

2018 INFORMS International Conference
Taipei, Taiwan, June 17–20, 2018
© 2018 INFORMS| ISBN 978-0-9906153-1-6
https://doi.org/10.1287/infp.2018.XXXX
pp. 000–000

Dominant Retailer, Lower Product Quality And Uninformed Customers

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Abstract A number of consumer and business reports suggest that slightly lower quality (or feature) variants of products are being sold through dominant and mass retailers, while higher quality variants continue to be sold through specialty and weaker retailers and, customers are uninformed about such differences. Using a game theoretic model, we find that (1.) in a bilateral monopoly of manufacturer and retailer an increase in bargaining power of the retailer leads to a lower product quality in the channel, if quality is non-contractible. (2.) The weaker retailer does not have an incentive to communicate its higher quality even if the advertising is costless, if the quality differences are not too high.

Keywords Game Theory ; Marketing ; Supply Chain Competition

1. Introduction

The impact of the presence of a dominant downstream channel member on the marketing mix of a manufacturer has been a matter of great interest for both researchers and practitioners alike. Extant literature on the issue has focused on the impact of the presence of a dominant retailer on the pricing and coordination strategies (Raju and Zhang 2005), promotions (Geylani, Dukes and Srinivasan 2007) and product placement (Dukes, Geylani and Srinivasan 2009) in a channel. However, it is well regarded that the growing dominance by some of the retailers has implications for a manufacturer's product policies too.

An interesting issue in this regard is the presence of two versions (often in terms of quality or features) of the same product in two different retail stores (with generally the lower quality version being available at the dominant retailer while the higher quality being available at the weaker retailer) with no effort on communicating the product differences on the part of the dominant retailer, the weaker retailer or the manufacturer. For example, consider the following customer complaint cited in Business week (Nussabaum 2007).

"I wanted an inexpensive digital camera for my daughter. After finding one with the basic features I wanted, I went to sears, target and walmart to check prices. All 3 stores sold the camera with the exact same model number. Sears -$119 target -$109 walmart - $99. I bought it at the manufactures online store but when the camera was delivered it DID NOT have all the features that the Sears and Target salesperson had shown me (couldn't get help at the Walmart store). I contacted the factory store and asked them if perhaps the one I got was an older version of this camera since the model number on the unit was the correct. The customer service agent apologized and said I must have gotten one of

the "WALMART" cameras. These units were manufactured just for them with the same model number but with reduced features. So while the price was a little lower at walmart, the value was worse since it was a stripped down version".

As it turns out, this consumer is not alone. In the recent past a number of customers have faced similar problems in product categories ranging from "plumbing to locks to power tools" as documented by discussions on online consumer forums (Practical Machinist 2010).

In this context it is surprising that there is an apparent lack of knowledge among consumers about the quality differences before purchase although the retailers carrying the higher-quality versions, and potentially the manufacturers, seem to have an incentive to inform them.

We study this phenomenon with a model of a single manufacturer supplying the product through a channel consisting of a dominant retailer and a weaker retailer who compete for the consumer demand consisting of three consumer segments. Retailers bargain on wholesale prices. We also assume a marginal cost function that is convex in product quality and consider quality to be non-contractible. We model spatial competition between retailers by employing a Hotelling (1929) line in which retailers are positioned at the ends. When quality differences are small, we find that, counter-intuitively, the weaker retailer does not advertise its quality advantage, even if advertising is costless. The rationale is that under this condition a gain in consumer demand due to the greater awareness in quality is outweighed by a loss of profit through an increase in price competition between retailers.

2. Model

There are three types of players in the market, customers, retailers and manufacturer. The following subsections describe the players, their decisions and payoffs.

