Double marginalization and vertical integration

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Old ‘pro-merger’ result: Vertical Integration benefits consumers

Cournot (1838) Spengler (1950)

**Perfect information**

Linear pricing \( w > c \) \( \Rightarrow \) DM

VI \( \Rightarrow \) EDM

This view of VI is still dominant today

**Source of debate:**

Two-part tariffs enough for EDM

Is EDM merger specific?
U.S. Vertical Merger Guidelines published in 2020

- Section 6: “Procompetitive effects”, almost entirely about EDM
- Former version (1984): did not mention EDM
- Standard and burden of proof subject to interpretations
- Dissent by 2 FTC Commissioners
- EDM in recent cases

Unilaterally withdrawn by FTC in September 2021
Purpose of the paper

\[ S_0 \quad S_1 \quad \ldots \quad S_i \quad \ldots \quad S_n \]

\[ B \]

Consumers
Purpose of the paper

Modeling environments where

- DM is optimal under sophisticated bargaining
- EDM can be merger-specific
- Foreclosure of competitors can harm or benefit consumers

Procurement model under asymmetric information

Two decisions
1. Extensive decision: Selection of a subset of suppliers
2. Intensive decision: Quantities traded with selected suppliers
Contributions of the paper

When Buyer controls production better than selection
VI benefits consumers

When Buyer controls selection better than production
VI may harm consumers

Empirical predictions to separate these two cases

- Case 1:
  - $B$ more likely to deal with aggressive suppliers
  - $B$ more likely to merge with less aggressive ones

- Case 2: The opposite!
Related literature

**Procurement with variable quantities: Full commitment**
Dasgupta and Spulber (1989), Riordan and Sappington (1987)

**Backward integration by monopsonistic or dominant buyer**
Perry (1978) [Linear], Riordan (1998) [RRC harms consumers], Loertscher and Reisinger (2014)

**Asymmetric information and auctions [Fixed quantity]**

**Empirical literature generally under perfect information**
Firms and consumers

**Upstream: Suppliers** $S_0, \ldots, S_n$

- with $c_0 \in \left[ c_0, \bar{c}_0 \right]$, $\ldots$, $c_n \in \left[ c_n, \bar{c}_n \right]$
- cdf $F_i$, and $f_i = F_i' > 0$

**Downstream: One buyer** $B$

- Revenue $R(q) = P(q)q - C(q)$
- Joint profit (single-peaked) $\Pi(q; c) = R(q) - cq$
- Monopoly quantity $q^m(c) = \arg \max_q \Pi(q; c)$
- Monopoly profit $\Pi^m(c) = \max_q \Pi(q; c)$
Introduction
Framework
Vertical integration
With whom?
Multi-sourcing
Bilateral info

\[ R(q) = P(q)q - C(q) \]

\[ S(q) \]

\[ S_0, S_1, \ldots, S_n \]

\[ a_0, a_1, \ldots, a_n \in [c_i, c_i'] \]

\[ P_i(\cdot) \text{ and } F_i(\cdot) \]

\[ F_n(\cdot) \text{ and } f_n(\cdot) \]
Dasgupta and Spulber (1989) “Managing procurement auctions”

\[ c_0 \in [c_0, \overline{c}_0] \]
\[ F_0(.) \text{ and } f_0(.) \]

\[ c_i \in [c_i, \overline{c}_i] \]
\[ F_i(.) \text{ and } f_i(.) \]

\[ c_n \in [c_n, \overline{c}_n] \]
\[ F_n(.) \text{ and } f_n(.) \]

- **Framework**
- **Vertical integration**
- **With whom?**
- **Multi-sourcing**
- **Bilateral info**
- **End**

\[ B \text{ has full commitment power } \implies \]
\[ c_i + \frac{F_i(c_i)}{f_i(c_i)} \]

\[ q = q^m \left( c_i + \frac{F_i(c_i)}{f_i(c_i)} \right) < q^m (c_i) \]

Revenue \( R(q) = P(q)q - C(q) \)

Consumers

Surplus \( S(q) \)
Bargaining over quantities

Bargaining $\equiv$ mechanism maximizing weighted profits

$$\prod_B + \sum \mu_i U_i$$

• Weights
  • $0 \leq \mu_i \leq 1$ reflects $S_i$’s influence
  • $1 - \mu_i$ reflects $B$’s control over quantity

• Bargaining $\equiv$ direct mechanism $(Q, M)$

• $\prod_B(c) = R(\sum Q_i(c)) - \sum M_i(c)$

• $U_i(c) = M_i(c) - c_iQ_i(c)$
Introduction

Framework

Vertical integration

With whom?

