Double marginalization and vertical integration

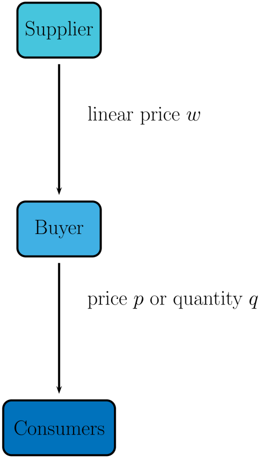
Philippe Choné, Laurent Linnemer, and Thibaud Vergé

CREST, Institut Polytechnique de Paris

Mannheim, November 2021

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

Cournot (1838) Spengler (1950)



Perfect information

Linear pricing$\Rightarrow$ $w > c \Rightarrow$ DM

VI $\Rightarrow$ EDM

This view of VI is still dominant today

Source of debate:

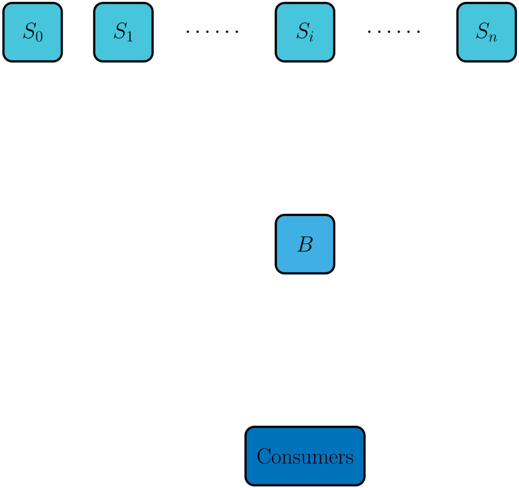
Two-part tariffs enough for EDM
Is EDM merger specific?

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Unilaterally withdrawn by FTC in September 2021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



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]

Loertscher and Marx (2019) [HM harms buyer], Loertscher and Marx (2020) [Incomplete Information Bargaining], Loertscher and Riordan (2019) [VM and invest.], Laffont and Tirole (1987), Myerson (1981)

Empirical literature generally under perfect information

Bonnet and Dubois (2010), Villas-Boas (2007) , Crawford, Lee, Whinston, and Yurukoglu (2018) , Hortaçsu and Syverson (2007), Atalay, Hortaçsu, and Syverson (2014, 2019 with Li)

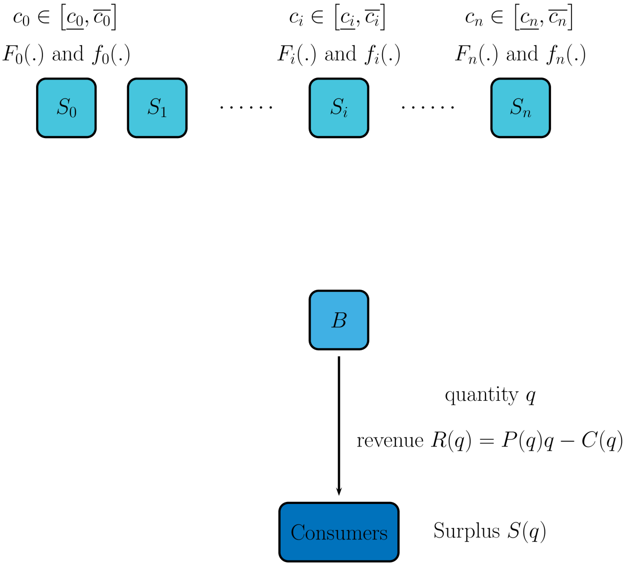
Firms and consumers

Upstream: Suppliers $S_0, \ldots, S_n$

- with $c_0 \in \left[\underline{c_0}, \overline{c_0}\right], \ldots, c_n \in \left[\underline{c_n}, \overline{c_n}\right]$,
- 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 $\Pi^m(c) = \max_q \Pi(q; c)$


