Secret Contracting in Interlocking Relationships

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Vertical restraints: theory vs practice

- **Literature**: mostly stylized market structures

  - **Monopoly**, either upstream or downstream (sometimes a competitive fringe)

  ![Diagram showing vertical coordination](image)

  *focus on *vertical coordination*

  - **information**: Rey and Tirole (1986)
  - **supply insurance**: Bolton and Whinston (*RES* 1993)
  - …
Vertical restraints: theory vs practice

- **Literature: mostly stylized market structures (cont’d)**
  - **Competing vertical structures**

  ![Diagram](image)

  e.g., franchising: each manufacturer has its own retail network
  - *collusion:* Jullien and Rey (*Rand* 2007)
  - ...
In practice: multiple “interlocking” bilateral relations

- Competing firms deal with the same competing suppliers
  - aircraft, cars, PCs, ...

- Major brands are carried on by all (or most) supermarket chains
  - Evian & Perrier / Carrefour & Auchan
  - Pepsi & Coke / Walmart & Safeway
Vertical restraints: theory vs practice

- Few papers on this, with two kinds of limitations
  - Restricted class of contracts: e.g., linear tariffs in Dobson & Waterson (*IJIO* 2007); two-part tariffs in Rey & Vergé (*JIE* 2010); linear or two-part tariffs in Allain & Chambolle (*IJIO* 2011)

- Nocke and Rey (2013)
  - Strategic interaction (imperfect competition) at both levels
    - differentiated duopoly upstream
    - Cournot homogeneous duopoly downstream
  - General nonlinear tariffs, secret contracting (passive beliefs)
    - competitive outcome: cost-based marginal input prices
    - exclusive dealing yields vertical foreclosure
    - vertical integration achieves the same result
This paper

Proposes a tractable and flexible model of interlocking relationships

- Differentiated suppliers and differentiated retailers
- Price competition
- Balanced bargaining power in bilateral relations
- Secret contracting
- General non-linear tariffs
- Tractability: “contract equilibrium”

Uses this setup to analyse the competitive effects of vertical restraints

- Resale Price Maintenance (minimum RPM, maximum RPM)
- Price Parity Clauses, Most-favoured Nation Clauses
- Dealership vs Agency
- Exclusive dealing ? Vertical integration? . . . ?
Framework

- **Market structure**
  - Successive duopolies: “manufacturers” $M_A$ and $M_B$, “retailers” $R_1$ and $R_2$
  - Constant returns to scale (at both levels)
  - Product differentiation (at both levels)
  - Exposition: symmetry, i.e., $c_i = c$, $\gamma_i = \gamma$ and $D_{ij}(p) = D(p_{ij}, p_{hj}, p_{ik}, p_{hk})$

- **Competition**
  - Wholesale market: non-linear tariffs $T_{A1}$, $T_{A2}$, $T_{B1}$, $T_{B2}$
  - Retail market: Bertrand competition in prices, $(p_{A1}, p_{B1})$ and $(p_{A2}, p_{B2})$
Secret contracting

- **Secret negotiations between each **$M_i$** and each **$R_j$**
  - The tariff $T_{ij}$ is not observed by $M_h$ or $R_k$ ($h \neq i \in \{A, B\}$, $k \neq j \in \{1, 2\}$)
  - **Avoids “strategic delegation”**
    - with public tariffs, incentives to “distort” them (depart from bilateral efficiency)
    - ... so as to alter downstream rival’s behaviour
    - e.g., increase marginal input prices so as to soften competition
  - **Avoids “technical” problems**
    - with public tariffs and simultaneous take-it-or-leave-it offers, a **multilateral** deviation may trigger a different market structure
    - e.g., a small change in $T_{A1}$ may induce $R_2$ to reject $M_B$’s offer
    - many different types of deviations
      $\rightarrow$ multiple continuation equilibria, inexistence problem.
- **Issue: beliefs**
  - suppose that $M_A$ makes a deviant offer to $R_1$
  - what should $R_1$ think of $M_A$’s offer to $R_2$?
Secret contracting

- **Passive beliefs** (Hart & Tirole, *Brookings* 1990)
  - Tractable: unique candidate equilibrium (cost-based marginal input prices)
  - But with Bertrand competition downstream, non-existence is an issue even without interbrand competition in prices; Rey & Vergé (*Rand* 2004)

