Impact of Third-Party Pricing Algorithms on Competition

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Introduction

- *Algorithmic pricing* is when prices are set using a software program which processes data.
- Algorithmic pricing can enhance efficiency by
  - conditioning prices on high frequency data
  - tailoring prices to narrow submarkets
  - improving optimization.

Introduction

A firm may choose to outsource its pricing algorithm to a data analytics company.

- Subscribing firms share their data with the third party.
- Third party trains a pricing algorithm based on subscribing firms' data and other data.
- Third party inputs current data into the pricing algorithm to recommend prices.
- Subscribing firms decide whether to implement recommended prices.

Introduction

A2i Pricecast technology "utilizes learning algorithms to construct dynamic profiles of customers and their usage patterns, as well as competitors. These systems rapidly and intelligently react to changing customer behavior, changing markets, and unexpected events."

PriceCast Technology

PriceCast-based systems deploy a novel application of Artificial Intelligence (AI), developed by a2i systems.

The systems utilize learning algorithms to construct dynamic profiles of customers and their usage patterns, as well as competitors and their strategies on both micro and macro scales. Sophisticated methods for reasoning about uncertainty and coping with incomplete data make PriceCast-based systems mimic a flexible, almost human-like, behavior.

The methods allow these systems to rapidly and intelligently react to changing customer behavior, changing markets, and unexpected events. The automated and continuous observation of the complex interactions obscured in the data result in a system with superhuman expertise. That is the key to the superior performance of PriceCast-based systems compared to less adaptable systems based on conventional technologies.

Introduction

- Efficiencies from outsourcing
  - Third party has more experience and expertise.
  - Third party has more data.
  - Third party has stronger incentives to invest in development.
- Risk of anticompetitive harm when a common third party recommends prices to competitors.

Competition Policy Challenge: *How do we prevent anticompetitive harm without interfering with procompetitive efficiencies?*

Introduction

Concerns from competition authorities

"If a sufficiently large proportion of an industry uses a single algorithm to set prices, this could result in ... the ability and incentive to increase prices."

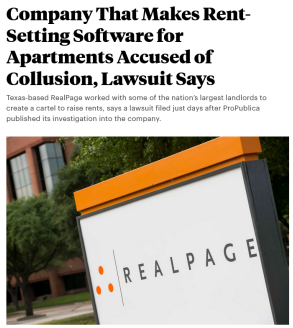
A third party "knows or accepts [it] could contribute to a collusive market outcome [and] it is even conceivable that [they] see such a contribution as an advantage, as it makes the algorithm more attractive for users."

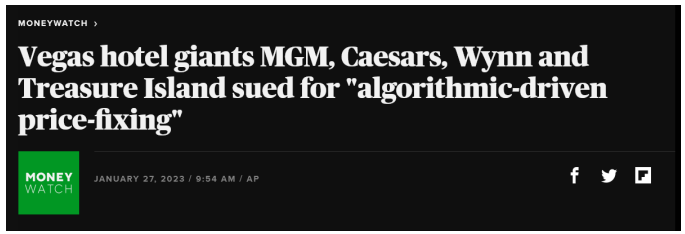
Monopolkommission

Introduction

Private and public cases

- Private litigation (United States)
  - Apartments (RealPage, Yardi)
  - Hotels (IDeaS, Rainmaker)
  - Health services (MultiPlan)
- Public litigation and investigations
  - Apartments: complaint in U.S. - DOJ Antitrust Division (RealPage)
  - Gasoline: investigations in Brazil - CADE (Aprix), Canada - Competition Bureau (Kalibrate)





Introduction

Empirical studies

Assad, Clark, Ershov, and Lu (*J, of Political Economy*, 2024)

- Market: retail gasoline (Germany)
- Developers: A2i Systems, Kalibrate
- Duopoly markets: effect on average price-cost margin
  - One station adopted: no effect.
  - Both stations adopted: increased around 30%.

Introduction

Empirical studies

Calder-Wang and Kim (working paper, 2024)

- Market: apartments (United States)
- Developer: RealPage
- Procompetitive: Compared to non-adopters, adopters had higher (lower) prices when demand is strong (weak).
- Anticompetitive: Estimation supports RealPage engaging in joint-profit maximization.

Introduction

Legislation (U.S.)

