9-2009

A Hybrid Firm's Pricing Strategy in Electronic Commerce under Channel Migration

Robert John KAUFFMAN
Singapore Management University, rkauffman@smu.edu.sg

Dongwon LEE
Korea University - Korea

Jung LEE
Korea University - Korea

Byungjoon YOO
Seoul National University

A Hybrid Firm's Pricing Strategy in Electronic Commerce Under Channel Migration

Robert J. Kauffman, Dongwon Lee, Jung Lee, and Byungjoon Yoo

ABSTRACT: Achieving an effective business design across the Internet and the off-line channel is a critical concern for a hybrid firm's choice of pricing strategy. Two pricing models are proposed to examine how consumer channel migration (one-way channel interaction from the traditional sales channel to the Internet) affects pricing strategy. One model has no interaction between the Internet and off-line channels. The other includes the possibility of one-way migration to the Internet channel and incorporates consumers' channel-switching costs and loyalty to the firm. The two models offer interesting results for understanding traditional and Internet-based selling. A high level of channel migration leads a firm to manage the two channels as one. With low channel migration, in contrast, the firm should optimize and manage each channel separately. The models had two main findings: (1) the level of channel migration determines a hybrid firm's pricing strategy; (2) a hybrid firm's price-level choice should be determined by the on-line demand proportion of its business. The modeling results were validated with empirical analysis for 10 large South Korean e-commerce firms by comparing prices in different product categories for various types of hybrid firms and Internet-only firms. This research offers new marketing strategy insights for managers of hybrid firms who wish to optimize price-setting decisions based on interactions between distribution channels and the intensity of the firm's involvement in the on-line channel.

KEY WORDS AND PHRASES: Business policy, channel migration, channel-switching costs, e-commerce, empirical research, hybrid firm, loyalty, marketing, on-line channel, pricing models, pricing strategy.

Pure Internet firms, such as Amazon.com and Buy.com, built successful e-commerce businesses in the retailing industry during the 1995 to 2000 period [54]. Pastore reports that 9 of the top 10 Internet-retailing sites in 1999 were Internet-only firms [70]. (See Appendix Table A1.) At that time, large traditional retailers such as Wal-Mart and Best Buy were not yet motivated to extend their business channels to the Internet, although they could have achieved competitive advantage in the Internet-retailing industry. To do this, they would have needed to utilize their accumulated business knowledge in terms of economies of scale, brand power, marketing channel integration and customer-relationship management [80].

The lack of early entry in the digital market was partly due to the low business flexibility of the large traditional retailers. Since the e-commerce industry was growing and changing rapidly, requiring different business models, the extent of available business flexibility was a necessary operational capability for the firms [34]. Young Internet-only firms like Amazon.com had comparatively higher business flexibility, which enabled them to achieve a better match

Dongwon Lee is the corresponding author.

with the Internet compared to the traditional channels of commerce in terms of virtual inventory and systems integration capabilities [40, 63].

Another reason for the slow adoption of the Internet channel was the profit uncertainty of business on the Internet. The wider reach of e-commerce drove fierce price competition among e-commerce firms, and low transaction costs and entry barriers on the Internet even accelerated it [5, 15]. To survive, e-commerce firms lowered their prices to the marginal cost to attract consumers. At Amazon.com, for example, bestsellers were sold at 30 to 40 percent discounts, and books in other categories at a 10 percent discount [45]. Buy.com offered a low-price guarantee for most of its products, and in many cases sold products below cost [88]. Large market shares in the e-commerce industry, however, did not guarantee large profits, and low prices and strong competition on the Internet finally caused on-line retailers to achieve no better than low profitability [27, 30]. According to Amazon.com's 10-K report in 2004, for example, its annualized deficits in 1999 and 2000 were $720 million and $1,411 million, respectively, and such losses continued until 2002 [20]. But according to the founder of Amazon.com, its losses occurred due to continued and heavy expansion. If Amazon.com had not had such aggressive investment, however, it could have advanced the date of the first profit.

After the dot-com bubble crash in 2000, though, large traditional retailing firms (e.g., Wal-Mart, Sears, and JCPenney) expanded their presence for retailing in the Internet channel. (Compare the leftmost and rightmost columns in Appendix Table A1.) For traditional retailers, entering the Internet channel was not a simple decision, though. The Internet is rapidly growing and provides new business opportunity for Internet-only retailers, but it is still a high-risk investment for traditional retailers [33].

The period since the latter part of the 1990s has seen the emergence of *hybrid firms* that blend use of the traditional channel and the Internet channel, and offer potential for growth in the e-commerce sector [34]. But in practice, the channel expansion brings several business problems in pricing. For example, should a hybrid firm charge the same price in the on-line channel as in its traditional stores? Or should it charge a lower price in the on-line channel? If the hybrid firm charges the same price in both channels, a practice known as *unified pricing*, it may struggle in the e-commerce industry because *Internet-only firms* usually charge lower prices than traditional stores [1, 15]. On the other hand, if the hybrid firm charges a lower price in its on-line channel to compete with Internet-only retailers, a practice known as *channel pricing*, it may not generate enough profit and may even suffer from channel cannibalization [32, 73]. Moreover, inconsistent pricing strategies across channels may cause confusion to consumers [10, 34].

Channel management thus is considered an important strategic issue for hybrid firms. The strategic closeness of the channels, or the degree of *channel interaction*, is of high interest [8, 60, 72]. Previous research suggests that channel interaction (i.e., consumers moving back and forth across different distribution channels) has been one of the basic assumptions or the consequence of other issues, and not the main focus of investigation. Channel interaction has been treated as a given or resulted from the interplay of various factors characterizing a situation. In this paper, the focus is more on how the hybrid firm should

strategically integrate its pricing for the off-line and on-line channels when it is possible for consumers to move in one direction: from the traditional distribution channel to the Internet. This kind of channel interaction will be referred to hereinafter as *channel migration*, to distinguish it from other settings where consumers are able to move back and forth across the channels [2].

Few research efforts have examined the degree to which channel interactions occur, although this kind of analysis has mostly been used to determine the basic structure of the hybrid firm at the macro level. If the two channels are viewed by a firm as completely separate, then the firm's actions will be more like those of two firms that have separate pricing strategies. If the two channels are treated as "close" to one another and pricing strategies are linked, then the firm will face a more complex decision-making process. Most previous studies investigated multichannel firms at a more micro level. For example, some studies focus on consumer behavior and preferences within a firm [48, 50, 72]. Others emphasize the related managerial problems from the perspective of customer relationships [65, 81].

Throughout this article, the discussion shows how the results are different from the predictions made by the *theory of price discrimination*. The theory explains how a firm can maximize its profit by charging different prices to different customers. Because a number of studies recommend that firms should use price discrimination on the Internet [7, 67], the present research shows results that are counter-intuitive to what is suggested by the conventional theory.

Literature Review

The importance of channel interaction in the hybrid firm is recognized in two streams of literature, one on *strategic channel management*, the other on *multichannel pricing*. A review of the relevant literature will be preceded by a discussion of the current practices of hybrid e-commerce firms in the United States.

Hybrid Firm Pricing Strategies

Over time, more and more customers have become multichannel shoppers. Boa, for example, reported that more than 60 percent of customers want to use multiple channels in making purchases [13]. According to a Forrester Research study, 140 million consumers, almost 50 percent of the total U.S. population, had already incorporated the Internet into their shopping habits, based on their searching and buying activities, or both, in 2005 [56]. Mendelsohn, Johnson, and Meyr further reported that 54 percent of on-line consumers had researched a product on-line and purchased it off-line, and another 37 percent had researched off-line and purchased on-line in 2005 [55]. The large proportion of multichannel shoppers indicates the high level of interactions between the different consumer distribution channels that seem to be present in the U.S. Internet retailing market and are likely to be occurring elsewhere.

Generally speaking, hybrid firms do not seem to be consistently using the unified-pricing strategy across different channels due to operational problems.

In the United States, for example, QVC.com, a well-known hybrid TV home-shopping and Internet retailer, has been using a unified-pricing strategy for the most part over time, and the firm is well known for emphasizing customer service to a greater extent than prices (although it aims to price on the low side of the marketplace) [57]. During the first few years of the 2000s, the word on the street was that it was hard for Wal-Mart and Walmart.com to implement identical prices in their physical stores and on the Internet. It was operationally difficult because the firm had approximately 600,000 different product stock-keeping units (SKUs) at the time [35]. These days, Walmart.com does not explicitly confirm that its on-line prices are the same as its off-line prices, although it is consistent in communicating to the market that all its prices are founded on the strategic model of being the low-price retailer in the channels in which it operates [39]. Practically speaking, though, it is impossible to have a pure unified-pricing strategy because prices are different even among off-line Wal-Mart stores due to the different tax systems they face in different states.

As a result, the larger off-line retailers seem to have been putting greater effort into price matching. For example, Sears and Best Buy have mostly adopted the policy of matching across different channels to ensure that their customers pay the lowest prices available both off-line and on-line [11, 75]. Even though it is not easy to perfectly match prices across channels, hybrid firms are apparently aware of the importance of price consistency and are doing their best to integrate their channels to implement a largely unified-pricing strategy [12]. This is probably true up to the firm's operational and cost-of-doing-business limits. For example, Sears states explicitly in its description of its pricing policy that price matching does not apply to its operations in Alaska or Hawaii, where local costs of doing business and high product transportation costs may make it impossible for the firm to achieve uniform profitability in different locations and on the Internet [75]. Another general issue that will influence a firm's ability to match prices comes with different state-level tax rates, and the fact that Internet-based purchases may or may not be taxed, depending on the locations of the seller and the buyer. With the price-matching strategies observed among large American firms, the trend for hybrid firms now seems to be toward channel integration, as Gulati and Garino have observed [34]. The purpose is to provide a consistent customer experience across channels [63].

Strategic Channel Management

Previous studies related to strategic channel management investigated the causes of channel interaction at the consumer level or the resulting strategies for channel interaction at the firm level (*see Table 1*). For example, Merrilees and Fenech discussed the key motivating factors of purchases in the on-line channel and the traditional catalog channel [58]. They reported the causes of channel interactions that make consumers move from one channel to the other: Web experience, information search, trust, ease of use, and accuracy. Similarly, Montoya-Weiss, Voss, and Grewal found that Web site design is a channel-selection factor [60]. In addition, Laukkanen showed that consumers

Table 1. Research on Strategic Management for Multichannel Marketing.

Level of analysis	Research	Focus	Findings
Consumer level	Bendoly et al. [8]	Role of consumers' channel integration beliefs on purchasing decision	Transparency of channel integration to consumers has significant impact on customer retention
	Kumar and Venkatesan [48]	Characteristics of multichannel consumers' purchasing behaviors	Contacts with firm, past experience, and high purchase frequency are positively associated with multichannel shopping behaviors
	Laukkanen [50]	Channel-preference characteristics in electronic bill payment	Internet and mobile users have different channel coherence in terms of Internet-banking experience
	Merrilees and Fenech [58]	B2B multichannel marketing strategy	Web experience, information search, trust, ease of use, and accuracy are key motivating factors in adopting Web as purchasing channel
	Montoya-Weiss et al. [60]	On-line channel usage and customer satisfaction	Web site design affects consumer evaluations of on-line channel service quality and risk
Firm level	Deleersnyder et al. [24]	Internet channel's impacts in newspaper industry	Cannibalization fears have been overstated
	Müller-Lankenau et al. [62]	Strategic channel alignment	Different paths of channel integration process are likely; there is no single best strategy for alignment
	Payne and Frow [72]	Strategic role of multichannel integration in CRM	Multichannel integration is key cross-functional process in CRM strategy development
	Steinfield et al. [80]	Competitive advantage by hybrid firm's channel integration	Low cost, value-added service, high trust, and wide reach are benefits of channel integration

exhibit differences in the mobile and Internet channels that help to explain why some consumers stay in their selected channel while others switch from one channel to another [50].

Kumar and Venkatesan developed a conceptual framework to identify consumer-level characteristics associated with purchasing behaviors across multiple channels [48]. They reported that communication between channels generates the synergic effect in multichannel shopping. The scope of their research spanned identification of the factors and the synergic consequences of channel interaction. Bendoly et al. pointed out the importance of the trend toward *channel integration*, when firms unify product prices across multiple distribution channels [8]. The extent of channel integration that is built into a business is a firm-level decision, as well as the rationale for making it transparent to consumers.

Channel integration is an organizational-level decision-making issue that has the potential to provide a basis for strategic advantage and heighten firm competitiveness. Payne and Frow suggested that customer-relationship management (CRM) strategies support effective channel-management strategies [72]. In addition, Steinfield, Bouwman, and Adelaar analyzed the synergistic aspects of channel integration as the outcomes of different degrees of interaction between channels [80]. Similarly, Deleersnydera et al. validated another important finding: that the synergic effect of channel integration is larger than its cannibalistic effects on sales [24]. However, Müller-Lankenau et al. use the terms *channel alignment* and *integration* interchangeably and suggest that there is no single best approach in multichannel retailing [62].

