National advertising and cooperation in a manufacturer-two-retailers channel

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November 2011

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November 25, 2011

Abstract

We consider a supply channel composed of one manufacturer and two retailers. Three cases are studied. The non-cooperative one is a leader-follower relationship. The manufacturer determines his spending in national advertising and the whole sale price. Then, the retailers determine non-cooperatively the price for consumers. The second case is a partial-cooperative one where retailers decide jointly for the price. In the third case, all members of the channel cooperate by maximizing a joint profit function. The spending in advertising and the quantity sold are the lowest in the partial-cooperative case, while retailers' price is the highest. Interestingly, when the degree of substituability between the two products proposed by retailers is low, these latter are worse off with partial-cooperation with respect to non-cooperation. Partial-cooperation is always the worst case for the manufacturer, the whole channel, consumers' surplus and social welfare, while cooperation is the best case. Cooperating members can share the extra-profit by a whole sale price.

Keywords: Game theory; Manufacturer-two-retailers; National advertising; Cooperation.

1 Introduction

Supply chain management research has gained a considerable attention from both the academics and the practitioners. The supply chain is generally conceptualized as a network of interconnected businesses that produce raw materials, change these materials into intermediate goods and then finished products, distribute and sale the products to the targeted consumers. One interesting issue in this area is how the actions taken by one member of the chain can influence the profitability of other members. The supply chain implies an important relationship between its different members as manufacturers and retailers. This relationship can be non-cooperative or cooperative. In the non-cooperative situation, each member of the supply chain has his own objective function; the members who act first, as manufacturers, are leaders, while those who react, as retailers, are followers. In a cooperative situation, the chain members work together for the same goal.

Many studies on advertising efforts and pricing policy have focused on distribution channels formed by one manufacturer and one retailer. Karray and Zaccour (2006) proposed a model to study the decision of a private label introduction for a retailer and its effects on the manufacturer. They showed that the private label introduction improves both the profit of the retailer and of the channel although it could harm the manufacturer's profit. Nevertheless, under some conditions, the manufacturer could profit from the private label introduction. Yue *et al.* (2006) studied the coordination of cooperative advertisement in a manufacturer-retailer supply chain when the manufacturer offers price deductions to consumers. They showed that for any given price deduction, the total profit for the supply chain with cooperative scheme is always higher than without cooperation. Xie and Wei (2009) addressed channel coordination by seeking optimal cooperative advertising strategies and equilibrium pricing in a manufacturer-retailer distribution channel. They compared two models: a non-cooperative, leader–follower game and a cooperative game. They showed that cooperative model achieves better coordination by generating higher channel total profit than the non-cooperative one, lower retailer price to consumers, and the advertising efforts are higher for all channel members. They identified the feasible solutions to a bargaining problem where the channel members can determine how to divide the extra-profits generated by cooperation.

Other papers have been interested by a one manufacturer-two retailers distribution channel without advertising. Cachon and Lariviere (2005) studied revenue-sharing contracts in a general supply chain model with revenues determined by each retailer's purchase quantity and price. Yang and Zhou (2006) considered the pricing and quantity decisions of a two-echelon system with a manufacturer who supplies a single product to two competitive retailers. They analyzed the effects of the duopolistic retailers' different competitive behaviors (Cournot, Collusion and Stackelberg) on the optimal decisions of the manufacturer and the retailers. Xiao and Qi (2008) considered the coordination of a supply chain with one manufacturer and two competing retailers after the production cost of the manufacturer was disrupted. They considered two coordination mechanisms: an all-unit quantity discount and an incremental quantity discount. For each mechanism, they developed the conditions under which the supply chain is coordinated and discussed how the cost disruption may affect the coordination mechanisms.

Karray and Zaccour (2007) considered a distribution channel formed by two manufacturers and two retailers to investigate whether cooperative advertising programs are profitable for such channels. They showed that, under some conditions, cooperative advertising may be profitable for retailers and the whole channel, and may not be profitable for manufacturers. However, their model is limited to local advertising with no national advertising, and full cooperation between the retailers or between all channel members are not studied.

