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# On manufacturers complementing the traditional retail channel with a direct online channel

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**Abstract** With the explosion of the Internet and the reach that it affords, many manufacturers have complemented their existing retail channels with an online channel, which allows them to sell directly to their consumers. Interestingly, there is a significant variation within product categories in manufacturer's use of the Internet as a direct distribution channel. The main objective of this study is to examine the strategic forces that may influence the manufacturer's decision to complement the retail channel with a direct online channel. In particular, we are interested in answering the following questions:

(I) Why is it that in some markets only a few firms find it optimal to complement their retail channels with a direct Internet channel while other firms do not?
(II) What strategic role (if any), does the direct Internet channel serve and how do market characteristics impact this role?

To address these issues we develop a model with a single strategic manufacturer serving a market through a single strategic retailer. In addition to the focal manufacturer's product the retailer carries products of competing manufacturers. Consumers in this market are one of two types. They are either *brand* loyal or *store* loyal. The retailer sets the retail price and the level of retail support, which impact the demand for the manufacturer's product. The retailer's decisions

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in turn depend on the wholesale price as well as the Internet price of the product if the manufacturer decides to complement the retail channel with an online channel.

Our analysis reveals that the optimality of complementing the retail channel with an online channel and the role served by the latter depends critically upon the level of support that the retailer allocates to the manufacturer's product in the absence of the online channel. The level of support allocated by the retailer, in the absence of the online channel, depends upon the retail margins on the manufacturer's product relative to that on rival products in the product category. When the size of the brand loyal segment is small relative to the size of the store loyal segment then in the absence of the online channel, the manufacturer can lower wholesale price and enhance retail support, especially when the retail margins on the rival products are low. In contrast, when the size of the loyal segment is large and the retail margins on rival products are high the manufacturer will find it more profitable to charge a high wholesale price even if that induces the retailer to extend low levels of support. If the manufacturer decides to complement the retail channel with an online channel, some consumers who would have purchased from the retailer might prefer to purchase online. Our analysis reveals that when consumers' sensitivity to price differences across the competing channels exceeds a certain threshold it is not optimal for the manufacturer to complement the retail channel with an online channel. However, this price sensitivity threshold itself depends upon product/market characteristics, suggesting that manufacturers seeking to complement their retail channels with an online channel should look beyond the nature of threat the online channel poses to the retail channel in devising their optimal distribution strategies. When the retail margins on rival products are sufficiently small, complementing the retail channel with an online channel when optimal allows the manufacturer to price discriminate and enhance profits. In contrast when retail margins on rival products are sufficiently high, complementing the retail channel with an online channel serves to enhance retail support. We also identify market conditions under which profits of *both* the manufacturer and the retailer are greater with the online channel than that without it. This is particularly interesting since the online channel competes with the retail channel.

**Keywords** Dual distribution · Price discrimination · Retail support · Channel conflict · Game-theory

**JEL classification** L42 · L81 · M31

## 1. Introduction

The reach of Internet has expanded at a torrid pace over the past few years. Compared with the physical distribution channel, the Internet can provide wide coverage with low operational cost. For manufacturers this greatly enhances the attractiveness of the Internet as an additional distributional channel. While most major manufacturers have established their presence on the Internet by delivering company image and product information, there is a significant variation in manufacturers' use of the Internet as a channel to sell directly to their consumers. That is while some manufactures prefer to complement their traditional retail channels with a direct online channel others do not. The main focus of this study is to shed light on strategic

forces that help explain this variation. At one level the explanation for this variation is obvious. Manufacturers will adopt a channel of distribution only if there is a sizable demand on that channel. This might help explain why manufacturers of frequently purchased packaged goods do not sell their products online, as consumers seldom purchase these products online—for example, very few consumers may prefer to purchase detergents online. In contrast, there is a sizeable online demand for computers and related peripheral products. Consequently, one observes almost all the major computer companies, such as *Compaq*, *Hewlett & Packard*, and *IBM* etc., adopting a dual distribution channel by not only selling through their traditional distribution channel (*Circuit City* and *CompUSA* etc.) but also selling products on their own websites. Thus, the variation in online demand may explain (at least partly) the observed variation in manufacturer's use of Internet as a direct online channel across industries.

However, the above argument does not help explain the observed variation in manufacturer's use of the Internet as a direct channel within a product category. For example, in the consumer electronics category leading manufacturers such as *Sony* and *Panasonic* use the Internet as a direct channel in addition to their traditional retail channels, while manufacturers such as *JVC* and *NEC* do not. These examples are not isolated—similar patterns are observed in other categories, such as Digital Cameras wherein manufacturers: *Sony*, *Kodak* and *Minolta* etc., sell through both distribution channels, while manufacturers, such as *Nikon*, *Canon*, and *Olympus* etc., only sell through their traditional retail outlets.

One reason for this observed variation might be related to order fulfillment costs. Selling direct on the Internet shifts the responsibility of maintaining inventory and fulfilling orders back to the manufacturer. Manufacturers who do not have the necessary infrastructure to fulfill orders may prefer not to sell direct through the online channel. This explanation, however, appears weak since, manufacturers such as *Nikon* and *Canon* who *do not* use the Internet as a direct channel sell accessories and reconditioned products on their websites. While we recognize that the infrastructure required for fulfilling orders for the entire portfolio of a manufacturer's products will be significantly larger than that required to fulfill orders of a much smaller set of products this practice does seem to suggest that fulfillment costs may not be a major issue. Indeed, we show that under certain market conditions, even if there is a sizeable online demand *and* there are no fulfillment costs a firm may still decide not to sell online. By considering a simple model we highlight the strategic issues that influence the manufacturer's decision of complementing its traditional retail channel with a direct online channel.

The new distribution channel can potentially change the historic relationship between the manufacturer and the retailer. On the one hand, it provides manufacturers a way to circumvent traditional retailers and sell directly to the consumers. This could reduce their dependence on the retailer and moderate pricing inefficiencies caused by the double marginalization problem (Jeuland and Shugan, 1983). With the direct Internet channel the manufacturer may be able to reach and sell to some of the target consumers at a higher margin. On the other hand, the direct Internet channel is likely to attract some customers who in the absence of this option would have purchased from the retailer. This might introduce some additional tensions in an already strained manufacturer-retailer relationship and

may cause the retailer to react in a way that adversely affects the manufacturer. A report titled *Facing the Forces of Change* summarizes this concern: "manufacturers and distributors face strained channel relationships as e-business makes its way into marketing channels and supply chains." (National Petroleum News, 2001). Similar concerns are documented in the *Harvard Business* case titled *HP Consumer Products Business Organizations: Distributing Printers via the Internet* (Lal et al., 1999).

The impact of this adverse reaction could be critical because in many product markets (Lal et al., 1999) the retailer not only helps deliver the product to the consumers but also builds brand awareness, provides brand information and customer support. For example in the consumer electronics product category, consumers get tailored information and assistance from trained salesperson, whose advice significantly affects consumers' brand choices. In addition, the amount of shelf space assigned and the way the retailer displays the brand all impact consumers' choices. The retailer may respond to competition from the manufacturer's direct Internet channel by lowering the level of support, which, in turn, will lower the demand for the manufacturer's product. There is ample evidence that channel conflict is one of the major factors that discourages manufacturers from using the Internet as a distribution channel complementing the existing traditional brick-and-mortar retailer. In 1999, Levi Strauss made an announcement of stopping investment in on-line sales of Levi products from their own web site (*Business* 2.0, 2000). At that time, many reviews suggested that, Levi Strauss made this decision because of complaints from the retailers who were upset about the potential competition from the online channel (*San Francisco Examiner*, 1999). Liz Claiborne explicitly states that they would not sell their products online to avoid competing with their retail partners (*Stores*, 1999). Thus, at least some manufacturers rely exclusively on their traditional retailers and choose to have a very limited presence on the Internet because of fear of alienating their traditional intermediaries.

In contrast, many manufacturers have successfully extended their distribution channel to the Internet. For example, in 2001, IBM, the technology giant sold $12 billion worth of goods through its IBM.com site, up 41% from the $8.6 billion it sold the year before. The site now accounts for 14% of IBM's total sales, up from 10% in 2000 (Business to Business Commerce, 2001). As noted above, these are not isolated examples. With the explosive growth of Internet commerce and increased proclivity of consumers' to shop on the Internet it is both timely and important to understand the forces that influence firms' incentive to complement their traditional retailers with a direct Internet channel. Specifically, we seek answers to the following questions. Why is it that in some markets only a few firms find it optimal to have a direct Internet channel while other firms do not? What strategic role (if any), does the direct Internet channel serve and how do market characteristics impact this role? Thus, we seek to identify firm/market specific factors and shed light on how they impact a manufacturer's decision to complement its traditional retailers with a direct Internet channel. Specifically, our analysis seeks to investigate how the characteristics of the manufacturer and the retailer's clientele mix affect the retailer's response to this new source of competition and how that influences the manufacturer's decision? Thus, the analysis seeks to explain the variation within product categories, in manufacturers' use of the Internet as a direct channel. Finally, we wish to address the issue of whether or not

retailer can benefit from the presence of the online channel? With the online channel competing with the retail channel for consumer demand, intuition might suggest the retailer is unlikely to benefit from additional competition. We seek to validate this conjecture as well.

### 1.1. Overview of the model, main results and intuition

To address these issues we consider a simple marketing channel with one strategic manufacturer who serves a market through a single retailer. In addition to the focal manufacturer's product the retailer carries products of competing manufacturers. To highlight the strategic forces at work in a transparent manner, the decisions of the rival manufacturers are assumed to be exogenous. Consumers in this market are one of two types. They are either *brand* loyal or *store* loyal. *Brand* loyal consumers are in the market to purchase the focal manufacturer's product as long as its price is less than their reservation price. In contrast, *store* loyal consumers are loyal to the retailer but uncommitted to any particular brand in the product category. In addition to retail price, the retailer decides on the level of merchandising support to provide to the focal brand. The level of support, which for simplicity is assumed to be high or low, influences the fraction of store loyal consumers that purchase the focal manufacturer's product, with a larger fraction purchasing the manufacturer's product when retail support is high relative to the case when it is low. Store loyal consumers, who do not purchase the focal brand, purchase one of the other brands in the product category. Retailer makes a constant (exogenous) margin on these sales. The focal manufacturer decides whether or not to complement this traditional retail channel with an Internet channel. If the manufacturer decides to rely exclusively on the retailer, he simply sets wholesale price. However, if the manufacturer decides to extend his distribution channel to the Internet, he sets the price of the product on the Internet in addition to the wholesale price. If the product is available on the manufacturer's website, some of the brand loyal consumers may prefer to purchase directly from the website. The fraction of brand loyal consumers that switch and purchase from the website is endogenously determined and depends upon how sensitive brand loyal consumers are to the price difference across the competing channels.

Our analysis shows that when the manufacturer does not sell its product on the Internet the retailer's decision to offer high or low merchandising support for the manufacturer's product depends upon its margin relative to margins on the other brands in the product category. In other words, to induce the retailer to offer high levels of merchandising support the focal manufacturer must set wholesale price so that the retail margins on its product are at least as high as that on other brands in the product category. When retail margins on the other brands in the category are sufficiently high this could be very costly, even if offering high levels of merchandising support significantly increases the store loyal consumers who purchase the focal product. In contrast, when the margins on the other products in the category are small and/or high levels of merchandising support significantly increases the store loyal consumers who purchase the focal product the manufacturer may find it optimal to charge a wholesale price low enough to induce the retailer to offer high levels of merchandising support.

Importantly, the role of clientele mix and its interplay with category characteristics also becomes evident from our analysis. By definition the store loyal consumers are

loyal to the retailer. The manufacturer can serve this segment only with the cooperation of the retailer. When the size of the store loyal segment is large and merchandising support significantly influences their behavior, the manufacturer would like the retailer to offer high levels of support to its product. As mentioned above to achieve this, the manufacturer must set wholesale prices low enough so that the retailer's margin on the manufacturer's product is higher than the other brands in the category. However, setting a low wholesale price to serve a larger fraction of the store loyal consumers also implies subsidizing the retailer's sales to the brand loyal consumers. Thus, when the manufacturer lowers wholesale prices to induce the retailer to offer high levels of merchandising support, the size of the brand loyal consumer segment implicitly imposes a cost. We find that complementing the traditional retail channel with a direct online channel can, under some conditions, reduce this cost.