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End

\( c_0 \in [c_0, \overline{c_0}] \)

\( F_0(.) \) and \( f_0(.) \)

\( S_0 \)

\( \mu_0 \)

\( c_i \in [c_i, \overline{c_i}] \)

\( F_i(.) \) and \( f_i(.) \)

\( S_i \)

\( \mu_i \)

\( c_n \in [c_n, \overline{c_n}] \)

\( F_n(.) \) and \( f_n(.) \)

\( S_n \)

\( \mu_n \)

Loertscher and Marx (2020)

“Incomplete Information Bargaining”

Bargaining weights \( \mu_i \)

Market as Mech. Designer

\( c_i + (1 - \mu_i) \frac{F_i(c_i)}{f_i(c_i)} \)

\( \equiv \psi_i(c_i; \mu_i) \)

\( B \)

\[ q = q^m(\psi_i(c_i; \mu_i)) \leq q^m(c_i) \]

Revenue \( R(q) = P(q)q - C(q) \)

Consumers

Surplus \( S(q) \)
Two-stage Bargaining: selection and quantity

E.g. two divisions: procurement and production

Selection stage: profits weighted with $\lambda$

$$\Pi_B + \sum \lambda_i U_i$$

- $1 - \lambda_i$ reflects buyer’s control over selection of $S_i$
- $\lambda = 0$: buyer has full control over selection

$\rightarrow S \equiv$ set of selected suppliers

Production stage: profits weighted with $\mu$

$$\Pi_B + \sum_{j \in S} \mu_j U_j$$
Bargaining environment
Influence over selection and Influence over production

\[ \mu = \lambda : \text{same control at both stages:} \]
\[ \mu = \lambda = 0 : B \text{ has full control} \]
\[ \mu = \lambda = 1 : \text{Total profit maximized} \]

\[ \mu \neq \lambda : \text{varying control:} \]
\[ \mu > \lambda : B \text{ controls more selection than production} \]
\[ \mu < \lambda : B \text{ controls more production than selection} \]

Subset with \( \mu_i > \lambda_i \) and another with \( \mu_j \leq \lambda_j \)
Introduction

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Selection Stage

Bargaining weights $\lambda_i$
Market as Mech. Designer

$$c_i + (1 - \lambda_i) \frac{F_i(c_i)}{f_i(c_i)} \equiv \psi_i(c_i; \lambda_i)$$

Production Stage

Bargaining weights $\mu_i$
Market as Mech. Designer

$$c_i + (1 - \mu_i) \frac{F_i(c_i)}{f_i(c_i)} \equiv \psi_i(c_i; \mu_i)$$

$$q = q^m(\psi_i(c_i; \mu_i)) \leq q^m(c_i)$$

revenue $R(q) = P(q)q - C(q)$

Consumers

Surplus $S(q)$
Selection stage

Assumption: unconditional winner privacy (UWP)
Selection reveals the minimal information about the suppliers’ costs needed to prove that they should be winning

Assumption: Monotonic selection rules
If $S_i$ with cost $c_i$ is selected then $S_i$ also selected with $c'_i < c_i$

Two outcomes of selection
- Set $S$ of selected suppliers
- For each $j \in S$ a threshold $c_j^{Sel}$. Selection $\Leftrightarrow c_j \leq c_j^{Sel}$

