Impact of Web−based E−Commerce on Channel Strategy

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Abstract

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Abstract

The existing literature and industry trends suggest that web-based channels are fast becoming an integral part of the traditionally offline retailers' overall channel strategy. This paper takes a game theoretic approach to study the impact of web-based e-commerce on the choice of distribution channel strategy by the retailers. The current practice by most firms is to adopt a multi-channel strategy, which includes both web-based channels and preexisting offline channels. Our analysis validates this trend by identifying it as one of the equilibriums of the game, resulting from the competitive pressure induces by the other retailers. However, a more interesting outcome from our analysis is that there are other possible outcomes.

The other possible outcomes include one where some sellers adopt a **coordinated** dual channel (i.e., both online and offline) strategy while the others continue selling through traditional offline channels, and another one where all the sellers switch to online channels. The latter outcome is unlikely to occur for industries where traditionally offline sellers have invested heavily in distribution-specific assets. However, it does provide an explanation for new web-based sellers' reluctance to include offline channels in their overall channel strategy.

Keywords: Electronic markets, e-commerce, online channels, offline channel, distribution, web-based selling, web-based channels

1.0 Introduction

Web-based retailing is fast gaining acceptance as a valid retail outlet among the US Internet users. An increasing number of households are connected to the Internet, indicating an increasing potential for shopping on the Internet. Jupiter Communications [15] estimated that more than a quarter of US adult Internet users made an online purchase in 1997, and predicted that the majority of online adults will have made at least one purchase online by the year 2000. According to the same report, almost half of the online users are expected to become online purchasers by 2002. Given this increasing acceptance of online channels, it is not surprising that more sellers are including web-based channels in their overall channel strategy. In this paper, we define sellers as any business entity that sells goods and service directly to the end consumers. In this case, traditional retailers as well as manufacturing companies can be all sellers if they sell their final products and goods to consumers.

Besides providing sellers with an opportunity to reach a wider audience, web-based sales channels can also provide them with better control over their sales and marketing activities [26], support for their existing offline channels (e.g., Marshall Industries) [26], ward off competition from new web-based entrants in their market (also termed as reintermediation by Chircu *et al.* [8]) and lower transaction costs [2, 6, 10, 17]. However, incorporating web-based channels in the overall channels strategy also raises some concerns. For example, the lack of prior experience in direct selling (since the web virtually makes the seller a direct seller) might increase the transaction cost of selling a product instead of reducing it. This is especially critical for sellers that have traditionally sold through retail stores (e.g. Toys-R-Us, Best Buy, Circuit City). Additionally, the cost of managing the channel conflict that may arise due to a multi-channel strategy may prove to be prohibitive for some sellers. Given the various advantages and disadvantages of web-based channels for sellers, we will try to address the following research questions:

1. *Under what conditions should traditional offline sellers (retailers) incorporate web-based channels in their overall channel strategy?*

2. *Should this new channel strategy consist of exclusive online channels or a dual channel strategy that is a combination of online and offline channel?*

3. *If a seller decides to adopt a dual channel strategy, what should be the extent of coordination between the online and offline channels?*

The answer to these questions becomes very important when one considers the fact that many sellers are following a multi-channel strategy that includes both web-based channels and preexisting offline channels, but have yet to show any evidence of the success of this strategy [14]. The existing channel literature from industrial organization and marketing disciplines sheds some light on the effect of the marketing environment on a firm's channel choice [19, 24]. We find that the research on direct channels has focused mainly on the optimization of operations within the firm [20, 21], while the research on retail channels has generally focused on studying the competition among retailers (e.g. [28]) and between the retailers and the direct sellers [3]. However, there is very little said on the subject of retailers switching to a direct seller mode (web-based, in our case) or to a multi-channel strategy (i.e., both direct and retail) and the conditions that would justify this change from their traditional channel strategy. Lal and Sarvary [16] provided guidelines for firms on when they should consider expanding their distribution network to the Internet. Their analysis, however, basically compares two simple channel strategies– the purely offline channel strategy and the hybrid online-offline channel strategy. In this paper, we have gone further and also included the exclusively online channel strategy and two forms of dual channel strategies in our analysis.

2.0 The Model

We begin our analysis by looking at a market with two sellers, selling the product to heterogeneous buyers, through traditional offline channels (i.e., non-web channels). The various elements of the model are explained as follows.

2.1 ***Buyers:*** Stone [25] classified shoppers as falling into one of four typical categories: economic, apathetic, personalized and ethical. Several researchers have tested and confirmed Stone's assertions [9, 18]. In this paper, we consider personalized and ethical shoppers, as well as recreational shoppers as defined by Belenger et al. [4], to be consumers with *low* intentions of using online channels (called Lows in this paper). Economic and apathetic shoppers were considered to be buyers with *high* intentions of shopping through web-based online channels (called Highs). However, we assume that *all the potential buyers have the same intrinsic valuation, V, for the product*. This assumption is quite common in spatial models, when sellers differentiate on the basis of their location rather than the product [26]. A detail classification of the buyers follows.

1. **Consumers with high intention of buying from web-based channels (Highs)**: Bellman et al. [5] indicated that individuals who shopped online were more like traditional catalogue shoppers. They suggest that the prototypical Internet shoppers are time starved and looking for convenience in buying. Stone [25] defined the *economic shopper* as one who views shopping as an economic activity and shops for the best bundle of quality and price, and *the apathetic shopper* as one who does not enjoy shopping and tries to minimize buying effort. Both types of buyers would also

qualify as buyers with comparatively high intentions of buying through online channels. Also, Highs do not particularly care whether they can try the product before they buy it so long as they can maximize their utility from the trade.

2. **Consumers with low intention of purchasing from web-based channels (Lows)**: These buyers have a low intention of purchasing from web-base channels for various reasons. For example, they may be easily distracted by complicated web sites due to the perceived over-involvement and mental fatigue [11], or they may not have high trust in web-based channels [12]. Stone [25] defined the *personalized shopper* as one who enjoys developing a close relationship with store personnel and tends to shop close to home, and *the ethical shopper* as one who feels a moral obligation to shop at local stores. Both these types of buyers would qualify as buyers with low intentions to buy through online channels, as would *recreational shoppers* [4], i.e., those who view shopping as an enjoyable activity and therefore desire to spend time in offline retail outlets.

Both Lows and Highs incur a discomfort cost, which is a percentage of their product valuation V, when buying through online channels. The decision to relate the discomfort cost to the product valuation is justified by the assumption that buyers may feel more discomfort if they have to buy an expensive product from online channels, and may feel comparatively less discomfort if they buy a relatively lower value product from the online channel. This discomfort cost is manifested, for example, in the lack of immediate gratification, the perceived risk associated with buying online [12], and the absence of a hands-on demonstration of the product. The discomfort cost of Highs is denoted by δ_1 and the discomfort cost of Lows is denoted by δ_2, where $\delta_1 < \delta_2$. We assume that each consumer will purchase either one or zero units of the product during the period under study. Without any loss of generality, the total number of buyers will be $2n$, and the segment sizes of Lows be *x%* of $2n$, with the remaining *(1-x)* % of $2n$ representing the segment size of Highs. Also, if we denote by $q \geq 0$ the quantity sold by the seller, q also denotes the actual number of buyers. Another major assumption we have made in our model is that the buyers' cost of buying from online or offline channel is zero. The only cost incurred by the buyer is reflected in the discomfort cost when buying online. This discomfort cost and the prices offered by the sellers are the only two main factors guiding a buyers' choice of channel. The demand in any of the channels is divided between the sellers on the basis of price offered by them. For equal prices the demand is divided equally among them and for different prices, the lower-priced seller gets all the demand in the respective channel.

If p_A and p_B denote the unit price of the product when sold through offline and online channels respectively, the utility function for Lows and Highs (Appendix A) is as follows:

$$U_H = \begin{cases} V(1-\delta_1) - p_B(1+\beta\theta) \ldots\ldots buy-online/exchange-online \\ V(1-\delta_1) - p_B \ldots\ldots buy-online/exchange-offline \\ V - p_A \ldots\ldots buy-offline \\ 0 \ldots\ldots not-buy \end{cases} \quad \textbf{(1a)}$$

$$U_L = \begin{cases} V(1-\delta_2) - p_B(1+\beta\theta) \ldots\ldots buy-online/exchange-online \\ V(1-\delta_2) - p_B \ldots\ldots buy-online/exchange-offline \\ V - p_A \ldots\ldots buy-offline \\ 0 \ldots\ldots not-buy \end{cases} \quad \textbf{(1b)}$$

Where,

- The parameter β denotes the probability that the consumer will need to access the channel again after he or she has bought the product in order to exchange or return the product or to get it repaired.
- The parameter θ denotes the cost, as a percentage of the selling price, incurred by any buyer who needs to access the online channel again after he or she has bought the product. For example, if the buyer needs to get the product exchanged or repaired, he or she may have to pay the cost of shipping the product to the seller if the purchase was made through a web-based channel. On the other hand, if the product was bought through offline channels, the buyer can simply take the product to the retail outlet at a minimal cost (i.e., negligible compared to the cost of shipping the product to the online seller). Although, buyers have to go to the offline stores, stand in a queue to make the return or exchange, this cost is canceled by the cost a buyer incurs when she or he has to drive to the post office and wait in line there, when making returns to online stores. Besides postage, online returns also incur some extra cost like packaging the merchandise for shipping, psychological cost associated with the delay in getting the refund or the replacement (as compared to almost no delay in case of offline returns), which are reflected in our choice of the variable θ.

