

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)?



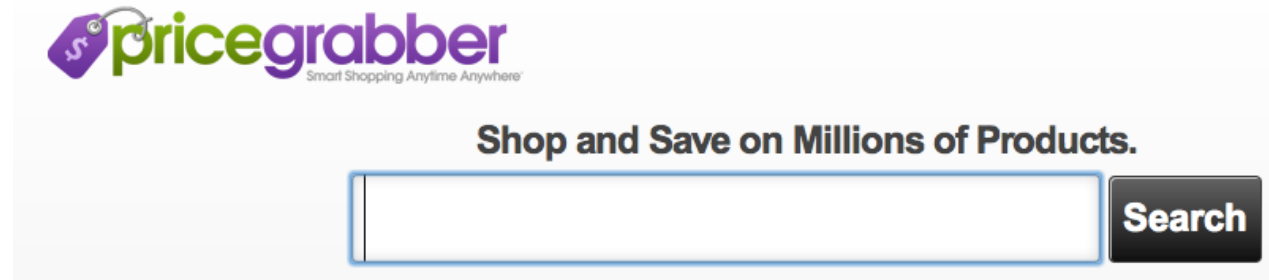
- Situation where two consumers are charged differently for the same product
- Based on how much are they willing to pay (reservation price)



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



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

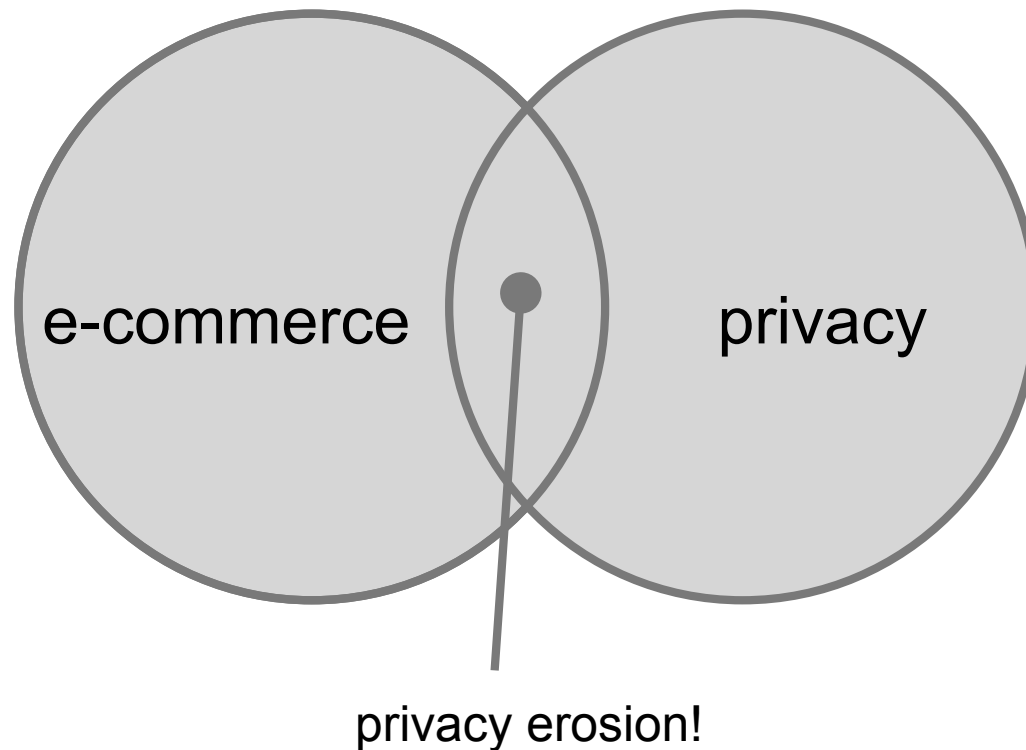
From Wikipedia, the free encyclopedia

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

Article 20.2 of the European Union

Directive 2006/123/EC on Services in the Internal Market (the “Services Directive”) prohibits discrimination based on grounds of the nationality or place of residence of service recipients

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

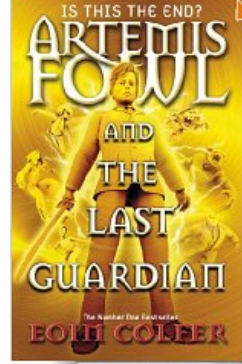
Artemis Fowl and the Last Guardian [K]
Eoin Colfer (Author)
★★★★☆ (230 customer reviews)

Print List Price: ~~\$18.99~~
Kindle Price: **\$11.34** includes VAT* & free inter
Whispernet
You Save: \$7.65 (40%)

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

Formats	Amazon price
Kindle Edition	\$11.34

Click to **LOOK INSIDE!**



IS THIS THE END?
ARTEMIS FOWL
AND
THE
LAST
GUARDIAN
Eoin Colfer

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

Digital List Price: ~~\$9.95~~ What's this?
Print List Price: ~~\$18.99~~
Kindle Price: **\$5.89** includes VAT* & free inter
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Formats	Amazon price	N
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+ 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

Jakub Mikians[†], László Gyarmati^{*}, Vijay Erramilli^{*}, Nikolaos Laoutaris^{*}
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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

ME WOMEN MEN BUSINESS FREE TIME LUGGAGE

VIP Club

Search

Leather bags for Men » Leather wallets for men » Exclusive leather wallet for men

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 ^

Please select colour:

☐ Add to Cart

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

Log In | Contact Us | Cart Contents (0)

ME WOMEN MEN BUSINESS FREE TIME LUGGAGE

VIP Club

Search

Leather bags for Men » Leather wallets for men » Exclusive leather wallet for men

Exclusive leather wallet for men

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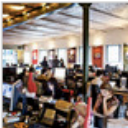
☐ Add to Cart


