Dynamic pricing with hidden capacities

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Motivation

- **Markets with following characteristics** (e.g., hotel accommodations, airline tickets, shipping, generated electricity):
  - Product expires at a fixed future point in time
  - Capacity is fixed well in advance
  - Competition over multiple periods
  - Capacities are privately known
- **These features have not been studied together in an equilibrium model of time-dated products**

Empirical observations

- Regular price adjustments
- Increasing (average) prices towards deadline
- More volatile price changes (price dispersion) close to deadline
- No clear monotone relationship between price dispersion and available capacity in the market

Model

Two firms $i = 1, 2$ competing á la Bertrand in two periods $t = 1, 2$ over demand of myopic (one in each period) consumer with reservation value $v = 1$. No costs of production and firms can be wither constrained or unconstrained with initial stock $s_i \in S = \{1, 2\}$. Each firm constrained with probability $Prob\,(s_i = 1) = \alpha$.

Dudey (1992) Equilibrium

If firms **share** their information, Dudey (1992) predicts monopoly pricing in all periods:

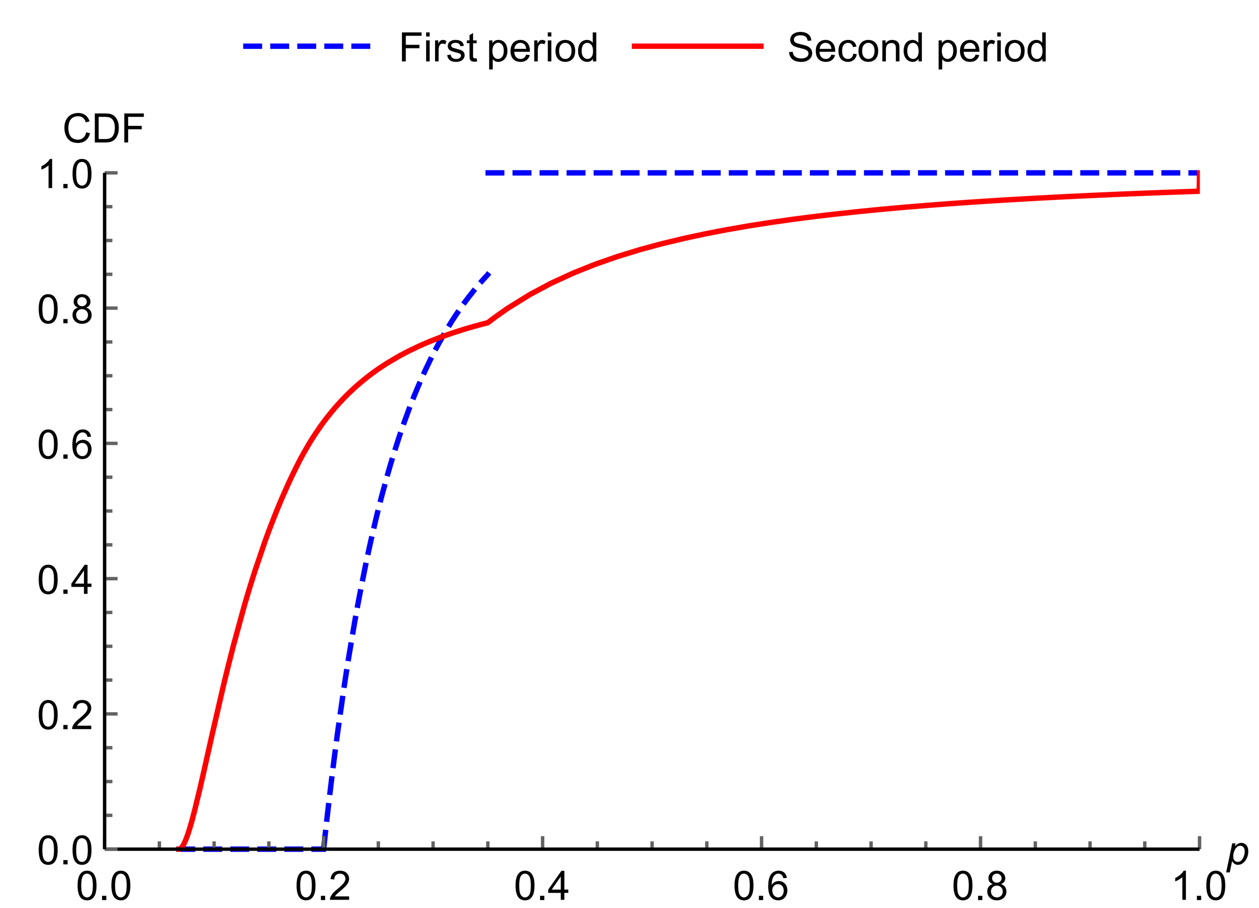
- Constrained firm can credibly threaten with competition unless she sells out first
- Unconstrained firm covers rest of demand

