DUAL SALES CHANNEL MANAGEMENT WITH BUYBACK CONTRACTS

by

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Abstract

We study a dual channel structure in which a manufacturer sells its product through an independent traditional retailer channel as well as a direct online channel (i.e., the Internet). The model conceptualizes service-based competition between the channels by considering consumer channel choice. The service level of the retailer channel is evaluated with its product availability level while the service level of the direct channel is evaluated with its delivery lead time. The consumers choose between channels by considering the channels' service levels and a number of other factors such as the relative convenience of channels. We base our studies on Chen et al. (2008). We extend their study by considering a buyback contract between the manufacturer and the retailer. We compare results under dual channel, direct-channel-only and retail-channel-only structures under wholesale price and buyback contracts.

GERİ ALIM KONTRATLARI İLE İKİLİ SATIŞ KANALLARININ YÖNETİLMESİ

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Tez Danışmanı: Yar. Doç. Dr. Murat Kaya

Anahtar Kelimeler: İkili kanallar, doğrudan kanal, hizmet tabanlı rekabet, ürün bulunabilirliği, tedarik zinciri kontratları

Özet

Bu tezde üreticilerin hem bağımsız geleneksel perakendeci kanalları hem de kendi doğrudan internet kanalları aracılığı ile satış yapabildikleri ikili satış kanalı sistemleri üzerinde çalışılmaktadır. Model, kanallar arasındaki hizmet tabanlı rekabeti kavramsallaştırmaktadır. Perakendecilerin hizmet seviyesi ürün bulunabilirliği ile, üreticilerin hizmet seviyesi ise tedarik süresi ile değerlendirilmektedir. Tüketiciler kanallar arasındaki tercihlerini, kanallar tarafından sağlanan hizmet seviyelerini ve perakendeci kanalını kullanmanın neden olduğu göreli rahatsızlık maliyeti gibi birtakım diğer faktörleri de değerlendirerek yapmaktadırlar. Çalışmalarımızda Chen vd. (2008) modelini taban aldık. Üretici ve perakendeci arasında geri alım kontratı uygulayarak modeli genişlettik. Sonuçları ikili kanal sistemleri, yalnız perakendeci ve yalnız doğrudan kanal sistemlerinde toptan satış ve geri alım kontratları altında kıyasladık.

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TABLE OF CONTENTS

List of Tables

List of Figures

1 CHAPTER-1

1.1. INTRODUCTION

As the number of alternatives to reach end consumers increases, it is getting more important for companies to design and coordinate their processes in a way that they can satisfy the needs of consumers. Dual channel structure is of increasing interest to manufacturers in order to survive in today's competitive markets. This thesis investigates the changes in the channel performance; i.e., total sales and total profit when a new channel is added to the existing channel structure under different contracting mechanisms.

We develop a dual channel model in which the manufacturer (he) sells directly through his website and also through an independent retail (she) channel. By doing so, the manufacturer increases his consumer base including the online channel consumers. Although the manufacturer's profit margin is higher in the direct channel, he shares the inventory risk with the retailer when he sells through the retailer. We determine the terms of the trade between the manufacturer and the retailer by a using buyback contract.

We also develop a *consumers' channel choice* model. The consumers choose between these two channels depending on the *service level* and the *relative inconvenience* of the channels. The service level of the direct channel is evaluated with its *delivery lead time* while the service level of the retailer channel is evaluated with its *product availability level*. We capture the relative inconvenience of the retailer with a parameter called *relative inconvenience cost*. This parameter reflects the time and effort

costs that consumers incur due to visiting the retailer.

By solving the model, we determine three types of dual channel strategies for the manufacturer. First, the manufacturer eliminates the retailer by setting a short delivery lead time when the direct channel cost is low. In this case, all consumers are served through the direct channel. Second, the manufacturer captures the retailer's profit when the direct channel cost is above a threshold and the relative inconvenience cost of the retailer is high. In this case, the consumer market is segmented into two. The first segment buys only from the direct channel. The second segment buys only from the retailer if the product is available otherwise the consumers leave the system without purchasing. Third, the manufacturer shares the profit with the retailer when the direct channel cost is high and the relative inconvenience cost of the retailer is low. In this case, the consumer market is segmented into three. The first segment only buys from the direct channel. The second segment first attempt to buy from the retailer channel. If the product is available then they buy the product from the retailer. If there is a stock-out, then those consumers buy from the direct channel. The third segment only buys from the retailer channel if the product is available otherwise they leave the system without purchasing.

In addition to observing the channel performance under the dual channel - buyback contract structure (DB), we also analyze dual channel - wholesale price contract (DW), retailer-only - buyback contract (RB), retailer-only - wholesale price contract (RW) and direct-only channel structures. By comparing the results of these cases, we determine under which parameter combinations switching to a dual channel structure or switching to the buyback contract is better for a manufacturer, assuming that the status quo is the retailer-only structure with wholesale price contract.

1.2. CONCEPTUAL BACKGROUND

In this section, we aim to explore the main issues that we cover in the thesis. First we discuss a number of existing *channel* structures. Then we explain the effects of consumer behavior on channel structures. We continue with a discussion on channel management, and finally we outline the concept of *coordination* with *contracts*.

1.2.1 Channel Structures and the Internet as a New Sales Channel

A distribution channel is a set of interdependent organizations that ensures a product arrives to the market. There are varieties of channel structures which are built on the idea of satisfying the needs of market segments in a precise way (Coughlan et al. 1992). Changes in technology and consumer preferences lead to the introduction of new channel structures. Personal computer industry is a good example to illustrate the noteworthy changes in channel structures. As computers first started to be sold in the market, direct sales forces were the only way of selling them. In 1970s retailers were also included in the channel as intermediaries. In mid of 1980s, customer awareness about PCs grew as the number of competitors increase. This change led to three important long term adjustments in the distribution channels. First, mass resellers entered to the market. Second, consumers started to order via the Internet in 1990s and finally, specialized computer stores opened (Winer 2007).

Channel structures can be classified under two main categories: *direct channel structures* and *indirect channel structures*. In a direct channel structure, all activities from the manufacturing of a product to reaching the end consumers are under the responsibility of a single firm, the manufacturer. Sales directly via the Internet and telephone, door-to-door selling, or retail outlets which are owned by manufacturers are different applications of direct channels. Indirect channel structure includes different levels of intermediaries depending on the type of business. In this case,

the manufacturer uses other companies to reach the end consumers. Direct channel structure entails the usage of direct sales force providing the opportunity of applying new strategies directly. By the help of the direct channel, the manufacturers can extend their contact with their consumers and obtain better information about market demand (Lee et al. 1997). A direct channel also allows the manufacturers to gain more profit by controlling pricing and distribution directly (Stern et al. 1996). However, the access of the direct sales force to consumers might be limited and managing a direct sales force is expensive. On the other hand, an indirect channel allows a company to reach more consumers by the help of intermediaries. In addition, the intermediaries perform some key functions such as gathering information, providing transportation and storage and financing (Winer 2007).

Both channel structures can be observed in different *formats*. *Physical (bricks and mortar) format* and *online (the Internet) format* are two of the most commonly applied channel formats. Table 1.1 provides examples of different structure/format combinations.

		Channel Format	
		Online	Physical
Channel Structure	Direct Channel	Web site of manufacturer (www.apple.com)	Manufacturer- owned stores (Apple retail store)
	Retailer Channel	Web site of retailer (www.bestbuy.com)	Standard retailing (Bestbuy retail stores)

Figure 1.1: Different Channel Structures

Both the manufacturers and the retailers might use one or more channel formats at the same time. For example, Apple, as a manufacturer, sells its products through both its direct online channel *apple.com* and through *Apple retail stores*. Similarly, BestBuy, a retailer, sells the products of different manufacturers through its physical

stores and website. Some consumer-goods manufacturers sell their products through both direct and indirect channels simultaneously. For example, a manufacturer might provide direct sales through company outlets meanwhile its products are also available at independent retailers. This new channel structure is referred to as a *dual channel structure*.

Dual channel structure may allow a firm to increase its market coverage, obtain lower channel cost and provide customized service to its customers (Keller, 2006). Beyond its advantages, a dual channel structure may also result in conflicts between the channel members as it introduces the manufacturer as a direct competitor to his retailers (See Section 1.2.3). With the widespread usage of the Internet, dual channel applications evolved into a new phase.

As a flexible, interactive distribution channel the Internet offers improvement on channel management. A large number of manufacturers including Compaq, Hewlett & Packard, IBM, and Nike apply a dual distribution channel strategy by selling online in addition to their traditional retailer channel. There are various advantages of including the Internet as a distribution channel. Beyond conventional direct channel applications, the Internet provides a higher accessibility for the consumers as it is not limited to a physical store. Moreover, the manufacturers can observe the changes in market and respond quickly (Kiang et al. 1999). However, Peterson et al. (1997) raise two questions regarding the interaction between the Internet and the traditional channels. The authors question if the Internet is a suitable substitute for the traditional channels and whether the Internet can dominate the current channel structures or not.

The characteristics of the product which is marketed through the Internet is an important factor for the success of the Internet sales. Peterson et al. (1997) classify products as *search goods* and *experience goods*. Search goods are defined as the products that can be evaluated by external information while experience goods require personal interaction with the product. The Internet might be an effective distribu-

tion channel for search goods whereas traditional channels might be better suited for experience goods. The Internet might also be suitable for high cost, infrequently purchased goods.

In this research, we focus on a dual channel structure which includes a direct channel in online format and a retailer channel in physical format. However, note that other channel combinations are also observed in practice. For example both the manufacturer and the retailer can manage an online channel. Alternatively the manufacturer can sell his product directly through both the online format and the physical format.

1.2.2 The Effect of Consumer Purchasing Behavior on Channel Structure

With the evolution of new channel structures, insight into the changing consumer behaviors becomes crucially important for channel management. In order to set the right channel strategies, companies should analyze how different consumers choose between competing channel structures.

Neslin et al. (2006) define six factors that determine the consumers' channel selection as marketing efforts, channel attributes, channel integration, social influence, situational factors and individual differences. By considering these factors, it is possible to differentiate online consumers from traditional channel consumers. Online consumers tend to give more importance to informativeness, convenience, time and effort savings whereas the traditional channel consumers tend to give more importance to enjoyment and service quality (Broekhunizen et al. 2003). Price is also one of the most important cues affecting the consumers' purchasing behavior. However, Bellman et al. (1999) report that online consumers' valuations regarding cost savings is lower than their valuations on time savings. On the other hand, Clay et al. (2001) claim that consumers' price sensitivity is dependent on their previous shopping behaviors. If a consumer is already price sensitive, then she can be more sensitive in

the online channel as a result of high flexibility. However if a consumer is price insensitive, then due to time considerations or high income she might tend to be less sensitive in the online channel.

Consumers' decision sequence is another important aspect of the their purchasing behavior. Peterson et al. (1997) suggest that the consumers' decision process is shaped around brand or product category preferences and channel preferences. At the information acquisition process, they either focus on a brand or a product category. The consumers also make a choice between the traditional channel and the online channel for information acquisition. Finally they choose a channel for final transaction and brand acquisition. The authors also state that brand-loyal consumers tend to moderate the competition between the online channel and the traditional channel because in such a case the consumers only focus on price information and product availability in the search process. In addition, Steinfield et al. (2002) point to the possible switches of the consumers from one channel to another during the purchasing process. Regarding the brand or product category preferences, Jupiter research results indicate that 77% of the online shoppers determine the specific product they want to purchase before the purchasing process (Gilly et al. 2000). In addition, HP research results show that 73% of the consumers who shop for printers are *brand-sure*; i.e., they know which brand they will buy from (Chen et al. 2008).

Considering the aforementioned information about consumers' purchasing behavior, the companies segment their consumer population. *Market segmentation* is a consumer analysis method which groups the consumers under different categories in order to investigate the common shopping habits (Winer 2007). In a dual channel structure, as Broekhuizen et al. (2003) state, channel loyalty is a more effective factor for channel segmentation than brand loyalty.

In our study we consider brand-sure consumers who have determined the product that they want to purchase. Therefore we segment the consumer population depending on their channel preferences, which in turn depend on the service levels that the

channels offer. We also allow the consumers to switch between channels in case of a stock-out.

1.2.3 Potential Issues in Channel Management

Retaining a dual channel structure provides greater market penetration than a single-channel structure by allowing the channel members to serve consumers from different segments. However dual channel structure also leads to a tension between the manufacturer and the retailer as it establishes the manufacturer as a direct competitor to his retailer. In literature, this tension is referred to as *channel conflict* (Tsay et al. 2004). Channel conflict originates from one channel members' behavior that prevents the other member(s) from obtaining its (their) goals. Channel conflict issue gained importance with the opening of factory outlets in 1980s and today it has reached a new phase with the inclusion of the Internet to channel structures. Manufacturer's attempt to open a direct channel is considered to be a threat by the retailer. Home Depot case is a well known example of channel conflict resulting from the dual channel structure. Home Depot is a large retailer of home improvement and construction products and services. After some of the suppliers of Home Depot opened their online direct channel, Home Depot send letters to her suppliers stating that she is hesitant about doing business with her competitors (Brooker 1999).

Double marginalization is another common problem encountered in channel management. Double marginalization reflects the inefficiencies in a channel (or, in a supply chain) due to decentralized decision making by a number of independent firms (Spengler 1950). We discuss double marginalization in detail in Section 1.2.4.

1.2.4 Coordination with Contracts

In order to eliminate the aforementioned channel problems and increase channel performance, firms should design and manage their channels carefully. The effectiveness of a channel depends on the degree that the companies synchronize and coordinate

their decentralized operations. On the other hand, synchronization of decentralized operations can lead to loss of competitive advantage. Hence it is important to align the incentives of the relevant parties (Özer 2006).

We illustrate these concepts with an example. Consider a vertically integrated firm (i.e., the manufacturer) that undertakes both production and distribution operations. The firm operates in a single selling season. Because of the nature of the business, neither carrying inventory from one period to the next nor placing a second production run is possible. Hence the firm needs to determine the production quantity prior to the selling season. However demand during the selling season is probabilistic.

Since demand is uncertain, upon deciding the production quantity, the firm faces a trade off between excess inventory and insufficient inventory. Holding excessive inventory cause inefficient investment because of the opportunity costs, inventory holding costs and costs of devaluation of inventory; whereas, insufficient inventory cause loss of goodwill cost and leads to decrease in profit because of lost sales. These two cases reflect an inventory management problem which is known as *inventory risk* (Kaya and Özer 2009). Let c be the *unit production cost* and p be the *unit selling price* of the product in the market. Assume that units unsold during the single period have no salvage value (as in the case of newspapers). Then, the cost of each unit of excess inventory to the firm is c and is referred to as the *overage cost* c_o whereas the cost of each unit of insufficient inventory is $p - c$ and referred to as the *underage cost* c_u.

Let Q be the quantity that the firm decides to produce. Let $F(.)$ denote the cumulative distribution function of the random demand for the product during the selling season. Then $F(Q)$ represents the probability that realized demand during the selling season will be smaller than Q. Thus the probability of having at least one unsold item at the end of the selling season is $F(Q)$ and the probability of stocking out is $1 - F(Q)$. The corresponding costs are $c_o F(Q)$ and $c_u(1 - F(Q))$. A balancing

quantity between the marginal cost of an additional item and the marginal benefit of a stocked-out item is the optimal quantity that should be produced by the firm; i.e., $c_o F(Q) = c_u(1 - F(Q))$. Hence, the optimum quantity should satisfy the following equation:

$$F(Q) = \frac{c_u}{c_u + c_o}. \tag{1.1}$$

Equation (1.1) is called as the *critical ratio*. The substitution of c_u and c_o values yield the optimal order quantity as follows:

$$Q^I = F^{-1}(\frac{p - c}{p}) \tag{1.2}$$

where F^{-1} is the inverse function of cumulative distribution function.

The same result can be obtained by analyzing the profit function of the firm. The expected sales of the firm is $E[\min(Q, D)]$; the minimum of its production quantity Q and *demand D*. The resulting expected profit is:

$$\Pi^I(Q) = pE[\min(Q, D)] - cQ. \tag{1.3}$$

This function is concave in Q. The optimum quantity that maximizes the profit is:

$$Q^I = F^{-1}(\frac{p - c}{p})$$

which is the same result as Equation (1.2).

Instead of managing both production and distribution simultaneously, the firm might alternatively choose to *disintegrate* the production and the distribution operations. In such a case, production of the product is provided by the manufacturer (he) and the distribution of the product is provided through a retailer (she). In this case, formal *contracts* can be used to align incentives between the members of the channel (i.e., between the manufacturer and the retailer). Contracts are used for defining the

rules of the trade between the channel members. An extended review of the academic literature on contracts can be found in Cachon (2003). For the purpose of this study we only analyze the wholesale price contract and the buyback contract in detail and briefly mention a number of other contract types.

The Wholesale Price Contract

The wholesale price contract is the most commonly used contract type in disintegrated channels because of its ease of application. In the wholesale price contract, the retailer pays a *wholesale price* w per unit ordered to the manufacturer. The retailer decides her order quantity Q by considering the wholesale price offered by the manufacturer. The manufacturer satisfies the retailer's order by producing Q units at a unit production cost of c, and delivers these units to the retailer. The retailer cannot return unsold units to the manufacturer. This contract yields a profit margin of $w-c$ to the manufacturer and a profit margin of $p-w$ to the retailer. The expected profit functions of the manufacturer, the retailer and the total channel are as follows:

$$\Pi_m^w(Q) = (w-c)Q, \tag{1.4a}$$

$$\Pi_r^w(Q) = pE[\min(Q,D)] - wQ, \tag{1.4b}$$

$$\begin{aligned} \Pi_{tot}^w &= \Pi_m^w(Q) + \Pi_r^w(Q), \\ &= pE[\min Q, D] - cQ. \end{aligned} \tag{1.4c}$$

In a disintegrated channel, the profit of the manufacturer is determined by the order quantity of the retailer. Once the retailer decides on Q, the manufacturer's profit is certain. However the retailer's demand quantity is unknown and she decides her order quantity in a way that maximizes her own profit in (1.4b). The resulting

order quantity of the retailer is:

$$Q^w = F^{-1}(\frac{p-w}{p}).$$

Channel Coordination and Double Marginalization

As we mentioned earlier, one purpose of contracts is to achieve channel coordination by preventing double marginalization. In this section, we analyze the efficiency of the wholesale price contract for channel coordination by emphasizing the differences between the results of the vertically integrated channel and the disintegrated channel.

Note that the expression for the total profit of the disintegrated channel in (1.4c) is same as the expression for the total profit of the vertically integrated channel in (1.3), and it is independent of the wholesale price value. Hence in a coordinated channel, the order (or, production) quantity should be equal to the order quantity of the the vertically integrated channel. When we compare the results of the integrated channel to the disintegrated channel under a wholesale price contract, we first observe that the retailer orders a lower number of products than what the integrated channel orders (i.e., $Q^w \leq Q^I$). The underlying reason behind the retailer's decision is the change in the balance of underage and overage costs. The overage cost of the retailer with a wholesale price contract contract (w) is higher than the overage cost of the integrated channel (c). At the same time, the underage cost of the retailer with a wholesale price contract ($p-w$) is lower than the underage cost of the integrated channel ($p-c$). Therefore the retailer's optimal solution is to order a lower quantity compared to the integrated channel. While determining her order quantity, the retailer maximizes her expected profit and ignores the total profit of the channel. In literature, this situation is referred to as double marginalization.

With proper contracting mechanisms, the manufacturer can induce the retailer to order the channel-optimal quantity, leading to maximum total channel profit. The extra profit can be shared by the channel member(s). A contract is classified

as *Pareto improving* if it leads to a profit increase for at least one of the channel members without decreasing the profit of the other channel members. The *efficiency of a contract* is measured by proportioning the total channel profit under the contract to the total profit of the vertically integrated channel. If the ratio is 1 then the channel is said to be *coordinated*. In this case, the channel achieves the maximum possible total profit.

Our analysis regarding the wholesale price contract shows that the wholesale price contract cannot achieve channel coordination. Next we study the buyback contract which is proven to be coordinating in the setting we consider (Cachon 2003).

The Buyback Contract

With a buyback contract, the manufacturer shares some of the retailer's inventory risk due to demand uncertainty. In a buyback contract (w, b), the manufacturer charges a wholesale price w per product and offers to buy the unsold products of the retailer at the end of the season at a buyback price b each. Therefore, the corresponding expected profits of the channel members and the total channel profit are as follows:

$$\Pi_m^b(Q) = (w-c)Q - bE[Q - \min(Q, D)], \tag{1.5a}$$

$$\begin{aligned}\Pi_r^b(Q) &= pE[\min(Q, D)] + bE[Q - \min(Q, D)] - wQ, \\ &= (p-b)E[\min(Q, D)] - (w-b)Q,\end{aligned} \tag{1.5b}$$

$$\Pi_{tot}^b = pE[\min(Q, D)] - cQ. \tag{1.5c}$$

Buyback contracts provide incentive to the retailer to increase her order quantity, and hence the level of product availability by decreasing her cost of overage. The overage cost of the retailer decreases to $w - b$. Considering the costs of underage and overage, the retailer's optimal order quantity becomes:

$$Q^b = F^{-1}(\frac{p-w}{p-b}).$$

Thus the retailer orders more than what she orders with a wholesale price contract. With appropriate choices of w and b, the retailer can be persuaded to order a quantity equal to the integrated channel's production quantity and hence coordination can be achieved. Coordination requires the equality of the critical ratio of the integrated channel and the critical ratio of the disintegrated channel under the buyback contract i.e. $\frac{p-w}{p-b} = \frac{p-c}{p}$. From this equality, the relation between b^b and w of a coordinating buyback contract determined as:

$$b^b = \frac{p(w-c)}{p-c}. \tag{1.6}$$

Buyback contract can also be used as a profit sharing mechanism between the manufacturer and the retailer. Comparing (1.5c) and (1.5b), we observe that the profit of the retailer under buyback contract can be written in terms of the total channel profit. If the contract parameters satisfy

$$(p-b) = \theta p \quad and \quad (w-b) = \theta c$$

then θ represents the retailer's share in total channel profit i.e. $\Pi_r^b(Q) = \theta \Pi_{tot}^b(Q)$.

Any (w, b) pair that satisfies (1.6) is a coordinating contract for the channel. Different values of (w,b^b) lead to different profit and risk sharing strategies. See Kaya and Özer (2009) for detailed analysis.

Other Contract Types

We use the wholesale price contract and the buyback contract in detail in our subsequent analysis. Here we mention some other contracts which are commonly used in literature and in practice. Under a *revenue sharing contract* the retailer shares her sales revenue with the manufacturer in exchange for a reduction in the wholesale price. Under a *sales rebate contract* the manufacturer provides a rebate (a monetary payment) to the retailer for each sold item above a threshold value. Under a *quan-*

tity flexibility contract, the retailer is permitted to change her order quantity after demand is realized. After the retailer determines her order quantity, the manufacturer commits to provide up to a threshold quantity and the retailer commits to buy more than a certain quantity. With a *quantity discount contract*, the wholesale price becomes a decreasing function of the retailer's order quantity. All of these contracts are found to be coordinating in the setting we consider by reallocating the inventory risk and profit between the channel members (Cachon 2003, Kaya and Özer 2009).

The Road Map for the Thesis

As above discussions point out, the manufacturers should manage their channels in a way that they satisfy the needs of consumers while they eliminate the potential conflicts with their retailers. In this research, we study a dual channel setting which consists of an online direct channel and a traditional retailer channel. We focus on the performance of the firms under three channel structures: dual channel, retailer-only channel and direct-only channel and two contracting practices: wholesale price contract and buyback contract. Figure 1.2 illustrates the different channel structure/contract combinations that we consider. As the arrows indicate, beginning with a traditional retailer channel under a wholesale price contract (which is the default setting in most of the traditional academic studies), the manufacturer might prefer to switch to other channel structures such as retailer-only channel under a buyback contract or dual channel under a wholesale price contract. By considering these alternatives, we figure out in which circumstances the manufacturer should prefer opening a direct channel over changing the contract type and vice versa. In addition, we study the efficiency of the buyback contract, which is known to be coordinating in a retailer-only channel structure, in a dual channel structure.

The remainder of the thesis is organized as follows: Section 3 summarizes the related literature. Section 4 describes the dual channel buyback contract model. In Section 5 we analyze the dual channel model under a wholesale price contract. In

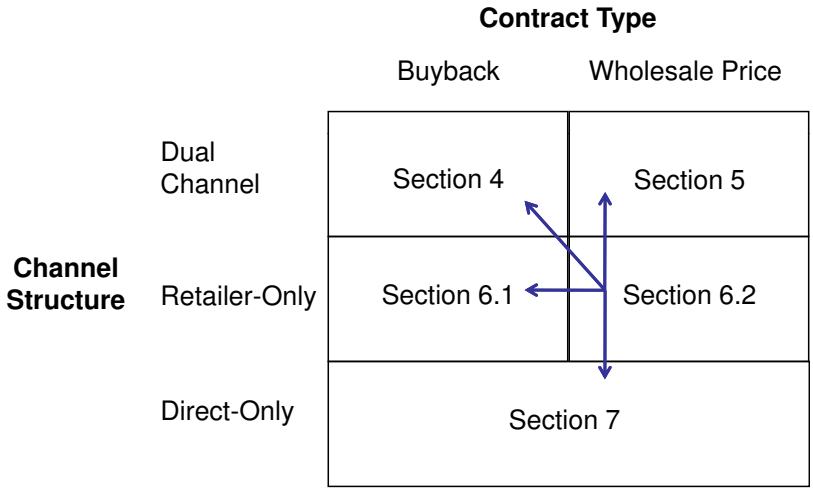

Figure 1.2: Possible Channel Structure/Contract Combinations

Section 6 we analyze the retailer-only channel model and in Section 7 we analyze the direct-only model. Section 8 presents a discussion on our results and Section 9 summarizes the thesis and mentions future research directions.

2 CHAPTER-2

2.1. LITERATURE REVIEW

We summarize the related literature in three related areas: dual channel management, supply chain contracting and consumer behavior.

Tsay et al. (2004a) review several channel structures by focusing on the conflict and coordination issues. The authors classify the existing channel structures under four categories regarding channel control and channel type. A channel can include single or multiple channel types and it can be controlled by the manufacturer or there can be independent intermediaries. Our main interest is on multiple-channel type systems with independent intermediaries.

Most of the papers that study dual channel management focus on price competition between the manufacturer and the retailer. Chiang et al. (2003) examine a dual channel structure under the assumption that customers obtain less value from the direct channel. Their study shows that the dual channel structure is effective in reducing double marginalization by creating a threat for the retailer. Therefore, even in the cases in which the expected sales of the direct channel is zero, it is optimal for the manufacturer to open a direct channel. Yan (2008) improves the work of Chiang et al. (2003) by including the profit sharing approach. Their study shows that a dual channel structure increases the total channel profit but depending on the perceived value of consumers, it may also cause a price war between the manufacturer and the retailer. Yet, the authors indicate that the profit sharing strategy increases the profit of both the manufacturer and the retailer. Avery et al. (2008) study the cannibaliza-

tion and complementarity effects of retailer store openings on catalogue and online channels of the manufacturer. The authors show that in the short term retailer stores cannibalize the sales through catalogues, but in the long term, complementary effects of the retailer stores are observed on both channels.

Rhee et al. (1999) segment the consumers into two as price-sensitive consumers and service-sensitive consumers. Their study show that when the consumers' valuations of retail service is similar in both segments, dual channel is the optimum strategy as a result of higher market coverage and lower wholesale price. But as the valuation of retailer service gets higher, the selling price at the retailer increases which also leads to an increase in the wholesale price. In this case, the manufacturer shuts down the direct channel and focuses only on the retailer channel. Dumrongsiri et al. (2006) change the utility definition of consumer which Chiang et al. (2003) and Yan et al. (2008) use in their models by adding a service quality term. Kumar et al. (2006) segment the consumer population into two: *brand-loyal consumers* and *store-loyal consumers*. Their model also allows the retailer to carry a competing product with the manufacturer's product. Therefore the authors introduce the merchandising support concept which influences the shopping behavior of the store-loyal consumers. Similar to previous studies, they also show that the existence of a competing direct channel improves the retailer performance hence improves the total channel performance.

Cattani et al. (2006) examine the pricing strategies of a retailer and a manufacturer under different strategies. They assume that the manufacturer commits to set the price of the direct channel same with the retailer channel in order to avoid channel conflict. Hendershott et al. (2006) analyze a system where a single manufacturer sells to more than one retailer. Consumers have different valuations for the product, and they search the retailers until they find a sufficiently low price. However, as consumers visit more retailers, their gain from the product decreases. In this setting, he authors show that adding a direct channel decreases the number of retailers in the

market. The retailers that enter the market have a reduced demand and they lower the market price. Bell et al. (2002) examine a model where a physical direct store and an independent retailer's store are located in the same mall. They compare the performance of the retailer in the case of competition with independent retailers with the performance in the case of competition with the manufacturer.

The models we mentioned so far ignore inventory-related issues. Boyaci (2004) studies a dual channel model in which both the retailer channel and the direct channel hold inventories. The manufacturer is assumed to have an infinite supply capacity such that he can instantly supply the demand of both channels. The model allows consumers to search the other channel if there is a stock-out in their first-choice channel. Hence, the manufacturer and the retailer compete both vertically and horizontally. Vertical competition reflects the double marginalization issue whereas horizontal competition reflects the competition due to demand substitution. The substitutability of the product is modeled with a parameter (substitution rate) which shows the fraction of the consumers in a channel who will search for the product in the other channel. Boyaci shows that increasing the double marginalization, i.e., increasing the wholesale price, leads to overstocking in the direct channel whereas it induces the retailer to understock. On the other hand, increasing horizontal competition, i.e., increasing one of the channels' substitution rate leads to overstocking in the other channel. The author also shows that simple contracting mechanisms such as buyback or revenue sharing cannot coordinate the dual channel described in the model.

