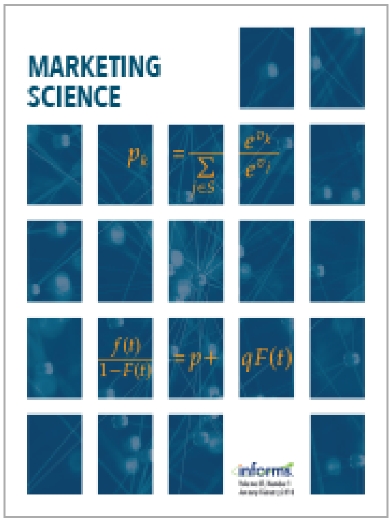

Marketing Science

Publication details, including instructions for authors and subscription information:
http://pubsonline.informs.org

Do Returns Policies Intensify Retail Competition?

Hao Wang,

MARKETING SCIENCE
Vol. 23, No. 4, Fall 2004, pp. 611–613
ISSN 0732-2399 | EISSN 1526-548X | 04 | 2304 | 0611

DOI 10.1287/mksc.1030.0025

Do Returns Policies Intensify Retail Competition?

Hao Wang
China Center for Economic Research, Peking University, Beijing, 100871, P.R. China, hwang@ccer.edu.cn

The paper "Manufacturer's Returns Policies and Retail Competition" by Padmanabhan and Png (1997) argues that returns policies intensify retail competition and therefore raise the manufacturer's profits. They reach that result through a problematic method to solve the game. Particularly, in the game where the manufacturer accepts returns, they unreasonably assume the retailers would never face stock constraints, thus changing the retail competition from a Cournot-like competition to a Bertrand one. Actually, in a game where retailers first order stocks and then compete by choosing prices, even if a manufacturer offers full return policies, the retailers can still use "insufficient" stocks as quantities precommitment in order to uphold retail prices. Hence, the retailers still face stock constraints at the final stage of the game. The nature of the game is essentially unaffected by returns policies when demand is certain. This note shows that returns policies do not intensify retail competition in the model proposed by Padmanabhan and Png (1997).

Key words: returns policies, retail competition; demand uncertainty; pricing
History: This paper was received March 6, 2002, and was with the author 1 month for 2 revisions.

1. The Paper

In this note we will discuss the paper "Manufacturer's Returns Policies and Retail Competition" by Padmanabhan and Png (1997)—PP hereafter—published in *Marketing Science*. PP consider a market where a monopoly upstream manufacturer sells through one or two downstream retailers. The product has limited shelf life. The retailers face linear demand curves. On pages 83–84, the paper defines a three-stage game:

> 1. The manufacturer sets distribution policy, which includes a uniform wholesale price and possibly a returns policy; 2. Given the manufacturer's distribution policy, the retailer(s) decide how much stock to order; 3. With stocks in hand, the retailer(s) set prices to the final consumers.

The central points of the paper can be summarized as follows. It first considers a benchmark where there is a single retailer. It is shown that a returns policy makes no difference in that case. Then the paper studies the case with two competing retailers. It finds a returns policy that intensifies the downstream competition, therefore leading to higher profits for the manufacturer. Notations include marginal production cost c, wholesale price w, retail price p, and retail stock s. Demand functions: $q = \alpha - \beta p$ for the monopoly retailer, and $q_1 = \alpha - \beta p_1 + \gamma p_2$, $q_2 = \alpha - \beta p_2 + \gamma p_1$ ($\beta > \gamma$) for the duopoly retailers.

2. Returns Policies and Retail Competition

Kreps and Scheinkman (1983) study a two-stage oligopoly game. In that game, competing firms first simultaneously choose production quantities. After the production levels are made public, there is price competition. Under certain conditions, they show that the unique equilibrium outcome is the Cournot outcome. The game proposed by PP actually fits the Kreps and Scheinkman model perfectly, except now we have a three-stage game where two competing retailers order stocks from an upstream manufacturer. Retail stocks are chosen at the second stage, and retail prices are chosen at the third stage. The question is whether a returns policy at the third stage affects the nature of the game. PP claim that in the game with returns, the retailers should always order sufficient stocks at the second stage, such that they never face stock constraints at the third stage. This means the game with a returns policy is no longer a Cournot-like game, but a Bertrand game, because the only effective decision of the retailers is choosing prices. This belief is not reasonable, because it deprives the retailers of the right to choose optimal stocks at the second stage. In fact, it is still in the retailers' interest to use stocks as quantities precommitment in order to uphold prices at the third stage. For example, suppose both retailers provide exactly identical services to consumers. According to PP, the downstream price competition should result in competitive outcome, which means zero profits for both retailers. However, if either retailer ordered stock less than the competitive level at the second stage, both retailers would make positive profits. Hence, ordering "insufficient" stock makes the retailers better off.

