Sharing Cost Information in Dynamic Oligopoly

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Background

Many industries have trade associations which aggregate market information

Association of Equipment Manufacturers

"[The] North America Construction Equipment Industry Trends Report...is a quarterly state of the industry report for the construction industry that asks participants about their unit volume of demand, company employment, unit volume of inventories, capital spending, profit margins, wages and salaries, prices of input materials, prices charged, shortages, export performance and planning scenarios. To share in the results of this important survey, your company must participate by providing data on your company's performance..." [1]

Background

Information sharing can promote collusive behavior

- Information exchange agreements of competitively relevant variables are analyzed under the rule of reason

Antitrust Guidelines for Collaborations Among Competitors

"The central question is whether the relevant agreement likely harms competition by increasing the ability or incentive profitably to raise price above or reduce output, quality, service, or innovation below what likely would prevail in the absence of the relevant agreement."

Issued by FTC and US DOJ - April 2000

Motivation

Sharing individualized or current/future prices is restricted by anti-trust law

- Precedent for controlling/eliminating factors that facilitate collusion
- Airline Tariff Publishing Case, GE Westinghouse price books, etc.

Sharing other industry information is generally unrestricted

- We study the impact of the exchange of information about firm costs

Questions

How is information on costs of production disseminated without an information exchange agreement?

- Price competition with private information on costs
- Framework is dynamic but finite (two-period)
- Multiple dimensions of private information

How does sharing industry-wide relevant cost information affect market welfare?

- Compare prices with and without information exchange
- Examine effect on incentives to collect information

Industry-wide costs

Main departure: firms possess information about different cost parameters

- Industry-wide (common) costs: labor, common inputs
- Firm-specific (private) costs: capital expenditures, support

Literature has examined cases where firms have a single parameter of uncertainty.

- In static environment analysis can be done on each parameter separately
- Restrictive when considering how information is released through competition.

Example: private costs

Firm *i*'s cost structure: θ_i private (firm specific) cost parameter

- Firm receives signal of cost level, $s_{i\theta}$
- Chooses price, p_{i1} given signal on cost

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When choosing prices in future, firm *j* responds to a high price with a high price

- Firm *i*'s future profits increases in firm *j*'s price.
- Firm *i* has incentive to set a high price initially (competition softening)

Example: industry costs

Firm i's cost structure: common cost ρ, specific cost θ_i

- Firm receives signals about cost for each component, $s_{i\theta}$ and $s_{i\rho}$, chooses price

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Firm j's future price depends on belief

- High $s_{i\theta}$ leads to larger price increase than high $s_{i\rho}$

Competition softening with common costs

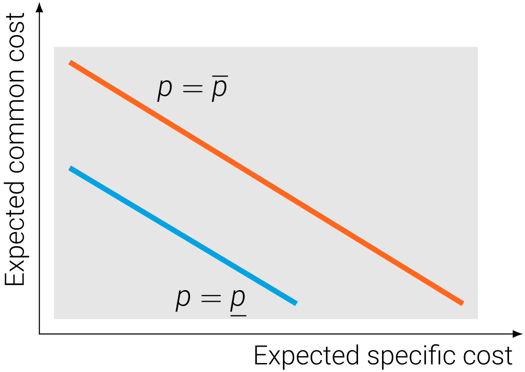

Figure: A high price (orange line) can be indicative of a high expected common cost or a high expected specific cost, while a low price (blue line) can be indicative of a low expected common cost or a low expected specific cost.

Competition softening with common costs

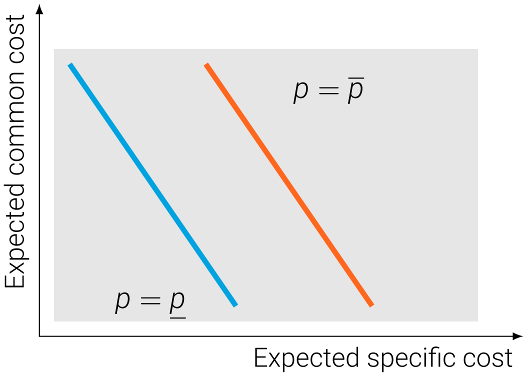

Figure: When price is more informative about specific costs, future prices are more responsive to current prices, higher incentive to soften competition.