- **Wary beliefs** (McAfee & Schwartz, *AER* 1994)
  - More “realistic”? 
  - Boil down to passive beliefs with Cournot competition downstream 
  - But not quite tractable with Bertrand competition downstream, even in the absence of interbrand competition (Rey & Vergé, *Rand* 2004)

- **Here: “Contract equilibrium”**
  - *A set of bilateral contracts forms a contract equilibrium if there is no incentive for a manufacturer and a retailer to alter the terms of their contract*
  - First developed by Crémer & Riordan (*Rand* 1987), later used by O’Brien & Shaffner (*Rand* 1992) in a similar context but without interbrand competition
  - Amounts to focus on “unilateral” deviations (with passive beliefs)
  - Interpretations: equilibrium refinement, (schizophrenic) agents
Competitive equilibrium

- **Competitive game**

1. Wholesale negotiations stage: each $M_i$ and each $R_j$ negotiate a tariff $T_{ij}$
   - maximize the joint profit of $M_i$ and $R_j$ given the other equilibrium tariffs
   - share the surplus according to bargaining power ($\alpha_M = \alpha, \alpha_R = 1 - \alpha$)

2. Retail competition stage: each $R_j$ sets prices $(p_{Aj}, p_{Bj})$, for $j = 1, 2$

Proposition

**There exists an equilibrium in which** $T^*_{ij}(q) = F_{ij} + cq$, for $i \in \{A, B\}$, $j \in \{1, 2\}$:

- all tariffs are two-part tariffs,
- with wholesale prices equal to marginal cost.

**Intuition**

- If $T_{ik}(q) = F_{ik} + cq$, $M_i$’s profit does not depend on sales made through $R_k$
- Joint profit of $M_i$ and $R_j$ is thus equal to (i) full margin on channel $M_i - R_j$ + (ii) downstream margin on channel $M_h - R_j$
- To maximize this, make $R_i$ the residual claimant: $T_{ij}(q) = F_{ij} + cq$
Tariffs that induce smooth retail behavior

Selling $Q_j = (q_{Aj}, q_{Bj})$ gives $R_j$ a retail revenue equal to

$$\rho_j (Q_j) \equiv (\hat{p}_{Aj} (Q_j) - \gamma) q_{Aj} + (\hat{p}_{Bj} (Q_j) - \gamma) q_{Bj},$$

where $\hat{P}_j (Q_j) = (\hat{p}_{Aj} (Q_j), \hat{p}_{Bj} (Q_j))$ is s.t. $\{ D_{ij} (\hat{P}_j, P_k^*) = q_{ij} \}_{i=A,B}.$

The equilibrium tariff $T_{hj}^*$ determines $R_j$’s “best response” to a given $q_{ij}$:

$$q_{hj}^r (q_{ij}) = \arg \max_{q_{hj}} \rho_j (q_{ij}, q_{hj}) - T_{hj}^* (q_{hj}).$$

We will say that $T_{hj}^*$ is “smooth” if it is differentiable and, for any $q_{ij}$:

$q_{hj}^r (q_{ij})$ is unique, characterized by the first-order condition

$$\frac{\partial \rho_j}{\partial q_{hj}} (q_{ij}, q_{hj}^r) = T_{hj}^{*'} (q_{hj}^r), \quad \text{(FOC)}$$

and such that $\frac{dq_{hj}^r}{dq_{ij}}$ exists.

Proposition

*In the class of tariffs that induce smooth retail behavior equilibrium tariffs are all “cost-based.”*
Unique equilibrium outcome in terms of prices and quantities

- Same as in a multi-brand duopoly: $R_1$ and $R_2$ both producing $A$ and $B$ at cost
- $T_{ij}^* (q_{ij}^*) = c$ yields

$$p_{ij}^* = p^* = \arg \max_p (p - c - \gamma) D (p^*, p^*, p^*, p^*) + (p^* - c - \gamma) D (p^*, p, p^*, p^*).$$

But multiple divisions of profits between manufacturers and retailers.