2.1. The Consumer Market

There are three segments of customers in the market based on their level of information before visiting the retail store. First, there is the informed segment, denoted as segment I, who knows about both product quality and prices at each of the retail outlets and comprises α percent of the market. Second, there are consumners who are only aware of the prices but not the quality differences at the retail shops. This partially informed segment, denoted as segment PI, consists of $(1-\alpha)\beta$ percent of the market. Finally, the uninformed segment NI, comprising $(1-\alpha)(1-\beta)$ percent of the market, are consumers who know neither exact prices nor quality differences between the retail outlets and are aware of only the location of each of the retail outlets. Our model is silent on the reason for lack of information about quality and price differences in the partially informed and the uninformed segments before visiting the stores. The difference in information sets could be due naivety of the customers, or their higher search (opportunity) cost for quality/price or any other factor. Similar to Schulman and Geng (2011) and Gabaix and Laibson (2006), we assume customers to be bounded rational. Furthermore, we assume that each consumer has demand for only one unit of the product. Given these characteristics, the uninformed customers visit their closest retailer to buy products and either buy or not buy the products depending on their reservation price and the price of the product prevailing at the retail outlet. It is assumed that for the uninformed segment, the quality of the product is same as that of the lower quality product in the channel. The three segments of consumers are uniformly distributed along a Hotelling line (1929). The retailers are at location 0 (Weaker Retailer) and 1 (Dominant Retailer). The consumer's utility function is given as $U_i(x) = \theta q_i - p_i - t \mid x - L_i \mid$ where t is the transportation/psychological cost, θ is a measure of preference for quality, x is the distance of the customer from a retailer located at L_i, p_i and q_i are the price and quality of the product at retailer i $(i = W, D)$. For most part of the analysis we normalize $\theta = 1$.

2.2. Retailers and Their Decisions

The weaker retailer is positioned at $L_W = 0$ on the Hotelling line and is characterized by low channel power such that it accepts the wholesale price, w_W and quality decisions, q_W made by the manufacturer in a Stackelberg framework. However, it maximizes profits with respect to its retail price p_W to cater to market demands D_W^{PI}, D_W^{NI} and D_W^I, from the partially informed, uninformed and the informed segments, respectively. The dominant retailer is positioned at $L_D = 1$ on the Hotelling line and is characterized by higher channel power such that it negotiates its wholesale price w_D keeping in mind the quality decision rule of the manufacturer q_D, its own profit maximizing retail pricing rule p_D and its market demands D_D^{PI}, D_D^{NI} and D_D^I, from the partially informed, uninformed and the informed segments respectively.

2.3. The manufacturer and its Decisions

It is assumed that the manufacturer's product quality q_i is non contractible but observable to the retailer i. The rationale for such an assumption is based on transaction cost theory (Coase 1937, Williamson 1975; see Rindfleisch and Heide 1997) considering that contracts regarding quality are incomplete by nature. Product quality (or a part of it) by its virtue cannot be seen and can only be felt once it is consumed. In the current model we assume that the manufacturer faces a convex marginal cost of quality assumed as q_i^2 and a constant marginal cost of quantity that is normalized to 0.

The demand and the profit functions facing the retailer and the manufacturers in the given model are given as $x_{NI} = \frac{1}{2}, x_{PI} = \frac{p_D - p_W + t}{2t}, x_I = \frac{q_W - q_D + p_D - p_W + t}{2t}$, $D_W^k = x_k$ and $D_D^k = 1 - x_k; k = NI, PI, I$.

$$w_D^* = \arg\max_{w_D} G = (\pi_M - \overline{\pi}_M)^{1-y} (\pi_D - \overline{\pi}_D)^y, \tag{1}$$

where $y \in [0,1]$ is the bargaining power of the dominant retailer,

$\overline{\pi}_M$ and $\overline{\pi}_D$ are the outside options for the manufacturers and dominant retailers, (2)