Pricing Strategies in Different Channels

Multichannel pricing research has two main branches based on the structure of competition that is assumed or occurs. If channel competition occurs between firms, then it is *firm-vs.-firm competition*. If competition occurs across channels within a multichannel firm, it will be referred to here as *channel-vs.-channel competition*. Multichannel firms should not just maximize profit in the separate channels but should consider the potential for sales cannibalization across channels and the resulting beneficial synergies.

From the firm-vs.-firm competition perspective, most studies focus on price comparisons between the on-line and off-line channels. There is a preconception that on-line prices are lower than off-line prices, and some early studies discuss the reliability of these perceptions on the part of consumers [4, 15, 61]. In addition to these largely empirical investigations, other authors have also used analytical modeling approaches in their research. Bakos et al. set up a model to analyze bundling strategies for products and services in on-line brokerage [5]. Zettelmeyer argued that low Internet prices are due to the relatively narrow reach of the Internet [89].

Not much research has been done on channel-vs.-channel competition relative to price-setting by multichannel firms. Exploratory research on cross-channel pricing opportunities for firms has been conducted by Sotgiu and Ancarani [77]. Some other studies compare the prices of Internet-only firms

and hybrid firms as a means to reveal the structure of cross-channel competition that occurs within a firm [1, 69]. They have consistently concluded that hybrid firms set higher prices than Internet-only firms, but do not provide any in-depth reasoning or theoretical explanations for their results. Other issues in channel-pricing competition within a firm have been examined by Ghose et al. in reference to the book industry, especially the cross-price elasticity of new and used books [31], and by Weng, who considered the impact of joint pricing decisions on the hybrid firm's channel coordination [87]. Table 2 presents a summary of previous studies on multichannel pricing strategies.

Previous studies often employ a basic assumption that there is some level of interaction between channels. Among the various studies, some investigate its causes at the consumer level. Others propose strategies toward channel integration at the organizational level to develop a channel management perspective, or else they find an optimal pricing structure across channels to support profit maximization. One limitation of these studies is that they do not explore the extent to which channel interaction occurs. They more or less treat interactions between consumer distribution channels as a given. This paper will investigate the extent of the impacts of *one-way channel migration* from the traditional channel to the Internet channel—an instance of more general channel interactions—at the firm level. More specifically, strategic pricing policies will be derived that optimize profitability as a new means to provide guidance on the hybrid firm's channel-management policy.

Pricing Models for the Hybrid Firm

As noted earlier, the model assumes one-directional movement or channel migration from the traditional channel to the Internet channel. This is due to a key assumption made in the present research: that consumers will have lower reservation prices in the electronic channel. Two types of pricing models are presented: one with no channel migration, and the other with channel migration. The broader term, *channel interaction*, typically refers to demand changes that occur due to consumers' use of multiple distribution channels for purchasing the same products [72]. Channel interaction is generally conceptualized with the assumption of bi-directional movement of customers [72]. *Channel cannibalization* occurs in such contexts when channel interaction or channel migration results in a decrease of total demand for the hybrid firm's products [73]. *Reservation price* is defined as the maximum price a customer is willing to pay for a sale item.

No channel migration means that consumers will stay within the traditional channel. The implication is that there will not be any cross-channel demand shifts in the normal course of business. Assuming some level of channel migration permits consumers to be multichannel shoppers who make utility-maximizing choices between the on-line and off-line channels based on their heterogeneous preferences and incentives. Demand within each channel will vary in the presence of repeat business. One expects that the presence of a large number of multichannel shoppers will affect the level of demand in each channel.

Table 2. Research on Multichannel Pricing Strategy.

Channel competition	Research	Focus	Findings
Between firms	Bailey [4]	Prices of books and CDs on-line and off-line	On-line prices are higher
	Bakos et al. [5]	Prices in on-line brokerage services	As consumers' willingness-to-pay for investment research declines, an incumbent finds it optimal to unbundle its offering
	Brynjolfsson and Smith [15]	Prices of books on-line and off-line	On-line prices are 9–16% lower than off-line prices
	Morton et al. [61]	Internet car-referral services	On-line consumers pay on average 2% less for cars
	Zettelmeyer [89]	Effect of size of Internet on pricing and communication	Lower prices on Internet are due to its relatively narrow reach
Within a firm	Ancarani and Shankar [1]	Prices of traditional, Internet-only, and hybrid firms	Hybrid firms post higher prices than Internet-only firms
	Ghose et al. [32]	Cross-price elasticity of new book demand and used book prices	Used books are not substitutes for new books
	Pan et al. [69]	Price competition between on-line and off-line channels	Internet-only retailers have lower prices than hybrid firms
	Sotgiu and Ancarani [77]	Multichannel pricing	Firms benefit from Internet's flexibility and increase consumer focus by effectively managing prices
	Weng [87]	Joint pricing for channel coordination	Optimal all-unit quantity discounts are equivalent to optimal incremental quantity discounts

The next section presents a model with fixed demand that assumes no channel migration. After this, the fixed demand assumption will be freed up in an extended model with flexible demand and channel migration. These two models generate different results, and their implications will be compared and discussed.

Base Case Pricing Model: Rigid Demand with No Channel Migration

Consider a large, off-line monopoly retailer that recently has been expanding its retailing channel onto the Internet and therefore might now be regarded as a hybrid firm. The rationale for the monopoly assumption, in addition to providing a base case for achieving tractable analytical results, is that it is intended to capture the essence of what happens when large, famous off-line firms with strong consumer followings enter the on-line channel. Examples include L.L.Bean, REI, and Lands' End. These large and famous off-line retailers usually have a degree of monopoly power relative to their customers because of the perceived uniqueness of what they do (e.g., L.L.Bean for its suburban New England clothing designs, REI for its outdoor sports equipment and co-op discounts, Lands' End for its high-quality clothing sales catalog operations). Since the hybrid firm in the model has a high-enough operational capacity in its business to be able to expand its channels of distribution, one can reasonably assume that it has a certain level of monopoly power relative to its customers.

The formal development of the model now begins. (By convention, the subscript e will represent the on-line, or electronic, channel and the subscript t the traditional channel. See Appendix Table A2 for a summary of all modeling notation used in this article.) Let k be the *proportion of potential demand* that arises for the firm in the on-line channel compared to the traditional channel, which is less than the demand from the traditional channel (i.e., $k < 1$). (The parameter k also can be interpreted as the proportion of consumers who prefer the on-line channel over the traditional channel.) Potential demand is defined as the demand that would occur if the price were zero. This assumption is natural for new entrants to the Internet channel, where there is a history of past traditional retailing business. This assumption is corroborated in general terms by empirical evidence from several reports on the percentage of e-commerce sector activities relative to total retailing activities. For example, according to the U.S. Census Bureau, e-commerce amounted to a little less than 2.5 percent of total retail revenues in the U.S. economy in 2005 [83]. Also, the portion of e-commerce is smaller than other traditional business channels, such as mail order or catalog. According to IBISWorld's Mail-Order U.S. Industry Report, the total revenue of the mail order industry in 2005 was $124.5 billion, while the e-commerce industry's total was $86.3 billion [37]. Even though e-commerce sector revenues increased by 7.2 percent (± 0.3 percent) from 2004, the traditional mail order channel is still larger than the on-line channel by almost 50 percent. So the on-line market is still smaller than the traditional retailing market, although it has been growing fast.

The reservation price R_e used in the on-line channel is lower than the one in the traditional channel, R_t (i.e., $R_e < R_t$). Consumers tend to believe that on-line prices are lower than off-line prices, inclusive of shipping and handling costs. Forrester Research surveys in 2004 and 2006 showed that more than 70 percent of consumers thought prices were lower on-line [38]. In addition, Shop.org and Forrester Research reported that nearly three-quarters of consumers expected on-line channels to provide lower prices [28]. A number of studies have also provided empirical and analytical evidence that prices are lower in the on-line channel than in off-line channels, as discussed earlier [1, 5, 15, 61]. As each channel has a downward-sloping demand curve, the demand levels of the off-line and on-line channels can be represented as in Equation (1).

Traditional and On-Line Channel Demand

$$d_t = D_t - \frac{D_t}{R_t} p_t, \quad d_e = D_e - \frac{D_e}{R_e} p_e \qquad (D_e = k \cdot D_t,\ k < 1). \tag{1}$$

D_t and D_e are the potential demand levels, p_t and p_e represent retail prices, and d_t and d_e represent the demand levels at price p_t and p_e, respectively, of the traditional and on-line channels (*see Figure 1*).

Next, estimating the total demand, we solve for the equilibrium prices of the hybrid firm. The hybrid firm's total demand d_h at price p_h is the sum of the traditional and on-line channel demand levels, because it is assumed that there is no channel migration. This makes it possible to derive a hybrid firm's total demand as:

The Hybrid Firm's Total Demand

$$\begin{aligned} d_h &= d_e + d_t \\ &= (1+k) D_t - \frac{(R_t k + R_e) \cdot D_t}{R_e R_t} && \text{if } 0 \le p_h \le R_e \quad \text{or} \\ &= D_t - \frac{D_t}{R_t} p_h && \text{if } R_e < p_h \le R_t. \end{aligned} \tag{2}$$

Figure 2 illustrates the demand curve of the hybrid firm.

The solid line represents the hybrid firm's demand curve. At each price level, total demand is the sum of the demand levels that occur separately in the traditional and on-line channels. If the hybrid firm charges a price between R_e and R_t, then demand will occur only in the traditional channel. If the price is between 0 and R_e, however, then demand will occur in both channels. For example, if the firm charges p_h, as shown in Figure 2, total demand will be d_h, which is the sum of d_e and d_t (i.e., $d_h = d_e + d_t$). d_e is the demand that will occur in the on-line channel with price p_h, and d_t is the level of demand occurring in the traditional channel with price p_h. As argued above, the hybrid firm will have two pricing strategy alternatives. One is to charge the same price in both

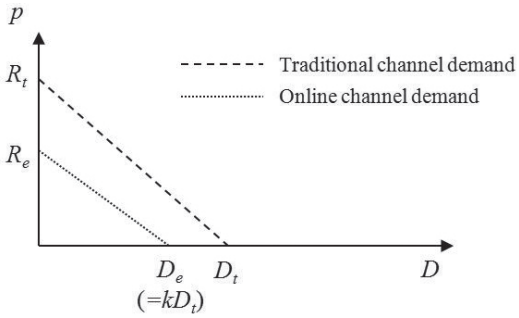

Figure 1. Demand Curves for Traditional and Online Channels

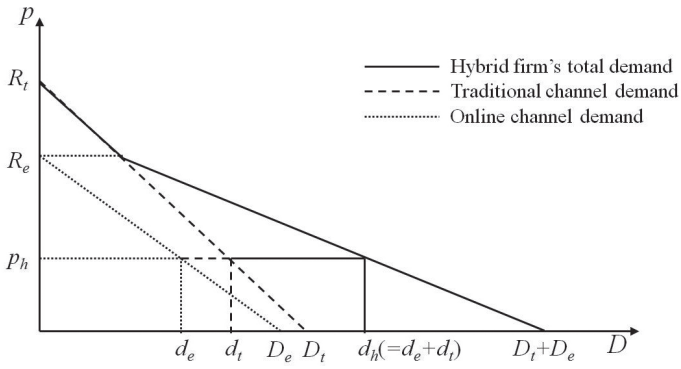

Figure 2. Demand Curve for the Hybrid Firm

channels, a *unified-pricing strategy*. The other is to charge different prices based on the channel, a *channel-pricing strategy*.

It is now necessary to see which pricing strategy is the best for the hybrid firm. In settings of this sort, it is common for there to be *fixed costs associated with selling* (e.g., based on the requirements of participation in a channel—a store, a Web site, promotion and advertising) and *variable costs associated with the volume of sales* (labor to support the transaction, cost of goods sold, etc.). For simplicity in the analysis and without loss of generality, it is assumed that there are no fixed costs or variable costs. Total profit is a linear function of total sales in the model. A profit parameter will be used only for comparison purposes, so assuming specific fixed and variable costs will not change the main results obtained. For these cases, the equilibrium prices and profits are represented in Figure 3 and Table 3. In these equations, p_h^* and $\pi_{h\_u}^*$ are the equilibrium price and profit of the unified-pricing hybrid firm, and p_t^*, p_e^*, and $\pi_{h\_c}^*$ are the equilibrium prices and total profit of the channel-pricing hybrid firm. To provide evidence that this is a reasonable simplification that does not introduce other, unintended circumstances, a model was analyzed with both fixed and variables costs. The corroborating evidence is presented

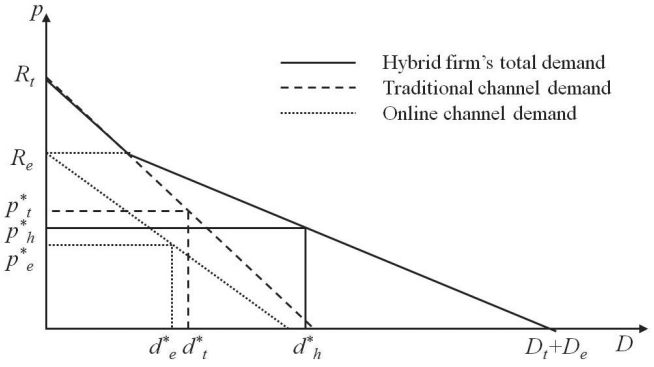

Figure 3. The Hybrid Firm's Optimal Price and Profit Under Different Pricing Strategies

Table 3. Equilibrium Prices and Profits Under Different Pricing Strategy Assumptions, Base Case.