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



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



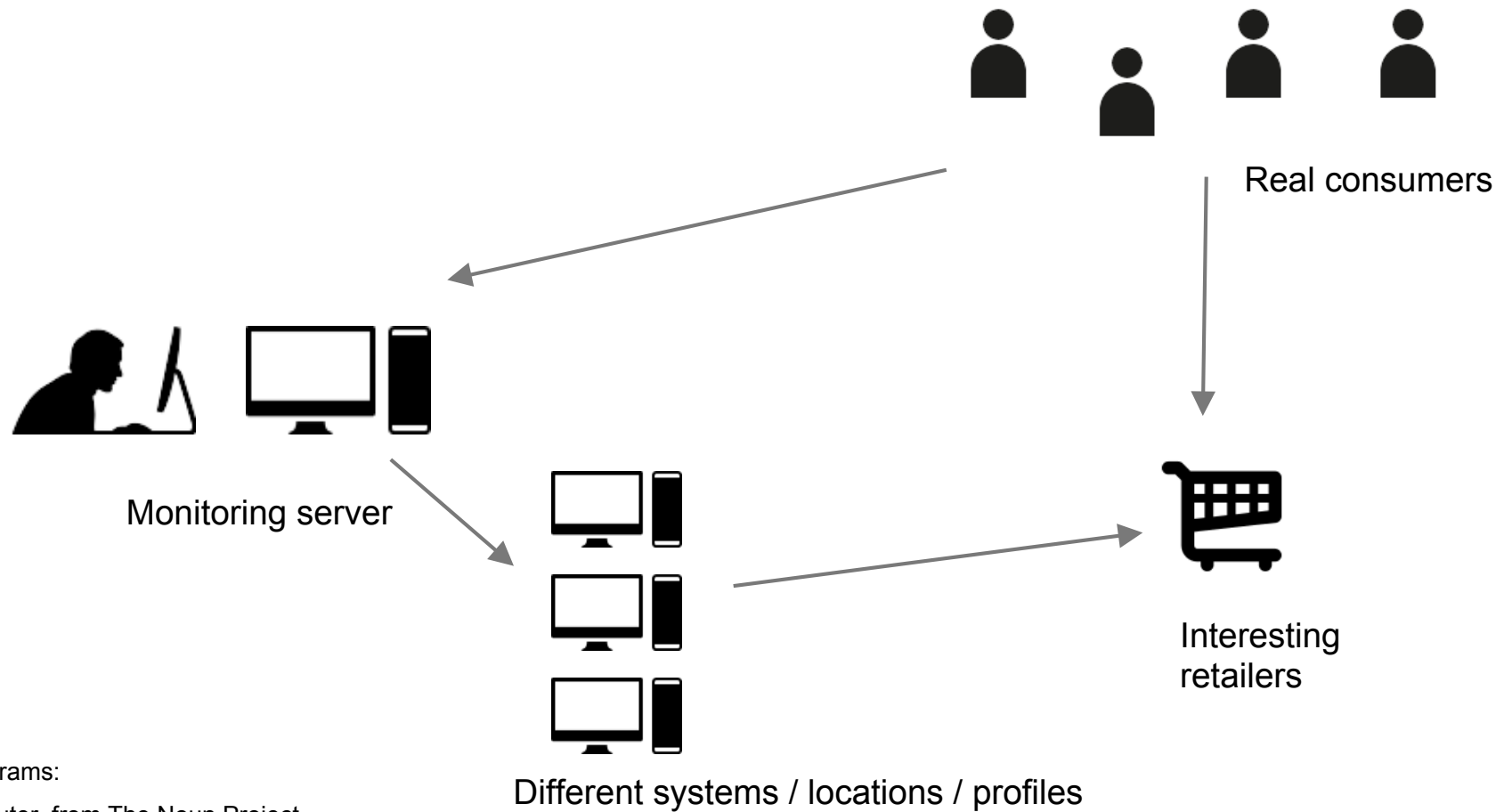
DG Internal Market and Services

European Commission > DGs > Internal Market and Services

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

 **Sheriff**

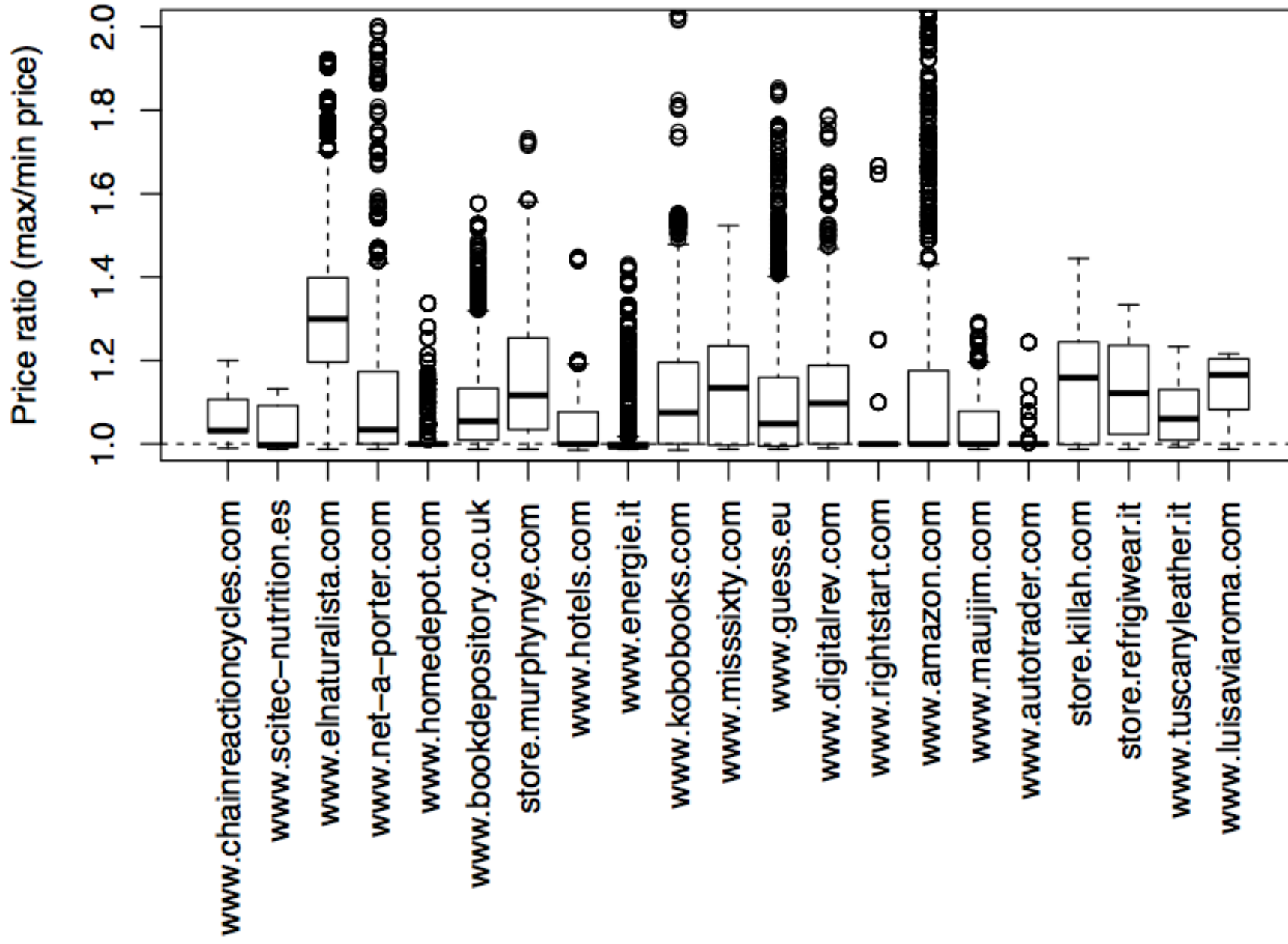
★★★★★ (0) | [Shopping](#) | [from Jakub Mikians](#)