Chiang et al. (2003) examine a two-echelon dual channel inventory model. The product is available both at the traditional retailer store and an online direct channel. The demand of the retailer channel consumers are satisfied by the on hand inventory of the retailer whereas the demand of online consumer are satisfied by the on-hand inventory of the manufacturer's warehouse. The consumers are allowed to search the other channel in case of a stock-out. The fraction of the consumers who will search the other channel is modeled with a parameter, the search rate. The consumers who will

not search the other channel and who cannot find the product at both channels will be lost. The authors focus on the optimal base-stock levels, inventory holding cost and lost sales cost. They show that inventory holding cost does not affect the base-stock levels of both the direct channel and the retailer channel. On the other hand, an increase in the lost sales cost increases the base-stock levels at both channels. The authors also show that the dual channel strategy performs better than retailer-only and direct-only strategies in most cases.

The second related literature in on supply chain (or, channel) contracts. This literature aims to determine coordinating contracts in different conditions. Cachon (2003) and Kaya and Özer (2009) provide an extensive summary on different contracting mechanisms. Lariviere et al. (2001) examine the efficiency of the wholesale price contract in response to the changes in the properties of demand distribution.

Regarding buyback contract applications, Pasternack (1985) first studied the optimal pricing and return policies for perishable commodities. He showed that unlimited return of retailer's unsold items at partial credit is system-optimal for appropriately chosen wholesale price and buyback price values. Donohue (2000) shows that the buyback contract is also coordinating in a two-mode production environment which allows the retailer to update her forecast and order accordingly. Emmons et al. (1998) study a classical buyback contract model with the difference of the retailer's price-dependent market demand. Lee et al. (2000) examine return policies on products which face price reduction during the selling season. The manufacturer can offer a full protection of the wholesale price reduction regardless of the time that the retailer purchases the product. Alternatively the manufacturer can set a time limit for the return of unsold items or he can offer a limited price protection. The authors show that price protection is coordinating if there is a single order opportunity, whereas it is not coordinating if there are two ordering opportunities.

Other contracting mechanisms are also covered in literature. Cachon et al. (2005) study revenue sharing contracts. The authors show that revenue sharing contracts

coordinate a channel with a single retailer who determines the optimal price and quantity. The study indicates that revenue sharing contracts are equivalent to buy-back contracts in a fixed-price newsvendor setting. Revenue sharing contracts are also found to be coordinating in channels with retailers competing in quantities. Tsay et al. (1999) extend the studies on quantity flexibility contracts by considering an agent which contracts with both a supplier and a retailer, i.e., a manufacturer. Taylor (2002) studies sales rebates contracts. He compares the linear rebate case in which the manufacturer provides a rebate for each sold item with target rebate case in which the manufacturer provides a rebate for the items above a threshold. He observes that in linear rebate case coordination is not achieved. Taylor also studies sales effort effects on rebate contracts. He shows that channel coordination is achieved in quantity and sales effort when rebate and buyback contracts are applied simultaneously. Jeuland et al. (2008) provide a discussion on the quantity discount contracts.

The third related literature stream is the papers that study consumer behavior under different channel structures (Neslin et al. 2006). Kumar et al. (2005) study the consumer characteristics and supplier factors that affect multi-channel purchasing behaviors. Kohli et al. (2004) study the effect of online channel decision support capabilities on consumer decision process. Bhatnagar et al. (2000) determine the factors that differentiate the online channel consumers than traditional channel consumers. Fitzsimons (2000) directs his studies to the consumer responses in case of a stock out.

3 CHAPTER-3

3.1. DUAL CHANNEL-BUYBACK CONTRACT (DB)

In this section, we present the most general form of our model: The dual channel - buyback contract case. The other cases are obtained through simplifications of this case. There is a single manufacturer (he) and a single retailer (she) in the system. The manufacturer sells his product through both the traditional retailer channel and an online direct channel. We model the relation between the firms in three stages: *contracting stage*, *operational decisions stage* and *consumer channel choice stage*. Figure 3.1 illustrates these stages.

At the contracting stage (Stage-1), the manufacturer determines the terms of the contract. At this stage our model differs from Chen et al.'s (2008) model. Unlike that study which uses a wholesale price contract, we use a buyback contract (w, b) with a *wholesale price* w and *buyback price* b. The manufacturer offers this buyback contract to the retailer. The retailer accepts the contract as long as his expected profit is nonnegative.

At the operational decisions stage (Stage-2), the firms play a *simultaneous move operational decisions game*: The retailer decides on her *service level* α without observing the manufacturer's decision and the manufacturer decides on the *delivery lead time* t in the direct channel without observing the retailer's decision. The service level α represents the probability that the retailer does not stock out during the

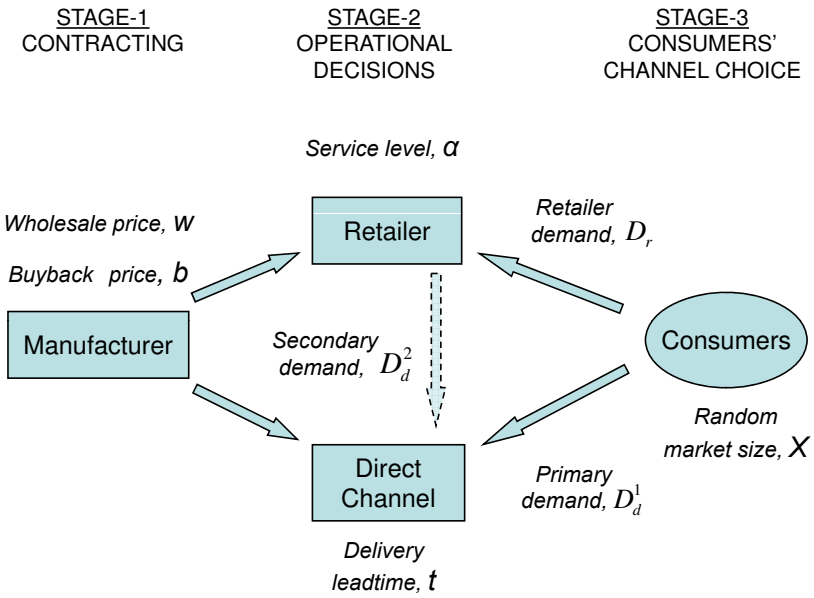

Figure 3.1: Sequence of Events

selling season. This probability corresponds to the Type-1 service level in inventory management (Nahmias 2001). The delivery lead time t represents the time between the placement and delivery of an order. The cost of the direct channel to the manufacturer is m/t^2. Hence, the manufacturer needs to incur a higher cost to offer fast delivery time in the direct channel. Both the manufacturer and the retailer aim to maximize their respective expected profits when making their decisions. Upon deciding on the α value, the retailer places the corresponding order with quantity Q from the manufacturer.

At the third stage (Stage-3), consumers decide which channel to buy from by considering the delivery lead time t offered by the manufacturer, the service level α offered by the retailer and *inconvenience cost of the retailer channel*, k. The inconvenience cost represents the decrease in consumer utility due to visiting the retailer. The *sales price*, p is the same in both channels. That is, we do not consider price competition between the channels.

In a dual channel setting with no price competition, consumers differ from each other by their *time sensitivity index* d which describes the consumers' willingness to

wait. Time sensitivity index is assumed to be uniformly distributed between 0 and 1. A low sensitivity index shows more toleration to longer delivery lead times, therefore the consumers with lower indexes are more likely to prefer the direct channel. The total number of consumers in the market is represented by a random variable X and it is assumed to be uniformly distributed between 0 and a which denotes the maximum size of the market.

We assume that the direct channel can satisfy the demand within the delivery lead time even if there is no on-hand inventory. Therefore there is no lost demand in the direct channel. On the other hand, the demand of the retailer channel is satisfied with the on-hand inventory of the retailer. In case of a stock-out at the retailer channel, the consumers are allowed to search for the product at the direct channel depending on the utility they derive from the direct channel. If they obtain a positive utility from the direct channel, then they purchase the product from the direct channel; otherwise they leave the system without purchasing. If the retailer has unsold stock at the end of the selling season, according the terms of the buyback contract, the manufacturer buys them back at b per unit.

Next we solve this three-stage model using backwards induction. First we analyze the consumer channel choice process at Stage-3. We determine the demand in each channel by using the information we obtained from consumers' channel choice model. Then we determine the Nash equilibrium of the simultaneous-move service game between the manufacturer and the retailer at Stage-2. Finally, at Stage-1, we determine the manufacturer's optimal buyback contract (w, b).

3.1.1 Consumers' Channel Choice

Our main interest when analyzing the consumers' channel choice is to determine how the consumer population will be segmented given the manufacturer and the retailer's decisions from stage 2. To do this, we introduce the utility functions of the consumers from both channels. Then we figure out the expected demands in each channel.

A consumer with time sensitivity index d derives utility u_d from direct channel. The utility obtained from the direct channel is affected by the price of the product p, the consumer's valuation of the product v, and the delivery lead time t decision of the manufacturer. Recall that p and v are exogenously given constants. The utility function of a consumer with time sensitivity index d is:

$$u_d(d) = v - p - dt.$$

In this expression the term dt reflects the decrease in consumer's utility due to waiting the delivery lead time.

The consumers obtain an *expected* utility from the retailer channel because of the probability of stocking out. The expected utility obtained from the retailer channel does not depend on the consumers' time sensitivity index d, and it is given by

$$E[u_r] = \phi(\alpha)\,(v - p) - k.$$

In this formulation, the retailer's *availability level* $\phi(\alpha)$ shows the probability that a consumer can find the product in the store. In our setting, this probability corresponds to the Type-2 service level, or the *fill rate* (Nahmias 2001). Availability level $\phi(\alpha)$ is a direct result of retailer's service level decision α. In order to be operative, the retailer should provide a positive utility to the consumers (i.e., $E[u_r] \geq 0$). Hence, we define the *minimum service level* of the retailer as:

$$\alpha_{min} \equiv \left\{ \alpha \in [0,1] \;\; | \;\; \phi(\alpha) = \frac{k}{v-p} \right\}. \tag{3.1}$$

Comparing the utilities obtained from the channels, we determine three market segments as illustrated in Figure 3.2. First, we determine the index of the consumer who is indifferent between buying from the two channels (d_1) and the index of the consumer who is indifferent between buying from the direct channel or not buying

(d_2). These two consumers act as the boundaries between the three market segments.

$$\begin{aligned} d_1 &\equiv \min\{\{d \mid u_d(d) = E[u_r]\}\ ,\ 1\} \\ &= \min\{[(v-p)(1-\phi(\alpha)) + k]/t\ ,\ 1\}, \\ d_2 &\equiv \min\{\{d \mid u_d(d) = 0\}\ ,\ 1\} \\ &= \min\{(v-p)/t\ ,\ 1\}. \end{aligned} \tag{3.2}$$

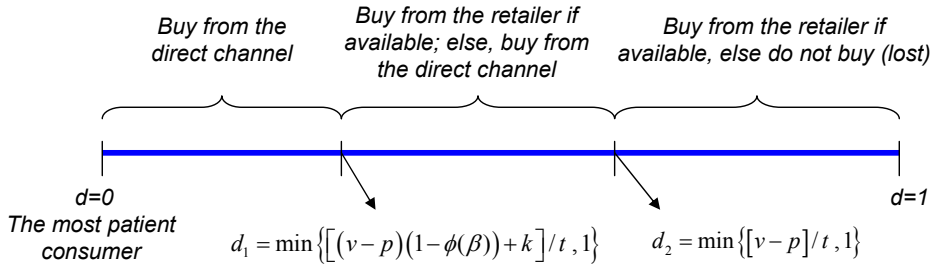

Figure 3.2: Consumer Segmentation

Each consumer prefers the channel which provides higher utility or prefers not to buy the product if both channels provide negative utility. Since the consumers are heterogenous in their channel preferences, we observe three consumer segments. The first segment includes the consumers whose direct channel utility is higher than their retailer channel utility (i.e., $u_d(d) \geq E[u_r]$). Therefore the consumers with time sensitivity index lower than d_1 prefer to buy from the direct channel. These type of consumers constitute the *primary demand* D_d^1 of the direct channel.

The second segment includes the consumers who derive positive utility from both channels while obtaining higher utility from the retailer channel (i.e., $E[u_r] \geq u_d(d) \geq 0$). These are the consumers with time sensitivity index values between d_1 and d_2. Such consumers constitute part of the retail channel demand D_r. These consumers buy the product if it is available in the retailer's store. If the product is not available in the store, the consumers purchase from the direct channel. These type of consumers constitutes the *secondary demand* D_d^2 of the direct channel.

The third segment includes the consumers who derive positive utility from the retailer channel but negative utility from the direct channel (i.e., $u_d \leq 0$). These consumers have a time sensitivity index $d > d_2$. They purchase from the retailer channel if the product is available. Otherwise, they leave the system without purchasing, and constitute the *lost demand* D_l.

Recall that the utility from the retail channel does not depend on the d index of the consumers. That is, either all consumers derive positive utility from the retail channel, or none. Hence, if the retailer channel will be operative, all consumers should be deriving positive utility from that channel. This is different from the situation with the direct channel because consumers with $d > d_2$ do not derive positive utility from the direct channel.

The three-segment case we described above (and Figure 3.2) is the most general case with $0 < d_1 < d_2 < 1$. The number of the segments in the market takes its final form depending on the manufacturer's delivery lead time decision and the retailer's service level decision. The following lemma summarizes the demand allocation and the operational status of the channels depending on the delivery lead time:

Lemma 1 *Random demand in the direct channel and in the retailer are as follows.*

Delivery lead time range	$t \leq t^e$ †	$t \in (t^e\,,\, v-p\,]$	$t \in (v-p\,,\, \infty\,)$	$t \to \infty$
Retailer's status	*inoperative*	*operative*	*operative*	*operative*
Direct channel coverage	*full*	*full*	*partial*	*zero*
Retailer demand (D_r)	0	$(1-d_1)X$	$(1-d_1)X$	X
Primary demand (D_d^1)	X	d_1X	d_1X	$n/a^\dagger$
Secondary demand (D_d^2)	n/a	$[D_r-q]^+$	$\frac{d_2-d_1}{1-d_1}\,[D_r-q]^+$	n/a
Lost demand (D_l)	n/a	0	$\frac{1-d_2}{1-d_1}\,[D_r-q]^+$	$[D_r-q]^+$

† $t^e \equiv (v-p)(1-\phi(\alpha))+k$ *and n/a: not applicable.*

Lemma 1 shows the four possibilities that can be observed in the dual channel structure. By setting t shorter than a threshold value $t^e \equiv (v-p)(1-\phi(\alpha))+k$, the manufacturer may choose to eliminate the retailer. In this case, the delivery lead

time is so short that all consumers prefer to buy from the direct channel. There is no segmentation in the market.

Note that for $t <= v - p$, we have $d_2 = 1$. Hence, all consumers derive positive utility from the direct channel. For these cases, no consumer is lost in the market because they can buy from the direct channel, if not from the retailer. Hence, for $t \in (t^e, v - p)$, we have two segments in the market. Since the time sensitivity index of the consumers is uniformly distributed, the primary demand of the direct channel is equal to $d_1 X$. The retailer's demand consists of the remaining of the market, which is equal to $(1 - d_1)X$. In this case, the consumers who face a stock-out in the retailer channel will meet their need from the direct channel. These consumers constitute the secondary demand of the direct channel and this quantity would be equal to the demand that the retailer cannot satisfy: $[D_r - q]^+$.

The manufacturer can segment the market into three by setting $t > (v - p)$. In this case, $d_2 < 1$ and hence, some consumers derive negative utility from the direct channel. These consumers would be lost if they cannot find the product in the retailer channel. This leads to the three-segment outcome we illustrated in Figure 3.2.

Alternatively, the manufacturer can set the delivery lead time so long that the direct channel becomes inoperative and market remains unsegmented. In this case, all consumers would visit the retailer and the consumers who cannot find the product in the retailer channel would be lost.

Market segmentation is also affected by the service level decision of the retailer. When $t > (v - p)$, if $\phi(\alpha) = k/(v - p)$, there are two segments in the market. The consumers with time sensitivity index $d < d_1$ buy only from the direct channel. The consumers with time sensitivity index $d > d_1$ buy only from the retailer channel as they do not derive positive utility from the direct channel. Hence there is no secondary demand of the direct channel.

3.1.2 Operational Decisions

At Stage-2, first we determine the objective functions of the retailer and the manufacturer. Then, we determine the best response functions of the manufacturer and the retailer to each others' actions and we find the Nash equilibrium of the operational decisions game.

Retailer's Problem

First we determine the expected profit function of the retailer, and then we analyze this function to obtain the retailer's best response function $\alpha^*(t)$ to the manufacturer's delivery lead time decision.

For given buyback contract parameters (w, b) the retailer's expected profit function is:

$$\Pi_r(\alpha) = pE[\min\{D_r, q\}] - wq + b(q - E[\min\{D_r, q\}]).$$

Here the term $E[\min\{D_r, q\}]$ denotes the expected sales of the retailer and the term $(q - E[\min\{D_r, q\}])$ denotes the expected quantity of unsold items at the end of the selling season. Recall that the manufacturer buys back the retailer's unsold inventory at b per unit. Hence the retailer's expected profit consists of her gain from sales, her gain from the manufacturer's buyback payment minus her payment to the manufacturer.

We first determine the order quantity $q(\alpha)$, the availability level $\phi(\alpha)$ and the expected sales of the retailer $E[\min\{D_r, q\}]$ for a given service level α that she determines. From Lemma 1, the retailer's demand D_r is equal to $(1 - d_1)X$ and hence it is uniformly distributed between 0 and $a(1 - d_1)$. The service level decision of the retailer determines the probability that she does not stock out during the selling season; i.e.,

$$Pr(D_r \leq q) = \alpha = \frac{q}{a(1 - d_1)}.$$

Therefore we determine the retailer's optimal order quantity q as

$$q(\alpha) = a\alpha(1 - d_1(\alpha)). \tag{3.3}$$

We define the *availability level* $\phi(\alpha)$ of the retailer as the probability that a consumer finds the product when she visits the retailer. We have

$$\begin{aligned}
\phi(\alpha) &= E[P(\text{A customer finds the product in the retailer store}|D_r)], \\
&= \int_{z=0}^{a(1-d_1(\alpha))} P(\text{find}|D_r = z)\frac{1}{a(1-d_1(\alpha))}dz, \\
&= \int_{z=0}^{q} 1\frac{1}{a(1-d_1(\alpha))}dz + \int_{z=q}^{a(1-d_1(\alpha))} \frac{q}{z}\frac{1}{a(1-d_1(\alpha))}dz.
\end{aligned}$$

By substituting $q(\alpha)$ from (3.3), we obtain

$$\phi(\alpha) = \alpha(1 - ln(\alpha)). \tag{3.4}$$

The expected sales of the retailer is

$$\begin{aligned}
E[\min\{D_r, q\}] &= \int_0^{a\alpha(1-d_1(\alpha))} z\frac{1}{a(1-d_1(\alpha))}dz + \int_{a\alpha(1-d_1(\alpha))}^{a(1-d_1(\alpha))} a\alpha(1-d_1(\alpha))\frac{1}{a(1-d_1(\alpha))}dz, \\
&= a(1-d_1(\alpha))\left(\alpha - \alpha^2/2\right).
\end{aligned}$$

Substituting $q(\alpha) = a\alpha(1 - d_1(\alpha))$, we have

$$E[\min\{D_r, q\}] = q\left(1 - \alpha/2\right). \tag{3.5}$$

We rewrite the expected utility of retailer by substituting values from (3.3), (3.4) and (3.5):

$$\Pi_r(\alpha) = a\alpha(1 - d_1(\alpha))\left(p - w - (p-b)\frac{\alpha}{2}\right). \tag{3.6}$$

We substitute the d_1 value from (3.2) into (3.6) to obtain the retailer's problem

as:

$$\max_{\alpha} \ \Pi_r(\alpha) = \frac{a\alpha}{t}\left(t - k - (v-p)(1-\alpha(1-\ln(\alpha)))\right)\left(p - w - (p-b)\frac{\alpha}{2}\right), \qquad (3.7)$$
$$\text{subject to} \ \ \alpha \in \{0, \ [\alpha_{min}, 1]\}.$$

Note that for $\alpha = 0$, the term $\ln(\alpha)$ is undefined. Therefore consider $\alpha = 0$ as $\alpha = 0 + \epsilon$.

Recall that α_{min} is the minimum service level that the retailer should provide (as defined in (3.1)). Solving the retailer's problem, we determine the retailer's best response as presented in the following Proposition.

Proposition 1 *The retailer's expected profit function has a unique local maximizer in the domain* $(0, \infty)$. *Let* $\alpha_i(t)$ *represent this local maximizer which is decreasing in the wholesale price,* w. *The retailer's best response function is*

$$\alpha^*(t) = \begin{cases} \alpha_{min}, & \textit{for } \alpha_i(t) \leq \alpha_{min}, \\ \alpha_i(t), & \textit{for } \alpha_i(t) \in (\alpha_{min}, 1), \\ 1, & \textit{for } \alpha_i(t) \geq 1, \end{cases}$$

if $\Pi_r(\alpha^*) \geq 0$ *holds. Otherwise, the retailer sets* $\alpha^*(t) = 0$.

Given a buyback contract (w, b), if the retailer's expected profit is nonnegative, the retailer's best response is either setting her service level equal to the minimum service level α_{min} or equal to local maximizer of the retailer's expected profit $\alpha_i(t)$ or equal to 1. The best response service level is found to be a decreasing function of the wholesale price w. Hence, by setting a high wholesale price the manufacturer might enforce the retailer to set her service level equal to the minimum service level α_{min}. The manufacturer might also offer a very high wholesale price which leads to a negative expected profit for the retailer. In such a case, the retailer does not enter the market by setting her service level equal to zero.

Manufacturer's Problem

Here, we first determine the manufacturer's expected profit function. Then we determine the best response delivery lead time $t(\alpha)$ function of the manufacturer to the retailer's α decision.

The profit function of the manufacturer is:

$$\Pi_m(t) = (w-c)q + (p-c)E[D_d^1 + D_d^2] - b(q - E[\min\{D_r, q\}]) - \frac{m}{t^2}.$$

In this expression, the term $(w-c)$ represents the profit margin of the manufacturer for each item that he sells to the retailer. The term $(p-c)$ is his profit margin from the direct channel sales. The term m/t^2 represents the direct channel cost where m is the direct channel cost parameter. Direct channel cost is used to capture the inventory and shipping costs of the direct channel to the manufacturer (which we do not explicitly model) [1]. The manufacturer needs to incur a higher cost if he wants to offer shorter delivery lead time to consumers.

Substituting the expected sales of the retailer from (3.5), we have

$$\max_t \quad \Pi_m(t) = (w - c - \frac{b\alpha}{2})q + (p-c)E[D_d^1 + D_d^2] - \frac{m}{t^2}. \tag{3.8}$$

In order to analyze the manufacturer's problem, we first determine the demand of the direct channel which is a sum of the primary and the secondary demand in that channel. Then, we determine the expressions for the manufacturer's expected profit function in the three t domains discussed in Lemma 1 (except the $t \to \infty$ case). Recall from Lemma 1 that we have differing d_1 and d_2 expressions on these three t domains. The following lemma summarizes the results.

Lemma 2 *The expected sales in the direct channel is* $E[D_d^1 + D_d^2] = (a/2)[\alpha(\alpha - 2)(d_2(\alpha) - d_1(\alpha)) + d_2(\alpha)]$. *The manufacturer's expected profit is a continuous function*

[1] We use the specific function m/t^2 to denote the cost of the direct channel. However, our structural results would follow for other convex decreasing cost function as well.

defined as

$$\Pi_m(t) = \begin{cases} \Pi_m^e(t) \equiv \frac{a}{2}(p-c) - \frac{m}{t^2}, & \text{for } t \le t^e, \\ \Pi_m^a(t) \equiv a(w-c)\alpha + \frac{a(p-c)(1-\alpha)^2}{2} - \frac{ab\alpha^2}{2} + \frac{1}{t}G^a(\alpha) - \frac{m}{t^2}, & \text{for } t \in (t^e, v-p], \\ \Pi_m^u(t) \equiv a(w-c)\alpha - \frac{ab\alpha^2}{2} + \frac{1}{t}G^u(\alpha) - \frac{m}{t^2}, & \text{for } t > v-p, \end{cases}$$

where $G^a(\alpha) \equiv (a\alpha/2)\left[(v-p)(1-\alpha(1-\ln(\alpha))) + k\right]\left[b\alpha + (p-c)(2-\alpha) - 2(w-c)\right]$ *and*
$G^u(\alpha) \equiv [a(p-c)(1-\alpha)^2(v-p)]/2 + (a\alpha/2)\left[(v-p)(1-\alpha(1-\ln(\alpha))) + k\right] \times$
$[b\alpha + (p-c)(2-\alpha) - 2(w-c)]$.

The first profit function represents the case in which the manufacturer eliminates the retailer by setting a very short delivery lead time. The second function represents the *aggressive case* in which the manufacturer ensures that all market is covered by the direct channel (in addition to the retailer) and allows no lost demand. The final function represents the *unaggressive case* in which the direct channel does not cover the whole consumer population (i.e., $d_2 < 1$). Lost demand is possible in this case. Superscript a is used for representing the aggressive case whereas superscript u is used for the unaggressive case. The following lemma further analyzes the profit functions of the manufacturer.

Lemma 3 *(i) The function* $\Pi_m^a(t)$ *is increasing in* t *when* $G^a(\alpha) \le 0$. *It is unimodal with a maximum at* $t_f^a = \frac{2m}{G^a(\alpha)}$ *when* $G^a(\alpha) > 0$.

(ii) The function $\Pi_m^u(t)$ *is increasing in* t *when* $G^u(\alpha) \le 0$. *It is unimodal with a maximum at* $t_f^u = \frac{2m}{G^u(\alpha)}$ *when* $G^u(\alpha) > 0$.

(iii) For $\alpha = 1$, *we have* $\Pi_m^u(t) = \Pi_m^a(t)$.

(iv) For $\alpha < 1$, $\Pi_m^a(t) = \Pi_m^u(t)$ *only for* $t = v - p$. *We have* $\Pi_m^u(t) > \Pi_m^a(t)$ *for* $t < v - p$, *and* $\Pi_m^a(t) > \Pi_m^u(t)$ *for* $t > v - p$.

Lemmas 2 and 3 lead us to determine the best response delivery lead time decision of the manufacturer in response to a given service level α decision of retailer.

Proposition 2 *Given the wholesale price w and the buyback price b, the manufacturer's best response to the retailer's service level α choice is*

$$t^*(\alpha) = \begin{cases} t^e, & \text{if } G^a(\alpha) > 0 \text{ and } t_f^a \leq t^e, \\ t_f^a = \frac{2m}{G^a(\alpha)}, & \text{if } G^a(\alpha) > 0 \text{ and } t_f^a \in (t^e, v-p], \\ v-p, & \text{if } G^u(\alpha) > 0 \text{ and } t_f^u \leq v-p \text{ and } (t_f^a > v-p \text{ or } G^a(\alpha) \leq 0), \\ t_f^u = \frac{2m}{G^u(\alpha)}, & \text{if } G^u(\alpha) > 0 \text{ and } t_f^u > v-p, \\ \infty, & \text{if } G^u(\alpha) \leq 0. \end{cases}$$

There are five types of delivery lead time decisions in the manufacturer's best response. At one extreme, the manufacturer eliminates the retailer by setting a very short delivery lead time; i.e., $t = t^e$. In this case, the manufacturer serves to all consumers which in turn leads to a high direct channel cost m/t^2. At the other extreme, the manufacturer sets a very long delivery lead time; i.e., $t \to \infty$. In this case, the direct channel becomes inoperative and part of the consumer demand is satisfied through the retailer channel depending on the service level decision of the retailer. Alternatively, the manufacturer might set his delivery lead time to one of the two interior solutions: t_f^a for the aggressive case, and t_f^u for the unaggressive case. Finally, there is the boundary solution $t = v - p$ between the aggressive and unaggressive cases.

The Nash Equilibrium

Next, we determine the Nash equilibrium of the operational decisions game between the manufacturer and the retailer for a given buyback contract (w, b). To do so, we simultaneously solve the best response functions that we characterized in Propositions 1 and 2. We could not obtain a closed form solution due to the complexities of the best response functions. Instead, we used the following algorithm to determine the equilibrium numerically.

The algorithm to determine the Nash equilibrium

Set $\delta = 0.01$, $\epsilon = 10^{-6}$, $\Pi_m^* =$ (small number)

(Find the Nash equilibrium of the operational decisions game for a given w and b)

For $i = 1$ to $i =$ number of initial seeds **Do**

Set $j = 0$ and $\alpha_j^* =$ (seed i) and $\alpha_{j+1} = t_{j+1}^* = t_j^* =$ (large number)

While $(\alpha_{j+1}^* - \alpha_j^* > \epsilon$ and $t_{j+1}^* - t_j^* > \epsilon)$ **Do**

$t_{j+1}^*(\alpha_j^*) \leftarrow$ (find the manufacturer's best response to α_j^*),

$\alpha_{j+1}^*(t_{j+1}^*) \leftarrow$ (find the retailer's best response to t_{j+1}^*)

$j \leftarrow j + 1$ (increment j by one)

End While

Report the Nash equilibrium as the pair $(\alpha_j^*(i), t_j^*(i))$

End For i loop

Check whether there are multiple equilibria

$t^* \leftarrow t_j^*(1)$ and $\alpha^* \leftarrow \alpha_j^*(1)$

If $\Pi_m^* \leq \Pi_m^*(t^*)$ (where $\Pi_m(t^*)$ is defined in (3.8))

then $\Pi_m^* \leftarrow \Pi_m(t^*)$ and $w^* \leftarrow w$

$w \leftarrow w + \delta$

Report Π_m^* and the corresponding (t^*, α^*).