Our research is closely related to the one of Xie and Wei (2009). We made some simplifications to their model by considering that there are no retailers' local advertising expenditures and no manufacturer's participation rate. However, we enrich their model by considering two competing retailers. This extension enables us to study the case of cooperation between the retailers. In addition, we evaluate the impact of cooperation between retailers and between all members of the supply chain on consumer's surplus and social welfare. Such comparisons are interesting and have not been done before by previous studies on supply chain.

we consider a supply channel game model with a single manufacturer and two retailers. The manufacturer sells a product with a whole sale price to the retailers, which sell the product purchased to final consumers. Without loss of generality, we suppose that production and handling costs are zero. The manufacturer uses national advertising to increase consumers' interest in the product. Consumers' demand for the product depends on its price and on the advertisement effort made. The manufacturer determines its whole sale price and national advertising spending. Then, the retailers determine the price for consumers. We consider and compare three cases. The non-cooperative case, where the manufacturer and the retailers decide non-cooperatively, and each of them maximizes its own profit. The partially-cooperative, where only the two retailers cooperate by maximizing a joint profit function. Finally, in the cooperative case, the three members of the supply channel engage in a cooperative program and maximize the whole profit of the supply chanel. We note that for the first two cases, the manufacturer is the leader while the retailers are the followers. This game is solved backward to obtain a subgame perfect Nash equilibrium.

We show that when only retailers cooperate, the price for consumers is the highest, while the quantity produced and the spending in advertising are the lowest with respect to non-cooperation and cooperation. Interestingly, when the degree of substituability between the goods proposed by retailers is not important, cooperation between retailers is harmful for them. Moreover, cooperation between retailers reduces the profit of the manufacturer and of all the chain.. Consequently, consumers' surplus and social welfare are higher with non-cooperation than with partial-cooperation between firms. When all members of the supply channel cooperate, the price for consumers is the lowest, the spending in advertising, production, total profit of the supply channel, consumers' surplus and social welfare are the highest. The manufacturer and retailers can determine a whole sale price enabling them to share this extra-profit due to cooperation. When this cooperative whole sale price is at its lower bound, all the extra-profit goes to the retailers; when it is at its higher bound, all the extra-profit goes to the manufacturer; and when it is in the middle, the extra-profit is equally shared by the manufacturer and the two retailers.

The paper is organized as follows. Section 2 presents our basic game-theoretic model. Section 3 solves the non-cooperative case. Section 4 solves the partially-cooperative case. Section 5 solves the cooperative game. Section 6 studies the extra-profit sharing. Section 7 discusses and compares the three cases studied, and Section 8 concludes.

2 The basic model

We consider a manufacturer-two-retailers distribution channel in which both retailers sell only the manufacturer's brand within the product class. Decision variables for the manufacturer are the national advertising expenditure A and the whole sale price to retailers w. The decision variables for the retailers are their retail prices $p_i, i = 1, 2$.For tractability reasons, we suppose that there are no local advertising expenditures for retailers. The game is a leader-follower one: the manufacturer chooses his decision variables, then the retailers choose their retail prices. This game is solved backward to get a subgame-perfect Nash equilibrium.

The manufacturer uses brand advertising to increase consumers' interest and demand for the good produced. Consumers' demand V_i for the good proposed by retailer i, also known as the sale response function, depends on the retail prices and the advertising level as

$$V_i(p_i, p_j, A) = g_i(p_i, p_j)h(A), i = 1, 2, j = 3 - i \quad (1)$$

where $g_i(p_i, p_j)$ and $h(A)$ reflect the impact of the retail prices and the brand advertising expenditures on the demand of product i, respectively.

As many studies (Xiao and Qi (2008)), we assume that the demand function for product i is linear with retail prices:[1]

$$g_i(p_i, p_j) = 1 - p_i + \beta p_j, 0 < \beta < 1, \; i = 1, 2, j = 3 - i \quad (2)$$

where β is the degree of substituability between the two products proposed by retailers. The maximum value for $g_i(p_i, p_j)$ is normalized to 1 for simplicity of the expressions.