By offering an online channel, the manufacturer can change the clientele mix of the retailer. Specifically, when the manufacturer complements the retail channel with a direct online channel, some of the brand loyal consumers switch from the retailer and purchase online. This skews the mix of retailer's clientele in favor of the store loyal consumers. The wholesale price subsidy offered by the manufacturer to induce the retailer to offer high level of merchandising support now applies to fewer brand loyal consumers. But if the online channel attracts too many brand loyal consumers one might expect the retailer to react adversely and lower support levels. In other words, if brand loyal consumers are sufficiently sensitive to the price difference across the competing channels then the retailer may lose significant sales from brand loyal consumers. We find that when the sensitivity of brand loyal consumers to price differences across the competing channels exceeds a certain threshold it will not be profitable for a manufacturer to complement the retail channel with a direct online channel. However, we find that this threshold depends on both category (such as the value of enhancing retail support, size of the store loyal consumer segment) and brand specific characteristics (such as the size of the brand loyal consumer segment). Specifically, we find that this threshold price sensitivity is decreasing in the value of enhancing retail support but non-monotonic (decreasing and then increasing) in the size of a brand's loyal segment.

We also find, very interestingly, that despite the competitive threat posed by the Internet channel the retailer's profits could be higher than that when there is no competing channel. This happens in markets where in the absence of the Internet channel the retailer extends very little support to the manufacturer's product and the average category margins are high. In contrast, in markets where the category margins are small relative to margins on the manufacturer's product, the retailer would prefer to offer high levels of merchandising support when the manufacturer has no online presence. In this case, the retailer is not very receptive to the new source of competition. These findings may help explain the behavior of manufacturer's such as *Levi Strauss* and *Liz Claiborne* who are reluctant to go online for fear of alienating their traditional retail partners. The findings also shed light on why *Sony* and *Panasonic* find it profitable to complement their traditional retail channels with an online channel while *JVC* and *NEC* in the same product category do not?

### 1.2. Related literature

Our research is related to the large and growing body of work on channel conflict and management. Within this body of work, research that analyzes the strategic interactions between the manufacturer and retailer when the manufacturer serves the consumer population using a direct channel, which competes with the traditional retail channel, is perhaps the most relevant. Research in this specific area can be broadly classified into two streams depending on whether the manufacturer owned channel is a physical store or an online store. Examples of manufacturer owned direct channel that have a physical presence include brick and mortar establishments in a regular mall or an outlet mall. In this genre, the first stream of literature analyzes situations where the direct channel is a physical store that competes with the retail store. Ahn et al. (2002), and Bell et al. (2002), consider variants of such a setup and offer insights on the strategic significance of the manufacturer owned channel. Ahn et al. (2002) show that manufacturers are able to price discriminate and get access to a distinct geographic segment of the market with the help of the manufacturer owned stores in remote locations (discount factory outlets). In contrast, Bell et al. (2002) focus on the case when the manufacturer owned store and two other retailers are co-located in the same mall. They argue that the manufacturer owned store helps alleviate the well-known "free-riding problem" (Telser, 1960) that occurs when agents cannot fully appropriate the benefits of their investments. In their context, because consumers may not purchase from the retailer that provides the service, there is a potential for free riding. In the absence of the manufacturer owned store this results in under provision of retail service. The manufacturer owned store serves to achieve a form of resale price maintenance (Telser, 1960) without relying on explicit arrangements.

The arguments proposed in our paper are distinct from that in the above studies. First, notice that in Ahn et al. (2002) the price at the manufacturer owned channel (outlet mall) has to necessarily be less than the retail price to attract any customers. Price discrimination occurs in their model because customers with low shopping costs avail the low price at the outlet mall while those with higher shopping costs pay a higher price at the retail outlet. In our setup, in contrast to Ahn et al. (2002), manufacturers can engage in price discrimination even if the price on the direct channel exceeds or is the same as that in the retail channel. This is because in our model the manufacturer's direct channel attracts the brand loyal consumers who value the convenience of shopping online. Our research is also distinct from that of Bell et al. (2002) in that we highlight the strategic role of a direct channel in the absence of any horizontal free-riding issues. We now turn to the literature that explicitly analyzes the strategic interactions between a direct online channel and the retailer.

Chiang et al. (2003) analyze a manufacturer's decision to sell direct over the Internet, exclusively through a retailer or through a hybrid of both approaches. They argue that the Internet channel serves the role of controlling the independent retailer's price thus alleviating the double-marginalization problem. Rhee and Park (2000) consider a similar setup where some consumers are sensitive to the service provided by the retailer. They find that in the absence of the direct channel retail prices are too high. Similar to Chiang et al. (2003) they show that by adopting the direct online

channel the manufacturer may be able to regulate the retailer's pricing behavior in a way that makes both parties better off. Tsay and Agarwal (2001) also consider the manufacturer's decision to sell direct, exclusively through a retailer or a hybrid of both. In their setup the manufacturer and the retailer decide on sales effort and the price in the respective channels. Sales effort in one channel is assumed to exert a positive externality on the demand in the other channel (if one exists). In addition to the problem of double marginalization there is the issue of the failure of each channel to internalize the positive externality of its sales efforts on the competing channel's demand. They show that under some conditions revisiting the wholesale pricing terms can improve the overall efficiency of the hybrid channel. More recently, Lal (2005) examines the effect of the manufacturer's decision to introduce a direct online channel on the retailer's incentive to bait and switch.

Our work contributes to this growing literature in several ways. First, the retailer in our model makes decisions that maximize category profits not just the profits on the manufacturer's product. We incorporate this feature by allowing the retailer to carry products that compete with the manufacturer's product. The retailer sets the price and the level of merchandising support, which influences the fraction of uncommitted buyers who buy the manufacturer's product (or its competing products). Second, and more importantly, the existence of rival brands in the retail channel allows us to investigate the strategic threat posed by them. In effect the existence of rival products in the retail channel endows the retailer with an outside option. This feature in our model is distinct from all the studies discussed above (with the exception of Lal, 2005) and allows us to study the intra-channel dynamics in new light. Thus, in deciding whether or not to complement the retail channel with an online channel, the manufacturer must recognize that the retailer has the option of shifting sales to rival brands in the product category if the competition between the online channel and the retail channel is too severe.

The rest of the paper is organized as follows. In Section 2 we outline the model and its assumptions. In Section 3.1 we derive the optimal strategies of the manufacturer and the retailer in the absence of the direct online channel. Then in Section 3.2 we derive the optimal strategies of the manufacturer when he decides to complement the retail channel with a direct online channel. The strategic role of the online channel may depend upon market conditions. These roles and conditions under which the online channel may or may not serve as a complement to the retail channel are delineated in Section 3.3. Although the online channel competes with the retail channel, under certain market conditions the profits of both the manufacturer and the retailer can be higher relative to the case when there is no online channel. These conditions are also identified in this Section. We conclude in Section 4 with a discussion and some directions for future research.

## 2. Model

To investigate the product-market characteristics that influence the optimality of complementing an existing retail channel with a direct online channel, we contemplate a market with a single strategic manufacturer (*focal* manufacturer) selling a branded product through a single strategic retailer. In addition to the manufacturer's prod-

uct the retailer carries the products of other manufacturers. To retain focus on the intra-channel dynamics and to keep the analysis transparent we abstract away from competition across manufacturers.[1] The focal manufacturer faces the decision of whether or not to complement the retail channel with a direct online channel. The manufacturer also decides on a constant wholesale price, $w$ that the retailer would be charged per unit—this decision is made whether or not the manufacturer decides to sell online.[2] Since the wholesale and retail prices of the *other* manufacturers' products are exogenous to the model we assume that the retailer makes a constant margin, $k$, on the *other* brands in the product category. In practice, this margin will depend both on the intensity of competition within the product category and across retailers in the market. The retailer takes the decisions of the focal manufacturer as given and decides on the retail price, $p_r$ and the level of merchandising support, $s$ to dedicate to the focal manufacturer's product. If the manufacturer decides to sell online then the online price, $p_m$ is set simultaneously with the retail price, $p_r$.

Consumers in our model are one of two types—*store* loyal or *brand* loyal. Both types of consumers are in the market to purchase at most one unit of the product as long as the price (online or retail) does not exceed their reservation price, $r$. The *store loyal* consumers in our model represent consumers who fulfill all their purchasing needs in the product category at a specific retailer—this segment is of size $\alpha_r$. These consumers are not loyal to any specific brand. Relative to the brand loyal consumers, store loyal consumers may be viewed as those who are less informed about the products in the specific category. Consequently, they value the product assortment at the retail store and rely on the retailer's advice to make their brand choice decision. Consumers of this type never consider purchasing online even if that option exists.[3] In addition to the above reasons, this type of behavior can occur because consumers of this type may have a need to touch and feel the product and actually see the product before purchasing. They might also find comfort in the fact that should the product not meet their needs they can return the product relatively easily at the retail store. Also note that, in contrast to online purchases product delivery is instantaneous at the retailer—store loyal consumers may value this feature as well. Thus, there are several reasons why some consumers may never consider purchasing online. As noted earlier the retailer can influence the purchasing decision of store loyal consumers. To capture this idea, we assume that the fraction of store loyal consumers that buys the manufacturer's brand depends upon the level of sales effort/support that the retailer allocates to the manufacturer's brand. In general the retailer will need to decide on the level of sales effort/support to dedicate to the different product categories as well as the level of support to allocate to the many brands in a given product category. The level of sales effort to allocate to each category may be determined by maximizing overall store profits with respect to these decisions. We let the parameter $\bar{s}$ denote

[1] The effects of incorporating manufacturer level competition are discussed towards the end of this Section.

[2] The wholesale price set however, may be different and will in general depend on whether or not the manufacturer decides to sell online.

[3] This assumption is not critical. All that we require is that the online channel attract more brand loyal consumers relative to store loyal consumers.

the optimal level of service to be dedicated to the one category that we analyze.[4] The retailer's problem then is to allocate $\bar{s}$ across the many brands in the product category. The level of retail support allocated to the focal manufacturer's product, $\bar{s}$ in our model comes at two levels, $s \in \{s_h, s_l\}$, with $1 \geq \bar{s} > s_h > s_l$ and $s_h + s_l = \bar{s}$.[5] Formally, for a given level of service, $s$, a fraction $\alpha_r s$ of the store loyal consumers purchase the manufacturer's brand and the remaining fraction $(\alpha_r(\bar{s} - s))$ purchase one of the other brands in the product category.

Consumers in the brand loyal segment have a strong preference for the manufacturer's product and will never consider purchasing a different brand—this segment is assumed to be of size $\alpha_m$. In the absence of the direct online channel they visit the retailer and purchase one unit if the retail price does not exceed their reservation price ($r$). On the other hand if the manufacturer decides to sell online a fraction of the brand loyal consumers shift their purchases online. To model the fraction of brand loyal consumers that switch from the retail channel to the online channel we incorporate the following features. Brand loyal consumers who switch to the online channel may do so because of the convenience that Internet shopping affords and/or because their shopping (transportation) costs are too high. We recognize that brand loyal consumers may be heterogeneous on these dimensions. Formally, we assume that a brand loyal consumer of type $\delta$ will purchase online as long as the difference in Internet price and retail price does not exceed $\delta$. To capture heterogeneity along this dimension across brand loyal consumers we assume that $\delta$ is uniformly distributed in the interval $[-d, d]$. This implies that some brand loyal consumers of type $\delta \in [0, d]$ will purchase online even if the online price is higher than the retail price. In contrast, brand loyal consumers of type $\delta \in [-d, 0)$ will consider purchasing online only if the online price is strictly less than retail price.[6] Given these assumptions, the fraction of brand loyal consumers who purchase from the Internet, denoted as $F$, can be computed:

$$F = 0.5 + \beta(p_r - p_m), \text{ where } \beta = 1/2d$$

The parameter $\beta$ can be viewed as price sensitivity of the *brand loyal* consumers, with high (low) values of $\beta$ depicting high (low) levels of switching across the competing channels. To capture the reality that manufacturers would consider going online only if there is a sizable demand from the online channel, we assume that $\alpha_m / \alpha_r s_h$ is sufficiently large. In particular, we assume $\alpha_m / \alpha_r s_h > 2/3$. This assumption also guarantees that $F$ is bounded between 0 and 1 given the optimal manufacturer and retailer strategies derived in our analysis. With these assumptions in place we can compute the demand for the manufacturer's product.

Let $D_r$ and $D_m$ respectively denote the retail demand and the online demand for the manufacturer's product. The consumer demand at the two outlets, if the manufacturer

[4] The cost of dedicating a service level of $\bar{s}$ to the category will be a function of $\bar{s}$. We assume that this cost is fixed and normalize it to zero without any loss of generality.

[5] Although, we let $s_l > 0$ to capture the institutional reality, $s_l$ can be normalized to zero with no effect on our findings. Modeling the service levels over a continuum also yields identical insights.