Remark: UWP $\Rightarrow c_j^{Sel} (c_S)$
Production stage

Recall $\psi_j(c_j; \mu_j) = c_j + (1 - \mu_j) \frac{F_j(c_j)}{f_j(c_j)}$

Proposition

- *The contract is granted to the supplier with the lowest* $\psi_j(c_j; \mu_j)$
- *The quantity is* $q^m(\psi_j(c_j; \mu_j))$
- *DM: $q^m(\psi_j(c_j; \mu_j)) < q^m(c_j)$*
Selection stage

Virtual profit: \[ \pi_i^V = \Pi (q^m (\Psi_i(c_i; \mu_i)); \Psi_i(c_i; \lambda_i)) \]
\[ \pi_i^V > 0 \] and \[ \pi_i^V \downarrow \text{ in } c_i \]

Proposition

*Under two-stage bargaining, only the supplier with the highest virtual profit is selected.*

Implementation

1. selection through a discriminatory clock auction
2. the winning supplier picks a two-part tariff in a menu
3. facing that tariff, the buyer chooses a quantity
Vertical integration

Integration $B + S_0 \Rightarrow (\lambda_0, \mu_0) \rightarrow (1, 1)$
Otherwise same as before
with $\pi_0^v \rightarrow \Pi^m(c_0)$
and $q_0$ increases from $q^m(\Psi_0(c_0; \mu_0))$ to $q^m(c_0)$ (EDM)

Extension: Imperfect internalization within integrated firm
$(\lambda_0, \mu_0) \rightarrow (\lambda'_0, \mu'_0) > (\lambda_0, \mu_0)$ but $(\lambda'_0, \mu'_0) < (1, 1)$
## Vertical integration

### Four regimes

<table>
<thead>
<tr>
<th>Regime</th>
<th>Condition</th>
<th>Consumers’ Surplus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pure EDM</td>
<td>$\Pi^m(c_0) &gt; \pi_0^v &gt; \pi_{(n)}^v$</td>
<td>$\uparrow$</td>
</tr>
<tr>
<td>Customer Foreclosure</td>
<td>$\Pi^m(c_0) &gt; \pi_{(n)}^v &gt; \pi_0^v$</td>
<td>$\uparrow$ or $\downarrow$</td>
</tr>
<tr>
<td>Exploitation</td>
<td>$\pi_{(n)}^v &gt; \Pi^m(c_0) &gt; \pi_{(n-1)}^v$</td>
<td>0</td>
</tr>
<tr>
<td>Indifference</td>
<td>$\pi_{(n-1)}^v &gt; \Pi^m(c_0)$</td>
<td>0</td>
</tr>
</tbody>
</table>

**Main issue:** Is foreclosure bad for consumers?

Make or buy frontier: $\Pi^m(c_0) = \pi_{(n)}^v$
When $B$ controls production better than selection

Case $\lambda \geq \mu : \text{VI always benefits consumers}$

Chicago-like result despite foreclosure

After VI $S_0$ is selected if $\Pi^m(c_0) \geq \pi_i^V$
but $\pi_i^V = \Pi(q^m(\Psi_i(c_i; \mu_i)) ; \Psi_i(c_i; \lambda_i)) > \Pi(q^m(\Psi_i(c_i; \mu_i)) ; \Psi_i(c_i; \mu_i))$
that is $\pi_i^V > \Pi^m(\Psi_i(c_i; \mu_i))$
meaning $q^m(c_0) > q^m(\Psi_i(c_i; \mu_i))$

Competitors are harmed but not consumers
When $B$ controls selection better than production

i.e. $\lambda_j < \mu_j$ : consumers are harmed with positive probability

Figure 1: Foreclosure area: $OCE$. Consumer harm: $ODE$. Consumer benefit: $ODC$
Consumer Harm with Supplier’s aggressiveness $\mu$

Figure 2: Foreclosure: $OCE$. Consumer harm: $ODE$. Consumer benefit: $ODC$

On expectation: consumers gain in (a) and lose in (b)
Caveat

Asymmetric cost distribution: VI can correct a discrimination

Figure 3: $S_0$ more efficient than $S_1$. $\lambda_0 = \lambda_1 = 0$ and no DM: $\mu_0 = \mu_1 = 1$
Asymmetric cost distribution: VI can correct a discrimination

More generally
Suppose that the buyer fully controls the selection decision ($\lambda_0 = \lambda_1 = 0$), there is no DM pre-merger ($\mu_0 = \mu_1 = 1$), and $c_0$ is lower than $c_1$ in the likelihood ratio order ($F_0/f_0 > F_1/f_1$). Then final consumers benefit from the foreclosure of $S_1$ with positive probability.

