Online Store as a New Direct Channel and Emerging Hybrid Channel System

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Abstract

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The surge of popularity of e-commerce not only generates numerous online sellers, but also leads many manufacturers to add direct online stores to their existing retail networks. Such a hybrid channel may enable a manufacturer to increase its market coverage and profit by customizing its product and service to the different needs of customer segments with separate channels. Conversely, the hybrid channel may lead to severe conflict and control problems because the manufacturer competes with its own retailers for the same customers. In contrast to the typical textbook advice, we show that hybrid channel using online marketing is optimal when customers are similar across segments in their valuations of retail services. The Internet has been adopted as a communication medium and eliminates boundary mechanisms which limit customers' channel switching. Consequently, a manufacturer's online store competes directly with its own retailers in the same market. Therefore, when service sensitive customers exhibit sufficiently large valuations of retail services, the manufacturer avoids price competition by eliminating online marketing and concentrates on the lucrative service sensitive segment with its brick-and-mortar retailers only.

(Channels of Distribution, Competitive Strategy, Game Theory, Electronic Commerce, Direct Online Marketing, Hybrid Channel, Channel Conflicts, Consumer Heterogeneity)
1. Introduction

Online marketing has emerged as a new direct channel as personal computers and the Internet have been rapidly gaining popularity among consumers. Personal computer has gone from being a gadget for early enthusiasts to a mainstream home electronic appliance within a decade. As of August 1998, nearly 50 million households in the US had at least one PC each, showing a 48% penetration rate (www.zdinfobeads.com). Using affordable personal computers, increasing number of people have become users of the Internet. More than 92 million people over the age of 16 are online in North America as of early 1999 (www.cnn.com, June 18, 1999). Such trend has been observed in most parts of Europe and Asia as well.

Given such popularity of personal computers and the Internet, the interactivity and low costs of online marketing generate numerous online sellers and proliferate e-business. For a few thousand dollars, anyone can become the owner of an online store and reach millions of customers worldwide. Online store can easily adjust price and promotions in response to changes in demand and competition. Then, starting from almost zero in 1995, electronic commerce generated about $301 billion in US revenue in 1998, which is equivalent to the size of the automobile industry (Washington Post, June 20, 1999). Total Web business revenue is expected to grow exponentially and will reach more than $1 trillion in 2003 (OECD 1999).

We recently observed a new trend amid fast growing e-commerce. Increasing number of manufacturers that already established market power through their retail networks add direct channels by opening online stores and compete with their own retailers in the same market. To mention a few, Compaq used to sell its products via an army of 11,000 local PC resellers. In January 1999, the company launched Compaq.com, a new division for direct sales over the Internet. IBM and Hewlett-Packard followed Compaq and are currently selling their personal computers directly online as well. You can purchase a Barbie doll at any toy store and also at Mattel's website, www.barbie.com. Sports marketing giant Nike has begun selling some of its high-end footwear and apparel directly to consumers via www.nike.com. General Motors also plan to sell their models directly over the Internet (www.cnn.com, June 30, 1999).

The previous literature prescribes that, when customer segments are sufficiently hetero-
geneous, a hybrid distribution system increases a firm’s market coverage and profit by customizing its product and service to the specific needs of the segments with separate channels (Moriarty and Moran 1990; Kotler 1997). However, the Internet has been adopted as a communication medium and eliminates boundary mechanisms which limit customers’ channel switching. Hence, in the case of hybrid channel using online marketing, the manufacturer may earn lower profit due to channel conflicts with its own retailers as it competes with them in the same market.

This paper shows analytically that hybrid channel using online marketing is optimal when customers are similar across segments. We model the competition between a manufacturer and a retailer. The retailer provides customers with the service that cannot be transferred over the Internet. The manufacturer will choose the most profitable channel type from the three alternatives: direct online marketing only, brick-and-mortar retailer only, or hybrid channel using both. We further assume two different customer segments: the price sensitive one who has zero valuation of the retail service and the service sensitive one who has a positive valuation of the service.

The equilibrium results show that the hybrid channel is optimal when the segments are similar in their valuations of the retail service. The hybrid channel provides customers with a choice of buying directly from the manufacturer or indirectly through the retailer. Hence, customers in the price sensitive segment patronize the online store for a lower price whereas customers in the service sensitive segment patronize the brick-and-mortar retailer in order to obtain its service. The increase in market coverage leads to greater profits for the manufacturer. The retailer can also be better off in the hybrid system as the manufacturer’s direct online price lowers wholesale price.

The segments are increasingly distinct as service sensitive customers are willing to pay a higher price for the retail service. The increase in their valuations of the service not only raises retail price, but wholesale price as well. The manufacturer, however, cannot increase wholesale price over direct online price. Otherwise, arbitrage enables the retailer to obtain products from the online store. Consequently, when the segments are sufficiently heterogeneous, the manufacturer employs the brick-and-mortar retailer only and focuses on
the increasingly lucrative service sensitive segment without a ceiling of wholesale price.

The rest of the paper is organized as follows. In section 2, we briefly review the relevant literature. In section 3, we present a model to describe the interaction between a manufacturer and a retailer. In section 4, we obtain the equilibrium profits in the three alternative channel structures. We then examine the condition under which the hybrid channel is the most profitable. In the last section, we summarize and discuss our findings and draw managerial implications of the results.

2. Background

Early enthusiasts of electronic commerce foresaw the decline in importance of conventional marketing intermediaries (Benjamim and Wigand 1995). The tremendous popularity of personal computers and the Internet enables buyers and sellers to engage directly in flexible and low-cost transactions with a great degree of interactivity. E-commerce lowers coordination and transaction costs so that it eliminates retailers and wholesalers.

Recent literature, however, maintains that the degree of disintermediation—the removal of marketing intermediaries—will not be significant (Sarkar et al. 1996; Alba et al. 1997). Although e-commerce enables manufacturers to deal directly with consumers, manufacturers have limited capability succeeding retailers in the marketplace. Some retail services cannot be transmitted through the Internet as well. For example, retailers play a key role in providing diverse transactional and post-sales services that cannot be digitized, such as personal inspections and quick gratification, on-site installation of peripherals, and easy and prompt replacement and refund of defective parts. Hence, buying a product from a brick-and-mortar retailer or directly from a manufacturer’s online store has its advantages and drawbacks.

In the PC market, buying retail implies that we have someone local to turn to if something goes wrong, but retail prices are apt to be higher. In contrast, buying direct is convenient and costs less. But we likely end up with less pre-installed software and, if something goes wrong, we have to work through mail to get satisfaction (Silverman 1997). We have frequently heard not only big savings at an online store, but also customer complaints about online shopping which would be avoided by personal communications in offline retailing, such as getting stuck
in the back-order without an immediate personal help, shady delivery claims, frustration with customer support, inadequate service in handling errors and questions, easily violated customer privacy (Berst 1999).

Given each store’s advantages and drawbacks, increasing number of manufacturers have adopted hybrid channels by adding online marketing to their existing distribution networks. Hybrid distribution channels have long been used in the industrial market (John and Weitz 1988). In recent years, more companies have employed diverse hybrid channels in the consumer market as well (Kotler 1997). The previous conceptual literature addresses the issue with consumer heterogeneity (Peterson et al. 1997). Online marketing is but one possible distribution channel that satisfies the specific needs of a customer segment. Specifically, when customers sufficiently differ across segments in their valuations of the offerings at an online and a brick-and-mortar retail stores, a firm employs both channels simultaneously to customize its product and service to the different needs of the segments. Consequently, the firm expands its market coverage and profit ( Moriarty and Moran 1990).

The heterogeneity hypothesis, however, implicitly assumes a boundary mechanism which limits customers’ channel switching. Without such a mechanism, a hybrid distribution system generates severe conflict and control problems between the channels. The two channels may end up competing for the same customers. In fact, there is no boundary mechanism in the case of hybrid channel using online marketing. The Internet has been widely adopted as a communication medium (Hoffman and Novak 1996). Consumers easily obtain free information from numerous websites in the Internet and then compare the sales offerings of identical products between an online and a brick-and-mortar retail stores. Hence, they can switch stores instantaneously.