The algorithm is an application of the *best response dynamics* methodology (Matsui 1992). At each iteration, the algorithm finds the retailer's best response α value and the manufacturer's best response t value to the the latest action of the other party. The algorithm runs until the (t, α) couple converges to (t^*, α^*). By definition, this (t^*, α^*) is a Nash equilibrium because neither the manufacturer nor the retailer has an incentive to deviate from their actions in this couple as long as the other party does not deviate.

3.1.3 The Contracting Stage

To find the manufacturer's optimal buyback contract parameters (w, b), we perform a grid-search over the wholesale price values $w \in [c, p]$ and the buyback price values $b \in [0, w]$. For a given (w, b) pair, the algorithm which is described in Section 3.1.2 finds the Nash equilibrium. The (w, b) pair for which the Nash equilibrium provides the highest expected profit for the manufacturer is determined as the optimal (w, b) pair contract for the manufacturer.

3.2. DUAL CHANNEL-WHOLESALE PRICE CONTRACT ANALYSIS (DW)

So far, we have analyzed the most general case of all: The dual channel-buyback contract case (DB). Here, we outline the analysis for the dual channel-wholesale price contract case (DW). The only difference from the DB case is the type of contract that the manufacturer offers at Stage-1. At this stage, the manufacturer offers a wholesale price contract with only a wholesale price parameter w, rather than a buyback contract (w, b). Hence, the DW case is simply a special case of the DB case with $b = 0$ forced at Stage-1.

The analysis of this case follows parallel steps with the DB analysis. Lemma 1 characterizes the demand allocations in channels at Stage-3. At Stage-2, for a given wholesale price, the retailer's problem is:

$$\begin{aligned} &\max_{\alpha} \;\; \Pi_r(\alpha) = \frac{a\alpha}{t}\left(t - k - (v-p)(1-\alpha(1-\ln(\alpha)))\right)\left(p - w - p\frac{\alpha}{2}\right), \\ &\text{subject to} \;\; \alpha \in \{0, \;\; [\alpha_{min}, 1]\}. \end{aligned}$$

The manufacturer's problem is

$$\max_{t} \;\; \Pi_m(t) = (w-c)q + (p-c)E[D_d^1 + D_d^2] - \frac{m}{t^2}.$$

Similar to the DB analysis, we find the best response functions of the firms and use these functions to determine the Nash equilibrium at Stage-2 using the algorithm in Section 3.1.2. At Stage-1, we determine the optimal wholesale price w for the manufacturer through a grid search over the wholesale price values $w \in [c, p]$. The wholesale price for which the Nash equilibrium provides the highest manufacturer profit is determined as the optimum wholesale price.

3.3. RETAILER-ONLY ANALYSIS

Most traditional supply chains consist of a manufacturer selling products through a bricks-and-mortar retailer channel. This case is a special case with delivery lead time $t \to \infty$. We study both buyback and wholesale price contract cases in this retailer-only model next.

3.3.1 Retailer-Only Analysis under Buyback Contract (RB)

Recall that the retailer's problem in the most general model DB from (3.7) is as follows:

$$\begin{aligned} &\max_{\alpha} \quad \Pi_r(\alpha) = (a\alpha)(1 - d_1(\alpha))(p - \frac{\alpha(p-b)}{2} - w), \\ &\text{subject to } \alpha \in [\alpha_{min}, 1]. \end{aligned}$$

When we set $t \to \infty$ the problem reduces to

$$\begin{aligned} &\max_{\alpha} \quad \Pi_r(\alpha) = (a\alpha)(p - \frac{\alpha(p-b)}{2} - w), \\ &\text{subject to } \alpha \in [\alpha_{min}, 1]. \end{aligned}$$

In this case the retailer's best response is to set $\alpha^* = \max\left\{\alpha_{min}, \frac{p-w}{p-b}\right\}$. In the absence of the manufacturer, the retailer simply solves the newsvendor problem we

described in Section 1.2.4. In this case, we observe a minimum service level constraint differently from the classic newsvendor problem. Recall that in order to be operative the retailer has to provide at least the minimum service level.

Anticipating the retailer's service level decision, the manufacturer chooses between two strategies. We refer to the first strategy as the *share profit* strategy. With this strategy, the manufacturer sets a low wholesale price, and the retailer responds by setting her optimal service level $\alpha = (p - w)/(p - b)$. In this case, the retailer's expected profit is positive. We refer to the second strategy as the *capture profit* strategy. With this strategy, the manufacturer sets a high wholesale price, and the retailer responds by setting the minimum service level $\alpha = \alpha_{min}$. In this case, the manufacturer captures all profit from the retailer.

In the retailer-only model, the expected profit of the manufacturer is

$$\Pi_m = q(w - c) - b[q - E[sales]] = (w - c)q - bq\alpha/2.$$

We solve the manufacturer's problem using both strategies separately. For the share profit strategy, we assume $\alpha = (p - w)/p$ and for the capture profit strategy, we assume $\alpha = \alpha_{min}$. For each strategy, we conduct a grip search over $w \in [c, p]$ and $b \in [0, w]$ to determine the optimal contract parameters (this is because the manufacturer's profit function fails to be jointly concave in w and b). In the end, we choose the strategy which provides the higher expected profit for the manufacturer.

3.3.2 Retailer-Only Analysis under Wholesale Price Contract (RW)

This case is a special case of the RB case with $b = 0$. Under the wholesale price contract the retailer's problem becomes

$$\max_{\alpha} \quad \Pi_r(\alpha) = \Pi_r(\alpha) = a\alpha(p - p\frac{\alpha}{2} - w),$$
$$\text{subject to } \alpha \in [\alpha_{min}, 1].$$

The minimum service level constraint that we observe in RB model also holds for the RW model. In this case, the retailer's best response is to set $\alpha^* = \max\left\{\alpha_{min}, \frac{p-w}{p}\right\}$. Again, the manufacturer chooses between two strategies, share profit strategy with $\alpha = p - w/p$ and capture profit strategy with $\alpha = \alpha_{min}$. This time, different from the RB case, the manufacturer's profit function is concave in w. Hence, we can determine the manufacturer's optimal w in closed form. The following proposition illustrates the manufacturer's strategy and corresponding results.

Proposition 3 *The manufacturer chooses between two strategies depending on whether* $(p-c) \geq (2+\sqrt{2})p\alpha_{min}$ *holds.*

Condition	$(p-c) \geq (2+\sqrt{2})p\alpha_{min}$	$(p-c) < (2+\sqrt{2})p\alpha_{min}$
Manufacturer's strategy	*Share profit*	*Capture all profit*
Wholesale price w	$\frac{p+c}{2}$	$p(1-\alpha_{min})$
Retailer's service level α	$\frac{p-c}{2p}$	α_{min}
Exp. profit of Manuf. $\Pi_m(w)$	$\frac{a(p-c)^2}{4p}$	$a\alpha_{min}(p-c-\frac{p\alpha_{min}}{2})$
Exp. profit of Retailer $\Pi_r(\alpha)$	$\frac{a(p-c)^2}{8p}$	0

The manufacturer anticipates the service level decision of the retailer and determines his optimal wholesale price value w^* such that he maximizes his own profit. By setting the wholesale price w above a threshold value (i.e., $w = p(1-\alpha_{min})$, the manufacturer may enforce the retailer to set $\alpha = \alpha_{min}$ and captures all the profit.

By setting a wholesale price below the threshold value (i.e, $w = \frac{p+c}{2}$), the the manufacturer may induce the retailer to set $\alpha = \frac{p-c}{2p}$ and share the profit with the retailer.

3.4. DIRECT-ONLY ANALYSIS (DO)

In addition to the dual channel and the retailer-only channel structures the manufacturer might prefer to operate through only his direct channel. In this case, the manufacturer's problem is

$$\max_t \quad \Pi_m(t) = (p-c)E[D_d^1 + D_d^2] - \frac{m}{t^2}.$$

When we substitute the manufacturer's expected sales $E[D_d^1 + D_d^2]$ from Lemma 2 and set $\alpha = 0$ to reflect the elimination of the retailer, we obtain $\Pi_m(t) = (p-c)\frac{a}{2}d_2 - \frac{m}{t^2}$. Substituting d_2 from (3.2), we obtain

$$\Pi_m(t) = \begin{cases} \Pi_m^f(t) \equiv (p-c)\frac{a}{2} - \frac{m}{t^2}, & \text{for } t \leq v-p \text{ (Full Coverage)}, \\ \Pi_m^p(t) \equiv (p-c)\frac{a}{2}\frac{v-p}{t} - \frac{m}{t^2}, & \text{for } t \geq v-p \text{ (Partial Coverage)}. \end{cases}$$

The manufacturer chooses either full coverage or partial coverage to maximize his expected profit. Following proposition summarizes the manufacturer's strategy in the direct-only channel structure.

Proposition 4 *The manufacturer chooses between two strategies depending on whether* $\frac{m}{a} < \frac{(p-c)(v-p)^2}{4}$ *holds.*

Relative Cost	*Condition*	*Coverage*	t^*	$\Pi_m^*(t)$
Low cost	$\frac{m}{a} < \frac{(p-c)(v-p)^2}{4}$	*Full cov.*	$v-p$	$\frac{(p-c)a}{2} - \frac{m}{(v-p)^2}$
High cost	$\frac{m}{a} \geq \frac{(p-c)(v-p)^2}{4}$	*Partial cov.*	$\frac{4m}{(p-c)((v-p))a}$	$\frac{a^2(p-c)^2(v-p)^2}{16m}$

The results show that in the direct-only channel structure, the manufacturer decides on his delivery lead time by considering the relation between the direct channel

cost m and the size of the market a. If the ratio m/a is below the threshold value $\frac{(p-c)(v-p)^2}{4}$, the manufacturer sets a low delivery lead time considering that the direct channel cost is low relative to the market size. If the ratio m/a is above the threshold, he sets a long delivery lead time and provides partial coverage.

4 CHAPTER-4

4.1. RESULTS

In this section, first we explain the solution methodology and the Mathematica code we developed to automate the solution. Second, we provide some of the numerical results and our observations. Third, we discuss the performance of the dual channel buyback contract structure under different parameter combinations. Finally, we compare the total channel performance under different channel structures.

4.1.1 The Mathematica Code

We developed a Mathematica code that solves the model for given values of the five parameters (v, p, k, c, m). The core of the code is the algorithm that we described in Section 3.1.2. The code uses this algorithm to determine the Nash equilibrium of the second stage game for given contact parameters w,b. The code determines the best contract parameters for the manufacturer through a nested grid search over the possible w and b values. Once the optimal contract parameters and the corresponding Nash equilibrium is determined, the code stores the *solution* of the game including the contract parameters, service levels, sales values in channels and the firms' expected profits. The code takes around 5 minutes to determine the solution for a given parameter set.

4.1.2 General Observations

To determine how the five parameters effect the outcome of the game, we solve the model for a number of parameter combinations. As illustrated in Table 4.1, we solved the model for low, medium and high values for each of the five parameters. Note from (7) that the parameters k,v and p need to satisfy $k \leq v - p$ because $\phi(\alpha) < 1$. Also recall the relation $c < p$. Due to these two constraints, the values that c, p and k can take are restricted; hence, the low, medium and high values for these parameters are determined as relative values. We solved the model for $3^5 = 243$ parameter combinations. The results for these runs are provided in Appendix C.

Table 4.1: Low, Medium, High Values of Parameters

m	**v**	**p/v**	**k/(v-p)**	**c/p**
1000	4	0.25	0.125	0
5000	8	0.5	0.5	0.25
10000	12	0.75	0.75	0.5

We observed that the 5-parameter space is partitioned into three equilibrium regions, corresponding to three dual channel strategies for the manufacturer:

Eliminate retailer (ER): In ER, the manufacturer eliminates the retailer and sells only through the direct channel. To do so, the manufacturer sets a high wholesale price w and a low buyback price b, and also a very competitive (i.e., low) delivery lead time t. Hence, the retailer does not enter to the market (or, eliminated). In this case, $d_1 = d_2 = 1$ and we observe only one segment.

Capture-all-profit (CP): In CP, the manufacturer uses both channels but captures all profit from the retailer. The retailer's minimum availability constraint is binding, i.e., she sets the minimum availability level. The manufacturer captures all profit from the retailer by choosing appropriate contract terms w and b. In this case, $d_1 = d_2 < 1$, and hence the market is segmented into two.

Share-profit (SP): In this case, the manufacturer sells through both channels and shares the profit with the retailer. He offers a high w and a high b to the retailer. By doing so, the manufacturer leaves a small profit margin for the retailer and shares

the inventory risk of the retailer. We have $d_1 < d_2 < 1$ and hence, we observe three consumer segments as discussed in Section 3.1.1.

Table 4.2 presents sample results from the 243 runs. Note that each equilibrium type points to three aspects of the solution: market segmentation, profit sharing and channel configuration. For each parameter set, the manufacturer determines the equilibrium type with his wholesale price and buyback price decisions at the contracting stage providing the optimal dual channel strategy for him. Hence, the three equilibrium types correspond to three dual channel strategies for the manufacturer.

Table 4.2: Sample Results from the 243 Run

Parameters					**Decision Variables**				**Profits**		**Sales**			**Eql.**
m	v	p	k	c	w^*	b^*	t^*	α^*	Π_m	Π_r	Direct	Retailer	Lost	Type
1000	12	3	4.50	0.75	2.75	0.00	9	0.19	1113	0	500	0	0	ER
5000	12	6	3.00	3.00	5.45	0.00	6	0.19	1361	0	500	0	0	ER
10000	12	3	1.13	1.50	3.00	0.00	9	0.03	627	0	500	0	0	ER
1000	4	2	1.50	1.00	2.00	2.00	3.79	0.38	306	0	264	146	90	CP
5000	8	4	3.00	2.00	3.55	1.65	4.74	0.38	695	0	422	48	30	CP
10000	8	2	4.50	1.00	2.00	2.00	12.63	0.38	299	0	237	162	101	CP
1000	4	2	1.00	1.00	1.95	1.85	3.94	0.38	291	5	216	189	95	SP
5000	4	3	0.75	1.50	2.95	2.90	27.21	0.50	369	12	17	364	119	SP
10000	8	6	1.50	1.50	5.90	5.85	18.52	0.68	1667	30	45	409	47	SP

4.1.3 Two-Parameter Analysis

Studying the outcome from the 243 runs gave us some insights into how the model parameters affect the outcome of the game. Next, to obtain better insights, we focus on two parameters at a time, and study the results in greater detail in two-dimensional parameter spaces. Although 10 combinations of the parameters are possible, we study only the pairs $m - c$, $p - k$ and $m - v$ as examples.

M-C Analysis

Table 4.3 illustrates the optimal strategy as functions of the direct channel cost m and the unit production cost c for given values of the other three model parameters v, p, k. We observe that for high values of c, the optimal strategy of the manufacturer

turns out to be capture profit. As c value increases, the profit margin gets too low to be shared between the firms. Hence, the manufacturer enforces the retailer to set the minimum service level α_{min}. In cases with small m, if the c value is small as well, then the manufacturer chooses to share the profits with the retailer because for such cases, the profit margin is large enough to share. The manufacturer chooses to operate with two channels to reach the maximum number of consumers. If m value is not low (i.e., for $m > 5000$), operating the direct channel is not cheap and hence the manufacturer chooses to use both channels and shares profits with the retailer.

Table 4.3: Manufacturer's Optimal Channel Strategy under Buyback Contract, when $v = 8$, $p = 4$, $k = 1$

m \ c	**0.00**	**0.25**	**0.50**	**0.75**	**1.00**	**1.25**	**1.50**	**1.75**	**2.00**	**2.25**	**2.50**	**2.75**	**3.00**	**3.25**	**3.50**	**3.75**
25000	SP	SP	SP	SP	SP	SP	SP	SP	SP	SP	SP	SP	SP	SP	SP	CP
22500	SP	SP	SP	SP	SP	SP	SP	SP	SP	SP	SP	SP	SP	SP	SP	CP
20000	SP	SP	SP	SP	SP	SP	SP	SP	SP	SP	SP	SP	SP	SP	SP	CP
17500	SP	SP	SP	SP	SP	SP	SP	SP	SP	SP	SP	SP	SP	SP	SP	CP
15000	SP	SP	SP	SP	SP	SP	SP	SP	SP	SP	SP	SP	SP	SP	SP	CP
12500	SP	SP	SP	SP	SP	SP	SP	SP	SP	SP	SP	SP	SP	SP	SP	CP
10000	SP	SP	SP	SP	SP	SP	SP	SP	SP	SP	SP	SP	SP	SP	SP	CP
7500	SP	SP	SP	SP	SP	SP	SP	SP	SP	SP	SP	SP	SP	SP	SP	CP
5000	SP	SP	SP	ER	ER	ER	ER	ER	ER	ER	ER	SR	SP	SP	SP	CP
2500	SP	SP	ER	ER	ER	ER	ER	ER	ER	ER	ER	ER	ER	ER	SP	CP
0	ER	ER	ER	ER	ER	ER	ER	ER	ER	ER	ER	ER	ER	ER	ER	ER

Figure 4.1 illustrates how the m/c plane is partitioned into three strategy regions. The figure also illustrates how the other model parameters affect the boundaries between these regions. For example, increasing the retailer inconvenience cost k causes the CP region to grow leftward.

Table 4.4 illustrates the details of a number of sample equilibrium results.

Table 4.4: Equilibrium Outcome in the m/c Plane, when $v = 8$, $p = 4$, $c = 1$

Parameters		**Contract Terms**		**Operational Decisions**		**Sales**		**Profits**		**Eql.**
c	m	w	b	t	α	**Direct**	**Retailer**	Π_m	Π_r	**Type**
0.25	2500	4	4	40	1	12	488	1752	0	SP
0.25	5000	3.95	3.95	66.66	1	7	493	1726	25	SP
0.25	10000	4	4	160	1	3	497	1750	0	SP
2.25	2500	3.9	0	4	0.07	500	0	719	0	ER
2.25	5000	3.9	0	4	0.07	500	0	562	0	ER
2.25	10000	3.95	3.85	11.35	0.36	127	240	440	7	SP
3.75	2500	3.9	1.05	10.66	0.07	188	41	30	0	CP
3.75	5000	3.9	1.05	21.32	0.07	94	53	19	0	CP
3.75	10000	3.9	1.05	42.64	0.07	47	59	13	0	CP

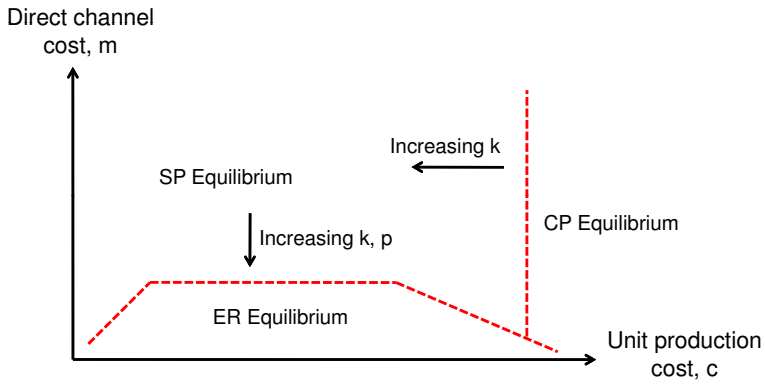

Figure 4.1: Manufacturer's Strategy on the m/c Plane

For a small c value such as $c = 0.25$, the manufacturer aims to reach all consumers because the profit margin is high. He wants the retailer to have very high availability levels such that she will not miss many consumers. To achieve this, the manufacturer sets the wholesale price equal to the buyback price, thus she undertakes all inventory risk of the retailer. The retailer responds by setting service level equal to 1. The manufacturer decides not to use the direct channel as indicated by the high t value and the sales values. While the retailer is responsible for almost all sales, her expected profit is very low or even zero because the wholesale price is close to or equal to the sales price. Hence, this is a special type of the *share profit* equilibrium. Note that this is not a *capture profit* type equilibrium because the retailer's service level is not the minimum service level.

As the c value increases to 2.25, the manufacturer changes his strategy depending on his direct channel cost m. For small values of m, the manufacturer incurs a relatively low cost from the direct channel. Hence, he chooses to sell only through the direct channel by setting a short delivery lead time and eliminates the retailer. However, as m increases the manufacturer uses the retailer channel more.

For sufficiently high values of c, the manufacturer captures the profit of the retailer independent of the direct channel cost m. In this case, there is a small profit margin to be shared between the firms. Hence, the manufacturer enforces the retailer to set

the minimum service level $\alpha = 0.07$ for this parameter combination. As indicated by the low buyback price b, the manufacturer does not share the retailer's inventory risk and the retailer's expected profit is zero.

P-K Analysis

Table 4.5 illustrates the manufacturer's optimal strategy as functions of the unit sales price of the product p and the retailer inconvenience cost k for given values of the other three model parameters v, m, c. In the table, we indicated the parameter combinations that do not satisfy the condition $k \leq (v - p)$ from (3.1) as N/A.

Table 4.5: Manufacturer's Optimal Channel Strategy under Buyback Contract, when $v = 8$, $m = 7500$, $c = 1$

p \ k	**0.75**	**1.25**	**1.75**	**2.25**	**2.75**	**3.25**	**3.75**	**4.25**	**4.75**	**5.25**
4.00	SP	SP	SP	SP	SP	SP	CP	N/A	N/A	N/A
3.75	SP	SP	SP	SP	SP	SP	SP	CP	N/A	N/A
3.50	SP	SP	SP	SP	SP	SP	SP	CP	N/A	N/A
3.25	ER	SP	SP	SP	SP	SP	SP	CP	CP	N/A
3.00	ER	ER	ER	SP	SP	SP	SP	SP	CP	N/A
2.75	ER	ER	ER	ER	SP	SP	SP	SP	CP	CP
2.5	ER	ER	ER	ER	SP	SP	SP	CP	CP	CP
2.25	ER	ER	ER	SP	SP	SP	SP	SP	CP	CP
2.00	ER	SP	SP	SP	SP	SP	SP	CP	CP	CP

We observe that for high k values, the retailer's minimum service level constraint $\alpha_{min} \equiv \left\{\alpha \in [0,1] \;\mid\; \phi(\alpha) = \frac{k}{v-p}\right\}$ becomes binding, leading to the capture-profit strategy for the manufacturer. The eliminate retailer (ER) strategy is observed for moderate values of p, when k is low.

Figure 4.2 illustrates how the other model parameters affect the boundaries between the equilibrium regions.

We observe that the ER region grows if the direct channel cost m decreases. In this case, the manufacturer prefers to use only the direct channel. Similarly, for smaller values of c CP region gets smaller and ER region grows. Increasing v value causes the CP region to grow, due to the minimum availability constraint.

Table 4.6 provides greater detail on a sample result set. For small k values such as $k = 1.25$, the minimum service level of the retailer is low. Hence the retailer

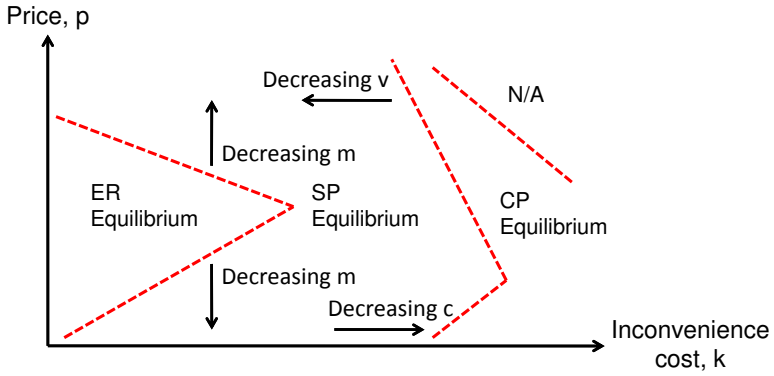

Figure 4.2: Manufacturer's Strategy on the p/k Plane

is a competitor for the manufacturer. In this case, when profit margin is low, i.e., $p = 2.5$ instead of sharing the profit with the retailer, the manufacturer decides to eliminate the retailer. As p increases to 3.5, the manufacturer changes his strategy as share profit. When k increases within the SP region (for example, from 1.25 to 2.75, when $p = 3.5$), the retailer increases her service level to attract consumers (0.54 to 0.56). As a response, the manufacturer decreases the delivery lead time (10.18 to 9.06). Increasing k reduces the quantity sold in the retail channel (324 to 256). If k increases further, then the retailer's minimum service constraint becomes binding and the manufacturer switches to the CP strategy. Observe that for $p = 3.5$, the manufacturer cuts both the wholesale price and the buyback price (significantly) when he switches to the CP strategy.

Table 4.6: Equilibrium Outcome in the p/k Plane, when $v = 8$, $m = 7500$, $c = 1$

Parameters		Contract Terms		Operational Decisions		Sales		Profits		Eql.
p	k	w	b	t	α	Direct	Retailer	Π_m	Π_r	Type
2.50	1.25	2.45	0	5.50	0.06	500	0	502	0	ER
2.50	2.75	2.45	2.35	8.14	0.40	281	161	505	4	SP
2.50	4.25	2	0.05	7.85	0.41	350	97	524	0	CP
3.00	1.25	2.9	0	5.00	0.07	500	0	700	0	ER
3.00	2.75	2.95	2.9	9.73	0.56	188	264	715	8	SP
3.00	4.25	2.95	2.9	8.65	0.58	278	186	745	5	SP
3.50	1.25	3.45	3.4	10.18	0.54	117	324	900	10	SP
3.50	2.75	3.45	3.4	9.06	0.56	194	256	928	8	SP
3.50	4.25	2.35	0.15	9.27	0.69	243	232	978	0	CP

M-V Analysis

Table 4.7 illustrates the optimal strategy of the manufacturer as functions of the direct channel cost m and the customer valuation v for given values of the other three model parameters p, k, c. For small values of v, the retailer's minimum service level constraint becomes binding. Hence the optimal channel strategy turns out to be capture-profit. For small values of m, the manufacturer eliminates the retailer because serving all customers through the direct channel is not expensive. The ER strategy is also observed for the higher values of m when v is high as well. This is because higher v values correspond to higher possible direct channel sales prices, which might offset higher possible direct channel costs.

Table 4.7: Manufacturer's Optimal Channel Strategy under Buyback Contract, when $p = 4$, $k = 1$, $c = 1$

m \ v	**5.0**	**5.5**	**6.0**	**6.5**	**7.0**	**7.5**	**8.0**
25000	CP	SP	SP	SP	SP	SP	SP
22500	CP	SP	SP	SP	SP	SP	SP
20000	CP	SP	SP	SP	SP	SP	SP
17500	CP	SP	SP	SP	SP	SP	SP
15000	CP	SP	SP	SP	SP	SP	SP
12500	CP	SP	SP	SP	SP	SP	SP
10000	CP	SP	SP	SP	SP	SP	SP
7500	CP	SP	SP	SP	SP	SP	SP
5000	CP	SP	SP	SP	SP	SP	ER
2500	CP	SP	SP	SP	ER	ER	ER
0	ER	ER	ER	ER	ER	ER	ER

Figure 4.3 illustrates the partitioning of the m/v plane into types equilibrium.

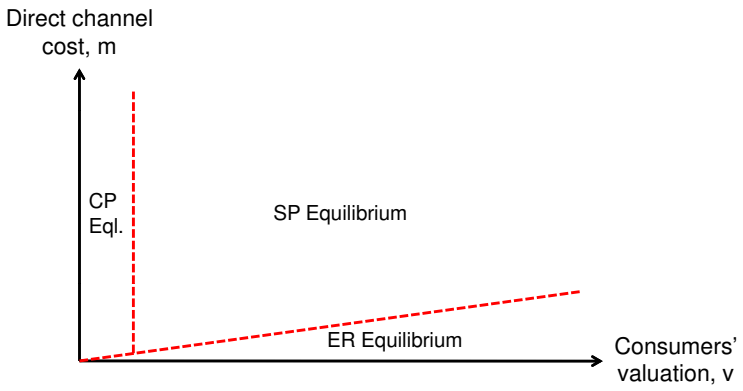

Figure 4.3: Manufacturer's Strategy on the m/v Plane

Table 4.8 provides the details of some of the equilibrium results.

Table 4.8: Equilibrium Outcome in the m/v Plane, when $p = 4$, $k = 1$, $c = 1$

Parameters		Contract Terms		Operational Decisions		Sales		Profits		Eql.
m	v	w	b	t	α	Direct	Retailer	Π_m	Π_r	Type
2500	5	3.95	3.9	10	1	50	450	1025	0	CP
2500	6	3.9	3.85	8.47	0.68	71	393	1119	29	SP
2500	7	3.8	0	3	0.1	500	0	1222	0	ER
2500	8	3.9	0	4	0.06	500	0	1344	0	ER
5000	5	3.95	3.9	20	1	25	475	1012	0	CP
5000	6	3.9	3.85	16.52	0.67	37	418	1099	31	SP
5000	7	3.9	3.85	13.26	0.68	51	411	1112	30	SP
5000	8	3.9	0	4	0.06	500	0	1187	0	ER

For the parameter set $k = 1$, $p = 4$, $c = 1$, when $v = 5$ the availability level $\phi(\alpha)$ turns out to be 1 which in turn makes the minimum service level equal to 1. Hence, for $v = 5$ the optimal channel strategy is CP independent of the m value. With this strategy, the retailer satisfies most of the demand. Given $p = 4$, $w = 3.95$ and $b = 3.9$, the retailer's underage and overage costs both are equal to 0.05. Yet, she has to order quite a large number of products and hence, her expected profit is zero.