[6] Brand loyal consumers of this type may also exhibit a preference for the retailer because they value service. We thank an anonymous reviewer for this interpretation.

chooses to sell the brand on his website, can be written as:

$$\begin{aligned} D_r &= \alpha_r s + \alpha_m(0.5 + \beta(p_m - p_r)) \\ D_m &= \alpha_m(0.5 - \beta(p_m - p_r)) \end{aligned} \tag{1}$$

If the manufacturer chooses not to sell the brand on his website, the demand functions are:

$$\begin{aligned} D_r &= \alpha_r s + \alpha_m \\ D_m &= 0 \end{aligned} \tag{2}$$

Before presenting our assumptions on how this game unfolds we want to briefly discuss the effect of including manufacturer level competition on our findings. Would competition at the manufacturer and retail level fundamentally change our result? We will argue that it will not under sufficiently, general conditions. As we will see later, the key driver of our results is how the introduction of the online channel skews the clientele mix of the retailer. Specifically, with the online channel attracting some of the brand loyal consumers of the focal brand, the retailer's clientele comprises of relatively more store loyal consumers vis-à-vis the case when there is no online channel. This allows the focal manufacturer to induce the retailer to extend high levels of support in a relatively inexpensive manner with the introduction of the online channel. Now consider the case when the competing manufacturer's wholesale prices are endogenous. Assume that only the focal manufacturer sells through the online channel. With some of the brand loyal consumers of the focal brand shifting their purchases to the online channel, the wholesale price decrease by the focal brand subsidizes fewer brand loyal consumers purchasing at the retailer. While a wholesale price decrease by its rival subsidizes all its brand loyal consumers purchasing from the retailer. Furthermore, the focal brand's margins on online sales are higher than that on retail sales and so the focal brand can compete more aggressively for the retailer's services. So even with manufacturer level competition the fundamental force that drives our results will remain in effect.[7] Similarly, if retail competition is explicitly analyzed, as long as the competing retailers have some pricing power our results will be qualitatively unaffected.

Finally, we view the interactions between the manufacturer and the retailer unfolding in three stages. In the first stage, the manufacturer decides whether or not to complement his retail channel with a direct online channel. Following this decision, the manufacturer sets the wholesale price, $w$ in the second stage. The retailer takes the manufacturer's first and second stage decisions as given and sets the retail price, $p_r$ and the level of sales effort/support, $s$ to allocate to the manufacturer's product in the third stage. When the manufacturer decides to sell direct, the online price, $p_m$ is set in this stage. The game structure is illustrated in Fig. 1.

[7] Indeed in an extension of our base model, we consider two manufacturers selling through a common retailer. In this extension, the wholesale prices, retail prices, retail service levels for both products and the online price of the focal manufacturer's product are endogenously determined. Although closed-form solutions are obtained, it is almost impossible to analytically delineate market conditions under which the various strategies would constitute an equilibrium. However, with the help of numerical simulations we are able to obtain results that are qualitatively similar to that from our base model.

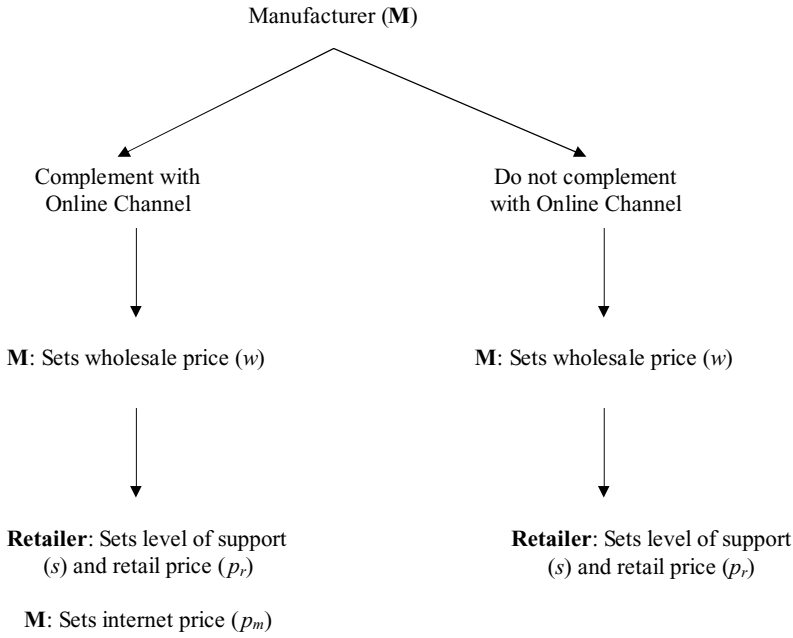



**Fig. 1** Game structure

Formally, given the manufacturer's first and second stage decisions, the retailer chooses the retail price and service level taking into account consumer demand specified in Eqs. (1) and (2) above. The retailer's profit, $\Pi_r\ (p_r, s)$, as a function of retail price and service level, is given by

$$\Pi_r(p_r, s) = D_r(p_r - w) + k\alpha_r(\bar{s} - s) \tag{3}$$

Recall that by allocating support level of $s$, to the focal brand, $\alpha_r(\bar{s} - s)$ store loyal consumers purchase one of the rival brands in the product category. Since the average retail margins on the rival brands is $k$, the second term on the right-hand side of Eq. (3) represents the retailer's profits from sales of other brands in the category. If the manufacturer decides to sell products online in the first stage then $D_r$ follows from Eq. (1) else it follows from (2).

In the former case, the optimal online and retail prices and support, $p_m^*$, $p_r^*$ and $s^*$, are obtained by simultaneously solving:

$$p_r^*(w), s^*(w) \in Arg\max \Pi_r(p_r, p_m, s) \tag{4}$$

$$p_m^*(w) \in Arg\max \Pi_m(p_r, p_m, s) \tag{5}$$

In contrast, when the manufacturer decides not to sell online, the optimal retail prices and support, $p_r^*$ and $s^*$, satisfy the following:

$$p_r^*(w), s^*(w) \in Arg \max \Pi_r(p_r, s) \tag{6}$$

The manufacturer's second stage decisions depend on its first stage decision i.e. whether or not it decides to sell through the direct online channel. If the manufacturer decides not to sell through the direct channel, the profits are given by:

$$\Pi_m(w|p_r^*(w), s^*(w)) = D_r w \tag{7}$$

where, $p_r^*(w)$, $s^*(w)$ follow from Eq. (6). The optimal wholesale price $w^*$, then satisfies the following:

$$w^* \in Arg \max \Pi_m(w|p_r^*(w), s^*(w)) \tag{8}$$

On the other hand, if the manufacturer decides to sell through the direct online channel in the first stage, the manufacturer's profit $\Pi_m$ is:

$$\Pi_m(w|p_r^*(w), p_m^*(w), s^*(w)) = D_r w + D_m p_m^*(w) \tag{9}$$

The optimal wholesale price, $w^*$, then satisfies the following:

$$w^* \in Arg \max \Pi_m(w|p_r^*(w), p_m^*(w), s^*(w)) \tag{10}$$

This concludes the discussion of the key model primitives and the solution procedure. The next section (Section 3) is the core of the paper. In this section we derive the optimal channel choice of the manufacturer. We do this by characterizing the optimal strategies of the manufacturer and the retailer for any given channel structure. The optimal channel structure and the conditions supporting that choice are determined by comparing the pay-offs across the two different choices—whether or not to complement the retail channel with a direct online channel?

## 3. Analysis of channel choice

The manufacturer's decision of whether or not to complement the retail channel with a direct online channel will depend upon the retailer's strategy when there is no online channel. Consequently, in Section 3.1 we derive the optimal strategies when the manufacturer has no direct channel. In that Section, we identify conditions under which it will be optimal for the manufacturer to induce the retailer to allocate high (low) levels of sales effort/support for its product. This is done in Lemma 1. When the manufacturer decides to sell through the direct online channel, in addition to the wholesale price, the manufacturer's internet price will influence the retailer's pricing and service decisions. In Section 3.2, we identify the manufacturer's profit maximizing wholesale and internet price that induce the retailer to offer low and high service (Lemmas 2 and 3 respectively). In Section 3.3, we compare the manufacturer's

payoffs from complementing the retail channel with an online channel with the case when there is no online channel to identify market conditions under which it may or may not be optimal for the manufacturer to have an online channel. In addition, the role served by the online channel and its relationship with market characteristics is highlighted in Section 3.3.

### 3.1. Optimal strategies when there is no direct channel

When the manufacturer does not sell its product through the online channel, the retailer's decisions on retail price and support levels are influenced by wholesale price $w$ . Given wholesale price $w$ , the retailer's profit $\Pi_r$ as a function of retail price $p_r$ and service level $s$, is defined in Eq. (3). In this case, since, the retailer's profit is increasing in retail price $p_r$ for any given wholesale price $w$ , the retailer always sets $p_r = r$. The optimal level of service allocated to the manufacturer's product depends on its margins relative to retail margins on other brands in the product category, $k$. If the manufacturer charges a wholesale price greater than $r- k$, the retail margins on the other products in the category would be more attractive. In this case, the retailer would allocate low levels of sales effort/support to the manufacturer's product. In contrast, if the manufacturer does not charge a wholesale price greater than $r- k$, the retail margins on the manufacturer's product are higher vis-à-vis other brands in the category and the retailer responds by allocating high levels of sales support to the manufacturer's product. Thus, manufacturer must trade-off the cost of wholesale price reductions with the benefit of enhanced retail support. The optimal wholesale, retail prices and resulting retail support levels are summarized in Lemma 1.

**Lemma 1.**

*(a) If $k > k^*$, the manufacturer charges wholesale price $w^* = r$ and the retailer provides low level of service: $s^* = s_l$*

*(b) if $k < k^*$, the manufacturer charges wholesale price $w^* = r - k$ and the retailer provides high level of service: $s^* = s_h$, where $k^* = \frac{\alpha_r (s_h - s_l) r}{\alpha_r s_h + \alpha_m}$*

**Proof:** See Appendix.[8] □

Lemma 1 states that the manufacturer's decision to charge a low enough wholesale price to induce the retailer to extend high levels of support depends on the attractiveness, to the retailer, of other brands in the product category. Not surprisingly, when the retail margins on the other brands exceed a certain threshold ($k^*$) the reduction in wholesale price required to induce the retailer to offer high levels of support is too high. In this case, the manufacturer finds it more profitable to charge a high wholesale price even if it comes at the expense of low retail support levels. In contrast, when retail margins on the other products in the category are low (less than $k^*$) the manufacturer will find it profitable to charge a wholesale price low enough so that the retailer prefers to extend high levels of support to its product. Thus, retailer's support decisions are influenced by the attractiveness of the manufacturer's product relative

[8] Proofs of all lemmas and propositions are in the appendix.

to other products in the product category and the manufacturer influences this attractiveness with its wholesale price. The threshold $k^*$ depends on market parameters and offers some interesting insights. When $(s_h - s_l)$ or $\alpha_r$ is high, inducing the retailer to offer high level of support has a relatively high payoff since the incremental demand from store loyal consumers is proportional to $(s_h\alpha - s_l)$ and $(_r$. Consequently, the threshold is increasing in $(s_h - s_l)$ and the size of the store loyal consumers, $(_r$. Notice that to induce the retailer to offer high level of support the manufacturer must lower wholesale price (offer a subsidy of $k$). This subsidy, however, applies not only to the sales to the store loyal consumers but also to the sales to brand loyal consumers. The latter would have purchased the manufacturer's product anyway. Hence, the threshold $k^*$ is decreasing in the size of the brand loyal segment $\alpha_{\mathrm{m}}$.

In Lemma 1, above, we have characterized the base case when the manufacturer has no direct online channel. The reader should note that depending on the wholesale price charged by the manufacturer, the retailer would extend high or low levels of support to the manufacturer's product. In both cases however, the retail price, $p_r^* = r$.

### 3.2. Optimal strategies with the online channel

We now characterize the manufacturer's optimal strategies that would induce the retailer to offer high/low levels of support, when the manufacturer complements its retail channel with a direct online channel. What distinguishes this analysis from that in the previous Section is that once the manufacturer's brand is available on its website, some of the *brand loyal* consumers will switch from the retailer to the online channel. In the presence of this competing channel, the retailer may change retail price and retail support depending on the manufacturer's online price, price sensitivity of brand loyal consumers, and the clientele mix. Similar to Lemma 1, we characterize the manufacturer's optimal strategy that would induce the retailer to offer low/high service when the retailer faces the competing online channel in Lemmas 2 and 3, respectively.