The absence of boundary mechanism calls for a game-theoretic model in order to examine competition between a manufacturer and its own retailers. Hybrid channels, however, have been underresearched analytically, despite their apparent popularity in the consumer as well as industrial markets.\footnote{Gallini and Lutz (1992) address the issue in their signaling model of a franchisor’s store-mix decisions. A new franchisor will own some stores in order to send a credible signal to potential franchisees regarding business prospects. The signaling model, however, does not well explain the case of a hybrid channel using
boundary mechanism exists in the market. A manufacturer's direct online store competes with its independent retailers for customers in the same market. Each customer will choose the best store given his/her specific valuations of the sales offerings at the online and brick-and-mortar stores. We operationalize consumer heterogeneity with their different valuations of the retailer's unique service that cannot be duplicated by the manufacturer over the Internet. Given customers' selections of store type, we examine the condition under which the hybrid channel is optimal for the manufacturer.

Our model differs from the previous channel literature in modeling competition (McGuire and Staelin 1983; Choi 1991). The previous studies assume that an intermediary competes either horizontally with another intermediary at the same level or vertically with a downstream (or upstream) channel member. When an intermediary competes both horizontally and vertically, it is assumed that the firm competes with two different channel members. In contrast, we assume that an upstream channel member (i.e., a manufacturer) competes with a downstream member (i.e., its independent retailer) both vertically and horizontally at the same time.

The analysis may apply well to hybrid channels using other conventional direct marketing such as mail orders and catalog selling. However, online marketing differs from conventional direct channels in disseminating information. Market information is almost complete and perfect in online marketing. Any consumer obtains information about online offers for free. Online marketers hardly limit their offerings to a specific group of customers. In the world of the Internet, numerous consumers disseminate information using e-mails or creating websites. Unlike online marketing, conventional direct marketers can control information dissemination at the level of individual consumers (Balasubramanian 1998). Subsequently, their selective dissemination of information calls for a model with uninformed consumers.

Furthermore, the interactivity of online marketing enables marketers to make ongoing adjustments of their prices to changes in demand and competition (Hoffman and Novak 1996). In adjusting price, online stores incur no additional time and costs that other direct
channels require to reprint direct mails and catalogs for a new price. Hence, firms frequently compete on price in online marketing as price is flexible. Conversely, price rigidity becomes an important issue in conventional direct marketing as considerable price stickiness can be generated by the fixed costs of changing price (a "menu cost") (Carlton 1986; Blinder 1994). Therefore, assuming complete and perfect information and price flexibility, our analysis is more suitable to a hybrid channel using online marketing.

3. The Model

A manufacturer sells a product either through a brick-and-mortar retailer\(^2\) or directly to consumers at its online store, or using both. Depending on its chosen channel type, the manufacturer will charge either a wholesale price to the retailer, \(\omega\), or a direct online price to consumers, \(p_m\), or both. We assume that \(\omega\) does not exceed \(p_m\), i.e., \(\omega \leq p_m\). Otherwise, the retailer would obtain a product from the online store at \(p_m\). Even when the manufacturer bans the retailer from purchasing at the online store, arbitrage enables the retailer to pay \(p_m\) for a unit of the product. Hence, there is no sales at any \(\omega\) which is higher than \(p_m\).

The retailer offers the transactional service \(S\) that the manufacturer cannot duplicate at its online store. Retail stores provide quick gratification and an opportunity for physical inspection. Salespeople easily identify customers' problems with personal communication and provide adequate customer service and technical support. Product exchanges and returns are much easier. Retail service \(S\) refers to the dollars expended by the retailer on such services.

Consumers will purchase one unit of product per period. We assume that their reservation prices are uniformly distributed along \([0, V]\) with unit height, i.e., \(v \in [0, V]\). Thus, \(V\) represents the market potential of the product. We further assume two different consumer segments in the market. In the first group, consumers have a positive valuation, \(t\sqrt{S}\), of the retailer's service, \(S\). This group is called the "service sensitive" segment and has proportion \(m\) in the market. On the other hand, consumers in the second group have zero valuation

\(^2\)In order to simplify the analysis, we assume that a manufacturer employs one retailer within a given sales area even though the manufacturer may have a large number of retailers in its retail network (McGuire and Staelin 1983).
of the service. They always look for the lowest price, regardless of service level. The latter group is called the "price sensitive" segment and has the remaining proportion, $1 - m$. Consequently, $t$ measures heterogeneity across the segments in the market.

Given the manufacturer's direct online price $p_m$ and the retailer's price $p_r$ and service $S$, a consumer of type $v \in [0, V]$ in the service sensitive segment will obtain the following surplus in consuming a product:

$$U_s(v) = \begin{cases} 
  v + t\sqrt{S} - p_r & \text{at the retail store,} \\
  v - p_m & \text{at the online store.}
\end{cases}$$

Note that consumers show decreasing marginal utility with respect to $S$. On the other hand, a consumer of the same type in the price sensitive segment will obtain the following surplus:

$$U_p(v) = v - p, \quad \text{where } p \text{ is either } p_r \text{ or } p_m.$$ 

Consumers will choose the store that produces the largest surplus. Thus, when $p_m \leq p_r \leq p_m + t\sqrt{S}$, consumers in the service sensitive segment patronize the brick-and-mortar retailer in order to obtain service $S$, whereas consumers in the price sensitive segment patronize the manufacturer's online store for the lowest price. Therefore, given the uniform distribution of reservation prices over $[0, V]$, the manufacturer and retailer will expect the following sales at their online and retail stores, respectively,

$$q_m = (1 - m)(V - p_m) \quad \text{and} \quad q_r = m\left(V + t\sqrt{S} - p_r\right).$$

If the retailer undercuts the manufacturer's online price, i.e., $p_r < p_m$, even consumers in the price sensitive segment purchase a product at the retail store. Subsequently, the manufacturer's online store has no sales. Conversely, if the retailer increases price over the manufacturer's online price by more than $t\sqrt{S}$, i.e., $p_r > p_m + t\sqrt{S}$, even consumers in the service sensitive segment purchase a product at the online store and forgo the retail service due to its high price.

We assume that the manufacturer incurs a constant marginal cost in production. We normalize it to zero without loss of generality. The retailer's service $S$ will appear as a variable cost in its profit function because the service is offered to the customers who purchase
a product from the retailer. Fixed costs are not considered in this paper. We further
omit the manufacturer’s service in the model. Neither do we consider the retailer’s pre-
sales merchandising efforts. These activities yield fixed costs in nature and are given to all
consumers, regardless of the channel type they choose. Subsequently, they do not affect
customer channel selection and a consequential equilibrium.

Furthermore, the manufacturer’s and retailer’s pre-sales services lead to a double moral
hazard problem as the services are costly to monitor and then non-contractible. Hence,
choosing an optimal marketing arrangement for channel participants becomes a central issue
(Moorthy 1987; Lal 1990; Desiraju and Moorthy 1997). However, the double moral hazards
compound the effect of consumers’ differing valuations of retail service on channel design.

We also assume no scale economy in shipping and handling products. The manufacturer
incurs the same costs delivering a product to an individual customer directly or indirectly
through the retailer. We assume a constant marginal shipping cost and normalize it to zero.
A manufacturer may choose offline retailing over online marketing in order to obtain scale
economy in the distribution of inexpensive bulky goods. The assumption of zero delivery
cost will eliminate the case when an optimal channel structure may arise from scale economy
in physical distribution.

Given the assumption of constant marginal costs, the manufacturer and retailer will expect
the following profits when \( p_m \leq p_r \leq p_m + t\sqrt{S} \),

\[
\Pi_m = p_m q_m + \omega q_r \quad \text{and} \quad \Pi_r = (p_r - \omega - S) q_r.
\]

For computational convenience, let \( s = \sqrt{S} \). Therefore, the firms obtain the following
demands and profits,

\[
\Pi_m = p_m q_m + \omega q_r \quad \text{and} \quad \Pi_r = \left( p_r - \omega - s^2 \right) q_r
\]

where \( q_m = (1 - m) (V - p_m) \) and \( q_r = m (V + t s - p_r) \).

4. Channel Design

We examine the competition between the manufacturer and its independent retailer in
a sequential game framework. First, the manufacturer will choose a channel structure:
employing either the retailer or direct online marketing, or hybrid channel using both simultaneously. Next, the manufacturer announces either a wholesale price $\omega$ or direct online price $p_m$ or both, depending on the chosen channel type. Last, if the manufacturer employs the retailer either solely or concurrently with online marketing, the retailer then chooses its retail price $p_r$ and service level $s$.