- U.S. Senate: "Preventing Algorithmic Collusion Act" (proposed, February 2024; reintroduced, January 2025)
- Housing market: laws passed in Berkeley, Minneapolis, Philadephia, San Francisco
- Common prohibition: A pricing algorithm that makes recommendations to a firm cannot be trained on or condition on nonpublic competitor data.

Introduction

Overview

1. Sources of anticompetitive harm
2. Critique of recent remedies
3. Proposed remedy

Anticompetitive Harm

Sources of anticompetitive harm from a third party recommending prices to competitors.

1. Agreement between the third party and subscribing firms to set supracompetitive prices.
2. Agreement between the third party and subscribing firms to share information resulting in supracompetitive prices.
3. Unilateral conduct by the third party resulting in supracompetitive prices.

Anticompetitive Harm

Price-fixing agreement

- Plaintiffs in private litigation in apartments and hotels claim a price-fixing agreement
  - Hotels: "Operator Defendants have agreed ... to outsource their independent pricing decision-making to a single, common pricing manager - IDeaS, which has willingly facilitated and enforced the conspiracy."
- Former DOJ-Antitrust Division head in Congressional testimony noted that "antitrust jurisprudence describes this behavior as a hub and spoke conspiracy."
- There are distinctive elements when the hub is supplying a pricing algorithm.

Anticompetitive Harm

Price-fixing agreement

- Proving agreement is more difficult.
  - With the usual upstream supplier, evidence of an agreement ("rim") comes from bilateral communications with downstream firms about their prices.
  - With a data analytics company as the upstream supplier, such communications is part of delivering a legitimate service.
- AI and data analytics is cast as the culprit when it is the procompetitive rationale for using a third party.
  - What are the implications when harm is intertwined with efficiency?

Anticompetitive Harm

Price-fixing agreement

"Hub-and-Spoke Collusion with a Third-Party Pricing Algorithm" (Harrington, working paper, 2024)

- Third party's efficiency
  - Price can condition on a varying demand state.
  - Efficiency is greater when market demand is more variable.
- Collusive agreement
  - Third party designs the pricing algorithm to maximize adopters' profits.
  - But it must incentivize firms to adopt the pricing algorithm.

Anticompetitive Harm

Price-fixing agreement

"Hub-and-Spoke Collusion with a Third-Party Pricing Algorithm" (Harrington, working paper, 2024)

- Factors in a firm's adoption decision.
  - Adopting means being able to condition price on the demand state.
  - Not adopting allows a firm to undercut the high average (collusive) price of adopting firms.
- Result: The greater is the third party's efficiency, the higher is the supracompetitive markup and the more profitable is collusion.
- Implication: Markets with larger procompetitive efficiencies have a higher risk of a collusive agreement.

Anticompetitive Harm

Price-fixing agreement

- RealPage cases: most damaging evidence is not associated with the algorithm.
  - RealPage organized monthly “user group” meetings attended by competing landlords.
  - RealPage stated in a widely-distributed document: “the vast majority of our clients have discontinued the use of concessions".
  - RealPage engaged in asymmetric overrides: put in place "guardrails" to reduce some price decreases generated by the algorithm.
- Guidance to third parties: Let data analytics speak and otherwise remain silent.

Anticompetitive Harm

Information exchange agreement

- Agreement among firms to share confidential, commercially sensitive data with the third party.
- DOJ Complaint against RealPage (August 2024)
  - "Landlords have agreed with one another to exchange nonpublic, competitively sensitive data through RealPage's revenue management software."
- DOJ must prove
  1. subscribing firms are sharing information through RealPage.
  2. subscribing firms have an agreement to share information.
  3. agreement is anticompetitive.

Anticompetitive Harm

Information exchange agreement

- *Are subscribing firms sharing information with each other?*
  - Third party is not directly sharing information; it is making price recommendations.
  - Third party may not be indirectly sharing information.
    - Is a firm able to infer other firms' shared data from its price recommendations?
  - "Using data across all your customers for research does not plausibly suggest that one customer has access to the confidential information of another customer." Judicial opinion from Hotels case

Anticompetitive Harm

Information exchange agreement

- *Do subscribing firms have an agreement to share information with the third party?*
  - Mutual adoption is not evidence of an agreement.
  - Third party's efficiency makes it in a firm's interest to share data even if other firms do not.
- *Is an agreement to share information anticompetitive?*
  - DOJ: "it removes competitive uncertainty and allows [firms] to agree with recommendations by RealPage that they increase rents."
  - Cannot be presumed to have anticompetitive effect because there are efficiencies.
  - Need to show there are minimal efficiencies or higher prices.