**Lemma 2.** *The manufacturer's optimal strategy that will induce the retailer to extend low level of support, $s^* = s_l$, is $w^* = p_m^* = r$.*

Lemma 2 identifies the optimal strategy for a manufacturer that would result in the retailer extending low level of support for its product. To see this, note that all wholesale prices, $w \in (r-k, r)$ are dominated by $w = r$, as they lower manufacturer's margins on retail sales without increasing demand. Can the manufacturer benefit form charging $p_m < p_m^* = r$? Charging $p_m < p_m^*$ will increase the fraction of brand loyal consumers that purchase from the online channel. Since, the manufacturer makes a margin of $r$ on retail sales shifting demand of brand loyal consumers to the online channel by charging $p_m < p_m^*$ strictly lowers profits. Thus the optimal wholesale price and Internet price will never be less than $r$ when the retailer is providing low level of service. In this case, the manufacturer's profits are: $(\alpha_r s_l + \alpha_m)r$, which is identical to the profits in the case when the manufacturer does not have an online channel and the retailer allocates low levels of support. We now identify the profit maximizing strategies that will help the manufacturer to induce the retailer to extend high support levels, despite the presence of a direct online channel.

**Lemma 3.** *The optimal strategies of the manufacturer that induce the retailer to extend high level of support and the corresponding strategies for the retailer are:*

(a) *If* $k < k_1$, *then* $w^* = r - k$, $p_m^* = r$, $s^* = s_h$ *and* $p_r^* = r$.
(b) *If* $k_1 < k < k_2$, *then* $w^* = r - k$, $w^* < p_m^* < r$, $s^* = s_h$ *and* $p_r^* = r$.
(c) *If* $k_2 < k < k_3$, *then* $w^* < p_m^* < r$, $s^* = s_h$ *and* $p_r^* = r$.

where $k_1 = \dfrac{1}{2\beta}$, $\quad k_2 = \dfrac{1}{2\beta} + \dfrac{2\alpha_r s_l}{3\alpha_m \beta}$, $\quad k_3 = \dfrac{2}{3\beta} + \dfrac{4\alpha_r s_h}{9\alpha_m \beta} + \dfrac{4\alpha_r s_l}{9\alpha_m \beta}$

The manufacturer's optimal strategy that would induce the retailer to extend high levels of support depends on market characteristics. When the brand loyal consumers are not very sensitive to price differences across competing channels i.e. $\beta$ is sufficiently small so that the online channel does not pose a significant threat to the retailer. In this case, the retail margins on the other brands in the product category will fall in the region identified in Lemma 3 (a): $k < k_1$. The manufacturer can get the retailer to extend high levels of support by charging a wholesale price of $r - k$ and an Internet price of, $p_m = r$. Since, brand loyal consumers are not very responsive to price differences across the two channels, demand is sticky and neither the retailer nor the manufacturer benefits from charging prices less than $r$. On the other hand when brand loyal consumers are moderately responsive (case b) to price difference across the two channels then the manufacturer lowers $p_m$ to attract more brand loyal consumers to the online channel. Although the retailer can reduce the number of brand loyal consumers that switch to the online channel by reducing price this strategy subsidizes the sales to retail loyal consumers. Under case (b) it is not in the retailer's best interest to lower price. When brand loyal consumers are even more responsive (case c) to price differences across the two channels, the manufacturer would want to reduce wholesale price further to induce more brand loyal consumers to switch to the online channel. But because prices are strategic complements, the retailer would want to lower price as well. Consequently, the manufacturer reduces wholesale price relative to the other cases, increasing retail margins to offset the loss in volume. When $k > k_3$, brand loyal consumers are extremely sensitive to the prices and this lowers the prices at both channels. Under these conditions we find that it is not possible to induce the retailer to offer high levels of support.

In this Section, we have characterized the profit maximizing strategy that helps the manufacturer induce the retailer to extend high/low level of support. The reader will also note that the optimality of complementing the retail channel with a direct online channel will depend on the level of support that the retailer extends in the absence of such a channel. We turn our attention to this issue in the next Section.

### 3.3. Online and off-line or just offline?

Notice that as illustrated in Fig. 1, the manufacturer has two choices: (a) rely exclusively on the retail channel or (b) complement the retail channel with a direct online channel. In each case, the manufacturer's profit depends on the level of support that the retailer extends to its product. The manufacturer will complement its traditional retail channel with a direct online channel only if the pay-offs from doing so exceed that from continuing to rely exclusively on its traditional channel. Thus, we derive

market conditions in which a manufacturer may (may not) benefit from complementing its traditional retail channel with a direct online channel by comparing profits across these two scenarios for different service levels extended by the retailer in the absence of the direct channel. In other words, if the retailer extends low (high) levels of support to the manufacturer's product in the absence of the online channel under what market conditions would the manufacturer benefit from selling through the direct online channel?

Under certain conditions, the manufacturer will prefer not to complement its traditional retail channel with a direct online channel. This condition is identified in Proposition 1 (Section 3.3.1). We then analyze the strategic role of complementing the retail channel with a direct online channel. As noted earlier, this role may depend on the level of support extended by the retailer in the absence of the direct online channel. Consequently, we consider two cases. First, we consider the case when the retailer extends high level of support to the manufacturer's product in the absence of the direct online channel. We identify market conditions under which complementing the traditional channel with a direct online channel increases the manufacturer's profits. This result is summarized in Proposition 2 (Section 3.3.2). Second, we consider the case when the retailer extends low level of support to the manufacturer's product in the absence of the competing channel and identify conditions so that the manufacturer's profit with the direct online channel is higher than that without it. This is done in Proposition 3 (Section 3.3.3). Finally, even though the manufacturer's online channel competes with the traditional retail channel for consumer demand, the retailer may not always be worse-off. Indeed, there are market conditions under which both the manufacturer and the retailer's profits are higher when the manufacturer complements the retail channel with a direct online channel. This condition is identified in Proposition 4 (Section 3.3.3).

### *3.3.1. Just offline*

Consider the case, when the manufacturer complements its traditional retail channel with a direct online channel. The profit-maximizing strategies that will induce the retailer to offer low/high levels of support in the presence of this competing online channel have been identified in Lemmas 2 and 3. In Lemma 3, we noted that when the brand loyal consumers are very sensitive to price differences across the competing channels, the online channel poses a significant threat to the traditional retail channel. Under these conditions one might expect that the manufacturer may not find it optimal to complement the retail channel with a direct online channel. This reasoning, however, may not always hold and indeed the retailer's clientele mix and support decisions play a major role on the optimality of the manufacturer's channel structure. These issues are highlighted in the following proposition.

**Proposition 1.** *If $\beta > \hat{\beta}$ or equivalently $k^* > k_3$ then $\forall k \in [k_3, k^*]$ the manufacturer strictly prefers not to complement the traditional retail channel with a direct online channel and is indifferent for all $k > k^* > k_3$.*

Following Lemma 3, for all $k > k_3$, the retailer offers low level of support in equilibrium. Thus, the manufacturer's profit with the online channel is identical

to that without the online channel when the retailer offers low levels of support, specifically: $(\alpha_r s_l + \alpha_m)r$. For all, $k \in [k_3, k^*]$ the manufacturer's profits in the absence of the online channel are: $(\alpha_r s_h + \alpha_m)(r - k)$, which following Lemma 1 is strictly greater than $(\alpha_r s_l + \alpha_m)r$. Thus, if $k > k_3$ but $k < k^*$ then the manufacturer strictly prefers not to complement the traditional channel with direct online channel. However, if $k$ is sufficiently large so that $k_3 < k^* < k$ then the manufacturer's profits with and without the online channel are the same: $(\alpha_r s_l + \alpha_m)r$. Consequently, in our model the focal manufacturer will not find it profitable to have an online channel if the retailer allocates low levels of support to the manufacturer's product in response. Within the context of our model, this has important implications as this suggests that the manufacturer should consider complementing the retail channel with an online channel only if the retailer can be induced into providing high levels of support. If the market conditions are such that it is too costly for the manufacturer to induce the retailer to extend high levels of support then the manufacturer is better off not adding the online channel.

Recall, that $k^* = \frac{\alpha_r(s_h - s_l)r}{\alpha_r s_h + \alpha_m}$, which is increasing in $\alpha_r(s_h - s_l)$ but decreasing in $\alpha_m$. Notice that the term $\alpha_r(s_h - s_l)$ represents the incremental demand from store loyal consumers which results from high levels of retail support. When the ratio of this incremental demand to the size of the manufacturer's brand loyal consumers $(\alpha_m)$ is sufficiently high, the condition $k^* > k_3$ will be satisfied especially when $\beta$ is sufficiently high $(\hat{\beta} > \hat{\beta})$. Under the conditions identified in Proposition 1, the manufacturer is weakly better off *not complementing* the retail channel with a direct online channel $\forall k > k^*$ but strictly better off $\forall k \in [k_3, k^*]$. Thus, when value of retail support is sufficiently high and the online channel poses a significant threat to the retail channel and the retailer's margins on rival products is sufficiently high, the manufacturer may be better off not selling through the online channel.

Interestingly, the threshold $\hat{\beta}$ depends both on product and market specific factors. The relationship between $\hat{\beta}$ and the size of the brand loyal segment is depicted in Fig. 2(a). Note that $\hat{\beta}$ is increasing in the size of the brand loyal segment. If we view a weak (strong) brand as one with a small (large) loyal segment whose rival products' retail margins are large (small) then this finding suggests that the conditions identified in Proposition 1 are more likely to be satisfied for a weak brand rather than a strong brand in a given product category. We also find that $\hat{\beta}$ is decreasing in $\alpha_r(s_h - s_l)$ (Fig. 2(b), below), suggesting that retailers may be more sensitive to the threat posed by the online channel in product categories where their support/service levels are valuable.

These findings might partly explain the behavior of firms such as Levi Strauss and Liz Claiborne who claim to have either reduced or stopped investing in their online channel to avoid competition with their retail partners. In these markets the retail support may be quite crucial in determining the sales of the manufacturers' products. Our analysis reveals that in such markets (Fig. 2(b)) the threshold $\hat{\beta}$ may be sufficiently low so that manufacturers may find it more profitable to not complement the retail channel with a direct online channel. In other words, the strategic response of the retail partners—that of lowering the level of support could have had an impact on firms' decision to curtail such investments. We now turn our attention to the strategic role of the online channel and its interplay with the level of retail support extended in the absence of such a channel.

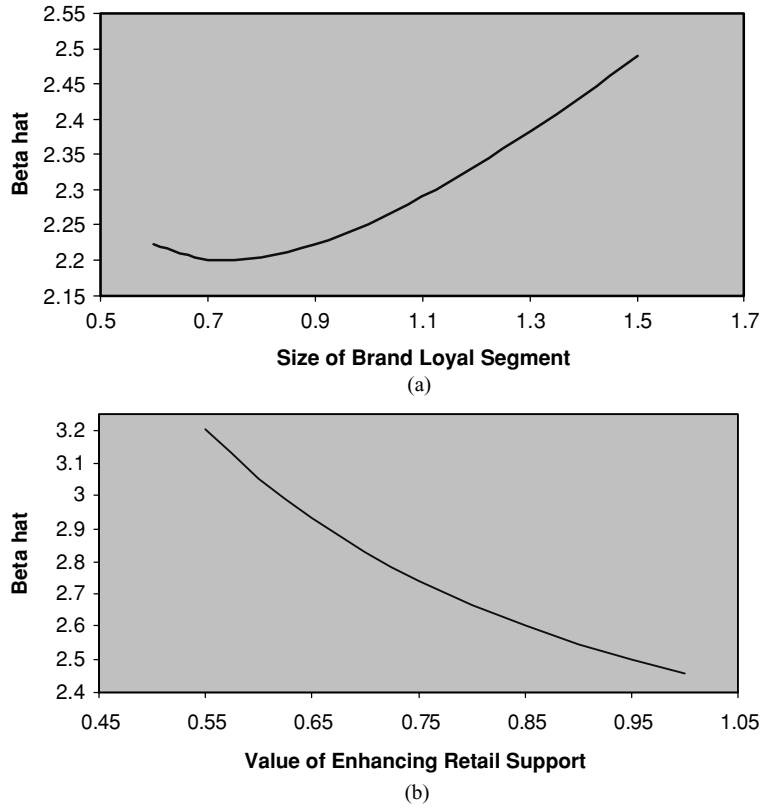



**Fig. 2** (a) Sensitivity of $\hat{\beta}$ to the size of the brand loyal segment ($\alpha_m$) and (b) Sensitivity of $\hat{\beta}$ to the value of enhanced retail support ($\alpha_u(s_h - s_l)$)

### *3.3.2. Go online to price discriminate*

Consider the case when $k < k^*$, so that in the absence of the online channel the manufacturer finds it profitable to charge a low enough wholesale price, and induce the retailer to extend high level of retail support to its product. In this case, complementing the retail channel with a direct online channel allows the manufacturer to change the clientele mix of the retailer. With some of the brand loyal consumers purchasing from the online channel the retailer's clientele mix is skewed more towards store loyal consumers. Notice that in the absence of the online channel, the manufacturer's margin on all retail sales, both to brand and store loyal consumers, is $r - k$ (see Lemma 1). This is because the manufacturer's wholesale price has to be low enough to ensure that the retail margins on its product are at least as high as those on the competing offerings that the retailer carries. The retailer in turn allocates high level of support to the manufacturer's product so that a larger fraction ($s_h\alpha_r < s_l\alpha_r$) of the store loyal consumers purchase the manufacturer's product. By skewing the retailer's clientele mix more towards store loyal consumers with the online channel, the manufacturer can increase profits especially if the manufacturer's margins ($p_m^*$) on online sales to brand

loyal consumers exceeds the manufacturer's margins on retail sales in the absence of the online channel ($r - k$). This result is summarized in Proposition 2 below.

