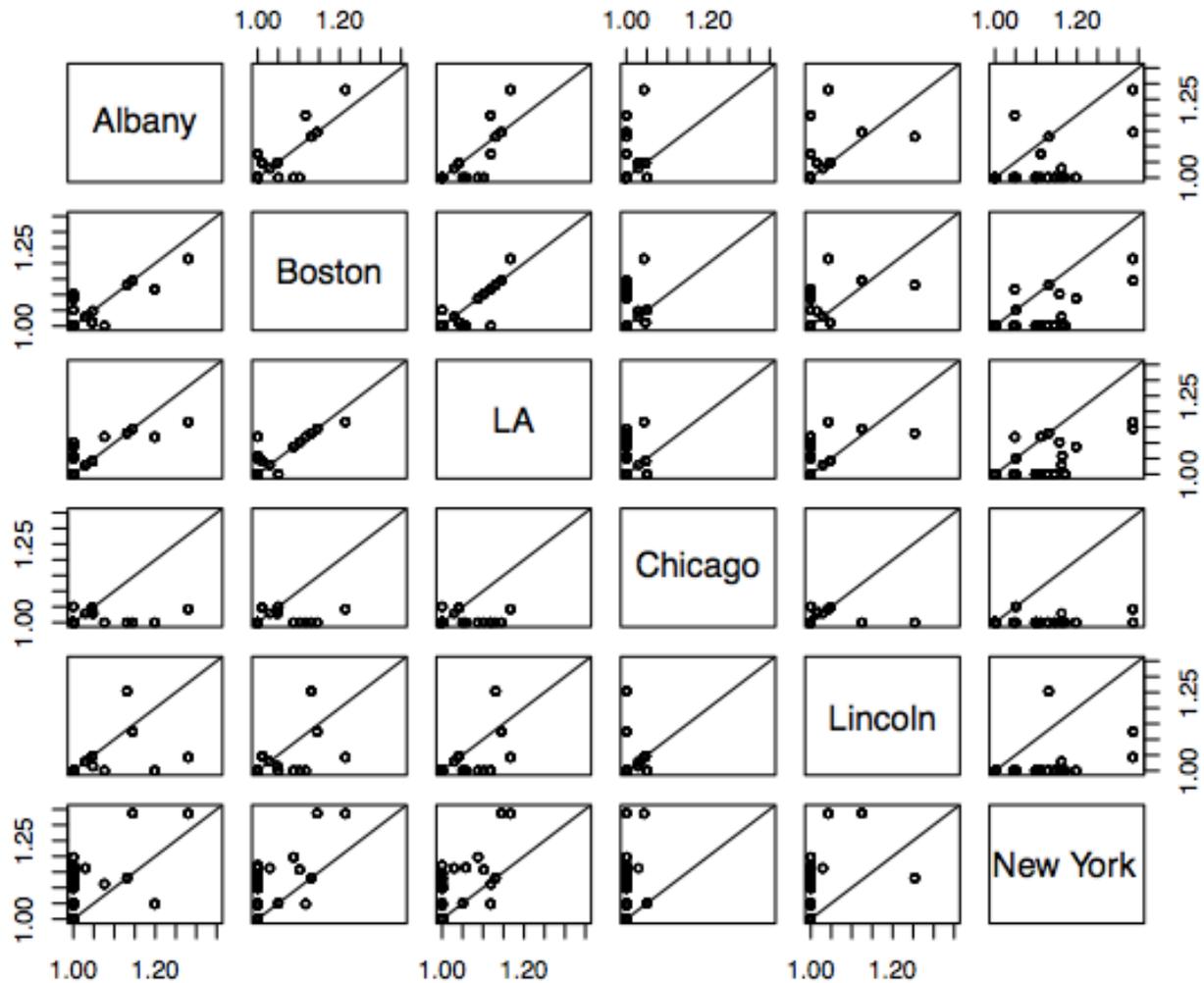


Which countries?



(b) www.amazon.com

Which states?



