Supplier Encroachment with a Dual-Purpose Retailer

3 Model and Benchmark

3.1 Model Setup

Suppltailerier

- sell through retailer

dual-purpose retailer

- choose order quantity
- maximize profit and consumer surplus

Strategies of retailer:

- Consumer cooperatives
- Certified B Corporation
- Commercial nonprofit

1: retailer's weight on profit
$\delta \in [0, 1)$: retailer's weight on consumer surplus

objective function:

- $v_R = \pi_R + \delta_{CS}$
- $v_S = \pi_S$
  - π: profit

c: Supplier direct selling cost

$p = a - bQ$: market clearing price

- Q: total quantity

$U(Q) = aQ - \frac{bQ^2}{2}$" consumer utility function

$cs = U(Q) - pQ = \frac{bQ^2}{2}$: consumer surplus

(in 5.1: $cs_R = \frac{q_R \cdot cs}{q_R + q_S}$)

1. Supplier decide encroach ability
2. supplier decide w(whilesale price)
3. retailer decide q_R(quantity)
4. supplier decide q_S(quantity)

3.2 Benchmark Analysis

3.2.1 Benchmark Game

for-profit retailer, no encroachment:

$$w^N = \frac{a}{2}$$
$$q_R^N = \frac{a}{4b}$$
$$\pi_S^N = \frac{a^2}{8b}$$
$$\pi_R^N = \frac{a^2}{16b}$$
$$cs^N = \frac{a^2}{32b}$$

3.2.2 The Peril of Being a Dual-Purpose Firm

dual-purpose retailer, no encroachment

$$w^{RN} = \frac{a}{2}$$
$$q_R^{RN} = \frac{a}{4b - 2b\delta}$$

$$\pi_S^{RN} = \frac{a^2}{4b(2-\delta)}$$
$$\pi_R^{RN} = \frac{a^2(1-\delta)}{4b(2-\delta)^2}$$

$$cs^{RN} = \frac{a^2}{8b(2-\delta)^2}$$

Observation 1

> In the absence of supplier encroachment, a dual-purpose retailer earns a lower profit than a for-profit retailer.

3.2.3 The Bright Side and Downside of Supplier Encroachment.

for-profit retailer, encroachment

Observation 2 (The Bright Side of Supplier Encroachment)

> In the benchmark with a for-profit retailer,
>
> (i) the supplier is never worse off for having the encroachment ability, and strictly better off for having the option of encroachment when
>
> $c \in [0, 5a/6)$;
>
> (ii) the retailer can be better off by supplier encroachment when
>
> $c \in (3a/[4\sqrt{2}], (1-\sqrt{2}/4)a)$.

Observation 3 (The Downside of Supplier Encroachment)

> In the benchmark with a for-profit retailer,
>
> both the retailer and consumers can be worse off by supplier encroachment when
>
> $c \in (3a/4, 5a/6)$.

4 Results

dual-purpose encroachment

4.1 Equilibrium

(1)

$\pi_S = (a - bq_R - bq_S)\, q_S - cq_S + wq_R$

(2)

$v_R = (a - bq_R - bq_S)\, q_R - wq_R + \frac{b\delta}{2}\,(q_R + q_S)^2$

4.2 Encroachment Outcomes under Dual-Purpose Setting

Proposition 1

> With a for-profit supplier and a dualpurpose retailer, there exists a threshold on δ, denoted by $\delta_E = 2\sqrt{2} - 2 < 1$, such that:
>
> (i) When $\delta \in [0, \delta_E]$,
>
> - (a) the supplier is better off for having the option of encroachment if $c \in [0, c_2(\delta))$,
> - (b) the supplier is indifferent if $c \in [c_2(\delta), a)$.
>
> (ii) When $\delta \in (\delta_E, 1)$,
>
> - (a) the supplier is better off for having the option of encroachment if $c \in [0, c_3(\delta))$ or $c \in (c_4(\delta), c_1(\delta))$ or $c \in (\max\{c_1(\delta), c_5(\delta)\}, c_2(\delta))$,
> - (b) the supplier is worse off for having the option of encroachment if $c \in (c_3(\delta), \min\{c_1(\delta), c_4(\delta)\})$ or $c \in (c_1(\delta), c_5(\delta))$, and
> - (c) the supplier is indifferent if $c \in [c_2(\delta), a)$.