Information sharing

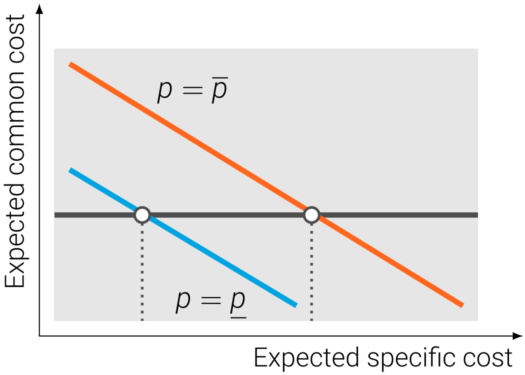

Figure: When the opponent has full knowledge of the firm's expectation of common costs (dark gray line) it can uniquely identify the firm's expected specific cost (dotted lines).

Outline of results

In the unique symmetric linear equilibrium

- Price is increasing in information on each cost component, relative weights depend on substitutability of demand
- Competition softening increases with equilibrium informativeness of price

Aggregating industry-wide (common) cost information

- Increases expectation and covariance of prices
- Increases firm profits and decreases welfare of consumers when demand is relatively inelastic
- Reduces value of acquiring firm-specific cost information

Outline of results

For an arbitrary number of firms n

- Competition softening decreases as number of firms grow
- For large n, information sharing can increase both consumer and producer surplus

General information sharing

- An agreement that increases informativeness of price will increase expected prices
- Sharing any information associated with common cost (private costs) will increase (decrease) incentive to soften competition all else equal.

Literature

1 **Information sharing, use, and acquisition**

- Information sharing: Gal-Or (1986), Raith (1996), Vives (2001),...
- Competitive concerns: Kuhn and Vives (1994), Kuhn (2001)
- Equilibrium efficient information use: Angeletos and Pavan (2007), Columbo et al. (2014), Myatt and Wallace (2015a,b)

2 **Information revealed in the course of competition.**

- Competition softening: Jeitschko et al. (2018), Mailath (1989), Mester (1992)
- Signal jamming: Bonatti et al. (2017), Bernhardt and Taub (2015), Mirman et al. (1993, 1994), Frankel and Kartik (2019)

Outline

1. Model
2. Equilibrium Characterization
3. Information Sharing and Welfare Analysis
4. Large markets (*n* firms)
5. Extensions
   - Value of Information
   - Generalized information sharing agreements

Model

- Two symmetric firms, i and j
- Commonly known demand: $q_{it} = a - bp_{it} + ep_{jt}$, with $|e| \leq b$; $e > 0$ is substitutes, $e < 0$ is complements
- Initially unknown constant marginal cost $c_i = \theta_i + \rho$
  - θ_i costs specific to firm i
  - ρ costs common to each firm
  - $(\theta_i, \theta_j, \rho)$ are jointly normal and independent, $x \sim N(\mu_x, \sigma_x^2)$
- Profits: $\pi_{it}(p_{it}, p_{jt}) = (p_{it} - c_{it})\, q_{it}$
- Firms maximize sum of profits over two periods,

$$\pi_{i1}\left(p_{i1}, p_{j1}\right) + \pi_{i2}\left(p_{i2}, p_{j2}\right)$$

Timeline

There are two rounds of competition.

