Sticks vs. Carrots: Is RPM Necessary?

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Definition

Resale Price Maintenance (RPM)
Contract defining choice of retail price to the retailer, e.g. price ceiling, price floor, administered price.

- Price ceilings $\Rightarrow$ benign, prima facia.
- Price floors $\Rightarrow$ anti-competitive?
  - per-se criminal offence in Canada until 2009.

- Anti-Competitive:
  - Manufacturer Cartels:
    - Tesler (1960)
    - Jullien and Rey (2007)
  - Retailer Cartels:
    - Posner (1976)
    - Rey and Verge (2004)
- Pro-Competitive:
  - Dealer Free-Riding:
    - Mathewson and Winter (1984)
    - Marvel and McCafferty (1984)
    - Perry and Porter (1990)
  - Correlation of Product and Price Info. Costs:
    - Winter (1993)
    - Iyer (1998)
    - Schulz (2004)

- Extant literature has focused on 2 questions:

1. Why is RPM used in a vertical relationship?
   - Incentive incompatibility in provision of sales service.
   - May arise as a solution to a vertical contracting problem.
2. Why the anti-trust imbalance towards price vs. non-price restraints?
   - RPM is outcome equivalent to Closed Distribution Territories.
   - Apply rule-of-reason to RPM.

- Left unanswered: Are vertical restraints necessary?

  If vertical restraints are deemed to be quasi-illegal, or even illegal, they may be dominated by other contractual instruments that are minimally sufficient and not open to legal challenge.

- Sticks vs. Carrots
  - vertical restraints: incentives enforced by threat to suspend supply.
  - bonus scheme: incentives provided by financial carrots.

- Question: Besides RPM, are other contracts minimally sufficient?
- I consider a model in the spirit Winter (1993)

1. Characterize incentive incompatibility in vertical supply chain.
2. Provide expressions for outcome under integration, decentralization.
3. Establish failure of spot-contracts.
4. Analyze vertical contracting in the absence of vertical restraints.
   - *(i)* Retail Bonus Contracts
   - *(ii)* Retail Sharing Contracts
5. *Price Ceilings (Omitted)*

Consider a linear city of unit length.

- **Production:**
  - Manufacturer distributes his product through two independent retailers.
  - Retailers are spatially differentiated, with locations fixed.
  - **Manufacturer:**
    - monopolist producer of indivisible good
    - zero per-unit cost of production
    - chooses contracts to offer retailers from Ω.
  - **Retailers:**
    - purchase good from manufacturer and resell it to consumers.
    - duopolist competitors in both price p and service s.
    - cost of providing service $c(s) = s$.

- Decentralization by assumption.
- Service interpreted as pre-sale service
  - rules out any consumer screening scheme
  - retailers compete in a *single* price and service level
- Service levels unobservable and/or unverifiable, thus not contractible

- **Consumers:**
  - Mass of 2 potential consumers uniformly distributed across city.
  - Each demands 0 or 1. Reservation value R.
  - Consumers are heterogeneous:
    - valuation of service: $\theta\sqrt{s}$
      - $\theta \in \{\theta_L, \theta_H\}$, where $\theta_L < \theta_H$
      - equal measure at each location
    - travel costs: $\theta|d - x|$
      -locations denoted by $x \sim U[0,1]$
  - Consumer decision: 0 *or* 1 and retailer.
  - Utility of consumer $\{x, \theta\}$ when buys from retailer at d offering (p, s) :

$$u(x, \theta) = R + \theta\sqrt{s} - \theta|d - x| - p$$

- Consumer type unobservable to manufacturer/retailer.

- Correlation of price and product info costs may seem ad-hoc.
- A concrete example:
  - Let θ is a consumer's opportunity cost of time
  - Amount of time to travel, and shopping from a retailer given by $|d - x|$
  - However, service decreases shopping time according to the function $\sqrt{s}$
  - Thus, the utility from purchasing

$$u(x, \theta) = R - \theta(|d - x| - \sqrt{s}) - p$$

- **Timing of events:**
  - Stage 1 (Contracting):
    - Manufacturer offers contracts
    - Retailers accept or reject
  - Stage 2 (Retail Competition):
    - Retailers simultaneously choose (p, s)
  - Stage 3 (Consumption):
    - Consumers decide 0 or 1 and retailer.