2.2 ***Sellers:*** These are profit-maximizing firms, selling a commodity product which is suitable to being sold through both online and offline channels. Without loss of the generality, the production costs (or the costs at which the seller may have bought the product from another seller) are assumed to be zero. This simply means that in the following analysis all prices have to be interpreted as a deviation from 0. We have also decided to exclude any variable costs associated with processing online and offline orders since they are assumed to be too low to have any major impact. The inventory management cost has also been assumed to be approximately the same for both online and offline channels since both can use IT to collaborate with their suppliers and minimize this cost. We also assume that *the sellers are already selling through offline channels*. This assumption reflects on the fact that sellers have been selling the product before the advent of web-based channels of distribution.

The sellers have four fundamental channel choices- (a) to continue selling through their traditional offline channels, (b) to completely switch to web-based channels, (c) to sell through both the online and offline channels without much coordination among the two channels and (d) to sell through well coordinated online and offline channels. Coordination among channels would imply whether the buyers who buy the product in one channel are allowed to return and exchange the product in the other channel. In case of minimum coordination this is not allowed (e.g. Barnes & Noble), i.e. buyers are allowed to return or exchange the product only at the channel from which it was purchased. In case of maximum coordination among the channels the buyers can purchase the product from online channels but return or exchange it at offline channels of the retailer that had made the sale (e.g. Wal Mart, Best Buy, and Gateway). Before going further, we have summarized the various parameters defined till now in Table 1.

To illustrate the impact of channel choice made by a seller on the channel strategy of all the remaining sellers, we will use the circular spatial model [27, 23], first proposed by Salop (1979) and subsequently used by many in marketing and industrial organization [e.g. 3, 27]. We have used the assumptions and findings from already existing works, based on this model, just to illustrate the affect of competition on the channel choice of retailers. For the sake of simplicity, we will assume that there are two sellers (or retailers) in the offline market (Figure 1), called Seller 1 and Seller 2.

Table 1 : Summary of parameters used in the model

No.	Parameter	Possible values	Description
1	V	positive	Buyer's valuation of the product
2	δ_1	0-1	Discomfort cost experienced by the buyers, with high intentions to buy from online channel. It is percentage of the valuation V of the product purchased.
3	δ_2	0-1 $\delta_2 > \delta_1$	Discomfort cost experienced by the buyers, with low intentions of buying from online channel. It is percentage of the valuation V of the product purchased.
4	X	0-1	Number of Lows as a fraction of the total demand
5	p_A	positive	Price of the product in offline channel
6	p_B	positive	Price of the product in online channel
7	β	0-1	Probability that the consumer will need to access the channel again after he or she has bought the product
8	θ	0-1	Cost, as a percentage of the selling price, incurred by any buyer who needs to access the online channel again after he or she has bought the product

[PLEASE INSERT FIGURE 1]

These retailers exist on the periphery of the circle, which represents the offline location of consumers. In equilibrium, the two sellers will have the same price for the product and attract the same number of buyers, i.e. n [27]. Given the four channel strategies available to each of the two sellers, there will be sixteen scenarios to analyze in order to identify the optimal channel strategy for both the sellers. These scenarios are defined in Table 2.

We will now define a two-stage game with the sellers and the consumers as the players (Figure 2) involved. In this game, the sellers get to move in the first stage, during which they decide on their channel strategy simultaneously. The consumers move in the second stage only, when they have to decide on their preferred channel and the price they are willing to pay for the product.

Table 2: All the possible scenarios for channel strategies adopted by sellers 1 and 2

Seller 2 / Seller 1	**Sell Offline**	**Sell Online**	**Uncoordinated dual channels**	**Coordinated dual channels**
Sell Offline	Scenario #1	Scenario #2	Scenario #3	Scenario #4
Sell Online	Scenario #5	Scenario #6	Scenario #7	Scenario #8
Uncoordinated dual channels	Scenario #9	Scenario #10	Scenario #11	Scenario #12
Coordinated dual channels	Scenario #13	Scenario #14	Scenario #15	Scenario #16

[PLEASE INSERT FIGURE 2]

2.3 ***Timing of Decisions***- We will assume that sellers and buyers make decisions in a sequential manner that can be divided into two stages.

a) **Stage I-** At this stage the sellers choose the channels they want to sell through and the price at which it wants to sell. We will denote the price by p_i, where i=A for offline and i=B for online prices. When deciding on their channel strategy, the sellers are aware of the discomfort cost incurred by the buyers with low and high intentions to buy through online channels.

b) **Stage II-** Each consumer decides whether to purchase one unit of the product. In making this decision, each consumer treats the distribution channel and the price of the product as given. After consumers' purchase decisions are made, the sellers collect their revenues from consumers and profits are realized.

3. Solution

We look for the equilibrium by solving this game backward, i.e., we solve stage II, and then stage I.

3.1 Stage II: Consumers Purchasing Decision--Estimate of Demand

At this stage, each consumer has the following information: (a) Whether the product is available for sale at online, offline, or both channels; (b) the price of the product; (c) their valuation of the product; and (d) the discomfort cost incurred by them if they buy online. In this stage, we estimate the demand for various channel choices that the sellers can make. Given the four channel strategies available to both the sellers, the buyers could encounter any of the 16 scenarios shown in the Table 2. In the remaining part of this section we will identify the total online and offline demand for both Highs and Lows for all these possible scenarios. We will not worry about the distribution of these demands among the two sellers at this stage. The distribution of demand will be computed once the sellers have decided on their profit maximizing prices for the sixteen scenarios. The demand for all the scenarios is computed by simply ensuring that the buyers' utility is some positive value when they make the purchase and this utility is more for the channel from which this purchase was made as compared to the utility from the other channel. For example, a buyer would buy from the online channel if his or her utility is positive for online purchase and this utility is greater than the one for offline purchase. Thus, by solving for $U_H, U_L \geq 0$ (equations 1a and 1b), and comparing U_H and U_L for different channel strategy options, we can determine the preferred channel for the both the Low and High type buyers, and also get the range for online and offline prices that these buyers are willing to pay, when buying from their preferred channel.

Scenario #1: Both the sellers sell only through the existing offline channels. The total number of buyers according to equations (1a) and (1b) will be

$$q'_{L} = 2xn.; q'_{H} = 2(1-x)n \ldots\ldots\ldots\ldots p_A \le V$$
$$q'_{H} = q'_{L} = 0 \ldots\ldots\ldots\ldots P_A > V \quad \textbf{(2)}$$

Scenario #2 (Scenario #5): Seller 1 (2) sells through offline channel and Seller 2 (1) sells through online channel. The total demand for the two channels is given in Table 3.

Table 3: Demand Functions for Scenario #2 (Scenario #5):

Pricing Constraints: ------------→		$p_A \le V$ and $p_B \le \frac{V(1-\delta_2)}{(1+\beta\theta)}$	$p_A \le V$ and $\frac{V(1-\delta_2)}{(1+\beta\theta)} < p_B \le \frac{V(1-\delta_1)}{(1+\beta\theta)}$	$p_A \le V$ and $p_B > \frac{V(1-\delta_1)}{(1+\beta\theta)}$
Total Online Demand	q_H	$2(1-x)n$	$2(1-x)n$	0
	q_L	$2xn$	0	0
Total Offline Demand	q'_H	0	0	2(1-x)n
	q'_L	0	2xn	2xn

Scenario #6: Both the sellers sell only through online channels. The total demand on this online channel is shown in Table 4.