- The tariff $T_{hj}$ affects $M_i$ and $R_j$’s outside options
Competitive equilibrium

Comparison with public contracting

- Rey and Vergé (JIE 2010): upstream bargaining power, two-part tariffs
- No retail bottleneck (potential entrants at each retail location)
  - each manufacturer internalizes retail margins (franchise fees)
  - but free-rides on rival’s upstream margin
  - sustaining monopoly prices would require positive upstream margins
    \[\rightarrow\] the equilibrium is somewhat competitive
- Retail bottlenecks (as in the present paper)
  - each retailer can reject one offer and keep accepting the rival’s one
  - retailers obtain positive rents
  - each retailer is indifferent between accepting both or either of the offers
    \[\rightarrow\] even small deviations can break this indifference
    \[\rightarrow\] multiple types of continuation equilibria
    \[\rightarrow\] existence pbms: for linear demand, no 2x2 eq in half of the parameter space
Endogeneous market structure

- **Market structure game**
  - Manufacturers and retailers simultaneously decide which channels (to which they participate) they are willing to activate.
  - Channel $i - j$ is activated if and only if $M_i$ and $R_j$ are both willing to activate it.
  - For each possible market structure, the payoffs are given by the corresponding contract equilibrium (restricting attention to two-part tariffs).
    - **Result:** for all possible market structures, equilibrium two-part tariffs are cost-based.

- Given that this game has many equilibria due to coordination problems, we concentrate on **coalition-proof Nash-equilibria** of this game (see Bernheim, Peleg and Whinston (*JET* 1987)).
Endogeneous market structure

● (Very Preliminary) Results

● Linear demand system: \( P_{ij} = 1 - q_{ij} - \mu q_{hj} - \rho q_{ik} - \mu \rho q_{hk} \), where \( 0 < \mu, \rho < 1 \).

● Zero marginal production and distribution costs \((c = \gamma = 0)\).

● When retailers are differentiated enough (i.e., \( \rho < \hat{\rho} (\mu) \)), all four channels are activated. Otherwise, there is exclusive dealing.
The impact of RPM

- Suppose now that each $M_i$ and each $R_j$ can contract on
  - a (non-linear) tariff $T_{ij}(q_{ij})$
  - the retail price $p_{ij}$
- The cost-based two-part tariff equilibria without RPM still exists
  - The equilibrium contract $T_{ij}^*(q) = F^* + cq$ induce $R_j$ to maximize the joint profit of the pair $M_i - R_j$.
  - There is thus no need for that pair to contract on $p_{ij}$

- But in addition

**Proposition**

There exists many equilibria with RPM; in particular:

1. There exists another “cost-based” two-part tariffs equilibrium, leading to the same equilibrium retail prices but a different division of profits.
2. There also exists infinitely many other equilibria “around” the above wholesale and retail prices.
Multiple equilibria with RPM

Sketch of the proof

- **There exists another cost-based two-part tariff equilibrium with RPM**

  - Suppose that $T^{**}_{ij}(q) = F^{**} + cq$ and $p^{**}_{ij} = p^*$.

  - The joint-profit of the pair $M_i - R_j$ is given by:

    $$(p_{ij} - c - \gamma) \, D_{ij} \left( p_{ij}, p^*_{-ij} \right) + (p^* - c - \gamma) \, D_{hj} \left( p_{ij}, p^*_{-ij} \right) + F^{**}.$$  

    i) This does not depend on $w_{ij}$ and can as well set $w_{ij} = c$

    ii) It is moreover maximized for $p^{**}_{ij} = p^*$.

- Equilibrium fees are here given by: $F^{**} = \alpha \left[ 2\pi(p^*) - \tilde{\pi}(p^*) \right]$, where

  $$\tilde{\pi}(p) = (p - c - \gamma) \, D(p, \infty, p, p).$$

  As $\tilde{\pi}(p^*) \leq \tilde{\pi}(p^*)$, we have $F^{**} \geq F^*$ $\implies$ $\Pi^{**}_{M} \geq \Pi^*_{M} \geq 0$, but $\Pi^{**}_{R} > 0$:

  $$\Pi^{**}_{R} = 2 \left[ (1 - \alpha) \pi(p^*) + \alpha (\tilde{\pi}(p^*) - \pi(p^*)) \right] > 0.$$
Multiple equilibria with RPM

Sketch of the proof (cont’d)

- There exist other (symmetric) equilibria for retail prices close enough to \( p^* \).

