Vertical Separation with Private Contracts

Marco Pagnozzi Salvatore Piccolo

Università di Napoli Federico II and *CSEF*

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  but *a retailer's strategy depends on its conjecture about the wholesale price paid by rival retailers*

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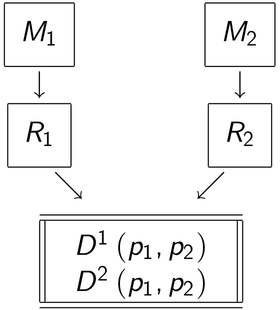
- If retailers conjecture that identical manufacturers always choose identical contracts (**symmetric beliefs**), manufacturers delegate and earn higher profit (with both price and quantity competition)
- When manufacturers delegate, their profit may be higher with private than with public contracts
- The results do not hinge on beliefs being *perfectly* symmetric

Related Literature

- Vertical separation with **public contracts** (Fershtman and Judd, 1987; Bonanno and Vickers, 1988; Vickers 1995; Rey and Stiglitz 1995)
- **Neutrality result** with private contracts and passive beliefs (Coughlan and Wernerfelt, 1989; Katz 1991; Caillaud and Rey 1995)
- Beliefs with a single manufacturer and **multiple retailers** (Horn and Wolinsky 1988; Hart and Tirole 1990; McAfee and Schwartz 1994; Rey and Vergè 2004)
- Vertical separation with **asymmetric information** (Katz 1991; Caillaud, Jullien and Picard 1995)

Model

- 2 manufacturers: M_1 and M_2 produce substitute goods
- 2 exclusive retailers: R_1 and R_2
- $D^i(p_i, p_j)$ = (smooth, symmetric) demand for good i, $i = 1, 2$
- Marginal cost = 0



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4. R_i observes demand and pays $w_i \cdot D^i \left(p_i, p_j\right)$

Assumptions

- $\dfrac{\partial D^i(p_i, p_j)}{\partial p_i} < 0; \quad \dfrac{\partial^2 D^i(p_i, p_j)}{\partial p_i^2} \leq 0$
- $\dfrac{\partial D^i(p_i, p_j)}{\partial p_j} \geq 0$: *substitute goods*

Let $\Pi_i(p_i, p_j) = D^i(p_i, p_j)(p_i - w_i)$ (retailer's profit)

- $\dfrac{\partial^2 \Pi_i(p_i, p_j)}{\partial p_i \partial p_j} > 0$: *strategic complements*
- $\dfrac{\partial^2 \Pi_i(p_i, p_j)}{\partial p_i^2} + \dfrac{\partial^2 \Pi_i(p_i, p_j)}{\partial p_i \partial p_j} < 0$: *stability*

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2. **Symmetric Beliefs**: R_i believes that M_i and M_j always offer the same contract — i.e., $\widetilde{w}_j(w_i) = w_i$
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3. **Mixed Beliefs**: if R_i is offered $w_i \neq w_i^*$, he believes that, with probability α, R_j is offered w_i and, with probability $(1-\alpha)$, R_j is offered w_j^*

Interpretation of Symmetric Beliefs I

- Passive beliefs may not be the most natural assumption:

  "If a manufacturer wants to change its contract, why should a competing identical manufacturer not want to do the same?"

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- **Incomplete Information**: retailers' are uninformed about some (correlated) characteristics of manufacturers that affects their contracts

e.g., Symmetric beliefs arise in a Hotelling model in which manufacturers are privately informed about their correlated costs of production, and costs have full support

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- With passive beliefs, a retailer must compute manufacturers' equilibrium contracts, given retailers' strategies, to make a conjecture about opponents' wholesale prices

$\Rightarrow$ symmetric beliefs are a "rule of thumb": a retailer bases his conjecture on the manufacturer's offer and only computes its own best strategy

Presentation Outline

- Beliefs:
  - Passive
  - Symmetric beliefs
  - Mixed
- Uncertainty about manufacturers' costs
- Extensions:
  - Private vs. public contracts
  - Quantity competition