Under unified-pricing strategy

$$\text{If } \frac{R_t - 2R_e}{R_t} \le k, \text{ then } p_h^* = \frac{R_e R_t (1+k)}{2(R_e + R_t k)} \text{ and } \pi_{h\_u}^* = \frac{1}{4}\frac{(1+k)^2 R_e R_t}{R_e + R_t k} \cdot D_t \quad (3.1)$$

$$\text{If } \frac{R_t - 2R_e}{R_t} > k, \text{ then } p_h^* = \frac{R_t}{2} \text{ and } \pi_{h\_u}^* = \frac{R_t}{4} \cdot D_t \quad (3.2)$$

Under channel-pricing strategy

$$p_t^* = \frac{R_t}{2},\ p_e^* = \frac{R_e}{2} \text{ and } \pi_{h\_c}^* = \pi_{t\_c}^* + \pi_{e\_c}^* = \frac{R_t + kR_e}{4} \cdot D_t \quad (4)$$

in Appendix Table A2. The same results were obtained as compared to the model without these costs.

Equation (2) shows the case when the firm has no incentive to extend the traditional channel to the Internet. If the proportion of total demand from the on-line channel is small, then it will be inappropriate for a potential hybrid firm to extend its business to the Internet. The firm will not be able to maximize profit this way, as the usual business intuition might suggest. Equations 3.1, 3.2, and 4 are presented in Table 3.

If the hybrid firm adopts a channel-pricing strategy, p_t^* and p_e^* will be the associated equilibrium prices for each channel, permitting prices to be optimized based on the demand in each channel. If the hybrid firm adopts a unified-pricing strategy, though, the price p_h^* will be optimized based on the total demand of the hybrid firm. The optimal price would occur between p_e^* and p_t^*. This is a little lower than p_t^* but a little higher than p_e^*. Moreover, if the profits from the two pricing strategies are compared, the channel-pricing

strategy (i.e., different prices in each channel) shows higher profits than the unified-pricing strategy (i.e., the same prices across the two channels). So, for the base case model, one may conclude that the channel-pricing strategy is optimal for the hybrid firm. Thus, the following first proposition is suggested:

> ***Proposition 1 (Optimal Prices and Profits of the Hybrid Firm Proposition):*** *If there is no channel migration, a channel-pricing strategy generates a higher profit than a unified-pricing strategy for the hybrid firm.* (Proofs of the first three propositions are given in Appendix 3.)

From P1, one learns that if channel migration is negligible, then the optimal pricing strategy for a hybrid firm is a channel-pricing strategy. To maximize profit, hybrid firms should charge different prices optimized for each channel.

Pricing Model of Flexible Demand with Channel Migration

Next, the model is extended by assuming that consumers are able to move freely from off-line to on-line, and vice versa, based on their preferences and any incentives they may obtain to do this. Thus,

Hybrid Firm's Demand Function

$$d_{h'} = d_{t'} + d_{e'} \tag{5}$$

$d_{t'} = d_t - (d_{t\to e} + d_{t\to leave})$ and $d_{e'} = d_e + d_{t\to e}$ with $d_{t\to e} = f(C_{SW}, p_t, p_e)$ and $d_{t\to leave} = f(p_t, p_e)$,

where the demand level with the asterisk represents the demand, assuming channel migration, and C_{SW} represents the customers' channel-switching cost.

Specifically, $d_{t\to e}$ represents the number of customers who change their purchasing channel from traditional to on-line, and $d_{t\to leave}$ represents the number of customers who decide not to buy the product and leave the firm. These numbers are determined by the customer's channel-switching cost and the prices on the traditional and on-line channels. The channel interaction level in this section will be determined by two parameters, $d_{t\to e}$ and $d_{t\to leave}$. The impact of the channel-migration level on the hybrid firm's pricing strategy will be analyzed by investigating $d_{t\to e}$ and $d_{t\to leave}$ functions.

To do this, consumers are divided into two groups based on their channel preferences. *Traditional channel consumers* are those who prefer the traditional channel to the on-line channel. *On-line channel consumers* have the opposite preferences. It is further assumed that every consumer has a single channel preference, not an attitude of indifference toward channel use. In addition, a consumer will not buy the same product from the traditional channel and the on-line channel simultaneously, even if given access to both channels for ordinary shopping.

Consumers in the model are price-sensitive. Other factors may enter a consumer's decision of channel choice, but textbooks treat price as the most important factor for consumer purchase decision-making [46, 85]. When a hybrid firm adopts a unified-pricing strategy across the channels, consumers will not have an incentive for moving from one channel to the other, because there will be no price differences from which to gain. However, when the hybrid firm adopts a channel-pricing strategy, some consumers may change their purchasing channel to look for and benefit from a lower price. The model supports the analysis of consumer behavior under a channel-pricing strategy.

Other often-observed reasons for consumers to make a choice to switch channels include whether the firm offers other nonprice incentives [19], provides a different set of products [43], makes affinity program rewards available [25, 42, 82], faces a potential loss of private information due to on-line privacy concerns in marketing [86], or has implemented other means to reduce information asymmetries and purchase transaction costs for the consumer [64]. Since the model does not consider these complications, the focus remains on the more basic channel-switching issues.

Let consumer i have two-dimensional heterogeneity in terms of channel-switching cost θ_i^{SW} and firm loyalty θ_i^{L}. The channel-switching cost, as defined by Chen and Hitt, is any perceived inconvenience a consumer might experience when switching to another purchasing channel [17]. For example, to buy a product through the on-line channel, the traditional consumer may have to buy a new computer and bear several types of perceived transaction risks, such as privacy, phishing, and security. Many researchers have investigated the causes, consequences, and specifics of on-line transaction risks [59, 66]. Not all consumers have the same level of channel-switching costs, though. Rather, their channel-switching costs will vary. It is assumed that each consumer's channel-switching cost is uniformly distributed over the range [0, 1]. A consumer with a high channel-switching cost will be close to 1, and the consumer's channel-switching cost also will be linearly proportional to its heterogeneous transaction-making preferences. The consumer channel-switching cost function for consumer i is represented with the constant γ as:

Consumer Channel-Switching Cost Function

$$C_{SW}\left(\theta_i^{SW}\right) = \gamma\theta_i^{SW}. \tag{6}$$

The other consumer heterogeneity that will be treated by the model is firm loyalty. For present purposes, firm loyalty is defined as a favorable attitude toward the firm that results in repeat buying behavior by the consumer. This is a modified definition of brand loyalty, based on the definitions suggested by Assael and by Keller [3, 41]. A favorable attitude is usually established based on satisfactory previous experiences with the firm that lead the consumer to purchase the firm's products again. A person who exhibits high firm loyalty would not be much affected by any source of inconvenience. For example, a consumer who has high firm loyalty for a specific type of product (e.g., Hewlett-Packard laser printers or Canon cameras) even though the transaction cost is high (indicating a strong source of inconvenience) will probably buy

the product from the company because the high loyalty mitigates the extent of the inconvenience caused by the high transaction cost.

In this model, a price difference can be the source of inconvenience for consumers [26]. The convenience of the on-line channel has been demonstrated as one of the reasons why customers prefer the on-line channel to the physical channel [47, 51]. Consider a consumer who bought a product from the traditional channel at price p_t. If it later becomes evident that the firm sells the same product at a lower price p_e in the on-line channel, then the consumer may feel misled into having paid too high a purchase price, possibly resulting in sense of inconvenience for the purchase. In other words, a consumer with a preference for the traditional channel might feel bad on realizing that the price paid in the traditional channel was higher than the price available on the on-line channel. The consumer might even feel deceived by the firm. To avoid this, according to Srivastava and Lurie, many hybrid firms now offer a price-matching guarantee across the on-line and off-line channels for consumers who cut across those segments [79]. This inconvenience occurs over a number of dimensions in addition to the channel chosen. For example, there recently were problems with temporal changes in the price of the Apple iPhone in which the vendor lowered the price from $599 to $399, setting off a storm of complaints from consumers who had queued up in a high-price frenzy to buy the new high-functionality mobile phone only two months earlier [14, 21].

A larger price difference will cause more inconvenience because it is the monetary value that the consumer could have saved in the case where the firm matched prices. In other words, the larger price difference between channels will lead the consumer to be more confused and to experience higher inconvenience. Since consumers are assumed to be price-sensitive, the price-difference parameter determines the level of inconvenience. However, the individual consumer's loyalty level will determine whether there is inconvenience [16]. A consumer who has high firm loyalty will not be affected much by the price-difference level, and will buy the product even though there is a large price difference between the channels. In business, price consistency is also one of the very important strategies for keeping high loyalty [53]. Thus, the inconvenience function of firm loyalty for consumer i, with a constant δ, is:

Consumer Channel-Switching Inconvenience Function

$$g\left(\theta_i^L\right) = -\delta\left|p_t - p_e\right|\theta_i^L. \tag{7}$$

Based on Equations (5) and (6), one can articulate how consumers react to the channel-pricing strategy of the hybrid firm. With channel pricing, a price-sensitive traditional channel consumer has three options:

- *Do not buy the product.* If the consumer's firm loyalty is low enough so that the inconvenience caused by the price difference $g(\theta)$ is large enough to make the total utility negative, then the consumer will not buy the product. Here, the utility will be zero, and the consumer will not take any action.

- *Buy from the on-line channel.* If the consumer's firm loyalty is high and the channel-switching cost is low, the consumer will buy the product from the on-line channel out of a desire to buy the product at a lower price. The associated utility function is $v_0 + g(\theta_i^L) - (P_e + C_{SW}(\theta_i^{SW}))$.
- *Buy from the traditional channel.* If the consumer has high firm loyalty and also has a high channel-switching cost, the consumer will stay in the traditional channel, where the purchase will occur. The consumer's utility function is $v_0 + g(\theta_i^L) - P_t$.

These three choices for how the consumer buys and their conditions are summarized in Table 4.

Figure 4 presents the relative proportions of consumer purchasing behavior on and off the Internet. The large square is the total demand of the traditional channel, and the white area is the proportion of consumers who do not purchase anything. The dotted gray area represents the consumers who stay and buy in the traditional channel, and the dark area represents consumers who change channels and purchase the product through the on-line channel. The proportion of consumers who do not buy anything is determined by customer loyalty θ^{L*}. Here, the heterogeneity level θ_i^{SW} satisfies $v_0 + g(\theta_i^L) - \text{Min}(p_t, p_e, C_{SW}(\theta_i^{SW})) = 0$. The proportion of consumers buying in the on-line channel is determined by the price sensitivity level θ_i^{SW}, where the heterogeneity level θ_i^{SW} satisfies $C_{SW}(\theta_i^{SW}) = p_t - p_e$.

Describing consumer behavior this way leads to several propositions. The next proposition discusses the impacts of firm loyalty and channel-switching costs on the profit of the hybrid firm, emphasizing the relative importance of one factor over the other. From these, one can assess the related channel-migration level $d_{t\to e} = \beta \cdot d_t$, where $\beta = f(\theta^{L*}, \theta^{SW*}) = \theta^{L*} \cdot \theta^{SW*}$, and $d_{t\to leave} = \alpha \cdot d_t$, $\alpha = f(\theta^{L*}) = 1 - \theta^{L*}$, which suggests the following proposition:

> ***Proposition 2 (Impact of Firm Loyalty and Channel-Switching Cost Proposition)****: Changes in firm loyalty level have a greater effect on the profit of the channel-pricing hybrid firm than the same amount of change in the channel-switching cost level.*

Disloyal customers leave the firm and do not buy the product at all, while price-sensitive customers with low channel-switching costs buy the product through the on-line channel. So the level of firm loyalty more critically affects the profit of the firm than does the channel-switching cost level. As a result, the firm would prefer to sell the product at a lower price than to lose the consumer to a competitor. For the retailer, channel-switching customers are preferred to disloyal customers who leave the firm.

The importance of firm loyalty has been discussed in a number of studies in marketing, economics, and business. In on-line consumer behavior studies, for example, loyalty and trust have been found to be the most important non-price-related factors in determining consumer purchasing behavior and firm profitability [74, 78]. Next shown is the channel-pricing strategy condition for the hybrid firm when channel switching is possible for consumers:

Table 4. Traditional Channel Consumer Reactions.