1. Firms receive independent signals about costs

$$s_{i\theta} | \theta_i \sim N\left(\theta_i, \sigma^2_{i\theta}\right), \quad s_{i\rho} | \rho \sim N\left(\rho, \sigma^2_{i\rho}\right)$$

2. Firms choose initial price p_{i1}
3. First period profits are realized and first period prices $\mathbf{p}_1 = (p_{i1}, p_{j1})$ are commonly observed
4. Firms observe (θ_i, ρ) (only uncertainty remaining is θ_j)
5. Given $(\theta_i, \rho, \mathbf{p}_1)$, firm chooses price p_{i2}

Pricing strategies

We constrain attention to symmetric linear pricing strategies

$$p_{it} = p_{0t} + p_{\theta t}\mathbb{E}\left[\theta_i \middle| \cdot\right] + p_{\rho t}\mathbb{E}\left[\rho \middle| \cdot\right] + p_{c_j t}\mathbb{E}\left[c_j \middle| \cdot\right]$$

- With multi-dimensional information, nonlinear iso-price curves lead to tractability problems
- When opponent uses a linear strategy, firm's best response is linear

First period pricing

Firm *i*'s first period profit maximization problem is

$$\max_p \mathbb{E}\left[\left(a - bp + ep_{j1}\right)\left(p - c_i\right) + \pi^{\star}_{i2}\left(\theta_i, \rho, \mathbf{p}_1\right) \middle| s_{i\rho}, s_{i\theta}\right]$$

- A (symmetric) linear pricing strategy is

$$p_{i1} = p_0 + p_\theta \mathbb{E}[\theta_i | s_{i\theta}] + p_\rho \mathbb{E}[\rho | s_{i\rho}]$$

Second period profits

In equilibrium, second period profits are

$$\pi^\star_{i2}\left(\theta_i, \rho, \mathbf{p}_1\right) = \frac{1}{4b}\left(a - bc_i + e\mathbb{E}\left[p^\star_{j2}\middle|\, \rho, p_1\right]\right)^2$$

Firm *i* influences competitor's price, p^*_{j2}, through the "public" expectation of cost, $\mathbb{E}[c_i|\rho, \mathbf{p}_1]$

$$\frac{\partial}{\partial p_{i1}}\pi^\star_{i2}\left(\theta_i, \rho, \mathbf{p}_1\right) = \frac{1}{2b}\left(a - bc_i + e\mathbb{E}\left[p^\star_{j2}\middle|\, \rho, \mathbf{p}_1\right]\right)\frac{\partial}{\partial p_{i1}}\mathbb{E}\left[p^\star_{j2}\middle|\, \rho, \mathbf{p}_1\right]$$

Information content of price

Impact of increasing first period price

$$\frac{\partial}{\partial p_{i1}} \mathbb{E}\left[p^{\star}_{j2} \middle| \rho, \mathbf{p}_1 \right] = \underbrace{\frac{be}{4b^2 - e^2}}_{\text{demand}} \underbrace{\frac{\partial}{\partial p_{i1}} \mathbb{E}\left[c_i \middle| \rho, \mathbf{p}_1 \right]}_{\text{information}}$$

Given linear strategies, impact of increase in price on “public” belief about firm-specific cost is constant

$$\kappa_i \equiv \frac{\partial}{\partial p_{i1}} \mathbb{E}\left[c_i \middle| \rho, \mathbf{p}_1 \right] = \frac{\sigma^2_\theta \bar{\tau}_{i\theta} p_\theta}{\sigma^2_\rho \left(1 - \bar{\tau}_{i\rho}\right) \bar{\tau}_{i\rho} p^2_\rho + \sigma^2_\theta \bar{\tau}_{i\theta} p^2_\theta}$$

and $\bar{\tau}_{ix} = \dfrac{\sigma^2_x}{\sigma^2_x + \sigma^2_{ix}}$

Informativeness parameter

$$\kappa_i = \frac{\sigma_\theta^2 \bar{\tau}_{i\theta} p_\theta}{\sigma_\rho^2 \left(1 - \bar{\tau}_{i\rho}\right) \bar{\tau}_{i\rho} p_\rho^2 + \sigma_\theta^2 \bar{\tau}_{i\theta} p_\theta^2}$$