In the game with returns, PP find the "equilibrium" wholesale price

$$w^* = \frac{\alpha + (\beta - \gamma)c}{2(\beta - \gamma)},$$

retail prices

$$p_1^* = p_2^* = \frac{(3\beta - 2\gamma)\alpha + \beta(\beta - \gamma)c}{2(2\beta - \gamma)(\beta - \gamma)},$$

and minimal retail stocks

$$s_1^* = s_2^* = \frac{\beta[\alpha - (\beta - \gamma)c]}{2(2\beta - \gamma)}.$$

Assuming that the retailers do not order excess stocks, PP find the manufacturer makes more profit with returns. This result is incorrect because of the problematic method used. The following two claims represent the finding of this research note. Claim 1 shows that the "equilibrium" found by PP is not an equilibrium. Claim 2 shows that returns policies make no difference in equilibrium.

Claim 1. *Starting from stocks $s_1 \geq s_1^*$ and $s_2 \geq s_2^* = s_1^*$ at the second stage, if either retailer instead orders stock $s_1^* - \varepsilon$, where $\varepsilon > 0$ is sufficiently small, she would make more profits.*

Proof. First we assume $s_1 = s_2 = s_1^* = s_2^*$. Now suppose Retailer 1 deviates to $s_1^\circ = s_1^* - \varepsilon$. While PP's "equilibrium" prices p_1^*, p_2^* now lead to a shortage, the retailers should charge higher retail prices that clear the market.[1] The retail prices satisfy $\alpha - \beta p_1 + \gamma p_2 = s_1^\circ = s_1^* - \varepsilon$ and $\alpha - \beta p_2 + \gamma p_1 = s_2^*$. From them we can work out the retail price $p_1^\circ = p_1^* + \beta\varepsilon/(\beta^2 - \gamma^2)$. Therefore, Retailer 1's profit after the deviation is

$$\pi_1^\circ = s_1^\circ(p_1^\circ - w^*) = (s_1^* - \varepsilon)\left(p_1^* - w^* + \frac{\beta\varepsilon}{\beta^2 - \gamma^2}\right)$$
$$= \pi_1^* + \left(\frac{\beta s_1^*}{\beta^2 - \gamma^2} - p_1^* + w^*\right)\varepsilon - \frac{\beta\varepsilon^2}{\beta^2 - \gamma^2}.$$

To show $\pi_1^\circ > \pi_1^*$, we only need $\beta s_1^*/(\beta^2 - \gamma^2) - p_1^* + w^* > 0$. Substituting s_1^*, p_1^*, and w^* into it, we would see that the inequality holds if and only if $\alpha - \beta c + \gamma c > 0$, which is assumed in the model.[2] Thus the deviation makes Retailer 1 better off.

Now we show that if $s_1 > s_1^*$ and $s_2 > s_1^*$, deviating to $s_1^\circ = s_1^* - \varepsilon$ makes Retailer 1 better off. Assuming ε is sufficiently small, Retailer 1 would face stock constraint, but Retailer 2 would not. Retailer 2 solves: $\text{Max}_{p_2}(p_2 - w^*)(\alpha - \beta p_2 + \gamma p_1)$, whose second-order condition is $\alpha - 2\beta p_2 + \gamma p_1 + \beta w^* = 0$, together with $\alpha - \beta p_1 + \gamma p_2 = s_1^* - \varepsilon$, we get $p_1^\circ = p_1^* + 2\beta\varepsilon/(2\beta^2 - \gamma^2)$. Therefore, Retailer 1's profit after the deviation is:

$$\pi_1^\circ = s_1^\circ(p_1^\circ - w^*) = (s_1^* - \varepsilon)\left(p_1^* - w^* + \frac{2\beta\varepsilon}{2\beta^2 - \gamma^2}\right)$$
$$= \pi_1^* + \varepsilon\left(\frac{2\beta s_1^*}{2\beta^2 - \gamma^2} - p_1^* + w^*\right)$$
$$- \frac{2\beta\varepsilon^2}{2\beta^2 - \gamma^2}.$$

To show $\pi_1^\circ \geq \pi_1^*$, we need $2\beta s_1^*/(2\beta^2 - \gamma^2) - p_1^* + w^* > 0$. Substituting w^*, s_1^*, and p_1^* into it, the inequality holds if and only if $\alpha - \beta c + \gamma c > 0$, which is assumed. It is easy to see that other situations ($s_1 > s_1^*$ and $s_2 = s_1^*$, or, $s_1 = s_1^*$ and $s_2 > s_1^*$) are not troubling. □

Claim 2. *In the game with returns, the equilibrium is the same as that without returns.*

Proof. Please see the Appendix.

Claim 2 shows that the retailers still play a Cournot-like game, but not a Bertrand game. That means the retailers still use stocks as quantities precommitment even if the manufacturer accepts returns. Particularly, they never order excess stocks.

3. Conclusion

The paper by PP (1997) claims that returns policies intensify retail competition. This result cannot be reached if the model is solved correctly. The paper unreasonably assumes that the retailers never face stock constraints when they are offered returns policies. As Kreps and Scheinkman (1983) demonstrate, firms can use quantity precommitment to achieve a Cournot-like outcome, even if they engage in price competition at the final stage of the game. A returns policy cannot change this story, particularly when demand is certain. Due to the problematic method used to solve the model, PP (1997) incorrectly alters the game with returns from a Cournot-like game to a Bertrand game. Singh and Vives (1984)

[1] This is because the retailers' revenue functions are strictly concave over the relevant range of p_1 or p_2.