... see choice of merging partner (▶)
Choice of partner in VI

*B* makes TIOLI offers to *S*<sub>0</sub> or *S*<sub>1</sub>

VI being profitable it would take place

If *S*<sub>0</sub> rejects the offer, *S*<sub>1</sub> and *B* merge, and *S*<sub>0</sub> is an outsider

*B* prefers *S*<sub>0</sub> if and only if

\[
\Pi^0_{BS_0} - \Pi^1_{S_0} \geq \Pi^1_{BS_1} - \Pi^0_{S_1},
\]

\[
\Rightarrow
\]

\[
\Pi^0_{BS_0} + \Pi^0_{S_1} \geq \Pi^1_{BS_1} + \Pi^1_{S_0},
\]
Choice of partner in VI

How to maximize expected industry profit?

- Avoid DM as much as possible!
  - When production in house no DM
  - When production outsourced DM $\downarrow$ when $\mu$ $\uparrow$

- Avoid foreclosure as much as possible
Choice of partner under one stage bargaining

two suppliers, same cost distribution $F$, bargaining weights $\lambda_0 = \mu_0 > \lambda_1 = \mu_1$

$B$ prefers to integrate with $S_1$

$S_0$ more aggressive
Choice of partner under one stage bargaining

two suppliers, same cost distribution $F$, bargaining weights $\lambda_0 = \lambda_1 = 0 < \mu_1 < \mu_0$

$B$ may prefer to integrate with $S_0$

$S_0$ more aggressive
Convex costs and multi-sourcing
Symmetric suppliers with cost functions $c_i q_i + \alpha q_i^2$

If full BP (or same BP for selection and production)

- Under separation: both suppliers always selected
- VI always benefits consumers

If buyer controls only selection

- Separation: $B$ doesn’t select $S_j$ for large $c_j$ to minimize rents
- Vertical integration:
  - Foreclosure of efficient competitors harms consumers
  - New effect: VI corrects inefficient exclusion of $S_0$ pre-merger
Convex costs and multi-sourcing

Buyer controls only selection. Two symmetric suppliers with cost $c_i q_i + q_i^2$, $\lambda = 0, \mu = 1$

Figure 4: Multisourcing in OADB pre-merger and below EE' post-merger
Bilateral information

Assume Buyer has private information on cost or demand

- No role if buyer is dominant (as we assumed)
- If there is a dominant supplier \( \max \mu_i^S > \mu_B \), merger with that supplier benefits consumers under one-stage bargaining
Wrap up

Final consumers benefit from VI (even foreclosure)
When $B$ has less control over the Make or Buy decision than over the quantity decision

Final consumers harmed by Foreclosure
When $B$ has more control over the Make or Buy decision than over the quantity decision

Predictions
- Supplier choice
- Endogenous merger
Antoine A. Cournot (1801-1876)
Dissent by FTC Commissioner Slaughter: Guidelines

- too optimistic about EDM being achieved / passed on to consumers
- Fail to force parties to prove timely, likely, and merger-specific EDM

Interdependence between EDM and potential harms
EDM in recent cases

- **AT&T - Time Warner (2018):**
  - DoJ expected EDM benefits $350m to be passed on to consumers
  - Noted by Judge Leon even before discussing ToH
- **Comcast - NBCU (2011):** DoJ “much, if not all, of any potential DM is reduced, if not completely eliminated, through the course of contract negotiations”

Standard of proof for EDM claims still too low?