$$\pi_M = \max_{q_D} \pi_M = D_D(w_D - q_D^2) + D_W(w_W - q_W^2), \tag{3}$$

$$\overline{\pi}_M = D_W(w_W - q_W^2), \overline{\pi}^D = 0, \tag{4}$$

$$\pi_D = \max_{p_D} \pi_D = D_D(p_D - w_D), \tag{5}$$

$$\text{and } \pi_W = \max_{pW} \pi_W = D_W(p_W - w_W), \tag{6}$$

$$D_D = (1-\alpha)\{\beta D_D^{PI} + (1-\beta) D_D^{NI}\} + \alpha D_D^I, \tag{7}$$

$$D_W = (1-\alpha)\{\beta D_W^{PI} + (1-\beta) D_W^{NI}\} + \alpha D_W^I, \tag{8}$$

$$D_W^k = x_k \text{ and } D_D^k = 1 - x_k; k = \{NI, PI, I\}, \text{and} \tag{9}$$

$$x_{NI} = \frac{1}{2}, x_{PI} = \frac{p_D - p_W + t}{2t}, \text{ and } x_I = \frac{q_W - q_D + p_D - p_W + t}{2t}. \tag{10}$$

2.4. Strategic Interactions

The sequence of events in the current model has been designed to capture asymmetry among retailers with respect to their power vis-à-vis the manufacturer, non-contractibility of quality and the medium term nature of the manufacturer's quality decision. At the first stage of the game the dominant retailer and the manufacturer bargain on wholesale prices. Retail dominance is measured by a retailer's level of bargaining power vis-à-vis the manufacturer. Bargaining power of the retailer is the relative ability of the retailer to influence decisions in negotiations with the manufacturer. Following wholesale price setting, the manufacturer makes its quality decisions for the dominant retailer and weaker retailer, and wholesale price decision for the weaker retailer. Finally the retailers simultaneously set prices and then market demand is realized.

3. Analysis and Results

3.1. Manufacturer, Competing Retailer and The Three Customer Segments

As is customary, we solve the game through backward induction. Thus, we start the analysis by studying the retail price competition and consumer choices in stages 3 and 4. Afterwards, we analyze the quality choice of the manufacturer and the bargaining process for wholesale prices in stages 1 and 2. Proofs are omitted for brevity and are available from the authors upon request.

3.1.1. Retail Price Equilibrium The market demands for each of segments are derived assuming full market coverage. The assumption is mathematically stated as below.

The following relationships are assumed to ensure market coverage and competition in each of the customer segments.

$$D_W^k \in [0,1] \text{ and } q_D - p_W - \frac{t}{2} > 0, \text{ for } k = (I, PI, NI) \tag{11}$$

The first equation or the competition condition ensures that in each of the segments the location of the indifferent customer is on the Hotelling line to ensure competition. The second condition ensures that both retailers together are able to cover the total market in the uninformed segment NI. The market coverage in the uninformed segment ensures that the market is covered in the other two segments whose market coverage conditions are given as $\frac{q_W+q_D-p_W-p_D}{t} > 1$ (for I segment) and $\frac{q_D+q_D-p_W-p_D}{t} > 1$ (for PI segment). Based on the demand functions, the retail price equilibrium is derived as below.

Lemma 1. *Equilibrium retail prices and comparative statics are given as,*

$$\begin{aligned} p_W &= \frac{3t - q_D\alpha + q_W\alpha + w_D\alpha + 2w_W\alpha + w_D\beta + 2w_W\beta - w_D\alpha\beta - 2w_W\alpha\beta}{3(\alpha+\beta-\alpha\beta)} \\ p_D &= \frac{3t + q_D\alpha - q_W\alpha + 2w_D\alpha + w_W\alpha + 2w_D\beta + w_W\beta - 2w_D\alpha\beta - w_W\alpha\beta}{3(\alpha+\beta-\alpha\beta)} \end{aligned} \tag{12}$$