As the v value increases to 6, the utilities of consumers increase. This causes an increase in the potential demand of the channels for given α or t values. Therefore, the manufacturer switches from CP to SP strategy. When v increases, the minimum service level decreases as well. This allows the retailer to offer a lower service level (0.67), which is still greater than the min service level. On the other hand, the manufacturer offers lower delivery lead time (i.e., better service to consumers). As a result, the quantity sold in the direct channel increases whereas the quantity sold in the retailer channel decreases. However, most of the sales are still through the retailer. When $m = 5000$, for example, with $p = 4$, $w = 3.9$ and $b = 3.85$, the cost of overage for the retailer is 0.05 per unit, whereas the cost of underage is 0.10 per unit. Yet, the retailer is ordering a lower number of units than in the CP case (418 versus 475). This reduces the inventory risk of the retailer and allows her to expect a positive profit of 31. If v increases further to 7, the manufacturer decreases the delivery lead time more (from 16.52 to 13.26), which causes an increase in the expected direct channel sales (from 37 to 51).

If v increases further to 8, potential demand from consumers increase, hence, the business becomes very profitable compared to the direct channel cost. The manufacturer decides to offer a very short delivery lead time of 4, and eliminates the retailer.

4.1.4 Comparison of Different Channel Structures

Upon completing our analysis on dual channel buyback contract structure, we focus on the comparison of channel efficiency under different structures as shown in Figure 4.4.

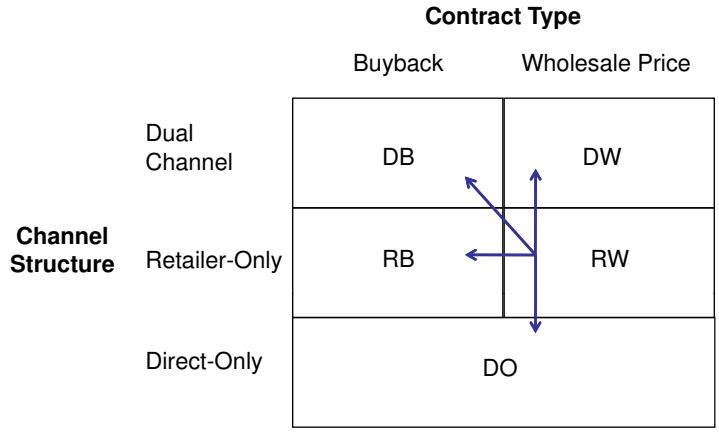

Figure 4.4: Possible Channel Structure/Contract Combinations

We compare the outcome from five structures (channel/contract combinations):

- DO: Direct channel only (hence, no contract)
- RW: Retailer channel only, wholesale price contract
- RB: Retailer channel only, buyback contract
- DW: Dual channel, wholesale price contract
- DB: Dual channel, buyback contract (our main model)

We assume that the default structure is a manufacturer-retailer supply chain with a wholesale contract (i.e, the RW structure). It is known in literature that the manufacturer can improve his profit by switching to a buyback contract (i.e., to RB), because doing so reduces double marginalization. An alternative is to switch to a dual-channel structure under a wholesale price contract (DW). Chen et al. (2008) consider such a model. Switching to the dual channel structure increases the manufacturer's profit because he can now serve different consumers through different channels. In this thesis, in addition to these two structures, we also consider the possibility of manufacturer doing both changes: Switching to the dual channel strategy and to the buyback contract (i.e., to DB strategy). In addition to the manufacturer's profit, we discuss the changes in the retailer's profit, total channel profit and other model results including the operational decisions, contract parameters and sales quantities. The details of these comparisons can be found in Appendices C and D.

Next we analyze the manufacturer's optimal channel structure in $m-c$ plane and $m-v$ plane.

M-C Analysis

Table 4.9 illustrates the total channel profit under different channel structures. We observe that the DB structure provides the highest total channel profit for all parameter combinations in this table. The second best structure is either DW or RB. The RB structure performs quite well for low unit cost c values. For low c values, the total profit margin is high, leading to high losses due to double marginalization. This is why the RB structure, in which the buyback contract mitigates double marginalization, performs well with low c values. With high c values, the loss due to double marginalization is low, and hence, the improvement of RB over RW is not significant. For high c values, switching to a dual channel strategy (to DW) is the better choice. The performance of DO structure depends critically on the direct channel cost m. This structure performs very poor for high m values. The performance of DW struc-

ture also deteriorates when m increases, but not as much as the DO structure because there are now two channels.

Table 4.9: Expected Total Channel Profit under Different Channel Structures for $v = 8$, $p = 4$, $k = 1$

Parameters		Total Channel Profit				
m	c	DO	RW	DW	RB	DB
5000	0	1687.50	1500.00	1687.50	2000.00	2000.00
5000	1.25	1062.50	717.50	1062.50	944.44	1062.50
5000	3.25	112.50	50.78	130.53	69.44	139.62
12500	0	1218.75	1500.00	1401.56	2000.00	2000.00
12500	1.25	405.00	481.56	570.20	625.00	668.71
12500	3.25	45.00	50.78	77.18	69.44	97.56
22500	0	711.11	1500.00	1451.32	2000.00	2000.00
22500	1.25	225.00	481.56	527.23	625.00	650.51
22500	3.25	25.00	50.78	61.37	69.44	85.14

Next, we analyze the expected profits of the manufacturer and the retailer as presented in Table 4.10 and Table 4.11.

Table 4.10: Manufacturer's Expected Profit under Different Channel Structures for $v = 8$, $p = 4$, $k = 1$

Parameters		Manufacturer Profit			
m	c	RW	DW	RB	DB
5000	0	1000.00	1687.50	2000.00	2000.00
5000	1.25	472.50	1062.50	911.11	1062.50
5000	3.25	50.78	130.07	65.28	137.81
12500	0	1000.00	1255.87	2000.00	2000.00
12500	1.25	472.50	704.80	911.11	930.28
12500	3.25	50.78	76.40	65.28	94.01
22500	0	1000.00	1134.73	2000.00	2000.00
22500	1.25	472.50	599.24	911.11	922.24
22500	3.25	50.78	60.50	65.28	81.32

Not surprisingly, the manufacturer's highest profit is in the DB structure, which is the most general structure of all. We compare the manufacturer's performance between the DW and RB structures. From Table 4.10, we observe that manufacturer's profit with RB is generally higher than his profit with DW. DW performs better than RB only when c is high and m is low. Hence, for a manufacturer currently operating in RW, most of the benefits would come from changing the contract to buyback rather than switching to a dual channel strategy. The reverse happens only when m is low and c is high.

From Table 4.11, we observe that the retailer's expected profit under the buyback

Table 4.11: Retailer's Expected Profit under Different Channel Structures for $v = 8$, $p = 4$, $k = 1$

Parameters		Retailer Profit			
m	c	RW	DW	RB	DB
5000	0	500.00	0.00	0.00	0.00
5000	1.25	245.00	0.00	33.33	0.00
5000	3.25	0.00	0.46	4.17	1.82
12500	0	500.00	145.68	0.00	0.00
12500	1.25	245.00	73.58	33.33	31.75
12500	3.25	0.00	0.78	4.17	3.55
22500	0	500.00	316.59	0.00	0.00
22500	1.25	245.00	151.14	33.33	32.43
22500	3.25	0.00	0.87	4.17	3.82

contract structures is generally lower than her expected profit under in the wholesale price structures. This is because the buyback contract gives too much power to the manufacturer. With the buyback contract, the manufacturer has two parameters to obtain profits from the retailer while keeping her in business. With wholesale price contract, he only has one parameter to do so.

Table 4.12: Model Results Under Different Structures in the m/c Plane for $v = 8$, $p = 4$, $k = 1$

	Parameters		Contract Terms		Operational Decisions		Sales		Eql.
Structure	m	c	w	b	t	α	Direct	Retailer	Type
DO	5000	0	-	-	4	-	500	-	-
DO	5000	1.25	-	-	4	-	500	-	-
DO	12500	0	-	-	4	-	500	-	-
DO	12500	1.25	-	-	4.5	-	440	-	-
RW	5000	0	2	-	-	0.5	-	375	-
RW	5000	1.25	2.6	-	-	0.35	-	289	-
RW	12500	0	2	-	-	0.5	-	375	-
RW	12500	1.25	2.6	-	-	0.35	-	289	-
DW	5000	0	3.9	-	4	0.068	500	0	ER
DW	5000	1.25	3.9	-	4	0.068	500	0	ER
DW	12500	0	2.8	-	6.9	0.37	205	211	SP
DW	12500	1.25	3.05	-	7.5	0.26	222	153	SP
RB	5000	0	4	4	-	1	-	500	-
RB	5000	1.25	3.9	3.85	-	0.66	-	444	-
RB	12500	0	4	4	-	1	-	500	-
RB	12500	1.25	3.9	3.85	-	0.66	-	444	-
DB	5000	0	4	4	450	1	0	500	SP
DB	5000	1.25	3.9	0	4	0.068	500	0	ER
DB	12500	0	4	4	450	1	0	500	SP
DB	12500	1.25	3.9	3.85	26	0.68	29	428	SP

So far we have compared profit values between structures. Table 4.12 compares other model results between the five structures for $m = 5000, 12500$ and $c = 0, 1.25$.

M-V Analysis

Table 4.13 illustrates the total channel profits under different channel structures in m/v plane. We observe that similar to the $m - c$ analysis, DB provides the highest total channel profit. The second most profitable channel structure depends on the m value. For small values of m, DW structure performs better than RW structure. On the other hand, for high values of m total channel profit is higher in RB structure.

Table 4.13: Expected Total Channel Profit under Different Structures for $k = 1$, $p = 4$, $c = 1$

Parameters		**Total Channel Profit**				
m	v	**DO**	**RW**	**DW**	**RB**	**DB**
2500	6.5	1100	844	1100	1111	1157
2500	7.5	1296	844	1296	1111	1296
5000	6.5	703	843	911	1111	1136
5000	7.5	1091	843	1091	1111	1148
12500	6.5	281	843	861	1111	1121
12500	7.5	551	843	887	1111	1128
22500	6.5	156	843	863	1111	1117
22500	7.5	306	843	866	1111	1120

Table 4.14 and 4.15 illustrates the respective profits of the manufacturer and the retailer.

Table 4.14: Manufacturer's Expected Profit under Different Channel Structures for $k = 1$, $p = 4$, $c = 1$

Parameters		**Manufacturer's Profit**			
m	v	**RW**	**DW**	**RB**	**DB**
2500	6.5	563	1100	1077	1129
2500	7.5	563	1296	1077	1296
5000	6.5	562	820	1077	1105
5000	7.5	562	1091	1077	1118
12500	6.5	562	666	1077	1089
12500	7.5	562	751	1077	1096
22500	6.5	562	620	1077	1084
22500	7.5	562	666	1077	1088

The manufacturer's profit is also highest under DB structure. As expected, for small values of m DW structure performs better than RW and RB structures. However as m increases, RB becomes more profitable for the manufacturer. Hence for a manufacturer who operates under RW structure, the policy should be opening a direct channel for small m values. For higher m values, the manufacturer should switch to buyback contract under retailer-only structure.

Table 4.15: Retailer's Expected Profit under Different Channel Structures for $k = 1$, $p = 4$, $c = 1$

Parameters		Retailer's Profit			
m	v	RW	DW	RB	DB
2500	6.5	281	0	33	28
2500	7.5	281	0	33	0
5000	6.5	281	91	33	30
5000	7.5	281	0	33	30
12500	6.5	281	195	33	32
12500	7.5	281	136	33	31
22500	6.5	281	243	33	32
22500	7.5	281	199	33	32

Table 4.16: Model Results Under Different Structures in the m/v Plane for $k = 1$, $p = 4$, $c = 1$

	Parameters		Contract Terms		Operational Decisions		Sales		Eql.
Structure	m	v	w	b	t	α	Direct	Retailer	Type
DO	2500	6.5	-	-	2.5	-	500	-	-
DO	2500	7.5	-	-	3.5	-	500	-	-
DO	12500	6.5	-	-	6.6	-	188	-	-
DO	12500	7.5	-	-	4.7	-	468	-	-
RW	2500	6.5	2.5	-	-	0.37	-	305	-
RW	2500	7.5	2.5	-	-	0.37	-	305	-
RW	12500	6.5	2.5	-	-	0.37	-	305	-
RW	12500	7.5	2.5	-	-	0.37	-	305	-
DW	2500	6.5	3.75	-	2.5	0.13	500	0	ER
DW	2500	7.5	3.86	-	3.5	0.08	500	0	ER
DW	12500	6.5	2.65	-	12	0.35	84	249	SP
DW	12500	7.5	2.8	-	8.7	0.32	156	208	SP
RB	2500	6.5	3.9	3.85	-	0.66	-	444	-
RB	2500	7.5	3.9	3.85	-	0.66	-	444	-
RB	12500	6.5	3.9	3.85	-	0.66	-	444	-
RB	12500	7.5	3.9	3.85	-	0.66	-	444	-
DB	2500	6.5	3.9	3.85	7.6	0.69	82	387	SP
DB	2500	7.5	3.85	0	3.5	0.08	500	0	ER
DB	12500	6.5	3.9	3.85	36	0.67	18	432	SP
DB	12500	7.5	3.9	3.85	29	0.67	25	429	SP

Table 4.16 illustrates the other model results for $m = 2500, 12500$ and $c = 6.5, 7.5$.

5 CHAPTER-5

5.1. CONCLUSIONS

In this thesis, we developed a game theoretical model of the dual channel relation between a manufacturer and a retailer. The relation between the firms is governed by a buyback contract. Different from the majority of the literature, the direct channel of the manufacturer and the retailer channel compete not in prices, but in service to consumers. We developed a detailed consumer choice model in which we consider a random number of consumers that are heterogeneous in their channel preference to choose between channels.

We solved the model using analytical and numerical (Mathematica) techniques. We determined three dual channel strategies for the manufacturer. Each strategy outlines how many products will be sold in each channel (in expectation), how the profits will be shared and how the consumer population will be segmented. We illustrated how the manufacturer's optimal strategy changes with respect to changes in the model parameters such as the cost of the direct channel, retailer's inconvenience cost and the sales price of the product.

In addition to studying the manufacturer's dual channel strategy under a buyback contract, we studied four other structures: dual channel with wholesale price contract, direct channel only, retail channel only with buyback contract, retail channel only with wholesale price contract. We compared the results of these structures. As expected, the dual channel buyback contract structure resulted in the highest manufacturer profit. With this structure, the manufacturer has two contract parameters

w,b and his direct channel to modify the retailer's actions. Because of this power, the manufacturer obtains the majority of the profits, leaving the retailer with zero or small profit. The retailer generally prefers the retailer-only channel with wholesale price contract.

We compared the performance of the two options that a manufacturer who operates only through a retail channel with a wholesale price contract has: (1) Switching to a buyback contract, which reduces double marginalization; (2) Switching to a dual channel strategy, which might provide greater market penetration. We determined that the first strategy is generally better than the second. For example, considering two of the model parameters, we find that switching to a dual channel strategy is better only if the cost of the direct channel is low and the unit production cost is high. If the unit production cost is high then for a fixed sales price, the total profit margin is low. In this case, the adverse effect of double marginalization is low, and as a result, the gain from a buyback contract is not high.

Appendix A: Notation

Exogenous Constants

v : Product's value to consumers

p : Selling price at both channels

a : Maximum market size for the product

k : Retailer inconvenience cost

c : Unit production cost

m : Direct channel cost parameter

Decision Variables

$\alpha \in [0, 1]$: Retailer's service level.

Corresponds to:

$\phi(\alpha) \in [0, 1]$: Availability level

$q(\alpha)$: Stocking level

t : Direct channel's delivery lead time

w : Wholesale price

b : Buyback price

Others

$d \in [0, 1]$: Consumer time-sensitivity index

D_d^1 : Primary demand in the direct channel

D_d^2 : Secondary demand in the direct channel

D_r : Demand in the retail channel

X : Market size $\sim UNIF[0, a]$

Appendix B: Proofs

Proof of Lemma 1: The demand of the channels is determined by considering the consumers' channel choice which model is discussed in Section 3.1.1. When one of the channels is inoperative, the operative channel faces all demand, X. When both channels are operative then the demand is allocated depending on the time sensitivity indices of the consumers. Recall that the time sensitivity index is uniformly distributed; i.e., $d \in [0,1]$. Hence the primary demand of the direct channel is $d_1 X$ and the retailer demand is $(1-d_1)X$. In the aggressive case, since there is no lost demand, the secondary demand of the direct channel is $[D_r - q]^+$. In the unaggressive case, part of the demand which is not satisfied through the retailer channel is satisfied by the direct channel. In this case, the secondary demand of the direct channel is $\frac{d_2-d_1}{1-d_1}[D_r - q]^+$ and the lost demand is $\frac{1-d_2}{1-d_1}[D_r - q]^+$.

Proof of Proposition 1: We determine the retailer's best response in four steps. First, we determine the α values which provide $\Pi_r(\alpha) = 0$. Second, we characterize the local maximizer of $\Pi_r(\alpha)$, α_i. Third, we show that the retailer's best response is either to set α_i or one of the boundary values α_{min} and 1. Fourth, we show that the retailer's best response value α^* is decreasing in the wholesale price w.

- **Step-1:** Defining the α values at which $\Pi_r(\alpha) = 0$. Recall that $\Pi_r(\alpha) = a\alpha[1-d_1(\alpha)][p - w - \frac{(p-b)\alpha}{2}]$ (3.6).
  - $\Pi_r(\alpha)$ crosses zero at $\alpha_1 = \frac{2(p-w)}{p-b}$.
  - $\Pi_r(\alpha)$ crosses zero at α values such that $(1-d_1(\alpha)) = 0$. By substituting the d_1 from (3.2), we obtain the following equality: $\alpha(a - \ln(\alpha)) = \frac{v-p+k-t}{v-p}$. Let $\alpha(a - \ln(\alpha) = Z(\alpha)$ and $\frac{v-p+k-t}{v-p} = S$.
    - $\lim_{\alpha \to 0^+} Z(\alpha) = 0$
    - $\frac{\partial Z(\alpha)}{\partial \alpha} > 0$ for $\alpha \in (0,1)$
    - $\frac{\partial Z(\alpha)}{\partial \alpha} = 0$ for $\alpha = 1$

* $\frac{\partial Z(\alpha)}{\partial \alpha} < 0$ for $\alpha \in (1, \infty)$
* $Z(\alpha) = 0$ when $\alpha = e$

Hence

* For $S < 0$, the equation $z(\alpha) = S$ is satisfied by a unique α value $\alpha_2 > e \cong 2.71$
* For $S \geq 0$ and $S \neq 1$, the equation $z(\alpha) = S$ is satisfied by two distinct α values: $\alpha_3 < 1$ and $\alpha_4 \in (1, e)$
* For $S = 1$, the equation $z(\alpha) = S$ is satisfied only by $\alpha = 1$

– This results implies that

* For $v - p - t + k < 0$, the equation $d_1(\alpha) = 1$ is satisfied by $\alpha_2 > e \cong 2.71$
* For $v - p - t + k \geq 0$ and $t \neq k$, the equation $d_1(\alpha) = 1$ is satisfied by $\alpha_3 < 1$ and $\alpha_4 \in (1, e)$ We do not consider the case with $t = k$, because the retailer is eliminated with $t = k$.

- **Step-2:** Defining the unique local maximizer of $\Pi_r(\alpha)$, α_i. Note that $\lim_{\alpha \to \infty} \Pi_r(\alpha) = \infty$ (3.7). We also observe $\frac{\partial \Pi_r(\alpha)}{\partial \alpha} = \frac{a}{2t}[2(w + p(\alpha - 1) - b\alpha)(k - t + v + p(\alpha - 1) - v\alpha) - (p - v)\alpha(4w - 3b\alpha + p(3\alpha - 4)ln(\alpha))]$ which implies $\lim_{\alpha \to 0^+} \frac{\partial \Pi_r(\alpha)}{\partial \alpha} = \frac{a}{t}[(p - w)(t - k - v + p)]$.

  We also observe that $\frac{\partial^4 \Pi_r(\alpha)}{\partial \alpha^4} = \frac{a(v-p)}{t}[\frac{4a(p-b)}{\alpha} + \frac{2(p-w)-(p-b)\alpha}{\alpha^2}] > 0$. Therefore $\frac{\partial^2 \Pi_r(\alpha)}{\partial \alpha^2}$ has a unique minimizer and $\frac{\partial \Pi_r(\alpha)}{\partial \alpha}$ crosses zero *at most* three times.

  Next we characterize the α_i values considering the two cases below.

  – **Case-1:** $v - p - t + k < 0$:

  * $\lim_{\alpha \to 0^+} \frac{\partial \Pi_r(\alpha)}{\partial \alpha} > 0$.
  * $\Pi_r(\alpha)$ crosses zero only at $\alpha_1 = 2(p - w)/p$, and $\alpha_2 > e$. Considering these
    · $\Pi_r(\alpha) \geq 0$ for $\alpha \in (0, \alpha_1)$

· $\Pi_r(\alpha) \leq 0$ for $\alpha \in (\alpha_1, \alpha_2)$

· $\Pi_r(\alpha) \geq 0$ for $\alpha \geq \alpha_2$.

Hence there is at least one local maximizer $\alpha_i \in (0, \alpha_1)$ and one local minimizer $\alpha_j \in (\alpha_1, \alpha_2)$. In addition, both α_i and α_j are unique. To have any other local maximum or minimum, the total number of positive extremum should be 4 contradicting with the fact $\frac{\partial \Pi_r(\alpha)}{\partial \alpha} = 0$ is satisfied at most at three positive α values. Hence, $\Pi_r(\alpha)$ has a unique local maximizer α_i. This maximizer satisfies $\alpha_i \in (0, \alpha_1)$.

– **Case-2:** $v - p - t + k > 0$:

∗ $\lim_{\alpha \to 0^+} \frac{\partial \Pi_r(\alpha)}{\partial \alpha} < 0$.

∗ $\Pi_r(\alpha)$ crosses zero only at $\alpha_1 = 2(p-w)/(p-b)$, $\alpha_3 < 1$ and $\alpha_4 \in (1, e)$.

Depending on the value of α_1, we analyze five possible cases:

∗ $\alpha_1 < \alpha_3 < \alpha_4 < e$

∗ $\alpha_1 = \alpha_3 < \alpha_4 < e$

∗ $\alpha_3 < \alpha_1 < \alpha_4 < e$

∗ $\alpha_3 < \alpha_1 = \alpha_4 < e$

∗ $\alpha_3 < \alpha_4 < \alpha_1 < e$

$\Pi_r(\alpha)$ has a local maximizer α_i and two local minimizers α_{j1} and α_{j2} that satisfy $\alpha_{j1} < \alpha_i < \alpha_{j2}$. Hence, α_i is the unique local maximizer. This maximizer satisfies $\alpha_i \in (0, \max\{\alpha_1, \alpha_3\}]$.

- **Step-3:** Showing that α^* is equal to either α_i, or one of the boundary values α_{min} and 1.

– For Case-1, the maximum α value that satisfies $\Pi_r(\alpha) = 0$ is $\alpha_2 > e$.

– For Case-2, the maximum α value satisfying $\Pi_r(\alpha) = 0$ is $\max(\alpha_1, \alpha_4)$. For both cases $\alpha > 1$ contradicting the fact that $\alpha \in [0, 1]$. Hence, the solution of the retailer's problem in (3.6) is either α_i, or one of the boundary

values α_{min} and 1 such that the retailer's expected profit is nonnegative. Otherwise, the retailer sets $\alpha^* = 0$.

- **Step-4:** Showing α^* decreases in the wholesale price w.
  - $\frac{\partial^2 \Pi_r(\alpha)}{\partial \alpha \, \partial w} = \frac{a}{t}\left[-t + k + (v-p)\left(1 - \alpha\left(1 - 2\ln(\alpha)\right)\right)\right] < 0$ due to $t \geq t^e = (v-p)\left(1-\alpha\left(1-\ln(\alpha)\right)\right) + k$. This inequality holds because the manufacturer does not set $t < t^e$ in the equilibrium.

Proof of Lemma 2: In Lemma 1, we characterize the demand allocation of the direct channel and the retailer channel depending on the delivery lead time decision of the manufacturer. We also determine the retailer's order quantity as $q = a\alpha(1 - d_1(\alpha))$. By substituting these values, we obtain the expected sales of the direct channel. Recall that the expected sales of the direct channel is the sum of the primary and the secondary demand; i.e., $E[D_d^1 + D_d^2]$. For example, when $t \in (v-p, \infty]$,

$$E[D_d^1 + D_d^2] = E[d_1 X] + E[\frac{d_2 - d_1}{1 - d_1}((1-d_1)X - q)]^+ =$$
$$d_1(a/2) + \int_{q=a\alpha(1-d_1(\alpha))}^{a(1-d_1(\alpha))} (d_2 - d_1)/(1-d_1)(z-q)[1/a(1-d_1)]dz.$$

Considering all segmentation cases, we find the expected sales in the direct channel as

$$E[D_d^1 + D_d^2] = \begin{cases} \frac{a}{2}, & \text{for } t \leq t^e, \\ \frac{a}{2}\left(\alpha(\alpha-2)+1\right) - \frac{a}{2t}\alpha(\alpha-2)\left((v-p)(1-\phi(\alpha)) + k\right), & \text{for } t \in (t^e, v-p], \\ \frac{a}{2t}\left(\alpha(\alpha-2)((v-p)\phi(\alpha) - k) + (v-p)\right), & \text{for } t \in (v-p\,,\,\infty), \\ 0, & \text{for } t \to \infty. \end{cases}$$

Finally, we substitute $E[D_d^1 + D_d^2]$, $q = a\alpha(1 - d_1(\alpha))$ and $\phi(\alpha) = \alpha(1 - \ln(\alpha))$ into (3.8) to find the manufacturer's expected profit function. For example, when $t \leq t^e$, we have $q = 0$ because $d_1(\alpha) = 0$. Hence, $\Pi_m(t) = (p-c)a/2 - m/t^2$.

Proof of Lemma 3: For part (i) and (ii), we have similar profit functions. We only analyze one of those functions and represent the function with $\Pi_m(t)$. Note that

$\Pi_m(t) = \frac{G(\alpha)}{t} - \frac{m}{t^2}$ and $\frac{\partial \Pi_m^a(t)}{\partial t} = \frac{-G(\alpha)}{t^2} + \frac{2m}{t^3} = \frac{1}{t^2}(\frac{2m}{t} - G(\alpha))$. The first derivative crosses zero at $t_f = \frac{2m}{G(\alpha)}$. For $G(\alpha) < 0$, we have $\frac{\partial \Pi_m(t)}{\partial t} > 0$ for all $t \in (0, \infty)$, hence $\Pi_m(t)$ is strictly increasing in t. For $G(\alpha) > 0$, we have $\frac{\partial \Pi_m(t)}{\partial t}|_{t \in (0, t_f)} > 0$ and $\frac{\partial \Pi_m(t)}{\partial t}|_{t > \in (t_f, \infty)} < 0$. Hence $\Pi_m(t)$ is unimodal and the maximizer is t_f.

Parts (iii) and (iv) follow from the definitions of the functions $\Pi_m^a(t)$ and $\Pi_m^u(t)$ in Lemma 2.

Proof of Proposition 2: In Lemma 2, we define $\Pi_m(t)$ in three connected regions. To characterize the best response of the manufacturer t^*, we examine $\Pi_m(t)$ in each region. Note that $G^u(\alpha) \geq G^a(\alpha)$. Hence, considering the relation between $G^u(\alpha)$ and $G^a(\alpha)$ we analyze three main cases.

- **Case 1:** When $G^u(\alpha) \geq G^a(\alpha) > 0$, we have $t_f^u \leq t_f^a$. We analyze resulting six sub-cases.

  - When $t_f^a \in (0, t^e]$ and $t_f^u \leq v - p$, $\Pi_m^e(t)$ is increasing and is maximized at $\Pi_m^e(t^e)$. From Lemma 3(i), $\Pi_m^a(t)$ is decreasing in $t \in (t^e, v - p]$ (because $t_f^a < t^e$) and from part (ii) $\Pi_m^u(t)$ is also decreasing in $t \in (v - p, \infty)$. Hence, $\Pi_m(t)$ achieves its maximum at $t^*(\alpha) = t^e$.
  - When $t_f^a \in (t^e, v - p\,]$ and $t_f^u \leq v - p$, $\Pi_m^e(t)$ is increasing; $\Pi_m^a(t)$ is increasing in $t \in (t^e, t_f^a]$ and decreasing thereafter; $\Pi_m^u(t)$ is decreasing in $t \in (v - p, \infty)$. Hence, $t^* = t_f^a$.
  - When $t_f^a \in (v - p, \infty)$ and $t_f^u \leq v - p$, $\Pi_m^e(t)$ is increasing; $\Pi_m^a(t)$ is increasing in $t \in (t^e, v - p]$ and achieves its maximum at $t = v - p$; $\Pi_m^u(t)$ is decreasing in $t \in (v - p, \infty)$. Hence, $t^* = v - p$.
  - Note that sub-cases $t_f^a \in (0, t^e]$, $t_f^u > v - p$; and $t_f^a \in (t^e, v - p\,]$, $t_f^u > v - p$ are not possible because $t_f^u \leq t_f^a$.
  - When $t_f^a \in (v - p, \infty)$ and $t_f^u > v - p$, $\Pi_m^e(t)$ is increasing; $\Pi_m^a(t)$ is increasing in $t \in (t^e, v - p]$ and achieves its maximum at $v - p$; $\Pi_m^u(t)$ is increasing in $t \in (v - p, t_f^u]$ and decreasing thereafter. Hence, $t^* = t_f^u$.

- **Case 2:** When $G^u(\alpha) > 0 \geq G^a(\alpha)$, we have $\Pi_m^e(t)$ and $\Pi_m^a(t)$ increasing in t. Hence, $\Pi_m(t)$ achieves its maximum at $t = v-p$ for $t \leq v-p$. If $t_f^u > v-p$, then $t^*(\alpha) = t_f^u$. Otherwise, $t^*(\alpha) = v-p$ because $\Pi_m^u(t)$ is decreasing in $t \in (t_f^u, \infty)$.