- Kwoka and Slade (2020): “Policy analysis too often automatically credits VM with the benefits predicted by the classic economic model. Critical error because assumptions not met
- Salop (2018) also says EDM claims should not be “silver bullets”
Bargaining environment
Influence over selection and Influence over production

\[ \mu = \lambda : \text{same control at both stages:} \]

\[ \mu = \lambda = 0 : B \text{ has full control} \]

\[ \mu = \lambda = 1 : \text{Total profit maximized} \]

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Bargaining environment
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\[ \mu < \lambda : B \text{ controls more production than selection} \]
Bargaining environment
Influence over selection and Influence over production

$\mu \neq \lambda$ : varying control:

$\mu > \lambda : B$ controls more selection than production

$\mu < \lambda : B$ controls more production than selection
Bargaining at the production stage

\[ U_j(\hat{c}_j; c) = (M_j - c_jQ_j), \]  \hspace{1cm} (1)

Supplier \( S_j \)'s expected utility is defined as

\[ u_j(c_j) = \max_{\hat{c}_j} \mathbb{E}_{c_{-j}} U_j(\hat{c}_j, c_{-j}). \]  \hspace{1cm} (2)

By the envelope theorem, the derivative of the rent is

\[ u'_j(c_j) = -\mathbb{E}_{c_{-j}} [Q_j(c_j, c_{-j})], \]  \hspace{1cm} (3)

\( M_j \) such that \( u_j(c_j^{Sel}) = 0. \)

\[ \mathbb{E}_c U_j(c) = \int_{c_j}^{c_j^{Sel}} u_j(c_j) \frac{F_j(c_j)}{F_j(c_j^{Sel})} dc_j = \int_{c_j}^{c_j^{Sel}} \mathbb{E}_{c_{-j}} [Q_j(c_j, c_{-j})] \frac{F_j(c_j)}{F_j(c_j^{Sel})} dc_j 
= \mathbb{E}_c \left[ Q_j(c_j, c_{-j}) \frac{F_j(c_j)}{f_j(c_j)} \right]. \]
Bargaining at the production stage

Conditional on $c$, the weighted industry profit is

$$R \left( \sum_{j \in S} Q_j \right) - \sum_{j \in S} M_j + \sum_{j \in S} \mu_j U_j = R \left( \sum_{j \in S} Q_j \right) - \sum_{j \in S} (c_j Q_j + (1 - \mu_j) U_j).$$

Taking the expectation and substituting

$$\mathbb{E}_c \left[ R \left( \sum_{j \in S} Q_j \right) - \sum_{j \in S} \psi_j(c_j; \mu_j) Q_j \right].$$

which is maximum . . .
Bargaining at the selection stage

At the selection stage, the bargaining mechanism maximizes

\[
\mathbb{E} \sum_j \tilde{x}_j \left\{ R(q^m(\psi_j(c_j; \mu_j))) - c_j q^m(\psi_j(c_j; \mu_j)) - U_j(c_j, c_{-j}) + \lambda_j U_j(c_j, c_{-j}) \right\} =
\]

\[
\mathbb{E} \sum_j \tilde{x}_j \left\{ R(q^m(\psi_j(c_j; \mu_j))) - c_j q^m(\psi_j(c_j; \mu_j)) - (1 - \lambda_j) \frac{F_j(c_j)}{f_j(c_j)} q^m(\psi_j(c_j; \mu_j)) \right\} =
\]

\[
\mathbb{E} \sum_j \tilde{x}_j \left\{ R(q^m(\psi_j(c_j; \mu_j))) - \psi_j(c_j; \lambda_j) q^m(\psi_j(c_j; \mu_j)) \right\} =
\]

\[
\mathbb{E} \sum_j \tilde{x}_j \Pi(q^m(\psi_j(c_j; \mu_j)); \psi_j(c_j; \lambda_j)).
\]
Choice of merging partner

When $B$ controls perfectly selection but not production
i.e. $\lambda_0 = \lambda_1 = 0$, and $\mu_0 = \mu_1 = 1$
i.e. no DM

⇒ Proposition
Suppose $c_0$ is lower than $c_1$ in the likelihood ratio order
($F_0/f_0 > F_1/f_1$) then $B$ prefers to integrate with supplier $S_0$
Configuration of Figure 3