Comparative statics are given as: $\frac{\partial p_W}{\partial \alpha} = \frac{\beta(q_W-q_D)-3t(1-\beta)}{3(\alpha+\beta-\alpha\beta)^2} \lessgtr 0$, $\frac{\partial D_W}{\partial \alpha} = \frac{q_W-q_D-(w_W-w_D)(1-\beta)}{2t} \lessgtr 0$, $\frac{\partial p_W}{\partial \beta} < 0$ *if* $q_D < q_W$; $p_D = \frac{3t+q_D\alpha-q_W\alpha+2w_D\alpha+w_W\alpha+2w_D\beta+w_W\beta-2w_D\alpha\beta-w_W\alpha\beta}{3(\alpha+\beta-\alpha\beta)}$, $\frac{\partial p_D}{\partial \alpha} = \frac{-\beta(q_W-q_D)-3t(1-\beta)}{3(\alpha+\beta-\alpha\beta)^2} < 0$.

Interestingly for the weaker retailer, neither prices nor demand would necessarily increase with an increase in proportion of the informed customers even if the advertising required to achieve this was costless. The effect of costless informative advertising on prices of the weaker retailer is critically dependent on a trade-off between gain from an increase in awareness among partially informed customers about higher quality of the retailer and the loss from

inducing competition in the uninformed customer segment. An analogous effect of costless informative advertising exists on the demand of the weaker retailer. It depends on the trade-off between increase in customer reservation prices for the weaker retailer on account of more awareness about its quality and the negative effect of the price disadvantage that the retailer has owning to its higher wholesale prices.

Proposition 1. *The weaker retailer's profit decreases with size of the informed segment if the dominant retailer's product quality is above a threshold, i.e.* $q_W > q_D > q_D^{Min} \Leftrightarrow \frac{\partial \pi_W}{\partial \alpha} < 0$, *and the weaker retailer's profit increases with size of informed segment if the dominant retailer's quality is below the threshold, i.e.* $q_D^{Min} > q_D > 0 \Leftrightarrow \frac{\partial \pi_W}{\partial \alpha} > 0$, *where*

$$q_D^{Min} = \frac{q_W(\alpha(-1+\beta)-2\beta) - 3t(-1+\beta) - (w_D - w_W)(\alpha(-1+\beta)-\beta)(-1+\beta)}{\alpha(-1+\beta)-2\beta} \tag{13}$$

The proposition states that given the market conditions, the weaker retailer is better off not conducting costless informative advertising if the quality differences between the dominant and the weaker retailers' products are not too high. The intuition for the result is that an increase in awareness about superior quality of the weaker retailer has two opposing effects on the profitability of the retailer. On one hand an increase in awareness of the weaker retailer's better quality allows a positive shift in the retailer's prices and demand while on the other hand such an advertising creates overall awareness among the market in the sense that some more customers enter the competitive market from the NI segment thereby creating more competition between the retailers which negatively affects prices and demands. A trade-off of these effects determines whether the weaker retailer is better off informing customers or not and it depends on the quality differences between the weaker retailer and the dominant retailer. Thus, we add to the literature by suggesting that a higher quality firm need not necessarily be better off doing informative advertising even when it is costless to advertise. Our results are in line with the general business intuition that advertising and information among customers generally increase competition and is thereby not always a good strategy.

3.1.2. Manufacturer's Product Quality and Wholesale Price Bargaining In this section we study the manufacturer's optimal choice of whole sale price and product quality for the weaker retailer, and product quality for the dominant retailer's product variant. Finally, we study the subsequent wholesale price bargaining that takes place between the manufacturer and the dominant retailer.