**Proposition 2.** *If $k < k_3$ then the manufacturer prefers to complement the traditional retail channel with a direct online channel.*

Following Lemma 3, for all $k < k_2$, $p_m^* > w^* = r - k$. In the absence of the online channel the manufacturer's margins on all sales is $r - k$, since $k < k^*$ (please see Lemma 1). With the online channel the manufacturer's margins on online sales to brand loyal consumers is strictly higher, while all sales through the retail channel yield a margin of $w^* = r - k$. Hence, in this region, the manufacturer can always price discriminate and enhance profits. If $k_2 < k < k^*$ manufacturer's margins on retail sales are less than $r - k$ but the margins on online sales are still higher than that on retail sales (see Lemma 3c). We find that as long as the brand loyal consumers are not too sensitive to price differences across the two channels ($k < k_3$) the online channel does not pose a significant threat to the retailer and can serve to increase manufacturer's profits.

It is worth noting that under the market conditions identified in Proposition 2, the manufacturer's decision to complement its retail channel with an online channel does not adversely influence the level of retail support. Consequently, the number of consumers who purchase the manufacturer's product remains the same whether or not the manufacturer decides to sell online. All brand loyal consumers and $s_h\alpha_r$ store loyal consumers purchase the manufacturer's product regardless of the manufacturer's decision to complement its retail channel with an online channel. While the total demand for the manufacturer's product is unaffected by this decision, the online channel changes the retailer's clientele mix and allows the manufacturer to streamline its pricing decisions. The manufacturer is able to ensure adequate retail support without compromising on its ability to extract rents from its brand loyal consumers. Thus, when market conditions are such that the retailer extends high levels of support to the manufacturer's product in the absence of the online channel, complementing the retail channel with an online channel (when optimal) serves to enhance the efficiency of the manufacturer's pricing decisions and increases profits. Increases in manufacturer's profits, however, come at the expense of a reduction in retailer's profits, since the retailer loses the demand of a fraction of brand loyal consumers to the competing channel. For more on this issue see the discussion following Proposition 4.

### *3.3.3. Go online to enhance retail support*

Consider the case when $k > k^*$, so that in the absence of the online channel the manufacturer finds it profitable to charge a wholesale price of $r$, and the retailer extends low level of support to its product. The manufacturer would always want the retailer to extend high level of support to its product so that a larger fraction of the store loyal consumers purchase its product. However, to guarantee this, the manufacturer must ensure that the retail margins on its product are at least as high as those on the competing offerings that the retailer carries ($k$). This can be an expensive proposition because the manufacturer must lower its margin (reduce wholesale price) on its existing consumer base of $s_l\alpha_r + \alpha_m$ by $k$, to increase demand by $(s_h - s_l)\alpha_r$ . If

the size of the brand loyal segment ($\alpha_m$) is sufficiently large relative to the store loyal segment ($\alpha_r$) the benefits from demand increase are not worth the costs. Indeed when $k > k^*$, the above holds and the manufacturer prefers to charge $w^* = r$ and the retailer offers low support. However, with the decision to complement its retail channel with a direct online channel the manufacturer can critically influence the above trade-off. To see this note that with a fraction of the brand loyal consumers purchasing online at $p_m^*$, the decrease in wholesale price to enhance retail support only applies to retail sales and not to online sales, as $p_m^* > w^*$, regardless of the value of $k$. Thus, by shifting the sales of a fraction of the brand loyal consumers to the online channel, the manufacturer can lower its wholesale price to make its brand sufficiently attractive to the retailer, without reducing its (manufacturer's) margin on the sales to all brand loyal consumers. In Proposition 3 we provide the conditions under which the manufacturer is able to enhance retail support and increase its profits by complementing the retail channel with a direct online channel.

**Proposition 3.** *If $\beta < \hat{\beta}$ or equivalently, $k^* < k_3$ then there must exist an interval $[k^*, k^* + \varsigma]$, $\varsigma > 0$, such that when k is within the interval, the manufacturer can increase profits by complementing the retail channel with a direct online channel.*

Recall that for all $k < k_3$ the manufacturer's profit from adding an online channel and inducing the retailer to offer high levels of support is greater than that from not having an online channel and getting high support. Following Lemma 1, when $k > k^*$ manufacturer's profits from charging $r$ and inducing the retailer to extend low levels of service are strictly higher than charging $r - k$ and inducing the retailer to extend high levels of support. Hence, when $k^* < k_3$, there is always an interval $[k^*, k^* + \varsigma]$ such that when $k$ is in this interval the manufacturer can enhance retail support by deciding to sell online.[9]

It is important to note that, when $k > k^*$, under the conditions identified in Proposition 3, the manufacturer can enhance retail support by complementing the retail channel with a direct online channel. This in turn, increases the demand for the manufacturer's product as more store loyal consumers purchase the manufacturer's product. In the absence of the online channel, the manufacturer charges a wholesale price of $r$, and retail margins on the manufacturer's product are zero. With the online channel, since the manufacturer lowers wholesale price ($w^* \leq r - k$) to enhance retail support, the retail margins on the manufacturer's product are strictly higher. Thus, when $k > k^*$, under the conditions identified in Proposition 3, the online channel not only serves to increase the level of retail support and manufacturer's profits it also increases the retailer's profits. This impact of the manufacturer's decision to complement the retail channel with a direct online channel, on retailer's profit is summarized in Proposition 4.

[9] This follows directly from Lemma 2 as the manufacturer's profits when the retailer offers low level of support is the same regardless of its decision to complement the retail channel with a direct online channel.

**Proposition 4.** *When the manufacturer finds it optimal to complement the retail channel with an online channel, compared to the profits in the absence of such a channel the retailer's profits with the online channel are:*

(a) *Lower if* $k < k^*$
(b) *Higher if* $k > k^*$.

Recall from Lemma 1, that when $k < k^*$, in the absence of the online channel the manufacturer charges a wholesale price of $r - k$ and the retailer extends high levels of support, selling the manufacturer's product at reservation price $r$ to all brand loyal consumers $(\alpha_m)$ and a large fraction of the store loyal consumers $(s_h\alpha_r)$ . When the manufacturer goes online, the total demand for the manufacturer's product does not change, since he goes online only if he gets high level of support from the retailer. Thus the total profits earned by the manufacturer and the retailer together do not change if all the consumers continue to pay $r$, as in the region $k < k_1$. Consequently, the retailer's profits are strictly lower as the manufacturer finds it more profitable to go online. When $k < k_1$, the Internet price $p_m$ is reduced to less than $r$ as the intensity of the competition between the retail channel and the new online channel increases. In other words, some of the consumers pay less than $r$ for the manufacturer's product and the total profits decrease. Thus the increase in manufacturer's profit from going online comes at the retailer's expense. The intuition for the second part of Proposition 4 is relatively straightforward. When $k < k^*$, in the absence of the online channel the manufacturer charges a wholesale price of $r$ and the retailer extends low levels of service, selling to all brand loyal consumers $(\alpha_m)$ and a small fraction of the store loyal consumers $(s_l\alpha_r)$. In this case, the retail margin on the sales of the manufacturer's product is *zero*. With the online channel, retail margins are always positive and while the retailer loses sales of some brand loyal consumers to the competing channel, by extending high support it sells to more store loyal consumers $(s_h\alpha_r > s_l\alpha_r)$ at a higher margin.

This finding offers valuable insight on markets in which retailers will (will not) be receptive to this new source of competition. The retailer extends high level of support to the manufacturer's product in the absence of the online channel, when the retail margins on that product are attractive relative to other brands in the category. This happens when $k < k^*$. Although under the conditions identified in Proposition 2, the retailer will continue to extend high levels of support to the manufacturer's product even when the manufacturer decides to complement the retail channel with an online channel, retail profits are lower. This finding sheds light on why retailers may grieve about attempts by some manufacturers to serve a fraction of their consumer population online. In contrast, when the retail margins on the manufacturer's product are not as attractive as those on other brands in the category, the retailer extends low level of support. In the context of our model this happens when $k > k^*$. In this case, following Proposition 4, the retailer is more likely to be receptive to the manufacturer's decision to go online channel, especially if the manufacturer increases retail margins in an attempt to enhance retail support. Under the conditions identified in Proposition 3, profits of both the manufacturer and the retailer are higher with the online channel than without it. This result highlights the interplay between the retailer's response to

the new source of competition and retail margins on the manufacturer's product in the absence of the channel.

## 4. Concluding remarks

In this paper we have examined the strategic impact of product/market characteristics on the manufacturer's decision to complement an existing retail channel with a direct online channel. In most markets there are some consumers who are committed to a specific brand but not to any specific channel and there are others who are committed to the retail store but not to any specific brand. The brand and store loyal consumers in our model capture the behavior of these types of consumers, respectively. While the brand loyal consumers will seek out the manufacturer's product, the store loyal consumers need some level of handholding or convincing to buy the manufacturer's product. The manufacturer will need the cooperation of the retailer to achieve this because these consumers are loyal to the retail store. In our model the level of retail support affects the fraction of store loyal consumers who buy the manufacturer's product. To induce the retailer to extend high levels of support, the manufacturer must ensure that retail margins on its product are at least as attractive as those on competing products in the category. In deciding the optimal wholesale price, the manufacturer must trade-off benefits from enhanced retail support with reduced margins on retail sales, especially on the sales to brand loyal consumers. The analysis sheds light on how the clientele mix and category margins influence the above trade-off in the absence of the online channel. The analysis also suggests that the role served by the online channel depends critically on product/market characteristics. The main managerial insights obtained from our analysis are discussed below.

When the size of the brand loyal segment is small relative to the size of the store loyal segment then in the absence of the online channel, the manufacturer can lower wholesale price and enhance retail support, especially when the retail margins on the rival products are low. In contrast, when the size of the loyal segment is large and the retail margins on rival products are high the manufacturer will find it more profitable to charge a high wholesale price even if that induces the retailer to extend low levels of support. If the manufacturer decides to complement the retail channel with an online channel, some consumers who would have purchased from the retailer might prefer to purchase online. The fraction of consumers that switch their purchases from the retail channel to the online channel will depend upon the perceived differentiation in the two outlets. When the outlets are not perceived to be significantly differentiated consumers will be more sensitive to the price difference across the two channels. Intuition might suggest that if consumers are sufficiently sensitive to price differences the manufacturer may find it more profitable to not complement the retail channel with a direct online channel. The argument being that when consumers are sufficiently sensitive the online channel may pose a significant threat to the retail channel and the retailer may not be receptive to this new source of competition. Our analysis reveals that when consumers' sensitivity to price differences across the competing channels exceeds a certain threshold it is not optimal for the manufacturer to complement the retail channel with an online channel. However, this price sensitivity threshold itself depends upon product/market characteristics, suggesting that manufacturers seeking

to complement their retail channels with an online channel should look beyond the nature of threat the online channel poses to the retail channel in devising their optimal distribution strategies.

The role served by the online channel depends upon the service/support levels extended by the retailer to the manufacturer's product in the absence of the online channel. When the retail margins on rival products are sufficiently small (lower than $k^*$) the retailer extends high levels of support to the manufacturer's product in the absence of the online channel. Under these conditions, complementing the retail channel with an online channel when optimal allows the manufacturer to price discriminate and enhance profits. In contrast, when retail margins on rival products are sufficiently high (higher than $k^*$) the retailer extends low levels of support to the manufacturer's product in the absence of the online channel. Under these conditions, complementing the retail channel with an online channel when optimal can serve to enhance retail support. We also identify market conditions under which the profits of both the manufacturer and the retailer will be greater with the online channel than that without it.