The game sequence implicitly assumes that the manufacturer has market power over the retailer (Choi 1991). Its dominant position enables the manufacturer to choose a channel structure, anticipating the impact of its wholesale and direct online prices on the retailer’s independent profit maximization. Then, we examine the manufacturer’s profits under the three alternative channel types: using (a) direct online marketing only, (b) the brick-and-mortar retailer only, and (c) both simultaneously. We first examine the case of direct marketing.

4a. Direct Online Marketing Only

If the manufacturer bypasses the retailer and sells a product directly to consumers at the online store only, a consumer of type $v \in [0, V]$ obtains surplus $U(v) = v - p_m$ in consuming a product, regardless of segments. Subsequently, the manufacturer obtains the following sales and profit,

$$ q_m = V - p_m \quad \text{and} \quad \Pi_m = p_m (V - p_m). $$

The first-order condition provides the optimal price, $p_m^* = V/2$. Given the linear demand function, the manufacturer charges half of the maximum reservation price and obtains half of the market, $q_m^* = V/2$, and the following profit,

$$ \Pi_m^* = \frac{V^2}{4}. \quad (1) $$

4b. Brick-and-Mortar Retailer Only

When the manufacturer sells a product through the retailer only, the retailer has kinked demand as illustrated in figure 1. When retail price $p_r$ is lower than $t_s$, every consumer in the service sensitive segment will purchase a product. Thus, the retailer obtains $q_r = q_s + q_p$, where $q_s$ and $q_p$ represent sales in the service and price sensitive segments, respectively,

$$ q_s = mV \quad \text{and} \quad q_p = (1 - m)(V - p_r). $$
When \( ts \leq p_r < V \), the retailer obtains

\[ q_s = m (V + ts - p_r) \quad \text{and} \quad q_p = (1 - m) (V - p_r) . \]

On the other hand, when \( V \leq p_r < V + ts \), no one in the price sensitive segment will purchase a product as consumption generates negative surplus. Consequently, the retailer obtains

\[ q_s = m (V + ts - p_r) \quad \text{and} \quad q_p = 0 . \]

If retail price exceeds \( V + ts \), there is no sales because even consumers in the service sensitive segment obtain negative surplus in consuming a product.

Insert Figure 1 here

**Proposition 1:** When it sells a product through the retailer only, the manufacturer makes the retailer serve only the service sensitive segment by raising wholesale price

\[
\text{if } \frac{t^2}{V} \geq \min \left[ \frac{4 (1 - \sqrt{m})}{(\sqrt{m} - m^2)}, \frac{4}{7m^2} \right].
\]

**Proof:** See Appendix I.

If retail price is lower than \( ts \), every consumer in the service sensitive segment is willing to purchase a product, regardless of service level. The retailer then decreases the level of service. Consequently, no optimal price exists as \( s \) diminishes in the case of \( 0 \leq p_r < ts \).

When \( ts \leq p_r < V \), the retailer draws consumers from both service and price sensitive segments at the following optimal price and service level,

\[
p_r^* = \frac{1}{4} \left(3V + \frac{7m^2t^2}{4}\right) \quad \text{and} \quad s^* = \frac{mt}{2} \quad \text{given} \quad \omega^* = \frac{1}{2} \left(V + \frac{m^2t^2}{4}\right).
\]

At the optimal price and service level, the firms obtain

\[
q_r^* = \frac{1}{4} \left(V + \frac{m^2t^2}{4}\right),
\]

\[
\Pi_m^* = \frac{1}{8} \left(V + \frac{m^2t^2}{4}\right)^2 \quad \text{and} \quad \Pi_r^* = \frac{1}{16} \left(V + \frac{m^2t^2}{4}\right)^2 .
\]
The above equilibrium can exist when

\[ 0 \leq \frac{t^2}{V} \leq \min \left[ \frac{4(1 - \sqrt{m})}{(\sqrt{m} - m^2)} , \frac{4}{7m^2} \right] . \]

Otherwise, the manufacturer raises wholesale price and leads the retailer to serve only the service sensitive segment by charging a price higher than \( V \), i.e. \( V \leq p_r < V + ts \). In such a case, the retailer sets

\[ p_r^* = \frac{1}{4} \left( 3V + \frac{7t^2}{4} \right) \quad \text{and} \quad s^* = \frac{t}{2} \quad \text{given} \quad \omega^* = \frac{1}{2} \left( V + \frac{t^2}{4} \right) . \]

Therefore, the manufacturer and retailer obtain the following sales and profits,

\[ q_r^* = \frac{m}{4} \left( V + \frac{t^2}{4} \right) , \quad \Pi_r^* = \frac{m}{8} \left( V + \frac{t^2}{4} \right)^2 \quad \text{and} \quad \Pi_m^* = \frac{m}{16} \left( V + \frac{t^2}{4} \right)^2 . \quad \tag{3} \]

Figure 2 illustrates the conditions under which the retailer serves either the service sensitive segment only or both service and price sensitive segments. Note that the horizontal axis represents the relative size of the service sensitive segment, \( m \). On the other hand, the vertical axis represents the relative salience of the retail service in product purchase in the service sensitive segment, \( t^2 / V \), which measures relative heterogeneity across the two segments.

Either when the service sensitive segment is not relatively large or when the retail service is not sufficiently valuable (i.e., region \( R_2 \)), the retailer serves both service and price sensitive segments by charging a low retail price. As shown in equation (2), the equilibrium sales and profits increase in \( m \) and \( t \). Consequently, as the service sensitive segment becomes larger and consumers in the segment are willing to pay a higher price for the service, the manufacturer and retailer increase price and service level. Both then obtain greater profits. Moreover, the game sequence implies that the manufacturer has greater power as a Stackelberg leader.

11
Thus, its dominant position enables the manufacturer to take twice as much gain from the increase in $m$ and $t$ as the retailer.

When the size of the service sensitive segment is sufficiently large or when consumers in the segment are willing to pay a sufficiently high price for the retail service, it would be more profitable to focus on the service sensitive segment with the increase in service and price. Consequently, the retailer serves the service sensitive segment solely in region $R_1$.

4c. Hybrid Channel

If $p_m \leq p_r \leq p_m + ts$, consumers in the price sensitive segment purchase a product from the manufacturer’s online store whereas consumers in the service sensitive segment purchase at the brick-and-mortar retailer. Using the hybrid channel, the manufacturer obtains the following direct and indirect sales,

$$q_m = q_p = (1 - m)(V - p_m) \quad \text{and} \quad q_r = q_s = m(V + ts - p_r),$$

where $q_m$ is the direct sales in the price sensitive segment and $q_r$ is the indirect sales through the retailer in the service sensitive segment. Given the retailer’s independent decisions on retail price and service level, the manufacturer maximizes profit $\Pi_m = p_m q_m + \omega q_r$. Under the assumption of linear demand, we obtain the following results,

**Proposition 2:** The hybrid channel can exist, regardless of $t^2/V$ when $0 < m \leq 1/2$ and

if $0 \leq \frac{t^2}{V} \leq \min \left\{ 8, \frac{4(2 - m)}{m} \right\}$ when $\frac{1}{2} < m < 1$.

Otherwise, the manufacturer employs the brick and-mortar retailer only.

**Proof:** See Appendix II.

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Insert Figure 3 here

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Figure 3 describes the conditions under which the hybrid channel can exist. In region $H_1$, the manufacturer charges

$$\omega^* = p^*_r = \frac{1}{2} \left[ V + \frac{mt^2}{4(2 - m)} \right].$$
Given $\omega^*$, the retailer sets price and service level at
\[
p_r^* = \frac{1}{4} \left[ 3V + \frac{(12 - 5m)t^2}{4(2 - m)} \right] \quad \text{and} \quad s^* = \frac{t}{2}.
\] (4)

In equilibrium, the manufacturer and retailer obtain
\[
q_r^* = \frac{m}{4} \left[ V + \frac{(4 - 3m)t^2}{4(2 - m)} \right] \quad \text{and} \quad q_m^* = \frac{(1 - m)}{2} \left[ V - \frac{mt^2}{4(2 - m)} \right],
\]
\[
\Pi_r^* = \frac{m}{16} \left[ V + \frac{(4 - 3m)t^2}{4(2 - m)} \right]^2 \quad \text{and}
\]
\[
\Pi_m^* = \frac{1}{8} \left[ (2 - m)V^2 + \frac{mt^2}{2} V + \frac{m^2t^4}{16(2 - m)} \right].
\] (5)

Increasing $t$ leads to higher wholesale and retail prices in equilibrium. As $t^2/V$ exceeds $g_2$ in the case of $2/3 \leq m < 1$, $p_r^*$ becomes higher than $V$. Thus, no one in the price sensitive segment is willing to purchase a product at the online store and the manufacturer uses the retailer solely.