The impact of national advertising expenditures on the demand of product i is an increasing and concave function consistent with the advertising saturation effect:[2]

$$h(A) = \sqrt{A} \quad (3)$$

[1] Using a more general and linear demand function as $g_i(p_i, p_j) = a - \alpha p_i + \beta p_j, 0 < a, 0 < \beta < \alpha$, does not change our analytical results.

[2] We can use a more general function $h(A) = l\sqrt{A}, l > 0$, but this has no effect on our analytical results.

Therefore, we have:

$$V_i(p_i, p_j, A) = (1 - p_i + \beta p_j)\sqrt{A}, i = 1, 2, j = 3 - i \tag{4}$$

We suppose that the manufacturer's unit production cost and the retailers' unit handling cost are constants. We normalize them to zero to simplify our expressions.

The profits of the manufacturer, each retailer, the two retailers, and the whole system are, respectively:

$$\Pi_m = w(V_1 + V_2) - A \tag{5}$$

$$\Pi_{r_i} = (p_i - w)V_i \tag{6}$$

$$\Pi_{r_1+r_2} = (p_1 - w)V_1 + (p_2 - w)V_2 \tag{7}$$

$$\Pi_t = \Pi_m + \Pi_{r_1} + \Pi_{r_2} = p_1V_1 + p_2V_2 - A \tag{8}$$

One of the most contribution of this paper is the evaluation of the impact of both cooperation between retailers and between all members on consumers' surplus and social welfare.

The consumers' surplus engendered by the consumption of quantity V_i of the product sailed by retailer i is:

$$CS(V_i) = \int_0^{V_i} p_i(t)dt - p_iV_i \tag{9}$$

From (4), we have:

$$p_i(V_i) = 1 + \beta p_j - \frac{V_i}{\sqrt{A}}, i = 1, 2, j = 3 - i \tag{10}$$

Using (10) in (9), we get:

$$CS(V_i) = \frac{V_i^2}{2\sqrt{A}} \tag{11}$$

The total consumers' surplus engendered by the consumption of the two products is:

$$CS_t = CS(V_1) + CS(V_2) \tag{12}$$

We define the social welfare as the total consumers' surplus plus the total profit of the supply chain:

$$S = CS_t + \Pi_t \tag{13}$$

In what follows, we will solve backward the three games.

3 The non-cooperative game

The three members of the supply channel behave non-cooperatively. It is a two-stage game. In the first stage, the manufacturer (leader) maximizes his profit with respect to its decision variables, which are w and A. Then, each retailer (follower) maximizes his profit function with respect to the price he proposes for consumers.

Solving the second-stage first-order conditions, which are $\frac{\partial \Pi_{r_i}}{\partial p_i} = 0, i = 1, 2$,gives the retail prices, which are symmetric:

$$p_i^* = p^* = \frac{1+w}{\delta} \tag{14}$$

where $\delta = 2 - \beta$. We can verify that $1 < \delta < 2$.

Using the expression given by (14) in (5), we get:

$$\Pi_m^* = \frac{2}{\delta} w(1 - \lambda w)\sqrt{A} - A \tag{15}$$

Using (15)and solving the first-stage first-order conditions[3] for the manufacturer, which are $\frac{\partial \Pi_m^*}{\partial w} = 0$ and $\frac{\partial \Pi_m^*}{\partial A} = 0$,we get the optimal whole sale price and advertising spending:

$$w^* = \frac{1}{2\lambda} \tag{16}$$

$$A^* = \frac{1}{16\lambda^2\delta^2} \tag{17}$$

where $\lambda = 1 - \beta$, verifies $0 < \frac{\lambda}{\delta} < 1/2$.

Using $w^* = \frac{1}{2\lambda}$ in the other expressions, we get the optimal values for the non-cooperative case of the other variables, which are given in Table 1. It is easy to verify that the whole sale price is lower than the retailers' price. Also, we can verify that $\Pi_m^* > 2\Pi_r^*$, meaning that the manufacturer gains more than the two retailers together.

