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Abstract

Category management practices aim at improving the business performance of retailers by focusing on delivering consumer value. Retailers often rely on the expertise of a leading manufacturer for retail category management, a form of retailer-supplier collaboration often referred to as a *category adviser arrangement*.

The goal of our research is to investigate the antitrust issues that may arise as a result of the category adviser arrangements. We show that there are cases where the category advisor arrangements deliver benefits to the category adviser, the retailer and the consumers, however, these benefits come at the expense of manufacturers other than the category adviser. On the other hand, there are also cases where consumer surplus decreases under the category adviser arrangement. We conclude that category adviser arrangements should be treated with care and should be better understood in order to deliver benefits to the category advisers, retailers and consumers.

1 Introduction

Category management is a supplier - retailer process for managing entire product categories as strategic business units with the goal of improving business performance through a focus on delivering consumer value. Understanding consumer preferences is an important component of retail category management practices because it is consumers who define what a category consists of: A product category is defined as a group of products that consumers perceive to be interrelated and/or substitutable.

There are various category management templates that are available for trading partners. A particular form of category management, called the *category adviser arrangement*, suggests that retailers appoint a leading manufacturer (often called the *category adviser* and sometimes also known as category captain) and rely on that manufacturer for recommendations regarding the retail management of the category. The retail management of a category involves decisions such as determining the retail price, merchandizing product assortment, shelf space allocation on the basis of

category goals and more importantly consumers' needs and wants. The retail management of a category requires that a substantial amount of resources be dedicated to analyzing and planning the category offering. The following quote provides a rationale for category adviser arrangements:

Retailers have access to more market information than ever, but often don't have the resources to analyze and identify significant consumer and category trends. Many retailers rely on manufacturers for expertise and guidance in this regard. It is common for retailers to appoint a savvy manufacturer as the 'captain' for a particular category and then to rely on that manufacturer for category insights and strategic recommendations that can boost volume and profitability (Category Management: Positioning Your Organization to Win, p.103).

The main reason for the retailers to engage in category adviser arrangements, as indicated in the above quote, is to incorporate manufacturers' expertise into category planning and increase profitability through more satisfied consumers and reduced cost of planning. On the other hand, though costly for them, the manufacturers are willing to participate in the category adviser arrangements because of their willingness to (1) have access to information on competitor's products (e.g., competitor's margins); and (2) be able to influence category decisions (ACNielsen's Study, 2002).

In a typical category adviser arrangement, the retailer shares all the pertinent information such as sales data, pricing, turnover, and shelf placement of the brands with the category adviser. The category adviser conducts an analysis about the category and provides the retailer with a detailed plan that includes *recommendations* about which brands to include in the category, where to locate each brand on the shelf, how much space to allocate to each brand, which new brands to include and which old brands to exclude from the category and pricing of the products in the category. The retailer is free to use any of the recommendations provided by the category adviser. As stated in the Demand Side Projects EU Competition Law Guidelines published by ECR Europe,

The retailer remains free to follow or not to follow the manufacturer's recommendation. The retailer should not enter into any agreement or understanding with the manufacturer concerning the setting of retail prices in the category, the selection of products for a category, or conditions on the retail shelf.

However, in practice, the category adviser arrangements vary depending on the degree to which the retailer takes into account category adviser's recommendation while

managing the category. Some retailers rely entirely on the category advisers for the planning of their categories while other retailers use the category advisers just as an advisers and keep all decision rights (Desrochers et al. 2003).

The goal of our research is to investigate the antitrust issues that may arise as a result of the category adviser arrangements. Specifically, we want to explore how category adviser practices may influence manufacturers, retailers and more importantly, retail prices and consumers. On the positive side, the retailer benefits from the expertise of the category adviser and offers products that are more in line with consumer demand, therefore, passing some of the benefits to consumers. However, this view ignores the strategic interaction and opportunism that the category adviser might take advantage of. An issue of primary concern to European (ECR Europe, 2004) and US (Desrochers et al. 2003) antitrust entities is that the category advisers may use their position to disadvantage competitors, which in turn may lead to restricted competition between the brands which in turn may harm the consumers. Another source of concern is the limited shelf space available for category display. The limitation of shelf space will increase the battle for shelf space (Corstjens and Corstjens 1995), which in turn may benefit the category advisers but may harm the consumers through restricted competition. Some of the tensions are summarized in the following quotes:

Vendors must now concern themselves with the profitability of the entire product category in which they compete, not just the performance of their own product. It no longer suffices simply to battle for one's company's position on the shelves. ... In essence, every vendor practicing CM also becomes a surrogate retailer, working from the broader perspective as well as from the narrower one, competitive self-interest. (Dussart 1998)

...it seems more likely that category management will boost total surplus rather than consumer surplus (Steiner 2001).

The marketing literature on category management considers various problems such as how category management influences the retail prices (Choi 1991) and Basuroy et al. 2001) and other issues such private label introductions (Raju et al. 1995). However, the marketing literature is silent on how category adviser arrangements will influence retail prices and consumers. Recently, antitrust concerns have been raised by Desrochers et al. (2002) and Steiner (2001). The main hypotheses in these papers is that the category adviser arrangements may lead to what they call (1) competitive exclusion and (2) competitive collusion. Competitive exclusion refers to situations where the category adviser takes advantage of its position to disadvantage

other manufacturers, and competitive collusion refers to situations where the category adviser coordinates competitors to collude and disadvantage the retailer. The papers hypothesize that both competitive exclusion and collusion result in limited competition that can harm the consumers.

Our research aims to better understand the impact and consequences of category adviser arrangements and limited shelf space availability on consumers. The key question that we are interested in is whether the performance improvement of the retailer and the category adviser come at the expense of consumers. Our research provides theoretical evidence for some of the hypotheses made by Desrochers et al. (2002) and extends their hypotheses by including shelf space limitations at the retailer. To our knowledge, our model is the first attempt at modeling category adviser arrangements. We show that category adviser arrangements may result in substantial benefits for the retailer, category adviser and consumers. However, the benefits come at the expense of the manufacturers other than the category adviser.

2 The Model

We consider a two-stage supply chain model with two manufacturers that sell products that are in the same category to consumers through a common retailer¹. The demand for each product is given by

$$\begin{aligned} q_1 &= a - bp_1 + b\theta p_2 \\ q_2 &= a - bp_2 + b\theta p_1 \end{aligned}$$

where a is the primary market demand and b captures the store level factors². The parameter b reflects how sensitive consumers are to a unit change in the retail price. The parameter θ can be interpreted as the degree of product differentiation, $\theta \in [0, 1]$, with $\theta = 0$ for independent products and $\theta = 1$ for perfect substitutes. The retailer's objective is to maximize the category profit

$$\Pi_R(p_1, p_2) = (p_1 - w_1)q_1 + (p_2 - w_2)q_2.$$

Manufacturers, on the other hand, maximize their own profits in anticipation of retailer's stocking quantity. Manufacturer i 's profit is

$$\Pi_i(w_i, w_j) = (w_i - c)q_i(p_i, p_j) \quad \text{for } i = 1, 2 \text{ and } i \neq j$$

¹The model can be extended to include multiple products.

²The model can be extended to allow for different primary market demands a_1 and a_2 .

where c is the unit production cost.³

We assume that the retailer has shelf space constraints. That is, the retailer allocates a total shelf space of S to the category and the total stocking quantity can not exceed the shelf space constraint.

We consider the following two scenarios that differ in who is responsible for the category planning. We restrict the category planning decisions to the stocking and pricing decisions only. In the first scenario that we consider, the benchmark scenario, we assume that the retailer is responsible for setting retail prices whereas in the second scenario, the category adviser recommends the retail price of the products in the category.

2.1 The Benchmark

In the first scenario that we consider, we assume that the retailer is managing the category. Given the wholesale prices, the retailer has to decide the retail price, equivalently the stocking quantity, for each product in the category. The sequence of events in the benchmark scenario are as follows

- Stage 1: The manufacturers act as Stackelberg leaders and set their wholesale prices w_1 and w_2 simultaneously.
- Stage 2: Given the wholesale prices, the retailer responds to the manufacturers by deciding on how much to stock in order to maximize category profit, subject to the shelf space constraint.