In conclusion, in this paper we attempt to investigate the strategic forces that influence manufacturer's decision to complement a retail channel with a direct online channel. The retail channel in our setup is distinct from extant models in that the retailer maximizes category profits not just brand profits. To address this issue and highlight the market forces that impact the manufacturer's decision in the most transparent manner we have made some simplifying assumptions. Specifically, we have abstracted from intra-category competition by fixing the retail margins on rival products. Nevertheless, as noted earlier, in an extension we explicitly analyze manufacturer level competition to obtain results that are qualitatively similar. Our findings are therefore sufficiently robust to competition at both the manufacturer and retail level.

**Lemma 1.**

*(a) If $k > k^*$, the manufacturer charges wholesale price $w^* = r$ and the retailer provides low level of service: $s^* = s_l$.*
*(b) if $k > k^*$, the manufacturer charges wholesale price $w^* = r - k$ and the retailer provides high level of service: $s^* = s_h$, where $k^* = \frac{\alpha_r(s_h - s_l)r}{\alpha_r s_h + \alpha_m}$.*

**Proof:** Consider the retailer's optimal strategies given wholesale price $w$, The retailer's profit $\Pi_r$ as a function of retail price $p_r$ and service level $s$, is given by

$$\Pi_r(p_r, s) = (\alpha_r s + \alpha_m)(p_r - w) + k\alpha_r(\bar{s} - s)$$

$$\text{and,} \quad \frac{\partial \Pi_r(p_r, s)}{\partial p_r} = \alpha_r s + \alpha_m > 0. \quad \text{Hence, } p_r^* = r.$$

Given wholesale price $w$ , the retailer provides high level of service if and only if

$$\Pi_r(p_r, s_h) > \Pi_r(p_r, s_l).$$

Or,

$$(\alpha_r s_h + \alpha_m)(r - w) + \alpha_r s_l k > (\alpha_r s_l + \alpha_m)(r - w) + \alpha_r s_h k,$$

which holds if $w < r - k$. Hence, to get high level of service the manufacturer cannot set $w$ higher than $r - k$. Now, we consider the manufacturer's optimal strategies:

The manufacturer's profit $\Pi_m$ is given by

$$\Pi_m(w|p^*(w),\ s^*(w)) = (\alpha_r s + \alpha_m)w$$

Similarly, $\frac{\partial \Pi_m(w)}{\partial w} = \alpha_r s + \alpha_m > 0$, so that the manufacturer's profit is increasing with wholesale price *w*. This in turn implies that $w^*$ should be as high as possible.

Thus, for high level of service, $w = r - k$. For low level of service, $w = r$

The manufacturer wants to get high level of service if and only if

$$\Pi_m(r - k|p_r, s_h) > \Pi_m(r|p_r, s_l), \text{ or}$$

$$(\alpha_r s_h + \alpha_m)(r - k) > (\alpha_r s_l + \alpha_m)r,$$

which holds if $k < \frac{\alpha_r(s_h - s_l)r}{\alpha_r s_h + \alpha_m}$

Therefore, when $k < \frac{\alpha_r(s_h - s_l)r}{\alpha_r s_h + \alpha_m}$, $w^* = r - k$, $p_r^* = r$, $s^* = s_h$. $\Pi_m = (\alpha_r s_h + \alpha_m)(r - k)$ When $k > \frac{\alpha_r(s_h - s_l)r}{\alpha_r s_h + \alpha_m}$, $w^* = r$, $p_r^* = r$, $s^* = s_l$. $\Pi_m = (\alpha_r s_l + \alpha_m)r$. □

**Lemma 2.** *The manufacturer's optimal strategy that will induce the retailer to extend low level of support, $s^* = s_l$, is $w^* = p_m^* = r$*

**Proof:** If the retailer provides low level of service when the manufacturer decides to sell online the manufacturer's profits are:

$$\Pi_m(w,\ p_m|p_r, s_l) = (\alpha_r s_l + \alpha_m(0.5 + \beta(p_m - p_r)))w + \alpha_m(0.5 + \beta(p_r - p_m))p_m$$

Since $\frac{\partial \Pi_m(w, p_m|p_r, s_l)}{\partial w} = \alpha_r s + \alpha_m(0.5 + \beta(p_m - p_r)) > 0$, $w^* = r$. It follows that $p_m^* = r$, $s^* = s_l$ and $p_r^* = r$. □

**Lemma 3.** *The optimal strategies of the manufacturer that induce the retailer to extend high level of support and the corresponding strategies for the retailer are:*

(a) *If $k < k_1$, then $w^* = r - k$, $p_m^* = r$, $s^* = s_h$ and $p_r^* = r$.*
(b) *If $k_1 < k < k_2$ , then $w^* = r - k$, $w^* < p_m^* < r$, $s^* = s_h$ and $p_r^* = r$.*
(c) *If $k_2 < k < k_3$ , then $w^* < p_m^* < r$, $s^* = s_h$ and $p_r^* = r$.*

where $k_1 = \dfrac{1}{2\beta}$, $\quad k_2 = \dfrac{1}{2\beta} + \dfrac{2\alpha_r s_l}{3\alpha_m \beta}$, $\quad k_3 = \dfrac{2}{3\beta} + \dfrac{4\alpha_r s_h}{9\alpha_m \beta} + \dfrac{4\alpha_r s_l}{9\alpha_m \beta}$

**Proof:** The manufacturer sets wholesale price recognizing its impact on the retailer's optimal strategies. The retailer's optimal price, $p_r^*$ however, could be a corner solution or an interior. Consequently, we derive the manufacturer's optimal strategies under the following three scenarios respectively:

1. $p_r$ is the corner solution or $\partial \Pi_r / \partial p_r|_{p_r=r,s=s_h} > 0$.
2. $p_r$ is the interior solution or $\partial \Pi_r / \partial p_r|_{p_r=r,s=s_h} < 0$

After characterizing the equilibrium strategies, we identify the conditions, which delineate each of these three regions.

Consider, the first scenario:

1. $p_r$ is the corner solution or $\partial \Pi_r / \partial p_r|_{p_r=r,s=s_h} > 0$.

There are two possibilities in this scenario:

(a) $\partial \Pi_r / \partial p_r|_{p_r=r,s=s_h} > 0$ and $\partial \Pi_r / \partial p_r|_{p_r=r,s=s_l} \geq 0$ or
(b) $\partial \Pi_r / \partial p_r|_{p_r=r,s=s_h} > 0$ and $\partial \Pi_r / \partial p_r|_{p_r=r,s=s_l} < 0$

□

*Case 1 (a):* $\partial \Pi_r / \partial p_r|_{p_r=r,s=s_h} > 0$ and $\partial \Pi_r / \partial p_r|_{p_r=r,s=s_l} \geq 0$.

In this case, the optimal retail price, $p_r^* = r$.

The optimal manufacturer Internet price, $p_m^*$, then can be obtained by solving the first order condition $\frac{\partial \Pi_m(p_m,w)}{\partial p_m}\Big|_{p_r=r} = 0$

$$p_m = \frac{w+r}{2} + \frac{1}{4\beta} \tag{1}$$

The retailer provides high level of support if

$$\Pi_r\left(p_r^*\big|_{s=s_h} = r, s_h\right) > \Pi_r\left(p_r^*\big|_{s=s_l} = r, s_l\right).$$

Or,

$$\begin{aligned}&(\alpha_r s_h + \alpha_m(0.5 + \beta(p_m - p_r)))(r - w) + \alpha_r s_l k \\ &> (\alpha_r s_l + \alpha_m(0.5 + \beta(p_m - p_r)))(r - w) + \alpha_r s_h k\end{aligned}$$

which holds if $w < r - k$.

Now let us derive the optimal wholesale price that induces the retailer to offer high level of support.

Substituting (1 and $P_r^* = r$ into the manufacturer's profit function and taking derivative of it with respect to $w$ , we get

$$\frac{\partial \Pi_m(p_m, w)}{\partial w} = \frac{1}{4}(4\alpha_r s_h + \alpha_m(3 - 2\beta r + 2\beta w))$$

We can see that at $w = r - k$, $\frac{\partial \Pi_m(p_m,w)}{\partial w}|_{w=r-k} = \frac{1}{4}\alpha_m(3 - 2\beta k) + \alpha_r s_h > 0$ if $k < \frac{3}{2\beta} + \frac{2\alpha_r s_h}{\alpha_m \beta}$.

Thus, when $k < \frac{3}{2\beta} + \frac{2\alpha_r s_h}{\alpha_m \beta}$, the optimal wholesale price to induce the retailer to offer high level of support is $w^* = r - k$.

Substituting $w^* = r - k$ into (1), we get $p_m = r - \frac{k}{2} + \frac{1}{4\beta}$.

Since $p_m$ can not exceed $r$, $p_m^* = \min\{r, r - \frac{k}{2} + \frac{1}{4\beta}\}$.

In other words, if $k < \frac{1}{2\beta}$, $p_r^* = r$. If $k > \frac{1}{2\beta}$, $p_m^* = r - \frac{k}{2} + \frac{1}{4\beta}$

Now we identify the conditions under which case (a) will arise i.e. $\partial \Pi_r / \partial p_r|_{p_r=r, s=s_h} > 0$ and $\partial \Pi_r / \partial p_r|_{p_r=r, s=s_l} \geq 0$.

The retailer's profit $\Pi_r(p_r, s_h)$, given wholesale price $w^*$ and manufacturer Internet price $p_m^*$, is

$$\Pi_r(p_r, s) = (\alpha_r s + \alpha_m(0.5 + \beta(p_m^* - p_r)))(p_r - w^*) - k\alpha_r s$$

As we have shown, if $\partial \Pi_r / \partial p_r|_{p_r=r, s=s_h} > 0$, $\partial \Pi_r / \partial p_r|_{p_r=r, s=s_l} \geq 0$ and $k < \frac{1}{2\beta}$, then $p_m^* = r$,

$$\frac{\partial \Pi_r(p_r, s)}{\partial p_r}\Big|_{w=r-k,\, p_m=r,\, p_r=r} = \frac{\alpha_m}{2} + \alpha_r s - \alpha_m \beta k$$

It is easily seen that $\partial \Pi_r / \partial p_r|_{p_r=r, s=s_h} > 0$ and $\partial \Pi_r / \partial p_r|_{p_r=r, s=s_l} \geq 0$ require that $k < \frac{1}{2\beta} + \frac{\alpha_r s_l}{\alpha_m \beta}$.

Therefore when $k < \frac{1}{2\beta}$, the optimal strategy of the manufacturer that induces the retailer to offer high service is $w^* = r - k$, when $\partial \Pi_r / \partial p_r|_{p_r=r, s=s_h} > 0$, $\partial \Pi_r / \partial p_r|_{p_r=r, s=s_l} \geq 0$. The corresponding strategy of the retailer is $s^* = s_h$ and $p_r^* = r$. The corresponding optimal Internet price is $p_m^* = r$. We denote this as strategy 1.

Recall that, when $k > \frac{1}{2\beta}$, $p_m$ would be the interior solution when the optimal retail strategy is $p_r^*|_{s=s_h} = r$ and $p_r^*|_{s=s_l} = r$. We will now identify the condition under which $p_r^*|_{s=s_h} = r$, $p_r^*|_{s=s_l} = r$ when $p_m$ is the interior solution.

Suppose $k > \frac{1}{2\beta}$, then $w^* = r - k$ and $p_m^* = r - \frac{k}{2} + \frac{1}{4\beta}$

$$\frac{\partial \Pi_r(p_r, s)}{\partial p_r}\Big|_{w=r-k,\, p_m=r-\frac{k}{2}+\frac{1}{4\beta},\, p_r=r} = \frac{3\alpha_m}{4} + \alpha_r s - \frac{3}{2}\alpha_m \beta k,$$

Thus $\partial \Pi_r / \partial p_r|_{p_r=r, s=s_h} > 0$ and $\partial \Pi_r / \partial p_r|_{p_r=r, s=s_l} \geq 0$ require $k < \frac{1}{2\beta} + \frac{2\alpha_r s_l}{3\alpha_m \beta}$.

Therefore, when $\frac{1}{2\beta} < k < \frac{1}{2\beta} + \frac{2\alpha_r s_l}{3\alpha_m \beta}$, the optimal strategies when the $\partial \Pi_r / \partial p_r|_{p_r=r, s=s_h} > 0$, $\partial \Pi_r / \partial p_r|_{p_r=r, s=s_l} \geq 0$ are $p_m^* = r - \frac{k}{2} + \frac{1}{4\beta}$, $w^* = r - k$, and $s^* = s_h$ $p_r^* = r$. Denote this as **strategy 2**.

Now , we check whether $p_m^* - w^* > 0$

$$p_m^* - w^* = \frac{k}{2} - \frac{1}{4\beta}$$

Since $k > \frac{1}{2\beta}$, $p_m^* - w^* > 0$.