Price not fully informative when $\bar{\tau}_{i\rho} \in (0, 1)$

- Continuum of types $(s_{i\theta}, s_{i\rho})$ that choose price p_{i1}
- Value of ρ informs likelihood of signal $s_{i\rho}$ received which informs likelihood of signal $s_{i\theta}$ received

Equilibrium

Fixed point: first period price coefficients $(p^\star_\theta, p^\star_\rho)$ imply a $\kappa^\star$ for which $(p^\star_\theta, p^\star_\rho)$ are optimal

Theorem

There exists a unique symmetric SPNE in linear strategies where

- $p^\star_\rho = p^\star_\theta = 1/2$ *when goods are independent* $(e = 0)$
- $p^\star_\theta < 1/2$, $p^\star_\theta < p^\star_\rho$ *when goods are substitutes* $(e > 0)$
- $p^\star_\rho < p^\star_\theta < 1/2$ *when goods are complements* $(e < 0)$
- $p^\star_\theta$ *is decreasing in* $\kappa^\star$

Equilibrium: outline of proof

1. Equations for p_θ and p_ρ given κ come from matching coefficients in first order condition

$$p_\theta^\star = \frac{1}{2+\beta\kappa^*} \text{ and } p_\rho^\star = \frac{1-\left(\frac{b-e}{2b-e}\right)\beta\kappa^*}{2-\frac{e}{b}\bar{\tau}_{i\rho}-\frac{1}{2}\left(1-\bar{\tau}_{i\rho}\right)\beta^2\kappa^*2}$$

2. Combine with definition of κ in terms of pricing coefficients

$$\kappa^\star = \frac{\sigma_\theta^2\bar{\tau}_{i\theta}p_\theta^\star}{\sigma_\rho^2\left(1-\bar{\tau}_{i\rho}\right)\bar{\tau}_{i\rho}p_\rho^{\star 2}+\sigma_\theta^2\bar{\tau}_{i\theta}p_\theta^{\star 2}}$$

Equilibrium: outline of proof

$$\underbrace{(2+\beta\kappa^{\star})^2\left(1-\left(\frac{b-e}{2b-e}\right)\beta\kappa^{\star}\right)^2 b\sigma_\rho^2\bar{\tau}_{i\rho}^2\kappa^{\star}}_{\text{LHS}}$$

$$=\underbrace{\left(\left(2b-e\bar{\tau}_{i\rho}\right)-\frac{1}{2}\left(1-\bar{\tau}_{i\rho}\right)\beta^2\kappa^{\star 2}b\right)^2\left(2-\left(1-\beta\right)\kappa^{\star}\right)\sigma_\theta^2\bar{\tau}_{i\theta}}_{\text{RHS}}$$

3. RHS is decreasing in $\kappa^{\star}$

4. LHS is increasing in $\kappa^{\star}$; or increasing-then-decreasing in $\kappa^{\star}$; where LHS is decreasing, LHS $>$ RHS

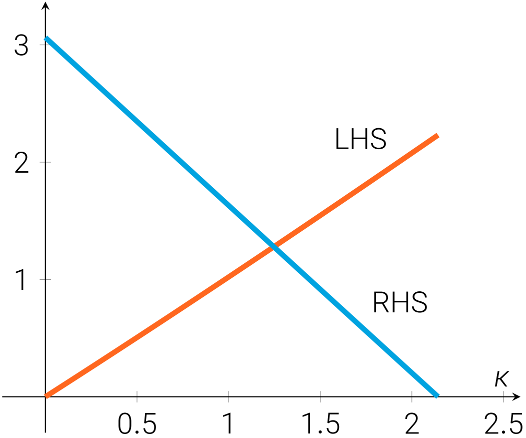

Figure: LHS and RHS for substitutes ($e/b = 0.5$)