Table 4: Demand Functions with online Channels Only

Pricing Constraints: -----------→	$p_B \le \frac{V(1-\delta_2)}{(1+\beta\theta)}$	$\frac{V(1-\delta_2)}{(1+\beta\theta)} < p_B \le \frac{V(1-\delta_1)}{(1+\beta\theta)}$	$p_B > \frac{V(1-\delta_1)}{(1+\beta\theta)}$
q_H	$2(1-x)n$	$2(1-x)n$	0
q_L	$2xn$	0	0

Scenario #3 (Scenario #9), Scenario #7 (Scenario #10) and Scenario #11: If Seller 1 (2) sells through offline channel and Seller 2 (1) sells through uncoordinated dual channels, or both the sellers sell through uncoordinated dual channels, or one of the seller sells through online channel and the other through uncoordinated dual channels, *the total* *online and offline demand would be same because all the online and offline price constraints will be same in all these cases*. This total demand is given in Table 5.

Table 5: Demand Functions if one of the sellers sells through offline or online channel and the other through uncoordinated dual channels or both sell through uncoordinated dual channels

Pricing Constraints: ------------→		$p_A \le V$ and $p_B \le \frac{p_A - \delta_2 V}{(1+\beta\theta)}$	$p_A \le V$ and $\frac{p_A - \delta_2 V}{1+\beta\theta} < p_B \le \frac{p_A - \delta_1 V}{(1+\beta\theta)}$	$p_A \le V$ and $p_A \ge p_B > \frac{p_A - \delta_1 V}{(1+\beta\theta)}$
Total Online Demand	q_H	2(1-x)n	2(1-x)n	0
	q_L	$2xn$	0	0
Total Offline Demand	$q_H^{'}$	0	0	2(1-x)n
	$q_L^{'}$	0	2xn	2xn

Scenario #4 (Scenario #13), and Scenario #16: Seller 1 (2) sells through offline channel and Seller 2 (1) sells through coordinated dual channels, or both sellers sell through coordinated dual channels. The total online and offline demand will be same for all these scenarios, again because the price constraints (for the buyers and sellers) remain same. The total online and offline demand for these scenarios is given in Table 6.

Table 6: Demand Functions if one of the sellers sells through offline channel and the other through coordinated dual channels or both sell through coordinated dual channels

Pricing Constraints: ------------→		$p_A \le V$ and $p_B \le p_A - \delta_2 V$	$p_A \le V$ and $p_A - \delta_1 V \ge p_B > p_A - \delta_2 V$	$p_A \le V$ and $p_A < p_B - \delta_1 V$
Total Online Demand	q_H	2(1-x)n	2(1-x)n	0
	q_L	$2xn$	0	0
Total Offline Demand	$q_H^{'}$	0	0	2(1-x)n
	$q_L^{'}$	0	2xn	2xn

Scenario #8 (Scenario # 14): Seller 1 (2) sells through online channel and Seller 2 (1) sells through coordinated dual channels. In this scenario the offline price will have to be less than V. However, the online prices offered by the two sellers could be different. If we denote the online price offered by Seller 1, i.e. the one with online channel strategy, by p_B^1 and the online price offered by Seller 2, i.e. the one with coordinated dual channel strategy, p_B^2 by then if $p_B^1 \le p_B^2$, the total online and offline demands are given in Table 7A, otherwise the total demands are given in Table 7B.

Table 7A: Demand Functions if one of the sellers sells through online channel and the other through coordinated dual channels and $p_B^1 \le p_B^2$

Pricing Constraints: ------------→		$p_A \le V$ and $p_B^2 \le \frac{V(1-\delta_2)}{(1+\beta\theta)}$	$p_A \le V$ and $\frac{V(1-\delta_2)}{1+\beta\theta} < p_B^2 \le \frac{V(1-\delta_1)}{(1+\beta\theta)}$	$p_A \le V$ and $p_A \ge p_B^2 > \frac{V(1-\delta_1)}{(1+\beta\theta)}$
Total Online Demand	q_H	2(1-x)n	2(1-x)n	0
	q_L	$2xn$	0	0
Total Offline Demand	$q_H^{'}$	0	0	2(1-x)n
	$q_L^{'}$	0	2xn	2xn

Table 7B: Demand Functions if one of the sellers sells through online channel and the other through coordinated dual channels and $p_B^1 > p_B^2$

Pricing Constraints: ------------→		$p_A \le V$ and $p_B^1 \le p_A - \delta_2 V$	$p_A \le V$ and $p_A - \delta_1 V \le p_B^1 < p_A - \delta_2 V$	$p_A \le V$ and $p_A - \delta_1 V < p_B^1$
Total Online Demand	q_H	2(1-x)n	2(1-x)n	0
	q_L	$2xn$	0	0
Total Offline Demand	$q_H^{'}$	0	0	2(1-x)n
	$q_L^{'}$	0	2xn	2xn

Scenario #12 (Scenario #15): Seller 1 (2) sells through uncoordinated dual channels and Seller 2 (1) sells through coordinated dual channels. In this scenario also the offline prices for both the sellers will have to be less than V. However their online prices again could be different. If we denote the online prices of Seller 1, i.e. the one with uncoordinated dual channel strategy, by p_B^1 and the online price offered by Seller 2, i.e.

the one with coordinated dual channel strategy, p_B^2 then the total online and offline demands are given in Table 8A, when $p_B^1 < p_B^2$, and in Table 8B otherwise.

Table 8A: Demand Functions if one of the sellers sells through uncoordinated dual channels and the other through coordinated dual channels, and $p_B^1 < p_B^2$

Pricing Constraints: ------------→		$p_A \le V$ and $p_B^2 \le \frac{V(1-\delta_2)}{(1+\beta\theta)}$	$p_A \le V$ and $\frac{V(1-\delta_2)}{1+\beta\theta} < p_B^2 \le \frac{V(1-\delta_1)}{(1+\beta\theta)}$	$p_A \le V$ and $p_A \ge p_B^2 > \frac{V(1-\delta_1)}{(1+\beta\theta)}$
Total Online Demand	q_H	2(1-x)n	2(1-x)n	0
	q_L	$2xn$	0	0
Total Offline Demand	q_H'	0	0	2(1-x)n
	q_L'	0	2xn	2xn

Table 8B: Demand Functions if one of the sellers sells through online channel and the other through coordinated dual channels and $p_B^2 \le p_B^1$

Pricing Constraints: ------------→		$p_A \le V$ and $p_B^1 \le p_A - \delta_2 V$	$p_A \le V$ and $p_A - \delta_1 V \ge p_B^1 > p_A - \delta_2 V$	$p_A \le V$ and $p_A - \delta_1 V < p_B^1$
Total Online Demand	q_H	2(1-x)n	2(1-x)n	0
	q_L	$2xn$	0	0
Total Offline Demand	q_H'	0	0	2(1-x)n
	q_L'	0	2xn	2xn

3.2 Stage 1: Sellers Select their channel and price to maximize their profits

In this stage, the sellers select their respective profit-maximizing price subject to consumers' demand functions, derived in stage II. The sellers are aware of the discomfort cost of the two types of buyers (i.e., when these buyers buy online), the percentage of Lows and Highs in the buyers' population, and the buyers' common valuation of the product. In this section we will derive the profit functions for the two sellers for various scenarios.

Scenario #1: Profit maximizing price, given that the product is sold offline by both the sellers is $p_A = V$ (please refer to equation 4) for both the sellers. None of the sellers have incentive to lower the price since it reduces the profits and none of the sellers have incentive to raise the price because buyers won't buy at a higher price. The profits for each seller for this scenario (section 2.2) is given by $\pi_i = nV$ for i = 1, 2 **(3)**

Scenario #2 (Scenario #5): When Seller 1 (2) sells through offline channel and Seller 2 (1) sells through online channel, the profit maximizing prices can be derived from Table 3. In this case Seller 1 (2) will get all the offline demand and Seller 2 (1) will get all the online demand. Without loss of generality, we will compute the profit functions only for scenario #2. The resulting profits for the two sellers are given in Table 9.

Table 9: Profit Functions for Scenario #2, i.e. Seller 1 sells through offline and Seller 2 sells through online channel

Profit Maximizing Prices ------------→		$p_A = V$ and $p_B = \frac{V(1-\delta_2)}{(1+\beta\theta)}$	$p_A = V$ and $p_B = \frac{V(1-\delta_1)}{(1+\beta\theta)}$	$p_A = V$ and $p_B > \frac{V(1-\delta_1)}{(1+\beta\theta)}$
Total Online Demand	q_H	2(1-x)n	2(1-x)n	0
	q_L	$2xn$	0	0
Total Offline Demand	q'_H	0	0	2(1-x)n
	q'_L	0	2xn	2xn
Profits for Seller 1		0	$2xnV$	$2nV$
Profits for Seller 2		$2nV\frac{1-\delta_2}{1+\beta\theta}$ **4a**	$2nV\frac{(1-x)(1-\delta_1)}{(1+\beta\theta)}$ **4b**	0 **4c**

Please Note: The pricing options given in column 4a and 4c result in zero profits for Seller 1 and Seller 2 respectively. The profit functions for these pricing strategies are not sustainable because the seller with zero profit can always change its channels strategy that gives it a positive profit. Therefore, we will ignore these pricing options in subsequent analysis leaving us with the profit functions given in the column 4b.