Consumer utility function	Condition	Action
$\text{Max}\left[\begin{matrix}0,\\ v_0+g\left(\theta_i^L\right)-\text{Min}\left(p_t,p_e,C_{SW}\left(\theta_i^{SW}\right)\right)\end{matrix}\right]$	if $v_0+g\left(\theta_i^L\right)-\text{Min}\left(p_t,p_e+C_{SW}\left(\theta_i^{SW}\right)\right)<0$	Do not buy
	if $C_{SW}\left(\theta_i^{SW}\right)<p_t-p_e$ and $v_0+g\left(\theta_i^L\right)-p_e-C_{SW}\left(\theta_i^{SW}\right)>0$	Buy from on-line channel
	if $C_{SW}\left(\theta_i^{SW}\right)>p_t-p_e$ and $v_0+g\left(\theta_i^L\right)-p_t>0$	Buy from traditional channel

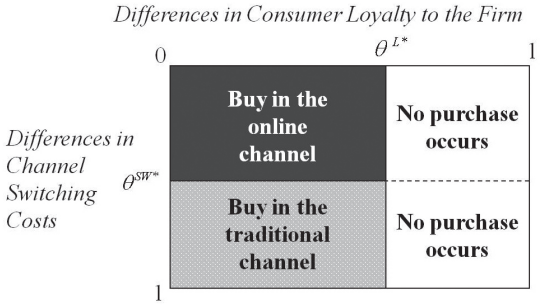

Figure 4. Customer Behavior with Different Channel Migration Conditions

Proposition 3 (One-Purchase Short-Term Profit Optimization Proposition). *If*

$$1+\theta^{L*}\left(1-\theta^{SW*}\right)+\theta^{L*}\theta^{SW*}\frac{R_e}{R_t}>\frac{2(1+k)^2 R_t R_e}{(R_e+kR_t)(R_t+kR_e)},$$

a hybrid firm will have an incentive to use the channel-pricing strategy when channel switching is possible for consumers.

If firm loyalty and channel-switching costs are high and on-line demand comprises only a small portion of total demand, then the hybrid firm will not be compelled to implement a unified-pricing strategy. Instead, it may use a channel-pricing strategy for a while. The difficulty is that it is hard for a firm to achieve high loyalty from its customers. According to Forrester Research, 53 percent of cross-channel customers say that price is more important than brand name when they make a purchase and also that channel-switching costs are decreasing as the penetration rate for the Internet retail has increased [55]. Not many firms are able to claim high loyalty from their customers, however. As a result, the hybrid firm may find that the potential benefits from implementing a channel-pricing strategy will not be so attractive as the modeling results might suggest. The implication is that there will be more instances of firms implementing unified-pricing strategies, even in the short term.

It is now appropriate to consider a longer-term perspective that includes the possibility of consumers who may wish to make repeated purchases from a firm across either or both of the two channels discussed. Consider the following additional proposition that focuses on long-term profit optimization:

Proposition 4 (Repeated-Purchase Long-Term Profit Optimization Proposition)*: In a setting with repeated purchases by the consumer, a unified-pricing strategy will always generate a higher level of profit than a channel-pricing strategy, regardless of the size of the on-line channel.* (The proof of the fourth proposition is available from the corresponding author.)

As long as the firm has a channel-pricing strategy, total demand will decrease by $1-\theta^{L*}$ and total profit will decrease by $(1-\theta^{L*})p_t^* + \theta^{L*}(1-\theta_i^{SW})(p_t^* - p_e^*)$

in the presence of repeated purchases by consumers. These losses continue until the prices of the two channels become equal, and eventually the firm will adopt a unified-pricing strategy. The resulting equilibrium price is lower than the equilibrium price of the unified-pricing firm, even with the possibility of repeated purchases by the consumer. This is because the total demand of the channel-pricing firm in equilibrium will be smaller than the demand of the unified-pricing firm. The higher equilibrium price always generates higher total profits. Because the equilibrium price of the unified-pricing firm is higher than that of the channel-pricing firm, we can easily predict that the total profit of the unified-pricing firm always will be higher than that of the channel-pricing firm. As a result of these observations, one may conclude that the optimal pricing strategy for the hybrid firm with channel migration is the unified-pricing strategy rather than the channel-pricing strategy.

Extended Results to Develop Hypotheses for Hybrid Firm's Optimal Pricing Strategy

By comparing the analytical results from the models developed, one can derive a couple of additional conjectures that will be formulated as hypotheses. They include:

> ***Hypothesis 1 (Channel Interaction as Pricing Strategy Determinant Hypothesis)****: The higher the degree of channel migration observed, the higher will be the profits generated when a firm implements a unified-pricing strategy.*

The theory also suggests that profits will be higher than what channel pricing produces in the long term. If there is channel migration, then unified pricing is the optimal pricing strategy for the hybrid firm, according to the results obtained by the modeling. Otherwise, a channel-pricing strategy will be the optimal approach for the hybrid firm. The next hypothesis characterizes the proportion of demand that a firm experiences in the on-line channel as a determinant of the hybrid firm's price level:

> ***Hypothesis 2 (On-Line Channel-to-Total Demand Proportion as Price-Level Determinant Hypothesis):*** *The higher the firm's proportion on-line relative to its total demand, the lower will be the equilibrium price under a unified-pricing strategy.*

H2 will be evaluated by conducting a variety of statistical tests on mean price differences using related empirical data from 10 South Korean hybrid retailers.

Empirical Analysis

The ideas outlined above will now be subjected to a quantitative analysis of South Korean Internet retailing data. The goal is to see whether it is possible

to establish some degree of concordance from the real-world data with the theoretical findings of the analytical models.

Observations of Pricing Strategies and On-Line Channel Demand of South Korean Hybrid Firms

The price levels of South Korean e-commerce firms were investigated to examine the On-Line Channel-to-Total Demand Proportion as Price-Level Determinant Hypothesis (H2). A comparison of the pricing strategies of different types of firms made it possible to examine the role of the on-line channel proportion of the hybrid firms. According to the Korean National Statistical Office, there were 4,531 Internet shopping malls in South Korea as of December 2006 [44]. Among these, 266 were multiproduct shopping malls like Amazon.com, and others were more specialized retailers like CDNow.com. The annualized transaction amount in 2006 totaled $13.46 billion.

Data were gathered from the top-10 on-line multi-shopping malls in South Korea. Firm rankings were obtained from Rankey.com, which provides Web site rankings based on different measures of consumer visit frequencies. For example, one relevant metric, the *VisitRatio*, is the relative number of visitors (in percentage terms) that a particular site in the multiproduct shopping mall category receives each week. Table 5 lists additional details on these firms.

The study found that there are three different types of hybrid firms in South Korea: TV home-shopping hybrid firms (HS hybrids) like QVC.com; department store hybrid firms (DS hybrids) like Sears.com; and department store and TV home-shopping hybrids (DS-HD hybrids). Among the top 10, there are four Internet-only firms, two TV home-shopping hybrid firms, three department store hybrid firms, and one combined department store and TV home-shopping hybrid firm (*see Table 5*). Price data from these firms for the period September 24 to December 1, 2005, were collected for 102 products in various product categories.

Products for this study were selected from the best-selling product lists provided by Enuri.com, the most popular product- and price-comparison site in South Korea. Based on by-category transaction-amount statistics from the Korean National Statistical Office, in-house electronics, other electronics, and other nonelectronics were selected as the three categories for further study [44]. Detailed descriptions of the 102 selected products are reported in Table 6.

To determine the reliability of the price information, 5 percent of the observations from Enuri.com were double-checked with the actual target sites. This made it possible to determine whether the price-comparison site provided matching correct simultaneous price information. To avoid sampling biases, items sold by fewer than 7 of the 10 firms were eliminated. As a result, it was determined that each item was sold by an average of 8.4 stores.

The effect of the proportion of on-line channel demand to total demand for the hybrid firms was examined by comparing the prices of hybrid and Internet-only firms using a Wilcoxon signed-rank test. Paired data were analyzed when a normal distribution of the data was doubtful [22]. The test is a nonparametric alternative to the paired *t*-test for the case of two related

Table 5. Descriptive Statistics on Top-10 Internet Shopping Malls in South Korea.

			2005			
Types	**Mall name**	**Site address**	**Visit ratio**	**Total sales (US$ MM)**	**On-line sales (US$ MM)**	**On-line sales percentage**
Shopping malls						
HS	GSeshop	GSEShop.com	9.18%	1,665	521	31.3%
	CJmall	CJMall.com	8.39%	1,311	300	22.9%
DS-HS	Hmall	Hmall.com	4.32%	1,044	54	5.0%
DS	Lotte	Lotte.com	5.49%	9,294	330	3.6%
	Shinsegae	Mall.Shinsegae.com	3.19%	9,553	115	1.2%
	Emart	Emart.com	1.49%	8,600	55	0.6%
Internet-only	Interpark	Interpark.com	22.89%	128	128	100.0%
retailers	DnShop	DnShop.com	17.34%	400	400	100.0%
	Hansol CS	CSClub.com	2.63%	14.3	14.3	100.0%
	Zero Market	ZeroMarket.com	3.83%	–	–	100.0%

Source: Company Web sites, reports, etc.

Notes: HS: TV home-shopping; DS: department store. VisitRatio is defined as percentage of total consumer visits to Web sites in overall group of firms for which data were collected. Data for VisitRatio are from Ranky.com for week of September 4, 2005. Other data are for 2005 overall.

Table 6. Target Product Categories for 2005 Data.

In-house electronics		Other electronics		Other nonelectronics	
Refrigerators	6	MP3 players	6	Cosmetics	8
Washers	4	Camcorders	3	Diapers	4
TVs	6	Navigators	3	Baby foods	5
Kim-Chi refrigerators	4	Electronic dictionaries	3	Perfumes	4
Vacuum cleaners	3	PC monitors	2	Baby seats	2
Microwave ovens	3	Games	3	Bicycles	2
Air cleaners	2	Game-sticks	2	Chairs	2
Bidets	2	Laptop computers	7	Beds	2
Humidifiers	1	Printers	4	Tables	1
Heaters	1	Phones	1	Trade Mill	1
Dishwashers	1			Snickers	2
Coffee makers	1				
Electronic shavers	1				
	35		34		33

Note: Total products: 102. See Appendix Table A4 for transaction amounts by category.

samples or repeated measurements on a single sample [22]. Because the prices in the sample vary from $30 to $1,300 and are not normally distributed, the assumption of normality is not appropriate. As hypothesized, the Wilcoxon test results with 102 matched observations yielded a *Z*-score of –6.829 ($p < 0.001$ based on a two-tailed test), supporting the observation that the hybrid firms had higher prices than the Internet-only firms (*see Table 7*). The results of the paired *t*-test are provided in Appendix Tables A5-1 to A5-3 so that the reader can compare the different results.

It was expected that higher prices would be observed for the hybrid firms based on the Optimal Prices and On-Line Channel Proportion of the Hybrid Firm Proposition (P2) and the On-Line Channel-to-Total Demand Proportion as Price-Level Determinant Hypothesis (H2). Because the Internet-only firms do not participate in the traditional retail channel, their prices are lower than those of the hybrid firms. Similar results were observed when the prices of Internet-only and hybrid firms in real-world shopping malls in the United States were compared, although full empirical results were not included to support the contention. Anecdotal evidence as of March 2009 suggests, for example, that Walmart.com was selling the iPod Nano, Blue (4th Generation) for $147.88, while Amazon.com was selling it for $133.95. Many instances of this kind of contrast in prices were seen.

Next, to compare the prices among hybrid firms, the hybrid firms were divided into the two groups discussed earlier: TV home-shopping hybrids (HS hybrids) and department store hybrids (DS hybrids). Hmall, a hybrid involving the TV home-shopping and department store channels (HS-DS hybrid), was excluded because its categories of hybridization are overlapping. The department store hybrid firms have a much lower proportion of on-line channel demand in comparison to the home-shopping hybrid firms. On average, the department store hybrid firms had less than 2 percent of their demand from the on-line channel based on amount of sales, while the home shopping hybrids had 27 percent.

Table 7. Wilcoxon Signed-Rank Test Results on Mean Price Differences Between Internet-Only and Hybrid Firms.

Mean differences	Ranks	*N*	Mean rank	Sum of ranks
Internet-only mean – hybrid mean	Negative ranks[a]	84	53.70	4,511.00
	Positive ranks[b]	16	33.69	539.00
	Ties[c]	2		
	Total	102		

Notes: [a] Internet-only < Hybrid, [b] Internet-only > Hybrid, [c] Internet-only = Hybrid. *Z*-score = 6.829, asymptotic significance is $p < 0.001$ (for a two-tailed test).

According to H2, DS hybrid firms were expected to have higher prices than HS hybrids and Internet-only firms, while HS hybrid firms would tend to have higher prices than Internet-only firms. To validate this hypothesis, another Wilcoxon signed-rank test was conducted for Internet-only firms versus DS hybrids, Internet-only firms versus HS hybrid firms, and finally DS hybrid firms versus HS hybrid firms. The results are reported in Table 8.