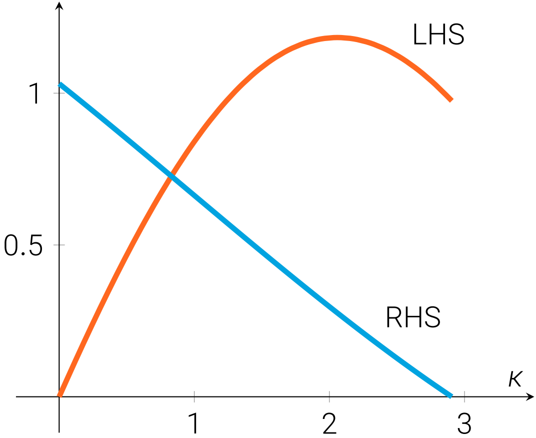

Figure: LHS and RHS for complements ($e/b = -0.975$)

Information aggregation

Firms share information about the common cost component, as in a trade association.

- Information is verifiable and excludable
- Direct impact: additional information, “better” price
- Strategic impact: all private information is in the private cost component

Informativeness with aggregation

A linear strategy in first period is

$$p^c_{i1} = p^c_0 + p^c_\theta \mathbb{E}[\theta_i | s_{i\theta}] + p^c_\rho \mathbb{E}[\rho | s_\rho]$$

Informativeness parameter

$$\kappa^\star_i = \frac{\sigma^2_\theta \bar{\tau}_{i\theta} p^\star_\theta}{\sigma^2_\rho \left(1 - \bar{\tau}_{i\rho}\right) \bar{\tau}_{i\rho} {p^\star_\rho}^2 + \sigma^2_\theta \bar{\tau}_{i\theta} {p^\star_\theta}^2} \quad \rightarrow \quad \kappa^c_i = \frac{1}{p^c_\theta}$$

Price is perfectly informative of $s_{i\theta}$; no additional private information to jam signal

Equilibrium with aggregation

Theorem

The unique SPNE is linear and

1. *First period price coefficients satisfy* $p_\theta^c \leq p_\theta^\star$
2. *Prices are more informative of private costs:* $\kappa^* \leq \kappa^c = \frac{1}{p_\theta^c}$
3. *Expected first period prices are higher and expected second period prices are the same with information sharing*

Equilibrium with aggregation

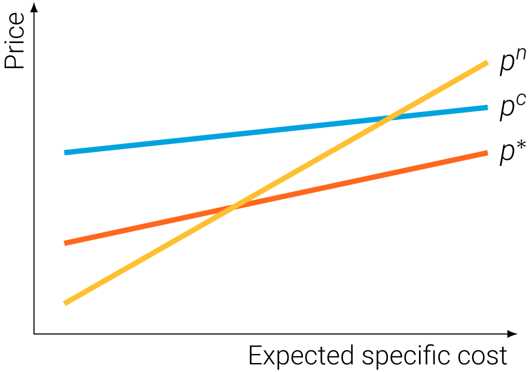

Figure: With private information about shared costs, prices (p^*) are more responsive to information about specific costs than when there is no private information about shared costs (p^c), but less responsive to information than when there is no private information at all (p^n).

Equilibrium with aggregation

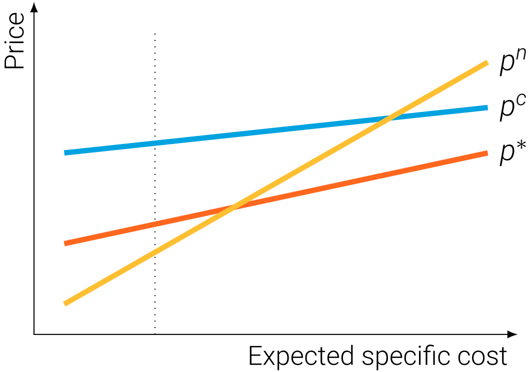

Figure: Expected prices (where conditional expected costs equal unconditional expected costs, the dotted line) are higher when firms share information, and $p^{\rho\hat{\theta}}$ will intersect $p^{\rho\theta}$ to the right of the intersection with $p^{\hat{\rho}\hat{\theta}}$.