  - For \( p^{**} \) close to \( p^* \), assume that all other contracts are given by
    i) two-part tariff: \( T^{**} = F^{**} + w^{**} q \)
    ii) RPM: \( p^{**} \)
  - The joint-profit of the pair \( M_i - R_j \) is then given by:
    \[
    (p_{ij} - c - \gamma) D \left( p_{ij}, p^{**}, p^{**}, p^{**} \right) + (p^{**} - w^{**} - \gamma) D \left( p^{**}, p_{ij}, p^{**}, p^{**} \right) + (w^{**} - c) D \left( p^{**}, p^{**}, p_{ij}, p^{**} \right)
    \]

  i) This does not depend on \( w_{ij} \) \( \longrightarrow \) can as well set \( w_{ij} = w^{**} \)
  ii) It is maximized for \( p_{ij} = p^{**} \) when \( (w^{**}, p^{**}) \) satisfies

    \[
    -(p^{**} - c - \gamma) \lambda + D(p^{**}) + (p^{**} - w^{**} - \gamma) \lambda_M + (w^{**} - c) \lambda_R = 0
    \]

    \[
    \iff D(p^{**}) - (p^{**} - c - \gamma) (\lambda - \lambda_M) = (w^{**} - c) (\lambda_M - \lambda_R),
    \]

    where

    \[
    \lambda = -\frac{\partial D_{ij}}{\partial p_{ij}}, \quad \lambda_M = \frac{\partial D_{ij}}{\partial p_{hj}}, \quad \lambda_R = \frac{\partial D_{ij}}{\partial p_{ik}}.
    \]
Minimum vs. maximum RPM

Is it min RPM or max RPM that is needed?

**Proposition**

*Minimum RPM may harm consumers if* $\lambda_M > \lambda_R$, *that is, if there is more substitution among brands than among retailers. Conversely, maximum RPM may be harmful if* $\lambda_M < \lambda_R$.*

**Remark:** Consistent with O’Brien & Shaffer (*Rand* 1992) [monopoly brand]

**Sketch of the proof**

Consider an equilibrium with imposed price $p^*$ close to $p^*$. Retailers would want to deviate downwards if and only if:

$$D(p^*) - (p^* - w^* - \gamma)(\lambda - \lambda_M) < 0$$

$$\iff D(p^*) - (p^* - c - \gamma)(\lambda - \lambda_M) + (w^* - c)(\lambda - \lambda_M) < 0$$

$$\iff w^* < c,$$

as $D(p^*) - (p^* - c - \gamma)(\lambda - \lambda_M) = (w^* - c)(\lambda_M - \lambda_R)$ and $\lambda > \lambda_R$. 
Sketch of the proof (cont’d)

Relationship between $p^{**}$ and $w^{**}$?

We have

$$\frac{dp^{**}}{dw^{**}} = \frac{\lambda_M - \lambda_R}{-D},$$

where

$$D = 2\lambda - 2\lambda_M - \lambda_R - \lambda_{MR} + (p^{**} - c - \gamma) \frac{d(\lambda-M)}{dp^{**}} + (w^{**} - c) \frac{d(\lambda-M-\lambda_R)}{dp^{**}},$$

and $\lambda_{MR} = \frac{\partial D_{ij}}{\partial p_{hk}}$.

As long as $D < 0$, $\frac{dp^{**}}{dw^{**}} \bigg|_{w^{**}=c}$ and $\lambda_M - \lambda_R \bigg|_{w^{**}=c}$ have the same sign.

Always satisfied in the linear demand case.
Price parity agreements

- **OFT’s case Imperial Tobacco**: no RPM, but each $M_i$ requires each $R_j$ to sell its product at the same price than its competitor product, i.e., $R_j$ is free to set the price $p_{ij}$ as long as $p_{ij} = p_{hj}$.