Scenario #3 (Scenario #9): When Seller 1 (2) sells through offline channel and Seller 2 (1) sells through uncoordinated dual channels, the total demand and profit maximizing prices are given in Table 5. In this scenario (i.e. #3), Seller 1 gets half the offline demand,

and Seller 2 gets all the online demand and half the offline demand. With this demand distribution their respective profit functions are given in the Table 10.

Table 10: Profit Functions when Seller 1 sells through offline channel and Seller 2 sells through uncoordinated dual channels

<table>
<tr><td colspan="2">Profit Maximizing Prices ------------→</td><td>$p_A = V$ and $p_B = \frac{V(1-\delta_2)}{(1+\beta\theta)}$</td><td>$p_A = V$ and $p_B = \frac{V(1-\delta_1)}{(1+\beta\theta)}$</td><td>$p_A = V$ and $p_B > \frac{V(1-\delta_1)}{(1+\beta\theta)}$</td></tr>
<tr><td rowspan="2">Total Online Demand</td><td>q_H</td><td>2(1-x)n</td><td>2(1-x)n</td><td>0</td></tr>
<tr><td>q_L</td><td>$2xn$</td><td>0</td><td>0</td></tr>
<tr><td rowspan="2">Total Offline Demand</td><td>$q_H^{'}$</td><td>0</td><td>0</td><td>2(1-x)n</td></tr>
<tr><td>$q_L^{'}$</td><td>0</td><td>2xn</td><td>2xn</td></tr>
<tr><td colspan="2">Profits for Seller 1</td><td>0</td><td>xnV</td><td>nV</td></tr>
<tr><td colspan="2">Profits for Seller 2</td><td>$2nV\frac{1-\delta_2}{1+\beta\theta}$
5a</td><td>$nV[x + \frac{2(1-x)(1-\delta_1)}{1+\beta\theta}]$
5b</td><td>nV
5c</td></tr>
</table>

Please Note: Since pricing strategy in column 5a results in zero profits for Seller 1, and the Seller 1 can always change its channel strategy to get positive profits, this pricing policy is not sustainable, and therefore will be ignored in subsequent analysis. This leaves us with profit functions given in the column 5b and 5c. For seller 2, 5b>5c when $\delta_1 \leq \frac{1-\beta\theta}{2}$. Therefore, profit functions given in column 5b will be used when this condition is true and profit functions given in column 5c will be used otherwise.

Scenario #4 (Scenario #13): When Seller 1 (2) sells through offline channel and Seller 2 (1) sells through coordinated dual channels, the total online and offline demand and profit maximizing prices are given in Table 6. Without loss of generalization we will consider only scenario #4. For this choice of channels, Seller 1 will get half the offline demand and seller 2 will get the other half of the offline demand and all the online demand. The profit functions for this demand distribution, among the two sellers, are given in Table 11.

Table 11: Profit functions when Seller 1 sells through offline channel and Seller 2 sells through coordinated dual channels

Profit Maximizing Prices ------------→		$p_A = V$ and $p_B = V(1-\delta_2)$	$p_A = V$ and $p_B = V(1-\delta_1)$	$p_A = V$ and $V > V(1-\delta_1)$
Total Online Demand	q_H	2(1-x)n	2(1-x)n	0
	q_L	$2xn$	0	0
Total Offline Demand	$q_H^{'}$	0	0	2(1-x)n
	$q_L^{'}$	0	2xn	2xn
Profits for Seller 1		0	xnV	nV
Profits for seller 2		$2nV(1-\delta_2)$ **6a**	$nV[x+2(1-x)(1-\delta_1)]$ **6b**	nV **6 c**

Please Note: For seller 2, 6b>6c is always true because $x+2(1-x)(1-\delta_1)>1$. Since pricing strategy given in column 6a results in a zero profit for Seller 1, the profit functions given in this column will be ignored in subsequent analysis. This leaving us with profit functions given in the column 6b.

Scenario #6: Profit maximizing prices for this scenario, when the product is sold online by both the sellers, can be derived from Table 4. Also the total online demand will be shared equally between the two sellers. The profits for the two sellers are given in Table 12.

Table 12: Profit Options for both the sellers, when they sell through online channels

Profit Maximizing Price -----------→		$p_B = \frac{V(1-\delta_2)}{(1+\beta\theta)}$	$p_B = \frac{V(1-\delta_1)}{(1+\beta\theta)}$	$p_B > \frac{V(1-\delta_1)}{(1+\beta\theta)}$
Total Online Demand	q_H	2(1-x)n	2(1-x)n	0
	q_L	$2xn$	0	0
Profits for each seller		$nV\frac{(1-x)(1-\delta_2)}{1+\beta\theta}$ **7a**	$nV\frac{(1-x)(1-\delta_1)}{(1+\beta\theta)}$ **7b**	0

Scenario #7 (Scenario #10): When Seller 1 (2) sells through online channel and Seller 2 (1) sells through uncoordinated dual channels, the total online and offline demand and the profit maximizing prices can be derived from Table 5. Without loss of any generalization, we will compute the profit functions for scenario #7. In this case, the online demand will be divided equally between Seller 1 and Seller 2, while all the offline demand would go to Seller 2. The profit functions for the two sellers are given in Table 13.

Table 13: Profit Functions when Seller 1 sells through online channel and Seller 2 sells through uncoordinated dual channels

Profit Maximizing Price ------------→		$p_A = V$ and $p_B = \frac{V(1-\delta_2)}{(1+\beta\theta)}$	$p_A = V$ and $p_B = \frac{V(1-\delta_1)}{(1+\beta\theta)}$	$p_A = V$ and $p_B > \frac{V(1-\delta_1)}{(1+\beta\theta)}$
Total Online Demand	q_H	2(1-x)n	2(1-x)n	0
	q_L	$2xn$	0	0
Total Offline Demand	$q_H^{'}$	0	0	2(1-x)n
	$q_L^{'}$	0	2xn	2xn
Profits for Seller 1		$nV\frac{(1-x)(1-\delta_2)}{1+\beta\theta}$	$nV\frac{(1-x)(1-\delta_1)}{1+\beta\theta}$	0
Profits for Seller 2		$nV\frac{(1-x)(1-\delta_2)}{1+\beta\theta}$ **8a**	$nV[2x+\frac{(1-x)(1-\delta_1)}{1+\beta\theta}]$ **8b**	$2nV$ **8c**

Scenario #8 (Scenario # 14): Total demand when Seller 1 (2) sells through online channel and Seller 2 (1) sells through coordinated dual channels is given in Table 7A and 7B. Because of symmetric nature of these two scenarios, we will only compute the profit functions for scenario #8. The profit maximizing online and offline prices in this scenario are $p_A = V$, $p_B^1 = \frac{V(1-\delta_2)}{(1+\beta\theta)}$ (from Table 7A) and $p_B^2 = V(1-\delta_2)$ (from Table 7B). Since $p_B^1 < p_B^2$, the demand functions from Table 7A would apply. The online demand will be shared equally among the two sellers, while the offline demand will all go to Seller 2. The profits for the two sellers in this case are given in Table 14.

Table 14: Profit Functions when Seller 1 sells through online channel and the Seller 2 sells through coordinated dual channels

Profit Maximizing Price ------------→		$p_A = V$ and $p_B = \frac{V(1-\delta_2)}{(1+\beta\theta)}$	$p_A = V$ and $p_B = \frac{V(1-\delta_1)}{(1+\beta\theta)}$	$p_A = V$ and $p_B > \frac{V(1-\delta_1)}{(1+\beta\theta)}$
Total Online Demand	q_H	2(1-x)n	2(1-x)n	0
	q_L	$2xn$	0	0
Total Offline Demand	$q_H^{'}$	0	0	2(1-x)n
	$q_L^{'}$	0	2xn	2xn
Profits for Seller 1		$nV\frac{(1-x)(1-\delta_2)}{1+\beta\theta}$	$nV\frac{(1-x)(1-\delta_1)}{(1+\beta\theta)}$	0
Profits for Seller 2		$nV\frac{(1-x)(1-\delta_2)}{1+\beta\theta}$ **9a**	$nV[2x+\frac{(1-x)(1-\delta_1)}{1+\beta\theta}]$ **9b**	$2nV$ **9c**

Scenario #11: Profit maximizing price and the total online and offline demand, when the product is sold through uncoordinated dual channels by both the sellers, is given in Table 5. The online and offline demand will be equally divided among the two sellers. The corresponding profit functions are given in Table 15.