You will

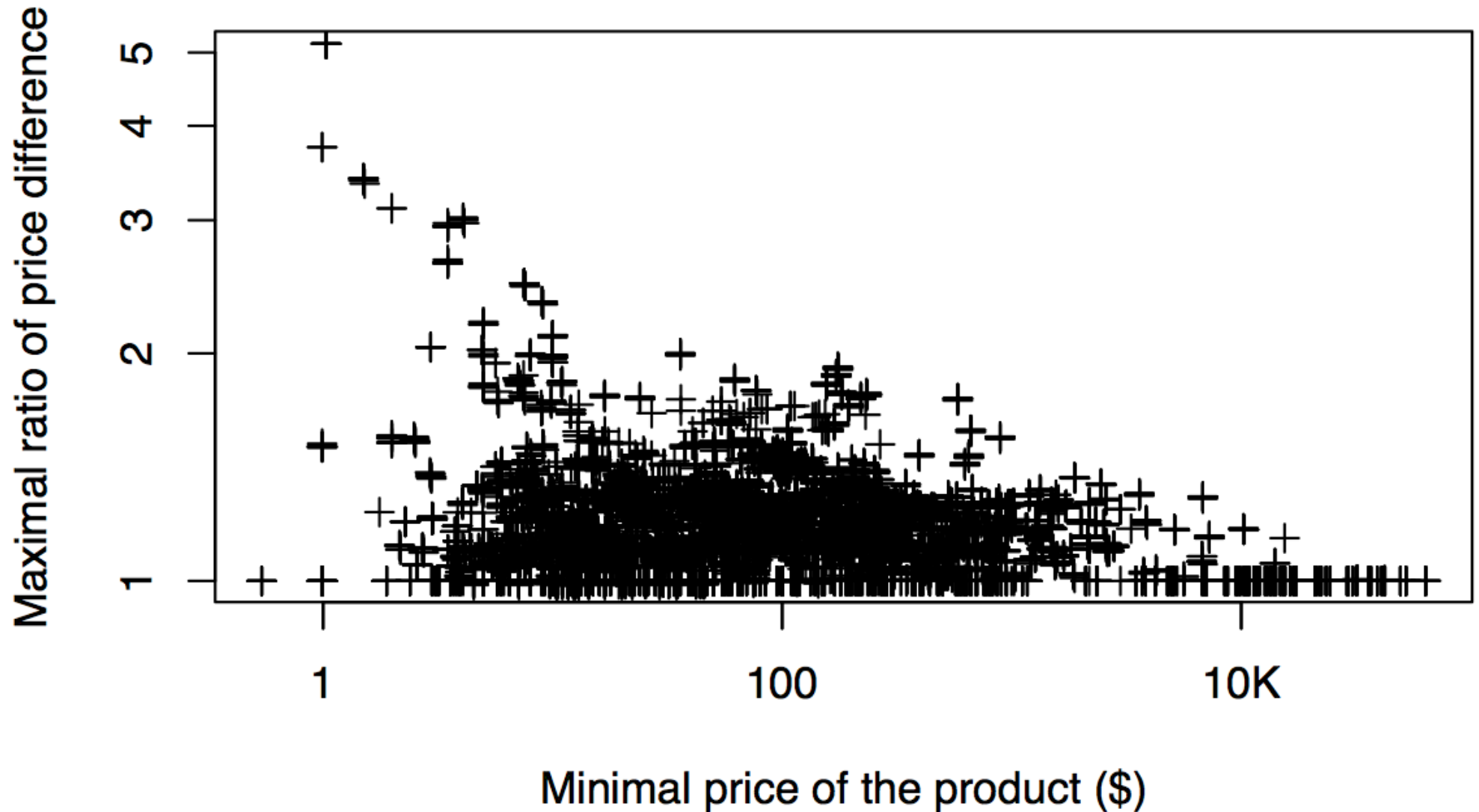
Initial results

- 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

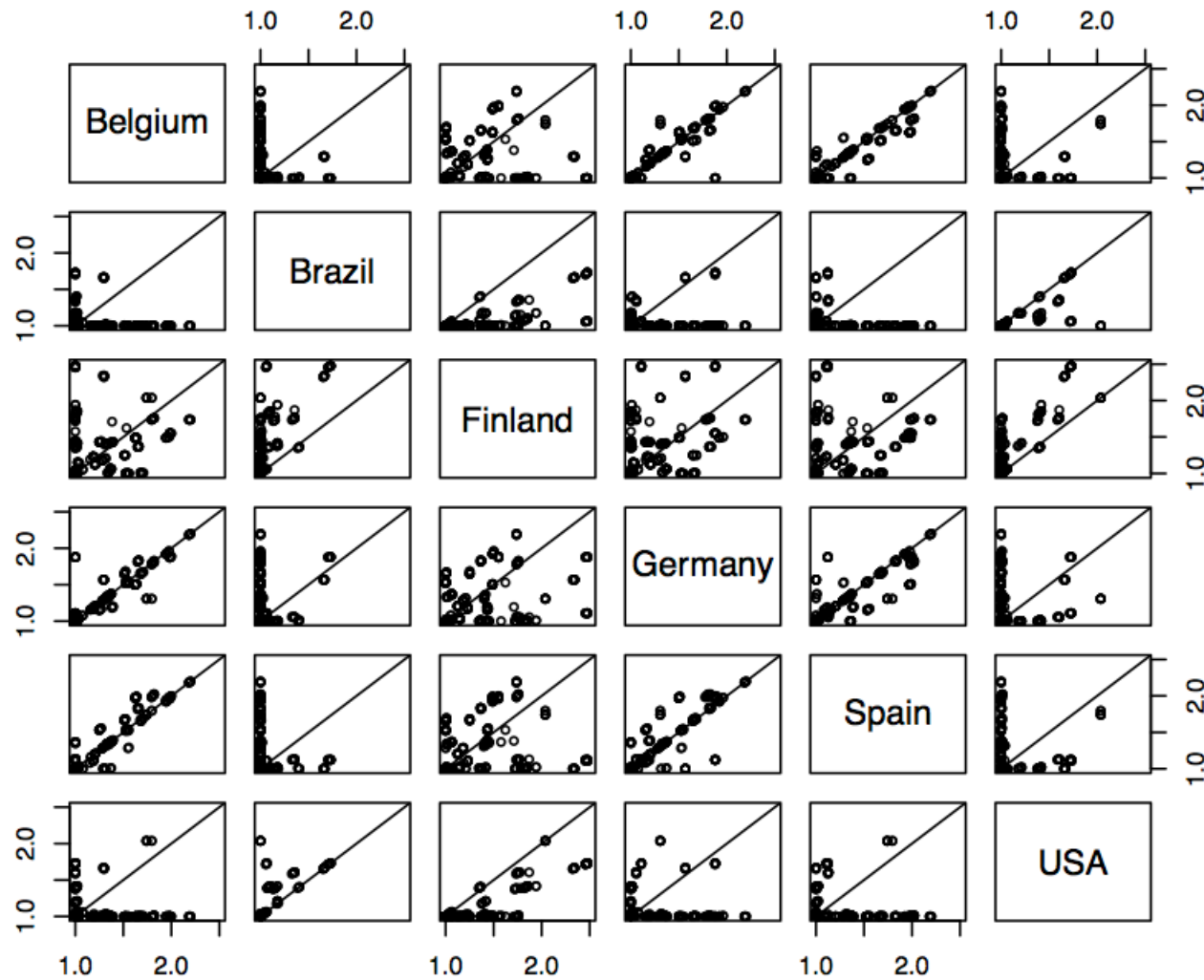
Which retailers?



Which products?

