

Competitive Price Discrimination, Imperfect Information, and Consumer Search

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Introduction

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 - Search frictions in online markets: De los Santos (2017), Jolivet & Turon (2019).
 - Empirical evidence for online price discrimination: Hannak et al. (2014), Larson et al. (2015), Escobari et al. (2019).
 - OECD (2016): "There are particular reasons to worry that price discrimination in digital markets will be harmful".

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 - Empirical evidence for online price discrimination: Hannak et al. (2014), Larson et al. (2015), Escobari et al. (2019).
 - OECD (2016): "There are particular reasons to worry that price discrimination in digital markets will be harmful".
- **Research questions:**
 - 1 When firms price discriminate, is it beneficial for consumers when search is less costly?
 - 2 Are prices lower (on average) when more consumers search?
 - 3 Is entry in these markets pro-competitive?

Framework

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- Consumers acquire consumption opportunities via **sequential search**.
 - The first search is free and search is random.
 - After receiving a price offer from the initial firm, the consumer decides whether or not to visit another firm, i.e. to *search*.
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 - Visiting any firm after the first incurs **search costs** $s \geq 0$ per firm...
- Firms know nothing about consumers' search histories.

Framework - information

- When a firm j is visited by a consumer, the firm receives a **binary private signal** $\tilde{v}_j \in \{\tilde{v}^L, \tilde{v}^H\}$ about this consumer's valuation:

$$Pr(\tilde{v}_j = \tilde{v}^H | v) = \begin{cases} \sigma & v \geq 0.5 \\ 1 - \sigma & v < 0.5 \end{cases}$$

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- Nomenclature:**
 - "High signal" \tilde{v}^H : Likelihood of $\tilde{v}^H \uparrow$ when $v \uparrow$.
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 - "High valuation consumers" have $v \geq 0.5$ and "low valuation consumers" have $v < 0.5$.
- A firm's pure strategy is a price tuple (p^L, p^H) .

Equilibrium analysis

Equilibrium candidates without on-path search

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- **PSE candidate 2** - search deterrence equilibrium:
 - Prices set in such a way that the consumers with highest incentives to search (low- v consumers) are exactly indifferent.
 - This equilibrium exists for low search costs.

Equilibrium candidates with on-path search

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- There is also a **mixed-strategy equilibrium** with a similar form and on-path search.

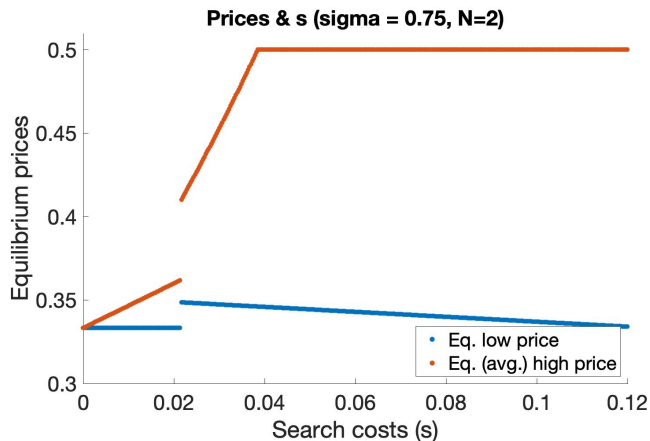
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- In both equilibria, high- v consumers **can't search on path**.
 - This follows from structural properties of the equilibrium candidates \rightarrow violations would imply undercutting motives or zero profits.
 - This matches the empirical pattern in Byrne & Martin (2021).

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 - This follows from structural properties of the equilibrium candidates \rightarrow violations would imply undercutting motives or zero profits.
 - This matches the empirical pattern in Byrne & Martin (2021).
- Existence: **Intermediate search costs** necessary & sufficient to sustain equilibria with search.

Visualization - search costs & prices



Intuition - search costs & prices

- Search costs & prices in **equilibria with search**:
 - Key notion: Consumers who arrive after search generate locally **inelastic demand** around p^L .
 - Search costs $s \downarrow \implies$ more consumers search on path \implies stronger upward pressure on $p^L \implies p^L \uparrow$.

Intuition - search costs & prices

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 - Search costs $s \downarrow \implies$ more consumers search on path \implies stronger upward pressure on $p^L \implies p^L \uparrow$.
- **Transition** search det. equilibrium \rightarrow equilibrium with search:
 - Volume of equilibrium search \uparrow , but prices \uparrow (!).
 - High- ν consumers lose ability to constrain prices with the threat of searching, so firms set higher prices after $\tilde{\nu}^H$.
 - **Second-order effect**: This induces low- ν consumers to start searching \implies price inelastic demand at $p^L \implies p^L \uparrow$

Firm entry & prices

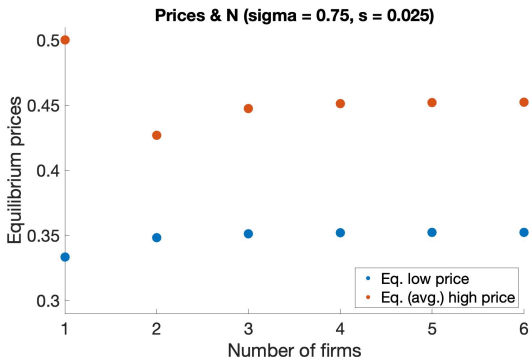
General remarks:

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- Other topics in the paper:
 - Effects of increases in N : Entry is only pro-competitive when eliminating a monopoly & search costs are small.
 - General signal distributions.
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Main take-aways

- 1 Equilibria with search require intermediate search costs. At small search costs, nobody searches.
- 2 If you are worried about price discrimination, reduce search costs to negligible levels.
- 3 But: Observing that more consumers search on-path is not an indicator for a job well done!