Algorithms on Digital Platforms: Empirical and Experimental Evidence

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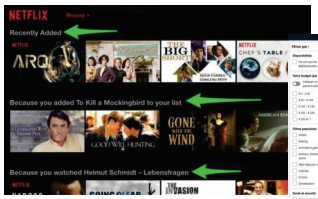
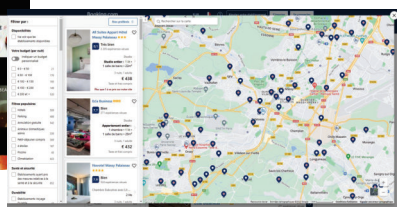
Motivation

- On digital platforms, algorithms are used for various reasons: **set prices**, **content recommendation**, **ad targeting**, etc.



Movie recommendations on Netflix


Hotel ranking on Booking

- There are concerns that they could impact **competition** between firms, or generate **biased** recommendations:

The New Yorker

Can Algorithms Form Price-Fixing Cartels?

Algorithm-driven (or bot-driven) selling, however, poses a new and formidable challenge to existing antitrust laws. If the practice hasn't yet...

25 avr. 2015

YouTube Regrets

A crowdsourced investigation into YouTube's recommendation algorithm

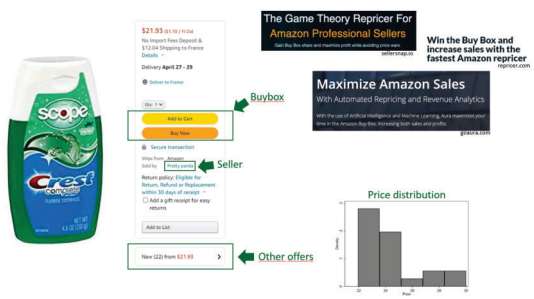
Mozilla study

- They also raise questions about how they actually work.

- What is their impact on market outcomes and users? How can more power be given to internet users?

Project #1: Algorithms and price dispersion

- **Price dispersion:** refers to the situation where different sellers offer different prices for the same good in the market.



Research question: Do pricing algorithms foster price dispersion on Amazon.com ?

Which mechanisms?

1. **Price revision frequency**: sellers with faster pricing technology commit to respond quickly to price changes of slower rivals. In response, slower sellers tend to compete less aggressively [Brown and MacKay, 2021].

2. **Opportunistic shortage pricing**: some sellers deliberately set up higher prices to retrieve residual demand when competitive sellers are out-of-stock.

Roadmap

- **Data collection**: high-frequency scraping of 10,000 best-sellers products (outsourced to Octoparse).

- **Identifying algorithmic sellers on Amazon**: build a heuristic based on:
  - Sellers prices correlation with specific benchmarks [Chen et al., 2016];
  - Frequency of price updates [Wieting and Sapi, 2021].

- **Identification strategy**: investigate the relationship between use of pricing algorithms and price dispersion by exploiting between and within variations in the data:

Variable	PPD	PQD	CV
Algorithmic seller	0.464 ***	0.045 ***	0.079 ***
	(0.045)	(0.002)	(0.005)
Amazon	-0.097 ***	0.021 ***	-0.003
	(0.033)	(0.002)	(0.003)
Product rating ({2,2.5} as a reference)			
{3,3.5}	-0.24	0.305 ***	0.085
	(2.1)	(0.1)	(0.222)
{4,4.5}	0.289	0.275 ***	0.166
	(2.09)	(0.1)	(0.221)
{5}	0.237	0.247 **	0.166
	(2.1)	(0.1)	(0.221)
Consumer reviews	-0.001 ***	0.000 ***	-0.000 ***
	(0.000)	(0.000)	(0.000)
Reputation variation	-0.44 ***	0.003 ***	-0.043 ***
	(0.009)	(0.000)	(0.001)
Market structure	0.134 ***	-0.001 ***	0.01 ***
	(0.001)	(0.000)	(0.000)
N	2,162,513	2,162,513	2,162,513
Fixed effects	Product & Date	Product & Date	Product & Date

Preliminary results using data from [Chen et al., 2016]

$$PPD = \frac{p_{it}^{max} - p_{it}^{min}}{\bar{p}_i}$$

$$PQD = \frac{p_{it}^{90} - p_{it}^{10}}{\bar{p}_i}$$

$$CV = \frac{\sigma_{it}}{\bar{p}_i}$$

- **Test previous mechanisms.**

- **Assess the impact on consumers.**

Project #2: Shopping for an algorithm

(joint with Felix Schleef)

Twitter's Jack Dorsey wants to build an app store for social media algorithms

Dorsey expands on Twitter's vision for a decentralized network

By Jacob Kastrenakes | @jake_k | Feb 9, 2021, 7:45pm EST

The Verge

Facebook could make its algorithms truly work for you

The social network guesses at what people want to see, often with disastrous results. What if we could tune those dials ourselves?

By Noah Giansiracusa Updated March 24, 2022, 11:59 a.m.

Boston Globe

- Let consumers choose the algorithms that dictate the content and products that are displayed to them on a digital platform.

Research question: Can competition between recommendation algorithms improve outcomes for consumers?

Ideas

- Experimental framework, search on a retail platform, consumers must find the product that fits them the most.

- Treatment with different levels of algorithm transparency.

References

Brown, Z. Y. and MacKay, A. (2021). Competition in pricing algorithms. *American Economic Journal: Microeconomics* (forthcoming).

Chen, L., Mislove, A., and Wilson, C. (2016). An empirical analysis of algorithmic pricing on amazon marketplace. Working paper.

Wieting, M. and Sapi, G. (2021). Algorithms in the marketplace: An empirical analysis of automated pricing in e-commerce. Working paper.