- **Case 3:** When $0 \geq G^u(\alpha) \geq G^a(\alpha)$, we have $\Pi_m^e(t)$, $\Pi_m^a(t)$ and $\Pi_m^u(t)$ all increasing in t. Hence, $\Pi_m(t)$ achieves its maximum at an arbitrarily large t. We denote this maximizer as $t^*(\alpha) \equiv \infty$.

Proof of Proposition 3: The retailer chooses $\alpha^* = \max\left\{\frac{p-w}{p}, \alpha_{min}\right\}$. For the wholesales price values over $w^b = p(1-\alpha_{min})$, the minimum service level is binding and the retailer sets $\alpha^* = \alpha_{min}$. Hence, the retailer's service level decision is

$$\alpha^*(t) = \begin{cases} \frac{p-w}{p}, & \text{for } w \leq w^b \qquad \text{Case-U (Unconstrained),} \\ \alpha_{min}, & \text{for } w > w^b \qquad \text{Case-C (Constrained).} \end{cases}$$

Considering the retailer's service level decision, the manufacturer chooses either Case-U; i.e., $\alpha = \frac{p-w}{p}$ or Case-C; i.e., $\alpha = \alpha_{min}$. Hence, the manufacturer's problem is

$$\begin{aligned} &\max\left\{\max_{w \leq w^b} \ \Pi_m^u, \max_{w > w^b} \ \Pi_m^c\right\}, \\ &\text{subject to } \ \Pi_r \geq 0. \end{aligned} \tag{5.1}$$

- **Case-U:** The manufacturer's profit under this case is $\Pi_m^u = q(w-c) = a\alpha(1-d_1)(w-c)$. Substituting $\alpha = \frac{p-w}{p}$ and $d_1 = 0$ we obtain $\Pi_m^u = \frac{a}{p}(-w^2 + w(p+c) - cp)$. This function is maximized at $w^{*u} = \frac{p+c}{2}$. In this case, the retailer sets $\alpha^*(\frac{p+c}{2}) = \frac{p-c}{2p}$.

- **Case-C:** The manufacturer's profit function under this case is $\Pi_m^u = q(w-c) = a\alpha_{min}(w-c)$. The manufacturer aims to capture the profit of the retailer, hence he sets a wholesale price for which $\Pi_r = \alpha_{min}a(p-w-p\frac{\alpha_{min}}{2}) = 0$ is provided. The resulting wholesale price is $w^{c*} = p(1-\frac{\alpha_{min}}{2})$.

The manufacturer chooses his strategy by comparing his expected profit under Case-U and Case-C. He prefers Case-C if $(p-c) \geq 2p\alpha_{min}$ and $\frac{(p-c)^2}{4p} \geq \alpha_{min}(p - c - \frac{p\alpha_{min}}{2})$. These two conditions reduce to $(p-c) \geq (2+\sqrt{2})p\alpha_{min}$. Hence for $(p-c) \geq (2+\sqrt{2})p\alpha_{min}$, the manufacturer chooses Case-U, otherwise he chooses Case-C.

Proof of Proposition 4: The full coverage profit $\Pi_m^f(t)$ is maximized at $t^{f*} = v - p$. The resulting profit is $\Pi_m^f(t^{f*}) = \frac{a(p-c)}{2} - \frac{m}{(v-p^2)}$.

The partial coverage profit $\Pi_m^p(t)$ is maximized at $t^{p*} = \frac{4m}{(p-c)(v-p)a}$. In that case the profit of the manufacturer is $\Pi_m^p(t^{p*}) = \frac{(p-c)^2(v-p)^2a^2}{16m}$.

In order to provide $t^{p*} \leq v - p$, the inequality $\frac{m}{a} \geq \frac{(p-c)(v-p)^2}{4}$ should hold. In this case $t^* = t^{p*}$ because $\Pi_m^p(t^{p*}) \geq \Pi_m^f(t^{f*})$. In the case that $\frac{m}{a} \leq \frac{(p-c)(v-p)^2}{4}$, t^{p*} becomes infeasible and $t^{f*} = v - p$ is the optimum solution. Hence optimum solution of the manufacturer is

$$t^* = \begin{cases} v-p, & \text{for } \frac{m}{a} \leq \frac{(p-c)(v-p)^2}{4} \quad \text{(Full Coverage)}, \\ \frac{4m}{(p-c)(v-p)a}, & \text{for } \frac{m}{a} \geq \frac{(p-c)(v-p)^2}{4} \quad \text{(Partial Coverage)}. \end{cases}$$

Appendix C: Results of the Buyback Contract

Table 5.1: The Numerical Experiments to Span the Parameter Space DB

Parameters					Decision Variables				Profits		Sales			Eql.
m	**v**	**p**	**k**	**c**	**w**	**b**	**t**	α	Π_m	Π_r	**Direct**	**Retailer**	**Lost**	**Type**
1000	4	1	0.375	0	1	1	∞	1.00	500	0	0	500	0	bco
1000	4	1	0.375	0.25	0.95	0.9	7.17	0.54	265	11	87	351	63	bco
1000	4	1	0.375	0.5	0.95	0.8	4.74	0.29	140	4	236	170	94	bco
1000	4	1	1.5	0	1	1	∞	1.00	500	0	0	500	0	bco
1000	4	1	1.5	0.25	0.95	0.9	6.23	0.55	275	9	168	280	52	bco
1000	4	1	1.5	0.5	0.95	0.85	5.20	0.39	147	5	243	177	80	bco
1000	4	1	2.25	0.00	1.00	1.00	∞	1.00	500	0	0	500	0	bco
1000	4	1	2.25	0.25	0.95	0.9	5.76	0.57	282	7	231	224	45	bco
1000	4	1	2.25	0.5	1	1	5.05	0.38	157	0	297	126	78	sqz
1000	4	2	0.25	0	2	2	∞	1.00	1000	0	0	500	0	bco
1000	4	2	0.25	0.5	1.95	1.9	5.39	0.53	537	11	78	353	69	bco
1000	4	2	0.25	1	1.95	1.85	4.33	0.36	277	7	147	244	109	bco
1000	4	2	1	0	2	2	∞	1.00	1000	0	0	500	0	bco
1000	4	2	1	0.5	1.95	1.9	4.75	0.54	552	9	148	292	60	bco
1000	4	2	1	1	1.95	1.85	3.94	0.38	291	5	216	189	95	bco
1000	4	2	1.5	0	2	2	∞	1.00	1000	0	0	500	0	bco
1000	4	2	1.5	0.5	1.9	1.85	5.26	0.71	564	23	155	319	26	bco
1000	4	2	1.5	1	2	2	3.79	0.38	306	0	264	146	90	sqz
1000	4	3	0.125	0	3	3	∞	1.00	1500	0	0	500	0	bco
1000	4	3	0.125	0.75	2.9	2.85	12.70	0.67	808	33	11	440	49	bco
1000	4	3	0.125	1.5	2.95	2.9	8.46	0.51	376	12	26	368	106	bco
1000	4	3	0.5	0	3	3	∞	1.00	1500	0	0	500	0	bco
1000	4	3	0.5	0.75	2.9	2.85	8.63	0.68	816	31	35	419	46	bco
1000	4	3	0.5	1.5	2.95	2.9	6.40	0.51	387	11	57	344	99	bco
1000	4	3	0.75	0	3	3	∞	1.00	1500	0	0	500	0	bco
1000	4	3	0.75	0.75	2.9	2.85	7.09	0.68	823	30	58	398	44	bco
1000	4	3	0.75	1.5	2.95	2.9	5.48	0.52	395	10	84	321	95	bco
1000	8	2	0.75	0	2	2	∞	1.00	1000	0	0	500	0	bco
1000	8	2	0.75	0.5	2	0	6.00	0.03	722	0	500	0	0	elm
1000	8	2	0.75	1	2	0	6.00	0.03	472	0	500	0	0	elm
1000	8	2	3	0	2	2	∞	1.00	1000	0	0	500	0	bco
1000	8	2	3	0.5	1.85	0	6.00	0.19	722	0	500	0	0	elm
1000	8	2	3	1	1.85	0	6.00	0.19	472	0	500	0	0	elm
1000	8	2	4.5	0	2	2	∞	1.00	1000	0	0	500	0	bco
1000	8	2	4.5	0.5	1.65	0	6.00	0.38	722	0	500	0	0	elm
1000	8	2	4.5	1	1.65	0	6.00	0.38	472	0	500	0	0	elm
1000	8	4	0.5	0	4	4	∞	1.00	2000	0	0	500	0	bco
1000	8	4	0.5	1	3.95	0	4.00	0.03	1437	0	500	0	0	elm
1000	8	4	0.5	2	3.95	0	4.00	0.03	937	0	500	0	0	elm
1000	8	4	2	0	4	4	∞	1.00	2000	0	0	500	0	bco
1000	8	4	2	1	3.65	0	4.00	0.19	1437	0	500	0	0	elm
1000	8	4	2	2	3.65	0	4.00	0.19	937	0	500	0	0	elm
1000	8	4	3	0	4	4	∞	1.00	2000	0	0	500	0	bco
1000	8	4	3	1	3.25	0	4.00	0.38	1438	0	500	0	0	elm
1000	8	4	3	2	3.25	0	4.00	0.38	938	0	500	0	0	elm

Parameters					Decision Variables				Profits		Sales			Eql.
m	**v**	**p**	**k**	**c**	**w**	**b**	**t**	α	Π_m	Π_r	**Direct**	**Retailer**	**Lost**	**Type**
1000	8	6	0.25	0	6	6	∞	1.00	3000	0	0	500	0	bco
1000	8	6	0.25	1.5	5.95	0	2.00	0.03	2000	0	500	0	0	elm
1000	8	6	0.25	3	5.95	0	2.00	0.03	1250	0	500	0	0	elm
1000	8	6	1	0	6	6	∞	1.00	3000	0	0	500	0	bco
1000	8	6	1	1.5	5.45	0	2.00	0.19	2000	0	500	0	0	elm
1000	8	6	1	3	5.45	0	2.00	0.19	1250	0	500	0	0	elm
1000	8	6	1.5	0	6	6	∞	1.00	3000	0	0	500	0	bco
1000	8	6	1.5	1.5	4.9	0	2.00	0.38	2000	0	500	0	0	elm
1000	8	6	1.5	3	4.9	0	2.00	0.38	1250	0	500	0	0	elm
1000	12	3	1.125	0	3	3	∞	1.00	1500	0	0	500	0	bco
1000	12	3	1.125	0.75	3	0	9.00	0.03	1113	0	500	0	0	elm
1000	12	3	1.125	1.5	3	0	9.00	0.03	738	0	500	0	0	elm
1000	12	3	4.5	0	3	3	∞	1.00	1500	0	0	500	0	bco
1000	12	3	4.5	0.75	2.75	0	9.00	0.19	1113	0	500	0	0	elm
1000	12	3	4.5	1.5	2.75	0	9.00	0.19	738	0	500	0	0	elm
1000	12	3	6.75	0	3	3	∞	1.00	1500	0	0	500	0	bco
1000	12	3	6.75	0.75	2.45	0	9.00	0.38	1113	0	500	0	0	elm
1000	12	3	6.75	1.5	2.45	0	9.00	0.38	738	0	500	0	0	elm
1000	12	6	0.75	0	6	6	∞	1.00	3000	0	0	500	0	bco
1000	12	6	0.75	1.5	5.95	0	6.00	0.03	2222	0	500	0	0	elm
1000	12	6	0.75	3	5.95	0	6.00	0.03	1472	0	500	0	0	elm
1000	12	6	3	0	6	6	∞	1.00	3000	0	0	500	0	bco
1000	12	6	3	1.5	5.45	0	6.00	0.19	2222	0	500	0	0	elm
1000	12	6	3	3	5.45	0	6.00	0.19	1472	0	500	0	0	elm
1000	12	6	4.5	0	6	6	∞	1.00	3000	0	0	500	0	bco
1000	12	6	4.5	1.5	4.9	0	6.00	0.38	2222	0	500	0	0	elm
1000	12	6	4.5	3	4.9	0	6.00	0.38	1472	0	500	0	0	elm
1000	12	9	0.375	0	9	9	∞	1.00	4500	0	0	500	0	bco
1000	12	9	0.375	2.25	8.9	0	3.00	0.03	3264	0	500	0	0	elm
1000	12	9	0.375	4.5	8.9	0	3.00	0.03	2139	0	500	0	0	elm
1000	12	9	1.5	0	9	9	∞	1.00	4500	0	0	500	0	bco
1000	12	9	1.5	2.25	8.2	0	3.00	0.19	3264	0	500	0	0	elm
1000	12	9	1.5	4.5	8.2	0	3.00	0.19	2139	0	500	0	0	elm
1000	12	9	2.25	0	9	9	∞	1.00	4500	0	0	500	0	bco
1000	12	9	2.25	2.25	7.3	0	3.00	0.38	3264	0	500	0	0	elm
1000	12	9	2.25	4.5	7.3	0	3.00	0.38	2139	0	500	0	0	elm
5000	4	1	0.375	0	1	1	∞	1.00	500	0	0	500	0	bco
5000	4	1	0.375	0.25	0.9	0.85	58.26	0.67	246	33	7	442	51	bco
5000	4	1	0.375	0.5	0.95	0.9	40.70	0.51	116	12	17	371	113	bco
5000	4	1	1.5	0	1	1	∞	1.00	500	0	0	500	0	bco
5000	4	1	1.5	0.25	0.9	0.85	36.91	0.67	249	32	25	427	49	bco
5000	4	1	1.5	0.5	0.95	0.9	30.22	0.51	118	12	36	355	109	bco
5000	4	1	2.25	0	1	1	∞	1.00	500	0	0	500	0	bco
5000	4	1	2.25	0.25	0.9	0.85	29.62	0.68	251	31	42	411	47	bco
5000	4	1	2.25	0.5	1	1	25.27	0.38	126	0	59	273	168	sqz

Parameters					Decision Variables				Profits		Sales			Eql.
m	**v**	**p**	**k**	**c**	**w**	**b**	**t**	α	Π_m	Π_r	**Direct**	**Retailer**	**Lost**	**Type**
5000	4	2	0.25	0	2	2	∞	1.00	1000	0	0	500	0	bco
5000	4	2	0.25	0.5	1.9	1.85	46.05	0.67	525	33	6	442	52	bco
5000	4	2	0.25	1	1.95	1.9	31.10	0.51	243	12	15	371	114	bco
5000	4	2	1	0	2	2	∞	1.00	1000	0	0	500	0	bco
5000	4	2	1	0.5	1.9	1.85	30.77	0.67	528	32	20	430	50	bco
5000	4	2	1	1	1.95	1.9	23.49	0.51	247	12	31	358	111	bco
5000	4	2	1.5	0	2	2	∞	1.00	1000	0	0	500	0	bco
5000	4	2	1.5	0.5	1.9	1.85	25.17	0.67	531	31	33	418	49	bco
5000	4	2	1.5	1	2	2	18.95	0.38	250	0	53	277	171	sqz
5000	4	3	0.125	0	3	3	∞	1.00	1500	0	0	500	0	bco
5000	4	3	0.125	0.75	2.9	2.85	61.91	0.67	802	33	2	444	54	bco
5000	4	3	0.125	1.5	2.95	2.9	41.36	0.50	365	12	6	374	121	bco
5000	4	3	0.5	0	2.95	2.95	800.00	1.00	1475	25	0	500	0	bco
5000	4	3	0.5	0.75	2.9	2.85	42.30	0.67	803	33	7	439	54	bco
5000	4	3	0.5	1.5	2.95	2.9	31.54	0.50	368	12	12	369	120	bco
5000	4	3	0.75	0	3	3	∞	1.00	1500	0	0	500	0	bco
5000	4	3	0.75	0.75	2.9	2.85	34.90	0.67	805	33	12	435	53	bco
5000	4	3	0.75	1.5	2.95	2.9	27.21	0.50	369	12	17	364	119	bco
5000	8	2	0.75	0	2	2	∞	1.00	1000	0	0	500	0	bco
5000	8	2	0.75	0.5	2	0	6.00	0.03	611	0	500	0	0	elm
5000	8	2	0.75	1	2	0	6.00	0.03	361	0	500	0	0	elm
5000	8	2	3	0	2	2	∞	1.00	1000	0	0	500	0	bco
5000	8	2	3	0.5	1.85	0	6.00	0.19	611	0	500	0	0	elm
5000	8	2	3	1	1.85	0	6.00	0.19	361	0	500	0	0	elm
5000	8	2	4.5	0	2	2	∞	1.00	1000	0	0	500	0	bco
5000	8	2	4.5	0.5	1.65	0	6.00	0.38	611	0	500	0	0	elm
5000	8	2	4.5	1	2	2	6.32	0.38	361	0	475	16	10	sqz
5000	8	4	0.5	0	4	4	∞	1.00	2000	0	0	500	0	bco
5000	8	4	0.5	1	3.95	0	4.00	0.03	1187	0	500	0	0	elm
5000	8	4	0.5	2	3.95	0	4.00	0.03	687	0	500	0	0	elm
5000	8	4	2	0	4	4	∞	1.00	2000	0	0	500	0	bco
5000	8	4	2	1	3.65	0	4.00	0.19	1187	0	500	0	0	elm
5000	8	4	2	2	3.65	0	4.00	0.19	687	0	500	0	0	elm
5000	8	4	3	0	4	4	∞	1.00	2000	0	0	500	0	bco
5000	8	4	3	1	3.95	3.9	6.13	0.59	1197	5	285	186	29	bco
5000	8	4	3	2	3.55	1.65	4.74	0.38	695	0	422	48	30	sqz
5000	8	6	0.25	0	6	6	∞	1.00	3000	0	0	500	0	bco
5000	8	6	0.25	1.5	5.9	5.85	16.47	0.68	1657	33	16	438	46	bco
5000	8	6	0.25	3	5.9	5.75	8.28	0.42	783	18	68	303	128	bco
5000	8	6	1	0	6	6	∞	1.00	3000	0	0	500	0	bco
5000	8	6	1	1.5	5.9	5.85	11.38	0.68	1679	30	53	406	41	bco
5000	8	6	1	3	5.9	5.75	7.10	0.42	812	16	114	267	119	bco
5000	8	6	1.5	0	6	6	∞	1.00	3000	0	0	500	0	bco
5000	8	6	1.5	1.5	5.9	5.85	9.41	0.69	1699	28	88	374	38	bco
5000	8	6	1.5	3	5.95	5.9	7.00	0.53	837	9	130	291	79	bco

Parameters					Decision Variables				Profits		Sales			Eql.
m	**v**	**p**	**k**	**c**	**w**	**b**	**t**	α	Π_m	Π_r	**Direct**	**Retailer**	**Lost**	**Type**
5000	12	3	1.125	0	3	3	∞	1.00	1500	0	0	500	0	bco
5000	12	3	1.125	0.75	3	0	9.00	0.03	1063	0	500	0	0	elm
5000	12	3	1.125	1.5	3	0	9.00	0.03	688	0	500	0	0	elm
5000	12	3	4.5	0	3	3	∞	1.00	1500	0	0	500	0	bco
5000	12	3	4.5	0.75	2.75	0	9.00	0.19	1063	0	500	0	0	elm
5000	12	3	4.5	1.5	2.75	0	9.00	0.19	688	0	500	0	0	elm
5000	12	3	6.75	0	3	3	∞	1.00	1500	0	0	500	0	bco
5000	12	3	6.75	0.75	2.45	0	9.00	0.38	1063	0	500	0	0	elm
5000	12	3	6.75	1.5	2.45	0	9.00	0.38	688	0	500	0	0	elm
5000	12	6	0.75	0	6	6	∞	1.00	3000	0	0	500	0	bco
5000	12	6	0.75	1.5	5.95	0	6.00	0.03	2111	0	500	0	0	elm
5000	12	6	0.75	3	5.95	0	6.00	0.03	1361	0	500	0	0	elm
5000	12	6	3	0	6	6	∞	1.00	3000	0	0	500	0	bco
5000	12	6	3	1.5	5.45	0	6.00	0.19	2111	0	500	0	0	elm
5000	12	6	3	3	5.45	0	6.00	0.19	1361	0	500	0	0	elm
5000	12	6	4.5	0	5.95	5.95	88.89	1.00	2976	24	25	475	0	bco
5000	12	6	4.5	1.5	4.9	0	6.00	0.38	2111	0	500	0	0	elm
5000	12	6	4.5	3	4.9	0	6.00	0.38	1361	0	500	0	0	elm
5000	12	9	0.375	0	9	9	∞	1.00	4500	0	0	500	0	bco
5000	12	9	0.375	2.25	8.9	0	3.00	0.03	2819	0	500	0	0	elm
5000	12	9	0.375	4.5	8.9	0	3.00	0.03	1694	0	500	0	0	elm
5000	12	9	1.5	0	9	9	∞	1.00	4500	0	0	500	0	bco
5000	12	9	1.5	2.25	8.2	0	3.00	0.19	2819	0	500	0	0	elm
5000	12	9	1.5	4.5	8.2	0	3.00	0.19	1694	0	500	0	0	elm
5000	12	9	2.25	0	9	9	∞	1.00	4500	0	0	500	0	bco
5000	12	9	2.25	2.25	7.3	0	3.00	0.38	2819	0	500	0	0	elm
5000	12	9	2.25	4.5	7.3	0	3.00	0.38	1694	0	500	0	0	elm
10000	4	1	0.375	0	1	1	∞	1.00	500	0	0	500	0	bco
10000	4	1	0.375	0.25	0.9	0.85	115.37	0.67	245	33	4	443	53	bco
10000	4	1	0.375	0.5	0.95	0.9	80.68	0.50	114	12	8	373	119	bco
10000	4	1	1.5	0	1	1	∞	1.00	500	0	0	500	0	bco
10000	4	1	1.5	0.25	0.9	0.85	73.26	0.67	247	33	12	435	52	bco
10000	4	1	1.5	0.5	0.95	0.9	60.11	0.50	115	12	18	365	117	bco
10000	4	1	2.25	0	0.95	0.95	355.56	1.00	475	25	3	497	0	bco
10000	4	1	2.25	0.25	0.9	0.85	58.87	0.67	248	32	21	428	51	bco
10000	4	1	2.25	0.5	1	1	50.54	0.38	122	0	30	291	179	sqz
10000	4	2	0.25	0	2	2	∞	1.00	1000	0	0	500	0	bco
10000	4	2	0.25	0.5	1.9	1.85	91.31	0.67	524	33	3	443	54	bco
10000	4	2	0.25	1	1.95	1.9	61.73	0.50	240	12	7	373	120	bco
10000	4	2	1	0	2	2	∞	1.00	1000	0	0	500	0	bco
10000	4	2	1	0.5	1.9	1.85	61.14	0.67	525	33	10	437	53	bco
10000	4	2	1	1	1.95	1.9	46.76	0.50	242	12	16	366	118	bco
10000	4	2	1.5	0	2	2	∞	1.00	1000	0	0	500	0	bco
10000	4	2	1.5	0.5	1.9	1.85	50.07	0.67	527	32	17	431	52	bco
10000	4	2	1.5	1	1.95	1.9	40.23	0.50	244	12	23	360	117	bco

Parameters					Decision Variables				Profits		Sales			Eql.
m	**v**	**p**	**k**	**c**	**w**	**b**	**t**	α	Π_m	Π_r	**Direct**	**Retailer**	**Lost**	**Type**
10000	4	3	0.125	0	3	3	∞	1.00	1500	0	0	500	0	bco
10000	4	3	0.125	0.75	2.9	2.85	123.41	0.67	801	33	1	444	55	bco
10000	4	3	0.125	1.5	2.95	2.9	82.48	0.50	364	12	3	374	123	bco
10000	4	3	0.5	0	2.95	2.95	1600.00	1.00	1475	25	0	500	0	bco
10000	4	3	0.5	0.75	2.9	2.85	84.38	0.67	802	33	4	442	55	bco
10000	4	3	0.5	1.5	2.95	2.9	62.97	0.50	365	12	6	372	122	bco
10000	4	3	0.75	0	3	3	∞	1.00	1500	0	0	500	0	bco
10000	4	3	0.75	0.75	2.9	2.85	69.67	0.67	802	33	6	440	54	bco
10000	4	3	0.75	1.5	2.95	2.9	54.37	0.50	366	12	9	370	122	bco
10000	8	2	0.75	0	2	2	∞	1.00	1000	0	0	500	0	bco
10000	8	2	0.75	0.5	1.9	1.85	32.47	0.68	534	32	24	435	41	bco
10000	8	2	0.75	1	1.95	1.85	14.31	0.36	271	7	135	247	118	bco
10000	8	2	3	0	2	2	∞	1.00	1000	0	0	500	0	bco
10000	8	2	3	0.5	1.9	1.85	21.46	0.69	548	28	83	383	34	bco
10000	8	2	3	1	1.95	1.85	13.02	0.37	284	5	197	197	106	bco
10000	8	2	4.5	0	2	2	∞	1.00	1000	0	0	500	0	bco
10000	8	2	4.5	0.5	1.9	1.85	17.42	0.70	560	24	141	331	29	bco
10000	8	2	4.5	1	2	2	12.63	0.38	299	0	237	162	100	sqz
10000	8	4	0.5	0	4	4	∞	1.00	2000	0	0	500	0	bco
10000	8	4	0.5	1	3.9	3.85	24.85	0.68	1098	32	21	436	43	bco
10000	8	4	0.5	2	3.95	3.85	10.72	0.36	539	7	121	250	129	bco
10000	8	4	2	0	4	4	∞	1.00	2000	0	0	500	0	bco
10000	8	4	2	1	3.9	3.85	16.95	0.69	1119	29	71	393	37	bco
10000	8	4	2	2	3.95	3.85	9.79	0.37	560	6	176	206	119	bco
10000	8	4	3	0	3.95	3.95	266.67	1.00	1975	25	6	494	0	bco
10000	8	4	3	1	3.9	3.85	13.92	0.70	1138	26	118	349	33	bco
10000	8	4	3	2	3.55	1.65	9.47	0.38	584	0	211	179	110	sqz
10000	8	6	0.25	0	6	6	∞	1.00	3000	0	0	500	0	bco
10000	8	6	0.25	1.5	5.9	5.85	32.16	0.67	1646	33	8	441	50	bco
10000	8	6	0.25	3	5.95	5.9	21.19	0.51	760	12	21	369	110	bco
10000	8	6	1	0	6	6	∞	1.00	3000	0	0	500	0	bco
10000	8	6	1	1.5	5.9	5.85	22.34	0.67	1657	32	27	425	48	bco
10000	8	6	1	3	5.95	5.9	16.14	0.51	776	11	45	350	105	bco
10000	8	6	1.5	0	6	6	∞	1.00	3000	0	0	500	0	bco
10000	8	6	1.5	1.5	5.9	5.85	18.52	0.68	1667	30	45	409	47	bco
10000	8	6	1.5	3	5.95	5.9	13.89	0.51	789	11	66	333	101	bco
10000	12	3	1.125	0	3	3	∞	1.00	1500	0	0	500	0	bco
10000	12	3	1.125	0.75	3	0	9.00	0.03	1002	0	500	0	0	elm
10000	12	3	1.125	1.5	3	0	9.00	0.03	627	0	500	0	0	elm
10000	12	3	4.5	0	3	3	∞	1.00	1500	0	0	500	0	bco
10000	12	3	4.5	0.75	2.75	0	9.00	0.19	1002	0	500	0	0	elm
10000	12	3	4.5	1.5	2.75	0	9.00	0.19	627	0	500	0	0	elm
10000	12	3	6.75	0	3	3	∞	1.00	1500	0	0	500	0	bco
10000	12	3	6.75	0.75	2.45	0	9.00	0.38	1002	0	500	0	0	elm
10000	12	3	6.75	1.5	2.45	0	9.00	0.38	627	0	500	0	0	elm

Parameters					Decision Variables				Profits		Sales			Eql.
m	**v**	**p**	**k**	**c**	**w**	**b**	**t**	α	Π_m	Π_r	**Direct**	**Retailer**	**Lost**	**Type**
10000	12	6	0.75	0	6	6	∞	1.00	3000	0	0	500	0	bco
10000	12	6	0.75	1.5	5.95	0	6.00	0.03	1972	0	500	0	0	elm
10000	12	6	0.75	3	5.95	0	6.00	0.03	1222	0	500	0	0	elm
10000	12	6	3	0	6	6	∞	1.00	3000	0	0	500	0	bco
10000	12	6	3	1.5	5.45	0	6.00	0.19	1972	0	500	0	0	elm
10000	12	6	3	3	5.45	0	6.00	0.19	1222	0	500	0	0	elm
10000	12	6	4.5	0	6	6	∞	1.00	3000	0	0	500	0	bco
10000	12	6	4.5	1.5	4.9	0	6.00	0.38	1972	0	500	0	0	elm
10000	12	6	4.5	3	4.9	0	6.00	0.38	1222	0	500	0	0	elm
10000	12	9	0.375	0	9	9	∞	1.00	4500	0	0	500	0	bco
10000	12	9	0.375	2.25	8.9	8.85	15.20	0.68	2522	32	26	434	40	bco
10000	12	9	0.375	4.5	8.95	8.85	6.48	0.36	1273	7	148	244	108	bco
10000	12	9	1.5	0	9	9	∞	1.00	4500	0	0	500	0	bco
10000	12	9	1.5	2.25	8.9	8.85	10.52	0.69	2574	28	85	382	33	bco
10000	12	9	1.5	4.5	8.95	8.85	5.95	0.38	1331	5	215	189	96	bco
10000	12	9	2.25	0	9	9	∞	1.00	4500	0	0	500	0	bco
10000	12	9	2.25	2.25	8.9	8.85	8.68	0.70	2621	24	141	330	29	bco
10000	12	9	2.25	4.5	9	9	5.62	0.38	1380	0	267	144	89	sqz