Table 15: Profit Options for the two sellers when they both sell through Uncoordinated dual Channels

Profit Maximizing Price ------------→		$p_A = V$ and $p_B = \frac{V(1-\delta_2)}{(1+\beta\theta)}$	$p_A = V$ and $p_B = \frac{V(1-\delta_1)}{(1+\beta\theta)}$	$p_A = V$ and $p_B > \frac{V(1-\delta_1)}{(1+\beta\theta)}$
Total Online Demand	q_H	2(1-x)n	2(1-x)n	0
	q_L	$2xn$	0	0
Total Offline Demand	$q_H^{'}$	0	0	2(1-x)n
	$q_L^{'}$	0	2xn	2xn
Profits for each of the sellers		$nV\frac{(1-x)(1-\delta_2)}{1+\beta\theta}$ **10a**	$nV[x+\frac{(1-x)((1-\delta_1)}{(1+\beta\theta)}]$ **10b**	nV **10c**

Scenario #12 (Scenario #15): When Seller 1 (2) sells through uncoordinated dual channels and Seller 2 (1) sells through coordinated dual channels, the demand is given in Tables 8A and 8B. Because of the symmetric nature of these scenarios, we will only compute the profit functions for scenario #12. The profit maximizing online and offline prices for this scenario are $p_A = V$, $p_B^1 = \frac{V(1-\delta_2)}{(1+\beta\theta)}$ (from Table 8A) and $p_B^2 = V(1-\delta_2)$ (from Table 8B). Since $p_B^1 < p_B^2$, the demand functions from Table 8A would apply. Both the online and the offline demand will be shared equally among the two sellers. The profits for the two sellers in this case are given in Table 16.

Table 16: Profit Functions when Seller 1 sells through uncoordinated dual channels and the seller 2 sells through coordinated dual channels

Profit Maximizing Price ------------→		$p_A = V$ and $p_B = \frac{V(1-\delta_2)}{(1+\beta\theta)}$	$p_A = V$ and $p_B = \frac{V(1-\delta_1)}{(1+\beta\theta)}$	$p_A = V$ and $p_B > \frac{V(1-\delta_1)}{(1+\beta\theta)}$
Total Online Demand	q_H	2(1-x)n	2(1-x)n	0
	q_L	$2xn$	0	0
Total Offline Demand	$q_H^{'}$	0	0	2(1-x)n
	$q_L^{'}$	0	2xn	2xn
Profits for Seller 1		$nV\frac{(1-x)(1-\delta_2)}{1+\beta\theta}$	$nV[x+\frac{(1-x)((1-\delta_1)}{(1+\beta\theta)}]$	nV
Profits for Seller 2		$nV\frac{(1-x)(1-\delta_2)}{1+\beta\theta}$ **11a**	$nV[x+\frac{(1-x)((1-\delta_1)}{(1+\beta\theta)}]$ **11b**	nV **11c**

Scenario #16: Both sellers sell through coordinated dual channels. The online and offline demands and the profit maximizing prices are given in Table 6. The demand in this scenario is equally divided between the two sellers, and the resulting profit functions are given in Table 17.

Table 17: Profit functions when both the sellers sell through coordinated dual channels

Profit Maximizing Prices -----------→		$p_A = V$ and $p_B = V(1-\delta_2)$	$p_A = V$ and $p_B = V(1-\delta_1)$	$p_A = V$ and $V(1-\delta_1) < p_B$
Total Online Demand	q_H	2(1-x)n	2(1-x)n	0
	q_L	$2xn$	0	0
Total Offline Demand	$q_H^{'}$	0	0	2(1-x)n
	$q_L^{'}$	0	2xn	2xn
Profits for each seller		$nV(1-\delta_2)$ **12a**	$nV[x+(1-x)(1-\delta_1)]$ **12b**	nV **12c**

3.3 Stage I: Seller's Channel Strategy Decision

In all the profit functions we have identified in the previous section, the offline prices remain the same for all scenarios, i.e. $p_A = V$. However, the sellers have more than one online pricing option whenever they include the online channel in their overall channel strategy. For scenarios in which only one of the sellers has included online channels in its channel strategy, this seller will choose p_B (i.e., online price) that maximizes its total profits. However, for scenarios in which both the sellers included online channels in their channel strategy, the online competition would ensure that the lowest online price prevails in the e-market. By choosing a higher online price, a seller would lose all the online sales and remaining offline sales (though at a higher price) never gives more profit. This online competition helps us to reduce the number of profit functions for various scenarios further. The number of profit functions is also reduced by elimination of those scenarios where one of the sellers ends up with negative profit, since these are not viable outcomes in this competitive game. After substituting these remaining profit functions in Table 2, we get the following Table 18.

Table 18: Profits Seller 1 and Seller 2 (π_1, π_2) under various scenarios, for $\delta_1 \le \frac{1-\beta\theta}{2}$

Seller 2 / Seller 1	Sell Offline	Sell Online	Sell through uncoordinated dual channels	Sell through coordinated dual channels
Sell Offline	nV, nV	$2xnV$, $2nV\frac{(1-x)(1-\delta_1)}{(1+\beta\theta)}$	xnV, $nV[x+\frac{2(1-x)(1-\delta_1)}{1+\beta\theta}]$	xnV, $nV[x+2(1-x)(1-\delta_1)]$
Sell Online	$2nV\frac{(1-x)(1-\delta_1)}{(1+\beta\theta)}$, $2xnV$	$nV\frac{(1-x)(1-\delta_2)}{1+\beta\theta}$, $nV\frac{(1-x)(1-\delta_2)}{1+\beta\theta}$	$nV\frac{(1-x)(1-\delta_2)}{1+\beta\theta}$, $nV\frac{(1-x)(1-\delta_2)}{1+\beta\theta}$	$nV\frac{(1-x)(1-\delta_2)}{1+\beta\theta}$, $nV\frac{(1-x)(1-\delta_2)}{1+\beta\theta}$
Sell through un-coordinated dual channels	$nV[x+\frac{2(1-x)(1-\delta_1)}{1+\beta\theta}]$ xnV	$nV\frac{(1-x)(1-\delta_2)}{1+\beta\theta}$, $nV\frac{(1-x)(1-\delta_2)}{1+\beta\theta}$	$nV\frac{(1-x)(1-\delta_2)}{1+\beta\theta}$, $nV\frac{(1-x)(1-\delta_2)}{1+\beta\theta}$	$nV\frac{(1-x)(1-\delta_2)}{1+\beta\theta}$, $nV\frac{(1-x)(1-\delta_2)}{1+\beta\theta}$
Sell through coordinated dual channels	$nV[x+2(1-x)(1-\delta_1)]$, xnV	$nV\frac{(1-x)(1-\delta_2)}{1+\beta\theta}$, $nV\frac{(1-x)(1-\delta_2)}{1+\beta\theta}$	$nV\frac{(1-x)(1-\delta_2)}{1+\beta\theta}$, $nV\frac{(1-x)(1-\delta_2)}{1+\beta\theta}$	$nV(1-\delta_2)$, $nV(1-\delta_2)$

Please Note: This payoff table will remain the same when $\delta_1 > \frac{1-\beta\theta}{2}$, except that the payoff for both the sellers for scenarios 3 and 9 will be nV.

Analysis of the payoffs for both the sellers, given in Table 18 leads us to propose the following.

Proposition 1: Both the sellers switching to online channels is a possible equilibrium outcome of this game, when $x \le \dfrac{1-\delta_2}{3+2\beta\theta-\delta_2}$ (please refer to appendix B for proof).

Without loss of generality let us assume that Seller 1 chooses to switch to online channel strategy. In this case, the Seller 2 is better off by adopting an online channel strategy. This option weakly dominates the other options in which seller 2 follows a pure online channel strategy, uncoordinated dual channel strategy, or a coordinated dual channel strategy. The reason for this is that with these other channel strategies, the Seller 2 ends up with the same revenues but with extra costs attributed to multi channel management (coordinated or uncoordinated). This equilibrium, however, will be visible in only those industries where the sellers have not invested heavily in offline-distribution specific assets, since the switching cost would prohibit them from completely abandoning their offline channels in the short run.

Another reason for the lack of evidence of this equilibrium is provided by further analysis of the condition, i.e. $x \leq \frac{1-\delta_2}{3+2\beta\theta-\delta_2}$. This inequality implies that when the costs associated with discomfort and online returns/exchanges, and/or high probability of returning or exchanging a product are high, the sellers would succeed with pure online channel strategy only if the percentage of buyers with low intentions of buying online (i.e., Lows) is low. Maybe in many industries these parameters still have relatively high values while at the same time the percentage of Lows is high, the condition specified in Proposition 2 is not satisfied and therefore this equilibrium, i.e. all sellers switching to online channels, does not exist.