4 The partially-cooperative game

In this section, the retailers decide to cooperate by maximizing their joint profit

function, while the manufacturer still maximizes his own profit function. This is a two-stage game where the manufacturer plays first (leader) and the retailers play second (followers).

[3] Second-order conditions are verified because $\frac{\partial^2 \Pi_m^*}{\partial w^2} < 0$, $\frac{\partial^2 \Pi_m^*}{\partial A^2} < 0$ and $\frac{\partial^2 \Pi_m^*}{\partial w \partial A} = 0$.

Solving the second-stage first-order conditions,[4] which are $\frac{\partial \Pi_{r_1+r_2}}{\partial p_i} = 0, i = 1, 2$,gives the retail prices, which are symmetric:

$$\bar{p}_i = \bar{p} = \frac{1+\lambda w}{2\lambda} \tag{18}$$

Using the expression given by (18) in (5), we get:

$$\bar{\Pi}_m = w(1-\lambda w)\sqrt{A} - A \tag{19}$$

Using (19)and solving the first-stage first-order conditions[5] for the manufacturer, which are $\frac{\partial \bar{\Pi}_m}{\partial w} = 0$ and $\frac{\partial \bar{\Pi}_m}{\partial A} = 0$,we get the optimal whole sale price and advertising spending:

$$\bar{w} = \frac{1}{2\lambda} \tag{20}$$

$$\bar{A} = \frac{1}{64\lambda^2} \tag{21}$$

Using the optimal values of the decision variables, we get the optimal values for the partially-cooperative case of the other variables which are given in Table 1.

We can verify that the whole sale price is lower than the retail price. It is easy to verify that $\bar{\Pi}_m = 2\bar{\Pi}_r$.Contrary to the non-cooperative case, when retailers cooperate, their joint gain is equal to that of the manufacturer.

5 The cooperative game

In this last case studied, the manufacturer and retailers agree to make decisions that maximize the total supply channel profit. Then, they negotiate how they will share the extra-profit engendered by such cooperation.

The total profit function of the system given by (8) can be written as:

$$\Pi_t = \left(p_1 + p_2 - p_1^2 - p_2^2 + 2\beta p_1 p_2\right)\sqrt{A} - A \tag{22}$$

[4]Second-order conditions are verified because $\begin{vmatrix} \frac{\partial^2 \Pi_{r1+r2}}{\partial p_1^2} & \frac{\partial^2 \Pi_{r1+r2}}{\partial p_1 \partial p_2} \\ \frac{\partial^2 \Pi_{r1+r2}}{\partial p_1 \partial p_2} & \frac{\partial^2 \Pi_{r1+r2}}{\partial p_2^2} \end{vmatrix} = \begin{vmatrix} -2\sqrt{A} & 2\beta\sqrt{A} \\ 2\beta\sqrt{A} & -2\sqrt{A} \end{vmatrix} > 0$

[5]Second-order conditions are verified because $\frac{\partial^2 \bar{\Pi}_m}{\partial w^2} = -2\lambda\sqrt{\bar{A}} < 0$, $\frac{\partial^2 \bar{\Pi}_m}{\partial A^2} = -\frac{\bar{w}}{8\bar{A}^{3/2}} < 0$ and $\frac{\partial^2 \bar{\Pi}_m}{\partial w \partial A} = 0$.

The whole profit of the system depends only on p_1, p_2 and A.The three first-order conditions[6] of optimality are $\frac{\partial \Pi_t}{\partial p_1} = 0$, $\frac{\partial \Pi_t}{\partial p_2} = 0$ and $\frac{\partial \Pi_t}{\partial A} = 0$, which give us the unique symmetric cooperative solution:

$$p_i^c = p^c = \frac{1}{2\lambda} \tag{23}$$

$$A^c = \frac{1}{16\lambda^2} \tag{24}$$

In Table 1 we give the cooperative values of the remaining expressions by using the optimal values of the decision variables.