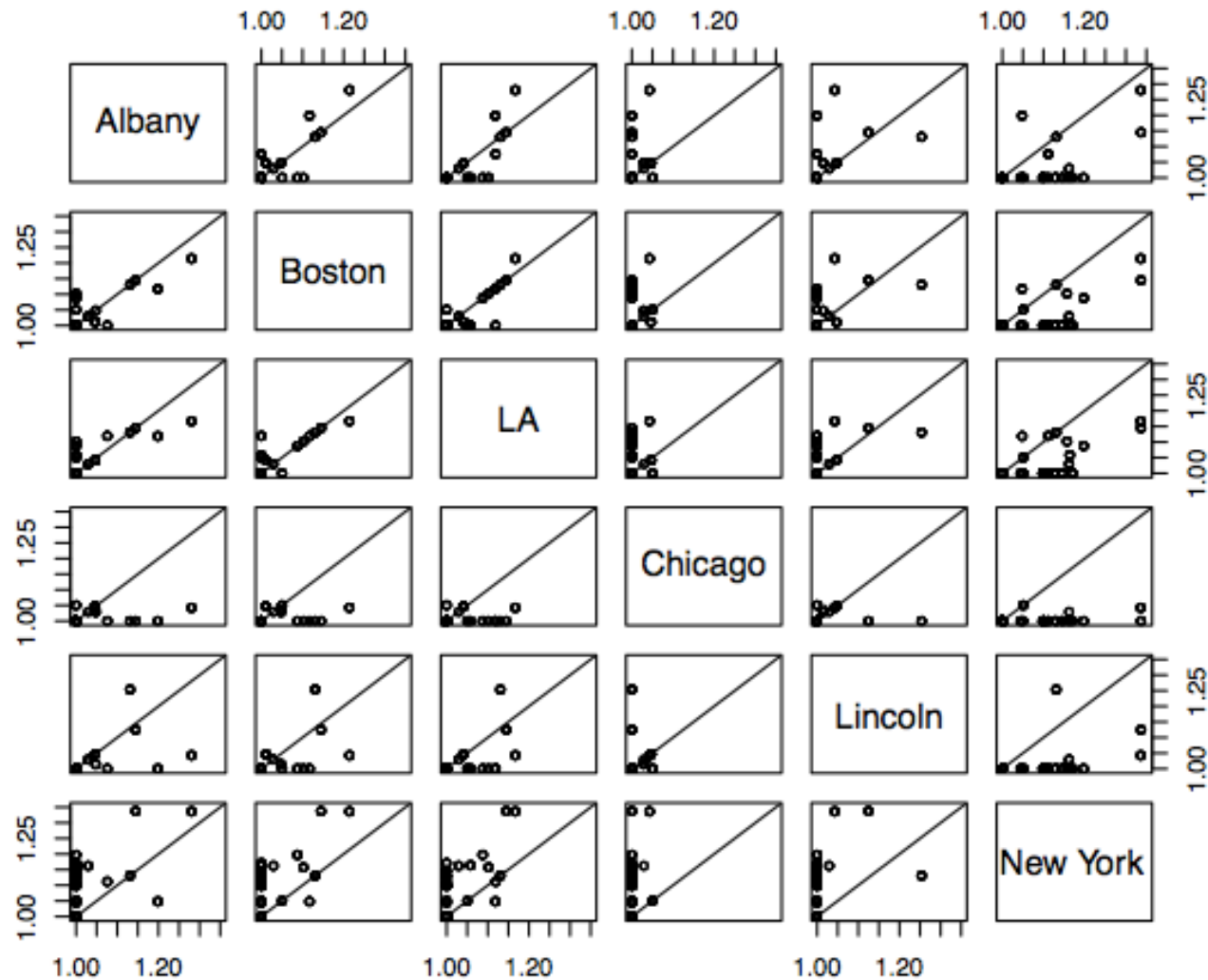


Which countries?



(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**

2 of 12

**Apple Will Fix Faulty iPhone 5 Sleep Bu...**






3 of 12

**Apple Will Fix Faulty iPhone 5 Sleep Bu...**



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**

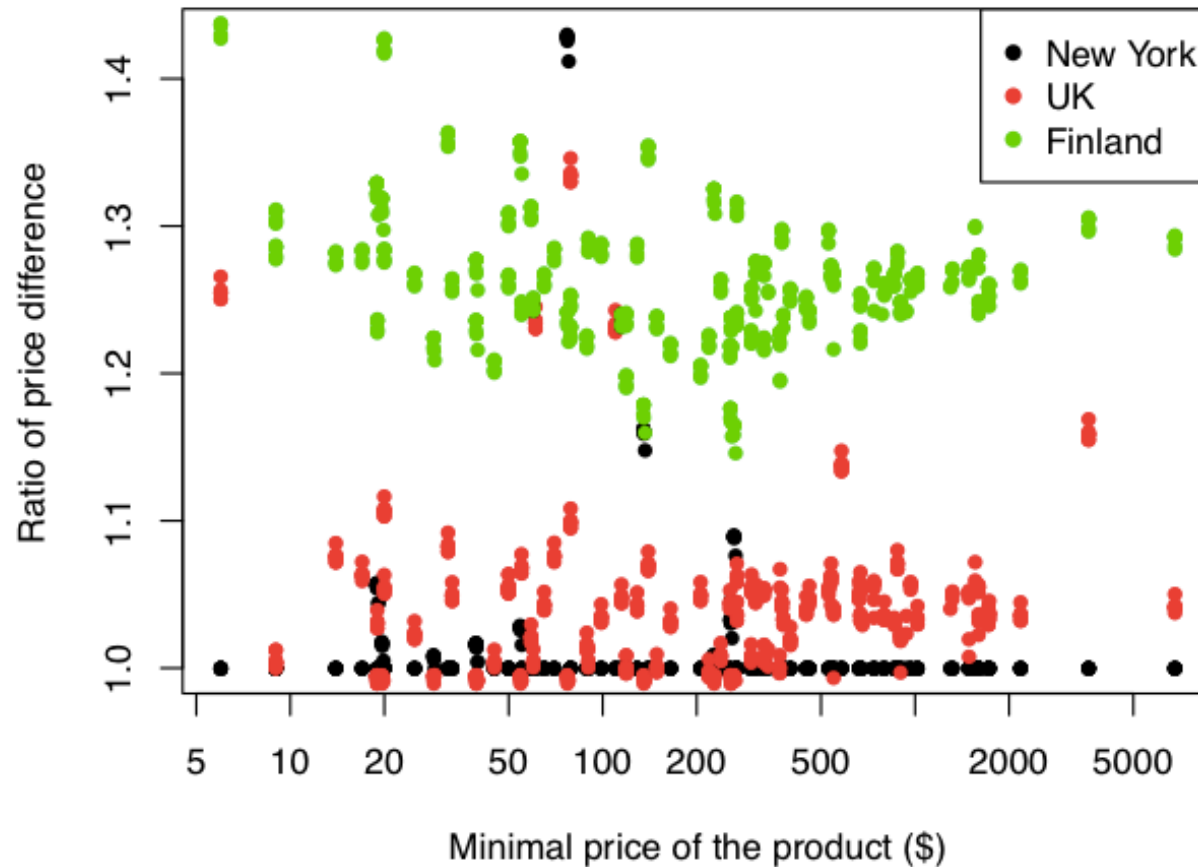
2 **Two Very Different Saints Come Marching In**

3 **The Scarcity Fallacy**

What types of pricing policies do we see?