We solve the model backwards and start with retailer's second stage price (quantity) decisions. For given wholesale prices w_1 and w_2 , the retailer solves the following constrained optimization problem.

$$\begin{aligned}
 (\mathbf{B}) \quad & \max_{p_1, p_2} && (p_1 - w_1)q_1 + (p_2 - w_2)q_2 \\
 & \text{s.t.} && q_1 + q_2 \leq S
 \end{aligned}$$

Denote the above optimization problem by **(B)**. Anticipating the retail prices and order quantities in response to wholesale prices, the manufacturers play a simultaneous-move Nash game using their profit functions $\Pi_i(w_i, w_j) = (w_i - c)q_i(p_i, p_j)$, for $i = 1, 2$. Denote the equilibrium wholesale prices by (w_1^*, w_2^*) and the equilibrium retail prices by (p_1^*, p_2^*) . In addition, denote the retailer's equilibrium profit by Π_R^* and manufacturers' equilibrium profits by Π_1^* and Π_2^* , respectively.

³The model can be extended to allow different production costs for the manufacturers.

Proposition 1 *If $S < \bar{S} \doteq [a+bc(\theta-1)]/(2-\theta)$, the shelf-space constraint is binding. In equilibrium,*

$$w_1^* = w_2^* = c + \frac{2S}{b(1+\theta)}, \quad p_1^* = p_2^* = \frac{2a-S}{2b(1-\theta)}, \quad q_1^* = q_2^* = S/2,$$

$$\Pi_R^* = \frac{S}{2} \left(\frac{2a(1+\theta) + S(3\theta-5)}{b(1-\theta^2)} - 2c \right) \quad \text{and} \quad \Pi_1^* = \Pi_2^* = \frac{S^2}{b(1+\theta)}.$$

Proof. All proofs are in the appendix. ■

We focus on the interesting case where the shelf space restricts equilibrium stocking quantities ($S < \bar{S}$). The retailer allocates the shelf space equally between the products. Note that the retail prices increase as the available shelf space S gets smaller. The implication is that the consumers are negatively influenced by the scarcity of the shelf space at the retailer. In addition, the retailer and manufacturer profits decrease as the shelf space allocated to the category decreases. Therefore, we can conclude that everybody (i.e., manufacturers, retailers, and consumers) becomes worse off as the shelf space allocated to the category gets limited.

2.2 Category Adviser Arrangement

In the second scenario that we consider, we assume that the retailer selects one of the manufacturers and the manufacturer makes recommendations to the retailer regarding the category planning. Suppose that the retailer appoints the first manufacturer as a category adviser. We also assume that the retailer makes the following information available to the category adviser: $\{w_2, S\}$. This modeling choice allows us to capture some important properties of the category adviser arrangements in practice. First, many category adviser arrangements assume that the retailer shares all the available data with the category adviser. We capture this by assuming that the retailer shares its knowledge of the wholesale price of the second manufacturer, w_2 , with the category adviser (Desrochers et al. 2002). Second, the inclusion of the shelf space constraint allows us to capture one of the most important features of today's retailing industry, namely that the shelf space allocated to categories is limited.

In addition, we assume that the retailer asks the category adviser to provide category plans in such a way that the retailer gets a minimum profit of K . The inclusion of the minimum profit target K will partially prevent the category adviser from opportunistic behavior.

Given our assumptions about the category adviser arrangement, the sequence of events in this scenario is as follows:

- Stage 1: The second manufacturer offers a wholesale price w_2 to the retailer.

- Stage 2: The retailer provides the information, $\{w_2, K, S\}$, to the category adviser.
- Stage 3: The category adviser decides what retail prices to recommend to the retailer.
- Stage 4: The retailer sets the retail price in line with category adviser's recommendations.