Equilibria with private information

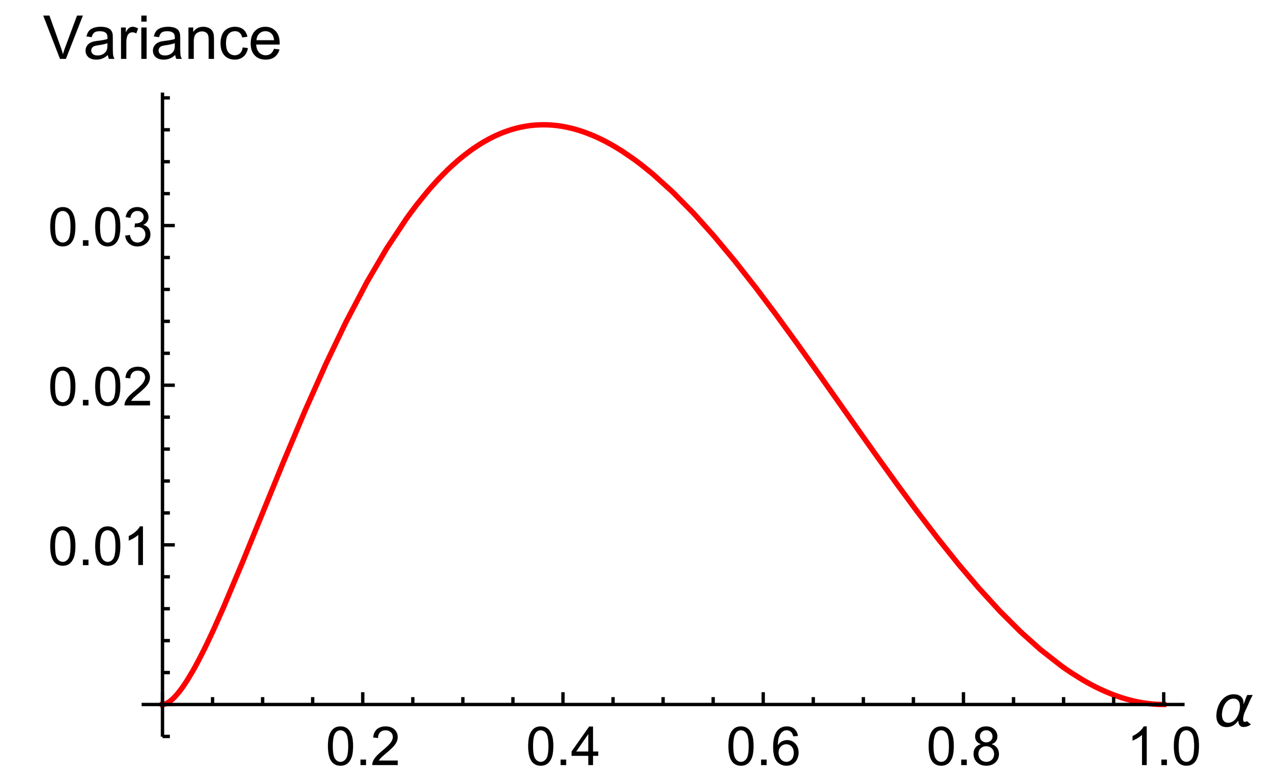
- Second period: price dispersion - firm, which did **not** sell a unit in first period holds posterior belief θ about being a monopolist (rival is sold out) (Janssen and Rasmusen (2002)) $\Longrightarrow$ mixes over interval $[\theta, 1]$ with mass point on 1. If rival still in market, also mix over $[\theta, 1]$, but no mass point.
- First period
  - No separating equilibrium
  - Unique pooling equilibrium with $p_1^* = \alpha$
  - Continuum of semi-separating equilibria with mixing in first period over the interval $[\alpha, \overline{p})$, where $\overline{p} \in (\alpha, 1]$. The higher $\overline{p}$ the higher the probability an unconstrained firm sells first, the lower the profits in second period and overall $\Longrightarrow$ Equilibria Pareto-ranked and inferior, from firm's perspective, to the pooling equilibrium.