Consumer surplus

Expected consumer surplus in each period of competition is represented by

$$\begin{aligned}\mathbb{E}\left[u\left(\mathbf{p}\right)\right] &= -2a\mathbb{E}[p_i] + b\mathbb{E}[p_i^2] - e\mathbb{E}[p_i p_j] \\ &= \left(-2a + (b-e)\mathbb{E}[p_i]\right)\mathbb{E}[p_i] + b\,\mathrm{Var}(p_i) - e\,\mathrm{Cov}(p_i, p_j)\end{aligned}$$

Consumer surplus

- Decreases in $\mathbb{E}[p_i]$ (in equilibrium, $a > (b-e)\mathbb{E}[p_i]$)
- Increases with $\mathrm{Var}(p_i)$
- Decreases in $\mathrm{Cov}(p_i, p_j)$ when $e > 0$ (increases when $e < 0$)

Producer surplus

Expected producer surplus in each period of competition is

$$\mathbb{E}[\Pi] = 2\left[(a-(b-e)\mathbb{E}[p_i])\left(\mathbb{E}[p_i]-\mathbb{E}[c_i]\right)+b\left(\text{Cov}\left(c_i,p_i\right)-\text{Var}(p_i)\right)\right.$$
$$\left.-e\left(\text{Cov}\left(c_i,\mathbb{E}[p_j]\right)-\text{Cov}\left(p_i,\mathbb{E}[p_j]\right)\right)\right]$$

Producer surplus

- Increases with expected price
- Increases as price becomes more correlated with cost
- Decreases as other firm's price becomes more correlated with cost

Information sharing

When firms share industry cost information

- Expected prices increase in the first period and are the same in the second period.
- Covariance of prices increases
- Competing effects on the variance of prices

Proposition

For large a relative to b and e, sharing common cost information will increase expected producer surplus and decrease expected consumer surplus

Extension to n firms

There are n firms each with demand

$$q_{itn}\left(p_{itn}, p_{-itn}\right) = \frac{1}{n-1}\left(a - bp_{itn} + \frac{e}{n-1}\sum_{j\neq i} p_{jtn}\right)$$

Information structure is essentially unchanged

⇝ When $n = 2$ return to the base model

Equilibrium pricing: n firms

Theorem

In the linear equilibrium of the n-firm model

$$p^\star_{i1n}\left(s_{i\theta}, s_{i\rho}\right) = p^\star_{0n} + p^\star_{\theta n}\mathbb{E}\left[\theta_i \middle| s_{i\theta}\right] + p^\star_{\rho n}\mathbb{E}\left[\rho \middle| s_{i\rho}\right],$$

$$\text{where } p^\star_{\theta n} = \frac{1}{2+\beta_n\kappa^\star_n},\quad p^\star_{\rho n} = \frac{b - \left(\frac{b-e}{2b-e}\right)\beta_n\kappa^\star_n}{2b - e\overline{\tau}_\rho - \frac{1}{2}\left(1-\overline{\tau}_\rho\right)\beta_n^2\kappa^{\star 2}_n},$$

$$\text{and } \beta_n = \frac{e^2}{(2b-e)\left(2\left(n-1\right)b+e\right)}$$

Strategic interaction between individual firms, β_n, is reduced as number of firms grows

Large number of firms

Theorem

In the linear equilibrium of the large-n extension, equilibrium prices are

$$p^{\star}_{i1\infty}\left(s_{i\theta}, s_{i\rho}\right) = p_{0\infty} + p^{\star}_{\theta\infty}\mathbb{E}\left[\theta_i | s_{i\theta}\right] + p^{\star}_{\rho\infty}\mathbb{E}\left[\rho | s_{i\rho}\right].$$