Table 5.2: The Numerical Experiments to Span the Parameter Space RB/DO

					RETAILER-ONLY						DIRECT-ONLY		
Parameters					Decision Variables			Profits		Sales	Decision Var.	Profit	Sales
m	**v**	**p**	**k**	**c**	**w**	**b**	α	Π_m	Π_r	**Retailer**	**t**	Π_m	**Direct**
1000	4	1	0.375	0	1	1	1.00	500	0	500	3.00	389	500
1000	4	1	0.375	0.25	1	1	1.00	250	0	500	3.00	264	500
1000	4	1	0.375	0.5	0.95	0.9	0.50	113	12	375	3.00	139	500
1000	4	1	1.5	0	1	1	1.00	500	0	500	3.00	389	500
1000	4	1	1.5	0.25	1	1	1.00	250	0	500	3.00	264	500
1000	4	1	1.5	0.5	0.95	0.9	0.50	113	12	375	3.00	139	500
1000	4	1	2.25	0	1	1	1.00	500	0	500	3.00	389	500
1000	4	1	2.25	0.25	1	1	1.00	250	0	500	3.00	264	500
1000	4	1	2.25	0.5	0.95	0.75	0.38	117	1	309	3.00	139	500
1000	4	2	0.25	0	2	2	1.00	1000	0	500	2.00	750	500
1000	4	2	0.25	0.5	1.9	1.85	0.67	522	33	444	2.00	500	500
1000	4	2	0.25	1	1.95	1.9	0.50	238	12	375	2.00	250	500
1000	4	2	1	0	2	2	1.00	1000	0	500	2.00	750	500
1000	4	2	1	0.5	1.9	1.85	0.67	522	33	444	2.00	500	500
1000	4	2	1	1	1.95	1.9	0.50	238	12	375	2.00	250	500
1000	4	2	1.5	0	2	2	1.00	1000	0	500	2.00	750	500
1000	4	2	1.5	0.5	1.9	1.85	0.67	522	33	444	2.00	500	500
1000	4	2	1.5	1	1.95	1.9	0.50	238	12	375	2.00	250	500
1000	4	3	0.125	0	3	3	1.00	1500	0	500	1.33	563	375
1000	4	3	0.125	0.75	2.9	2.85	0.67	800	33	444	1.78	316	281
1000	4	3	0.125	1.5	2.95	2.9	0.50	362	13	375	2.67	141	188
1000	4	3	0.5	0	3	3	1.00	1500	0	500	1.33	563	375
1000	4	3	0.5	0.75	2.9	2.85	0.67	800	33	444	1.78	316	281
1000	4	3	0.5	1.5	2.95	2.9	0.50	362	13	375	2.67	141	188
1000	4	3	0.75	0	3	3	1.00	1500	0	500	1.33	563	375
1000	4	3	0.75	0.75	2.9	2.85	0.67	800	33	444	1.78	316	281
1000	4	3	0.75	1.5	2.95	2.9	0.50	362	13	375	2.67	141	188
1000	8	2	0.75	0	2	2	1.00	1000	0	500	6.00	972	500
1000	8	2	0.75	0.5	1.9	1.85	0.67	522	33	444	6.00	722	500
1000	8	2	0.75	1	1.95	1.9	0.50	238	12	375	6.00	472	500
1000	8	2	3	0	2	2	1.00	1000	0	500	6.00	972	500
1000	8	2	3	0.5	1.9	1.85	0.67	522	33	444	6.00	722	500
1000	8	2	3	1	1.95	1.9	0.50	238	12	375	6.00	472	500
1000	8	2	4.5	0	2	2	1.00	1000	0	500	6.00	972	500
1000	8	2	4.5	0.5	1.9	1.85	0.67	522	33	444	6.00	722	500
1000	8	2	4.5	1	1.95	1.9	0.50	238	12	375	6.00	472	500
1000	8	4	0.5	0	4	4	1.00	2000	0	500	4.00	1938	500
1000	8	4	0.5	1	3.9	3.85	0.67	1078	33	444	4.00	1438	500
1000	8	4	0.5	2	3.95	3.9	0.50	487	13	375	4.00	938	500
1000	8	4	2	0	4	4	1.00	2000	0	500	4.00	1938	500
1000	8	4	2	1	3.9	3.85	0.67	1078	33	444	4.00	1438	500
1000	8	4	2	2	3.95	3.9	0.50	487	13	375	4.00	938	500
1000	8	4	3	0	4	4	1.00	2000	0	500	4.00	1938	500
1000	8	4	3	1	3.9	3.85	0.67	1078	33	444	4.00	1438	500
1000	8	4	3	2	3.95	3.9	0.50	487	13	375	4.00	938	500

					RETAILER-ONLY						DIRECT-ONLY		
Parameters					Decision Variables			Profits		Sales	Decision Var.	Profit	Sales
m	**v**	**p**	**k**	**c**	**w**	**b**	α	Π_m	Π_r	**Retailer**	**t**	Π_m	**Direct**
1000	8	6	0.25	0	6	6	1.00	3000	0	500	2.00	2750	500
1000	8	6	0.25	1.5	5.9	5.85	0.67	1633	33	444	2.00	2000	500
1000	8	6	0.25	3	5.95	5.9	0.50	737	13	375	2.00	1250	500
1000	8	6	1	0	6	6	1.00	3000	0	500	2.00	2750	500
1000	8	6	1	1.5	5.9	5.85	0.67	1633	33	444	2.00	2000	500
1000	8	6	1	3	5.95	5.9	0.50	737	13	375	2.00	1250	500
1000	8	6	1.5	0	6	6	1.00	3000	0	500	2.00	2750	500
1000	8	6	1.5	1.5	5.9	5.85	0.67	1633	33	444	2.00	2000	500
1000	8	6	1.5	3	5.95	5.9	0.50	737	13	375	2.00	1250	500
1000	12	3	1.125	0	3	3	1.00	1500	0	500	9.00	1488	500
1000	12	3	1.125	0.75	2.9	2.85	0.67	800	33	444	9.00	1113	500
1000	12	3	1.125	1.5	2.95	2.9	0.50	362	13	375	9.00	738	500
1000	12	3	4.5	0	3	3	1.00	1500	0	500	9.00	1488	500
1000	12	3	4.5	0.75	2.9	2.85	0.67	800	33	444	9.00	1113	500
1000	12	3	4.5	1.5	2.95	2.9	0.50	362	13	375	9.00	738	500
1000	12	3	6.75	0	3	3	1.00	1500	0	500	9.00	1488	500
1000	12	3	6.75	0.75	2.9	2.85	0.67	800	33	444	9.00	1113	500
1000	12	3	6.75	1.5	2.95	2.9	0.50	362	13	375	9.00	738	500
1000	12	6	0.75	0	6	6	1.00	3000	0	500	6.00	2972	500
1000	12	6	0.75	1.5	5.9	5.85	0.67	1633	33	444	6.00	2222	500
1000	12	6	0.75	3	5.95	5.9	0.50	737	13	375	6.00	1472	500
1000	12	6	3	0	6	6	1.00	3000	0	500	6.00	2972	500
1000	12	6	3	1.5	5.9	5.85	0.67	1633	33	444	6.00	2222	500
1000	12	6	3	3	5.95	5.9	0.50	737	13	375	6.00	1472	500
1000	12	6	4.5	0	6	6	1.00	3000	0	500	6.00	2972	500
1000	12	6	4.5	1.5	5.9	5.85	0.67	1633	33	444	6.00	2222	500
1000	12	6	4.5	3	5.95	5.9	0.50	737	13	375	6.00	1472	500
1000	12	9	0.375	0	9	9	1.00	4500	0	500	3.00	4389	500
1000	12	9	0.375	2.25	8.85	8.8	0.75	2475	56	469	3.00	3264	500
1000	12	9	0.375	4.5	8.95	8.9	0.50	1113	12	375	3.00	2139	500
1000	12	9	1.5	0	9	9	1.00	4500	0	500	3.00	4389	500
1000	12	9	1.5	2.25	8.85	8.8	0.75	2475	56	469	3.00	3264	500
1000	12	9	1.5	4.5	8.95	8.9	0.50	1113	12	375	3.00	2139	500
1000	12	9	2.25	0	9	9	1.00	4500	0	500	3.00	4389	500
1000	12	9	2.25	2.25	8.85	8.8	0.75	2475	56	469	3.00	3264	500
1000	12	9	2.25	4.5	8.95	8.9	0.50	1113	12	375	3.00	2139	500
5000	4	1	0.375	0	1	1	1.00	500	0	500	6.67	113	225
5000	4	1	0.375	0.25	1	1	1.00	250	0	500	8.89	63	169
5000	4	1	0.375	0.5	0.95	0.9	0.50	113	12	375	13.33	28	113
5000	4	1	1.5	0	1	1	1.00	500	0	500	6.67	113	225
5000	4	1	1.5	0.25	1	1	1.00	250	0	500	8.89	63	169
5000	4	1	1.5	0.5	0.95	0.9	0.50	113	12	375	13.33	28	113
5000	4	1	2.25	0	1	1	1.00	500	0	500	6.67	113	225
5000	4	1	2.25	0.25	1	1	1.00	250	0	500	8.89	63	169
5000	4	1	2.25	0.5	0.95	0.75	0.38	117	1	309	13.33	28	113

					RETAILER-ONLY						DIRECT-ONLY		
Parameters					Decision Variables			Profits		Sales	Decision Var.	Profit	Sales
m	**v**	**p**	**k**	**c**	**w**	**b**	α	Π_m	Π_r	**Retailer**	**t**	Π_m	**Direct**
5000	4	2	0.25	0	2	2	1.00	1000	0	500	5.00	200	200
5000	4	2	0.25	0.5	1.9	1.85	0.67	522	33	444	6.67	113	150
5000	4	2	0.25	1	1.95	1.9	0.50	238	12	375	10.00	50	100
5000	4	2	1	0	2	2	1.00	1000	0	500	5.00	200	200
5000	4	2	1	0.5	1.9	1.85	0.67	522	33	444	6.67	113	150
5000	4	2	1	1	1.95	1.9	0.50	238	12	375	10.00	50	100
5000	4	2	1.5	0	2	2	1.00	1000	0	500	5.00	200	200
5000	4	2	1.5	0.5	1.9	1.85	0.67	522	33	444	6.67	113	150
5000	4	2	1.5	1	1.95	1.9	0.50	238	12	375	10.00	50	100
5000	4	3	0.125	0	3	3	1.00	1500	0	500	6.67	113	75
5000	4	3	0.125	0.75	2.9	2.85	0.67	800	33	444	8.89	63	56
5000	4	3	0.125	1.5	2.95	2.9	0.50	362	13	375	13.33	28	38
5000	4	3	0.5	0	3	3	1.00	1500	0	500	6.67	113	75
5000	4	3	0.5	0.75	2.9	2.85	0.67	800	33	444	8.89	63	56
5000	4	3	0.5	1.5	2.95	2.9	0.50	362	13	375	13.33	28	38
5000	4	3	0.75	0	3	3	1.00	1500	0	500	6.67	113	75
5000	4	3	0.75	0.75	2.9	2.85	0.67	800	33	444	8.89	63	56
5000	4	3	0.75	1.5	2.95	2.9	0.50	362	13	375	13.33	28	38
5000	8	2	0.75	0	2	2	1.00	1000	0	500	6.00	861	500
5000	8	2	0.75	0.5	1.9	1.85	0.67	522	33	444	6.00	611	500
5000	8	2	0.75	1	1.95	1.9	0.50	238	12	375	6.00	361	500
5000	8	2	3	0	2	2	1.00	1000	0	500	6.00	861	500
5000	8	2	3	0.5	1.9	1.85	0.67	522	33	444	6.00	611	500
5000	8	2	3	1	1.95	1.9	0.50	238	12	375	6.00	361	500
5000	8	2	4.5	0	2	2	1.00	1000	0	500	6.00	861	500
5000	8	2	4.5	0.5	1.9	1.85	0.67	522	33	444	6.00	611	500
5000	8	2	4.5	1	1.95	1.9	0.50	238	12	375	6.00	361	500
5000	8	4	0.5	0	4	4	1.00	2000	0	500	4.00	1688	500
5000	8	4	0.5	1	3.9	3.85	0.67	1078	33	444	4.00	1188	500
5000	8	4	0.5	2	3.95	3.9	0.50	487	13	375	4.00	688	500
5000	8	4	2	0	4	4	1.00	2000	0	500	4.00	1688	500
5000	8	4	2	1	3.9	3.85	0.67	1078	33	444	4.00	1188	500
5000	8	4	2	2	3.95	3.9	0.50	487	13	375	4.00	688	500
5000	8	4	3	0	4	4	1.00	2000	0	500	4.00	1688	500
5000	8	4	3	1	3.9	3.85	0.67	1078	33	444	4.00	1188	500
5000	8	4	3	2	3.95	3.9	0.50	487	13	375	4.00	688	500
5000	8	6	0.25	0	6	6	1.00	3000	0	500	2.00	1750	500
5000	8	6	0.25	1.5	5.9	5.85	0.67	1633	33	444	2.22	1013	450
5000	8	6	0.25	3	5.95	5.9	0.50	737	13	375	3.33	450	300
5000	8	6	1	0	6	6	1.00	3000	0	500	2.00	1750	500
5000	8	6	1	1.5	5.9	5.85	0.67	1633	33	444	2.22	1013	450
5000	8	6	1	3	5.95	5.9	0.50	737	13	375	3.33	450	300
5000	8	6	1.5	0	6	6	1.00	3000	0	500	2.00	1750	500
5000	8	6	1.5	1.5	5.9	5.85	0.67	1633	33	444	2.22	1013	450
5000	8	6	1.5	3	5.95	5.9	0.50	737	13	375	3.33	450	300

					RETAILER-ONLY						DIRECT-ONLY		
Parameters					Decision Variables			Profits		Sales	Decision Var.	Profit	Sales
m	**v**	**p**	**k**	**c**	**w**	**b**	α	Π_m	Π_r	**Retailer**	**t**	Π_m	**Direct**
5000	12	3	1.125	0	3	3	1.00	1500	0	500	9.00	1438	500
5000	12	3	1.125	0.75	2.9	2.85	0.67	800	33	444	9.00	1063	500
5000	12	3	1.125	1.5	2.95	2.9	0.50	362	13	375	9.00	688	500
5000	12	3	4.5	0	3	3	1.00	1500	0	500	9.00	1438	500
5000	12	3	4.5	0.75	2.9	2.85	0.67	800	33	444	9.00	1063	500
5000	12	3	4.5	1.5	2.95	2.9	0.50	362	13	375	9.00	688	500
5000	12	3	6.75	0	3	3	1.00	1500	0	500	9.00	1438	500
5000	12	3	6.75	0.75	2.9	2.85	0.67	800	33	444	9.00	1063	500
5000	12	3	6.75	1.5	2.95	2.9	0.50	362	13	375	9.00	688	500
5000	12	6	0.75	0	6	6	1.00	3000	0	500	6.00	2861	500
5000	12	6	0.75	1.5	5.9	5.85	0.67	1633	33	444	6.00	2111	500
5000	12	6	0.75	3	5.95	5.9	0.50	737	13	375	6.00	1361	500
5000	12	6	3	0	6	6	1.00	3000	0	500	6.00	2861	500
5000	12	6	3	1.5	5.9	5.85	0.67	1633	33	444	6.00	2111	500
5000	12	6	3	3	5.95	5.9	0.50	737	13	375	6.00	1361	500
5000	12	6	4.5	0	6	6	1.00	3000	0	500	6.00	2861	500
5000	12	6	4.5	1.5	5.9	5.85	0.67	1633	33	444	6.00	2111	500
5000	12	6	4.5	3	5.95	5.9	0.50	737	13	375	6.00	1361	500
5000	12	9	0.375	0	9	9	1.00	4500	0	500	3.00	3944	500
5000	12	9	0.375	2.25	8.85	8.8	0.75	2475	56	469	3.00	2819	500
5000	12	9	0.375	4.5	8.95	8.9	0.50	1113	12	375	3.00	1694	500
5000	12	9	1.5	0	9	9	1.00	4500	0	500	3.00	3944	500
5000	12	9	1.5	2.25	8.85	8.8	0.75	2475	56	469	3.00	2819	500
5000	12	9	1.5	4.5	8.95	8.9	0.50	1113	12	375	3.00	1694	500
5000	12	9	2.25	0	9	9	1.00	4500	0	500	3.00	3944	500
5000	12	9	2.25	2.25	8.85	8.8	0.75	2475	56	469	3.00	2819	500
5000	12	9	2.25	4.5	8.95	8.9	0.50	1113	12	375	3.00	1694	500
10000	4	1	0.375	0	1	1	1.00	500	0	500	13.33	56	113
10000	4	1	0.375	0.25	1	1	1.00	250	0	500	17.78	32	84
10000	4	1	0.375	0.5	0.95	0.9	0.50	113	12	375	26.67	14	56
10000	4	1	1.5	0	1	1	1.00	500	0	500	13.33	56	113
10000	4	1	1.5	0.25	1	1	1.00	250	0	500	17.78	32	84
10000	4	1	1.5	0.5	0.95	0.9	0.50	113	12	375	26.67	14	56
10000	4	1	2.25	0	1	1	1.00	500	0	500	13.33	56	113
10000	4	1	2.25	0.25	1	1	1.00	250	0	500	17.78	32	84
10000	4	1	2.25	0.5	0.95	0.75	0.38	117	1	309	26.67	14	56
10000	4	2	0.25	0	2	2	1.00	1000	0	500	10.00	100	100
10000	4	2	0.25	0.5	1.9	1.85	0.67	522	33	444	13.33	56	75
10000	4	2	0.25	1	1.95	1.9	0.50	238	12	375	20.00	25	50
10000	4	2	1	0	2	2	1.00	1000	0	500	10.00	100	100
10000	4	2	1	0.5	1.9	1.85	0.67	522	33	444	13.33	56	75
10000	4	2	1	1	1.95	1.9	0.50	238	12	375	20.00	25	50
10000	4	2	1.5	0	2	2	1.00	1000	0	500	10.00	100	100
10000	4	2	1.5	0.5	1.9	1.85	0.67	522	33	444	13.33	56	75
10000	4	2	1.5	1	1.95	1.9	0.50	238	12	375	20.00	25	50

					RETAILER-ONLY						DIRECT-ONLY		
Parameters					Decision Variables			Profits		Sales	Decision Var.	Profit	Sales
m	**v**	**p**	**k**	**c**	**w**	**b**	α	Π_m	Π_r	**Retailer**	**t**	Π_m	**Direct**
10000	4	3	0.125	0	3	3	1.00	1500	0	500	13.33	56	38
10000	4	3	0.125	0.75	2.9	2.85	0.67	800	33	444	17.78	32	28
10000	4	3	0.125	1.5	2.95	2.9	0.50	362	13	375	26.67	14	19
10000	4	3	0.5	0	3	3	1.00	1500	0	500	13.33	56	38
10000	4	3	0.5	0.75	2.9	2.85	0.67	800	33	444	17.78	32	28
10000	4	3	0.5	1.5	2.95	2.9	0.50	362	13	375	26.67	14	19
10000	4	3	0.75	0	3	3	1.00	1500	0	500	13.33	56	38
10000	4	3	0.75	0.75	2.9	2.85	0.67	800	33	444	17.78	32	28
10000	4	3	0.75	1.5	2.95	2.9	0.50	362	13	375	26.67	14	19
10000	8	2	0.75	0	2	2	1.00	1000	0	500	6.00	722	500
10000	8	2	0.75	0.5	1.9	1.85	0.67	522	33	444	6.00	472	500
10000	8	2	0.75	1	1.95	1.9	0.50	238	12	375	6.67	225	450
10000	8	2	3	0	2	2	1.00	1000	0	500	6.00	722	500
10000	8	2	3	0.5	1.9	1.85	0.67	522	33	444	6.00	472	500
10000	8	2	3	1	1.95	1.9	0.50	238	12	375	6.67	225	450
10000	8	2	4.5	0	2	2	1.00	1000	0	500	6.00	722	500
10000	8	2	4.5	0.5	1.9	1.85	0.67	522	33	444	6.00	472	500
10000	8	2	4.5	1	1.95	1.9	0.50	238	12	375	6.67	225	450
10000	8	4	0.5	0	4	4	1.00	2000	0	500	4.00	1375	500
10000	8	4	0.5	1	3.9	3.85	0.67	1078	33	444	4.00	875	500
10000	8	4	0.5	2	3.95	3.9	0.50	487	13	375	5.00	400	400
10000	8	4	2	0	4	4	1.00	2000	0	500	4.00	1375	500
10000	8	4	2	1	3.9	3.85	0.67	1078	33	444	4.00	875	500
10000	8	4	2	2	3.95	3.9	0.50	487	13	375	5.00	400	400
10000	8	4	3	0	4	4	1.00	2000	0	500	4.00	1375	500
10000	8	4	3	1	3.9	3.85	0.67	1078	33	444	4.00	875	500
10000	8	4	3	2	3.95	3.9	0.50	487	13	375	5.00	400	400
10000	8	6	0.25	0	6	6	1.00	3000	0	500	3.33	900	300
10000	8	6	0.25	1.5	5.9	5.85	0.67	1633	33	444	4.44	506	225
10000	8	6	0.25	3	5.95	5.9	0.50	737	13	375	6.67	225	150
10000	8	6	1	0	6	6	1.00	3000	0	500	3.33	900	300
10000	8	6	1	1.5	5.9	5.85	0.67	1633	33	444	4.44	506	225
10000	8	6	1	3	5.95	5.9	0.50	737	13	375	6.67	225	150
10000	8	6	1.5	0	6	6	1.00	3000	0	500	3.33	900	300
10000	8	6	1.5	1.5	5.9	5.85	0.67	1633	33	444	4.44	506	225
10000	8	6	1.5	3	5.95	5.9	0.50	737	13	375	6.67	225	150
10000	12	3	1.125	0	3	3	1.00	1500	0	500	9.00	1377	500
10000	12	3	1.125	0.75	2.9	2.85	0.67	800	33	444	9.00	1002	500
10000	12	3	1.125	1.5	2.95	2.9	0.50	362	13	375	9.00	627	500
10000	12	3	4.5	0	3	3	1.00	1500	0	500	9.00	1377	500
10000	12	3	4.5	0.75	2.9	2.85	0.67	800	33	444	9.00	1002	500
10000	12	3	4.5	1.5	2.95	2.9	0.50	362	13	375	9.00	627	500
10000	12	3	6.75	0	3	3	1.00	1500	0	500	9.00	1377	500
10000	12	3	6.75	0.75	2.9	2.85	0.67	800	33	444	9.00	1002	500
10000	12	3	6.75	1.5	2.95	2.9	0.50	362	13	375	9.00	627	500

					RETAILER-ONLY						DIRECT-ONLY		
Parameters					Decision Variables			Profits		Sales	Decision Var.	Profit	Sales
m	**v**	**p**	**k**	**c**	**w**	**b**	α	Π_m	Π_r	**Retailer**	**t**	Π_m	**Direct**
10000	12	6	0.75	0	6	6	1.00	3000	0	500	6.00	2722	500
10000	12	6	0.75	1.5	5.9	5.85	0.67	1633	33	444	6.00	1972	500
10000	12	6	0.75	3	5.95	5.9	0.50	737	13	375	6.00	1222	500
10000	12	6	3	0	6	6	1.00	3000	0	500	6.00	2722	500
10000	12	6	3	1.5	5.9	5.85	0.67	1633	33	444	6.00	1972	500
10000	12	6	3	3	5.95	5.9	0.50	737	13	375	6.00	1222	500
10000	12	6	4.5	0	6	6	1.00	3000	0	500	6.00	2722	500
10000	12	6	4.5	1.5	5.9	5.85	0.67	1633	33	444	6.00	1972	500
10000	12	6	4.5	3	5.95	5.9	0.50	737	13	375	6.00	1222	500
10000	12	9	0.375	0	9	9	1.00	4500	0	500	3.00	3389	500
10000	12	9	0.375	2.25	8.85	8.8	0.75	2475	56	469	3.00	2264	500
10000	12	9	0.375	4.5	8.95	8.9	0.50	1113	12	375	3.00	1139	500
10000	12	9	1.5	0	9	9	1.00	4500	0	500	3.00	3389	500
10000	12	9	1.5	2.25	8.85	8.8	0.75	2475	56	469	3.00	2264	500
10000	12	9	1.5	4.5	8.95	8.9	0.50	1113	12	375	3.00	1139	500
10000	12	9	2.25	0	9	9	1.00	4500	0	500	3.00	3389	500
10000	12	9	2.25	2.25	8.85	8.8	0.75	2475	56	469	3.00	2264	500
10000	12	9	2.25	4.5	8.95	8.9	0.50	1113	12	375	3.00	1139	500

Table 5.3: Dual Channel Strategy in the m/c Plane, v=8, p=4, k=1

Parameters		Decision Variables				Profits		Sales			Eql.
m	**c**	**w**	**b**	**t**	α	Π_m	Π_r	**Direct**	**Retailer**	**Lost**	**Type**
0	0	0	0	1.00	1.00	2000	0	500	0	0	ER
0	0.25	3.1	0.35	1.63	0.49	1875	0	500	0	0	ER
0	0.5	3.1	0.35	1.63	0.49	1750	0	500	0	0	ER
0	0.75	3.1	0.35	1.63	0.49	1625	0	500	0	0	ER
0	1	3.1	0.35	1.63	0.49	1500	0	500	0	0	ER
0	1.25	3.1	0.35	1.63	0.49	1375	0	500	0	0	ER
0	1.5	3.1	0.35	1.63	0.49	1250	0	500	0	0	ER
0	1.75	3.1	0.35	1.63	0.49	1125	0	500	0	0	ER
0	2	3.1	0.35	1.63	0.49	1000	0	500	0	0	ER
0	2.25	3.1	0.35	1.63	0.49	875	0	500	0	0	ER
0	2.5	3.1	0.35	1.63	0.49	750	0	500	0	0	ER
0	2.75	3.1	0.35	1.63	0.49	625	0	500	0	0	ER
0	3	3.1	0.35	1.63	0.49	500	0	500	0	0	ER
0	3.25	3.55	2.15	1.65	0.49	375	0	500	0	0	ER
0	3.5	3.55	2.15	1.65	0.49	250	0	500	0	0	ER
0	3.75	3.75	2.95	1.68	0.48	125	0	500	0	0	ER
2500	0	4	4	∞	1.00	2000	0	0	500	0	SP
2500	0.25	4	4	40.00	1.00	1752	0	12	488	0	SP
2500	0.5	3.9	0	4.00	0.07	1594	0	500	0	0	ER
2500	0.75	3.9	0	4.00	0.07	1469	0	500	0	0	ER
2500	1	3.9	0	4.00	0.07	1344	0	500	0	0	ER
2500	1.25	3.9	0	4.00	0.07	1219	0	500	0	0	ER
2500	1.5	3.9	0	4.00	0.07	1094	0	500	0	0	ER
2500	1.75	3.9	0	4.00	0.07	969	0	500	0	0	ER
2500	2	3.9	0	4.00	0.07	844	0	500	0	0	ER
2500	2.25	3.9	0	4.00	0.07	719	0	500	0	0	ER
2500	2.5	3.9	0	4.00	0.07	594	0	500	0	0	ER
2500	2.75	3.9	0	4.00	0.07	469	0	500	0	0	ER
2500	3	3.9	0	4.00	0.07	344	0	500	0	0	ER
2500	3.25	3.9	0	4.00	0.07	219	0	500	0	0	ER
2500	3.5	3.95	3.3	5.60	0.09	106	1	354	26	120	SP
2500	3.75	3.9	1.05	10.66	0.07	30	0	188	41	272	CP
5000	0	4	4	∞	1.00	2000	0	0	500	0	SP
5000	0.25	3.95	3.95	66.67	1.00	1726	25	7	493	0	SP
5000	0.5	4	4	39.72	0.93	1528	0	13	485	2	SP
5000	0.75	3.9	0	4.00	0.07	1313	0	500	0	0	ER
5000	1	3.9	0	4.00	0.07	1187	0	500	0	0	ER
5000	1.25	3.9	0	4.00	0.07	1063	0	500	0	0	ER
5000	1.5	3.9	0	4.00	0.07	937	0	500	0	0	ER
5000	1.75	3.9	0	4.00	0.07	813	0	500	0	0	ER
5000	2	3.9	0	4.00	0.07	688	0	500	0	0	ER
5000	2.25	3.9	0	4.00	0.07	562	0	500	0	0	ER
5000	2.5	3.9	0	4.00	0.07	438	0	500	0	0	ER
5000	2.75	3.95	3.65	5.41	0.17	324	1	343	67	89	SP
5000	3	3.95	3.65	6.51	0.16	225	2	288	78	135	SP