When $t^2/V$ is greater than $g_2$ in the case of $0 < m < 2/3$, $p_r^*$ in equation (4) becomes lower than $ts^*$. The retailer then charges $p_r^* = ts^* = t^2/2$ as every customer in the service sensitive segment purchases a product, regardless of $p_r$. Anticipating the retailer's price strategy, the manufacturer charges the following in region $H_2$,
\[
\omega^* = p_m^* = \frac{t^2}{4} - V.
\]

Hence, in equilibrium, the manufacturer and retailer obtain
\[
q_r^* = mV \quad \text{and} \quad q_m^* = (1 - m) \left( 2V - \frac{t^2}{4} \right),
\]
\[
\Pi_r^* = mV^2 \quad \text{and} \quad \Pi_m^* = -(2 - m)V^2 + \frac{(3 - 2m)t^2}{4} V - \frac{(1 - m)t^4}{16}.
\] (6)

If $t^2/V$ exceeds $8$ in the case of $1/2 \leq m < 2/3$. $p_m^*$ becomes higher than $V$. Subsequently, direct online marketing disappears as no one in the price sensitive segment purchases a product at the online store.

When $t^2/V$ is greater than $g_4$ in the case of $0 < m < 1/2$ (region $H_3$), the manufacturer sets $\omega^* = p_m^* = V/(2(1 - m)$ anticipating the retailer's price strategy $p_r = ts$. In equilibrium,
the firms obtain
\[ q_r^* = mV \quad \text{and} \quad q_m^* = \frac{(1 - 2m)V}{2}, \]
\[ \Pi_r^* = mV \left[ \frac{t^2}{4} - \frac{V}{2(1 - m)} \right] \quad \text{and} \quad \Pi_m^* = \frac{V^2}{4(1 - m)}. \] (7)

Note that the manufacturer's total sales is the same as that in the case of online marketing only, i.e., \( q_i^* = q_r^* + q_m^* = V/2. \)

On the other hand, when \( t^2/V \) is lower than \( g_1 \), the valuation of the retail service in the service sensitive segment is lower than the difference in the retailer's and online prices. Thus, even customers in the service sensitive segment would forgo the retail service and purchase a product from the online store. Subsequently, online marketing's disintermediation might occur in region \( H_4 \). In such a case, however, the retailer will cut price down to \( p_r = p_m + ts \) in order to obtain positive sales. Anticipating the retailer's price strategy, the manufacturer maximizes profit at \( \omega^* = p_m^* = V/2 \). Given \( \omega^* \), the retailer sets \( p_r^* = (V + t^2)/2 \) and \( s^* = t/2 \) and obtains sales \( q_r^* = mV/2 \) and profit \( \Pi_r^* = mt^2V/8 \). Therefore, the manufacturer obtains the following total sales and profit in equilibrium,
\[ q_i^* = q_m^* + q_r^* = \frac{V}{2} \quad \text{and} \quad \Pi_m^* = \frac{V^2}{4}. \] (8)

The manufacturer obtains the same sales and profit as in the case of direct online marketing. The manufacturer then remains indifferent in the retailer's carrying the product. Conversely, the retailer strives to carry the product in order to sell service to customers in the service sensitive segment. Consequently, the manufacturer will let the retailer deliver a product with service to consumers in the service sensitive segment. In doing so, the retailer makes profit from selling services.

We assume a linear demand for the mathematical tractability in deriving analytical results. The linearity, however, leads to the multiple regions of the existence condition of the hybrid channel, \( H_1 \) to \( H_4 \). If we assume a non-linear demand without an intercept, we expect a single region of the existence condition. Nevertheless, we would obtain the identical managerial implications.

Customers in the service sensitive segment are willing to pay a higher price for a product and accompanying services. As the retailer increases price with services, the manufacturer
increases wholesale price as well. However, the manufacturer cannot increase wholesale price over online price. Otherwise, arbitrage enables the retailer to obtain products from the online store. On the other hand, the manufacturer should keep online price low enough to capture customers in the price sensitive segment. Consequently, the wholesale price is identical to the direct online price in equilibrium.

The hybrid channel can exist regardless of $t^2/V$ when there are more customers in the price sensitive segment. The greater size of the price sensitive segment ensures profit at the online store. Even when there are more customers in the service sensitive segment, unless $t^2/V$ is sufficiently high, the manufacturer employs the brick-and-mortar retailer and online marketing simultaneously in order to meet the different customer needs in the two segments.

As $t^2/V$ increases, retail service is increasingly salient in product purchase in the service sensitive segment. The retailer then increases price with a higher level of service. The increase in retail price, in turn, enables the manufacturer to increase wholesale price. However, the manufacturer should charge wholesale price lower than online price in order to sustain the hybrid channel. Subsequently, the increase in wholesale price lifts online price up. When $t^2/V$ is sufficiently high, online marketing is not viable as online price exceeds the maximum reservation price in the price sensitive segment. The larger the service sensitive segment is, the less likely the hybrid channel is viable with increasing $t^2/V$.

The hybrid channel is, of course not viable either when no customer has a positive valuation of the retail service, i.e., $m = 0$, or when every customer has a positive valuation, i.e., $m = 1$. As $m$ approaches 0, the retailer's sales diminishes and online marketing's disintermediation can occur. Conversely, as $m$ approaches 1, direct online sales diminishes and the manufacturer employs the brick-and-mortar retailer only.

4d. Choosing the Right Channel Structure

Manufacturer and retailer are independent decision makers. Each makes pricing decisions in order to maximize its own profit, instead of maximizing total channel profits. The retailer then sets price too high and serves too few customers. Bypassing the retailer with online marketing, the manufacturer lowers retail price and increases quantity. However, the
manufacturer loses a business opportunity in the service sensitive segment. Even though
customers are willing to pay a higher price for the service that cannot be transferred over
the Internet, the manufacturer cannot capitalize such valuations of the service. A brick-
and-mortar retailer can provide such service to customers in the service sensitive segment.
However, if the manufacturer employs a retailer without online marketing, the retailer either
does not provide enough service to customers or serves the service sensitive segment only.

Hybrid channel system has an advantage of satisfying different needs in both service and
price sensitive segments using brick-and-mortar retailers and direct online marketing simulta-
nuously. Nonetheless, arbitrage prevents the manufacturer from increasing wholesale price
over online price. Intuitively, either when the portion of the service sensitive segment is suf-
ciently large or when retail service is sufficiently valuable in the segment, the manufacturer
may abandon the price sensitive segment in order to eliminate the limiting online price and
focus on the lucrative service sensitive segment without a ceiling of wholesale price.

Our results are consistent with intuition. We obtain the following results from the com-
parison of the firms’ profits in the three alternative channel structures,

Proposition 3: The hybrid marketing channel is optimal

\[
\text{if } 0 \leq \frac{t^2}{V} \leq 4 \sqrt{\frac{2}{m(1-m)}} \left[ 1 - \sqrt{\frac{m(1-m)}{2}} \right] \text{ when } 0 < m \leq 0.42135 \ldots, \\
\text{if } 0 \leq \frac{t^2}{V} \leq \frac{4(16 - 7m)}{3(4 - 3m) - 4\sqrt{(2m - 1)(m-1)}} \text{ when } 0.42135 \ldots < m \leq 0.47948 \ldots, \\
\text{if } 0 \leq \frac{t^2}{V} \leq 4 \sqrt{\frac{2-m}{m}} \text{ when } 0.47948 \ldots < m < 1.
\]

Otherwise, employing the brick-and-mortar retailer is optimal.

Proof: See Appendix III.