Proposition 2

> With a for-profit supplier and a dualpurpose retailer, there exists a threshold on δ, denoted by $\delta_R = (34 - 16\sqrt{2})/23 < 1$, such that:
>
> (i) When $\delta \in [0, \delta_R]$, the retailer is better off by supplier encroachment if $c \in (c_6(\delta), c_7(\delta))$, and worse off by supplier encroachment if $c \in [0, c_6(\delta))$ or $c \in (c_7(\delta), a)$.
>
> (ii) When $\delta \in (\delta_R, 1)$, the retailer is always worse off by supplier encroachment.

4.3 Implication for Firm Profitability

- Retailer can boost profit from being dual-purpose?

Proposition 3

> In the presence of supplier encroachment, a dual-purpose retailer earns a higher profit than a for-profit retailer when:
>
> (i) $c \in \left(c_3(\delta), \min\left\{(3a\sqrt{2-2\delta})/(8-4\delta), c_4(\delta)\right\}\right)$; or
>
> (ii) $c \in \left(\max\left\{a - a\sqrt{2-2\delta}/(4-2\delta), c_2(\delta)\right\}, 5a/6\right)$.

4.4 Implications for Consumer Surplus

Proposition 4

> Consumer surplus when the retailer is a dual-purpose corporation compared to when he is a purely for-profit firm:
>
> (i) is lower if $c \in (c_3(\delta), \min\{(3a-3a\delta)/(2-\delta), c_4(\delta)\})$;
>
> (ii) is indifferent if $c \in (3a/5, c_2(\delta))$;
>
> (iii) is higher if c is not within the region specified above.

Proposition 5

> Retailer's interest in consumer surplus
>
> (i) increases his own profit but reduces consumer surplus if $c \in \left(c_3(\delta), \min\{(3a\sqrt{2-2\delta})/(8-4\delta), (3a-3a\delta)/\ \ (2-\delta), c_4(\delta)\}\right)$;
>
> (ii) increases both his own profit and consumer surplus if $\ \ (a)\ \ \ c \in \left(\max\left\{c_3(\delta), (3a-3a\delta)/(2-\delta)\right\}, (3a\ \sqrt{2-2\delta})/(8-4\delta)\right)$; or (b) $c \in (\max\{a - a\sqrt{2-2\delta}/\ \ (4-2\delta), c_2(\delta)\}, 5a/6)$.

5 Extensions

5.1 Consumer Surplus Specific to the Retailer’s Quantity

retailer only care his consumers' surplus

$$cs_R = \frac{q_R \cdot cs}{q_R + q_S}$$

Proposition 6

> Under the parsimonious dual-purpose retailer setting,
>
> (i) the supplier is always better off for having the encroachment ability;
>
> (ii) the retailer is better off by supplier encroachment if $c \in (\bar{c}_3(\delta), \bar{c}_4(\delta))$.

Proposition 7

> (i) The retailer earns a higher profit from establishing himself as a parsimonious dual-purpose firm rather than a pure profit maximizer if:
>
> - (a) $c \in (\bar{c}_5(\delta), \bar{c}_6(\delta))$; or $
> - (b) c \in\left(\max \left\{\bar{c}*{2}(\delta), \bar{c}*{7}(\delta)\right\}, 5 a / 6\right) $.
>
> (ii) The presence of parsimonious dual-purpose retailer has no effect on consumer surplus if $c \in (3a/5, \bar{c}_2(\delta))$; Otherwise, it always increases consumer surplus.

5.2 Extremely High Interests in Consumer Surplus

$\delta \in [1, 2)$

Proposition 8

> When $\delta \in [1, 2)$,
>
> (i) the supplier is worse off for having the option to encroach if $c \in (0, \tilde{c}_2(\delta))$;
>
> (ii) the retailer's profit is always worse off by supplier encroachment;

> (iii) the dual-purpose structure always hurts the retailer's profit but benefits consumer surplus.

5.3 Price Competition

k: differentiation

$$q_i = \frac{(1-k)a - p_i + kp_i}{1-k^2}$$

- tension between supplier encroachment and the retailer’s dual-purpose structure becomes less intense
- the encroachment deterrence effect (i.e., deterring the supplier from selling a positive quantity) is not present with a dual-purpose retailer
- the reduction in wholesale price is less pronounced than under quantity competition
- the supplier will sell a positive quantity through her direct channel in a smaller region of parameter space
- the supplier secures greater retail profit (relies more on reselling) by raising the wholesale price even if her selling cost is relatively small