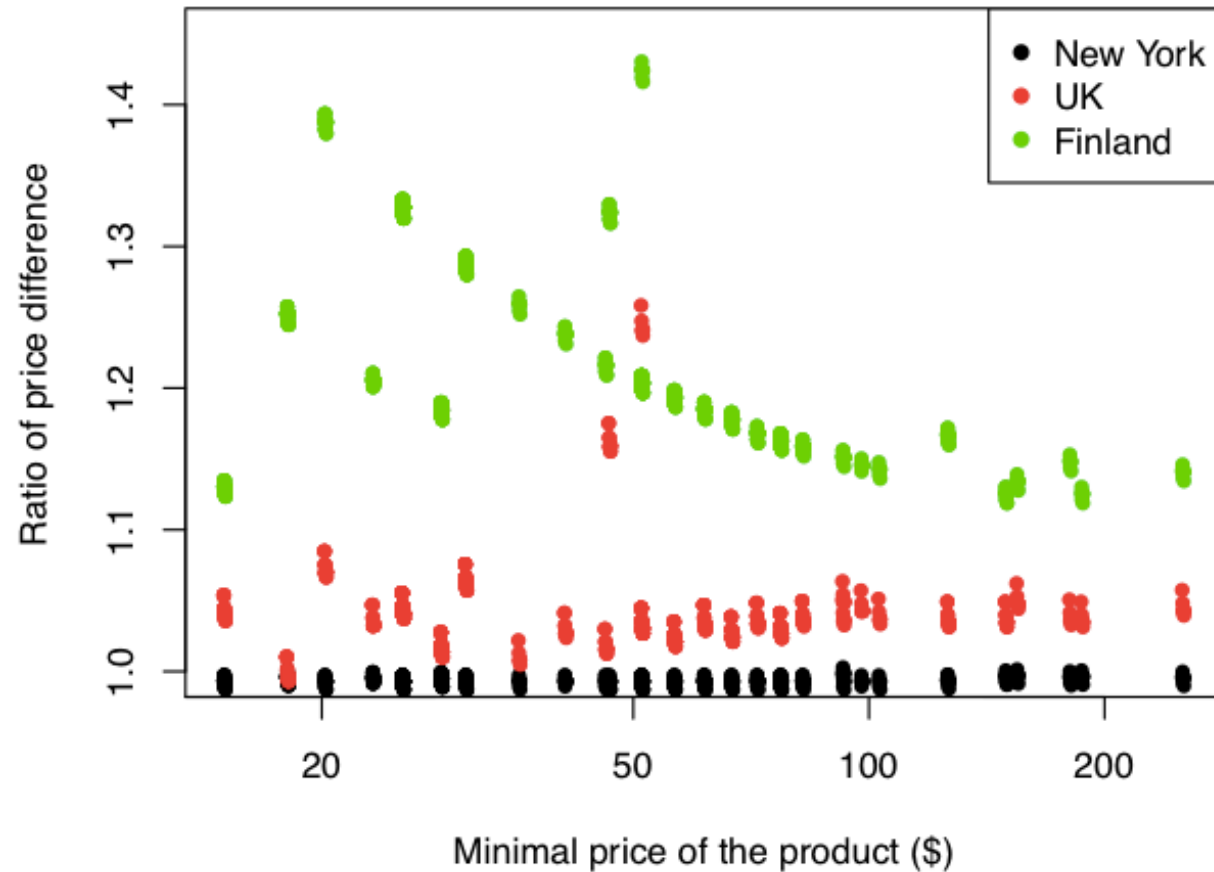
[MULTIPLICATIVE]



(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)