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Insert Figure 4 here

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Figure 4 shows the conditions under which the hybrid channel is the most profitable.
The hybrid channel is optimal for the manufacturer in regions H₁ to H₄. In region H₁,
the manufacturer obtains the sales and profit in equation (5). The increase in the relative valuation of retail service \(t^2/V\) in the service sensitive segment leads to increasing retail and wholesale prices. However, wholesale price is bounded by online price due to the possibility of arbitrage. When \(t^2/V\) exceeds \(f_2\) in the interval \(0.47948 < m \leq 1\), it is more profitable for the manufacturer to focus on the increasingly lucrative service sensitive segment with the brick-and-mortar retailer only.

The manufacturer obtains the sales and profit shown in equation (6) in region \(H_2\) and equation (7) in region \(H_3\). The previous section shows that the hybrid channel can exist, regardless of \(t^2/V\), when there are more customers in the price sensitive segment. Nevertheless, the manufacturer employs the brick-and-mortar retailer only for the service sensitive segment if retail service is sufficiently important in product purchase in the segment, i.e., \(t^2/V > f_6\) in the interval \(0.0 < m \leq 0.42135\) and \(t^2/V > f_5\) in the interval \(0.42135 < m \leq 0.47948\).

Online marketing's disintermediation seems to occur in region \(H_4\). If \(t^2/V\) is lower than \(f_1\), customers in the service sensitive segment have marginal valuations of the service. The price and service sensitive segments are increasingly similar. Subsequently, replacing the independent retailer with online marketing becomes more profitable for the manufacturer. However, it is infeasible to employ direct online marketing solely because the retailer will cut price down to \(p_r = p_m + ts\) in order to sustain positive sales. Therefore, as shown in equation (8), the manufacturer obtains the identical sales and profits, regardless of the retailer's carrying the product. The manufacturer then sells a product in the price sensitive segment directly at the online store whereas it allows the retailer to deliver a product with the service to customers in the service sensitive segment.

Note that the hybrid channel yields greater profits for the retailer as well at a sufficiently large value of \(t^2/V\). The retailer serves only the service sensitive segment either in the hybrid or conventional channel when \(t^2/V\) is sufficiently large (region \(R_1\) in figure 2). In contrast to the conventional case, wholesale price is restricted by online price in the hybrid channel. Hence, the equilibrium wholesale price in the hybrid channel is lower than that in the conventional case. Consequently, the retailer obtains greater profits under the lower wholesale price.
5. Summary and Discussion

In spite of early enthusiasts' conjecture of online marketing's disintermediation, Alba et al. (1997) predict that the degree will not be significant. Even though the interactivity and convenience of online marketing enable manufacturers to bypass marketing intermediaries and to sell directly to consumers, conventional brick-and-mortar retailers still provide unique services that cannot be digitized and transferred over the Internet. Given the advantages and drawbacks of online and offline retailing, increasing number of manufacturers have adopted hybrid channels by adding online marketing to their already established retail networks.

This paper shows analytically that disintermediation will not occur unless no customer has a positive valuation of retail services. We further show that hybrid channel using online marketing is optimal when customers are similar across segments in their valuations of the services. Service sensitive consumers purchase a product at the retailers whereas price sensitive consumers purchase from the online store. However, when customers sufficiently differ across the segments, the manufacturer can make greater profits by serving only the customers who are willing to pay a higher price for the services with the brick-and-mortar retailers.

Our findings seem to fly in the face of the typical textbook advice that, when segments are sufficiently heterogeneous, a manufacturer increases its market coverage and profit by adding more channels to the existing ones in order to tailor its offerings to the specific needs of the segments. This hypothesis, however, implicitly assumes a boundary mechanism which limits customers' channel switching. In fact, the tremendous popularity of the Internet as a communication medium eliminates such boundary mechanisms in the market. Consequently, a manufacturer's online store competes with its own retailers in the same market. Then, when service sensitive consumers exhibit sufficiently large valuations of retail services, the manufacturer avoids price competition by eliminating the online store and concentrates on the lucrative service sensitive segment with the conventional retailers only.

Launching a direct online marketing division, Compaq.com, the former chief executive at Compaq, Eckhard Pfeiffer, pointed out that Compaq provides "the total solution" to customers, giving them a choice of buying direct from the company or indirectly from its
distribution network for the customers who seek additional expertise, advice, and technical support (Reuters, November 11, 1998). The success of the hybrid distribution system will depend on whether the PC resellers' additional expertise and technical support are so unique that Compaq cannot duplicate such services over the Internet and whether these services are sufficiently salient in some consumers' purchase decisions. If so, unless customers differ too much across segments in their valuations of the resellers' services, the hybrid channel will lead to the increase in market coverage and profit.

We expect online marketing's disintermediation in such product categories as music and video compact disks, computer software and games, and books. Most offline retail services in these industries can be digitized and efficiently transmitted through the Internet. Traditional brick-and-mortar retailers add not much value with their services. We then predict that manufacturers' online stores or online retailers will replace conventional retail stores in these product categories.

In modeling competition, we do not consider the transportation costs that a customer incurs in visiting a conventional retailer, including not only moving costs over the physical distance between the customer and store location but also all other inconveniences such as time constraints, long lines, and heavy crowd. Customers would save such transportation costs if they use an online store instead. These transportation costs are constant given each consumer's location and increase the preference of online shopping over traditional retail stores. Hence, unless conventional retailers compete with an online store using store location, such transportation costs do not change the implications of the equilibrium, but uniformly shift the regions where the hybrid channel is optimal upward. Subsequently, the hybrid channel becomes more likely in the market.

Scale economy in shipping and handling will move the regions where the hybrid channel is optimal downward. Instead of shipping a product to each customer in online marketing, a manufacturer may incur lower distribution costs with a retail network under scale economy in physical distribution. In such a case, using brick-and-mortar retailers is more profitable and the hybrid channel becomes less likely in the market. Conversely, the decrease in inventory costs in online marketing would lead a manufacturer to adopt the hybrid channel more likely.
We confine our investigation to the case when a manufacturer compete with its own retailer both vertically and horizontally using direct online marketing. An extension would be to include additional competition either at the retail or manufacturer level for the generality of the results. Drawing upon the findings in the channel literature (McGuire and Staelin 1983; Choi 1991), we conjecture that the additional competition will lower either wholesale or direct online price and makes the hybrid channel less profitable. Furthermore, our analysis confines retail services mainly to transaction-related services such as quick gratification and personal help, easy returns and exchanges, prompt delivery and customer support. When we extend our analysis to the case of other post-purchase services, we should consider the possibility of unbundling services if a third party can provide such services more efficiently and economically.

The narrow perspective and restricted scope of the model may limit the generality of the results and interpretation. Nevertheless, the findings in this paper present a host of testable propositions for management strategists. Future empirical research should be pursued for further managerial insights.
References


Appendix I: Distribution Through the Retailer Only

When the manufacturer employs the retailer only, the retailer has demand

\[ q_r = q_s + q_p = \begin{cases} 
  mV + (1 - m)(V - p_r) & \text{when } 0 \leq p_r < ts \\
  m(V + ts - p_r) + (1 - m)(V - p_r) & \text{when } ts \leq p_r < V \\
  m(V + ts - p_r) & \text{when } V \leq p_r < V + ts 
\end{cases} \]

where \( q_s \) and \( q_p \) represent sales in the service and price sensitive segments, respectively. Hence, when \( 0 \leq p_r < ts \), the retailer earns the following profit given \( \omega \),

\[ \Pi_r = \left( p_r - \omega - s^2 \right) \left[ mV + (1 - m)(V - p_r) \right]. \]

The first derivative with respect to \( s \) is \(-2qs^*_r\). Then, the optimal service level is no service at all. Consequently, no optimal price exists as \( s \) diminishes in the interval \( 0 \leq p_r < ts \).