Parameters		Decision Variables				Profits		Sales			Eql.
m	**c**	**w**	**b**	**t**	α	Π_m	Π_r	**Direct**	**Retailer**	**Lost**	**Type**
5000	3.25	3.95	3.6	8.14	0.14	138	2	236	75	189	SP
5000	3.5	3.95	3.5	11.37	0.11	67	2	173	68	259	SP
5000	3.75	3.9	1.05	21.32	0.07	19	0	94	53	353	CP
7500	0	3.95	3.95	600.00	1.00	1975	25	1	499	0	SP
7500	0.25	4	4	120.07	1.00	1751	0	4	496	0	SP
7500	0.5	4	4	59.45	0.93	1527	0	9	489	2	SP
7500	0.75	3.9	3.85	16.85	0.69	1282	31	44	419	37	SP
7500	1	3.9	3.85	16.45	0.69	1112	31	45	418	37	SP
7500	1.25	3.95	3.9	10.16	0.54	960	11	101	334	65	SP
7500	1.5	3.95	3.9	10.50	0.53	820	11	98	335	67	SP
7500	1.75	3.95	3.85	7.39	0.37	691	6	190	220	90	SP
7500	2	3.95	3.85	7.96	0.37	576	6	177	224	99	SP
7500	2.25	3.95	3.8	7.36	0.28	467	4	221	162	118	SP
7500	2.5	3.95	3.8	8.25	0.28	366	4	198	167	134	SP
7500	2.75	3.95	3.75	8.72	0.22	272	3	202	133	165	SP
7500	3	3.95	3.75	10.42	0.22	187	4	170	141	189	SP
7500	3.25	3.95	3.65	12.37	0.15	113	3	153	103	244	SP
7500	3.5	3.95	3.55	17.14	0.12	54	2	114	86	300	SP
7500	3.75	3.9	1.05	31.98	0.07	15	0	63	57	380	CP
10000	0	4	4	∞	1.00	2000	0	0	500	0	SP
10000	0.25	4	4	160.00	1.00	1750	0	3	497	0	SP
10000	0.5	4	4	79.18	0.93	1527	0	6	491	2	SP
10000	0.75	3.9	3.85	22.01	0.68	1274	31	34	425	41	SP
10000	1	3.9	3.85	21.53	0.68	1104	31	35	424	41	SP
10000	1.25	3.95	3.9	13.20	0.53	939	11	79	343	78	SP
10000	1.5	3.95	3.9	13.68	0.53	803	11	77	344	79	SP
10000	1.75	3.95	3.9	14.22	0.53	667	11	74	345	81	SP
10000	2	3.95	3.85	10.39	0.36	545	7	138	236	126	SP
10000	2.25	3.95	3.85	11.35	0.36	440	7	127	240	133	SP
10000	2.5	3.95	3.8	10.85	0.27	338	5	152	179	168	SP
10000	2.75	3.95	3.8	12.44	0.27	249	5	133	184	183	SP
10000	3	3.95	3.75	13.81	0.21	169	4	129	150	221	SP
10000	3.25	3.95	3.7	16.83	0.17	101	3	110	130	260	SP
10000	3.5	3.95	3.55	22.84	0.11	47	2	85	91	324	SP
10000	3.75	3.9	1.05	42.64	0.07	13	0	47	59	394	CP
12500	0	4	4	∞	1.00	2000	0	0	500	0	SP
12500	0.25	4	4	200.00	1.00	1750	0	2	498	0	SP
12500	0.5	4	4	98.90	0.93	1527	0	5	492	2	SP
12500	0.75	3.9	3.85	27.16	0.68	1269	32	28	428	44	SP
12500	1	3.9	3.85	26.61	0.68	1100	32	28	428	43	SP
12500	1.25	3.9	3.85	26.08	0.68	930	32	29	428	43	SP
12500	1.5	3.95	3.9	16.86	0.52	791	11	63	350	87	SP
12500	1.75	3.95	3.9	17.56	0.52	657	11	60	351	89	SP
12500	2	3.9	3.75	14.66	0.42	526	17	88	291	122	SP
12500	2.25	3.95	3.85	14.04	0.35	424	7	104	247	150	SP

Parameters		Decision Variables				Profits		Sales			Eql.
m	**c**	**w**	**b**	**t**	α	Π_m	Π_r	**Direct**	**Retailer**	**Lost**	**Type**
12500	2.5	3.95	3.85	15.53	0.35	324	7	94	250	157	SP
12500	2.75	3.95	3.8	15.47	0.26	236	5	108	191	201	SP
12500	3	3.95	3.75	17.20	0.21	159	4	104	156	240	SP
12500	3.25	3.95	3.7	21.00	0.17	94	4	88	134	277	SP
12500	3.5	3.95	3.55	28.54	0.11	44	2	68	94	338	SP
12500	3.75	3.9	1.05	53.30	0.07	12	0	38	61	402	CP
15000	0	4	4	∞	1.00	2000	0	0	500	0	SP
15000	0.25	4	4	240.00	1.00	1750	0	2	498	0	SP
15000	0.5	4	4	118.62	0.93	1526	0	4	493	2	SP
15000	0.75	3.85	3.8	43.55	0.76	1266	55	15	458	27	SP
15000	1	3.9	3.85	31.68	0.68	1096	32	24	431	45	SP
15000	1.25	3.9	3.85	31.08	0.68	927	32	24	430	45	SP
15000	1.5	3.95	3.9	20.04	0.52	783	12	53	354	93	SP
15000	1.75	3.95	3.9	20.89	0.52	651	12	51	355	94	SP
15000	2	3.95	3.9	21.84	0.52	518	12	49	355	96	SP
15000	2.25	3.95	3.85	16.74	0.35	412	7	87	252	161	SP
15000	2.5	3.95	3.85	18.54	0.35	315	7	79	254	167	SP
15000	2.75	3.95	3.8	18.50	0.26	227	5	90	195	214	SP
15000	3	3.95	3.75	20.60	0.21	152	4	87	160	253	SP
15000	3.25	3.95	3.7	25.18	0.17	89	4	74	137	289	SP
15000	3.5	3.95	3.55	34.23	0.11	41	2	57	95	348	SP
15000	3.75	3.9	1.05	63.97	0.07	11	0	31	61	407	CP
17500	0	3.95	3.95	1400.00	1.00	1975	25	0	500	0	SP
17500	0.25	4	4	280.00	1.00	1750	0	2	498	0	SP
17500	0.5	4	4	138.35	0.93	1526	0	4	494	2	SP
17500	0.75	3.85	3.8	50.59	0.76	1265	55	13	460	27	SP
17500	1	3.9	3.85	36.76	0.68	1094	32	21	433	47	SP
17500	1.25	3.9	3.85	36.08	0.68	925	32	21	432	46	SP
17500	1.5	3.95	3.9	23.22	0.52	777	12	46	357	97	SP
17500	1.75	3.95	3.9	24.23	0.51	646	12	44	357	98	SP
17500	2	3.95	3.9	25.35	0.51	514	12	42	358	99	SP
17500	2.25	3.95	3.85	19.44	0.35	404	7	76	255	169	SP
17500	2.5	3.95	3.85	21.56	0.35	309	7	68	257	174	SP
17500	2.75	3.95	3.8	21.53	0.26	221	5	78	199	224	SP
17500	3	3.95	3.75	24.00	0.21	147	4	75	163	263	SP
17500	3.25	3.95	3.7	29.36	0.17	86	4	63	139	297	SP
17500	3.5	3.95	3.55	39.93	0.11	39	3	49	97	354	SP
17500	3.75	3.9	1.05	74.63	0.07	11	0	27	62	411	CP
20000	0	4	4	∞	1.00	2000	0	0	500	0	SP
20000	0.25	4	4	320.00	1.00	1750	0	2	498	0	SP
20000	0.5	4	4	158.07	0.93	1526	0	3	494	2	SP
20000	0.75	3.85	3.8	57.64	0.76	1264	55	11	461	28	SP
20000	1	3.9	3.85	41.83	0.68	1092	32	18	434	48	SP
20000	1.25	3.9	3.85	41.08	0.68	924	32	19	434	48	SP
20000	1.5	3.95	3.9	26.40	0.51	773	12	41	359	100	SP

Parameters		Decision Variables				Profits		Sales			Eql.
m	**c**	**w**	**b**	**t**	α	Π_m	Π_r	**Direct**	**Retailer**	**Lost**	**Type**
20000	1.75	3.95	3.9	27.57	0.51	642	12	39	359	101	SP
20000	2	3.95	3.9	28.86	0.51	511	12	37	360	102	SP
20000	2.25	3.95	3.85	22.14	0.35	398	8	66	258	176	SP
20000	2.5	3.95	3.85	24.57	0.34	304	8	60	260	180	SP
20000	2.75	3.95	3.8	24.56	0.26	216	6	68	201	231	SP
20000	3	3.95	3.75	27.40	0.21	143	4	65	165	270	SP
20000	3.25	3.95	3.7	33.54	0.17	83	4	56	141	303	SP
20000	3.5	3.95	3.55	45.63	0.11	38	3	43	98	359	SP
20000	3.75	3.9	1.05	85.29	0.07	10	0	23	62	414	CP
22500	0	4	4	∞	1.00	2000	0	0	500	0	SP
22500	0.25	4	4	360.00	1.00	1750	0	1	499	0	SP
22500	0.5	4	4	177.79	0.93	1526	0	3	495	2	SP
22500	0.75	3.85	3.8	64.68	0.75	1263	55	10	462	28	SP
22500	1	3.9	3.85	46.90	0.67	1090	32	16	435	49	SP
22500	1.25	3.9	3.85	46.08	0.67	922	32	17	435	48	SP
22500	1.5	3.95	3.9	29.58	0.51	769	12	36	361	103	SP
22500	1.75	3.95	3.9	30.90	0.51	639	12	35	361	104	SP
22500	2	3.95	3.9	32.37	0.51	509	12	33	362	105	SP
22500	2.25	3.95	3.85	24.84	0.34	393	8	59	260	181	SP
22500	2.5	3.95	3.85	27.58	0.34	300	8	54	262	185	SP
22500	2.75	3.95	3.8	27.60	0.26	212	6	61	203	236	SP
22500	3	3.95	3.8	32.67	0.26	140	6	52	205	243	SP
22500	3.25	3.95	3.7	37.71	0.17	81	4	49	142	308	SP
22500	3.5	3.95	3.55	51.33	0.11	37	3	38	99	363	SP
22500	3.75	3.9	1.05	95.95	0.07	10	0	21	63	416	CP
25000	0	4	4	∞	1.00	2000	0	0	500	0	SP
25000	0.25	4	4	400.00	1.00	1750	0	1	499	0	SP
25000	0.5	4	4	197.51	0.93	1526	0	3	495	2	SP
25000	0.75	3.85	3.8	71.73	0.75	1262	55	9	462	28	SP
25000	1	3.9	3.85	51.97	0.67	1089	33	15	436	49	SP
25000	1.25	3.9	3.85	51.08	0.67	921	33	15	436	49	SP
25000	1.5	3.95	3.9	32.75	0.51	766	12	33	362	105	SP
25000	1.75	3.95	3.9	34.24	0.51	636	12	32	362	106	SP
25000	2	3.95	3.9	35.88	0.51	507	12	30	363	107	SP
25000	2.25	3.95	3.85	27.54	0.34	389	8	54	262	185	SP
25000	2.5	3.95	3.85	30.60	0.34	297	8	48	263	188	SP
25000	2.75	3.95	3.8	30.63	0.26	209	6	55	204	241	SP
25000	3	3.95	3.8	36.28	0.26	138	6	46	207	247	SP
25000	3.25	3.95	3.7	41.89	0.17	80	4	44	143	312	SP
25000	3.5	3.95	3.55	57.03	0.11	36	3	34	99	367	SP
25000	3.75	3.9	1.05	106.61	0.07	10	0	19	63	418	CP

Table 5.4: RB/DO Strategies in the m/c Plane, v=8, p=4, k=1

		RETAILER-ONLY						DIRECT-ONLY		
Parameters		Decision Variables			Profits		Sales	Decision Var.	Profit	Sales
m	**c**	**w**	**b**	α	Π_m	Π_r	**Retailer**	**t**	Π_m	**Direct**
0	0	4	4	1.00	2000	0	500	4.00	2000	500
0	0.25	4	4	1.00	1750	0	500	4.00	1875	500
0	0.5	4	4	0.93	1526	0	497	4.00	1750	500
0	0.75	3.85	3.8	0.75	1256	56	469	4.00	1625	500
0	1	3.9	3.85	0.67	1078	33	444	4.00	1500	500
0	1.25	3.9	3.85	0.67	911	33	444	4.00	1375	500
0	1.5	3.9	3.85	0.67	744	33	444	4.00	1250	500
0	1.75	3.95	3.9	0.50	613	13	375	4.00	1125	500
0	2	3.95	3.9	0.50	487	13	375	4.00	1000	500
0	2.25	3.95	3.9	0.50	362	13	375	4.00	875	500
0	2.5	3.95	3.85	0.33	269	8	278	4.00	750	500
0	2.75	3.95	3.85	0.33	186	8	278	4.00	625	500
0	3	3.95	3.8	0.25	119	6	219	4.00	500	500
0	3.25	3.95	3.7	0.17	65	4	153	4.00	375	500
0	3.5	3.95	3.6	0.13	28	3	117	4.00	250	500
0	3.75	4	4	0.07	8	0	65	4.00	125	500
2500	0	4	4	1.00	2000	0	500	4.00	1844	500
2500	0.25	4	4	1.00	1750	0	500	4.00	1719	500
2500	0.5	4	4	0.93	1526	0	497	4.00	1594	500
2500	0.75	3.85	3.8	0.75	1256	56	469	4.00	1469	500
2500	1	3.9	3.85	0.67	1078	33	444	4.00	1344	500
2500	1.25	3.9	3.85	0.67	911	33	444	4.00	1219	500
2500	1.5	3.9	3.85	0.67	744	33	444	4.00	1094	500
2500	1.75	3.95	3.9	0.50	613	13	375	4.00	969	500
2500	2	3.95	3.9	0.50	487	13	375	4.00	844	500
2500	2.25	3.95	3.9	0.50	362	13	375	4.00	719	500
2500	2.5	3.95	3.85	0.33	269	8	278	4.00	594	500
2500	2.75	3.95	3.85	0.33	186	8	278	4.00	469	500
2500	3	3.95	3.8	0.25	119	6	219	4.00	344	500
2500	3.25	3.95	3.7	0.17	65	4	153	4.00	219	500
2500	3.5	3.95	3.6	0.13	28	3	117	5.00	100	400
2500	3.75	4	4	0.07	8	0	65	10.00	25	200
5000	0	4	4	1.00	2000	0	500	4.00	1688	500
5000	0.25	4	4	1.00	1750	0	500	4.00	1563	500
5000	0.5	4	4	0.93	1526	0	497	4.00	1438	500
5000	0.75	3.85	3.8	0.75	1256	56	469	4.00	1313	500
5000	1	3.9	3.85	0.67	1078	33	444	4.00	1188	500
5000	1.25	3.9	3.85	0.67	911	33	444	4.00	1063	500
5000	1.5	3.9	3.85	0.67	744	33	444	4.00	938	500
5000	1.75	3.95	3.9	0.50	613	13	375	4.00	813	500
5000	2	3.95	3.9	0.50	487	13	375	4.00	688	500
5000	2.25	3.95	3.9	0.50	362	13	375	4.00	563	500
5000	2.5	3.95	3.85	0.33	269	8	278	4.00	438	500
5000	2.75	3.95	3.85	0.33	186	8	278	4.00	313	500
5000	3	3.95	3.8	0.25	119	6	219	5.00	200	400

		RETAILER-ONLY						DIRECT-ONLY		
Parameters		Decision Variables			Profits		Sales	Decision Var.	Profit	Sales
m	**c**	**w**	**b**	α	Π_m	Π_r	**Retailer**	**t**	Π_m	**Direct**
5000	3.25	3.95	3.7	0.17	65	4	153	6.67	113	300
5000	3.5	3.95	3.6	0.13	28	3	117	10.00	50	200
5000	3.75	4	4	0.07	8	0	65	20.00	13	100
7500	0	4	4	1.00	2000	0	500	4.00	1531	500
7500	0.25	4	4	1.00	1750	0	500	4.00	1406	500
7500	0.5	4	4	0.93	1526	0	497	4.00	1281	500
7500	0.75	3.85	3.8	0.75	1256	56	469	4.00	1156	500
7500	1	3.9	3.85	0.67	1078	33	444	4.00	1031	500
7500	1.25	3.9	3.85	0.67	911	33	444	4.00	906	500
7500	1.5	3.9	3.85	0.67	744	33	444	4.00	781	500
7500	1.75	3.95	3.9	0.50	613	13	375	4.00	656	500
7500	2	3.95	3.9	0.50	487	13	375	4.00	531	500
7500	2.25	3.95	3.9	0.50	362	13	375	4.29	408	467
7500	2.5	3.95	3.85	0.33	269	8	278	5.00	300	400
7500	2.75	3.95	3.85	0.33	186	8	278	6.00	208	333
7500	3	3.95	3.8	0.25	119	6	219	7.50	133	267
7500	3.25	3.95	3.7	0.17	65	4	153	10.00	75	200
7500	3.5	3.95	3.6	0.13	28	3	117	15.00	33	133
7500	3.75	4	4	0.07	8	0	65	30.00	8	67
10000	0	4	4	1.00	2000	0	500	4.00	1375	500
10000	0.25	4	4	1.00	1750	0	500	4.00	1250	500
10000	0.5	4	4	0.93	1526	0	497	4.00	1125	500
10000	0.75	3.85	3.8	0.75	1256	56	469	4.00	1000	500
10000	1	3.9	3.85	0.67	1078	33	444	4.00	875	500
10000	1.25	3.9	3.85	0.67	911	33	444	4.00	750	500
10000	1.5	3.9	3.85	0.67	744	33	444	4.00	625	500
10000	1.75	3.95	3.9	0.50	613	13	375	4.44	506	450
10000	2	3.95	3.9	0.50	487	13	375	5.00	400	400
10000	2.25	3.95	3.9	0.50	362	13	375	5.71	306	350
10000	2.5	3.95	3.85	0.33	269	8	278	6.67	225	300
10000	2.75	3.95	3.85	0.33	186	8	278	8.00	156	250
10000	3	3.95	3.8	0.25	119	6	219	10.00	100	200
10000	3.25	3.95	3.7	0.17	65	4	153	13.33	56	150
10000	3.5	3.95	3.6	0.13	28	3	117	20.00	25	100
10000	3.75	4	4	0.07	8	0	65	40.00	6	50
12500	0	4	4	1.00	2000	0	500	4.00	1219	500
12500	0.25	4	4	1.00	1750	0	500	4.00	1094	500
12500	0.5	4	4	0.93	1526	0	497	4.00	969	500
12500	0.75	3.85	3.8	0.75	1256	56	469	4.00	844	500
12500	1	3.9	3.85	0.67	1078	33	444	4.17	720	480
12500	1.25	3.9	3.85	0.67	911	33	444	4.55	605	440
12500	1.5	3.9	3.85	0.67	744	33	444	5.00	500	400
12500	1.75	3.95	3.9	0.50	613	13	375	5.56	405	360
12500	2	3.95	3.9	0.50	487	13	375	6.25	320	320
12500	2.25	3.95	3.9	0.50	362	13	375	7.14	245	280

		RETAILER-ONLY						DIRECT-ONLY		
Parameters		Decision Variables			Profits		Sales	Decision Var.	Profit	Sales
m	**c**	**w**	**b**	α	Π_m	Π_r	**Retailer**	**t**	Π_m	**Direct**
12500	2.5	3.95	3.85	0.33	269	8	278	8.33	180	240
12500	2.75	3.95	3.85	0.33	186	8	278	10.00	125	200
12500	3	3.95	3.8	0.25	119	6	219	12.50	80	160
12500	3.25	3.95	3.7	0.17	65	4	153	16.67	45	120
12500	3.5	3.95	3.6	0.13	28	3	117	25.00	20	80
12500	3.75	4	4	0.07	8	0	65	50.00	5	40
15000	0	4	4	1.00	2000	0	500	4.00	1063	500
15000	0.25	4	4	1.00	1750	0	500	4.00	938	500
15000	0.5	4	4	0.93	1526	0	497	4.29	817	467
15000	0.75	3.85	3.8	0.75	1256	56	469	4.62	704	433
15000	1	3.9	3.85	0.67	1078	33	444	5.00	600	400
15000	1.25	3.9	3.85	0.67	911	33	444	5.45	504	367
15000	1.5	3.9	3.85	0.67	744	33	444	6.00	417	333
15000	1.75	3.95	3.9	0.50	613	13	375	6.67	338	300
15000	2	3.95	3.9	0.50	487	13	375	7.50	267	267
15000	2.25	3.95	3.9	0.50	362	13	375	8.57	204	233
15000	2.5	3.95	3.85	0.33	269	8	278	10.00	150	200
15000	2.75	3.95	3.85	0.33	186	8	278	12.00	104	167
15000	3	3.95	3.8	0.25	119	6	219	15.00	67	133
15000	3.25	3.95	3.7	0.17	65	4	153	20.00	38	100
15000	3.5	3.95	3.6	0.13	28	3	117	30.00	17	67
15000	3.75	4	4	0.07	8	0	65	60.00	4	33
17500	0	4	4	1.00	2000	0	500	4.38	914	457
17500	0.25	4	4	1.00	1750	0	500	4.67	804	429
17500	0.5	4	4	0.93	1526	0	497	5.00	700	400
17500	0.75	3.85	3.8	0.75	1256	56	469	5.38	604	371
17500	1	3.9	3.85	0.67	1078	33	444	5.83	514	343
17500	1.25	3.9	3.85	0.67	911	33	444	6.36	432	314
17500	1.5	3.9	3.85	0.67	744	33	444	7.00	357	286
17500	1.75	3.95	3.9	0.50	613	13	375	7.78	289	257
17500	2	3.95	3.9	0.50	487	13	375	8.75	229	229
17500	2.25	3.95	3.9	0.50	362	13	375	10.00	175	200
17500	2.5	3.95	3.85	0.33	269	8	278	11.67	129	171
17500	2.75	3.95	3.85	0.33	186	8	278	14.00	89	143
17500	3	3.95	3.8	0.25	119	6	219	17.50	57	114
17500	3.25	3.95	3.7	0.17	65	4	153	23.33	32	86
17500	3.5	3.95	3.6	0.13	28	3	117	35.00	14	57
17500	3.75	4	4	0.07	8	0	65	70.00	4	29
20000	0	4	4	1.00	2000	0	500	5.00	800	400
20000	0.25	4	4	1.00	1750	0	500	5.33	703	375
20000	0.5	4	4	0.93	1526	0	497	5.71	613	350
20000	0.75	3.85	3.8	0.75	1256	56	469	6.15	528	325
20000	1	3.9	3.85	0.67	1078	33	444	6.67	450	300
20000	1.25	3.9	3.85	0.67	911	33	444	7.27	378	275
20000	1.5	3.9	3.85	0.67	744	33	444	8.00	313	250

		RETAILER-ONLY						DIRECT-ONLY		
Parameters		Decision Variables			Profits		Sales	Decision Var.	Profit	Sales
m	**c**	**w**	**b**	α	Π_m	Π_r	**Retailer**	**t**	Π_m	**Direct**
20000	1.75	3.95	3.9	0.50	613	13	375	8.89	253	225
20000	2	3.95	3.9	0.50	487	13	375	10.00	200	200
20000	2.25	3.95	3.9	0.50	362	13	375	11.43	153	175
20000	2.5	3.95	3.85	0.33	269	8	278	13.33	113	150
20000	2.75	3.95	3.85	0.33	186	8	278	16.00	78	125
20000	3	3.95	3.8	0.25	119	6	219	20.00	50	100
20000	3.25	3.95	3.7	0.17	65	4	153	26.67	28	75
20000	3.5	3.95	3.6	0.13	28	3	117	40.00	13	50
20000	3.75	4	4	0.07	8	0	65	80.00	3	25
22500	0	4	4	1.00	2000	0	500	5.63	711	356
22500	0.25	4	4	1.00	1750	0	500	6.00	625	333
22500	0.5	4	4	0.93	1526	0	497	6.43	544	311
22500	0.75	3.85	3.8	0.75	1256	56	469	6.92	469	289
22500	1	3.9	3.85	0.67	1078	33	444	7.50	400	267
22500	1.25	3.9	3.85	0.67	911	33	444	8.18	336	244
22500	1.5	3.9	3.85	0.67	744	33	444	9.00	278	222
22500	1.75	3.95	3.9	0.50	613	13	375	10.00	225	200
22500	2	3.95	3.9	0.50	487	13	375	11.25	178	178
22500	2.25	3.95	3.9	0.50	362	13	375	12.86	136	156
22500	2.5	3.95	3.85	0.33	269	8	278	15.00	100	133
22500	2.75	3.95	3.85	0.33	186	8	278	18.00	69	111
22500	3	3.95	3.8	0.25	119	6	219	22.50	44	89
22500	3.25	3.95	3.7	0.17	65	4	153	30.00	25	67
22500	3.5	3.95	3.6	0.13	28	3	117	45.00	11	44
22500	3.75	4	4	0.07	8	0	65	90.00	3	22
25000	0	4	4	1.00	2000	0	500	6.25	640	320
25000	0.25	4	4	1.00	1750	0	500	6.67	563	300
25000	0.5	4	4	0.93	1526	0	497	7.14	490	280
25000	0.75	3.85	3.8	0.75	1256	56	469	7.69	423	260
25000	1	3.9	3.85	0.67	1078	33	444	8.33	360	240
25000	1.25	3.9	3.85	0.67	911	33	444	9.09	303	220
25000	1.5	3.9	3.85	0.67	744	33	444	10.00	250	200
25000	1.75	3.95	3.9	0.50	613	13	375	11.11	203	180
25000	2	3.95	3.9	0.50	487	13	375	12.50	160	160
25000	2.25	3.95	3.9	0.50	362	13	375	14.29	123	140
25000	2.5	3.95	3.85	0.33	269	8	278	16.67	90	120
25000	2.75	3.95	3.85	0.33	186	8	278	20.00	63	100
25000	3	3.95	3.8	0.25	119	6	219	25.00	40	80
25000	3.25	3.95	3.7	0.17	65	4	153	33.33	23	60
25000	3.5	3.95	3.6	0.13	28	3	117	50.00	10	40
25000	3.75	4	4	0.07	8	0	65	100.00	3	20

Table 5.5: Dual Channel Strategy in the p/k Plane, m=7500, v=8, c=1

Parameters		Decision Variables				Profits		Sales			Eql.
p	**k**	**w**	**b**	**t**	α	Π_m	Π_r	**Direct**	**Retailer**	**Lost**	**Type**
2.00	0.75	2	0	6.00	0.03	292	0	500	0	0	ER
2.00	1.25	1.95	1.8	8.97	0.29	293	4	261	155	83	SP
2.00	1.75	1.95	1.8	8.91	0.29	296	3	276	143	81	SP
2.00	2.25	1.95	1.8	8.85	0.30	299	3	290	130	79	SP
2.00	2.75	1.95	1.8	8.80	0.30	302	3	305	118	77	SP
2.00	3.25	1.95	1.85	9.94	0.39	306	4	261	166	73	SP
2.00	3.75	1.95	1.85	9.75	0.40	310	4	280	150	70	SP
2.00	4.25	2	2	9.09	0.34	316	0	330	96	74	CP
2.00	4.75	2	2	9.80	0.43	323	0	306	131	63	CP
2.00	5.25	2	2	9.92	0.54	324	0	302	157	41	CP
2.25	0.75	2.25	0	5.75	0.03	398	0	500	0	0	ER
2.25	1.25	2.2	0	5.75	0.06	398	0	500	0	0	ER
2.25	1.75	2.15	0	5.75	0.09	398	0	500	0	0	ER
2.25	2.25	2.2	2.1	9.08	0.39	398	5	245	187	69	SP
2.25	2.75	2.2	2.1	8.95	0.39	403	4	264	170	66	SP
2.25	3.25	2.2	2.1	8.83	0.40	408	4	284	153	63	SP
2.25	3.75	2.2	2.1	8.72	0.41	413	3	304	136	60	SP
2.25	4.25	2.2	2.1	8.61	0.42	419	3	324	119	56	SP
2.25	4.75	2.25	2.25	9.13	0.47	429	0	315	133	52	CP
2.25	5.25	2.25	2.25	9.27	0.61	431	0	310	161	28	CP
2.50	0.75	2.5	0	5.50	0.03	502	0	500	0	0	ER
2.50	1.25	2.45	0	5.50	0.06	502	0	500	0	0	ER
2.50	1.75	2.4	0	5.50	0.09	502	0	500	0	0	ER
2.50	2.25	2.35	0	5.50	0.14	502	0	500	0	0	ER
2.50	2.75	2.45	2.35	8.14	0.40	505	4	281	161	59	SP
2.50	3.25	2.45	2.35	8.07	0.41	511	4	301	143	56	SP
2.50	3.75	2.45	2.35	8.00	0.42	517	3	321	125	53	SP
2.50	4.25	2	0.05	7.85	0.41	524	0	350	97	53	CP
2.50	4.75	2.25	1.55	8.88	0.53	538	0	310	147	43	CP
2.50	5.25	2.25	1.8	8.62	0.71	535	0	319	166	15	CP
2.75	0.75	2.75	0	5.25	0.03	603	0	500	0	0	ER
2.75	1.25	2.7	0	5.25	0.06	603	0	500	0	0	ER
2.75	1.75	2.65	0	5.25	0.10	603	0	500	0	0	ER
2.75	2.25	2.55	0	5.25	0.15	603	0	500	0	0	ER
2.75	2.75	2.7	2.65	10.21	0.56	607	8	183	269	48	SP
2.75	3.25	2.7	2.65	9.77	0.56	616	7	211	245	44	SP
2.75	3.75	2.7	2.65	9.36	0.57	624	7	240	220	40	SP
2.75	4.25	2.7	2.65	8.97	0.58	634	6	271	193	36	SP
2.75	4.75	2.6	2.25	8.90	0.60	649	0	295	172	33	CP
2.75	5.25	2.7	2.65	5.71	1.00	605	0	459	41	0	CP
3.00	0.75	2.95	0	5.00	0.03	700	0	500	0	0	ER
3.00	1.25	2.9	0	5.00	0.07	700	0	500	0	0	ER
3.00	1.75	2.85	0	5.00	0.11	700	0	500	0	0	ER
3.00	2.25	2.95	2.9	10.15	0.55	707	9	162	287	51	SP
3.00	2.75	2.95	2.9	9.73	0.56	715	8	188	264	48	SP