We solve the problem backwards: At stage 3, for a given $\{w_2, K, S\}$, the category adviser solves

$$\begin{aligned}
(\mathbf{CC}) \quad & \max_{w_1, p_1, p_2} && (w_1 - c)q_1(p_1, p_2) \\
& \text{s.t.} && (p_1 - w_1)q_1 + (p_2 - w_2)q_2 \geq K \\
& && q_1 + q_2 \leq S
\end{aligned}$$

Denote the above optimization problem by (\mathbf{CC}) . An outline of the solution to the optimization problem (\mathbf{CC}) and manufacturer 2's choice of w_2 is given in the appendix. The wholesale prices and recommended retail prices are given in the following proposition.

Proposition 2 *If $S < \bar{S}^c \doteq 0.25[a + bc(\theta - 1)](\theta + 3)$, the equilibrium wholesale and recommended retail prices are*

$$\begin{aligned}
w_1^c &= \frac{1}{6} \left(\frac{8a}{b(1-\theta)} - \frac{S(\theta+7)}{b(1-\theta^2)} - \frac{8K}{S} - 2c \right) & w_2^c &= c + \frac{S}{b(1+\theta)} \\
p_1^c &= \frac{4a(1+\theta) - S(3+\theta)}{4b(1-\theta^2)} & p_2^c &= \frac{4a(1+\theta) - S(1+3\theta)}{4b(1-\theta^2)}
\end{aligned}$$

Again we focus on the interesting case where the stocking quantities are constrained by the shelf space. Note that the retail prices for both products increase as the shelf space allocated to the category gets smaller. Denote the retailer's equilibrium profit by Π_R^c and manufacturers' equilibrium profits by Π_1^c and Π_2^c , respectively. The corresponding equilibrium profits are

$$\begin{aligned}
\Pi_R^c &= K \\
\Pi_1^c &= \frac{4b(4K + cS)(1 - \theta^2) + S^2(5 - \theta) - 4aS(1 + \theta)}{16b(1 - \theta^2)} \\
\Pi_2^c &= \frac{4aS(1 + \theta) - S^2(5 - \theta) - 4bcS(1 - \theta^2)}{16b(1 - \theta^2)}
\end{aligned}$$

Our findings for the category adviser scenario and the implications of our findings can be summarized as follows:

- **Result 1:** The category adviser allocates the shelf space as follows: $q_1^c = 3S/4$ and $q_2^c = S/4$. Therefore, $q_1^c > q_2^c$. This result clearly shows that the category adviser takes advantage of its position and allocates a bigger shelf space to its own product. If we had multiple products in the category, this effect would be magnified and the category adviser would exclude some of the products that would otherwise be included in the category by the retailer. The exclusion of some of the products from the category may, in the long run, lead to unsatisfied customers.
- **Result 2:** Comparing retail prices: $p_1^c < p_2^c$. The retail price of category adviser's product is lower than the other manufacturer's retail price. Again, the category adviser takes advantage of its position and favors its own product.

3 Findings

Below we compare the two scenarios for different values of shelf space constraint S . We can show that $\bar{S} < \bar{S}^c$, therefore we consider the following two cases only: (1) $S \leq \bar{S}$ where both scenarios are constrained and (2) $\bar{S} < S \leq \bar{S}^c$ where the benchmark scenario is unconstrained and the category adviser scenario is constrained⁴.

3.1 Case 1: $S < \bar{S}$

Both the benchmark and the category adviser scenarios are constrained in this case.

- **Result 1** $q_1^c > q_1^*$ and $q_2^c < q_2^*$. That is the category adviser takes more shelf space in the category adviser scenario. As Corstjens and Corstjens argue in their influential book on Store Wars

... shelfspace is one of the most powerful sources of mindspace and shelfspace is another zero sum resource, any gains in the shelfspace that are won from competitors are doubly valuable (p. 53).

- **Result 2:** Retail prices: $p_2^c > p_2^* = p_1^* > p_1^c$. The retail prices

$$p_1^* - p_1^c = \frac{S}{4b(1+\theta)} \quad p_2^c - p_2^* = \frac{S}{4b(1+\theta)}$$

The category adviser takes advantage and reduces its retail price in the category adviser scenario whereas it increases its competitor's retail price.

⁴It is straightforward to consider the third case where $S > \bar{S}^c$.