Empirical Implications

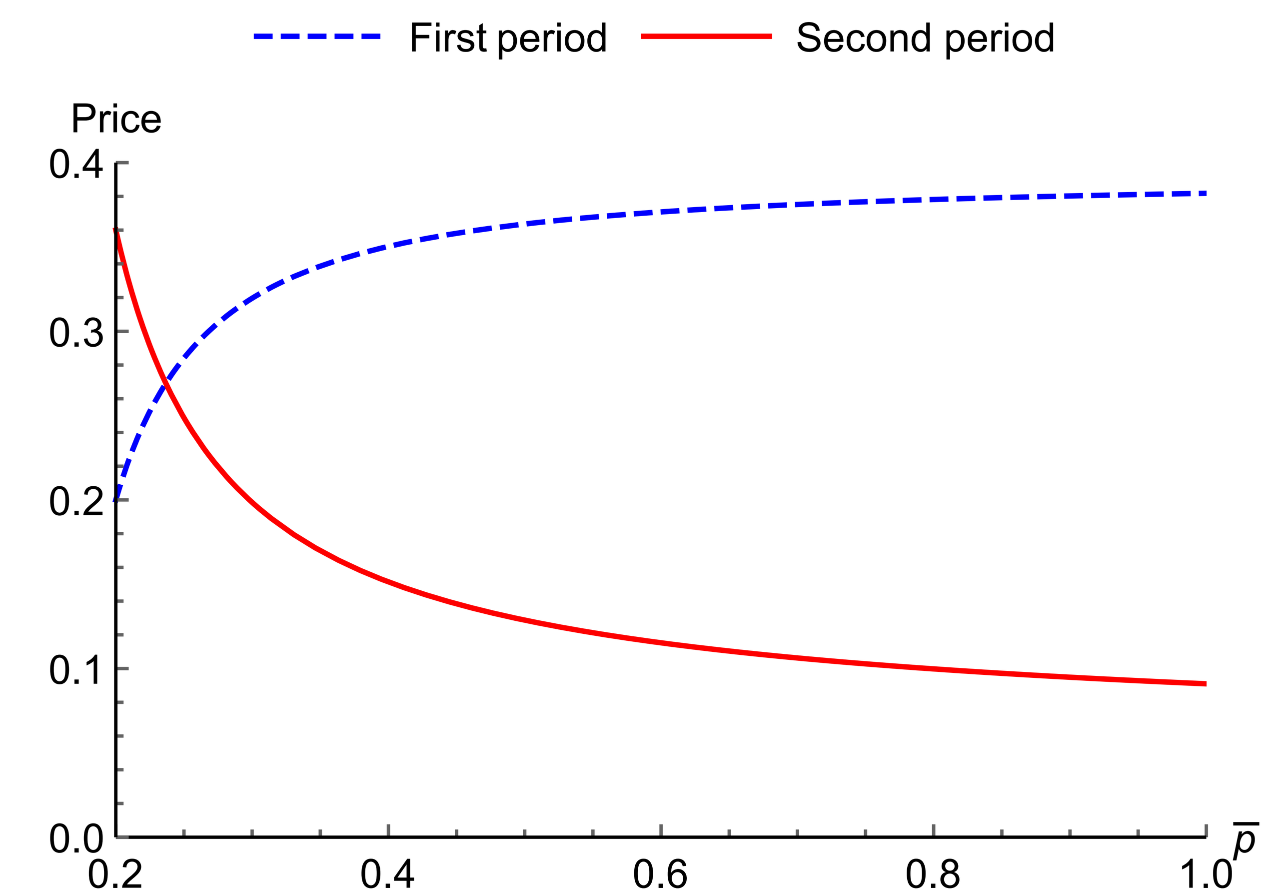
- Price dispersion is larger in periods closer to the deadline (Calibrated for $\alpha = 0.2$ and $\overline{p} = 0.35$.)



- Flights expected to be peak do not have more dispersion than those that are expected to be off-peak.



- Prices increase over time if first-period price interval relatively small. (Calibrated for $\alpha = 0.2$ and $\overline{p} = 0.35$.)



Welfare Implications

Ratio of ex ante expected profits with information sharing relative to private information is at least $\frac{2(2-\alpha)}{(3-\alpha)}$. Especially for small α, information exchange on capacities leads to significantly higher profits (up to 33%) and, thus, to significantly lower consumer surplus

Extensions

Voluntary (costly) disclosure and (costly) industrial espionage.