(a) www.homedepot.com

More complex policies seem to exist

THE WALL STREET JOURNAL.  TECH

TOP STORIES IN TECH 1 of 12

 Microsoft Plots Original Shows for Xbox

 Apple Will Fix Faulty iPhone 5 Sleep Bu... 2 of 12

 Apple Will Fix Faulty iPhone 5 Sleep Bu... 3 of 12



WHAT THEY KNOW

Websites Vary Prices, Deals Based on Users' Information

 Email  Print  Save   146 Comments     

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.

Popular Now

ARTICLES

1 [Afghan Leader, Baltimore Restaurateur](#)

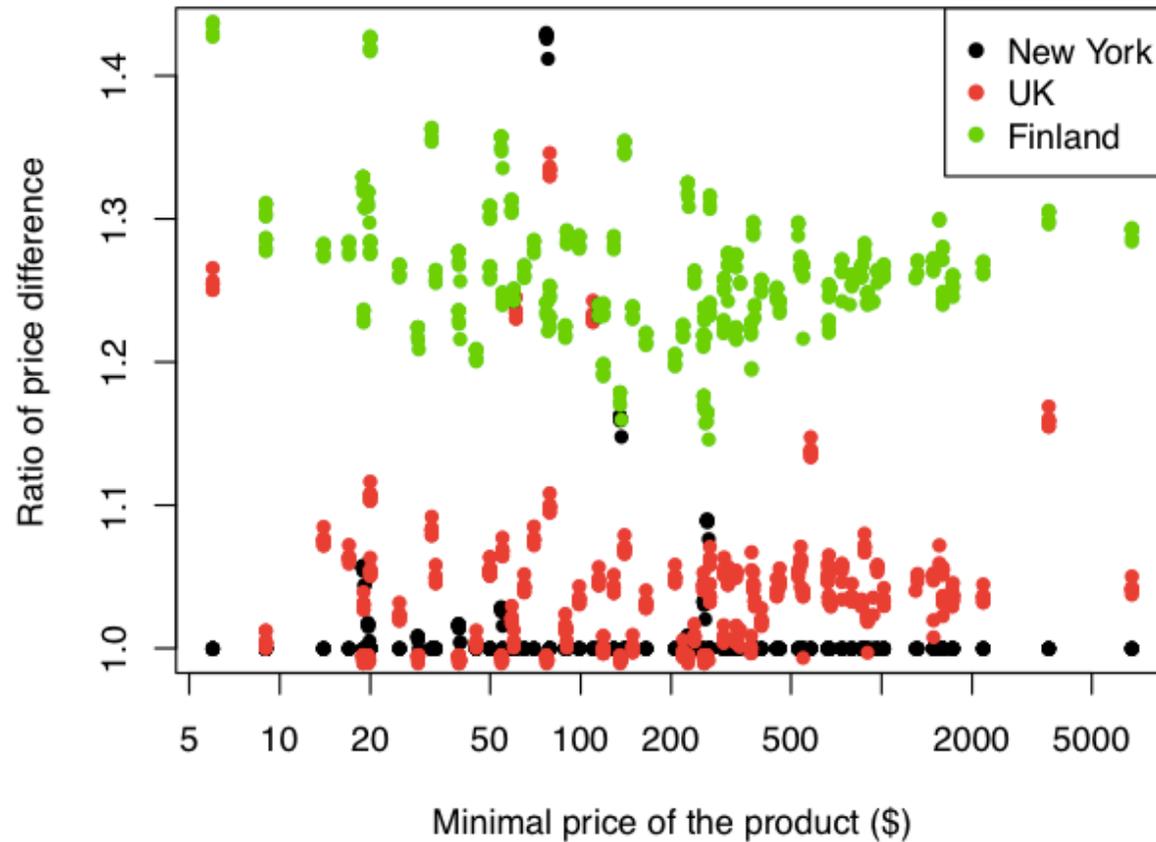
2 [Two Very Different Saints Come Marching In](#)

3 [The Scarcity Fallacy](#)

What types of pricing policies do we see?