As expected, each comparison supported H2 and P2. Generally speaking, the on-line channel portion of total demand appears to determine the price level that the hybrid firms select, and a higher portion leads to the lower prices. Price differences were all significant at the 0.001 level.

Finally, a Friedman test (a nonparametric test that compares three or more paired groups) was conducted to compare the price levels of all the hybrid firm types at once [22]. Much the same as the parametric repeated measures (e.g., ANOVA), the Friedman test is a nonparametric statistical test used to detect differences in treatments across multiple test attempts. The procedure involves ranking each block together and considering the values of ranks by columns [22] (*see Table 9*). The results show that firms with smaller on-line demand proportions, especially department store hybrids, charge higher prices in the on-line channel. Internet-only firms achieve all of their demand in the on-line channel, while the rates for the department hybrid firms and the home-shopping hybrid firms are only 2 percent and 27 percent, respectively. The price differences between the firm types should be ordered as $p_e < p_{h\_DS}$ (100 percent – 2 percent = 98 percent), $p_e < p_{h\_HS}$ (100 percent – 27 percent = 73 percent), and $p_{h\_HS} < p_{h\_DS}$ (27 percent – 2 percent = 25 percent), as in Table 9.

Similar results were observed when Internet-only, home-shopping hybrid, and department store hybrid firm prices were compared with prices in real-world shopping malls in the United States. As of March 2009, for example, an electronics product, the Olympus E420 10MP Digital SLR Camera, sold at Walmart.com for $549.84, while at QVC.com it went for $499.96 and at Amazon.com for a little less at $498.00. These firms represent DS-hybrid, HS-hybrid, and Internet-only firms in the United States.

Finally, the consistency of the results across different product categories was examined by conducting category-based Friedman tests. As reported in Table 10, the results from each product category corroborate the finding that the prices of the hybrid firm are largely determined by the portion of the on-line channel.

Table 8. Wilcoxon Signed-Rank Test Results for Mean Price Differences of Firms.

Mean differences	Ranks	*N*	Mean rank	Sum of ranks	Test stat.
Internet-only firms	Negative ranks[a]	83	50.30	4,175.00	$Z = 7.034$
vs. DS hybrid firms	Positive ranks[b]	12	32.08	385.00	$p < 0.001$
	Ties[c]	4			
	Total	99			
Internet-only firms	Negative ranks[d]	72	55.89	4,024.00	$Z = 5.154$
vs. HS hybrid firms	Positive ranks[e]	28	36.64	1,026.00	$p < 0.001$
	Ties[f]	2			
	Total	102			
HS hybrid firms	Negative ranks[g]	69	45.94	3,170.00	$Z = 4.015$
vs. DS hybrid firms	Positive ranks[h]	23	48.17	1,108.00	$p < 0.001$
	Ties[i]	7			
	Total	99			

Notes: [a] Internet-only < DS hybrids, [b] Internet-only > DS hybrids, [c] Internet-only = DS hybrids, [d] Internet-only < HS hybrids, [e] Internet-only > HS hybrids, [f] Internet-only = HS hybrids, [g] HS hybrid < DS hybrid, [h] HS hybrid > DS hybrid, [i] HS hybrid = DS hybrid.

Table 9. Friedman Test Results for Mean Price Differences: Internet-Only, Home-Shopping, and Department Store Hybrid Firms.

Firms	Mean rank
DS hybrid	2.59
HS hybrid	1.97
Internet-only	1.43

Note: $N = 99$, $\chi^2 = 68.92$. $df = 2$, $p < 0.001$.

Table 10. Friedman Test Results for Mean Price Differences: By Product Category.

Product category	Firm	Mean rank	Test stat.
In-house electronics	DS hybrid	2.66	$N = 35$, $\chi^2 = 26.80$,
	HS hybrid	1.91	$df = 2$,
	Internet-only	1.43	$p < 0.001$
Other electronics	DS hybrid	2.43	$N = 34$, $\chi^2 = 15.82$,
	HS hybrid	2.06	$df = 2$,
	Internet-only	1.51	$p < 0.001$
Other nonelectronics	DS hybrid	2.78	$N = 30$, $\chi^2 = 27.88$,
	HS hybrid	1.63	$df = 2$,
	Internet-only	1.58	$p < 0.001$

Conclusion

For the hybrid firm, managing pricing and demand across the traditional channel and the Internet channel is a significant strategic concern. If the channels overlap and consumers are free to move from the traditional channel to the on-line channel, then the firm should treat the two channels as one large channel with two types of customers. If the channels work independently, though, the firm should manage each one separately.

This research proposed two types of pricing models and demonstrated how one-way interaction between the on-line and off-line channels—from the traditional channel to the on-line channel—affects a hybrid firm's pricing strategies. The first model assumes no (or negligible) channel migration. Since there will be few customers moving across the two channels, the demand levels of the on-line and off-line channels will be relatively rigid and stable. Under this assumption, charging different prices to on-line and off-line customers turns out to be the optimal pricing strategy compared to charging the same price across both channels. The second model assumes a certain level of channel migration from the traditional channel to the Internet channel. In this model, customers are able to move across the channels to pursue value based on their channel-switching costs and loyalty to a firm. A customer who has a low level of perceived cost for switching from the traditional channel to the Internet channel can easily change channel. A consumer who has high loyalty to the

firm, though, may not wish to leave the firm and switch to another channel. Based on these settings, it was found that charging the same price in both the on-line and the off-line channel is the best pricing strategy for a hybrid firm from a long-term perspective. When the possibility of more flexible demand was considered, however, a different result was obtained from the first model, suggesting that it may not be beneficial to charge different prices across the different channels.

Based on the examination of several analytical models, four propositions were developed as well as two additional hypotheses of interest in this context. First, it was conjectured that the optimal pricing strategy of the hybrid firm is determined by the existence and extent of channel migration. Second, it was also conjectured that the price levels a hybrid firm sets will be determined by its on-line channel proportion. These conjectures were examined with data from 10 South Korean e-commerce firms. The investigation led to the conclusion that the proposed analytical arguments are true. The second hypothesis was validated by comparing the prices of various types of hybrid firms. All the comparisons made on the basis of nonparametric paired mean difference tests offered consistent support.

These observations of South Korean e-commerce pricing strategies have implications for marketing and IS research. The results presented in the prior literature are not contradicted, but the analytical insights are deeper. First, evidence was found for the higher prices of hybrid firms, as has been shown in previous studies [1, 69]. It was also possible to reconcile these results with the size of the electronic channel portion of the hybrid firm's business, as a determinant of its prices. Zettelmeyer analyzed the role of Internet size in on-line pricing [89]. His research was extended by specifying the portion of the Internet channel for each hybrid firm. Second, heterogeneous and diverse product categories represented by the firms in the data offer the potential for generalizability. Most of the prior research occurred within limited categories, such as cars and books [31, 61]. The present study covers 34 categories, from furniture to diapers to electronics. The large variety of categories represented by the data limits the potential biases that may arise with too few product types, and so this increases the generalizability of the present contribution. Finally, observations from the United States and South Korea were integrated. Most of the prior studies were limited to data from just one country, usually the United States [15, 69]. Moreover, the results show consistent results from these two countries, which both were early adopters of e-commerce. The United States is one of the largest markets in the world for on-line shopping, and South Korea continues to be a "digital mecca" for on-line shopping in Asia.

Overall, the results explain the current trends observed in the channel-migration strategies of hybrid firms quite well. For example, Barnes and Noble initially motivated its customers to use the on-line channel by offering large discounts to reduce their transaction costs. However, after some "tipping point" is reached in terms of the size of the on-line channel demand that Barnes and Noble (and BN.com) face, the firm may consider adopting unified-pricing strategies to enhance long-term profits. What will be needed is a careful effort on the firm's part to understand the impacts of channel migration in its business environment.

Contributions

Overall, this research has several implications for theory and practice related to pricing strategies in the digital economy. It has been long thought that implementing a price-discrimination strategy generally increases the economic welfare of a firm [84]. By charging different prices to customers with different levels of willingness-to-pay, firms are able to achieve the maximum level of profit from their target customer segments. This research explored the application of the theory of price discrimination in the first proposition. It showed why charging different prices on each channel (channel pricing, in other words) is optimal when there is a negligible level of channel migration. The following three propositions included the assumption of channel migration. For these, conditions were derived under which it appears that price discrimination across channels may not be the optimal strategy. When considerations of channel-switching cost and customer loyalty were added to the model, it was found that charging the same price—the unified-pricing strategy—actually may generate higher profit. For some time, it has been widely accepted in e-commerce that low menu and transaction costs tend to increase a firm's pricing flexibility and accelerate the emergence of price discrimination [29, 68]. This research has incorporated consideration of customer loyalty and channel-switching costs to explore the efficacy of implementing price discrimination by a hybrid firm. The results are also in harmony with prior theoretical findings on price matching [9].

Second, the relative size of the on-line channel is emphasized as a key determinant of price level. E-commerce firm-pricing strategy is of interest due to the different pricing approaches that can be applied with the firm's potential market power in mind. For a hybrid firm, protecting existing profits from the traditional channel is as important as the generation of new profits from the on-line channel. Unexpected price changes can endanger the firm's profit, and yet a rigid pricing strategy also may cause the firm to become less effective than it should be in achieving high profitability [9]. In this research, it is suggested that a firm's pricing strategy should be made based on the proportion of sales that occur via the on-line channel. To analyze the pricing strategy of hybrid and Internet-only firms, other studies have used parameters such as transportation or transaction costs [18, 89]. These parameters are usually hard to conceptualize and estimate, though, because consumers experience different levels of transaction costs [36]. The present research employed the size of the on-line market as a proxy for penetration rate for e-commerce. The use of this much more readily measured parameter—the on-line proportion of sales—enabled a strong empirical validation of the propositions and enhanced the real-world applicability of the findings.

The last contribution is the conceptual separation of channel-switching costs from firm loyalty. The analyses considered them in one model to explain customer behavior in an integrated way. Both switching costs and loyalty have been recognized as important research issues in marketing, management, and economics. But they are usually considered to be two sides of the same coin [49]. A consumer who has high loyalty toward a firm will face high switching costs, and vice versa. This research, however, made a distinction

between switching to another channel to purchase a product from the same firm and switching to another firm's products. In the hybrid firm's context, customers can switch to another channel with or without switching to consume another firm's products. According to Mendelsohn et al. [55], 49 percent of multichannel shoppers make their purchases from a different off-line retailer than the one they use on-line to conduct their product search. This shows that the decision-making processes of firm selection and brand selection are independent from channel selection. In the analysis of customer behaviors, these two different concepts were combined in one model to show their different roles in the functioning of customer behavior. So far as can be determined, this has never been done before in a modeling context like the one treated in the present research, whereas there are many studies that analyze only one of the concepts [52, 76].

Limitations and Future Research

The current study has several limitations that deserve discussion. First, the reader should recognize that the monopoly assumption employed in the model may not always be realistic. In many cases, competition between firms may need to be more fully considered. On the other hand, every firm has its own level of monopoly power in its industry, especially when the firm is among the leading companies. Thus, the model is more appropriate for application to the pricing strategies of large firms than small firms. The model can be extended by relaxing this assumption to more closely track the effects of competitive market structure.

Another limitation is that the model focuses on consumer behavior in the traditional channel. It emphasizes what happens with pricing strategy when a traditional retailing firm expands its distribution channels to include the Internet. The opposite situation is an appropriate one to consider also. Examples include Gateway Computer, a former Internet-only PC catalog store that later opened up proprietary retail stores and eventually partnered with Best Buy, Costco, Staples, Circuit City, and other leading retailers (and finally was acquired by Acer Computers of Taiwan in 2007). Going forward, the opportunity exists to further enrich the scenarios analyzed in the present study. Settings could be included in which the switching behavior across channels might begin with an analysis of primarily on-line shoppers, for example.

In addition, some of the limitations of the data set and data analysis should be mentioned. The use of data from South Korean e-commerce firms limits the generalizability of the findings. Although this group of firms is believed to provide a basis for establishing meaningful results, it cannot be claimed that the dynamics of competition in the South Korean market are the same as in other Asian countries, or in Europe or North America. Future research using U.S. or European firm data would facilitate comparisons of the main results across the different countries in those regions. Also, analysis of a larger data set will be necessary for more rigorous validation of the hypotheses. Since the present research only reported on product category-level price analysis, it would be appropriate in future research to conduct firm-level analysis to

gauge the impact of the proportion of the firm's demand from the on-line channel in more detail.

Finally, other important criteria in purchase decision-making may have relevance. Although the study assumed that customers are price-sensitive and their behaviors are determined mainly by price, there are other factors that customers consider, such as convenience, product availability, and trust [6, 23]. Extensions of the model that consider these factors would enrich the managerial applicability of the research.