Table1

Comparison of the results for the three cases[7]

Non-cooperation	Partial-cooperation	Cooperation	Comparisons
$w^* = \frac{1}{2\lambda}$	$\bar{w} = \frac{1}{2\lambda}$	$\frac{1+\delta^2}{4\lambda\delta^2} < w^c < \frac{\delta^3-\lambda}{2\lambda\delta^3}$	$w^c < w^* = \bar{w}$
$p^* = \frac{\lambda+\delta}{2\lambda\delta}$	$\bar{p} = \frac{3}{4\lambda}$	$p^c = \frac{1}{2\lambda}$	$p^c < p^* < \overline{p}$
$V^* = \frac{1}{8\lambda\delta^2}$	$\bar{V} = \frac{1}{32\lambda}$	$V^c = \frac{1}{8\lambda}$	$\bar{V} < V^* < V^c$
$A^* = \frac{1}{16\lambda^2\delta^2}$	$\bar{A} = \frac{1}{64\lambda^2}$	$A^c = \frac{1}{16\lambda^2}$	$\bar{A} < A^* < A^c$
$\Pi_r^* = \frac{1}{16\lambda\delta^3}$	$\bar{\Pi}_r = \frac{1}{128\lambda^2}$	$\Pi_r^c = \frac{1-2\lambda w^c}{16\lambda^2}$	$\bar{\Pi}_r < \Pi_r^* \Leftrightarrow \beta < 3-\sqrt{5}$
$\Pi_m^* = \frac{1}{16\lambda^2\delta^2}$	$\bar{\Pi}_m = \frac{1}{64\lambda^2}$	$\Pi_m^c = \frac{4\lambda w^c - 1}{16\lambda^2}$	$\bar{\Pi}_m < \Pi_m^*$
$\Pi_t^* = \frac{2\lambda+\delta}{16\lambda^2\delta^3}$	$\bar{\Pi}_t = \frac{1}{32\lambda^2}$	$\Pi_t^c = \frac{1}{16\lambda^2}$	$\bar{\Pi}_t < \Pi_t^* < \Pi_t^c$
$CS_t^* = \frac{1}{16\lambda\delta^3}$	$\overline{CS_t} = \frac{1}{128\lambda}$	$CS_t^c = \frac{1}{16\lambda}$	$\overline{CS_t} < CS^* < CS_t^c$
$S^* = \frac{3\lambda+\delta}{16\lambda^2\delta^3}$	$\bar{S} = \frac{4+\lambda}{128\lambda^2}$	$S_t^c = \frac{\delta}{16\lambda^2}$	$\bar{S} < S^* < S_t^c$

6 Extra-profit sharing

To commit to a cooperative program, the profits of the manufacturer and retailers through cooperation should be higher than their own profits realized in the non-cooperative Stackelberg game. We need a bargaining mechanism to motivate the channel members to cooperate and to share the extra-profit engendered by cooperation, which is:

$$\Delta\Pi_t = \Pi_t^c - \Pi_t^* > 0 \tag{25}$$

[6] Second-order conditions are verified by using the following partial derivatives: $\frac{\partial^2 \Pi_t}{\partial p_1^2} = \frac{\partial^2 \Pi_t}{\partial p_2^2} = -2\sqrt{A}$, $\frac{\partial^2 \Pi_t}{\partial p_1 \partial p_2} = 2\beta\sqrt{A}$, $\frac{\partial^2 \Pi_t}{\partial A \partial p_1} = \frac{\partial^2 \Pi_t}{\partial A \partial p_2} = 0$, $\frac{\partial^2 \Pi_t}{\partial A^2} = \frac{-1}{8\lambda A^{3/2}}$

[7] Almost all the comparisons are easy to establish. We present some of them: *i)* $\bar{\Pi}_r < \Pi_r^* \Leftrightarrow \beta^2 - 6\beta + 4 = \left[\beta - (3-\sqrt{5})\right]\left[\beta - (3+\sqrt{5})\right] > 0 \Leftrightarrow \beta < 3 - \sqrt{5}$.

ii) $\bar{\Pi}_t < \Pi_t^* \Leftrightarrow 6(1-\beta) + \beta^2 > 0$: which is true.

iii) $\Pi_t^* < \Pi_t^c \Leftrightarrow 6\beta^2 - \beta^3 - 9\beta + 4 = 4(1-\beta)^2(1-\frac{\beta}{4}) > 0$: which is evident.