*Case 1 (b):* $\partial \Pi_r / \partial p_r|_{p_r=r, s=s_h} > 0$ *but* $\partial \Pi_r / \partial p_r|_{p_r=r, s=s_l} < 0$.

Suppose $\partial \Pi_r / \partial p_r |_{p_r=r, s=s_h} > 0$ but $\partial \Pi_r / \partial p_r |_{p_r=r, s=s_l} < 0$. The retailer charges $p_r^* = r$ when providing high level of support. The manufacturer would charge an Internet price such that the following first order condition is satisfied

$$\begin{aligned} &\frac{\partial \Pi_m(p_m, w)}{\partial p_m} \Big|_{p_r=r, s=s_h} = 0 \\ &\text{It gives } p_m^* = \frac{r+w}{2} + \frac{1}{4\beta} \end{aligned} \tag{2}$$

If the retailer were to offer low level of support, the optimal retail prices and Internet price can be obtained by solving the following first order conditions simultaneously:

$$\begin{aligned} \frac{\partial \Pi_m(p_m, w)}{\partial p_m} \Big|_{s=s_l} &= \alpha_m \left( \frac{1}{2} + \beta(p_r + w - 2p_m) \right) = 0 \\ \frac{\partial \Pi_r(p_r, s)}{\partial p_r} \Big|_{s=s_l} &= \alpha_r s_l + \alpha_m \left( \frac{1}{2} + \beta(p_m - 2p_r + w) \right) = 0 \end{aligned}$$

Which gives,

$$\begin{aligned} p_r^* &= \frac{1}{2\beta} + \frac{2\alpha_r s_l}{3\alpha_m \beta} + w \\ p_m^* &= \frac{1}{2\beta} + \frac{\alpha_r s_l}{3\alpha_m \beta} + w \end{aligned} \tag{3}$$

The retailer provides high level of support if

$$\Pi_r \left( p_r^* |_{s=s_h} = r, s_h \right) \geq \Pi_r \left( p_r^* |_{s=s_l} < r, s_l \right)$$

Substituting (2) into $\Pi_r(p_r^*|_{s=s_h} = r, s_h)$ and (3) into $\Pi_r(p_r^*|_{s=s_l} < r, s_l)$ we get

$$\begin{aligned} &\Pi_r(p_r^*|_{s=s_h} = r, s_h) - \Pi_r(p_r^*|_{s=s_l} < r, s_l) \\ &= \left( \begin{array}{c} \alpha_r k s_l - \dfrac{9\alpha_m^2 + 36\alpha_m \beta \alpha_r s_h k + 24\alpha_m \alpha_r s_l + 16\alpha_r^2 s_l^2}{36\alpha_m \beta} \\ + \dfrac{1}{4}(r-w)(4\alpha_r s_h + 3\alpha_m - 2\alpha_m \beta (r-w)) \end{array} \right) \end{aligned} \tag{4}$$

In order to get high level of support, the manufacturer must set $w$ such that (4>0, which implies that

$$r - \frac{3}{4\beta} - \frac{\alpha_r s_h}{\alpha_m \beta} - \frac{\sqrt{A}}{12\alpha_m \beta} < w < r - \frac{3}{4\beta} - \frac{\alpha_r s_h}{\alpha_m \beta} + \frac{\sqrt{A}}{12\alpha_m \beta}$$

where $A = 9\alpha_m^2 - 24\alpha_m \alpha_r (12\beta k s_h - 9s_h + 8s_l - 12\beta k s_l) + 16\alpha_r^2 (9s_h^2 - 8s_l^2)$

Now let us derive the optimal wholesale price that induces the retailer to offer high level of support.

Substituting (2) and $p_r^* = r$ into the manufacturer's profit function and taking derivative of it with respect to $w$ , we get

$$\frac{\partial \Pi_m(p_m, w)}{\partial w} = \frac{1}{4}(4\alpha_r s_h + \alpha_m(3 - 2\beta r + 2\beta w))$$

At $w = r - \frac{3}{4\beta} - \frac{\alpha_r s_h}{\alpha_m \beta} + \frac{\sqrt{A}}{12\alpha_m \beta}$, it is easily seen that

$$\frac{\partial \Pi_m(p_m, w)}{\partial w}\Big|_{w=r-\frac{3}{4\beta}-\frac{\alpha_r s_h}{\alpha_m\beta}+\frac{\sqrt{A}}{12\alpha_m\beta}} = \frac{1}{24}\left(9\alpha_m + 12\alpha_r s_h + \sqrt{A}\right) > 0$$

Therefore, the optimal wholesale price to induce the retailer to offer high level of support is

$$w^* = r - \frac{3}{4\beta} - \frac{\alpha_r s_h}{\alpha_m \beta} + \frac{\sqrt{A}}{12\alpha_m \beta} \tag{5}$$

Substituting (5) into (2), we get

$$p_m^* = r - \frac{1}{8\beta} - \frac{\alpha_r s_h}{2\alpha_m \beta} + \frac{\sqrt{A}}{24\alpha_m \beta} \tag{6}$$

Now we derive the conditions under which $\partial \Pi_r / \partial p_r|_{p_r=r, s=s_h} > 0$ but $\partial \Pi_r / \partial p_r|_{p_r=r, s=s_l} < 0$.

$$\frac{\partial \Pi_r(p_r, s)}{\partial p_r}\Big|_{p_r=r, s=s_h, w=r-\frac{3}{4\beta}-\frac{\alpha_r s_h}{\alpha_m\beta}+\frac{\sqrt{A}}{12\alpha_m\beta}, p_m=r-\frac{1}{8\beta}-\frac{\alpha_r s_h}{2\alpha_m\beta}+\frac{\sqrt{A}}{24\alpha_m\beta}} = \frac{1}{8}(-3\alpha_m - 4\alpha_r s_h + \sqrt{A})$$

$A - (3\alpha_m + 4\alpha_r s_h)^2 > 0$ implies that $32\alpha_r(s_h - s_l)(\alpha_m(6 - 9\beta k) + 4\alpha_r(s_h + s_l)) > 0$, or $k < \frac{2}{3\beta} + \frac{4\alpha_r s_h}{9\alpha_m \beta} + \frac{4\alpha_r s_l}{9\alpha_m \beta}$, $\partial \Pi_r / \partial p_r|_{p_r=r, s=s_l} < 0$ requires that $p_r^* = r$ ( $p_r^*$ as specified in(3) given $w^*$ as specified in (5)).

Substituting (3) and (5) into $r - p_r^*$, we get

$$r - p_r^* = \frac{1}{12\alpha_m \beta}(3\alpha_m + 4\alpha_r(3s_h - 2s_l) - \sqrt{A})$$
$$(3\alpha_m + 4\alpha_r(3s_h - 2s_l))^2 - A = -48\alpha_r(s_h - s_l)(\alpha_m(3 - 6\beta k) + 4\alpha_r s_l)$$

When $k > \frac{1}{2\beta} + \frac{2\alpha_r s_l}{3\alpha_m \beta}$, condition $\partial \Pi_r / \partial p_r|_{p_r=r, s=s_l} < 0$ is satisfied given $w^*$ as specified in (5).

Therefore, when $\frac{1}{2\beta} + \frac{2\alpha_r s_l}{3\alpha_m \beta} < k < \frac{2}{3\beta} + \frac{4\alpha_r s_h}{9\alpha_m \beta} + \frac{4\alpha_r s_l}{9\alpha_m \beta}$, the optimal strategies when the $\partial \Pi_r / \partial p_r|_{p_r=r, s=s_h} > 0$ but $\partial \Pi_r / \partial p_r|_{p_r=r, s=s_l} < 0$ are $p_m^* = r - \frac{1}{8\beta} - \frac{\alpha_r s_h}{2\alpha_m \beta} + \frac{\sqrt{A}}{24\alpha_m \beta}$, $w^* = r - \frac{3}{4\beta} - \frac{\alpha_r s_h}{\alpha_m \beta} + \frac{\sqrt{A}}{12\alpha_m \beta}$, and $s^* = s_h$, $p_r^* = r$. Denote this as **strategy 3**.

Now let us check whether $p_m^* - w^* > 0$

$$p_m^* - w^* = \frac{1}{24\alpha_m \beta}(15\alpha_m + 12\alpha_r s_h - \sqrt{A})$$
$$(15\alpha_m + 12\alpha_r s_h)^2 - A = 8(27\alpha_m^2 + 16\alpha_r^2 s_l^2 + 6\alpha_m \alpha_r(3s_h + 4s_l + 6\beta k(s_h - s_l)))$$

Obviously, $p_m^* - w^* > 0$.

Then we check whether $p_m^* < r$

$$r - p_m^* = \frac{1}{24\alpha_m\beta}(3\alpha_m + 12\alpha_r s_h - \sqrt{A})$$
$$(3\alpha_m + 12\alpha_r s_h)^2 - A = 16\alpha_r(8\alpha_r s_l^2 + 3\alpha_m(-3s_h + 4s_l + 6\beta k(s_h - s_l)))$$

Since $k > \frac{1}{2\beta} + \frac{2\alpha_r s_l}{3\alpha_m\beta}$, $(3\alpha_s + 12\alpha_u s_h)^2 - A > 0$. So $p_m^* < r$.

*Case 2*. $p_r$ is the interior solution or $\partial\Pi_r/\partial p_r|_{p_r=r,s=s_h} < 0$.

Suppose $\partial\Pi_r/\partial p_r|_{p_r=r,s=s_h} < 0$. For any given $w$ , the optimal $p_r$ and $p_m$ to induce the retailer to provides high level of support can be obtained by solving the following first order conditions

$$\left.\frac{\partial\Pi(p_m, w)}{\partial p_m}\right|_{s=s_h} = \alpha_m\left(\frac{1}{2} + \beta(p_r + w - 2p_m)\right) = 0$$
$$\left.\frac{\partial\Pi_r(p_r, s)}{\partial p_r}\right|_{s=s_h} = \alpha_r s_h + \alpha_m\left(\frac{1}{2} + \beta(p_m - 2p_r + w)\right) = 0$$

which gives

$$\begin{aligned} p_r^* &= \frac{1}{2\beta} + \frac{2\alpha_r s_h}{3\alpha_m\beta} + w \\ p_m^* &= \frac{1}{2\beta} + \frac{\alpha_r s_h}{3\alpha_m\beta} + w \end{aligned} \tag{7}$$

Anticipating the optimal retail price and Internet price as specified in (7), the manufacturer would set its wholesale price $w$ as high as possible.

Since $p_m^* < p_r^* \le r$, the maximum $w$ the manufacturer could charge is such that $p_r^* = r$. Thus,

$$w^* = r - \frac{1}{2\beta} - \frac{2\alpha_r s_h}{3\alpha_m\beta}$$

Next, we check the conditions under which the retailer would offer high level of support.

The retailer would offer high level of support if and only if

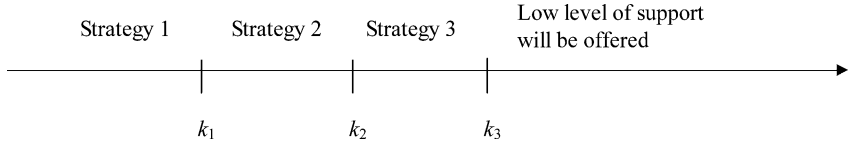
$$\Pi(p_r^*, s_h) - \Pi(p_r^*, s_l) \ge 0$$

Substituting (7) into $\Pi(p_r^*, s_h)$ and (3) into $\Pi(p_r^*, s_l)$, we get

$$\Pi(p_r^*, s_h) - \Pi(p_r^*, s_l) = \frac{\alpha_r(s_h - s_l)(\alpha_m(6 - 9\beta k) + 4\alpha_r(s_h + s_l))}{9\alpha_m\beta}$$

Thus, $\Pi(p_r^*, s_h) - \Pi(p_r^*, s_l) \geq 0$, if and only if $k < \frac{2}{3\beta} + \frac{4\alpha_r s_h}{9\alpha_m \beta} + \frac{4\alpha_r s_l}{9\alpha_m \beta}$. In other words, when $k > \frac{2}{3\beta} + \frac{4\alpha_r s_h}{9\alpha_m \beta} + \frac{4\alpha_r s_l}{9\alpha_m \beta}$, the retailer would not offer high level of support to the manufacturer.

We summarize the result in the following graph. The optimal strategies of the manufacturer that induce the retailer to extend high level of support and the corresponding strategies for the retailer are depicted in the following graph.