When \( ts \leq p_r < V \), the retailer earns profit

\[ \Pi_r = \left( p_r - \omega - s^2 \right) \left[ m(V + ts - p_r) + (1 - m)(V - p_r) \right]. \]

From the first-order conditions, we obtain

\[ p_r^* = \frac{1}{2} \left( V + \omega + \frac{3m^2t^2}{4} \right) \quad \text{and} \quad s^* = \frac{mt}{2}. \]

The second-order conditions are satisfied because

\[ \frac{\partial^2 \Pi_r}{\partial p_r^2} = -2 < 0 \quad \text{and} \quad \frac{\partial^2 \Pi_r}{\partial p_r^2} \frac{\partial^2 \Pi_r}{\partial s^2} - \left( \frac{\partial^2 \Pi_r}{\partial p_r \partial s} \right)^2 = 2m^2t^2 + 4(V - p_r) > 0. \]

Hence, the retailer obtains the following sales at \( p_r^* \) and \( s^* \),

\[ q_r^* = \frac{1}{2} \left( V - \omega + \frac{m^2t^2}{4} \right). \]

Given \( q_r^* \), the manufacturer earns \( \Pi_m^* = \omega q_r^* \). The first-order condition then yields

\[ \omega^* = \frac{1}{2} \left( V + \frac{m^2t^2}{4} \right). \]

The second-order condition is satisfied because \( \frac{\partial^2 \Pi_m}{\partial \omega^2} = -1 \). At \( \omega^* \), we obtain

\[ p_r^* = \frac{1}{4} \left( 3V + \frac{7m^2t^2}{4} \right), \quad s^* = \frac{mt}{2}, \quad q_r^* = \frac{1}{4} \left( V + \frac{m^2t^2}{4} \right), \]

\[ \Pi_m^* = \frac{1}{8} \left( V + \frac{m^2t^2}{4} \right)^2, \quad \text{and} \quad \Pi_r^* = \frac{1}{16} \left( V + \frac{m^2t^2}{4} \right)^2. \quad (1.1) \]

Since \( ts \leq p_r \leq V \), we obtain the following condition for the existence of the equilibrium,

\[ 0 \leq \frac{t^2}{V} \leq \min \left[ \frac{4}{7m^2}, \frac{12}{(8 - 7m)m} \right]. \]

23
When $V \leq p_r < V + ts$, the retailer earns profit
\[ \Pi_r = m \left( p_r - \omega - s^2 \right) (V + ts - p_r). \] (1.2)

Thus, the first-order conditions provide
\[ p_r^* = \frac{1}{2} \left( V + \omega + \frac{3t^2}{4} \right) \quad \text{and} \quad s^* = \frac{t}{2}. \] (1.3)

The second-order conditions are satisfied because
\[ \frac{\partial^2 \Pi_r}{\partial p_r^2} = -2m \leq 0 \quad \text{and} \quad \frac{\partial^2 \Pi_r}{\partial p_r^2} \frac{\partial^2 \Pi_r}{\partial s^2} - \left( \frac{\partial^2 \Pi_r}{\partial p_r \partial s} \right)^2 = m^2 \left[ \frac{t^2}{2} + 2(V - \omega) \right] \geq 0. \]

The retailer obtains the following sales at $p_r^*$ and $s^*$,
\[ q_r^* = \frac{m}{2} \left( V - \omega + \frac{t^2}{4} \right). \] (1.4)

Given $q_r^*$, the manufacturer earns $\Pi_m^* = \omega q_r^*$. Then, we obtain the following optimal wholesale price from the first-order condition,
\[ \omega^* = \frac{1}{2} \left( V + \frac{t^2}{4} \right). \]

The second-order condition is satisfied since $\partial^2 \Pi_m^*/\partial \omega^2 = -m$. At $\omega^*$, we obtain
\[ p_r^* = \frac{1}{4} \left( 3V + \frac{7t^2}{4} \right) \quad s^* = \frac{t}{2}, \quad q_r^* = \frac{m}{4} \left( V + \frac{t^2}{4} \right), \]
\[ \Pi_m^* = \frac{m}{8} \left( V + \frac{t^2}{4} \right)^2, \quad \text{and} \quad \Pi_r^* = \frac{m}{16} \left( V + \frac{t^2}{4} \right)^2. \] (1.5)

Since $V \leq p_r < V + ts$, the above equilibrium is valid when $t^2/V \geq 4/7$.

$\Pi_m^*$ in (1.1) is greater than $\Pi_m^*$ in (1.5) when
\[ \frac{t^2}{V} \leq \frac{4(1 - \sqrt{m})}{(\sqrt{m} - m^2)} \]
because
\[ \frac{1}{8} \left( V + \frac{m^2 t^2}{4} \right)^2 - \frac{m}{8} \left( V + \frac{t^2}{4} \right)^2 \]
\[ = \frac{1}{8} \left[ (1 + \sqrt{m})V + \frac{(\sqrt{m} + m^2)t^2}{4} \right] \left[ (1 - \sqrt{m})V - \frac{(\sqrt{m} - m^2)t^2}{4} \right]. \]

It is shown that
\[ \frac{4}{7} < \frac{4(1 - \sqrt{m})}{(\sqrt{m} - m^2)} < \frac{12}{(8 - 7m)m} \quad \text{when} \quad 0 \leq m \leq 1. \]
and
\[ \frac{4(1 - \sqrt{m})}{(\sqrt{m} - m^2)} \leq \frac{4}{7m^2} \quad \text{when} \quad 0 \leq m \leq 0.451458 \cdots \]
\[ \frac{4(1 - \sqrt{m})}{(\sqrt{m} - m^2)} > \frac{4}{7m^2} \quad \text{when} \quad 0.451458 \cdots < m \leq 1. \]

Therefore, the manufacturer obtains profit
\[
\Pi^* = \frac{1}{8} \left( V + \frac{m^2 t^2}{4} \right)^2 \quad \text{if} \quad 0 \leq \frac{t^2}{V} \leq \min \left[ \frac{4(1 - \sqrt{m})}{(\sqrt{m} - m^2)}, \frac{4}{7m^2} \right],
\]
\[
\Pi^* = \frac{m}{8} \left( V + \frac{t^2}{4} \right)^2 \quad \text{otherwise}.
\]
Appendix II: Hybrid Distribution Channel

When \( p_m \leq p_r \leq p_m + ts \), the manufacturer maintains a hybrid channel using the retailer and direct online marketing simultaneously. The firms then obtain

\[
q_m = q_p = (1 - m)(V - p_m) \quad \text{and} \quad q_r = q_s = m(V + ts - p_r),
\]

where \( q_p \) and \( q_s \) represent sales in the price and service sensitive segments, respectively. Given \( \omega \), the retailer obtains profit

\[
\Pi_r = mt(p_r - \omega - s^2)(V + ts - p_r).
\]

Note that the profit function is identical to equation (I.2). Thus, we obtain the same optimal price and service level as in (I.3). Given the retailer’s sales shown in (I.4), the manufacturer obtains profit

\[
\Pi_m = p_m q_m + \omega q_r = (1 - m)p_m(V - p_m) + \omega m \frac{t^2}{2} \left( V - \omega + \frac{t^2}{4} \right).
\]

The manufacturer maximizes its profit with respect to \( p_m \) and \( \omega \) under condition \( \omega \leq p_m \). Hence, using Kuhn-Tucker conditions, we obtain the following optimal wholesale and direct online prices,

\[
\omega^* = \frac{1}{2} \left[ V + \frac{mt^2}{4(2 - m)} \right].
\]

Given \( \omega^* = p_m^* \),

\[
p_r^* = \frac{1}{4} \left[ 3V + \frac{(12 - 5m)t^2}{4(2 - m)} \right],
\]

\[
q_r^* = \frac{m}{4} \left[ V + \frac{(4 - 3m)t^2}{4(2 - m)} \right] \quad \text{and} \quad q_m^* = \frac{(1 - m)}{2} \left[ V - \frac{mt^2}{4(2 - m)} \right],
\]

\[
\Pi_r^* = \frac{m}{16} \left[ V + \frac{(4 - 3m)t^2}{4(2 - m)} \right]^2 \quad \text{and} \quad \Pi_m^* = \frac{1}{8} \left[ (2 - m)V^2 + \frac{mt^2}{2}V + \frac{mt^2}{16(2 - m)} \right].
\]

Note that \( p_m^* \) is always positive and \( p_r^* \) is always lower than \( V + ts^* \). Furthermore, \( p_r^* \) is always greater than \( p_m^* = \omega^* \). Since \( p_r^* \) should also be greater than \( ts^* \),

\[
p_r^* - ts^* = \frac{1}{4} \left[ 3V + \frac{(3m - 4)t^2}{4(2 - m)} \right] \geq 0, \quad \text{then} \quad \frac{t^2}{V} \leq \frac{12(2 - m)}{(4 - 3m)}. \]

Because \( p_m^* \) should be less than \( V \),

\[
V - p_m^* = \frac{1}{2} \left[ V - \frac{mt^2}{4(2 - m)} \right] \geq 0, \quad \text{then} \quad \frac{t^2}{V} \leq \frac{4(2 - m)}{m}.
\]
Moreover, since \( p^*_r \) should be less than \( p^*_m + ts^* \),
\[
p^*_r - p^*_m = \frac{1}{4} \left[ V + \frac{(12 - 7m)t^2}{4(2 - m)} \right] \leq ts^* = \frac{t^2}{2}.
\]
then \( \frac{t^2}{V} \geq \frac{4(2 - m)}{(4 - m)} \).