To share this extra-profit due to cooperation, the members of the channel can set a whole sale price w^c for each unit of product purchased by the retailers from the manufacturer.

Using expression (5) with production and advertising spending equal to V^c and A^c, respectively, the profit of the manufacturer under cooperation is:

$$\Pi_m^c = \frac{4\lambda w^c - 1}{16\lambda^2} \tag{26}$$

The manufacturer will participate to cooperation iff

$$\Pi_m^c > \Pi_m^* \Leftrightarrow w^c > w_{\max}^c = \frac{1+\delta^2}{4\lambda\delta^2} \tag{27}$$

Thus, if the whole sale price is higher than $w_{\max}^c$, the manufacturer finds cooperation interesting.

Using expression (6) with retail prices and expenditures in advertising equal to p^c and V^c, respectively, the profit of each retailer under cooperation is:

$$\Pi_r^c = \frac{1 - 2\lambda w^c}{16\lambda^2} \tag{28}$$

Non-cooperating retailers will participate to the cooperative game iff

$$\Pi_r^c > \Pi_r^* \Leftrightarrow w^c < w_{\min}^c = \frac{\delta^3 - \lambda}{2\lambda\delta^3} \tag{29}$$

Therefore, when the whole sale price does not exceed a certain value $w_{\min}^c$, it is in the interest of non-cooperating retailers to cooperate with the whole supply chain. Thus, we can establish the following proposition:

Proposition 1 *To get all partners interested by cooperation, the whole sale price should be between a minimal value and a maximal value*

$$w_{\min}^c < w^c < w_{\max}^c \tag{30}$$

We can easily verify that $w_{\min}^c < w_{\max}^c$ and that when inequality (30) is verified, then $w^c < p^c$.

A whole sale price near $w_{\min}^c$ gives a higher share of the extra-profit to the retailers, and when it is near $w_{\max}^c$, it gives a higher share to the manufacturer.

When $w^c = w_{\min}^c$, all the exta-profit goes to the retailers: the manufacturer is indifferent between cooperating or not. When $w^c = w_{\max}^c$,all the exta-profit goes to the manufacturer: the retailers are indifferent between cooperation and non-cooperation.

Proposition 2 *The whole sale price that split equally the extra-profit between the manufacturer and the two retailers is*

$$w_e^c = \frac{w_{\min}^c + w_{\max}^c}{2} \tag{31}$$

Indeed, with $w^c = w_e^c$,we have $\frac{\Delta\Pi_t}{2} = \Pi_m^c - \Pi_m^*$.

7 Comparison of results and discussions

From the comparisons presented in Table 1, we have the following propositions.

Proposition 3 *(i)* $w^c < w^* = \bar{w}$,*(ii)* $p^c < p^* < \bar{p}$,*(iii)* $\bar{V} < V^* < V^c$, *(iv)* $\bar{A} < A^* < A^c$.

The above proposition shows that the whole sale price does not depend on whether retailers cooperate or not. Moreover, the whole sale price of cooperation, which is determined to share the extra-profit, is the lowest because the retail price is the lowest with respect to those of non-cooperation or partial-cooperation. With partial-cooperation, the retail price is the highest, whereas the quantity purchased and the spending in advertising are the lowest. However, with cooperation, the retail price is the lowest, the quantity purchased and the spending in advertising are the highest. The fact that the expenditures in advertising are the lowest under partial-cooperation is a new and interesting result, which hasn't been studied by Xie and Wei (2009) as they considered only one retailer. We can expect that the best situation for consumers is cooperation of all members of the channel, and the worst situation for them is partial-cooperation between retailers.