[2] Actually PP do not explicitly assume $\alpha - \beta c + \gamma c > 0$, but this condition is required for the model to make sense. Otherwise, even if both retailers charge prices equal to the marginal production cost c, the total quantity demand is still nonpositive. Thus, the equilibrium would be trivial.

show that in a differentiated duopoly, price competition is more intense than quantity competition, provided the goods are substitutes. If the game with returns were treated as a Bertrand game, we would observe more-intense retail competition, which leads to higher upstream profit. PP (1997) provides empirical evidence that returns policies narrow retail margins, but the implication of this note is that we cannot attribute that to intensified retail competition. The demand uncertainty theories (Marvel and Peck 1995) might explain that better.

Acknowledgment
The author is grateful to the editor, area editor, and three anonymous referees for very helpful suggestions.

Appendix

Proof of Claim 2. Suppose the equilibrium retail stocks are s_1, s_2. If both retailers always order excess stocks at the second stage, the outcome would be that which PP find, which is not an equilibrium as Claim 1 shows. If one retailer orders excess stock but the other does not, which means we would have an asymmetric equilibrium, one can show this is impossible because the retailer who orders excess stock can do better by ordering a little bit less than her actual sale. We omit the detail here. If neither retailer orders excess stock, the retail prices must satisfy $\alpha - \beta p_1 + \gamma p_2 = s_1$ and $\alpha - \beta p_2 + \gamma p_1 = s_2$. Solving this equation system, we have

$$p_1 = \frac{\alpha}{\beta - \gamma} - \frac{\beta s_1 + \gamma s_2}{\beta^2 - \gamma^2}, \qquad p_2 = \frac{\alpha}{\beta - \gamma} - \frac{\gamma s_1 + \beta s_2}{\beta^2 - \gamma^2}. \tag{1}$$

At the second stage, the retailers choose s_1, s_2 to maximize their profits:

$$\pi_1 = s_1(p_1 - w) = s_1\left(\frac{\alpha}{\beta - \gamma} - \frac{\beta s_1 + \gamma s_2}{\beta^2 - \gamma^2} - w\right)$$

and

$$\pi_2 = s_2(p_2 - w) = s_2\left(\frac{\alpha}{\beta - \gamma} - \frac{\beta s_2 + \gamma s_1}{\beta^2 - \gamma^2} - w\right).$$

The first-order conditions are

$$s_1 = \frac{1}{2\beta}[\alpha(\beta+\gamma) - w(\beta^2 - \gamma^2) - \gamma s_2] \quad \text{and}$$

$$s_2 = \frac{1}{2\beta}[\alpha(\beta+\gamma) - w(\beta^2 - \gamma^2) - \gamma s_1].$$

From this equation system we obtain

$$s_1 = s_2 = \frac{\alpha(\beta+\gamma) - w(\beta^2 - r^2)}{2\beta + \gamma}. \tag{2}$$

At the first stage, the manufacturer chooses wholesale price w to maximize its profit $\Pi = (w - c)(s_1 + s_2)$. Substituting (2) into Π and solving the problem, we get wholesale price

$$w = \frac{\alpha + (\beta - \gamma)c}{2(\beta - \gamma)}.$$

Substituting w into (2), we get

$$s_1 = s_2 = \frac{\beta + \gamma}{2(2\beta + \gamma)}[\alpha - (\beta - \gamma)c];$$

substituting w into (1), we get

$$p_1 = p_2 = \frac{(3\beta + \gamma)\alpha + (\beta^2 - \gamma^2)c}{2(2\beta + \gamma)(\beta - \gamma)}.$$

This retail sale and price configuration is feasible, and hence is the unique equilibrium of the game. Referring to Table 2 on page 86 of Png (1997), we see the equilibrium is the same as that without returns.[3] □

References

Kreps, David M., Jose A. Scheinkman. 1983. Quantity precommitment and Bertrand competition yield Cournot outcomes. *Bell J. Econom.* **14** 326–337.

Marvel, Howard, James Peck. 1995. Demand uncertainty and returns policies. *Internat. Econom. Rev.* **36**(3) 691–714.

Padmanabhan, V., I. P. L. Png. 1997. Manufacturer's returns policies and retail competition. *Marketing Sci.* **16**(1) 81–94.

Pasternack, Barry A. 1985. Optimal pricing and return policies for perishable commodities. *Marketing Sci.* **4**(2) 166–176.

Singh, Nirvikar, Xavier Vives. 1984. Price and quantity competition in a differentiated duopoly. *Rand J. Econom.* **15**(4) 546–554.

[3] There is a typo in Table 2 of Png (1997). The equilibrium retail prices in the game without returns should be $((3\beta + \gamma)\alpha + (\beta^2 - \gamma^2)c)/(2(2\beta + \gamma)(\beta - \gamma))$, not $((3\beta + \gamma)\alpha - (\beta^2 - \gamma^2)c)/(2(2\beta + \gamma)(\beta - \gamma))$.