Letting $r = e/b$,

$$p^{\star}_{\theta\infty} = \frac{1}{2}, \quad p^{\star}_{\rho\infty} = \frac{1}{2 - r\overline{\tau}_{\rho}},$$
$$p^{\star}_{0\infty} = \frac{1}{2-r}\left(\frac{a}{b} + \frac{1}{2}r\mu_{\theta} + \mu_{\rho}\right) - \frac{\mu_{\rho}}{2 - r\overline{\tau}_{\rho}}.$$

Information sharing: large n

With a large number of firms, information sharing implies all firms learn true value for ρ.

- Impact of information sharing: $\bar{\tau}_\rho \to 1$ when $\bar{\tau}_\rho > 0$.

Producer surplus is increasing in precision for $\bar{\tau}_\rho \in (0, 1)$.

Consumer surplus increases with information sharing if either

- firms are selling goods are not too substitutable ($e \ll b$, i.e. $r \ll 1$), or
- information prior to sharing is dispersed ($\bar{\tau}_\rho \ll 1$)

Value of information

Effect of increased precision of cost information...

...in the first period:

- Reduces variance of signals around true parameters
- Can change the first period pricing strategy - how to use information in each component

...in the second period:

- Only impact is via change in strategies or inferences about opponent

Information acquisition

We consider an equilibrium setting where acquisition of more precise information is costly

- Marginal increase does not effect first period strategy (envelope theorem)
- Unobserved deviation does not effect price informativeness
- Second period profits not impacted

Benefit of increase in precision on first period profit

$$\frac{\partial}{\partial \tau_{i\theta}} \mathbb{E}\left[\pi_{i1}^{\star}\right] = \frac{\partial}{\partial \tau_{i\theta}} \mathrm{Var}(\mathbb{E}[\theta_i | s_{i\theta}]) \left(1 - p_{\theta}^{\star}\right) p_{\theta}^{\star} b$$

Information sharing

Changes in first period profit with respect to $\tau_{i\theta}$

$$\frac{\partial}{\partial \tau_{i\theta}} \mathbb{E}\left[\pi_{i1}^{c}\right] = \frac{\partial}{\partial \tau_{i\theta}} \text{Var}(\mathbb{E}[\theta_i | s_{i\theta}]) \left(1 - p_{\theta}^{c}\right) p_{\theta}^{c} b$$

Proposition

The value of information is lower when firms share industry relevant information

$$\frac{\partial}{\partial \tau_{i\theta}} \mathbb{E}\left[\pi_{i1}^{\star}\right] > \frac{\partial}{\partial \tau_{i\theta}} \mathbb{E}\left[\pi_{i1}^{c}\right]$$

Type of competition and information

Cournot competition

- Competition softening: want to signal low costs due to strategic substitutes
- Expected prices decrease with information sharing

Full information sharing

- Firms share both common and firm specific cost information
- Consumer welfare increases with information sharing

Generalized information sharing

Each firm's signals is set of data $r_{ixm} = x + u_{ixm}$ where $u_{ixm} \sim N(0, \sigma^2_{ux})$, iid.

- Signals before sharing: $s_{ix} = x + \frac{1}{M_{ix}} \sum_{m=1}^{M_{ix}} u_{ixm}$.