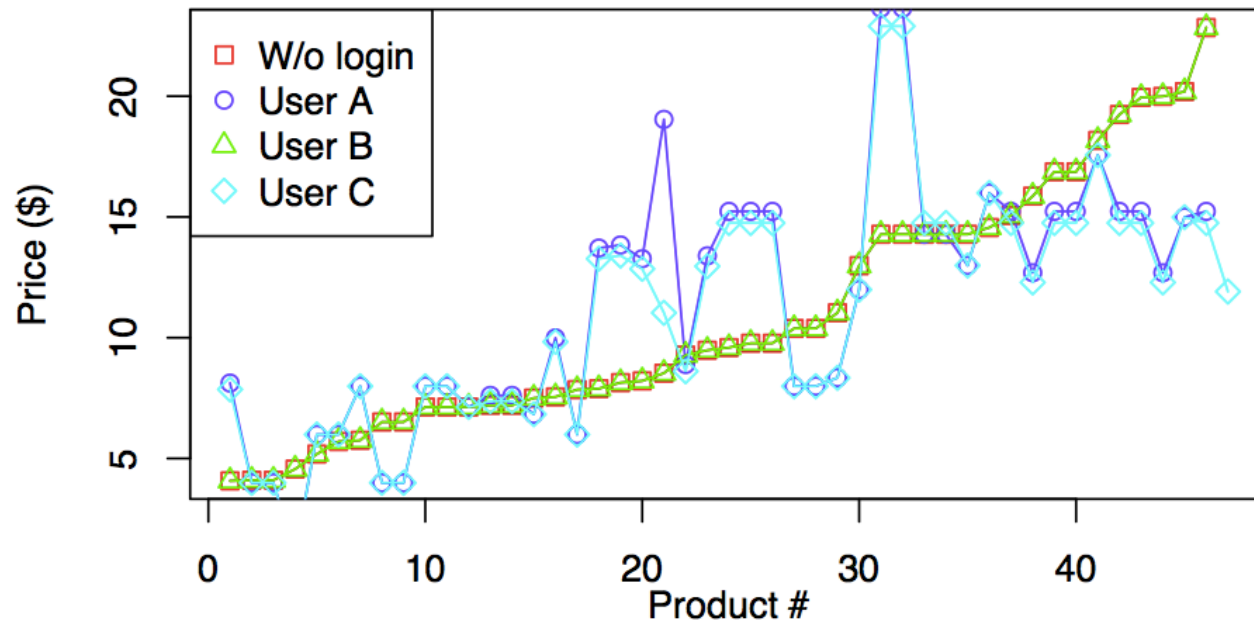


Figure 10: The impact of login on the price of Kindle ebooks at www.amazon.com

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

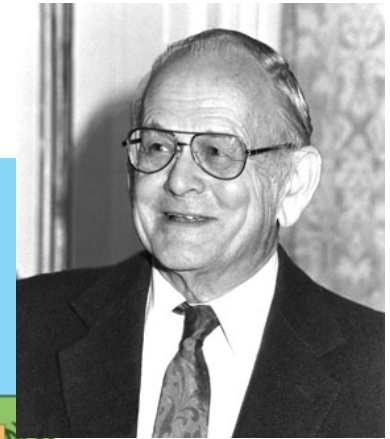
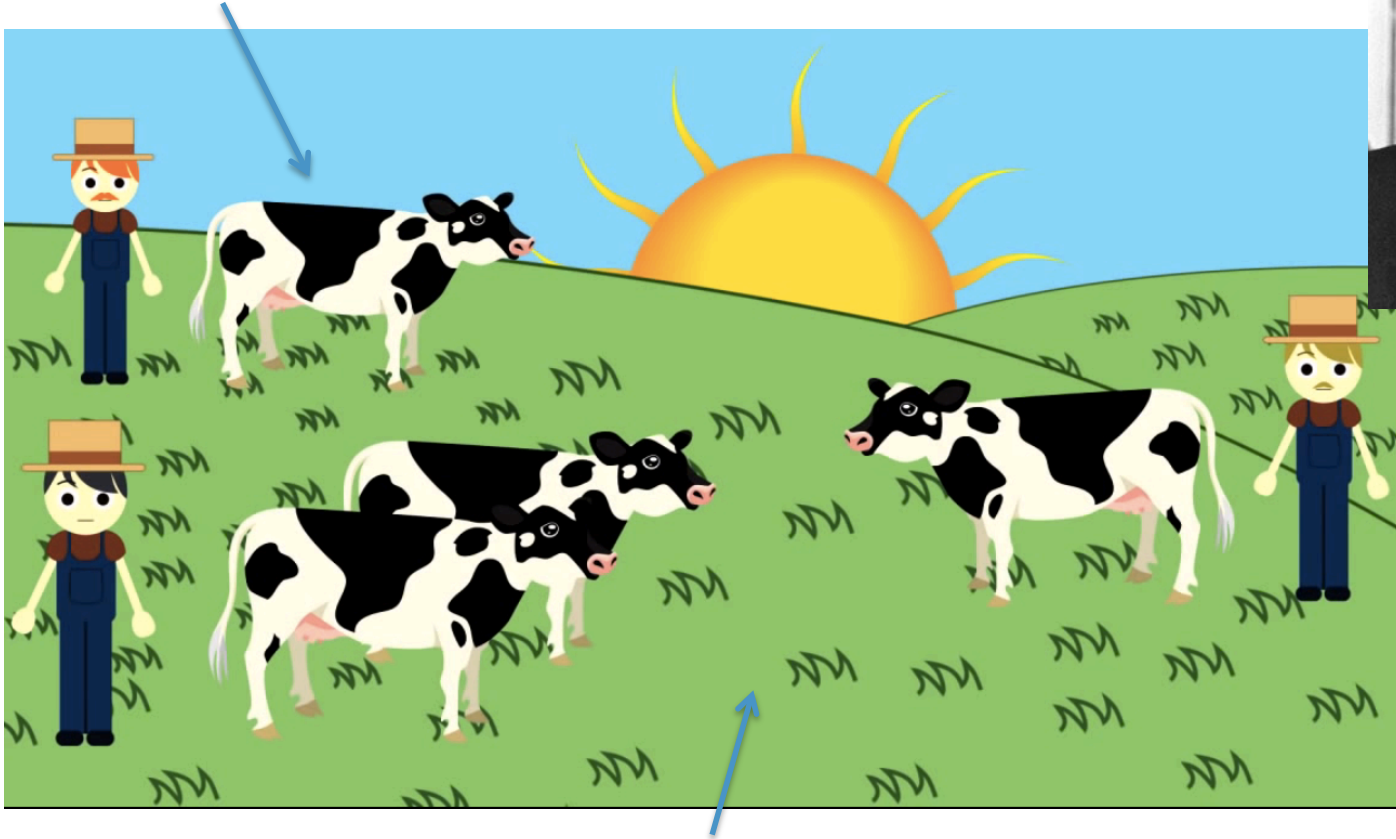
Ongoing work

- Advertising related