$c_0 \in [\underline{c_0}, \overline{c_0}]$
$F_0(.)$ and $f_0(.)$
$c_i \in [\underline{c_i}, \overline{c_i}]$
$F_i(.)$ and $f_i(.)$
$c_n \in [\underline{c_n}, \overline{c_n}]$
$F_n(.)$ and $f_n(.)$
S_0
S_1
......
S_i
......
S_n
B
quantity q
revenue $R(q) = P(q)q - C(q)$
Consumers
Surplus $S(q)$

$c_0 \in [\underline{c_0}, \overline{c_0}]$ $\quad$ $c_i \in [\underline{c_i}, \overline{c_i}]$ $\quad$ $c_n \in [\underline{c_n}, \overline{c_n}]$

$F_0(.)$ and $f_0(.)$ $\quad$ $F_i(.)$ and $f_i(.)$ $\quad$ $F_n(.)$ and $f_n(.)$

S_0 $\quad$ S_1 $\quad$ ...... $\quad$ S_i $\quad$ ...... $\quad$ S_n

Dasgupta and Spulber (1989)
"Managing procurement auctions"

B has full commitment power $\Longrightarrow$ DM $c_i + \frac{F_i(c_i)}{f_i(c_i)}$

B

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

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

Consumers $\quad$ Surplus $S(q)$

Bargaining over quantities

Bargaining ≡ mechanism maximizing weighted profits

$$\Pi_B + \sum \mu_i U_i$$

- Weights
  - $0 \leqslant \mu_i \leqslant 1$ reflects S_i's influence
  - $1 - \mu_i$ reflects B's control over quantity
- Bargaining ≡ direct mechanism $(\mathbf{Q}, \mathbf{M})$
- $\Pi_B(\mathbf{c}) = R\left(\sum Q_i(\mathbf{c})\right) - \sum M_i(\mathbf{c})$
- $U_i(\mathbf{c}) = M_i(\mathbf{c}) - c_i Q_i(\mathbf{c})$

$c_0 \in [\underline{c_0}, \overline{c_0}]$ $\quad$ $c_i \in [\underline{c_i}, \overline{c_i}]$ $\quad$ $c_n \in [\underline{c_n}, \overline{c_n}]$

$F_0(.)$ and $f_0(.)$ $\quad$ $F_i(.)$ and $f_i(.)$ $\quad$ $F_n(.)$ and $f_n(.)$

S_0 $\quad$ S_1 $\quad$ ...... $\quad$ S_i $\quad$ ...... $\quad$ S_n

μ_0 $\quad$ μ_1 $\quad$ μ_i $\quad$ μ_n

Loertscher and Marx (2020)
"Incomplete Information Bargaining"

Bargaining weights μ_i
Market as Mech. Designer

DM

$$\Longrightarrow \underbrace{c_i + (1-\mu_i)\frac{F_i(c_i)}{f_i(c_i)}}_{\equiv \Psi_i(c_i;\mu_i)}$$

B

$$q = q^m\left(\Psi_i(c_i;\mu_i)\right) \leqslant q^m\left(c_i\right)$$

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 $\boldsymbol{\lambda}$

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

- $1 - \lambda_i$ reflects buyer's control over selection of S_i
- $\boldsymbol{\lambda} = 0$: buyer has full control over selection

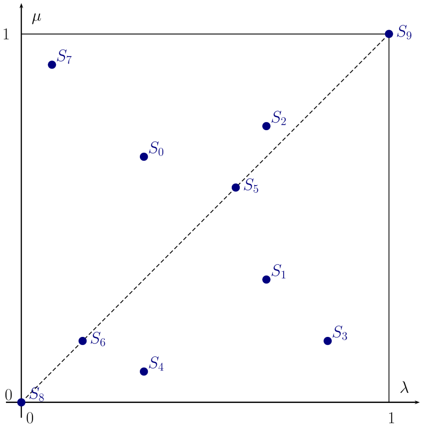
$\longrightarrow \mathcal{S} \equiv$ set of selected suppliers

Production stage: profits weighted with $\boldsymbol{\mu}$

$$\Pi_B + \sum_{j \in \mathcal{S}} \mu_j U_j$$

Bargaining environment

Influence over selection and Influence over production



$\boldsymbol{\mu} = \boldsymbol{\lambda}$: same control at both stages:

$\boldsymbol{\mu} = \boldsymbol{\lambda} = 0$: *B* has full control

$\boldsymbol{\mu} = \boldsymbol{\lambda} = 1$: Total profit maximized

$\boldsymbol{\mu} \neq \boldsymbol{\lambda}$: varying control:

$\boldsymbol{\mu} > \boldsymbol{\lambda}$: *B* controls more selection than production

$\boldsymbol{\mu} < \boldsymbol{\lambda}$: *B* controls more production than selection

Subset with $\mu_i > \lambda_i$ and another with $\mu_j \leqslant \lambda_j$

S_0 S_1 ...... S_i ...... S_n

λ_0 λ_1 λ_i λ_n

Selection Stage

Bargaining weights λ_i
Market as Mech. Designer $\Longrightarrow$ $\underbrace{c_i + (1-\lambda_i)\frac{F_i(c_i)}{f_i(c_i)}}_{\equiv \Psi_i(c_i;\lambda_i)}$

S_j S_i S_k

μ_j μ_i μ_k

Production Stage

Bargaining weights μ_i
Market as Mech. Designer $\Longrightarrow$ DM $\underbrace{c_i + (1-\mu_i)\frac{F_i(c_i)}{f_i(c_i)}}_{\equiv \Psi_i(c_i;\mu_i)}$

B

$q = q^m\left(\Psi_i(c_i;\mu_i)\right) \leqslant q^m\left(c_i\right)$

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 $\mathcal{S}$ of selected suppliers
- For each $j \in \mathcal{S}$ a threshold c_j^{Sel}. Selection $\Leftrightarrow c_j \leqslant c_j^{\mathrm{Sel}}$

Remark: UWP $\Rightarrow c_j^{\mathrm{Sel}}(\mathbf{c}_{-\mathcal{S}})$

Production stage

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

Proposition

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

Standard proof

Selection stage

Virtual profit: $\pi_i^v = \Pi\left(q^m\left(\Psi_i(c_i;\mu_i)\right);\Psi_i(c_i;\lambda_i)\right)$

$\pi_i^v > 0$ and $\pi_i^v \searrow$ 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

Standard proof

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

Regime	Condition	Consumers' Surplus
Pure EDM	$\Pi^m(c_0) > \pi_0^v > \pi_{(n)}^v$	$\nearrow$
Customer Foreclosure	$\Pi^m(c_0) > \pi_{(n)}^v > \pi_0^v$	$\nearrow$ or $\searrow$
Exploitation	$\pi_{(n)}^v > \Pi^m(c_0) > \pi_{(n-1)}^v$	0
Indifference	$\pi_{(n-1)}^v > \Pi^m(c_0)$	0

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 $\boldsymbol{\lambda} \geqslant \boldsymbol{\mu}$: VI always benefits consumers

Chicago-like result despite foreclosure

After VI S_0 is selected if $\Pi^m(c_0) \geqslant \pi_i^v$

but $\pi_i^v = \Pi\left(q^m\left(\Psi_i(c_i;\mu_i)\right);\Psi_i(c_i;\lambda_i)\right) > \Pi\left(q^m\left(\Psi_i(c_i;\mu_i)\right);\Psi_i(c_i;\mu_i)\right)$

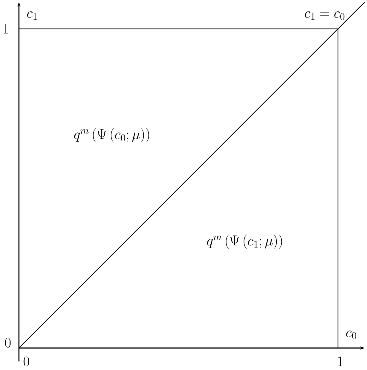
that is $\pi_i^v > \Pi^m\left(\Psi_i(c_i;\mu_i)\right)$

meaning $q^m(c_0) > q^m\left(\Psi_i(c_i;\mu_i)\right)$

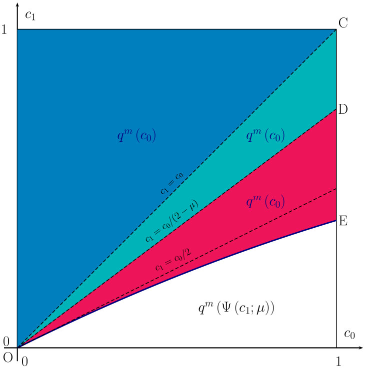
Competitors are harmed but not consumers