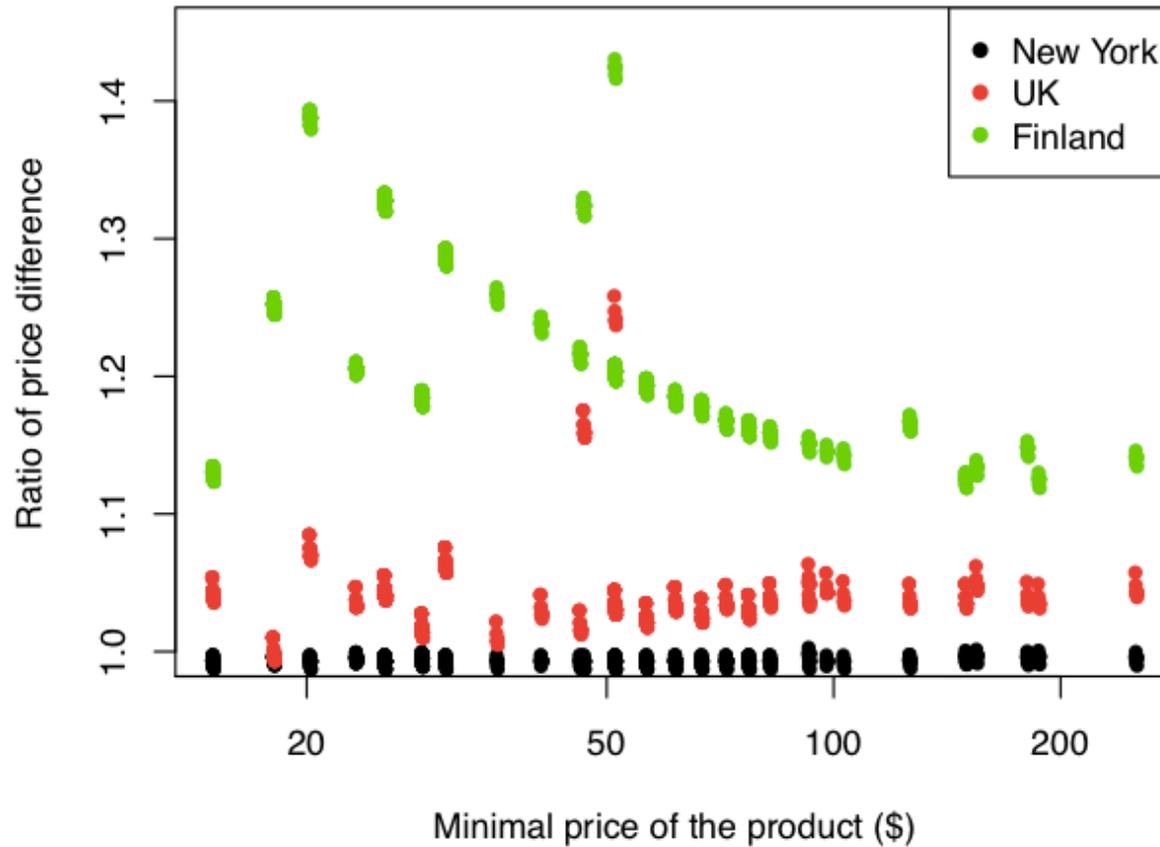
[MULTIPLICATIVE]



(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)