Proposition 2: Both the sellers adopting a coordinated dual channel strategy is one of the equilibriums of this game as long as the percentage of Lows (i.e. buyers with low intentions to buy online), in the buyer population remains less than $1-\delta_2$.

Without loss of generality let us assume that Seller 1 chooses to continue with its offline channel strategy. In this case, the Seller 2 is better off to adopt a coordinated dual channel strategy (please refer to appendix C for proof). However, if the Seller 2 decided to do so, the Seller 1 is better off with adopting a coordinated dual channel strategy (please refer to appendix D for proof), if $1-\delta_2 \geq x$. This condition would imply that as the discomfort cost of the Lows rises, percentage of Lows has to go down, in order for the sellers to make more profits with coordinated dual channel strategy as compared to the profits they made with offline channel strategy. The sellers can lower this discomfort cost by addressing the concerns of the buyers (e.g. security, reliability, delay in trade completion etc.) who have low intentions to buy online. Although, this equilibrium is visible in many industries where the traditionally offline retailers are moving towards well coordinated dual channels (e.g. Wal-Mart, Best Buy, Charles Schwab, Gateway etc.), the success of this strategy has to be validated for many industries, as indicated by the empirical investigation done by J.C. Williams Group and BizRate.com [14]. One reason for the apparent failure of this channel strategy could be that the discomfort costs are still high for many buyers, and they form a major portion of the total demand in many of these industries.

Proposition 3: One of the sellers continues selling through its offline channel while the other one adopts a coordinated dual channel policy, will be the equilibrium outcome when $1-\delta_2 < x$.

Without loss of generality let us assume that Seller 1 chooses to continue with its offline channel strategy. In this case, the Seller 2 is better off to adopt a coordinated dual channel strategy (please refer to appendix C). However, even if the Seller 2 decides to do so, the Seller 1 is still better off continuing with its traditional offline channel strategy (please refer to appendix D for proof), if $x > 1-\delta_2$. This equilibrium is also visible in many industries where some of the traditionally offline retailers are moving towards well coordinated dual channels (e.g. Dell) while others are following a well coordinated dual channel strategy (e.g. Gateway). These markets could also be characterized by either of the following-

- Buyers have low discomfort cost for online channels, and there is a high proportion of buyers with low intention to buy online (e.g. markets for products which can be easily be traded online, but most buyers want to try them out in offline stores before buying them)
- Buyers have high discomfort costs associated with online channels, and the proportion of buyers with low intention to buy online is small.

Equilibriums obtained after analysis of Table 18 are summarized in Table 19.

Table 20: Possible equilibriums of the game described in Figure 2.

	$x \le \frac{1-\delta_2}{3+2\beta\theta-\delta_2}$	$x > \frac{1-\delta_2}{3+2\beta\theta-\delta_2}$
$x \le 1-\delta_2$	*Both the sellers have an online channel strategy, or both have coordinated dual channel strategy*	*Both the sellers have coordinated dual channel strategy*
$x > 1-\delta_2$	NOT POSSIBLE since if $x \le \frac{1-\delta_2}{3+2\beta\theta-\delta_2}$, it has to be $1-\delta_2 \ge x$	*One of the sellers sells through offline channel, while other sells through coordinated dual channels.*

Now that we have identified the equilibrium outcomes of our given model, we would like to identify the conditions in terms of transaction costs of these channels strategies, which need to be satisfied for the sellers to adopt these strategies. We will include the sunk and fixed costs (and any switching costs) that may be associated with setting up a selling or distribution channel for the product in the total cost incurred by selling through online or offline channels. We denote T_A as the total transaction cost of selling the product through traditional offline channels and T_B as the total transaction cost of selling the product through web-based online channels. Even though there is some empirical evidence to suggest that overall direct marketing activities are less costly to perform through the Internet than through more traditional channels [2, 6, 10], we have not imposed this precondition in the model. The reason for doing so is that many firms may end up incurring more transaction cost when selling online because of their lack of experience with the direct channel. If the product is sold through both online and offline channels, and both channels are well coordinated (e.g. the product bought online could be returned to the offline stores), then we include another cost C_{AB}, the cost of coordinating between the two channels to minimize channel conflict and to improve customer service. When we include these costs in the payoffs for both the sellers in the equilibrium outcomes, we end up with the following propositions.

Proposition 4: Both the sellers adopt the coordinated dual channel strategy because the market competition forces them to do so, and not necessarily because they are economically better off.

The sellers will be better off with coordinated dual channel strategy only when the additional cost of selling through online channel and coordinating between its offline and online channel satisfies the condition $T_B + C_{AB} \leq -nV\delta_2$. (Please refer to Appendix E), which is never possible. This proposition is not out of ordinary because if we observe the payoffs in Table 18, we see that by adopting a coordinated dual channel strategy, the sellers end up with a lesser payoff (i.e. $nV(1-\delta_2)$) as compared to their payoff with offline channel strategy (i.e. nV). At the same time the transaction costs have increased from T_A (for offline channel strategy) to $T_A + T_B + C_{AB}$ (for coordinated dual channel strategy). Apart from the ones identified in Proposition 2, the increased transaction costs could be another of the reason for lack of successful implementation of coordinated dual channel strategy by many sellers [14].

Proposition 5: One of the sellers would be economically better off by switching to coordinated dual channel strategy, as compared to continuing with its traditional offline channel strategy, when the additional transaction cost of selling through an online channel and coordinating between its offline and online channels is less than $nV(1-x)(1-\delta_1)]$*, i.e.* $T_B + C_{AB} \leq nV(1-x)(1-\delta_1)]$. (Please refer to Appendix F).

Further analysis of the conditionality shows that as the buyers with high intentions of buying online (i.e., Highs) become more comfortable with buying online (i.e. $(1-\delta_1)$ increases) and their proportion in the market increases (i.e. *1-x* increases), the seller selling through coordinated dual channel strategy in this equilibrium, can afford a relatively higher increase in transaction costs associated with coordinated dual channel strategy. On the other hand, if the comfort level of Highs with online channel remains same or decreases, and the proportion of Highs in the market decreases, there will be pressure on the seller with coordinated dual channel strategy to control and reduce the additional transaction costs associated with this channel strategy.

Proposition 6: The sellers will be economically better off by switching to online channel strategy, as compared to continuing with their traditional offline channel strategy, when the unit cost of selling through the online channel satisfies the inequality,

$$\frac{T_B}{n} \leq \frac{T_A}{n} - V[2x - \frac{(1-x)(1-\delta_2)}{(1+\beta\theta)}].$$ (Please refer to Appendix G).

If the sellers are to economically better of by switching to online channel they need to control their online selling costs so that it satisfies the condition given in Proposition 5. As we can see form the inequality, representing this condition, the factor which puts pressure on this cost reduction is $V[2x - \frac{(1-x)(1-\delta_2)}{(1+\beta\theta)}]$. One obvious observation is that more the valuation of the product, more will be the pressure on the sellers to reduce their online transaction costs. The reason being that with high valuations, buyers will have high discomfort costs (since the discomfort cost is dependent on the valuation) and therefore more will be the pressure on the sellers to reduce their online price (i.e., $p_B = \frac{V(1-\delta_2)}{(1+\beta\theta)}$) so as to attract maximum demand to the online channel. With these reduced prices, the sellers would stand to improve their profitability only if they reduce their online transaction costs.

The same argument would be true when the discomfort cost factor of Lows, i.e. δ_2 and/or the percentage of Lows (i.e., buyers with low intentions to buy online and represented by x) increases. These increases would increase the term $[2x - \frac{(1-x)(1-\delta_2)}{(1+\beta\theta)}]$, which in turn will require the sellers to reduce their online transaction costs by a comparatively larger amount. Same argument would hold if the probability of returns/exchange by buyer and/or the cost associated with returning the product increases for the buyers.

5. Discussion and Conclusion

Analysis of the model leads to the conclusion that the sellers would either end up with coordinated dual channel strategies, or online channel strategy or one of them would adopt a coordinated dual channel strategy, while the other would continue with the traditional offline channel strategy. The outcome would depend on the conditions satisfied by the percentage of buyers, with low intentions to buy online, in the market as identified in Propositions 1, 2 and3. As we have already mentioned, the equilibriums described in propositions 2 and 3 are being observed in some industries. One reason why we do not have many examples of sellers switching completely to online channels could be because of their heavy investments trade specific assets required for offline selling [8]. We do however observe that purely online firms are predominantly keeping away from offline markets (e.g. Amazon.com, Dell). This would justify the existence of the equilibrium described in Proposition 2, i.e. when both the sellers are online they do not have the incentive to change their channel strategies, provide that the condition identified in Proposition 2.