When B controls selection better than production

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



(a) Vertical separation



(b) Effect of the merger

Figure 1: Foreclosure area: *OCE*. Consumer harm: *ODE*. Consumer benefit: *ODC*

Consumer Harm $\nearrow$ with Supplier's aggressiveness μ

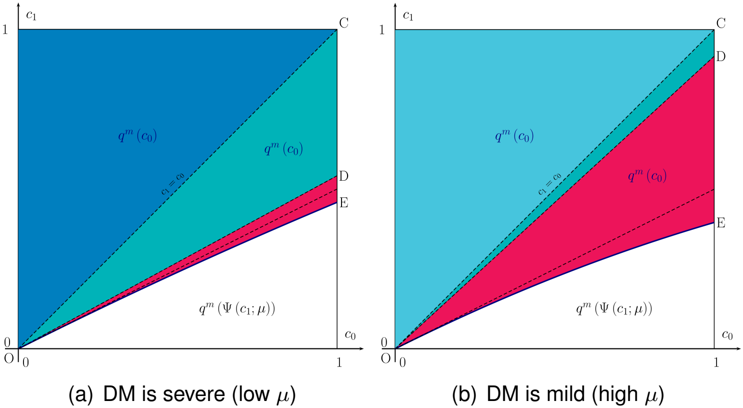
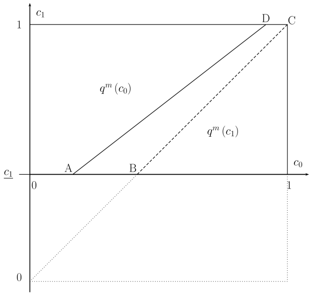


Figure 2: Foreclosure: *OCE*. Consumer harm: *ODE*. Consumer benefit: *ODC*

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

Caveat

Asymmetric cost distribution: VI can correct a discrimination



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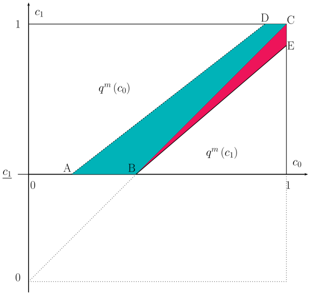


(b) Effect of the merger

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_0 or S_1

VI being profitable it would take place

If S_0 rejects the offer, S_1 and B merge, and S_0 is an outsider

B prefers S_0 if and only if

$$\Pi^0_{BS_0} - \Pi^1_{S_0} \geqslant \Pi^1_{BS_1} - \Pi^0_{S_1},$$

$$\Rightarrow$$

$$\Pi^0_{BS_0} + \Pi^0_{S_1} \geqslant \Pi^1_{BS_1} + \Pi^1_{S_0},$$

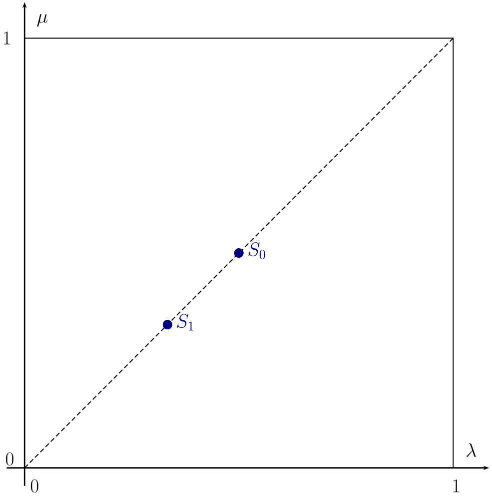
Choice of partner in VI

How to maximize expected industry profit?