- **Result 4:** The total supply chain (retailer and both manufacturers) profit in the benchmark scenario is

$$\Pi_{SC}^* = \frac{S(2a - S)}{2b(1 - \theta)} - cS$$

Similarly, the total supply chain profit in the category adviser scenario is

$$\Pi_{SC}^c = \frac{8aS(1 + \theta) - S^2(5 + 3\theta)}{8b(1 - \theta^2)} - cS$$

It can be shown that $\Pi_{SC}^* > \Pi_{SC}^c$. The decrease in the total supply chain profit in the category adviser scenario is due to the decrease in the average retail prices in the category adviser scenario.

- **Result 5:** Category adviser's profit: $\Pi_1^c > \Pi_1^*$ if

$$K > \frac{S}{16} \left(\frac{S(11 - 15\theta) + 4a(1 + \theta)}{b(1 - \theta^2)} \right)$$

As K increases, the category adviser's profit also increases. The increase in the profits is caused by an increase in the shelf space and an increase in the category adviser's margins.

- **Result 6:** Consumer surplus. Denote the consumer surplus in the benchmark and category adviser scenarios as CS^* and CS^c , respectively. One can show that $CS^c \geq CS^*$ with equality holding at $\theta = 1$. This implies that consumers are better off in the category adviser scenario. This is mainly due to the fact that consumers consume the same amount (S) but at a lower average price.

Summary: Consumer surplus increases under the category adviser scenario and this increase comes at the expense of the supply chain. In particular, the increase in the consumer surplus most likely comes at the expense of the second manufacturer.

3.2 Case 2: $\bar{S} < S \leq \bar{S}^c$

For $\bar{S} < S < \bar{S}^c$ the benchmark scenario is unconstrained and the category adviser scenario is constrained.

- **Result 1:** The total supply chain profit under the benchmark and category adviser scenario is

$$\Pi_{SC}^* = \frac{[a + bc(\theta - 1)]^2(3 - 2\theta)}{2b(\theta - 2)^2(1 - \theta)} \quad \Pi_{SC}^c = \frac{8aS(1 + \theta) - S^2(5 + 3\theta)}{8b(1 - \theta^2)} - cS$$

Depending on the system parameters, it may be that $\Pi_{SC}^* \lesseqgtr \Pi_{SC}^c$

- **Result 2:** Depending on the system parameters, one may have $CS^* \stackrel{\cong}{\cong} CS^c$. This result implies that depending on the system parameters, consumers can be better off in any one of the scenarios.

Summary: There are cases where the consumer surplus is better under the benchmark scenario and there are cases where consumer surplus is better under the category adviser scenario.

4 Conclusions

The main conclusion of our research is that consumers may be better off under the category adviser scenario compared to the benchmark scenario. However, the improvement in consumer surplus comes at the expense of the second manufacturer. On the other hand, we may also have cases where the supply chain as a whole may benefit from the category adviser arrangement however this time the benefits come at the expense of the consumer surplus. Consequently, we argue that the category adviser arrangements should be treated with care and should be better understood in order to deliver benefits not only to the category advisers and the retailers but also to consumers.

The main premise of the category management and subsequently the category adviser initiatives in practice is to deliver consumer value and result in a win-win type of situations. However, we show that one's benefit always comes at the expense of the other. From retailer's point of view, the category adviser arrangements can be used as a way of extracting some surplus from the manufacturers and redistributing it to the consumers.

The next steps would be to explore the impact of category adviser arrangements on variety that is offered by the retailer. Another future research direction would be to consider the possibility of asymmetric information between the retailer and the category adviser. This would allow us to capture the fact that the category advisers have superior information about the consumers which is one of the most cited reasons behind the adoption of category adviser arrangements in practice. The inclusion of asymmetric information would work in favor of category adviser arrangements.