Therefore, the above equilibrium is valid when
\[
\frac{4(2 - m)}{(4 - m)} \leq \frac{t^2}{V} \leq \min \left[ \frac{12(2 - m)}{(4 - 3m)}, \frac{4(2 - m)}{m} \right].
\]

If \( t^2/V < 4(2 - m)/(4 - m) \), the manufacturer would capture both segments using online marketing only. In order to obtain positive sales, the retailer should cut price down to \( p_r = p_m + ts \). Then, the retailer will obtain
\[
q_r = m(V + ts - p_r) = m(V - p_m),
\]
\[
\Pi_r = m(p_r - \omega - s^2)(V - p_m) = m(p_m + ts - \omega - s^2)(V - p_m).
\]

From the first-order condition, we obtain \( s^* = t/2 \). Thus, \( p^*_r = p_m + ts^* \). Given \( p^*_r \) and \( s^* \), the manufacturer will maximize the following profit under condition \( \omega \leq p_m \),
\[
\Pi_m = p_m q_m + \omega q_r = p_m(1 - m)(V - p_m) + \omega m(V - p_m).
\]

Using Kuhn-Tucker conditions, we obtain \( \omega^* = p^*_m = V/2 \). Therefore,
\[
p^*_r = \frac{V}{2} + \frac{t^2}{2}, \quad q^*_r = \frac{mV}{2}, \quad q^*_m = \frac{(1 - m)V}{2}, \quad \Pi^*_r = \frac{m t^2 V}{8}, \quad \text{and} \quad \Pi^*_m = \frac{V^2}{4}.
\]

Note that the manufacturer's total sales and profits are the same as those in the case of direct marketing, \( q^* = q^*_m + q^*_r = V/2 \).

Furthermore, it is shown that
\[
\frac{4(2 - m)}{m} \geq \frac{12(2 - m)}{(4 - 3m)} \quad \text{when} \quad 0 \leq m \leq \frac{2}{3}.
\]

If \( t^2/V > 12(2 - m)/(4 - 3m) \), \( p^*_r \) in (II.1) is lower than \( ts^* \). Thus, the retailer's sales is invariant in \( p_r \), i.e., \( q_r = q_m = mV \). The retailer then obtains \( \Pi_r = (p_r - \omega - s^2)mV \). As \( \partial \Pi_r/\partial p_r = mV > 0 \) and \( \partial \Pi_r/\partial s = -2mVs < 0 \), the retailer increases price whereas it decreases service level to \( p_r = ts \). Hence, \( \Pi_r = (ts - \omega - s^2)mV \). The first-order condition provides \( s^* = t/2 \) and \( p^*_r = ts^* = t^2/2 \). Given \( p^*_r \) and \( s^* \), the manufacturer earns
\[
\Pi_m = \omega q_r + p_m q_m = mV \omega + (1 - m)p_m(V - p_m).
\]

The manufacturer maximizes its profit with respect to \( p_m \) and \( \omega \) under condition \( \omega \leq p_m \). Using Kuhn-Tucker conditions, we obtain \( \omega^* = p^*_m = V/2(1 - m) \). Then,
\[
q^*_m = \frac{(1 - 2m)V}{2}, \quad \Pi^*_m = \frac{V^2}{4(1 - m)} \quad \text{and} \quad \Pi^*_r = mV \left[ \frac{t^2}{4} - \frac{V}{2(1 - m)} \right].
\]

(II.3)
Note that the manufacturer's total sales is the same as that in the case of direct marketing, i.e., \( q^*_m = q^*_m + q^*_r = V/2 \). For the validity of the above equilibrium, \( p^*_m \) should be less than \( V \) and \( p^*_r \) in (1.3) should be lower than \( ts^* \) given \( \omega^* \).

\[
p^*_m = \frac{V}{2(1-m)} < V \quad \text{and} \quad p^*_r - ts^* = \frac{1}{4} \left[ \frac{(3 - 2m)V}{2(1 - m)} - \frac{t^2}{2} \right] < 0.
\]

Therefore, the above equilibrium is valid when

\[
0 \leq m < \frac{1}{2} \quad \text{and} \quad \frac{t^2}{V} \geq \frac{2(3 - 2m)}{(1 - m)}.
\]

If \( t^2/V < 2(3 - 2m)/(1 - m) \), \( \omega \) is bounded by the condition \( p_r = ts \),

\[
p^*_r - ts^* = \frac{1}{2} \left( V + \omega - \frac{t^2}{4} \right) = 0, \quad \text{then} \quad \omega^* = p^*_m = \frac{t^2}{4} - V.
\]

Hence,

\[
q^*_m = (1-m)\left(2V - \frac{t^2}{4}\right),
\]

\[
\Pi^*_m = -2(2-m)V^2 + \frac{(3 - 2m)t^2}{4}V - \frac{(1-m)t^4}{16} \quad \text{and} \quad \Pi^*_r = mV^2. \quad (1.4)
\]

Since \( p^*_m \) should be less than \( V \), the above equilibrium is valid when

\[
\frac{t^2}{V} \leq 8 \quad \text{and} \quad \frac{12(2-m)}{(4-3m)} < \frac{t^2}{V} \leq \frac{2(3 - 2m)}{(1 - m)}.
\]

Note that when \( 0 \leq m < 1/2 \),

\[
\frac{2(3 - 2m)}{(1 - m)} \leq 8.
\]

Therefore, the manufacturer earns profit

\[
\Pi^*_m := \frac{V^2}{4} \quad \text{if} \quad 0 \leq \frac{t^2}{V} \leq \frac{4(2-m)}{(4-m)} \quad \text{when} \quad 0 \leq m \leq 1,
\]

\[
\Pi^*_m := \frac{1}{8} \left[ (2-m)V^2 + \frac{mt^2}{2}V + \frac{m^2t^4}{16(2-m)} \right] \quad \text{if} \quad \frac{4(2-m)}{(4-m)} < \frac{t^2}{V} \leq \min \left[ \frac{12(2-m)}{(4-3m)}, \frac{4(2-m)}{m} \right] \quad \text{when} \quad 0 \leq m \leq 1,
\]

\[
\Pi^*_m := -2(2-m)V^2 + \frac{(3 - 2m)t^2}{4}V - \frac{(1-m)t^4}{16} \quad \text{if} \quad \frac{12(2-m)}{(4-3m)} < \frac{t^2}{V} \leq \min \left[ 8, \frac{2(3 - 2m)}{(1 - m)} \right] \quad \text{when} \quad 0 \leq m \leq \frac{2}{3},
\]

\[
\Pi^*_m := \frac{V^2}{4(1-m)} \quad \text{if} \quad \frac{t^2}{V} > \frac{2(3 - 2m)}{(1 - m)} \quad \text{when} \quad 0 \leq m \leq \frac{1}{2}.
\]
Appendix III: Choosing the Right Channel Structure

As shown in (1), direct marketing yields profit \( \Pi_m^* = \frac{V^2}{4} \). On the other hand, the hybrid channel provides the following profit to the manufacturer as shown in (II.2),

\[
\Pi_m^* = \frac{1}{8} \left[ (2 - m)V^2 + \frac{mt^2}{2}V + \frac{m^2t^4}{16(2 - m)} \right] \quad \text{if} \quad \frac{4(2 - m)}{(4 - m)} \leq \frac{t^2}{V} \leq \min \left[ \frac{12(2 - m)}{(4 - 3m)} , \frac{4(2 - m)}{m} \right]. \tag{III.1}
\]

The hybrid channel produces greater profits than direct marketing when

\[
\frac{t^2}{V} \geq 4 \left[ 1 + \sqrt{\frac{2}{2 - m}} \right]^{-1}.
\]