- Avoid DM as much as possible!
  - When production in house no DM
  - When production outsourced DM $\searrow$ when $\mu \nearrow$
- Avoid foreclosure as much as possible

Choice of partner under one stage bargaining

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

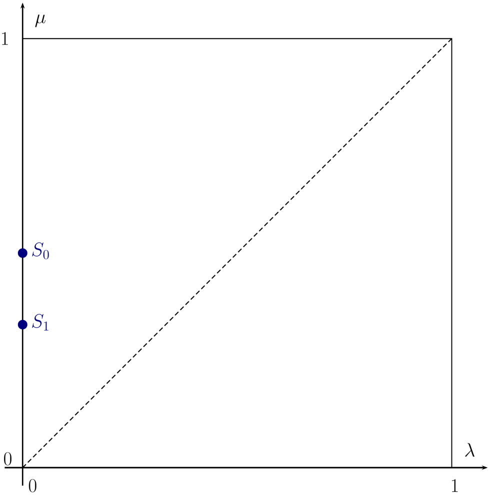


B prefers to integrate with S_1

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)

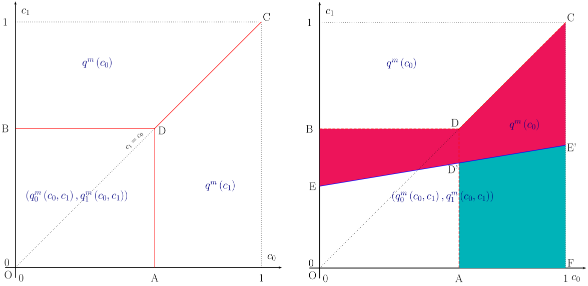
- Under separation: both suppliers always selected
- VI always benefits consumers

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 $c_i q_i + q_i^2$, $\lambda = 0, \mu = 1$



(a) Vertical separation (b) Merger with S_0

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)

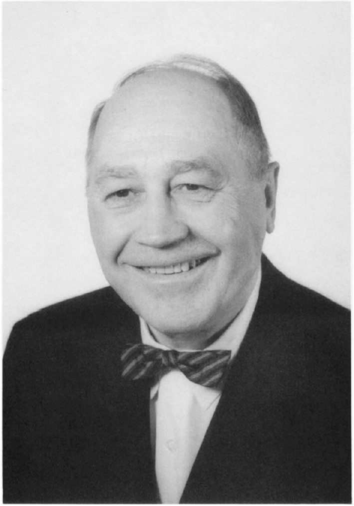
When B has less control over the Make or Buy decision than over the quantity decision

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



Joseph J. Spengler (1902-1991), Duke, AEA President 1965 Return

Antoine A. Cournot (1801-1876) Return

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

FTC Commissioner Wilson (2020), Global Antitrust Institute (2020)

Return

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"*

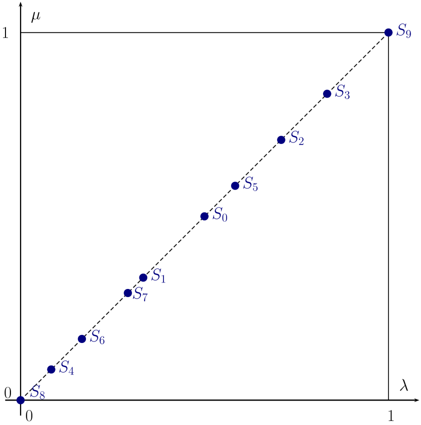
Standard of proof for EDM claims still too low?

- 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"

Return

Bargaining environment

Influence over selection and Influence over production



$\boldsymbol{\mu} = \boldsymbol{\lambda}$: same control at both stages:

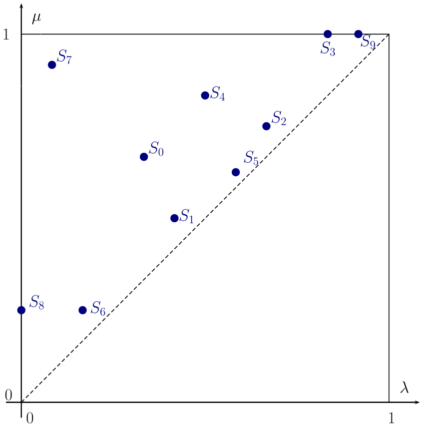
$\boldsymbol{\mu} = \boldsymbol{\lambda} = 0$: *B* has full control