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5 Appendix

5.1 Solution to the Problem B

The Lagrangian is defined as

$$\mathcal{L}(p_1, p_2, \lambda) = (p_1 - w_1)q_1 + (p_2 - w_2)q_2 - \lambda((q_1 + q_2) - S), \quad \lambda \geq 0$$

The first order conditions are

$$\begin{aligned} \frac{\partial \mathcal{L}}{\partial p_1} &= a - bp_1 - \lambda b(\theta - 1) + b\theta p_2 - b(p_1 - w_1) + b\theta(p_2 - w_2) = 0 \\ \frac{\partial \mathcal{L}}{\partial p_2} &= a - bp_2 - \lambda b(\theta - 1) + b\theta p_1 - b(p_2 - w_2) + b\theta(p_1 - w_1) = 0 \\ \frac{\partial \mathcal{L}}{\partial \lambda} &= S - 2a - b(p_1 + p_2)(\theta - 1) = 0 \end{aligned}$$

Solving the first order conditions for the unknowns we get,

$$\begin{aligned} p_1(w_1, w_2) &= \frac{4a - 2S + b(1 - \theta)(w_1 - w_2)}{4b(\theta - 1)} \\ p_2(w_1, w_2) &= \frac{4a - 2S + b(1 - \theta)(w_1 - w_2)}{4b(\theta - 1)} \\ \lambda &= -\frac{2S - 2a + b(1 - \theta)(w_1 + w_2)}{2b(1 - \theta)} \end{aligned}$$

Manufacturers' profit functions at stage 1 are

$$\begin{aligned} \Pi_1(w_1, w_2) &= \frac{1}{4}(w_1 - c)(2S + b(1 + \theta)(w_2 - w_1)) \\ \Pi_2(w_1, w_2) &= \frac{1}{4}(w_2 - c)(2S + b(1 + \theta)(w_1 - w_2)) \end{aligned}$$

The equilibrium wholesale prices can be found as

$$w_1^* = c + \frac{2S}{b(1 + \theta)} \quad w_2^* = c + \frac{2S}{b(1 + \theta)}$$

The equilibrium retail prices are given by

$$p_1^* = \frac{2a - S}{2b(1 - \theta)} \quad p_2^* = \frac{2a - S}{2b(1 - \theta)}$$

and the lagrange multiplier λ is given by

$$\lambda = \frac{a - 3S + (a + S)\theta}{b(1 - \theta^2)} - c$$

5.2 Solution to the Problem CC

The Lagrangian is defined as

$$\mathcal{L}(w_1, p_1, p_2, \lambda) = (p_1 - w_1)q_1 - \lambda((q_1 + q_2) - S) - \mu(K - [(p_1 - w_1)q_1 + (p_2 - w_2)q_2]),$$

with $\lambda \geq 0$ and $\mu \geq 0$. The first order conditions are

$$\frac{\partial \mathcal{L}}{\partial w_1} = 0 \quad \frac{\partial \mathcal{L}}{\partial p_1} = 0 \quad \frac{\partial \mathcal{L}}{\partial p_2} = 0 \quad \frac{\partial \mathcal{L}}{\partial \lambda} = 0 \quad \frac{\partial \mathcal{L}}{\partial \mu} = 0$$

Solving all five equations for the five unknowns we get,

$$\begin{aligned} w_1(w_2) &= \frac{b^2 c^2 (\theta^2 - 1) + 8bK(\theta - 1) + 8aS - 4S^2 - 4bSw_2(\theta - 1) + b^2 w_2^2 (1 - \theta^2)}{2b(\theta - 1)(bc - 2S + bc\theta - bw_2 - bw_2\theta)} \\ p_1(w_2) &= \frac{4a - 2S + b(1 - \theta)(c - w_2)}{4b(1 - \theta)} \\ p_2(w_2) &= \frac{4a - 2S - b(1 - \theta)(c - w_2)}{4b(1 - \theta)} \\ \lambda &= \frac{2S - 2a + b(1 - \theta)(c + w_2)}{2b(\theta - 1)} \\ \mu &= 1 \end{aligned}$$

The second manufacturer's anticipates the above prices and chooses the w_2 such that Π_2 is maximized,

$$\max_{w_2} \Pi_2(w_2) = (w_2 - c)q_2(w_1, p_1, p_2)$$

The equilibrium w_2 is

$$w_2^c = c + \frac{S}{b(1 + \theta)}$$

Substituting back w_2^c , we can find equilibrium retail prices.