- Two assumptions to close the model:
- Under vertical integration:
  - *Assumption* (1) - Symmetric configuration of retailers.
  - *Assumption* (2) - Low type consumer are fully served.

  - Necessary condition: $0 < \theta_L < \theta_H < 1$

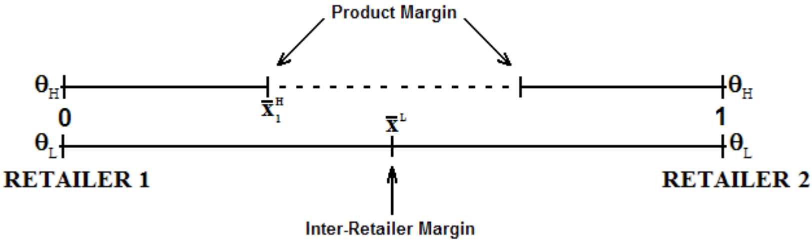
  - (1) rules out large variation between consumer tastes.
  - Else, an asymmetric configuration of stores to segment high and low type consumers.

  - Now, $\nexists$ symmetric equilibrium where both segments fully served.

  - (2) establishes segment of consumers that is fully served is low-type.
  - Else, a price ceiling forms the minimally sufficient contract.

- Characterization of Demand at Retailer 1:

$$q_1(p_1, p_2, s_1, s_2) = \overline{x}^L + \overline{x}_1^H$$



- When vertically integrated, the manufacturer sets the prices and service levels of both stores to maximize total profits
- The manufacturer's problem under vertical integration

$$\max_{p_1, p_2, s_1, s_2} \Pi^M = p_1 q_1(p_1, p_2, s_1, s_2) - s_1 + p_2 q_2(p_1, p_2, s_1, s_2) - s_2$$

- When decentralized, each retailer sets his own prices and service levels, to maximize the profits at his own store
- Given w, a retailer's problem in a decentralized equilibrium

$$\max_{\widehat{p}_1, \widehat{s}_1} \pi_i^r = (\widehat{p}_i - w) q_i(\widehat{p}_i, p_j, \widehat{s}_i, s_j) - \widehat{s}_i$$

- The separation of downstream from upstream results in 2 externalities
  - Use Π^M from vertical integration to write a retailer $i's$ PMP as

$$\max_{\widehat{p_i},\widehat{s_i}} \pi_i^r = \Pi^M - wq_i(\widehat{p_i}, p_j, \widehat{s_i}, s_j) - p_j q_j(\widehat{p_i}, p_j, \widehat{s_i}, s_j) - s_j$$

  - The FOCs characterizing equilibrium choice of (p_i, s_i)

$$\frac{\partial \pi_i}{\partial p_i} = \frac{\partial \Pi^M}{\partial p_i} - w\frac{\partial q_i}{\partial p_i} - p_j\frac{\partial q_j}{\partial p_i} = 0$$
$$\frac{\partial \pi_i}{\partial s_i} = \frac{\partial \Pi^M}{\partial s_i} - w\frac{\partial q_i}{\partial s_i} - p_j\frac{\partial q_j}{\partial s_i} = 0$$

  - Vertical Externality: Double Marginalization
  - Horizontal Externality: Competition and Nash Conjectures

- *Under Assumptions (1) and (2), the symmetric price and service levels under vertical integration*

$$p^* = \frac{2R + \theta_H}{4 - \theta_H}$$
$$s^* = \frac{1}{4}(p^*)^2$$

- Under vertical integration, manufacturer focuses on product margin
  - Consumers on the product margin are high type
    - high level of service to attract high type consumers into market.
    - high types less price-elastic ⇒ charge a higher price in return.