 - How much targeting is going on?
 - Is Do-Not-Track being respected
 - Can we demonstrate profile trading between ad networks?

the Tragedy of the Commons is lurking

Garrett Hardin, 1968

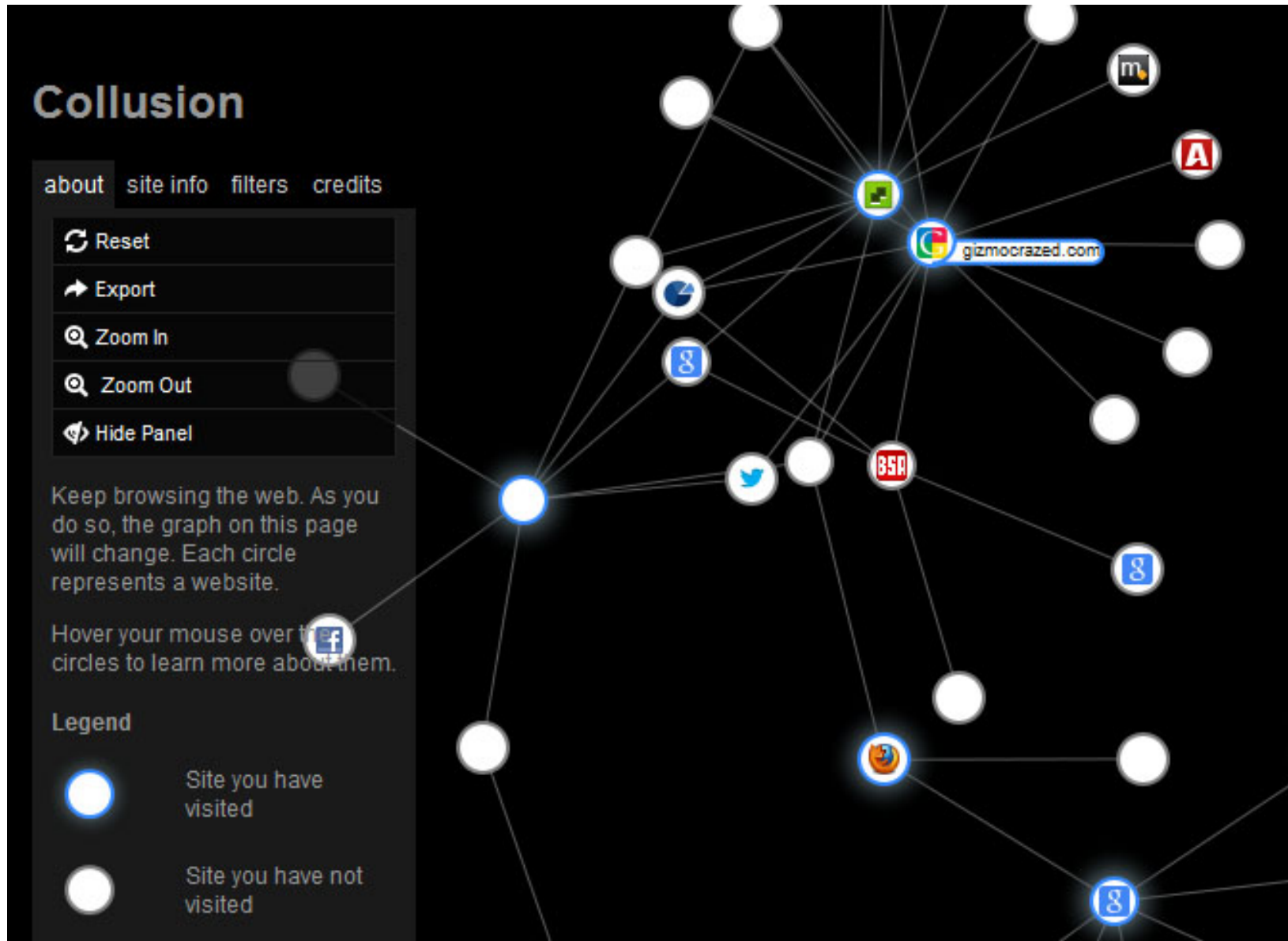
Internet company in
Information Economics