Acknowledgments

An earlier version of this paper was presented at the 2d Korea University MIS Symposium, February 2007. The authors thank the symposium participants as well as three discussants, V. Sambamurthy, Bernard Tan, and Patrick Chau, for helpful suggestions. Jae-Nam Lee, Se-Joon Hong, Jaemin Han, Yongmoo Suh, and Howon Jung also offered useful input. The paper was improved based on comments from Vladimir Zwass and three anonymous reviewers for this journal. Rob Kauffman thanks the Center for Advancing Business Through Information Technology (CABIT) at Arizona State University, the W.P. Carey Chair for support, and the Shidler School of Business at the University of Hawaii for partial support. Dongwon Lee thanks Korea University for grant funding. Byungjoon Yoo thanks the Management Research Center at Seoul National University for grant funding. The authors contributed equally to this research. All errors of fact and interpretation are solely the authors' responsibility.

REFERENCES

1. Ancarani, F., and Shankar, V. Price levels and price dispersion within and across multiple retailer types: Further evidence and extension. *Journal of the Academy of Marketing Science, 32,* 2 (April 2004), 176–187.

2. Ansari, A.; Mela, C.F.; and Neslin, S.A. Customer channel migration. *Journal of Marketing Research, 45,* 1 (February 2008), 60–76.

3. Assael, H.A. *Consumer Behavior and Marketing Action,* 4th ed. Boston: PWS-Kent, 1992.

4. Bailey, J.P. Intermediation and Electronic Markets: Aggregation and Pricing in Internet Commerce. Ph.D. dissertation, Massachusetts Institute of Technology, 1998.

5. Bakos, Y.; Lucas, H.C., Jr.; Oh, W.; Simon, G.; Viswanathan, S.; and Weber, B. The impact of e-commerce on competition in the retail brokerage industry. *Information Systems Research, 16,* 4 (December 2005), 352–371.

6. Balachander, S., and Farquhar, P.F. Gaining more by stocking less: A competitive analysis of product availability. *Marketing Science, 13,* 1 (winter 1994), 3–22.

7. Baye, M.R., and Morgan, J. Information gatekeepers and price discrimination on the Internet. *Economics Letters, 76,* 1 (June 2002), 47–51.

8. Bendoly, E.; Blocher, J.D.; Bretthauer, K.M.; Krishnan, S.; and Venkataramanan, M.A. Online/in-store integration and customer retention. *Journal of Service Research, 7,* 4 (May 2005), 313–327.

9. Bergen, M.; Kauffman, R.J.; and Lee, D. Beyond the hype of frictionless markets: Evidence of heterogeneity in price rigidity on the Internet, *Journal of Management Information Systems, 22,* 2 (fall 2005), 57–89.
10. Bergen, M.; Dutta, S.; Levy, D.; Ritson, M.; and Zbaracki, M. Shattering the myth of costless price changes: A framework for dynamic pricing, *European Management Journal, 21,* 6 (December 2003), 663–669.
11. BestBuy. Help: Price matching/price guarantee, November 11, 2007. Available at www.bestbuy.com/site/olspage.jsp?type=page&contentId=1043363603302&id=cat12098, accessed April 1, 2009.
12. Bils, M., and Klenow, P. Some evidence on the importance of sticky prices. *Journal of Political Economy, 112,* 5 (October 2004), 947–985.
13. Boa, B. Welcome to the world of multichannel retailing. *Flora Magazine,* Rio Rancho, NM: Cenflo, Inc., 2003.
14. Brenn, M. The iPhone vs. the PS3: A price cut comparison. *eFlux Media,* September 7, 2007. Available at www.efluxmedia.com/news_The_iPhone_vs_the_PS3_A_Price_Cut_Comparison_08398.html, accessed April 1, 2009.
15. Brynjolfsson, E., and Smith, M.D. Frictionless commerce? A comparison of Internet and conventional retailers. *Management Science, 46,* 4 (April 2000), 563–585.
16. Caruana, A., and Fenech, N. The effect of perceived value and overall satisfaction on loyalty: A study among Maltese dental patients. *Journal of Medical Marketing, 5,* 3 (July 2005), 245–255.
17. Chen, P.Y., and Hitt, L.M. Measuring switching costs and their determinants in Internet enabled businesses: A study of the online brokerage industry. *Information Systems Research, 13,* 3 (September 2002), 255–276.
18. Chun, S., and Kim, J. Pricing strategies in B2C electronic commerce: Analytical and empirical approaches. *Decision Support Systems, 40,* 2 (August 2005), 375–388.
19. Clay, K.; Krishnan, R.; Wolff, E.; and Fernandes, D. Retail strategies on the Web: Price and non-price competition in the online book industry. *Journal of Industrial Economics, 50,* 3 (September 2002), 351–367.
20. *CNN Money.* Amazon posts a profit, January 22, 2002. Available at http://money.cnn.com/2002/01/ 22/technology/amazon/, accessed April 1, 2009.
21. Cohen, P. iPhone pricing and the early adopter tax. *MacWorld,* September 6, 2007. Available at www.macworld.com/weblogs/editors/2007/09/iphoneprice/index.php, accessed April 1, 2009.
22. Conover, W.J. *Practical Nonparametric Statistics,* 2d ed. New York: John Wiley, 1980.
23. Corbitt, B.J.; Thanasankit, T.; and Yi., H. Trust and e-commerce: A study of consumer perceptions. *Electronic Commerce Research and Applications, 2,* 3 (autumn 2003), 203–215.
24. Deleersnyder, B.; Geyskens, I.; Gielensc, K.; and Dekimpe, M.G. How cannibalistic is the new market? A study of the newspaper industry in the United Kingdom and the Netherlands. *International Journal of Research in Marketing, 19,* 4 (December 2002), 337–348.
25. Deneckere, R.; Kovenock, D.; and Lee, R. A model of price leadership based on consumer loyalty. *Journal of Industrial Economics, 40,* 2 (June 1992), 147–156.

26. Dutta, S.; Biswas, A.; and Grewal, D. Low price signal default: An empirical investigation of its consequences. *Journal of the Academy of Marketing Science, 35,* 1 (March 2007), 76–88.
27. Evans, P., and Wurster, T.S. Getting real about virtual commerce. *Harvard Business Review, 77,* 6 (November 1999), 84–94.
28. Forrester Research. The state of retailing online 8.0, Cambridge, MA, 2005. Sponsored by Shop.org. Available at www.forrester.com/ER/Press/Release/0,1769,1009,00.html, accessed April 1, 2009.
29. Fudenberg, D., and Villas-Boas, J.M. Behavior-based price discrimination and customer recognition. In J. Hendershott (ed.), *Handbook of Economics and Information Systems.* Amsterdam: Elsevier, 2005, pp. 41–47.
30. Gallaugher, J. E-commerce and the undulating distribution channel. *Communications of the ACM, 45,* 7 (July 2002), 89–95.
31. Ghose, A.; Smith, M.; and Telang, R. Internet exchanges for used books: An empirical analysis of product cannibalization and welfare impact. *Information Systems Research, 17,* 1 (March 2006), 3–19.
32. Ghose, A.; Telang, R.; and Krishnan, R. Effect of electronic secondary markets on the supply chain. *Journal of Management Information Systems, 22,* 2 (fall 2005), 91–120.
33. Grewal, D.; Iyer, G.R.; and Levy, M. Internet retailing: Enablers, limiters and market consequences. *Journal of Business Research, 57,* 7 (July 2004), 703–713.
34. Gulati, R., and Garino, J. Get the right mix of bricks and clicks. *Harvard Business Review, 78,* 3 (May 2000), 107–114.
35. Heller, L. Making Walmart.com "the Wal-Mart of the Web." *Drug Store News,* June 12, 2000. Available at http://findarticles.com/p/articles/mi_m3374/is_8_22/ai_63411741, accessed April 1, 2009.
36. Hotelling, H. The economics of exhaustible resources. *Journal of Political Economy, 39,* 2 (April 1931), 137–175.
37. IBISWorld. Mail-order U.S. industry report, April 12, 2008. Available at www.ibisworld.com/industry/retail.aspx?indid=1931&chid=1, accessed April 1, 2009.
38. Johnson, C.A.; Mulpuru, S.; and Hult, P. Web buyers still expect lower prices online. *Forrester Trends,* February 13, 2007. Cambridge, MA.
39. Kabel, M. Wal-Mart defends imports, price strategy. Associated Press, October 12, 2007. Available at www.tulsaworld.com/TWPDFs/2007/Final/W_101207_E_3.pdf, accessed April 1, 2009.
40. Kauffman, R.J., and Wang, B. Tuning into the digital channel: Evaluating business model characteristics for Internet firm survival. *Information Technology and Management, 9,* 3 (September 2008), 215–232.
41. Keller, K.L. Conceptualizing, measuring, and managing customer-based brand equity. *Journal of Marketing, 57,* 1 (January 1993), 1–22.
42. Klemperer, P.D. Collusion via switching costs: How "frequent-flyer" programs, trading stamps, and technology choices aid collusion. Working paper 786. Graduate School of Business, Stanford University, May 1984.
43. Klemperer, P.D. Markets with consumer switching costs. *Quarterly Journal of Economics, 102,* 2 (May 1987), 375–394.
44. Korean National Statistical Office. 2006 annual report of cyber-shopping malls, Seoul, South Korea, February 2007. Available at www.ipc.go.kr/

servlet/download?pt=/ipckor/policy&fn=suec0612.pdf, accessed April 1, 2009.
45. Kotha, S. Amazon.com: Expanding beyond books. In C.W.L. Hill and G.R. Jones (eds.), *Strategic Management: An Integrated Approach,* 4th ed. Boston: Houghton-Mifflin, 1998.
46. Kotler, P., and Keller, K.L. *Marketing Management.* Upper Saddle River, NJ: Pearson Education, 2006.
47. Koufaris, M.; Kambil, A.; and LaBarbera, P.A. Consumer behavior in Web-based commerce: An empirical study. *International Journal of Electronic Commerce, 6,* 2 (winter 2001–2), 131–154.
48. Kumar, V., and Venkatesan, R. Who are the multichannel shoppers and how do they behave? Correlates of multi-channel shopping behavior. *Journal of Interactive Marketing, 19,* 2 (spring 2005), 44–62.
49. Lam, S.Y.; Shankar, V.; Erramilli, M.K.; and Murthy B. Customer value, satisfaction, loyalty, and switching costs: An illustration from a business-to-business service context. *Marketing Science, 32,* 3 (June 2004), 293–311.
50. Laukkanen, T. Customer preferred channel attributes in multi-channel electronic banking. *International Journal of Retail & Distribution Management, 35,* 5 (2007), 393–412.
51. Liao, Z., and Cheung, M.T. Internet-based e-banking and consumer attitudes: An empirical study. *Information and Management, 39,* 4 (January 2002), 283–295.
52. Lin, H.H., and Wang, Y.S. An examination of the determinants of customer loyalty in mobile commerce contexts. *Information and Management, 43,* 3 (April 2006), 271–282.
53. Lui, S.S.; Ngo, H.; and Hon, A.H.Y. The role of price-matching characteristics in influencing store loyalty. *Journal of Business Research, 59,* 4 (April 2006), 475–482.
54. McLean, R., and Blackie, N.M. Virgin lifestyle: The future of super brands in the new network economy. In L. Banwell and M. Collier (eds.), *Human Aspects of the Information Society: An International Collection of Papers.* Newcastle, UK: Information Management Research Institute, Northumbria University, 2002, pp. 70–77.
55. Mendelsohn, T.; Johnson, C.A.; and Meyr, S. Trends: Understanding U.S. Cross-Channel Shoppers: Demystifying Consumers Who Influence More Than $125 Billion in Offline Sales. Forrester Research Report, April 19, 2006. Cambridge, MA.
56. Mendelsohn T.; Baird, N.; Johnson, C.A.; and Meyer, S. How the Web is changing in-store experience. Forrest Research Report, October 5, 2005, Cambridge, MA, .
57. Mello, J.P. Netflix, QVC rated e-tail customer service champs. *E-Commerce Times,* June 1, 2007. Available at www.ecommercetimes.com/story/57639.html, accessed April 1, 2009.
58. Merrilees, B., and Fenech, T. From catalog to Web: B2B multi-channel marketing strategy. *Industrial Marketing Management, 36,* 1 (January 2007), 44–49.
59. Miyazaki, A.D., and Fernandez, A. Consumer perceptions of privacy and security risks for online shopping. *Journal of Consumer Affairs, 35,* 1 (March 2001), 27–54.