Note that

\[
\frac{4(2 - m)}{(4 - m)} \leq 4 \left[ 1 + \sqrt{\frac{2}{2 - m}} \right]^{-1}.
\]

When the manufacturer uses the retailer only, it obtains the following profit as shown in (I.1),

\[
\Pi_m^* = \frac{1}{8} \left( V + \frac{m^2t^2}{4} \right)^2 \quad \text{if} \quad 0 \leq \frac{t^2}{V} \leq \min \left[ \frac{4(1 - \sqrt{m})}{(\sqrt{m} - m^2)} , \frac{4}{7m^2} \right]. \tag{III.2}
\]

The hybrid channel produces greater profits since \( \Pi_m^* \) in (III.1) is always greater than \( \Pi_m^* \) in (III.2). As shown in (II.4), the hybrid channel yields profit

\[
\Pi_m^* = -(2 - m)V^2 + \frac{(3 - 2m)t^2}{4}V - \frac{(1 - m)t^4}{16} \quad \text{if} \quad \frac{12(2 - m)}{(4 - 3m)} < \frac{t^2}{V} \leq \min \left[ 8 , \frac{2(3 - 2m)}{1 - m} \right] \quad \text{when} \quad 0 \leq m \leq \frac{2}{3}. \tag{III.3}
\]

It is shown that \( \Pi_m^* \) in (III.3) is greater than \( \Pi_m^* \) in (III.2) when

\[
\frac{4(17 - 8m)}{(12 - 8m - m^3) + R_m} \leq \frac{t^2}{V} \leq \frac{4(17 - 8m)}{(12 - 8m - m^3) - R_m},
\]

where \( R_m = \sqrt{8(m - 1)(m^4 - m^3 + m^2 - 2m - 1)} \), in which the set (III.4) is a subset. Furthermore, as shown in (II.3), the hybrid channel yields profit

\[
\Pi_m^* = \frac{V^2}{4(1 - m)} \quad \text{if} \quad \frac{t^2}{V} > \frac{2(3 - 2m)}{(1 - m)} \quad \text{when} \quad 0 \leq m \leq \frac{1}{2}. \tag{III.5}
\]

\( \Pi_m^* \) in (III.5) is greater than \( \Pi_m^* \) in (III.2) when

\[
0 \leq \frac{t^2}{V} \leq \frac{4(1 + m)}{m^2 \left[ (1 - m) + \sqrt{2(1 - m)} \right]}.
\]
which is greater than $4(1 - \sqrt{m})/(\sqrt{m} - m^2)$. Therefore, the hybrid channel always provides greater profits than $\Pi_m^*$ in (III.2).

The manufacturer obtains the following profit as shown in (I.5) by employing the retailer only,

$$\Pi_m^* = \frac{m}{8} \left( V + \frac{t^2}{4} \right)^2 \quad \text{if} \quad \frac{t^2}{V} \geq \min \left[ \frac{4(1 - \sqrt{m})}{(\sqrt{m} - m^2)}, \frac{4}{7m^2} \right]. \quad \text{(III.6)}$$

Then, $\Pi_m^*$ in (III.6) is greater than $\Pi_\ast_n^*$ in (III.1) when

$$\frac{t^2}{V} \geq 4 \sqrt{\frac{2 - m}{m}}.$$

Note that

$$4 \left[ 1 + \sqrt{\frac{2}{2 - m}} \right]^{-1} \leq 4 \sqrt{\frac{2 - m}{m}} \leq 4 \left( \frac{2 - m}{m} \right).$$

On the other hand,

$$4 \sqrt{\frac{2 - m}{m}} \leq \frac{12(2 - m)}{(4 - 3m)} \quad \text{if} \quad 0.47948 \cdots \leq m \leq 1.0.$$

$\Pi_m^*$ in (III.6) is greater than $\Pi_\ast_n^*$ in (III.5) when

$$\frac{t^2}{V} \geq 4 \sqrt{\frac{2}{m(1 - m)} \left[ 1 - \sqrt{\frac{m(1 - m)}{2}} \right]}.$$

Note that, if $0 \leq m \leq 0.42135 \cdots$.

$$\frac{2(3 - 2m)}{(1 - m)} \leq 4 \sqrt{\frac{2}{m(1 - m)} \left[ 1 - \sqrt{\frac{m(1 - m)}{2}} \right]}.$$

Furthermore, $\Pi_m^*$ in (III.6) is greater than $\Pi_\ast_n^*$ in (III.3) when

$$\frac{t^2}{V} \geq \frac{4(16 - 7m)}{3(4 - 3m) - 4\sqrt{(2m - 1)(m - 1)}}.$$

It is shown that

$$\frac{12(2 - m)}{(4 - 3m)} \leq \frac{4(16 - 7m)}{3(4 - 3m) - 4\sqrt{(2m - 1)(m - 1)}} \quad \text{if} \quad 0 \leq m \leq 0.47948 \cdots,$$

$$\frac{2(3 - 2m)}{(1 - m)} \leq \frac{4(16 - 7m)}{3(4 - 3m) - 4\sqrt{(2m - 1)(m - 1)}} \quad \text{if} \quad 0 \leq m \leq 0.42135 \cdots.$$

Therefore, the manufacturer obtains profit $\Pi_m^*$ in (III.6) by employing the retailer solely if

$$\frac{t^2}{V} \geq 4 \sqrt{\frac{2}{m(1 - m)} \left[ 1 - \sqrt{\frac{m(1 - m)}{2}} \right]} \quad \text{when} \quad 0 \leq m < 0.42135 \cdots.$$
\[
\frac{t^2}{V} \geq \frac{4(16 - 7m)}{3(4 - 3m) - 4\sqrt{(2m - 1)(m - 1)}} \quad \text{when } 0.42135 \cdots \leq m < 0.47948 \cdots ,
\]
\[
\frac{t^2}{V} \geq 4\sqrt{\frac{2 - m}{m}} \quad \text{when } 0.47948 \cdots \leq m \leq 1 .
\]

The manufacturer obtains profit \( \Pi_m' = V^2/4 \) by adopting direct online marketing solely if

\[
0 \leq \frac{t^2}{V} \leq 4 \left[ 1 + \sqrt{\frac{2}{2 - m}} \right]^{-1} .
\]

As shown in appendix II, however, it is infeasible to employ an online store only. In such a case, the retailer will cut price down to \( p_r = p_m + ts \) in order to obtain positive sales. Anticipating the retailer's price strategy, the manufacturer charges \( \omega^* = p_m^* = V/2 \) and obtains the total sales and profit, \( q_t^* = q_m^* + q_r^* = V/2 \) and \( \Pi_m^* = V^2/4 \), which are the same as those in the case of online marketing only. In contrast, the retailer obtains positive sales and profit, \( q_r^* = mV/2 \) and \( \Pi_r^* = mt^2V/8 \). Thus, the manufacturer is indifferent in the retailer's carrying the product whereas the retailer strives to sell it to service sensitive consumers. Therefore, the manufacturer allows the retailer to carry the product in the hybrid distribution channel.
Figure 1: Consumer Demand in the Case of Using a Retailer Only.

Figure 2: The Conditions under which the Retailer serves both price and service sensitive segments.
Figure 3: The Conditions under which the Hybrid Channel can Exist, where
\[ g_1 = \frac{4(2-m)}{(4-m)}, \quad g_2 = \frac{4(2-m)}{m}, \quad g_3 = \frac{12(2-m)}{(4-3m)}, \text{ and } g_4 = \frac{2(3-2m)}{(1-m)}. \]

Figure 4: The Conditions under which the Hybrid Channel is Optimal, where
\[ f_1 = 4 \left( 1 + \sqrt{\frac{2}{2-m}} \right)^{-1}, \quad f_2 = 4 \sqrt{\frac{2-m}{m}}, \quad f_3 = \frac{12(2-m)}{(4-3m)}, \quad f_4 = \frac{2(3-2m)}{(1-m)}. \]
\[ f_5 = \frac{4(16-7m)}{3(4-3m) - 4\sqrt{(2m-1)(m-1)}}, \quad \text{ and } \quad f_6 = 4\sqrt{\frac{2}{m(1-m)}} \left[ 1 - \sqrt{\frac{m(1-m)}{2}} \right]. \]
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