Passive Beliefs

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Lemma

With passive beliefs, $w_1 = w_2 = 0$ *and the retail price is* p^e *s.t.*

$$\underbrace{\frac{\partial D^i(p^e,p^e)}{\partial p_i} p^e + D^i\left(p^e, p^e\right)}_{marginal\ revenue} = 0$$

Neutrality result: *Manufacturers' profit does not depend on their organizational structure (Katz, 1991)*

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- Separated manufacturers act as if integrated with retailers

$\Rightarrow$ Manufacturers have no incentive to sell through retailers

Symmetric Beliefs

- 3 subgames:

1. Both manufacturers choose vertical integration
2. Both manufacturers choose vertical separation
3. One manufacturer chooses separation, the other manufacturer chooses integration

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3. One manufacturer chooses separation,
   the other manufacturer chooses integration

- With integrated manufacturers, the retail price is p^e
  (the same as with passive beliefs)

2 Separated Manufacturers

- Given w_i, R_i maximizes expected profit

$$\max_{p_i} \; (p_i - w_i)\, D^i(p_i, p_j(\widetilde{w}_j(w_i)))$$

where $p_j(\widetilde{w}_j(w_i))$ is R_i's expectation about p_j

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- When R_i is offered w_i, he conjectures that R_j is also offered w_i
- The price chosen by R_j when he is offered w_i is

$$\hat{p} (w_i) \in \arg\max_{p_j} \ (p_j - w_i) D^j (p_j, \hat{p} (w_i))$$

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$\Rightarrow$ When R_i is offered w_i, he chooses $\hat{p} (w_i)$ and expects R_j to choose $\hat{p} (w_i)$ too

2 Separated Manufacturers

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$\Rightarrow$ With symmetric beliefs, separated manufacturers choose

$$w^* \in \arg\max_{w_i} \left[\underbrace{w_i D^i \left(\hat{p}\left(w_i\right), \hat{p}\left(w^*\right)\right)}_{\text{wholesale revenue}} + T_i \right]$$

$$s.t. \quad T_i = \underbrace{D^i \left(\hat{p}(w_i), \hat{p}(w_i)\right) \left(\hat{p}(w_i) - w_i\right)}_{R_i\text{'s expected profit}} \qquad \text{(IR)}$$

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- M_i expects R_j to choose $\hat{p}\left(w^*\right)$ in equilibrium
- R_i believes that R_j chooses $\hat{p}(w_i)$

2 Separated Manufacturers

Lemma

With separated manufacturers, the wholesale price is $w^* > 0$ *s.t.*

$$\underbrace{\frac{\partial D^i(\hat{p}(w^*),\hat{p}(w^*))}{\partial p_i} w^*}_{<0} + \underbrace{\frac{\partial D^i(\hat{p}(w^*),\hat{p}(w^*))}{\partial p_j} (\hat{p}(w^*) - w^*)}_{\textbf{belief effect } >0} \equiv 0$$

and the retail price is $p^* \equiv \hat{p}(w^*) > p^e$

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$\Rightarrow$ M_is charge $w^* > 0$ and reduce competition among retailers

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- With **passive beliefs**, if M_i chooses a high wholesale price M_j has an incentive to undercut it, since R_j expects this to increase profit
- With **symmetric beliefs**, if M_j undercuts M_i's wholesale price R_j does not expect M_i to maintain a high wholesale price, so R_j expects lower profit and pays a lower franchise fee

Asymmetric Hierarchies

- In subgame 3:

Lemma

If M_i is separated while M_j is integrated, M_i chooses $w_i = 0$ and the retail price is p^e s.t.

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- M_i and M_j obtain the same profit

Equilibrium in Period 1

- Since manufacturers extract the whole surplus, M_i's profit is

M_i		Integration	Separation
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There are two equilibria: (I; I) and (S; S).
The equilibrium with separation Pareto dominates (and risk dominates) the equilibrium with integration.

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The equilibrium with separation Pareto dominates (and risk dominates) the equilibrium with integration.