Proposition 2. *(1) The manufacturer's qulity and wholesale price decision for the weaker retailer are given as* $q_W = \frac{\alpha}{2(\alpha+\beta-\alpha\beta)}$ *and* $w_W = \frac{1}{2}\left(-q_D^2 + 2w_D + \frac{\alpha^2}{4(\alpha+\beta-\alpha\beta)^2} + \frac{3t - q_D\alpha + \frac{\alpha^2}{2(\alpha+\beta-\alpha\beta)}}{\alpha+\beta-\alpha\beta}\right)$, *where* q_D *is given below.*

(2) The participation constraint $q_D - p_W - \frac{t}{2} > 0$ *is binding on the manufacturer's optimal quality decision for the dominant retailer and hence, the manufacturer chooses the dominant retailer's quality at the lowest quality level for market coverage as given by,*

$$\begin{aligned} q_D^* = \frac{1}{2(\alpha+\beta-\alpha\beta)^2}(&-5\alpha^2 + 8(-1+\alpha)\alpha\beta - 3(-1+\alpha)^2\beta^2 \\ &+\sqrt{3}\sqrt{((\alpha+\beta-\alpha\beta)^2(2\alpha(4t+(5+t+2w_D)\alpha) \\ &-2(-1+\alpha)((5+4w_D)\alpha+2t(2+\alpha))\beta + (3+2t+4w_D)(-1+\alpha)^2\beta^2)))\end{aligned} \tag{14}$$

and $\frac{\partial q_D^*}{\partial w_D} > 0$.

The weaker retailer's product quality decreases with an increase in size of the PI segment because the segment cannot ascertain quality levels between retailers but can ascertain price levels. In such a case, the manufacturer cannot recover the investment in quality through

higher price and hence, decreases the quality level for the weaker retailer as the size of the PI segment increases. The manufacturer's wholesale price for the weaker retailer increases with its wholesale price for the dominant retailer and increases with its increase in quality for the weaker retailer.

In the current context the manufacturer can increase profits by decreasing the quality for the dominant retailer. Doing so will increase the margins for the dominant retailer's product and increase demand for the weaker retailer's product However, because we have assumed that the full market is covered in equilibrium and there is competition in all the segments of customers, the market coverage or participation constraints becomes binding when the manufacturer tries to decrease the product quality too much. This leads to the result that the manufacturer produces a level of quality just to keep the participation constraint binding and the constraint determines the level of quality as function of the exogenous wholesale price at this stage of the game. Thus, given that the manufacturer chooses the lowest quality possible for the dominant retailer's product to have market coverage, the rest of the analysis critically depends on the final negotiation that takes place on the range of possible values for w_D.

Lemma 2. *The Manufacturer's preferred wholesale price is* $w_D = \min\left(\overline{w}_D^1, \overline{w}_D^2\right)$ *while the dominant retailer's preferred wholesale price is* $w_D = \max\left(\underline{w}_D^1, \underline{w}_D^2\right)$. *The manufacturer's profit increases monotonically with* w_D *i.e.* $\frac{\partial \pi_M}{\partial w_D} > 0$ *and the dominant retailer's profit decreases monotonically with* w_D *i.e.* $\frac{\partial \pi_R}{\partial w_D} < 0$ *for the feasible range of values of* w_D. *Negotiation takes place in the range* $w_D \in \left[\max\left(\underline{w}_D^1, \underline{w}_D^2\right), \min\left(\overline{w}_D^1, \overline{w}_D^2\right)\right]$, *where* $\underline{w}_D^1, \underline{w}_D^2, \overline{w}_D^1$, *and* $\overline{w}_D^2$ *are given in the appendix available by the author upon request.*

To understand the incentives for the two parties i.e. the manufacturer and the dominant retailer, in this negotiation, we consider their preferred wholesale price without any negotiation. Such an analysis will reflect the divergence of interest among the manufacturer and the retailer with respect to their wholesale prices and a bargaining outcome will lie between the two extreme values which the two firms want, on basis of the the power division between them. The upper and lower bounds for the ranges for negotiation are determined by the market coverage constraints and the preferred whole sale price of the manufacturer and the retailer.

Proposition 3. *The product quality for the dominant retailer's product variant goes down with an increase in power of the dominant retailer i.e.* $\frac{\partial q_D^*}{\partial y} < 0$.