$\boldsymbol{\mu} = \boldsymbol{\lambda} = 1$: Total profit maximized

$\boldsymbol{\mu} \neq \boldsymbol{\lambda}$: varying control:

Bargaining environment

Influence over selection and Influence over production



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$\boldsymbol{\mu} > \boldsymbol{\lambda}$: *B* controls more selection than production

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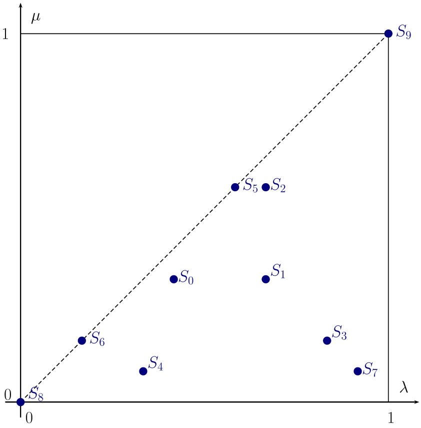
Return

Bargaining environment

Influence over selection and Influence over production



$\boldsymbol{\mu} \neq \boldsymbol{\lambda}$: varying control:

$\boldsymbol{\mu} > \boldsymbol{\lambda}$:*B* controls more selection than production

$\boldsymbol{\mu} < \boldsymbol{\lambda}$: *B* controls more production than selection

Return

Bargaining at the production stage

$$U_j(\hat{c}_j;\mathbf{c}) = (M_j - c_j Q_j)\,, \tag{1}$$

Supplier S_j's expected utility is defined as

$$u_j(c_j) = \max_{\hat{c}_j} \mathbb{E}_{\mathbf{c}_{-j}} U_j(\hat{c}_j, \mathbf{c}_{-j}). \tag{2}$$

By the envelope theorem, the derivative of the rent is

$$u_j'(c_j) = -\mathbb{E}_{\mathbf{c}_{-j}}\ [Q_j(c_j, \mathbf{c}_{-j})]\,, \tag{3}$$

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

$$\begin{aligned}\mathbb{E}_{\mathbf{c}} U_j(\mathbf{c}) &= \int_{\underline{c}_j}^{c_j^{\mathrm{Sel}}} u_j(c_j)\frac{F_j(c_j)}{F_j(c_j^{\mathrm{Sel}})}dc_j = \int_{\underline{c}_j}^{c_j^{\mathrm{Sel}}} \mathbb{E}_{\mathbf{c}_{-j}}\left[Q_j(c_j, \mathbf{c}_{-j})\right]\frac{F_j(c_j)}{F_j(c_j^{\mathrm{Sel}})}dc_j \\ &= \mathbb{E}_{\mathbf{c}}\left[Q_j(c_j, \mathbf{c}_{-j})\frac{F_j(c_j)}{f_j(c_j)}\right].\end{aligned}$$

Bargaining at the production stage

Conditional on **c**, the weighted industry profit is

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

Taking the expectation and substituting

$$\mathbb{E}_{\mathbf{c}}\left[R\left(\sum_{j\in\mathcal{S}} Q_j\right) - \sum_{j\in\mathcal{S}} \Psi_j(c_j;\mu_j) Q_j\right].$$

which is maximum . . .

Return

Bargaining at the selection stage

At the selection stage, the bargaining mechanism maximizes

$$\mathbb{E}\ \sum_j \tilde{x}_j\ \{R(q^m(\Psi_j(c_j;\mu_j))) - c_j q^m(\Psi_j(c_j;\mu_j)) - U_j(c_j, c_{-j})\ + \lambda_j U_j(c_j, c_{-j})\} \quad =$$

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

$$\mathbb{E}\ \sum_j \tilde{x}_j\ \{R(q^m(\Psi_j(c_j;\mu_j))) - \Psi_j(c_j;\lambda_j) q^m(\Psi_j(c_j;\mu_j))\ \} \quad =$$

$$\mathbb{E}\ \sum_j \tilde{x}_j\ \Pi(q^m(\Psi_j(c_j;\mu_j)); \Psi_j(c_j;\lambda_j)).$$

Return

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

$\Rightarrow$ 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