- Given w, in any symmetric decentralized equilibrium where they low types are fully served

$$p^D(w) = \frac{(2R + \theta_H)\theta_L}{(4 - \frac{3}{2}\theta_H)\theta_L + \theta_H} + \frac{\theta_H + (2 - \frac{3}{2}\theta_H)\theta_L}{(4 - \frac{3}{2}\theta_H)\theta_L + \theta_H} w$$

$$s^D(w) = \frac{9}{16}[p^c(w) - w]^2$$

- When decentralized, retailers consider inter-retailer margin as well.
  - Consumers on inter-retailer margin are low type
    - low type consumers have less use for service.
    - instead, attracted to one retailer over another by lower prices

Integrated	Decentralized
$p^* = \frac{2R+\theta_H}{4-\theta_H}$	$p^D = \frac{(2R+\theta_H)\theta_L}{(4-\frac{3}{2}\theta_H)\theta_L+\theta_H} + \frac{\theta_H+(2-\frac{3}{2}\theta_H)\theta_L}{(4-\frac{3}{2}\theta_H)\theta_L+\theta_H} w$
$s^* = \frac{1}{4}[p^*]^2$	$s^D = \frac{9}{16}[p^D - w]^2$

- Note:
  - Decentralized service levels depends on retail margin.
  - Difference between price under VI and D **not only** due to intro. of w
  - Even when $w = 0$, $p^* \neq p^D$ since there is a horizontal externality

Proposition

In a decentralized retail network $\{F, w\}$ *fails to coordinate the vertical supply chain. However,* $\{F, w, \underline{p}\}$ *is sufficient.*

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- Failure of Spot Contracts:
  - Sufficiency of spot contracts requires $\epsilon_p^r / \epsilon_p^M = \epsilon_s^r / \epsilon_s^M$
  - But in the model, retailers bias towards price competition, in the sense that
$$\frac{\epsilon_p^r}{\epsilon_p^M} = \frac{\theta_H}{\theta_H + 2\theta_L} > \frac{1}{3} = \frac{\epsilon_s^r}{\epsilon_s^M}$$
  - Price competition drives retail margins too low to underwrite service.
- Vertical Restraints:
  - RPM can serve to guarantee a large enough retail margin.

- Driving Force Behind Price Floors

  1. Retailer competition in price and service
  2. Bias towards price competition in the sense that

$$\frac{\epsilon_p^r}{\epsilon_p^M} > \frac{\epsilon_s^r}{\epsilon_s^M}$$

  or equivalently

$$MRS_{p,s}^r > MRS_{p,s}^M$$

- RPM *can* align the incentives of retailers and manufacturer.
- However, RPM may be legally unenforceable.
  - court of law may not rule for manufacturer if retailer breaches floor.
  - optimal strategy for a retailer, is indeed, to breach price floor.

- Manufacturer may be interested in other forms of contracting.
  - Basic problem: w/o sufficient incentives, retailers under-provide service.
  - Intuitive solution: financial incentive scheme.

- We now look for alternative minimally sufficient contracts
  1. Bonus Contracts - Contracts based on a retailer's own targets
  2. Sharing Contracts - Contracts based on a retailer sharing scheme

- We take a First Order Approach to the Vertical Contracting Problem
  - Demand is well-behaved
  - Profit functions are strictly quasi-concave

- What type of incentive contacts are feasible?:
  - *Prices*
  - *Service Levels*
  - *Profits*
  - *Sales Quantity*
  - *Sales Revenue*