Amount of firm i's data shared with firm j: $\tilde{M}_{jx}, x = \rho, \theta_i$.

$$\tilde{s}_{i\rho} = \rho + \frac{1}{M_{i\rho} + \tilde{M}_{i\rho}} \left(\sum_{m=1}^{M_{i\rho}} u_{i\rho m} + \sum_{m=1}^{\tilde{M}_{i\rho}} u_{j\rho m} \right)$$

$$\tilde{s}_{i\theta_j} = \theta_j + \frac{1}{\tilde{M}_{i\theta_j}} \sum_{m=1}^{\tilde{M}_{j\theta_j}} u_{j\theta_j m}; \quad \tilde{s}_{i\theta_i} = \theta_i + \frac{1}{M_{i\theta_i}} \sum_{m=1}^{M_{i\theta_i}} u_{i\theta_i m}$$

Generalized information sharing

First period linear pricing strategy

$$\tilde{p}_{j1} = \tilde{p}_0 + \tilde{p}_{j\rho}\mathbb{E}[\rho|\tilde{s}_{j\rho}] + \tilde{p}_{j\theta_j}\mathbb{E}[\theta_j|\tilde{s}_{j\theta_j}] + \tilde{p}_{j\theta_i}\mathbb{E}[\theta_i|\tilde{s}_{j\theta_i}] + \tilde{p}_{j\tilde{s}_{i\theta_j}}\mathbb{E}[\theta_j|\tilde{s}_{i\theta_j}]$$

Public information after first period: $(\rho, \mathbf{p}_1, \tilde{\varepsilon}_\rho, \tilde{s}_{j\theta_i}, \tilde{s}_{i\theta_j})$

- $\tilde{\varepsilon}_\rho$ is shared common cost information net ρ.

Informativeness of price

$$\tilde{\kappa} = \frac{\tilde{p}_{j\theta_j}\tilde{\tilde{\tau}}_{j\theta_j}\sigma_\theta^2\left(1 - \frac{\tilde{M}_{i\theta_j}}{M_{j\theta_j}}\frac{M_{j\theta_j}\sigma_\theta^2+\sigma_{u\theta_j}^2}{\tilde{M}_{i\theta_j}\sigma_\theta^2+\sigma_{u\theta_j}^2}\right)}{\tilde{p}_{j\theta_j}^2\tilde{\tilde{\tau}}_{j\theta_j}\sigma_\theta^2\left(1 - \frac{\tilde{M}_{i\theta_j}}{M_{j\theta_j}}\frac{M_{j\theta_j}\sigma_\theta^2+\sigma_{u\theta_j}^2}{\tilde{M}_{i\theta_j}\sigma_\theta^2+\sigma_{u\theta_j}^2}\right) + \tilde{p}_{j\rho}^2\tilde{\tilde{\tau}}_{j\rho}\left(1 - \tilde{\tilde{\tau}}_{j\rho}\right)\sigma_\rho^2\left(1 - \frac{\tilde{M}_{j\rho}+\tilde{M}_{i\rho}}{M_{j\rho}+\tilde{M}_{j\rho}}\right)}$$

Generalized information sharing

Expected first period prices increase with $\tilde{\kappa}$ while second period prices are unaffected.

- Sharing information about common cost increases the equilibrium informativeness of prices
- Sharing information about firm specific costs decreases the informativeness

Ex-ante expected prices are

$$\mathbb{E}[\tilde{p}_{i1}] = \frac{a + b(\mu_\rho + \mu_\theta)}{2b - e}\left(1 + \frac{1}{2}\beta\tilde{\kappa}\right); \quad \mathbb{E}[\tilde{p}_{i2}] = \frac{a + b(\mu_\rho + \mu_\theta)}{2b - e}$$

Conclusion

In the unique symmetric linear equilibrium with common and private cost parameters we consider

- How firms use information on each cost component
- Informativeness of price and impact on expected prices

Aggregating industry-wide cost information ($n = 2$)

- Increases expected prices and covariance of prices
- Decreases consumer surplus and increases profits when goods relatively inelastic
- Lowers value of collecting private cost information

Conclusion

Can aggregation of cost information harm competition?

- Depends on type of information shared

Number of firms is small

- Competition softening may lead to increased prices
- Incentive to distort prices upward can facilitate collusion

Large number of firms

- Large space of parameters where both consumer and producer surplus increases with information sharing
- Welfare improving when information is dispersed or products are not very substitutable