Proposition 4 *(i)* $\bar{\Pi}_r < \Pi_r^* \Leftrightarrow \beta < 3 - \sqrt{5}$,*(ii)* $\bar{\Pi}_m < \Pi_m^*$, *(iii)* $\bar{\Pi}_t < \Pi_t^* < \Pi_t^c$.

When the degree of substituability between the two products is sufficiently low, cooperating retailers gain less than with non-cooperation. This result is interesting and even surprising because usually firms are better off when they cooperate. This result is due to the spending in national advertising. Indeed, when retailers unilaterally cooperate, the manufacturer feels threatened and reduces his advertising spending while keeping the same whole sale price, leading to an important reduction in sales and to a diminution of his own profit and those of retailers. With the present model, we can easily show that, when there is no advertising, the retailers are always better off under partial-cooperation. When the degree of substituability between the two products is sufficiently high, we have the standard result that partial-cooperation of retailers increases their profit with respect to non-cooperation. When retailers cooperate, the profit of the manufacturer decreases because there is no change in the whole sale price and the quantities sold are decreased. Consequently, the total profit of the supply channel is the lowest with partial-cooperation and the highest with cooperation.

Proposition 5 *(i)* $\overline{CS_t} < CS_t^* < CS_t^c$, *(ii)* $\overline{S} < S^* < S^c$.

It is clear that the worst situation for consumers and the society is the partial-cooperative case, and the better one is the cooperative case.

8 Conclusion

Our paper extends the growing literature on supply channel by analyzing pricing and advertising strategies for a supply channel consisting of one manufacturer and two retailers.

The manufacturer produces one product that he sells to two retailers. The retailers sell only the manufacturer's product to consumers. The manufacturer decides on the wholesale price and uses brand advertising to attract consumers and to increase the overall demand as a result. The retailers, on the other hand, decide on the retail prices. Consumers' demand depends on the retail prices of the two retailers and on the manufacturer's advertising spending.

First, we model the decision process as a non-cooperative game in which the manufacturer is leader and the retailers are followers. The manufacturer chooses the spending in national advertising and the whole sale price, then each retailer chooses its price to consumers. Then, we consider the same model but we assume that both retailers work together to maximize their joint profit (partial-cooperative case). Finally, we adopt a cooperative game in which all members of the supply channel maximize the total channel profit.

We show that the whole sale price does not depend on whether retailers cooperate or not. With partial-cooperation, the retail price is the highest, whereas the quantity purchased and the expenditures in advertising are the lowest. The fact that the expenditures in advertising is the lowest under partial-cooperation is a new and interesting result.

When the degree of substituability between the two products is sufficiently low, cooperating retailers gain less than with non-cooperation. This result is interesting and even surprising because usually firms are better off when they cooperate. This result is due to the spending in national advertising. Indeed, when retailers unilaterally cooperate, the manufacturer feels threatened and reduces his advertising spending while keeping the same whole sale price, leading to an important reduction in sales and to a diminution of his own profit and those of retailers. With the present model, we can easily show that when there is no advertising spending, the retailers are always better when they cooperate. When the degree of substituability between the two products is sufficiently high, we have the standard result that partial-cooperation of retailers increases their profits with respect to non-cooperation. In addition, cooperation between retailers decreases the profit of the manufacturer because there is no change in the whole sale price and the quantities sailed are diminished. As a result, the total profit of the supply channel is the lowest with partial-cooperation and the highest with cooperation.

The worst situation for consumers and the society is the partial-cooperative case, and the better one is the cooperative one. Cooperating partners can share the extra-profit by setting a whole sale price which is lower than the one of non-cooperation or partial-cooperation. There exists a whole sale price that splits the extra-profit equally between the manufacturer and the two retailers.

Finally, this model can be extended by considering that retailers spend in local advertising, and that the manufacturer pays a fraction of this local advertising cost.

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