Anticompetitive Harm

Information exchange agreement

- Is it a concerted practice?
- European Commission guidance (2023) on the exchange of commercially sensitive information via a third party.
  - Competitors are liable if they are aware of the third party using the information to pursue an anticompetitive objective.
  - Third party is liable if it intends to contribute to or was aware of or could reasonably have foreseen anticompetitive effect.
- This legal path may be effective if it can be shown
  - the third party has an anticompetitive objective
  - the subscribing firms have knowledge of this anticompetitive objective.

Anticompetitive Harm

Unilateral conduct

- A third party is interested in creating value for subscribing firms because
  - it can then charge a higher fee
  - it will result in more subscriptions.
- Sources of value
  - Prices better respond to market conditions
  - Prices are higher
    - Coordinated price increases
    - Avoiding price wars: "How to avoid price wars and maintain market share." (Feedvisor)

Anticompetitive Harm

Unilateral conduct

- A third party may choose to make the pricing algorithm supracompetitive without the request, approval, or knowledge of the subscribing firms.
- Research questions
  - Does the third party have an incentive to build in a supracompetitive markup?
  - If it does, what are remedies?

Anticompetitive Harm

Unilateral conduct

Harrington (*Management Science*, 2022)

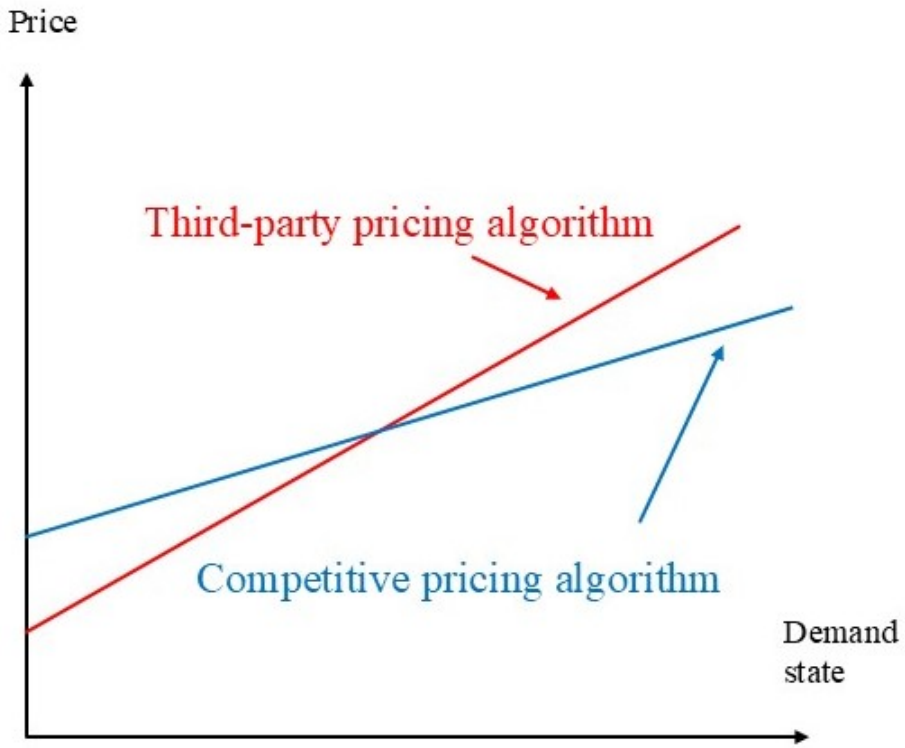
- Third party's efficiency: pricing algorithm allows price to respond to varying demand.
- Third party's objective is to maximize its profit from selling the pricing algorithm
  - Design of pricing algorithm maximizes a firm's willingness-to-pay = profit from adopting minus profit from not adopting.
  - No collusive agreement so it is not assumed to maximize adopters' profits.
  - Third party takes into account that its algorithm will "compete against itself".