We also observe that two of the equilibriums have one or both the sellers adopting coordinated dual channel strategies. However, this equilibrium outcome would be economically better for the relevant seller only of the transaction cost conditions identified in Propositions 4 and 5 are satisfied. That these conditions are not satisfied in all cases is evident in some empirical findings that most of the sellers who have adopted the multi-channel strategy have yet to show any evidence of the success of this strategy as compared to their performance with a traditional offline-only channel strategy [e.g. 14]. In a research study based on more than 48,000 interviews with shoppers in all channels and in-depth interviews with more than 40 retail executives that was conducted for Shop.org, the J.C. Williams Group and BizRate.com) reported that many retail executives readily acknowledge that they are far from realizing rewards from true multi-channel integration.

The Shop.org study mentioned above also raises the question of whether the traditional offline sellers (e.g., retailers) are free to choose their optimal channel strategy involving web-based channels. The decision is comparatively easy for the direct sellers, that is, those who were traditionally selling through mail order catalogues [1]. All they have to do is to switch their contact medium with their customers from paper-based catalogues to web-based catalogues. Also, the direct sellers already have the infrastructure to support direct trade. Therefore, unlike the offline retailers, they do not incur huge switching costs. However, the decision to change or modify their traditional channel strategy is not as easy for the other group of offline sellers, the retailers. They have already invested heavily in the offline transaction specific assets, which make it difficult for them to completely switch to online selling. Even when they are ready to incorporate the web-based channel in their overall channel strategy, the challenge for most of these sellers comes less from the technology itself than from the complexities of managing a well coordinated dual-channel structure, because of various concerns associated with this strategy [22].

The most important concern is ensuring that incentives are aligned across multiple channels [14, 22]. The problem is even more severe for firms that want to employ a hybrid model in which goods are only showcased in one channel but can also be purchased on the other channel, or in which goods sold in one channel can be returned or exchanged at another channel. To separate the purchase of goods from their fulfillment in that way, organizational and inter-firm incentives will have to be significantly altered because the incentives for sales effort are usually tied to the measure of actual sales.

The coordinated online-offline channel strategy also adds to the channel conflict problem in a variety of other ways. One is that the price-conscious consumer, after taking the in-store sales advice or simply checking out the product in the offline store, can discover the lowest price on the Internet and then buy from the channel that gives that lower price. This type of consumer behavior would make it difficult for the seller to measure the performance of its online and offline channels.

Finally, another important concern for firms following a coordinated dual channel strategy is to improve the match between what consumers want and what they can get and thus reduce the compromise that consumers have to make [14, 21]. In this regard, firms are in an awkward transition. Their “old” distributed inventory system in the offline stores competes with their “new” centralized inventory management system in the online stores, while some hybrid system tries to integrate the two and, in turn, further adds to the cost of coordination between the online and offline channels.

In conclusion, although the equilibriums suggest that sellers will end up either with coordinated dual channel strategy, or online channel strategy or continue with their offline channel strategy (depending on the conditions specified in Propositions 1 to 3), these sellers will be economically better off in these equilibriums only if they manage their transaction costs so as to satisfy the conditions identified in Propositions 4 to 6. Sellers are under more pressure to lower their online transaction costs (as compared to offline transaction costs) when any combination of the product valuation, the percentage of buyers who have low intentions of using online channels, the discomfort cost of these buyers, and the probability and cost associated with returning/exchanging the product are high. So what are the implications of these findings for the traditionally offline sellers? That most of these sellers will be forced into coordinated dual-channel strategy by the competition in their respective markets, is evident in various industries. These sellers, however, have control over their online transaction costs and costs of coordination between their offline and online channels, and at the same addressing the concerns raised by multi-channel management, in order to successfully implement a coordinated dual channel strategy.

Our analysis has its limitations. The assumptions about consumer choice between the online and offline channels are straightforward, and this simplicity is important for a flexible but robust model. It is important to acknowledge, however, that consumer choice is guided by more complex heuristics that need to be studied independently. In order to gain insight, our analysis also assumes an idealized market structure. Real life markets are more complicated, and so the results should be interpreted with this in mind. Also, the model assumes that transaction costs of selling and market size are the main criterion for deciding the optimal channel strategy. Firms, however, use many other factors, such as product attributes, control and flexibility offered by the channel, distribution density provided by the various channel options, and the pressure from customers. Given these limitations, the results of the analysis are not universally applicable. However, they do provide us some significant insights about the impact of the Internet on the channel strategies of sellers in their respective industry explain certain trends observed in many industries, i.e. a move towards well coordinated dual channel strategy.

APPENDICES

A. Utility functions: The expected utility of the Lows when they buy online and have to return the product to the online channel is-

$= (1-\beta)(V - p_B - \delta V) + \beta(V - p_B - \delta V - \beta p_B) = V(1-\delta) - p_B(1+\beta\theta)$. Similarly the expected utility of the Lows when they buy online and have to return the product to the online channel is $= (1-\beta)(V - p_B) + \beta(V - p_B - \beta p_B) = V - p_B - \beta p_B$.

In the same way, we can compute the expected utility for the buyers when they can buy online but exchange offline. However, in case of coordinated channels, the buyer can buy online but exchange the product offline, in which case they will not incur any discomfort cost the second time when they go to exchange the product.

B. Both sellers sell through online channels when $2xnv \le nv\dfrac{(1-x)(1-\delta_2)}{1+\beta\theta}$.

Rearranging the variables gives us $x \le \dfrac{1-\delta_2}{3+2\beta\theta-\delta_2}$.

C. When Seller 1 (2) continues selling through offline channel, the payoff for Seller 2 (1) with coordinated channel strategy is always better off than for any other channel strategy. Payoff for seller 2 (1) for all the options is given in row 1 of Table 18. These payoffs are $2nV\dfrac{(1-x)(1-\delta_1)}{(1+\beta\theta)}$, $nV[x+\dfrac{2(1-x)(1-\delta_1)}{1+\beta\theta}]$ and $nV[x+2(1-x)(1-\delta_1)]$. As we can see

$$2nV\frac{(1-x)(1-\delta_1)}{(1+\beta\theta)} < nv[x+\frac{2(1-x)(1-\delta_1)}{(1+\beta\theta)} < nv[x+2(1-x)(1-\delta_1)]$$

D. When the seller 2 (1) sells through coordinated dual channels, the best option for Seller 1 (2) is to sell through coordinated dual channel strategy if $xnV \le nv(1-\delta_2)$, giving us the condition $1-\delta_2 \ge x$. If $x > 1-\delta_2$ then the Seller 1 (2) is better off by continuing with its offline channel strategy.

E. Substituting the transaction costs in payoff functions for the sellers in scenario 16 and scenario 1 (Please refer to Table 18), we get payoff for Seller 1 (2) with coordinated dual channel strategy, i.e. $nv(1-\delta_2)-T_A-T_B-C_{AB}$, and the payoff with offline channel strategy is $nv-T_A$. Comparing the two, i.e. $nV(1-\delta_2)-T_A-T_B-C_{AB} \geq nV-T_A$, we get the condition, $T_B+C_{AB} \leq -nV\delta_2$ when the sellers will be better off adopting a coordinated dual channel strategy.

F. When Seller 1(2) sells through offline channel and the seller 2 (1) sells through coordinated dual-channels, the payoff for Seller 2 (1), given in Table 18, is $nV[x+2(1-x)(1-\delta_1)]-T_A-T_B-C_{AB}$. Seller 2(1) would adopt this channel strategy if this payoff is better the one obtained with selling through offline channel, i.e. $nV-T_A$. Comparing these, i.e. $nV[x+2(1-x)(1-\delta_1)]-T_A-T_B-C_{AB} > nV-T_A$, we get the condition $T_B+C_{AB} \leq nV(1-x)(1-2\delta_1)$, when the seller 2 (1) is better off with a coordinated dual channel strategy in response to Seller 1 (2) strategy of selling through offline channel.

G. We first substitute the relevant transaction costs in the payoff functions for both the sellers (please refer to Table 18), when they both sell through offline channels and when they both switch to online channels. Next we compare these payoffs for each of the sellers, i.e. $nV\dfrac{(1-x)(1-\delta_2)}{(1+\beta\theta)}-T_B \geq 2xnV-T_A]$ to get the condition, $\dfrac{T_B}{n} \leq \dfrac{T_A}{n}-V[2x-\dfrac{(1-x)(1-\delta_2)}{(1+\beta\theta)}]$ when the sellers are better off by switching to online channels.