60. Montoya-Weiss, M.; Voss, G.B.; and Grewal, D. Determinants of online channel use and overall satisfaction with a relational, multichannel service provider. *Journal of the Academy of Marketing Science, 31,* 4 (winter 2003), 448–458.
61. Morton, F.S.; Zettelmeyer, F.; and Silva-Risso, J. Internet car retailing. *Journal of Industrial Economics, 49,* 4 (December 2001), 501–519.
62. Müller-Lankenau, C.; Wehmeyer, K.; and Klein, S. Strategic channel alignment: An analysis of the configuration of physical and virtual marketing channels. *Information Systems and E-Business Management, 4,* 2 (April 2006), 187–216.
63. Mulpuru, S. Trends 2006: Online retail. Forrester Research Report, December 13, 2005. Cambridge, MA.
64. Nelson, P. Information and consumer behavior. *Journal of Political Economy, 78,* 2 (March-April 1970), 311–329.
65. Neslin, S.A.; Grewal, D.; Leghorn, R.; Shankar, V.; Teerling, M.L.; Thomas, J.S.; and Verhoef, P.C. Challenges and opportunities in multichannel customer management. *Management Journal of Service Research, 9,* 2 (November 2006), 95–112.
66. Novak, T.P.; Hoffman, D.L.; and Peralta, M. Building consumer trust in online environments: The case for information privacy. *Communications of the ACM, 40,* 4 (April 1999), 80–85.
67. Odlyzko, A.M. Privacy, economics, and price discrimination on the Internet. In N. Sadeh (ed.), *Proceedings of the Fifth International Conference on Electronic Commerce.* New York: ACM Press, 2003, pp. 355–366.
68. Odlyzko, A.M. The evolution of price discrimination in transportation and its implications for the Internet. *Review of Network Economics, 3,* 3 (September 2004), 323–346.
69. Pan, X.; Shankar, V.; and Ratchford, B.T. Price competition between pure-play vs. bricks-and-clicks e-tailers: Analytical model and empirical analysis. In M.R. Baye (ed.), *Advances in Applied Microeconomics: Economics of the Internet and e-Commerce*. Amsterdam: Elsevier, 2002, pp. 29–62.
70. Pastore, M. PC data online, top 20 e-tailers of August 1999. Clickz.com, New York, 1999. Available at www.clickz.com/showPage.html?page=201421, accessed April 1, 2009.
71. Pastore, M. PC data online, top 20 e-tailers of January 2001. Clickz.com, New York, 2001. Available at www.clickz.com/showPage.html?page=589061, accessed April 1, 2009.
72. Payne, A., and Frow, P. The role of multi-channel integration in customer relationship management. *Industrial Marketing Management, 33,* 6 (August 2004), 527–538.
73. Riggins, F.J. A multichannel model of separating equilibrium in the face of the digital divide. *Journal of Management Information Systems, 21,* 2 (fall 2004), 161–179.
74. Scheraga, D. Penney's net advantage. *Chain Store Age,* September 2000, 114–118.
75. Sears.com. Sears Price Matching Plus Policy/Price Protection Policy, November 2, 2008. Available at www.sears.com/shc/s/nb_10153_12605_NB_CSpricematch?adCell=AF, accessed April 1, 2009.

76. Sen, R.; King, R.; and Shaw, M. Buyers' choice of online search: Strategy and its managerial implications. *Journal of Management Information. Systems, 23,* 1 (summer 2006), 211–238.
77. Sotgiu, F., and Ancarani, F. Exploiting the opportunities of Internet and multi-channel pricing: An exploratory research. *Journal of Product and Brand Management, 13,* 2 (2004), 125–136.
78. Srinivasan, S.S.; Anderson, R.E.; and Ponnavolu, K. Customer loyalty in e-commerce: An exploration of its antecedents and consequences. *Journal of Retailing, 78,* 1 (spring 2002), 41–51.
79. Srivastava, J., and Lurie, N.H. Price-matching guarantees as signals of low prices. *Journal of Retailing, 80,* 2 (summer 2004), 117–128.
80. Steinfield, C.; Bouwman, H.; and Adelaar, T. The dynamics of click and mortar e-commerce: Opportunities and management strategies. *International Journal of Electronic Commerce, 7,* 1 (fall 2002), 93–120.
81. Stone, M.; Hobbs, M.; and Khaleeli, M. Multichannel customer management: The benefits and challenges. *Journal of Database Marketing, 10,* 1 (September 2002), 39–52.
82. Summers, L.H. On frequent-flyer programs and other loyalty-inducing economic arrangements. Discussion paper 1337, Harvard Institute of Economic Research, Harvard University, Cambridge, MA, 1985.
83. United States Census Bureau. E-commerce 2005, E-stats, Washington, DC, May 25, 2005. Available at www.census.gov/eos/www/2005/2005 reportfinal.pdf, accessed April 1, 2009.
84. Varian, H. Price discrimination. In R. Schmalensee and R. Willig (eds.), *Handbook of Industrial Organization.* Amsterdam: Elsevier/North-Holland, 1987, pp. 598–654.
85. Varian, H. *Microeconomic Analysis,* 3d ed. New York: Norton, 1992.
86. Weiss, R.M., and Mehrotra, A.K. Online dynamic pricing: Efficiency, equity and the future of e-commerce. *Virginia Journal of Law and Technology, 6,* 2 (summer 2001), 1–14.
87. Weng, Z.K. Channel coordination and quantity discounts. *Management Science, 41,* 9 (September 1995), 1509–1522.
88. Wolverton, T. Buy.com Vows to Undersell Amazon Books. *CNET News.com,* June 25, 2002. Available at http://news.com.com/Buy.com+vows+to+undersell+Amazon+books/2100–1017_3–938981.html, accessed April 1, 2009.
89. Zettelmeyer, F. Expanding to the Internet: Pricing and communication strategies when firms compete on multiple channels. *Journal of Marketing Research, 37,* 3 (May 2000), 292–308.

Appendix 1

Table A1. Top-20 E-Retailers, August 1999 and January 2001.

Rank	E-retailer	No. of Buyers
	August 1999	
1	Amazon.com	789,000
2	Buy.com	314,000
3	BarnesandNoble.com	289,000
4	Ticketmaster.com	269,000
5	PlanetRX.com	256,000
6	MotherNature.com	241,000
7	Drugstore.com	191,000
8	Gateway.com	167,000
9	CDNow.com	95,000
10	SmarterKids.com	93,000
11	Chipshot.com	80,000
12	Hallmark.com	80,000
13	Egghead.com	73,000
14	Yahoo.com	67,000
15	OfficeMax.com	65,000
16	Etoys.com	57,000
17	JCrew.com	52,000
18	Spree.com	52,000
19	Compaq.com	51,000
20	TowerRecords.com	43,000
	January 2001	
1	Amazon.com	2,330,000
2	BarnesandNoble.com	638,000
3	Ticketmaster.com	636,000
4	Half.com	567,000
5	JCPenney.com	545,000
6	Drugstore.com	322,000
7	Walmart.com	286,000
8	CDNow.com	263,000
9	ShopIntuit.com	245,000
10	Sears.com	215,000
11	eToys.com	188,000
12	Staples.com	186,000
13	CyberRebate.com	185,000
14	Spiegel.com	159,000
15	Buy.com	153,000
16	JCrew.com	136,000
17	VictoriasSecret.com	133,000
18	Gap.com	122,000
19	OldNavy.com	122,000
20	1800Flowers.com	115,000

Sources: [70, 71]. Buyer-related data are estimates by the source, not actual numbers representing home users.

Table A2. Modeling Notation and Definitions.

Notation	Definition	Comments
k	Proportion of potential demand arising for hybrid firm on-line channel compared to traditional channel	Demand in electronic channel is assumed to be less than in the traditional channel, $k < 1$
D_t, D_e	Potential demand levels of traditional and on-line channels	Potential demand is larger in traditional channel than in on-line channel ($D_e = k \cdot D_t$)
d_t, d_e	Demand levels occurred from traditional and on-line channels at specified price (i.e., p_t and p_e)	Hybrid firm's total demand level is summation of traditional and electronic channel demand levels ($d_h = d_t + d_e$)
d_h	Hybrid firm's total demand at price p_h	
$d_{t\to e}$	Number of customers who switch from traditional channel to on-line channel	
$d_{t\to leave}$	Number of customers who decide not to buy and leave traditional channel	
$d_{1\to 2\_u}$	Number of customers who switch from Firm 1 to unified-pricing Firm 2	
$d_{1\to 2\_c}$	Number of customers who switch from Firm 1 to channel-pricing Firm 2	
R_t, R_e	Consumer's reservation prices of traditional and on-line channels	Reservation price is higher in traditional channel than in on-line channel ($R_e < R_t$)
p_t, p_e	Prices charged to traditional channel customers and on-line channel customers	
p_{h_u}, p_{h_c}	Hybrid firm's prices under unified-pricing strategy and channel-pricing strategy	
p_{1,h_u}	Firm 1's price with unified-pricing strategy under competition with Firm 2	

p_{2e}	Firm 2's on-line channel price under competition with Firm 1	
π_{h_u}, π_{h_c}	Hybrid firm's profits under unified-pricing strategy and channel-pricing strategy	
π_{t_c}, π_{e_c}	Profits from traditional channel and on-line channel under channel-pricing strategy	
θ^{SW}, θ^{L}	Customer heterogeneity in channel-switching cost and firm loyalty	They are independent from each other
v_{ct}, v_{ce}	Variable costs occurred in traditional channel and on-line channel	Variable cost in traditional channel will usually be higher than on Internet
fc_t, fc_e	Fixed costs occurred in on-line channel and traditional channel	
C^{SW}	Customer's channel-switching cost: $C_{SW}(\theta_i^{SW}) = \gamma\theta_i^{SW}$	Channel-switching cost is a function of customer heterogeneity θ^{SW}
g	Customer's channel-switching inconvenience: $g(\theta_i^L) = -\delta \lvert p_t - p_e \rvert \theta_i^L$	Customer channel-switching inconvenience is function of traditional and on-line channel prices and customer heterogeneity θ^L
C_{F_SW}	Customer's firm-switching cost: $C_{F\_SW}(\theta_i^L) = \lambda(1 - \theta_i^L)$	Firm-switching cost is a function of customer heterogeneity θ^L
γ, δ, λ	Constants for customer's channel-switching cost, customer's channel-switching inconvenience, and customer's firm-switching cost	
T	Time period	

Appendix 3. Proofs of Main Propositions

A. Proof of Proposition 1 (Optimal Prices and Profits of Hybrid Firm Proposition)

To prove $\pi^*_{h\_u} < \pi^*_{h\_c} = \pi^*_{e\_c} + \pi^*_{t\_c}$,

$$\text{If } \frac{R_t - 2R_e}{R_t} \le k,\ \pi^*_{h\_u} - \pi^*_{h\_c} = \frac{1}{4}\frac{(1+k)^2 \cdot R_e \cdot R_t}{R_e + R_t \cdot k} \cdot D_t - \frac{R_t + k \cdot R_e}{4} \cdot D_t$$

$$= -\frac{D_t}{4} \cdot \frac{(R_t - R_e)^2}{R_e + R_t \cdot k} < 0.$$

$$\text{If } \frac{R_t - 2R_e}{R_t} > k,\ \pi^*_{h\_u} - \pi^*_{h\_c} = \frac{R_t}{4} \cdot D_t - \frac{R_t + k \cdot R_e}{4} \cdot D_t = -\frac{k \cdot R_e}{4} \cdot D_t < 0.$$

Q.E.D.

A-1. Proof of Proposition 1 with Variable and Fixed Costs Considered

In the case of channel-pricing strategy, the price and profit levels are as follows:

$$\pi^*_{h\_c} = \pi^*_{t\_c} + \pi^*_{e\_c} = D_t \cdot \left\{ \frac{R_t + R_e + vc_t + vc_e}{2} - \frac{(R_t + vc_t)^2}{4R_t} - \frac{(R_e + vc_e)^2}{4R_e} \right\} - (fc_t + fc_e)$$

$$\pi^*_{t\_c} = \frac{R_t + vc_t}{2} \cdot \left(1 - \frac{1}{R_t} \cdot \frac{R_t + vc_t}{2}\right) \cdot D_t - fc_t \text{ and } p^*_{t\_c} = \frac{R_t + vc_t}{2},$$

$$\pi^*_{e\_c} = \frac{R_e + vc_e}{2} \cdot \left(1 - \frac{1}{R_e} \cdot \frac{R_e + vc_e}{2}\right) \cdot k \cdot D_t - fc_e \text{ and } p^*_{e\_c} = \frac{R_e + vc_e}{2}.$$

In the case of unified-pricing strategy, the contrasting price and profit levels are:

$$\pi^*_{h\_u} = -D_t \cdot \left[\begin{array}{l} \dfrac{\left\{R_e \cdot (R_t + vc_t) + (k \cdot R_t \cdot (R_e + vc_e))\right\}^2}{4R_t \cdot R_e \cdot (R_e + k \cdot R_t)} \\ -\dfrac{R_e \cdot (k \cdot R_t + vc_t) + R_t \cdot (R_e + vc_e)}{R_t \cdot R_e} \\ \cdot \dfrac{R_e \cdot (R_t + vc_t) + k \cdot R_t \cdot (R_e + vc_e)}{2(R_e + k \cdot R_t)} \\ +(vc_t + k \cdot vc_e) \end{array} \right] - (fc_t + fc_e)$$

$$p^*_{h\_u} = \frac{R_e \cdot (R_t + vc_t) + k \cdot R_t \cdot (R_e + vc_e)}{2(R_e + k \cdot R_t)}.$$

From these relations, one can see that the unified-pricing strategy is a special subset of channel-pricing strategy for the separate channels. In other words, in the set of various separate pricing strategies (p_t, p_e), by assigning a restrictive condition $p_t = p_e$, one unified-pricing strategy can be derived based on

$$p^*_{h\_u} = \frac{R_e \cdot (R_t + vc_t) + k \cdot R_t \cdot (R_e + vc_e)}{2(R_e + k \cdot R_t)}.$$

So if there is no channel migration, regardless of the value of variable and fixed costs in the two channels, the profit of the hybrid firm with a separate channel strategy will be greater than or equal to the profit associated with the unified-pricing strategy. The two profits will be the same only when p_{h_u} is equal to $p_{t\_c} = p_{e\_c}$. Q.E.D.