The manufacturer's preferred course of action once the quality decision has been made will be to negotiate a high wholesale price, so that its margins are maximized. This will be so because a decrease in demand for the dominant retailer from the increase in wholesale prices actually helps the manufacturer since it can earn a better margin from the same demand through the weaker retailer's product. However, the dominant retailer would want a lower wholesale price because, a lower wholesale price would have a direct margin enhancement effect and an indirect demand increase effect. Because the dominant retailer gains both in form of margins as well as demand from a decrease in wholesale price it will have a strong incentive to negotiate a lower wholesale price. An indirect effect of all these effects will be that the quality of the dominant retailer's product will go down with a greater weight on the dominant retailer's wholesale prices i.e. an increase in the power of the dominant retailer would lead to a decrease in product quality because quality is an increasing function of wholesale prices. The above discussion is formally stated as part of lemma 2 and proposition 3.

Proposition 4. *If* $0 < t < \frac{\alpha^2+4\alpha\beta-\alpha^2\beta}{12\alpha+12\beta-24\alpha\beta-12\beta^2+12\alpha\beta^2}$ *and* $0 < y^*(\alpha,\beta) < y < 1$, *then* $\frac{\partial \pi_W}{\partial \alpha} > 0$. *If* $0 < t < \frac{\alpha^2+4\alpha\beta-\alpha^2\beta}{12\alpha+12\beta-24\alpha\beta-12\beta^2+12\alpha\beta^2}$ *and* $0 < y < y^*(\alpha,\beta) < 1$, *or* $t > \frac{\alpha^2+4\alpha\beta-\alpha^2\beta}{12\alpha+12\beta-24\alpha\beta-12\beta^2+12\alpha\beta^2}$ *and* $0 < y < 1$, *then* $\frac{\partial \pi_W}{\partial \alpha} < 0$.

Finally, we evaluate whether conditions exist in which the weaker retailer may not conduct costless informative advertising given the outcome of the wholesale price negotiations between the manufacturer and the dominant retailer. At the equilibrium we do find that there exist conditions in which the weaker retailer would not implement such advertising. Interestingly, we find that the incentive to increase the size of the informative segment or implement advertising increases with an increase in the dominance of the dominant retailer when differentiation between firms is low.

The intuition for this result is that, as an increase in dominant retailer's power takes place, the dominant retailer starts negotiating lower wholesale prices with the manufacturer, to increase its demand as well as margin. The reason is that it already knows that the manufacturer provides a quality level that is sub optimal, because the manufacturer can earn more profits by diverting demand to the weaker retailer's shop. Such a decrease in wholesale prices decreases the reservation prices required for market coverage for the dominant retailer's product and hence, the manufacturer can afford to reduce the quality level even further. Given that the quality level decreases with an increase in retailer's power, the difference in the quality level between the weaker retailer and the dominant retailer's products increases. On the other hand the dominant retailer is much more competitive in the partially informed segment because of its lower prices. Such a severe pressure on the pricing front incentivizes the weaker retailer to carry out advertising because the negative effect of price competition from more information among customers is diminished. This happens because of the already existing lower prices while the positive benefit from advertising quality differences increases because the dominant retailer's quality is even lower now. These effects are stronger when the differentiation between firms is lower.

An increase in size of the informed segment decreases the manufacturer's profit. The rationale for this result is that an increase in the informed segment increases price competition and hence, decreases the prices of the retailers. The decrease in prices of the retailers causes a drop in the overall channel profit because the market is saturated and demand is not increasing as a result.

4. Summary

In this research we find that retail dominance leads to a decrease in product quality and a lack of information about such a decrease in quality can be an equilibrium outcome. Our explanation for the decrease in product quality with increase in bargaining power of the dominant retailer is new to the literature and we also show that under many situations weaker retailers may not advertise their higher quality. *I*t is important to acknowledge that while we offer an explanation for both the phenomena of decrease in quality with retail dominance and lack of knowledge in customers about quality differences across different types of retailers, there can be other explanations that address these two puzzles partially. In such cases, future empirical studies are needed to identify the explanatory power of different theories.

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