- Consider the contract $\{F, w, I(T)\}$ where $T \in \{\pi, q, R\}$.
- The design problem

$$\max_{\substack{F,w,I(T)\\ p_1,s_1,p_2,s_2}} \; (w-c)q_1 + F - I(T_1) + (w-c)q_2 + F - I(T_2)$$

$$st. \quad for\ i = 1,2\ and\ j \neq i$$

$$(IR_i) \quad (p_i - w)q_i - F + I(T_i) \geq 0$$

$$(IC_i) \quad (p_i, s_i) \in \arg\max_{\widehat{p}_i, \widehat{s}_i} \; (\widehat{p}_i - w)\widehat{q}_i - F + I(\widehat{T}_i) \;\; st.\ (\widehat{p}_j, \widehat{s}_j) = (p_j, s_j)$$

Proposition

Neither $\{F, w, I(\pi)\}$ *nor* $\{F, w, I(q)\}$ *are sufficient to achieve the first-best equilibrium. However,* $\{F, w, I(R)\}$ *is sufficient.*

- Sketch of Proof:
  - Part (i) (with some abuse of notation):
    - since $\nexists$ w s.t.

$$\frac{\partial \pi_i^r(p^*, s^*, w)}{\partial p_i} = \frac{\partial \pi_i^r(p^*, s^*, w)}{\partial s_i} = 0.$$

    - Thus, $\nexists$ $\{w, I(\pi_i^r)\}$ s.t.

$$(1 + I'(\pi_i^r))\frac{\partial \pi_i^r(p^*, s^*, w)}{\partial p_i} = (1 + I'(\pi_i^r))\frac{\partial \pi_i^r(p^*, s^*, w)}{\partial s_i} = 0.$$

  - Part (ii): (by contradiction)
    - From the FOCs characterizing (p_i, s_i), sufficiency of $I(q)$ requires

$$\frac{\epsilon_p^r}{\epsilon_p^M} = \frac{\epsilon_s^r}{\epsilon_s^M}$$

    - But in our model

$$\frac{\epsilon_p^r}{\epsilon_p^M} > \frac{\epsilon_s^r}{\epsilon_s^M}$$

- Part (*iii*): (direct)
  - Use Π^M to rewrite retailer $i's$ problem as

$$\max_{\widehat{p}_i, \widehat{s}_i} \pi_i^r = \Pi^M - wq_i - p_j q_j - s_j + I(R_i)$$

  - The FOCs characterizing equilibrium choice of (p_i, s_i)

$$\frac{\partial \pi_i}{\partial p_i} = \frac{\partial \Pi^M}{\partial p_i} - w\frac{\partial q_i}{\partial p_i} - p_j \frac{\partial q_j}{\partial p_i} + I'(R_i)\frac{\partial R_i}{\partial p_i} = 0 \quad (1)$$

$$\frac{\partial \pi_i}{\partial s_i} = \frac{\partial \Pi^M}{\partial s_i} - w\frac{\partial q_i}{\partial s_i} - p_j \frac{\partial q_j}{\partial s_i} + I'(R_i)\frac{\partial R_i}{\partial s_i} = 0 \quad (2)$$

- Using (2), set w to elicit s^*, conditional on p^*

$$w^R = \left(\frac{\epsilon_s^r}{\epsilon_s^M} + I'(R^*) \right) p^*$$

- Now, from (1), the differential equation characterizing $I(R)$

$$I'(R^*) = \left(\frac{\epsilon_p^r}{\epsilon_p^M} - \frac{\epsilon_s^r}{\epsilon_s^M} \right) \epsilon_p^r$$

- Finally to extract downstream rents & achieve budget balancedness

$$F^R = \pi_i^r + I(R^*)$$

- $I(\pi_i^r)$ does not alter decentralized outcome at all.
- $I(q_i)$ does not alter bias towards price competition.
  - retailer may want to increase q, to get higher $I(q_i)$, by accommodating high types
  - however, if does so, opponent will undercut on price to steal low types
  - thus, does not disengage from price competition
- Result more broad than appears:
  1. Consider $wq - I(q) \Rightarrow$ non-linear wholesale pricing
  2. Corollary: Quantity forcing is insufficient

- An incentive scheme based on revenue (or "*sales*") bonuses is minimally sufficient
  - Examples: Sales Commissions, Revenue Support Adjustments, ...