- Separation is a **weakly dominant strategy** (since $p^* > p^e$):

  by charging a high w_i, M_i induces R_i to pay a high fee and sell at a high price, thus increasing profit

Mixed Beliefs

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- Let p_α^* be the equilibrium retail price
- Let $\widetilde{p}_j(w_i)$ be the price that R_i expects R_j to choose, when R_j is offered w_i
- R_i chooses the retail price

$$\hat{p}_\alpha(w_i) \in \arg\max_{p_i} (p_i - w_i) \times \left[\begin{array}{c} \alpha D^i(p_i, \widetilde{p}_j(w_i)) + \\ (1-\alpha) D^i(p_i, p_\alpha^*) \end{array} \right]$$

Mixed Beliefs

- Solving manufacturers' problem:

Lemma

With mixed beliefs, the wholesale price w_α^* is s.t.

$$\frac{\partial D^i(\hat{p}_\alpha(w_\alpha^*),\hat{p}_\alpha(w_\alpha^*))}{\partial p_i} w_\alpha^* + \underbrace{\alpha \frac{\partial D^i(\hat{p}_\alpha(w_\alpha^*),\hat{p}_\alpha(w_\alpha^*))}{\partial p_j} \left(\hat{p}_\alpha\left(w_\alpha^*\right) - w_\alpha^*\right)}_{\textbf{belief effect } > 0} \equiv 0$$

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- The belief effect is *weaker* than with symmetric beliefs

Mixed Beliefs

Theorem

With separated manufacturers, when $\alpha \in (0;1)$
the wholesale price w_{α}^{*} *is s.t.* $0 < w_{\alpha}^{*} < w^{*}$ *and*
the retail price p_{α}^{*} *is s.t.* $p^{e} < p_{\alpha}^{*} < p^{*}$*.*
Separation is a weakly dominant strategy $\forall \alpha \neq 0$*.*

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With separated manufacturers, when $\alpha \in (0;1)$
the wholesale price w^*_α *is s.t.* $0 < w^*_\alpha < w^*$ *and*
the retail price p^*_α *is s.t.* $p^e < p^*_\alpha < p^*$.
Separation is a weakly dominant strategy $\forall \alpha \neq 0$.

$\Rightarrow$ With an arbitrarily small “uncertainty” about a rival's offer, the **belief effect** allows manufacturers to increase profit

Mixed Beliefs

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With separated manufacturers, when $\alpha \in (0;1)$ *the wholesale price* w^*_α *is s.t.* $0 < w^*_\alpha < w^*$ *and the retail price* p^*_α *is s.t.* $p^e < p^*_\alpha < p^*$*.*
Separation is a weakly dominant strategy $\forall \alpha \neq 0$*.*

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- When $\alpha = 0:$ $w_\alpha^* = 0$ and $p_\alpha^* = p^e$ (passive beliefs)
- When $\alpha = 1:$ $w_\alpha^* = w^*$ and $p_\alpha^* = p^*$ (symmetric beliefs)

Uncertainty about Manufacturers' Costs

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$\Rightarrow$ **Partly symmetric beliefs** naturally arise in equilibrium since R_i uses w_i to infer information about c_j and hence w_j

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Theorem

If $\beta \approx 1$, vertical separation is a strictly dominant strategy for manufacturers.

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e.g., With linear demand, profits are higher with private contracts

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$\Rightarrow$ With symmetric beliefs, the *belief effect* allows separated manufacturers to maximize joint profit (by extracting the whole surplus ex ante)

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⇒ With **quantity competition**, prices and manufacturers' profits are always higher with private than with public contracts

Conclusions

- With private contracts and not completely passive beliefs, manufacturers prefer to sell through retailers, both with price and quantity competition
- By charging high wholesale prices, manufacturers earn high fees and reduce competition among retailers (by affecting retailers' beliefs about rivals' strategies)
- Manufacturers may agree to keep contracts private
- Symmetric beliefs naturally arise when manufacturers are privately informed about their correlated costs