The “commons”: consumer trust on the web and it's business models

Playing Cassandra:

If left on its own ... Information Economics will die!



Sounds crazy ... but it has happened before



Moonshots!





Our moonshot...

The Data Transparency Lab (DTL)



DATA TRANSPARENCY LAB

A community-based effort to reveal the flow and usage of personal data online, and to explore ways towards a transparent and respectful data trade in the future.

As an online user you share your personal data with a lot of people and services. The resulting consequences are not always clear and you may ask yourself *"Why do I see this advertisement all the time?"*, *"Why am I getting targeted differently than others?"* and *"How do I get labeled in the online world?"*. With the data transparency lab we want you to ...

EXPLORE

where your online information is going to and how it is being used.

DISCOVER

what you can do to regain control of your personal data.

SHARE

tools, methodologies and datasets and make data transparency a reality.

The Data Transparency Lab is a community-based effort among universities, businesses and institutions to support the research in tools and reporting to shed light on the dark use of personal data in online services, empowering users to be in control of their personal data online.

For researchers

Research and infrastructure grants

The DTL will donate infrastructure to host distributed experiments as well as to store and analyze big data pertaining to online privacy and related topics. Also, through an open call for proposals, the DTL will award grants to academics wanting to conduct research in this field.

Community

Open up and foster a community for shaping a research agenda around online privacy and data transparency. The community will share results, methodologies, and data and work together for the development of easy to use tools that will bring more transparency into the use of personal information online.

Community

Open up and foster a community for shaping a research agenda around online privacy and data transparency. The community will share results, methodologies, and data and work together for the development of easy to use tools that will bring more transparency into the use of personal information online.

Initial areas and tools of interest:

Detect

- Behavioral targeted advertising
- Online price discrimination
- IP/Browser-based fingerprinting
- Profile trading
- Violation of Do-Not-Track

Value

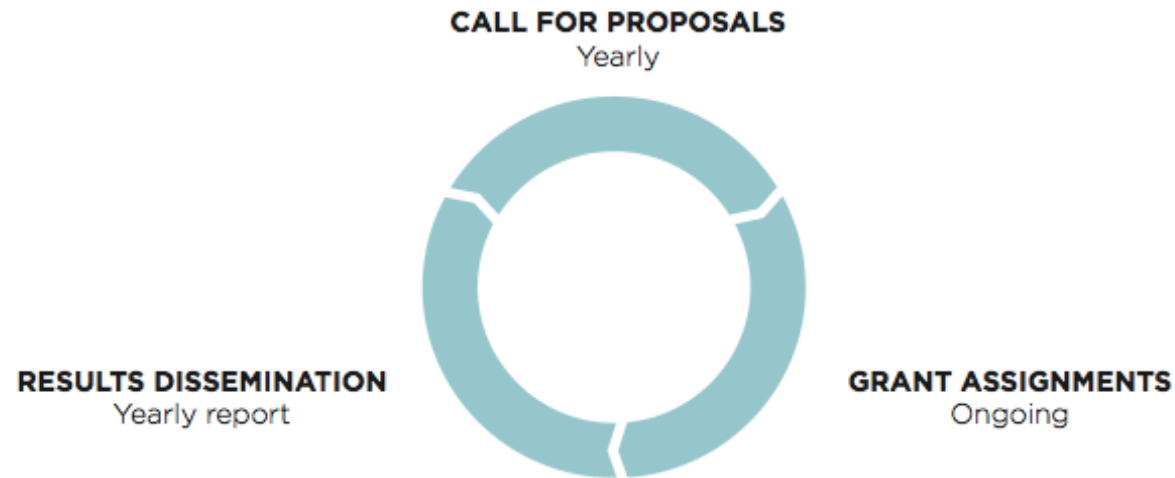
- What is the economic value of personal information for the advertisement ecosystem
- What users believe their personal data is worth

Reverse engineer

- Behavioral targeted advertising
- Price discrimination

Share

- Encode data of browsing behaviour and displayed ads in order to build up crowd sourced databases for analysis purposes



Want to get involved?

Join us in conducting research, developing and testing tools that will bring transparency on the web.
Skills sought include:

- Machine learning
- Online auctions
- Natural language processing
- Crypto
- Differential privacy
- Multiparty secure computation
- Economics
- Network measurements

Stay tuned ...



Thank you -- Questions?

- Sheriff extension available at
<http://pdexperiment.cba.upc.edu>
- DTL at <http://www.datatransparencylab.org/>
- Publications
 - J. 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**. [\[pdf\]](#)