Anticompetitive Harm

Unilateral conduct

Compared to the pricing algorithm that firms would independently design, the third party's pricing algorithm

- is more sensitive to the demand state
- but average price is the same - no supracompetitive markup.



Anticompetitive Harm

Unilateral conduct

- Takeaway
  - A third party's pricing algorithm need not have a supracompetitive markup.
- Caveat
  - There may be other market conditions whereby a third party unilaterally programs in a supracompetitive markup.
- Goal: design a remedy that restricts the conduct of third parties so
  - pricing algorithms do not cause anticompetitive harm
  - and does not interfere with procompetitive efficiencies.

Remedy for Unilateral Conduct

Preventing Algorithmic Collusion Act: prohibits a third party from recommending prices to a firm based on nonpublic competitor data.

- Flaw #1: Harms procompetitive efficiencies
  - Makes it difficult to distinguish market-wide and firm-specific demand changes.
  - Makes entry less profitable.
- Flaw #2: May not prevent anticompetitive harm.
  - When past prices are public information, a third party can produce supracompetitive prices without using nonpublic competitor data.
    - Workaround is developed in J. Harrington, "A Critique of Recent Remedies for Third-Party Pricing Algorithms and Why the Solution is not Restrictions on Data Sharing," working paper, March 2025.
- Source of harm is shared objective, not shared data.

Remedy for Unilateral Conduct

Desiderata of a remedy

1. Remedy applies to unilateral conduct.
   - Third party may be the only one with intent.
   - Even when there is an agreement, it may be difficult to prove.
2. Remedy does not regulate the design of the pricing algorithm.
   - We do not know enough to effectively regulate.
   - With more knowledge and experience, a regulatory remedy may be feasible in the future.

Proposed Remedy: *Advising competitors in their pricing when it is reasonably foreseeable that it may substantially lessen competition is unlawful.*

Remedy for Unilateral Conduct

Description

"Advising competitors in their pricing" can involve recommending

- specific prices – apartments, gasoline, hotels
- a minimum price – trade associations
- a maximum discount – Eturas programming a cap on discounts of 3%
- a surcharge – International Air Transport Association recommended a fuel surcharge to air cargo suppliers
- not to offer discounts or negotiate with customers
- how much to supply, how much capacity to hold

Remedy for Unilateral Conduct

Description

An "adviser" is in a contractual relationship with the firm and includes:

- data analytics companies, such as RealPage, IDeaS
- management consulting firms, such as Bain, McKinsey
- companies that collect and share data, such as AgriStats, OPIS
- platforms, such as Airbnb ("Smart Pricing")
- trade associations

Remedy for Unilateral Conduct

Evaluation

1. If the remedy is effectively implemented, is it good policy?
2. Can the remedy be effectively implemented?

- Establishing a violation requires showing
  - a third party is advising two or more competitors with regards to their prices.
  - and a third party has
    - intent to have anticompetitive effect
    - or there is anticompetitive effect which the third party should have anticipated (ex ante) or detected (ex post).

Remedy for Unilateral Conduct

Evaluation

Evidence of anticompetitive intent: internal documents

- Expressing a goal or plan to set prices above competitive or "but for" levels.
- Expressing a goal or plan to maximize subscribers' joint profits.
- Expressing a goal or plan to reduce competition (e.g., avoid price wars).

Remedy for Unilateral Conduct

Evaluation

Evidence of anticompetitive intent: program code

- Program's objective is anticompetitive.
  - With an optimization algorithm, the objective is to maximize subscribing firms' joint profits.
  - With a reinforcement learning algorithm, the performance metric is subscribing firms' joint profits.
- Experiments with common price changes for subscribing firms.
- Distorts the pricing algorithm to result in supracompetitive prices.
  - Solves for individual profit-maximizing prices and adds a markup.
  - Uses an inflated cost.
  - Asymmetric overrides.

Concluding Remarks

- Third-party pricing algorithms create a tension for competition policy.
  - **Prospect of procompetitive efficiencies** from a firm outsourcing its pricing algorithm to a third party.
  - **Risk of anticompetitive harm** when the same third party recommends prices to competitors.
- Competition law is not designed to address the harm from a third party's unilateral conduct.
- Remedies
  - Regulating the design of the pricing algorithm requires the **government** to know what causes harm.
  - Proposed remedy requires the **third party** to know what causes harm.