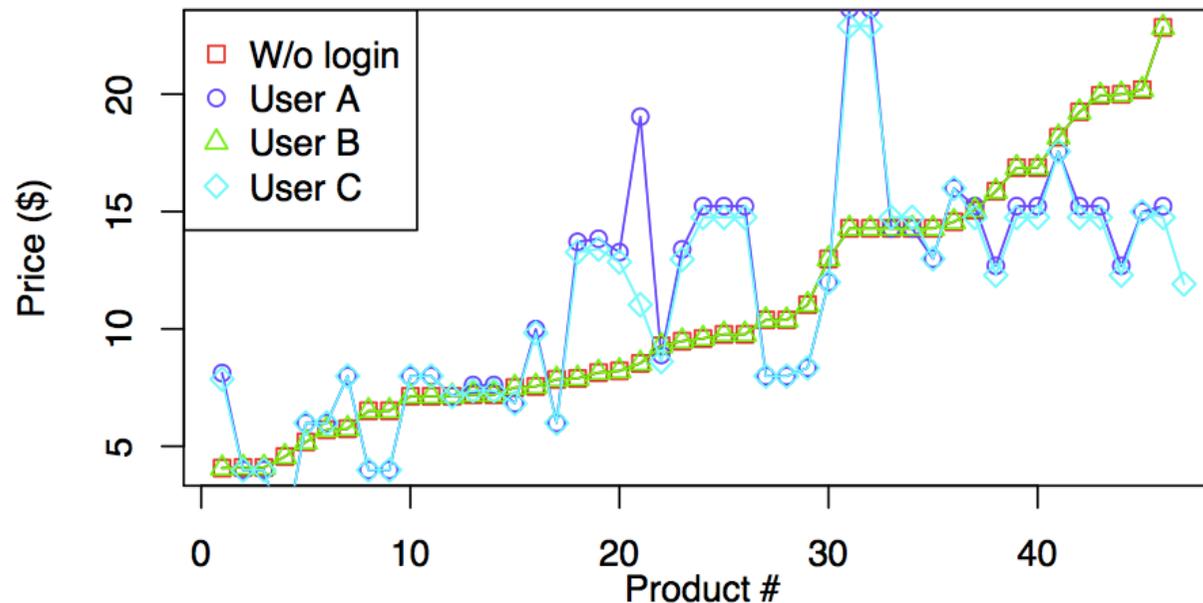


Figure 10: The impact of login on the price of Kindle ebooks at www.amazon.com

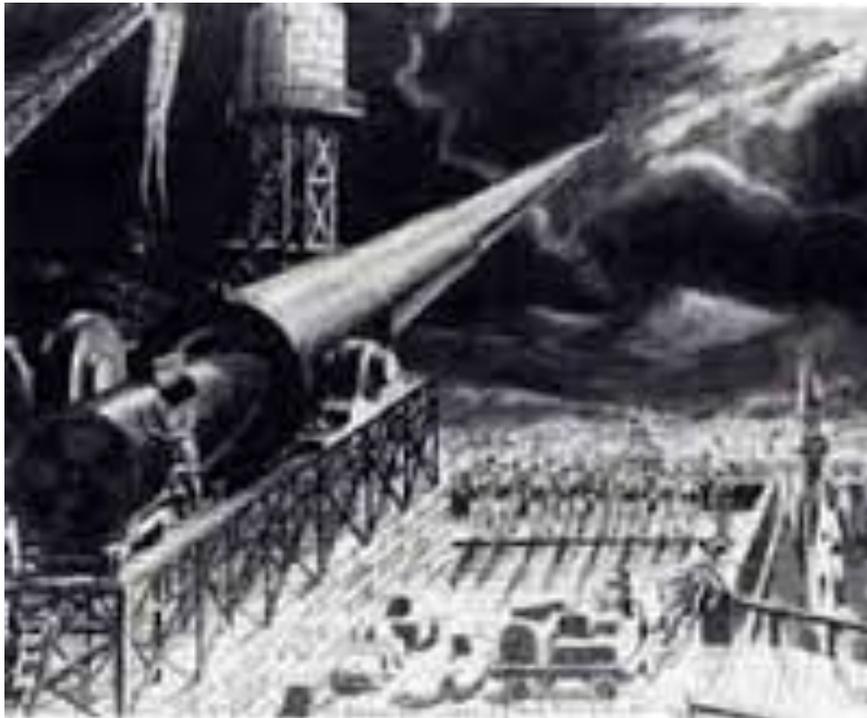
Hard to demonstrate PD based on Personal info

- Our measurement servers have a clean history → location is the diff factor
- Real uses however get prices that depend also on their profile
 - E.g., cookie history
- Cookie history
 - Has higher “dimensionality” than Location
 - Difficult to gather (would users trust a service and hand it over?)

Ongoing work

- PD related
 - Revive and scale up \$heriff
 - Make it go viral
 - Use it to collect a larger dataset
- Advertising related
 - How much targeting is going on?
 - Is Do-Not-Track being respected
 - 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?

- \$heriff extension available at

<http://pdexperiment.cba.upc.edu>

- Publications

Mikians, L. Gyarmati, V. Erramilli, N. Laoutaris, “Crowd-assisted Search for Price Discrimination in E-Commerce: First results,” **ACM CoNEXT.13**. [\[full version\]](#)

J. Mikians, L. Gyarmati, V. Erramilli, N. Laoutaris, “Detecting price and search discrimination on the Internet,” in Proc. of **ACM HotNets'12**. [\[pdf\]](#)