References

1. Bain & Company. Catalog companies set multi-channel standard. *Fighting fire with water -From channel conflict to confluence,* (2001).
2. Bakos, J. Y. A strategic analysis of electronic market places. *MIS Quarterly,* (September1991), 295-310.
3. Balasubramaniam, S. Mail vs. Mall: A strategic analysis of competition between direct marketers and conventional retailers. *Marketing Science* Vol. 17, No. 13 (1998), 181-195.
4. Belenger, D., and Kargaonkar, P.K. Profiling the recreational shopper. *Journal of Retailing,* 56, (3), (1980), 77-92.
5. Bellman, S., Lohse, G.L., and Johnson, E.J. Predictors of on-line buying behavior. *Communications of the ACM,* 42, (12), (1999), 32-8.
6. Benjamin, R., and Wigand, R. Electronic commerce: effects on electronic markets. *Journal of Computer-Mediated Communication,* 1, (3), (December 1995).
7. Brynjolfsson, E., Smith, and Michael D. Frictionless commerce? A comparison of Internet and conventional retailers. Typescript, MIT Sloan School of Management (1999).
8. Chircu, A.M., and Kauffman, R.J. Reintermediation and Strategies in Business-to-Business Electronic Commerce. *International Journal of Electronic Commerce*, 4(4), (2000), 7-42.
9. Haws, J.M., and Lumpkin, J.R. Understanding the outshopper. *Journal of the Academy of Marketing Science,* (12), (1984), 200-18.

10. Hoffman, D.L., Novak, T. P., and Chatterjee, P. Scenarios for the web: opportunities and challenges. *Journal of Computer-Mediated Communication,* 1, (3), (1995).

11. Hoffman, D.L., and Novak, T.P. Marketing in hypermedia computer mediated environments: conceptual foundations. *Journal of Marketing,* 60, (03), (1996), 308-19.

12. http://64.28.79.74/metrics/2001/metric228.html. More than 80% of online shoppers fear credit card fraud, (June 21, 2001).

13. IDC Analyst Report. *U.S. PC Channel Review and Forecast 1996-2002,* http://www.idc.com, *, (*1998).

14. J.C. Williams Group, BizRate.com 2001. *Multi-Channel Retail Report 2001*. http://www.shop.org, (2001).

15. Jupiter Communications. *1998 Online Shopping Report*, (http://www.jup.com/) (1998).

16. Lal, R., and Sarvary, M. When and how is the Internet likely to decrease price competition? *Marketing Science,* Vol. 18, No. 4, (1999), 485-503.

17. Lee, H.G., and Clark, T. Impacts of electronic marketplace on transaction cost and market structure. *International Journal of Electronic Commerce,* 1(1), (1996), 127-149.

18. Lumpkin, J.R., Haws, J.M., and Darden, W.R. Shopping patterns of rural consumer: exploring the relationship between shopping orientations and out shopping. *Journal of Business Research,* 14, (1986), 63-81.

19. Majumdar, S.K., and Venkatraman, R. Going direct to market: The influence of exchange conditions. *Strategic Management Journal,* 16, (1995), 352-372.

20. Morwitz, V., and Schmittlein, D.C. Testing new direct marketing offerings: The interplay of management judgment and statistical models. *Management Science*, 44, 5, (1998), 610-628.

21. Rao, V.R., and Steckel J.H. Selecting, evaluating and updating prospects in direct mail marketing. *Journal of Direct Marketing,* 9, (1995), 20-31.

22. Saloner, G., and Spence A.M. *Creating And Capturing Value.* John Wiley & Sons, Inc., New York, (2002).

23. Salop, S.C. Monopolistic Competition with Outside Goods. *The Bell Journal of Economics*, 10, (1979), 141-156.

24. Stern, L.W., El-Ansari, A., and Coughlan, A. *Marketing Channels:* 5th ed. Prentice Hall, Englewood Cliffs, NJ.

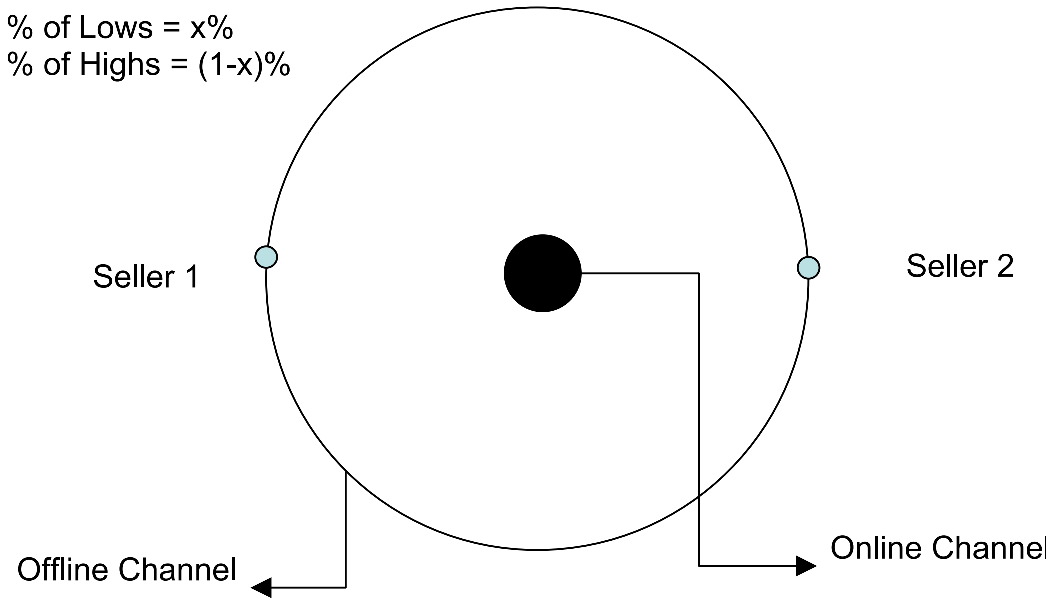
25. Stone, G.P. City shoppers and urban identification: Observation on the social psychology of the city life. *American Journal of Sociology,* 60, (1954), 36-55.

26. Timmers, P. *Electronic Commerce*: John Wiley & Sons Inc., New York, (2000).

27. Tirole, J. *The Theory of Industrial Organization*: 5th ed., MIT Press, Cambridge, MA. (1992), 277-280.

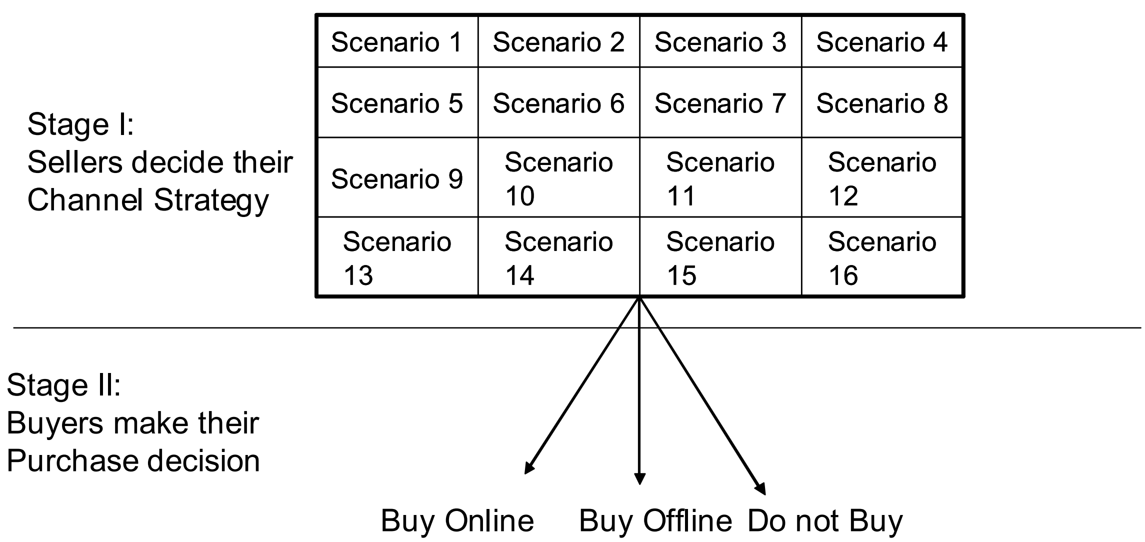
28. Trivedi, M. Distribution channels: An extension of exclusive retailership. *Management Science,* Vol. 44, No. 7, July (1998), 896-909.

Figure 1: Circular Spatial model with 2 sellers and 2n buyers



Please note: The location of the sellers in the offline market does not matter
Because we have assumed negligible transportation cost of for the buyers
in the offline markets.

Figure 2: Sequence of moves by the players involved in the game



Please Note: The various scenarios are defined in Table 2