**Strategy 1:** $p_m^* = r$, $w^* = r - k$, $p_r^* = r$.
**Strategy 2:** $p_m^* = r - \frac{k}{2} + \frac{1}{4\beta}$, $w^* = r - k$, $p_r^* = r$
**Strategy 3:** $p_m^* = r - \frac{1}{8\beta} - \frac{\alpha_r s_h}{2\alpha_m \beta} + \frac{\sqrt{A}}{24\alpha_m \beta}$, $w^* = r - \frac{3}{4\beta} - \frac{\alpha_r s_h}{\alpha_m \beta} + \frac{\sqrt{A}}{12\alpha_m \beta}$, $p_r^* = r$.

Where $A = 9\alpha_m^2 - 24\alpha_m \alpha_r (12\beta k s_h - 9s_h + 8s_l - 12\beta k s_l) + 16\alpha_r^2 \left(9s_h^2 - 8s_l^2\right)$

$$k_1 : \frac{1}{2\beta}$$
$$k_2 : \frac{1}{2\beta} + \frac{2\alpha_r s_l}{3\alpha_m \beta}$$
$$k_3 : \frac{2}{3\beta} + \frac{4\alpha_r s_h}{9\alpha_m \beta} + \frac{4\alpha_r s_l}{9\alpha_m \beta}$$

**Proposition 1.** *If $\beta > \hat{\beta}$ or equivalently $k^* > k_3$ then $\forall k \in [k_3, k^*]$ the manufacturer strictly prefers not to complement the traditional retail channel with a direct online channel and is indifferent for all $k > k^* > k_3$.*

**Proof:** Let $\Pi_{mh}^c$ and $\Pi_{ml}^c$ denote the profits of the manufacturer when he gets high and low support respectively, with the online channel. Let $\Pi_{mh}^{nc}$ and $\Pi_{ml}^{nc}$ denote the profits of the manufacturer when he gets high and low support respectively, in the absence of the online channel. □

Recall from Lemma 3, when $k > k_3$, the retailer offers low level of support to the manufacturer with the online channel. With Lemma 2, It is easy to see that $\Pi_{ml}^{nc} = \Pi_{ml}^c$. In Lemma 1, we have shown that when $k > k^*$, $\Pi_{ml}^{nc} < \Pi_{mh}^c$ in the absence of an online channel. Thus, when $k_3 < k < k^*$, $\Pi_{ml}^c < \Pi_{mh}^{nc}$. So the manufacturer will prefer not to complement its traditional retail channel with a direct online channel.

$$\text{The condition } k^* > k_3 \text{ implie that } \frac{\alpha_r (s_h - s_l) r}{\alpha_r s_h + \alpha_m} > \frac{2}{3\beta} + \frac{4\alpha_r s_h}{9\alpha_m \beta} + \frac{4\alpha_r s_l}{9\alpha_m \beta}$$

$$\text{Which yields, } \beta > \frac{(6\alpha_m + 4\alpha_r s_h + 4\alpha_r s_l)(\alpha_r s_h + \alpha_m)}{9\alpha_m k \alpha_r (s_h - s_l) r}$$

$$\text{Define } \widehat{\beta} = \frac{(6\alpha_m + 4\alpha_r s_h + 4\alpha_r s_l)(\alpha_r s_h + \alpha_m)}{9\alpha_m k \alpha_r (s_h - s_l) r}$$

Therefore, If $\beta > \widehat{\beta}$ or equivalently $k^* < k_3$, then $\forall k \in [k_3, k^*]$, the maufacturer prefers not to complement the traditional retail channel with a direct online channel.

Again from Lemma 3, the retailer would offer low level of support to the manufacturer with the online channel when $k < k_3$. From Lemma 1, when $k < k^*$, $\Pi_{ml}^{nc} > \Pi_{mh}^{nc}$, in other words, the manufacturer would get low level of support from the retailer. Thus when $k > k^* > k_3$, the manufacturer is indifferent.

**Proposition 2.** *If $k < K_3$ then the manufacturer prefers to complement the traditional retail channel with a direct online channel.*

**Proof:** From Lemma 3, when $k \leq k_2$, the optimal strategies are $w^* = r - k$, $r - k < p_m^* \leq r$ and $p_r^* = r$ if the manufacturer wants to get high level of support when going online. Let $M$ denote the proportion of *committed* consumers who purchase from the online channel, $0 > M > 1$. Then $\Pi_{mh}^c$, the manufacturer's profits from getting high level of support in the presence of the online channel, is given by

$$\begin{aligned}
\Pi_{mh}^c &= (\alpha_r s_h + \alpha_m(1 - M))w + \alpha_m M p_m \\
\Pi_{mh}^c &= (\alpha_r s_h + \alpha_m)w^* + \alpha_m M(p_m^* - w^*) \\
&= (\alpha_r s_h + \alpha_m)(r - k) + \alpha_m M(p_m^* - w^*) \\
&\geq (\alpha_r s_h + \alpha_m)(r - k)
\end{aligned}$$

Since $\Pi_{mh}^{nc} = (\alpha_r s_h + \alpha_m)(r - k)$, $\Pi_{mh}^c > \Pi_{mh}^{nc}$ if $k \leq k_2$.

Now consider the case when $k_2 < k \leq k_3$.

Define $DF(k) = \Pi_{mh}^c - \Pi_{mh}^{nc}$. Differentiating $DF$ with respect to $k$, we get

$$\frac{dDF(k)}{dk} = \frac{1}{2}$$
$$\left(2\alpha_m + \alpha_r(s_h + s_l) - \frac{3\alpha_r(3\alpha_m + 4\alpha_r s_h)(s_h - s_l)}{\sqrt{9\alpha_m^2 + 24\alpha_m\alpha_r(9s_h - 8s_l - 12\beta k(s_h - s_l)) + 16\alpha_r^2\left(9s_h^2 - 8s_l^2\right)}}\right)$$

Note that $\frac{dDF(k)}{dk}$ decreases with $k$. In other words, $DF(k)$ is concave in $k$ in the interval $k \in [k_2, k_3]$. Thus, if $DF$ is positive at both ends of the interval, then $DF$ is positive over the entire interval. We know that $DF(k_2) < 0$ by the above argument. We now check whether $DF(k_3) < 0$

$$DF(k_3) = \frac{15\alpha_m^2 - 4\alpha_r^2 s_h^2 + 16\alpha_r^2 s_h s_l + 10\alpha_m\alpha_r s_h + 16\alpha_m\alpha_r s_l}{36\alpha_m\beta}$$

Since $\alpha_m < 2\alpha_r s_h/3$, $DF(k_3) < 0$. Thus $DF(k) < 0$ over the interval $k \in [k_2, k_3]$

Note that we are discussing the case in which the manufacturer's optimal strategy is to get high level of support in the absence of an online channel. In other words, $k < k^*$.

Recall from Lemma 1, if $k<k^*$, then $\Pi^{nc}_{mh} > \Pi^{nc}_{ml}$. Therefore when $k \leq k_3$ and $k<k^*$, $\Pi^{c}_{mh} < \Pi^{nc}_{mh} > \Pi^{nc}_{ml}$, and the manufacturer prefers to complement the existing retail outlet with an online channel. □

**Proposition 3.** *If $\beta < \hat{\beta}$, then there must exist an interval $[k^*, k^* + \varsigma]$, $\varsigma > 0$, such that when k is within the interval, the manufacturer can increase profits by complementing the retail channel with a direct online channel.*

**Proof:** Recall from Lemma 1, when $k \geq k^*$, the manufacturer prefers low level of support in the absence of the online channel, or $\Pi^{nc}_{ml} \geq \Pi^{nc}_{mh}$. In Lemma 2, we have shown that $\Pi^{nc}_{ml} = \Pi^{c}_{ml}$. Thus, the manufacturer can make more profits by selling on the Internet only if his optimal strategy when selling online is to get high level of support or $\Pi^{c}_{mh} > \Pi^{nc}_{ml} = \Pi^{c}_{ml}$. Following Lemma 3, the manufacturer will get high level of support when selling online only if $k < k_3$. □

From Proposition 2, when $k < k_3$, $\Pi^{c}_{mh} > \Pi^{nc}_{mh}$. From Lemma 1, when $k = k^*$, $\Pi^{nc}_{mh} = \Pi^{nc}_{ml}$ thus $\Pi^{c}_{mh} > \Pi^{nc}_{ml}$. By continuity, there must exist an interval exist an interval $[k^*, k^* + \varsigma]$ such that when $k$ is within the interval $\Pi^{c}_{mh} > \Pi^{nc}_{ml}$. Following proposition 1, condition $k^* < k_3$ requires that $\beta < \hat{\beta}$.

Thus, if $\beta < \hat{\beta}$, then there must exist an interval $[k^*, k^* + \varsigma]$, $\varsigma<0$, such that when $k$ is within the interval, the manufacturer can increase profits by complementing the retail channel with a direct online channel.

**Proposition 4.** *When the manufacturer finds it optimal to complement the retail channel with an online channel, compared to the profits in the absence of such a channel the retailer's profits with the online channel are:*

(a) *Lower if $k < k^*$*
(b) *Higher if $k>k^*$.*

**Proof:**

(a) Let $\Pi^{nc}_{t}(\Pi^{c}_{t})$ denote the total profits of the manufacturer and the retailer in the absence (presence) of the online channel. When $k < k^*$,

$$\Pi^{nc}_{t} = (\alpha_r s_h + \alpha_m) p_r - \alpha_r s_h k = (\alpha_r s_h + \alpha_m) r + \alpha_r s_l k$$

Let $M$ denote the proportion of *brand loyal* consumers who purchase online. The total profits of the manufacturer and the retailer, denoted by $\Pi^{c}_{t}$ are

$$\Pi^{c}_{t} = \alpha_r s_h p_r + \alpha_m M p_m + \alpha_m (1 - M) p_r + \alpha_r s_l k$$

Recall from Proposition 2, only if $k \leq k_3$ the manufacturer finds it optimal to complement the retail channel with an online channel when $k \leq k^*$. Recall from

Lemma 3, for $k \leq k_3$ there are two cases: $k \leq k_1$ and $k_1 \leq k \leq k_3$. We consider them in turn.
When $k \leq k_1$, $p_r = p_m = r$.

$$\Pi_t^c = \alpha_r s_h p_r + \alpha_m M p_m + \alpha_m (1 - M) p_r + \alpha_r s_l k = (\alpha_r s_h + \alpha_m) r + \alpha_r s_l k = \Pi_t^{nc}$$

Thus, the total profits are the same when the manufacturer does not sell on the Internet as when he sells on the Internet. Since the manufacturer's profits from selling on the Internet are higher, the retailer's profits must be lower compared to the case when the manufacturer does not sell on the Internet.
When $k_1 \leq k \leq k_3$, $p_r = r$ and $p_m < r$.

$$\begin{aligned}\Pi_t^c &= \alpha_r s_h p_r + \alpha_m M p_m + \alpha_m (1 - M) p_r + \alpha_r s_l k < \alpha_r s_h r \\ &\quad + \alpha_m M r + \alpha_m (1 - M) r + \alpha_r s_l k = \Pi_t^{nc}\end{aligned}$$

Now, the total profits when the manufacturer sells on the Internet are less than when he does not sell on the Internet. Since the manufacturer makes more profits when the manufacturer sells on the Internet, the retailer's profits must be lower.
Therefore, if $k < k^*$, the retailer makes less profits when the manufacturer sells on the Internet.

(b) When $k > k^*$, the manufacturer prefers low level of support when he does not sell on the Internet. In this case, $p_r = r$ and $w = r$. The retailer's profits when the manufacturer does not sell on the Internet, denoted by $\Pi_r^{nc}$, are:

$$\Pi_r^{nc} = (\alpha_r s_l + \alpha_m)(p_r - w) + \alpha_r s_h k$$

As noted before, the manufacturer prefers high level of service when he sells on the Internet. Then the retailer's profits when the manufacturer sells on the Internet, denoted by $\Pi_r^c$, are given by

$$\Pi_r^c = (\alpha_r s_h + (1 - M)\alpha_m)(p_r - w) + \alpha_r s_l k$$

Let us consider the two cases: $k \leq k_2$ and $k_2 \leq k \leq k_3$. When $k \leq k_2$, $p_r - w = k$. So, $\Pi_r^c = (\alpha_r s_h + (1 - M)\alpha_m)(p_r - w) + \alpha_r s_l k = \alpha_r s_h k + (1 - M)\alpha_m k + \alpha_r s_l k > \Pi_r^{nc}$.
When $k_2 \leq k \leq k_3$, $\Pi_r^c = (\alpha_r s_h + (1 - M)\alpha_m)(p_r - w) + \alpha_r s_l k = \alpha_r s_h k + (1 - M)\alpha_m k + \alpha_r s_l k > \Pi_r^{nc}$
Therefore, if $k > k^*$, the retailer makes more profits when the manufacturer finds it optimal to sell on the internet.

□

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