- $I(R_i)$ exploits cause of incentive incompatibility

$$I'(R^*) = \left(\left| \frac{\epsilon_p^r}{\epsilon_p^M} - \frac{\epsilon_s^r}{\epsilon_s^M} \right| \right) \epsilon_p^r$$

  - higher bonus levels attainable not only by ↑ sales, but also by ↑ price.
  - higher service follows, as there is sufficient price cost margin.

- Upstream firm's role in this contract cannot be understated
  - Holmstrom (1982) third-party budget breaker
  - Collects resources up-front, through F, to finance $I(R)$

- Capital constrained retailers not able to finance large franchise fees.
- Bonus scheme will be infeasible.

- Incentive schemes must be budget-balanced at the downstream level

- A *profit sharing* scheme is sufficient and downstream budget-balanced
- But profits may be unobservable/unverifiable...

- M sports franchises symmetrically spaced around a circular city
- Each franchise competes against neighbors:
  1. Price of stadium tickets
  2. "Competitiveness" of their team

- Two types of consumers
  1. Diehards:
     - Support their chosen team, regardless of whether it is winning or losing
     - Are more prone to travelling to "away games"
  2. Bandwagons:
     - Support their chosen team, only if it is having a winning season
     - Prefer going to "home games"

- Franchisor prefers "parity" and "highly competitive teams"
  - Claim that this will "broaden fan-base"
- Franchisees are biased towards price competition
  - More likely to offer discounted tickets than a "winning" team
- Incentive scheme in sports franchising $\Rightarrow$ Revenue Sharing

- Consider the contract $\{F, w, S(R)\}$
  - manufacturer collects $S(R_1)$ from retailer 1 and gives it to retailer 2
  - in return, retailer 1 receives $S(R_2)$ from retailer 2

- By construction, sharing rule is downstream budget-balanced

- Not obvious that a revenue sharing scheme is sufficient
  - getting a share of opponent's revenue may create incentives
  - taking away part of own revenue has the reverse effect

Proposition

In a decentralized retail network, $\{F, w, S(R)\}$ is sufficient and downstream budget balanced

- Sketch of Proof:
  - The first order conditions characterizing retailer choice of (p_i, s_i)

$$\frac{\partial \pi_i}{\partial p_i} = \frac{\partial \Pi}{\partial p_i} - w\frac{\partial q_i}{\partial p_i} - p_j\frac{\partial q_j}{\partial p_i} - S'(R_i)\frac{\partial R_i}{\partial p_i} + S'(R_j)\frac{\partial R_j}{\partial p_i} = 0 \quad (3)$$

$$\frac{\partial \pi_i}{\partial s_i} = \frac{\partial \Pi}{\partial s_i} - w\frac{\partial q_i}{\partial s_i} - p_j\frac{\partial q_j}{\partial s_i} - S'(R_i)\frac{\partial R_i}{\partial s_i} + S'(R_j)\frac{\partial R_j}{\partial s_i} = 0 \quad (4)$$

- From (4), set w to elicit s^*, conditional on p^*

$$w^{Sharing} = \left(\frac{\epsilon_s^r}{\epsilon_s^M} [1 - S'(R^*)] - S'(R^*) \right) p^* \quad (5)$$

- Then from (3), the differential equation characterizing $S(R)$

$$S'(R^*) = \frac{\frac{\epsilon_p^r}{\epsilon_p^M} - \frac{\epsilon_s^r}{\epsilon_s^M}}{\left(\frac{\epsilon_p^r}{\epsilon_p^M} - \frac{\epsilon_s^r}{\epsilon_s^M} - \frac{1}{\epsilon_p^r} \right)} \quad (6)$$

- I Characterize the *remainder* of the solution space of Winter (1993).
- More complete understanding of the vertical contracting problem:
    1. Provide better understanding why sophisticated contracts are needed.
    2. Show minimally sufficient contracts not restricted to vertical restraints.
    3. Establishes that solution space is complex.