With regard to the other results from Propositions 2 to 4, the fixed costs need not be considered. When the variable costs are greater in the traditional channel than in the electronic channel, the benefit of separate pricing will be greater if this difference is considered. However, the results from Propositions 2 to 4 would not be affected because the relative changes will not influence the direction of the signs of the first-order conditions or the relative magnitudes of the sums of the infinite series of profits.

B. Proof of Proposition 2 (Impact of Firm Loyalty and Channel-Switching Cost Proposition)

We define $\Delta\pi_h = \pi_h^{T+1} - \pi_h^T$ for any time T. We also define,

$$\pi_h^{T+1} = \pi_h^T \left[\theta^{L^*} \left(1 - \theta^{SW^*}\right) + \theta^{L^*}\theta^{SW^*} \frac{R_e}{R_t} \right],$$

$$\Delta\pi_h = \pi_h^{T+1} - \pi_h^T = \pi_h^T \left[\theta^{L^*} \left(1 - \theta^{SW^*}\right) + \theta^{L^*}\theta^{SW^*} \frac{R_e}{R_t - 1} \right],$$

$$\frac{\partial \Delta\pi_h}{\partial \theta^{L^*}} = \pi_h^T \left[1 - \theta^{SW^*} + \theta^{SW^*} \frac{R_e}{R_t} \right], \quad \frac{\partial \Delta\pi_h}{\partial \theta^{SW^*}} = \pi_h^T \left[-\theta^{L^*} + \theta^{L^*} \frac{R_e}{R_t} \right],$$

and

$$\frac{\partial \Delta\pi_h}{\partial \theta^{L^*}} - \frac{\partial \Delta\pi_h}{\partial \theta^{SW^*}} = \pi_h^T \left\{ \left[1 - \theta^{SW^*} \left(1 - \frac{R_e}{R_t} \right) \right] + \theta^{L^*} \left(1 - \frac{R_e}{R_t} \right) \right\} > 0.$$

Therefore, with $\theta^{SW*} < 1$ and $(1 - R_e/R_t) < 1$, it is known that $\theta^{SW*}(1 - R_e/R_t) < 1$ will be true. Q.E.D.

C. Proof of Proposition 3 (One-Purchase Short-Term Profit-Optimization Proposition)

We define $\pi_{h\_c}^{TOTAL}$ as the total profit of the channel-pricing hybrid firm when it is able to adjust its price in a second period after observing its customers' responses to its previous price in the first period. The total profit of the unified-pricing hybrid firm in a similar setting is given by $\pi_{h\_u}^{TOTAL}$. From the Firm Loyalty and Channel-Switching Cost Proposition (P2), it is known that

$$\pi_{h\_c}^{TOTAL} = \pi_{h\_c}^{TIME1} + \pi_{h\_c}^{TIME2} = \pi_{h\_c}^{TIME1} + \pi_{h\_c}^{TIME1}\left[\theta^{L*}\left(1-\theta^{SW*}\right) + \theta^{L*}\theta^{SW*}\frac{R_e}{R_t}\right]$$

and

$$\pi_{h\_u}^{TOTAL} = 2\pi_{h\_u}^{TIME1}.$$

Based on Equations (3.1) and (4), then,

$$\pi_{h\_c}^{TIME1} = \frac{R_t + k \cdot R_e}{4} \cdot D_t$$

and

$$\pi_{h\_c}^{TIME1} = \frac{1}{4}\frac{(1+k)^2 \cdot R_t \cdot R_e}{R_e + k \cdot R_t} \cdot D_t.$$

If

$$\pi_{h\_c}^{TOTAL} - \pi_{h\_u}^{TOTAL} = \left[\frac{R_t + k \cdot R_e}{4} \cdot \left\{1 + \theta^{L*} \cdot \left(1-\theta^{SW*}\right) + \theta^{L*} \cdot \theta^{SW*} \cdot \frac{R_e}{R_t}\right\} - \frac{1}{2}\frac{(1+k)^2 \cdot R_t \cdot R_e}{R_e + k \cdot R_t}\right] \cdot D_t$$

$$\rightarrow 1 + \theta^{L*} \cdot \left(1-\theta^{SW*}\right) + \theta^{L*} \cdot \theta^{SW*} \cdot \frac{R_e}{R_t} > \frac{2(1+k)^2 \cdot R_t \cdot R_e}{\left(R_e + k \cdot R_t\right) \cdot \left(R_t + k \cdot R_e\right)},$$

the firm will have an incentive to adopt the channel-pricing strategy when adjusting the first period price is possible in the second period. Q.E.D.

Table A4. Korean On-line Mall Transaction Amounts, by Product Category, 2006.

Category	Transaction amount	On-line demand (%)	Category	Transaction amount	On-line demand (%)
Computers, electronics	120	9.2	Flowers	4	0.3
Software, games	7	0.6	Sports, leisure	44	3.4
Home electronics	194	15.0	Cars	121	9.3
Books	61	4.7	Fashions	248	19.2
CDs, music, videos	7	0.6	Cosmetics, perfume	65	5.0
Ticketing	200	15.5	Office products	14	1.1
Babies, toys	69	5.3	Food	25	1.9
Beverages	48	3.7	Services	5	0.4
			Miscellaneous	64	4.9
Total	1,297	100			

Note: Transaction amounts are stated in US$ billions.

Appendix 5. Paired *t*-Test Results

To examine the effect of the proportion of on-line channel demand to the total demand for the hybrid firms, a paired mean difference one-tailed *t*-test was conducted to compare the prices of hybrid and Internet-only firms. The hybrid firms had higher prices than the Internet-only firms. See Table A5-1.

The higher prices of the hybrid firms were expected based on the Optimal Prices and On-line Channel Proportion of the Hybrid Firm Proposition (P2) and the On-line Channel-to-Total Demand Proportion as Price Level Determinant Hypothesis (H2). Because the Internet-only firms do not participate in the traditional retail channel, their prices are lower than the prices of the hybrid firms.

Next, the top-ranking firms were selected and their prices were compared: Interpark and DnShop representing the Internet-only retailers; GSeshop and CJmall representing the hybrid firms. Those four firms covered 58 percent of the total *VisitRatio* of the multi-shopping mall category. Since the top-ranking firms are able to achieve operational economies of scale based on the higher level of competition they experience, their prices were expected to be closer to their marginal costs. The results in Table A5-2 show that Internet-only firms' prices were about 2.1 percent less (about $10, on average), while the hybrid firms' prices were lower by 1.2 percent (or about $6). The lesser difference for the most popular hybrid firms may indicate their relative inflexibility in making price adjustments due to their operations in the traditional channel in parallel with the Internet channel. This is likely to be the case because the traditional channel is still the main source of profit for hybrid firms. So this result is consistent with the Optimal Prices and On-line Channel Proportion of

Table A5-1. *t*-Test Results for Mean Price Differences Between Internet-Only and Hybrid Firms.

Internet-only mean	Hybrid mean	Result	Difference	Signif.
492.07	511.28	$p_e < p_h$	19.21	0.001

Notes: p_e = on-line prices for Internet-only firms. p_h = on-line prices for hybrid firms. Mean prices are denominated in U.S. dollars.

Table A5-2. *t*-Test Results on the Mean Price Differences of the Top-Ranking Firms.

Internet-only firm mean	Hybrid mean	Result	Difference	Signif.
481.67	505.29	$p_e < p_h$	23.62	0.001

Notes: p_e = on-line prices for Internet-only firms. p_h = on-line prices for hybrid firms. Mean prices are expressed in U.S. dollars.

Table A5-3. *t*-Test Results for Mean Price Differences: Internet-Only, Home-Shopping, and Department Store Hybrid Firms.

Internet-only	HS hybrid	DS hybrid	Result	Difference	Signif.
–	522.62	530.54	$p_{h\_HS} < p_{h\_DS}$	7.92	0.005
506.39	–	530.54	$p_e < p_{h\_DS}$	24.25	0.000
492.07	508.09	–	$p_e < p_{h\_HS}$	16.02	0.003

Notes: p_{h_HS} = Prices at TV home-shopping hybrid firms. p_{h_DS} = prices at department store hybrid firms. p_e = price at Internet-only retailers.

the Hybrid Firm Proposition (P2) and the On-line Channel-to-Total Demand Proportion as Price-Level Determinant Hypothesis (H2).

Finally, as with the other tests that were conducted and discussed, the prices of the hybrid firms were compared (see Table A5-3). The approach was to create two groups: TV home-shopping hybrids (HS hybrids) and department store hybrids (DS hybrids). Hmall, a hybrid involving the TV home-shopping and department store channels (HS-DS hybrids), was again omitted. Next, *t*-tests were conducted for mean differences with three types of on-line firms: Internet-only and HS and DS hybrids. The department store hybrid firms had a much lower proportion of on-line channel than the home-shopping hybrid firms. On average, the department store hybrid firms had less than 2 percent of their demand from the on-line channel based on amount of sales, while the home-shopping hybrids had 27 percent. The *t*-test results show that firms with smaller on-line demand proportions relative to total demand, especially department store hybrids, charge higher prices in the on-line channel.

ROBERT J. KAUFFMAN (rkauffman@asu.edu) is the W.P. Carey Chair in Information Systems at the W.P. Carey School of Business, Arizona State University, where he has joint appointments in IS, finance, supply chain management, and informatics and computer science. His degrees are from the University of Colorado at Boulder (B.A.), Cornell University (M.A.), and Carnegie Mellon (M.S., Ph.D.). He has served on the faculties of New York University, the University of Minnesota, and the University of Rochester, and has worked in international banking and finance in New York City. He is also a past chair of the Department of Information and Decision Sciences of the Carlson School of Management, and director of the MIS Research Center at the University of Minnesota. His research interests span the economics of IS, financial markets, technology adoption, competitive strategy and technology, IT value, strategic pricing and technology, supply chain management, and theory development and empirical methods for IS research. He has won numerous research awards, including the 2006 outstanding research contribution award for modeling and strategic decision-making research on embedded standards in technology-based products from *IEEE Transactions on Engineering Management*, and the 2007 best research award from the *Journal of the Association of Information Systems* for theory-building research in the area of product and market transparency made possible by information technology. His recent paper on the diffusion of multiple generations of wireless mobile phones was nominated for a best research award at the 2008 International Conference on Information Systems. His publications have appeared in *Information Systems Research*, *Journal of Management Information Systems*, *MIS Quarterly*, *Management Science*, *Organization Science*, *Telecommunications Policy*, *Information Technology and Management*, *Decision Sciences*, and other leading journals.

DONGWON LEE (mislee@korea.ac.kr) is an assistant professor of management information systems in the Business School at Korea University (KUBS). He earned his Ph.D. degree in MIS from the Curtis L. Carlson School of Management at the University of Minnesota. He received his B.B.A. and M.B.A. degrees from the College of Business Administration at Seoul National University and his M.S. in MIS from the Eller College of Management at the University of Arizona. His research interests include pricing strategies in e-commerce, competition in telecommunications market, adoption of new technologies, knowledge management and sharing, on-line/off-line channel analysis, and technology convergence and platform pricing. His research papers have appeared in the *Journal of Management Information Systems*, *International Journal of Electronic Commerce*, *Communications of the AIS*, *Information Systems Frontiers*, *Electronic Markets*, *Journal of Global Information Technology Management*, and *ACM Crossroads*.

JUNG LEE (symbori@korea.ac.kr) is a doctoral student in MIS in the Business School at Korea University (KUBS). She holds an M.S. in information systems from Yonsei University and a B.S. in biology from Korea Advanced Institute of Science and Technology (KAIST). Her research interests include electronic word-of-mouth and multifirm environments in electronic commerce.

BYUNGJOON YOO (byoo@snu.ac.kr) is an associate professor in the Graduate School of Business at Seoul National University. Previously he worked at Korea University and Hong Kong University of Science and Technology. His research interests relate to B2B e-commerce, on-line auctions, and the pricing strategies of digital goods, such as software products and on-line games. He has published on these topics in *Management Science*, *Journal of Management Information Systems*, and *Journal of Organizational Computing and Electronic Commerce*. He has consulting experience with the Korea Stock Exchange, Korea Game Development and Promotion Institute, and other companies. His work focuses on the impacts of information systems and on-line transactions, and on the strategic uses of information technology.