- **Are price parity agreements akin to RPM? No, they have no effect.**

  Focus on two-part tariffs (for sake of exposition). When facing wholesale prices $W_j = (w_{ij}, w_{hj})$, $R_j$ sets prices $p_{ij} = p_{hj} = p_j$ such that:

  $$p_j (W_j) = \arg \max_{p_j} \sum_{l=i,h} (p_j - w_{lj} - \gamma) \, D_{lj} (p_j, p_j, p^*_k, p^*_k).$$

  When negotiating over $T_{ij}$, $M_i$ and $R_j$ maximize their joint-profit:

  $$\left( p_j \left( w_{ij}, w^*_{hj} \right) - c - \gamma \right) \, D_{ij} \left( p_j \left( w_{ij}, w^*_{hj} \right), p_j \left( w_{ij}, w^*_{hj} \right), p^*_k, p^*_k \right) + \left( p_j \left( w_{ij}, w^*_{hj} \right) - w^*_{hj} - \gamma \right) \, D_{hj} \left( p_j \left( w_{ij}, w^*_{hj} \right), p_j \left( w_{ij}, w^*_{hj} \right), p^*_k, p^*_k \right) + (w_{ik} - c) \, D_{ik} \left( p^*_k, p^*_k, p_j \left( w_{ij}, w^*_{hj} \right), p_j \left( w_{ij}, w^*_{hj} \right) \right)$$
Price parity agreements

- **Are price parity agreements akin to RPM? No, they have no effect.**

  Using the first-order condition characterizing $p_j(W_j)$, the first-order condition characterizing $w_{ij}^*$ writes as:

  $$p_j'(W_j^*) \left[ (\lambda - \lambda_M) (w_{ij}^* - c) - (\lambda_R + \lambda_{MR}) (w_{ik}^* - c) \right] = 0.$$  

  Similar equations for the other three negotiations. Under reasonable conditions on the demand functions, the unique equilibrium is with cost-based tariffs.

- **In equilibrium, the retail prices are the same than without RPM.**
Agency contracts

- **Agency relationships (online platforms: Amazon, Expedia, ...)**
  - $M_i$ keeps ownership of the goods, has “control” over the retail prices and compensates the retailers for the service they provide
  - $M_i$ and $R_j$ negotiate over the retail price $p_{ij}$ and the compensation to $R_j$
  - The compensation can for instance depend on quantity sold, e.g., a two-part scheme: a fixed ($T_{ij}$) and a per-unit ($m_{ij}$) transfers

- **Agency relationships are thus equivalent to our setting with RPM**
  - Simply rewrite $m_{ij} = p_{ij} - w_{ij}$ and $T_{ij} = F_{ij}$

- **Price Parity Agreements (or also referred to as MFNs)**
  - Interpret price parity as the following: each retailer $R_j$ requires each manufacturer $M_i$ to set the same retail prices for its brand in the other retail outlets (i.e., impose $p_{ij} = p_{ik}$)
  - **Issue**: Once $p_{ik}$ is set, no room for negotiation over $p_{ij}$
    - for any pair of retail prices $(p_i, p_h)$, there exists an equilibrium with $p_{ij} = p_{ik} = p_i$ and $p_{hj} = p_{hk} = p_h$
Research avenues

Interpret RPM as unilateral retail price setting by the manufacturer (could do the same in the standard wholesale contract model).

Issue: timing of decisions

- In some contexts, it may seem natural to have the producer set the retail price before the wholesale contracts are negotiated (for instance when regulatory intervention - resale below-cost laws for instance - lead to such a timing).
- However, in other situations (e.g., e-books, platforms for hotel bookings, app stores), commissions are negotiated before the “producers” (publishers, hotels, app builders, etc.) set their prices.
Conclusion

- **Flexible and yet tractable framework**
  - Upstream and downstream differentiation
  - General non-linear tariffs
  - Balanced bargaining power
  - Allows for vertical restraints

- **Confirms that interlocking relationships “matter”**
  Equilibrium analysis quite different from
  - “flat” market structure (e.g., vertically integrated firms)
  - franchise networks
  - distinct set of suppliers

- “Easy” to test empirically
Conclusion

- Can be put to further use

  - Arbitrary number of firms
    - entry / exit

  - Who deals with whom?

  - Exclusive Dealing
    - mono-branding
    - exclusive territories

  - Vertical Integration

  - Multi-product manufacturers
    - Product variety
    - Product innovation

  - ...

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