Parameters		Decision Variables				Profits		Sales			Eql.
p	**k**	**w**	**b**	**t**	α	Π_m	Π_r	**Direct**	**Retailer**	**Lost**	**Type**
3.00	3.25	2.95	2.9	9.35	0.56	724	7	216	240	44	SP
3.00	3.75	2.95	2.9	8.99	0.57	734	6	246	214	41	SP
3.00	4.25	2.95	2.9	8.65	0.58	745	5	278	186	36	SP
3.00	4.75	2	0.15	8.93	0.70	758	0	280	200	20	CP
3.00	5.25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
3.25	0.75	3.2	0	4.75	0.04	793	0	500	0	0	RE
3.25	1.25	3.2	3.15	10.58	0.54	796	10	116	326	58	SP
3.25	1.75	3.2	3.15	10.14	0.55	805	10	140	305	55	SP
3.25	2.25	3.2	3.15	9.73	0.55	813	9	165	283	52	SP
3.25	2.75	3.2	3.15	9.36	0.56	822	8	192	260	48	SP
3.25	3.25	3.2	3.15	9.01	0.56	832	7	220	235	45	SP
3.25	3.75	3.2	3.15	8.69	0.57	843	6	250	208	41	SP
3.25	4.25	2.7	1.35	8.58	0.58	859	0	277	183	40	CP
3.25	4.75	3.2	3.15	6.32	1.00	813	0	376	124	0	CP
3.25	5.25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
3.50	0.75	3.45	3.4	10.62	0.54	892	11	95	344	62	SP
3.50	1.25	3.45	3.4	10.18	0.54	900	10	117	324	59	SP
3.50	1.75	3.45	3.4	9.77	0.55	909	9	141	303	56	SP
3.50	2.25	3.45	3.4	9.40	0.55	918	9	167	280	53	SP
3.50	2.75	3.45	3.4	9.06	0.56	928	8	194	256	50	SP
3.50	3.25	3.45	3.4	8.75	0.56	939	7	223	231	46	SP
3.50	3.75	3.45	3.4	8.46	0.57	950	6	253	204	43	SP
3.50	4.25	2.35	0.15	9.27	0.69	978	0	243	232	25	CP
3.50	4.75	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
3.50	5.25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
3.75	0.75	3.65	3.6	17.95	0.69	994	31	36	426	37	SP
3.75	1.25	3.7	3.65	9.88	0.54	1003	10	117	323	60	SP
3.75	1.75	3.7	3.65	9.50	0.54	1012	9	142	301	57	SP
3.75	2.25	3.7	3.65	9.15	0.55	1022	9	168	278	54	SP
3.75	2.75	3.65	3.6	11.20	0.71	1034	24	137	336	27	SP
3.75	3.25	3.65	3.6	10.20	0.71	1047	22	172	304	24	SP
3.75	3.75	3.65	3.6	9.34	0.72	1061	19	212	267	21	SP
3.75	4.25	3.7	3.65	7.06	1.00	1026	0	301	199	0	CP
3.75	4.75	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
3.75	5.25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
4.00	0.75	3.9	3.85	17.64	0.69	1108	31	36	426	38	SP
4.00	1.25	3.9	3.85	15.41	0.69	1116	30	55	409	36	SP
4.00	1.75	3.9	3.85	13.66	0.69	1126	29	79	388	33	SP
4.00	2.25	3.9	3.85	12.25	0.70	1137	27	106	364	30	SP
4.00	2.75	3.9	3.85	11.09	0.70	1149	24	137	335	28	SP
4.00	3.25	3.9	3.85	10.12	0.71	1162	22	172	303	25	SP
4.00	3.75	2.65	0	9.43	0.67	1187	5	212	256	32	CP
4.00	4.25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
4.00	4.75	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
4.00	5.25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Table 5.6: RB/DO Strategies in the p/k Plane, m=7500, v=8, c=1

		RETAILER-ONLY						DIRECT-ONLY		
Parameters		Decision Variables			Profits		Sales	Decision Var.	Profit	Sales
p	**k**	**w**	**b**	α	Π_m	Π_r	**Retailer**	**t**	Π_m	**Direct**
2.00	0.75	1.95	1.9	0.50	238	12	375	6	292	500
2.00	1.25	1.95	1.9	0.50	238	12	375	6	292	500
2.00	1.75	1.95	1.9	0.50	238	12	375	6	292	500
2.00	2.25	1.95	1.9	0.50	238	12	375	6	292	500
2.00	2.75	1.95	1.9	0.50	238	12	375	6	292	500
2.00	3.25	1.95	1.9	0.50	238	12	375	6	292	500
2.00	3.75	1.95	1.9	0.50	238	12	375	6	292	500
2.00	4.25	1.95	1.9	0.50	238	12	375	6	292	500
2.00	4.75	1.85	1.3	0.43	245	0	337	6	292	500
2.00	5.25	1.85	1.45	0.54	248	0	396	6	292	500
2.25	0.75	2.2	2.15	0.50	331	12	375	5.75	398	500
2.25	1.25	2.2	2.15	0.50	331	12	375	5.75	398	500
2.25	1.75	2.2	2.15	0.50	331	12	375	5.75	398	500
2.25	2.25	2.2	2.15	0.50	331	12	375	5.75	398	500
2.25	2.75	2.2	2.15	0.50	331	12	375	5.75	398	500
2.25	3.25	2.2	2.15	0.50	331	12	375	5.75	398	500
2.25	3.75	2.2	2.15	0.50	331	12	375	5.75	398	500
2.25	4.25	2.2	2.15	0.50	331	12	375	5.75	398	500
2.25	4.75	1.8	0.35	0.47	338	1	360	5.75	398	500
2.25	5.25	2.05	1.6	0.61	343	0	425	5.75	398	500
2.50	0.75	2.45	2.4	0.50	425	13	375	5.5	502	500
2.50	1.25	2.45	2.4	0.50	425	13	375	5.5	502	500
2.50	1.75	2.45	2.4	0.50	425	13	375	5.5	502	500
2.50	2.25	2.45	2.4	0.50	425	13	375	5.5	502	500
2.50	2.75	2.45	2.4	0.50	425	13	375	5.5	502	500
2.50	3.25	2.45	2.4	0.50	425	13	375	5.5	502	500
2.50	3.75	2.45	2.4	0.50	425	13	375	5.5	502	500
2.50	4.25	2.45	2.4	0.50	425	13	375	5.5	502	500
2.50	4.75	2.5	2.5	0.53	443	0	387	5.5	502	500
2.50	5.25	2.5	2.5	0.71	434	0	459	5.5	502	500
2.75	0.75	2.65	2.6	0.67	522	33	444	5.25	603	500
2.75	1.25	2.65	2.6	0.67	522	33	444	5.25	603	500
2.75	1.75	2.65	2.6	0.67	522	33	444	5.25	603	500
2.75	2.25	2.65	2.6	0.67	522	33	444	5.25	603	500
2.75	2.75	2.65	2.6	0.67	522	33	444	5.25	603	500
2.75	3.25	2.65	2.6	0.67	522	33	444	5.25	603	500
2.75	3.75	2.65	2.6	0.67	522	33	444	5.25	603	500
2.75	4.25	2.65	2.6	0.67	522	33	444	5.25	603	500
2.75	4.75	2.75	2.75	0.60	555	0	419	5.25	603	500
2.75	5.25	2.65	2.6	0.67	522	33	444	5.25	603	500
3.00	0.75	2.9	2.85	0.67	633	33	444	5	700	500
3.00	1.25	2.9	2.85	0.67	633	33	444	5	700	500
3.00	1.75	2.9	2.85	0.67	633	33	444	5	700	500
3.00	2.25	2.9	2.85	0.67	633	33	444	5	700	500
3.00	2.75	2.9	2.85	0.67	633	33	444	5	700	500

		RETAILER-ONLY						DIRECT-ONLY		
Parameters		Decision Variables			Profits		Sales	Decision Var.	Profit	Sales
p	**k**	**w**	**b**	α	Π_m	Π_r	**Retailer**	**t**	Π_m	**Direct**
3.00	3.25	2.9	2.85	0.67	633	33	444	5	700	500
3.00	3.75	2.9	2.85	0.67	633	33	444	5	700	500
3.00	4.25	2.9	2.85	0.67	633	33	444	5	700	500
3.00	4.75	3	3	0.70	665	0	455	5	700	500
3.00	5.25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
3.25	0.75	3.15	3.1	0.67	744	33	444	4.75	793	500
3.25	1.25	3.15	3.1	0.67	744	33	444	4.75	793	500
3.25	1.75	3.15	3.1	0.67	744	33	444	4.75	793	500
3.25	2.25	3.15	3.1	0.67	744	33	444	4.75	793	500
3.25	2.75	3.15	3.1	0.67	744	33	444	4.75	793	500
3.25	3.25	3.15	3.1	0.67	744	33	444	4.75	793	500
3.25	3.75	3.15	3.1	0.67	744	33	444	4.75	793	500
3.25	4.25	3.25	3.25	0.58	758	0	411	4.75	793	500
3.25	4.75	3.15	3.1	0.67	744	33	444	4.75	793	500
3.25	5.25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
3.50	0.75	3.4	3.35	0.67	856	33	444	4.5	880	500
3.50	1.25	3.4	3.35	0.67	856	33	444	4.5	880	500
3.50	1.75	3.4	3.35	0.67	856	33	444	4.5	880	500
3.50	2.25	3.4	3.35	0.67	856	33	444	4.5	880	500
3.50	2.75	3.4	3.35	0.67	856	33	444	4.5	880	500
3.50	3.25	3.4	3.35	0.67	856	33	444	4.5	880	500
3.50	3.75	3.4	3.35	0.67	856	33	444	4.5	880	500
3.50	4.25	3.5	3.5	0.69	891	0	451	4.5	880	500
3.50	4.75	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
3.50	5.25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
3.75	0.75	3.65	3.6	0.67	967	33	444	4.25	960	500
3.75	1.25	3.65	3.6	0.67	967	33	444	4.25	960	500
3.75	1.75	3.65	3.6	0.67	967	33	444	4.25	960	500
3.75	2.25	3.65	3.6	0.67	967	33	444	4.25	960	500
3.75	2.75	3.65	3.6	0.67	967	33	444	4.25	960	500
3.75	3.25	3.65	3.6	0.67	967	33	444	4.25	960	500
3.75	3.75	3.65	3.6	0.67	967	33	444	4.25	960	500
3.75	4.25	3.65	3.6	0.67	967	33	444	4.25	960	500
3.75	4.75	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
3.75	5.25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
4.00	0.75	3.9	3.85	0.67	1078	33	444	4	1031	500
4.00	1.25	3.9	3.85	0.67	1078	33	444	4	1031	500
4.00	1.75	3.9	3.85	0.67	1078	33	444	4	1031	500
4.00	2.25	3.9	3.85	0.67	1078	33	444	4	1031	500
4.00	2.75	3.9	3.85	0.67	1078	33	444	4	1031	500
4.00	3.25	3.9	3.85	0.67	1078	33	444	4	1031	500
4.00	3.75	4	4	0.67	1112	0	445	4	1031	500
4.00	4.25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
4.00	4.75	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
4.00	5.25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Table 5.7: Dual Channel Strategy in the m/v Plane, p=4, k=1, c=1

Parameters		Decision Variables				Profits		Sales			Eql.
m	**v**	**w**	**b**	**t**	α	Π_m	Π_r	**Direct**	**Retailer**	**Lost**	**Type**
0	5	1	0	1.00	1.00	1500	0	500	0	0	ER
0	5.5	3.35	1.35	1.24	0.49	1500	0	500	0	0	ER
0	6	3.1	0.35	1.32	0.49	1500	0	500	0	0	ER
0	6.5	3.45	1.75	1.40	0.49	1500	0	500	0	0	ER
0	7	3.35	1.35	1.48	0.49	1500	0	500	0	0	ER
0	7.5	3.25	0.95	1.56	0.49	1500	0	500	0	0	ER
0	8	3.1	0.35	1.63	0.49	1500	0	500	0	0	ER
2500	5	3.95	3.9	10.00	1.00	1025	0	50	450	0	CP
2500	5.5	3.9	3.85	9.68	0.68	1109	30	58	399	43	SP
2500	6	3.9	3.85	8.47	0.69	1119	29	71	393	37	SP
2500	6.5	3.9	3.85	7.63	0.70	1129	28	82	387	31	SP
2500	7	3.8	0	3.00	0.10	1222	0	500	0	0	ER
2500	7.5	3.85	0	3.50	0.08	1296	0	500	0	0	ER
2500	8	3.9	0	4.00	0.07	1344	0	500	0	0	ER
5000	5	3.95	3.9	20.00	1.00	1013	0	25	475	0	CP
5000	5.5	3.9	3.85	19.12	0.67	1094	31	30	421	49	SP
5000	6	3.9	3.85	16.52	0.68	1100	31	37	418	46	SP
5000	6.5	3.9	3.85	14.66	0.68	1106	31	44	415	42	SP
5000	7	3.9	3.85	13.26	0.69	1112	30	51	411	38	SP
5000	7.5	3.9	3.85	12.20	0.69	1119	30	58	409	34	SP
5000	8	3.9	0	4.00	0.07	1187	0	500	0	0	ER
7500	5	3.95	3.9	30.00	1.00	1008	0	17	483	0	CP
7500	5.5	3.9	3.85	28.56	0.67	1089	32	20	429	51	SP
7500	6	3.9	3.85	24.57	0.67	1093	32	25	427	49	SP
7500	6.5	3.9	3.85	21.68	0.68	1097	32	30	424	46	SP
7500	7	3.9	3.85	19.49	0.68	1102	31	35	422	43	SP
7500	7.5	3.9	3.85	17.80	0.68	1107	31	40	420	40	SP
7500	8	3.9	3.85	16.45	0.69	1112	31	45	418	37	SP
10000	5	3.95	3.9	40.00	1.00	1006	0	12	488	0	CP
10000	5.5	3.9	3.85	37.99	0.67	1086	32	15	433	52	SP
10000	6	3.9	3.85	32.62	0.67	1089	32	19	431	50	SP
10000	6.5	3.9	3.85	28.70	0.67	1092	32	23	429	48	SP
10000	7	3.9	3.85	25.72	0.68	1096	32	27	427	46	SP
10000	7.5	3.9	3.85	23.39	0.68	1100	32	31	426	43	SP
10000	8	3.9	3.85	21.53	0.68	1104	31	35	424	41	SP
12500	5	3.95	3.9	50.00	1.00	1005	0	10	490	0	CP
12500	5.5	3.9	3.85	47.43	0.67	1084	33	12	435	53	SP
12500	6	3.9	3.85	40.67	0.67	1087	32	15	434	51	SP
12500	6.5	3.9	3.85	35.71	0.67	1090	32	18	432	50	SP
12500	7	3.9	3.85	31.94	0.68	1093	32	21	431	48	SP
12500	7.5	3.9	3.85	28.98	0.68	1096	32	25	429	46	SP
12500	8	3.9	3.85	26.61	0.68	1100	32	28	428	43	SP
15000	5	3.95	3.9	60.00	1.00	1004	0	8	492	0	CP
15000	5.5	3.9	3.85	56.87	0.67	1083	33	10	437	53	SP
15000	6	3.9	3.85	48.72	0.67	1085	33	13	435	52	SP

Parameters		Decision Variables				Profits		Sales			Eql.
m	**v**	**w**	**b**	**t**	α	Π_m	Π_r	**Direct**	**Retailer**	**Lost**	**Type**
15000	6.5	3.9	3.85	42.73	0.67	1088	32	15	434	51	SP
15000	7	3.9	3.85	38.16	0.67	1090	32	18	433	49	SP
15000	7.5	3.9	3.85	34.57	0.68	1093	32	21	432	47	SP
15000	8	3.9	3.85	31.68	0.68	1096	32	24	431	45	SP
17500	5	3.95	3.9	70.00	1.00	1004	0	7	493	0	CP
17500	5.5	3.9	3.85	66.31	0.67	1082	33	9	438	54	SP
17500	6	3.9	3.85	56.77	0.67	1084	33	11	437	53	SP
17500	6.5	3.9	3.85	49.75	0.67	1086	33	13	436	51	SP
17500	7	3.9	3.85	44.38	0.67	1089	32	16	435	50	SP
17500	7.5	3.9	3.85	40.15	0.67	1091	32	18	434	48	SP
17500	8	3.9	3.85	36.76	0.68	1094	32	21	433	47	SP
20000	5	3.95	3.9	80.00	1.00	1003	0	6	494	0	CP
20000	5.5	3.9	3.85	75.75	0.67	1082	33	8	439	54	SP
20000	6	3.9	3.85	64.82	0.67	1083	33	9	438	53	SP
20000	6.5	3.9	3.85	56.77	0.67	1085	33	11	437	52	SP
20000	7	3.9	3.85	50.60	0.67	1087	33	14	436	51	SP
20000	7.5	3.9	3.85	45.74	0.67	1090	32	16	435	49	SP
20000	8	3.9	3.85	41.83	0.68	1092	32	18	434	48	SP
22500	5	3.95	3.9	90.00	1.00	1003	0	6	494	0	CP
22500	5.5	3.9	3.85	85.19	0.67	1081	33	7	439	54	SP
22500	6	3.9	3.85	72.87	0.67	1083	33	8	438	53	SP
22500	6.5	3.9	3.85	63.79	0.67	1084	33	10	438	52	SP
22500	7	3.9	3.85	56.82	0.67	1086	33	12	437	51	SP
22500	7.5	3.9	3.85	51.33	0.67	1088	33	14	436	50	SP
22500	8	3.9	3.85	46.90	0.67	1090	32	16	435	49	SP
25000	5	3.95	3.9	100.00	1.00	1003	0	5	495	0	CP
25000	5.5	3.9	3.85	94.63	0.67	1081	33	6	440	54	SP
25000	6	3.9	3.85	80.93	0.67	1082	33	8	439	53	SP
25000	6.5	3.9	3.85	70.80	0.67	1084	33	9	438	53	SP
25000	7	3.9	3.85	63.04	0.67	1085	33	11	437	52	SP
25000	7.5	3.9	3.85	56.91	0.67	1087	33	13	437	50	SP
25000	8	3.9	3.85	51.97	0.67	1089	33	15	436	49	SP

Table 5.8: RB/DO Strategies in the m/v Plane, p=4, k=1, c=1

		RETAILER-ONLY						DIRECT-ONLY		
Parameters		Decision Variables			Profits		Sales	Decision Var.	Profit	Sales
m	**v**	**w**	**b**	α	Π_m	Π_r	**Retailer**	**t**	Π_m	**Direct**
0	5	3.9	3.85	0.67	1078	33	444	1.00	1500	500
0	5.5	3.9	3.85	0.67	1078	33	444	1.50	1500	500
0	6	3.9	3.85	0.67	1078	33	444	2.00	1500	500
0	6.5	3.9	3.85	0.67	1078	33	444	2.50	1500	500
0	7	3.9	3.85	0.67	1078	33	444	3.00	1500	500
0	7.5	3.9	3.85	0.67	1078	33	444	3.50	1500	500
0	8	3.9	3.85	0.67	1078	33	444	4.00	1500	500
2500	5	3.9	3.85	0.67	1078	33	444	3.33	225	150
2500	5.5	3.9	3.85	0.67	1078	33	444	2.22	506	338
2500	6	3.9	3.85	0.67	1078	33	444	2.00	875	500
2500	6.5	3.9	3.85	0.67	1078	33	444	2.50	1100	500
2500	7	3.9	3.85	0.67	1078	33	444	3.00	1222	500
2500	7.5	3.9	3.85	0.67	1078	33	444	3.50	1296	500
2500	8	3.9	3.85	0.67	1078	33	444	4.00	1344	500
5000	5	3.9	3.85	0.67	1078	33	444	6.67	113	75
5000	5.5	3.9	3.85	0.67	1078	33	444	4.44	253	169
5000	6	3.9	3.85	0.67	1078	33	444	3.33	450	300
5000	6.5	3.9	3.85	0.67	1078	33	444	2.67	703	469
5000	7	3.9	3.85	0.67	1078	33	444	3.00	944	500
5000	7.5	3.9	3.85	0.67	1078	33	444	3.50	1092	500
5000	8	3.9	3.85	0.67	1078	33	444	4.00	1188	500
7500	5	3.9	3.85	0.67	1078	33	444	10.00	75	50
7500	5.5	3.9	3.85	0.67	1078	33	444	6.67	169	113
7500	6	3.9	3.85	0.67	1078	33	444	5.00	300	200
7500	6.5	3.9	3.85	0.67	1078	33	444	4.00	469	313
7500	7	3.9	3.85	0.67	1078	33	444	3.33	675	450
7500	7.5	3.9	3.85	0.67	1078	33	444	3.50	888	500
7500	8	3.9	3.85	0.67	1078	33	444	4.00	1031	500
10000	5	3.9	3.85	0.67	1078	33	444	13.33	56	38
10000	5.5	3.9	3.85	0.67	1078	33	444	8.89	127	84
10000	6	3.9	3.85	0.67	1078	33	444	6.67	225	150
10000	6.5	3.9	3.85	0.67	1078	33	444	5.33	352	234
10000	7	3.9	3.85	0.67	1078	33	444	4.44	506	338
10000	7.5	3.9	3.85	0.67	1078	33	444	3.81	689	459
10000	8	3.9	3.85	0.67	1078	33	444	4.00	875	500
12500	5	3.9	3.85	0.67	1078	33	444	16.67	45	30
12500	5.5	3.9	3.85	0.67	1078	33	444	11.11	101	68
12500	6	3.9	3.85	0.67	1078	33	444	8.33	180	120
12500	6.5	3.9	3.85	0.67	1078	33	444	6.67	281	188
12500	7	3.9	3.85	0.67	1078	33	444	5.56	405	270
12500	7.5	3.9	3.85	0.67	1078	33	444	4.76	551	368
12500	8	3.9	3.85	0.67	1078	33	444	4.17	720	480
15000	5	3.9	3.85	0.67	1078	33	444	20.00	38	25
15000	5.5	3.9	3.85	0.67	1078	33	444	13.33	84	56
15000	6	3.9	3.85	0.67	1078	33	444	10.00	150	100

		RETAILER-ONLY						DIRECT-ONLY		
Parameters		Decision Variables			Profits		Sales	Decision Var.	Profit	Sales
m	**v**	**w**	**b**	α	Π_m	Π_r	**Retailer**	**t**	Π_m	**Direct**
15000	6.5	3.9	3.85	0.67	1078	33	444	8.00	234	156
15000	7	3.9	3.85	0.67	1078	33	444	6.67	338	225
15000	7.5	3.9	3.85	0.67	1078	33	444	5.71	459	306
15000	8	3.9	3.85	0.67	1078	33	444	5.00	600	400
17500	5	3.9	3.85	0.67	1078	33	444	23.33	32	21
17500	5.5	3.9	3.85	0.67	1078	33	444	15.56	72	48
17500	6	3.9	3.85	0.67	1078	33	444	11.67	129	86
17500	6.5	3.9	3.85	0.67	1078	33	444	9.33	201	134
17500	7	3.9	3.85	0.67	1078	33	444	7.78	289	193
17500	7.5	3.9	3.85	0.67	1078	33	444	6.67	394	263
17500	8	3.9	3.85	0.67	1078	33	444	5.83	514	343
20000	5	3.9	3.85	0.67	1078	33	444	26.67	28	19
20000	5.5	3.9	3.85	0.67	1078	33	444	17.78	63	42
20000	6	3.9	3.85	0.67	1078	33	444	13.33	113	75
20000	6.5	3.9	3.85	0.67	1078	33	444	10.67	176	117
20000	7	3.9	3.85	0.67	1078	33	444	8.89	253	169
20000	7.5	3.9	3.85	0.67	1078	33	444	7.62	345	230
20000	8	3.9	3.85	0.67	1078	33	444	6.67	450	300
22500	5	3.9	3.85	0.67	1078	33	444	30.00	25	17
22500	5.5	3.9	3.85	0.67	1078	33	444	20.00	56	38
22500	6	3.9	3.85	0.67	1078	33	444	15.00	100	67
22500	6.5	3.9	3.85	0.67	1078	33	444	12.00	156	104
22500	7	3.9	3.85	0.67	1078	33	444	10.00	225	150
22500	7.5	3.9	3.85	0.67	1078	33	444	8.57	306	204
22500	8	3.9	3.85	0.67	1078	33	444	7.50	400	267
25000	5	3.9	3.85	0.67	1078	33	444	33.33	23	15
25000	5.5	3.9	3.85	0.67	1078	33	444	22.22	51	34
25000	6	3.9	3.85	0.67	1078	33	444	16.67	90	60
25000	6.5	3.9	3.85	0.67	1078	33	444	13.33	141	94
25000	7	3.9	3.85	0.67	1078	33	444	11.11	203	135
25000	7.5	3.9	3.85	0.67	1078	33	444	9.52	276	184
25000	8	3.9	3.85	0.67	1078	33	444	8.33	360	240

Appendix D: Results of the Wholesale Price Contract

Table 5.9: The Numerical Experiments to Span the Parameter Space DW

Parameters					Decision Variables			Profits		Sales			Eql.
m	**v**	**p**	**k**	**c**	**w**	**t**	α	Π_m	Π_r	**Direct**	**Retailer**	**Lost**	**Type**
1000	4	1	0.375	0	1	3.00	0.03	389	0	500	0	0	ER
1000	4	1	0.375	0.25	1	3.00	0.03	264	0	500	0	0	ER
1000	4	1	0.375	0.5	1	3.00	0.03	139	0	500	0	0	ER
1000	4	1	1.5	0	0.95	3.00	0.19	389	0	500	0	0	ER
1000	4	1	1.5	0.25	0.95	3.00	0.19	264	0	500	0	0	ER
1000	4	1	1.5	0.5	0.9	3.80	0.19	144	0	394	36	70	CP
1000	4	1	2.25	0	0.8	3.44	0.38	391	0	437	39	24	CP
1000	4	1	2.25	0.25	0.8	4.05	0.38	271	1	371	80	49	CP
1000	4	1	2.25	0.5	0.8	4.93	0.38	156	1	304	121	75	CP
1000	4	2	0.25	0	2	2.00	0.03	750	0	500	0	0	ER
1000	4	2	0.25	0.5	2	2.00	0.03	500	0	500	0	0	ER
1000	4	2	0.25	1	1.75	2.63	0.15	256	7	349	65	86	SP
1000	4	2	1	0	1.85	2.00	0.19	750	0	500	0	0	ER
1000	4	2	1	0.5	1.8	2.00	0.19	500	0	497	2	1	SP
1000	4	2	1	1	1.8	2.85	0.19	272	1	351	51	99	CP
1000	4	2	1.5	0	1.6	2.58	0.38	763	2	388	69	43	CP
1000	4	2	1.5	0.5	1.6	3.04	0.38	529	2	329	106	65	CP
1000	4	2	1.5	1	1.6	3.70	0.38	303	3	271	142	88	CP
1000	4	3	0.125	0	1.75	3.59	0.44	845	236	75	311	114	SP
1000	4	3	0.125	0.75	2.05	3.45	0.33	519	132	98	244	157	SP
1000	4	3	0.125	1.5	2.35	3.93	0.23	258	60	105	172	223	SP
1000	4	3	0.5	0	1.7	3.20	0.46	883	221	121	280	99	SP
1000	4	3	0.5	0.75	2	3.17	0.36	546	125	137	222	142	SP
1000	4	3	0.5	1.5	2.7	3.80	0.19	293	3	131	125	244	CP
1000	4	3	0.75	0	2.4	3.44	0.38	1003	7	146	219	135	CP
1000	4	3	0.75	0.75	2.4	4.05	0.38	692	8	124	233	144	CP
1000	4	3	0.75	1.5	2.4	4.93	0.38	385	8	101	247	152	CP
1000	8	2	0.75	0	2	6.00	0.03	972	0	500	0	0	ER
1000	8	2	0.75	0.5	2	6.00	0.03	722	0	500	0	0	ER
1000	8	2	0.75	1	2	6.00	0.03	472	0	500	0	0	ER
1000	8	2	3	0	1.85	6.00	0.19	972	0	500	0	0	ER
1000	8	2	3	0.5	1.85	6.00	0.19	722	0	500	0	0	ER
1000	8	2	3	1	1.85	6.00	0.19	472	0	500	0	0	ER
1000	8	2	4.5	0	1.65	6.00	0.38	972	0	500	0	0	ER
1000	8	2	4.5	0.5	1.65	6.00	0.38	722	0	500	0	0	ER
1000	8	2	4.5	1	1.65	6.00	0.38	472	0	500	0	0	ER
1000	8	4	0.5	0	3.95	4.00	0.03	1938	0	500	0	0	ER
1000	8	4	0.5	1	3.95	4.00	0.03	1437	0	500	0	0	ER
1000	8	4	0.5	2	3.95	4.00	0.03	937	0	500	0	0	ER
1000	8	4	2	0	3.65	4.00	0.19	1938	0	500	0	0	ER
1000	8	4	2	1	3.65	4.00	0.19	1437	0	500	0	0	ER
1000	8	4	2	2	3.65	4.00	0.19	937	0	500	0	0	ER
1000	8	4	3	0	3.25	4.00	0.38	1938	0	500	0	0	ER
1000	8	4	3	1	3.25	4.00	0.38	1438	0	500	0	0	ER
1000	8	4	3	2	3.25	4.00	0.38	938	0	500	0	0	ER

Parameters					Decision Variables			Profits		Sales			Eql.
m	**v**	**p**	**k**	**c**	**w**	**t**	α	Π_m	Π_r	**Direct**	**Retailer**	**Lost**	**Type**
1000	8	6	0.25	0	5.95	2.00	0.03	2750	0	500	0	0	ER
1000	8	6	0.25	1.5	5.95	2.00	0.03	2000	0	500	0	0	ER
1000	8	6	0.25	3	5.95	2.00	0.03	1250	0	500	0	0	ER
1000	8	6	1	0	5.45	2.00	0.19	2750	0	500	0	0	ER
1000	8	6	1	1.5	5.45	2.00	0.19	2000	0	500	0	0	ER
1000	8	6	1	3	5.45	2.00	0.19	1250	0	500	0	0	ER
1000	8	6	1.5	0	4.9	2.00	0.38	2750	0	500	0	0	ER
1000	8	6	1.5	1.5	4.9	2.00	0.38	2000	0	500	0	0	ER
1000	8	6	1.5	3	4.9	2.00	0.38	1250	0	500	0	0	ER
1000	12	3	1.125	0	3	9.00	0.03	1488	0	500	0	0	ER
1000	12	3	1.125	0.75	3	9.00	0.03	1113	0	500	0	0	ER
1000	12	3	1.125	1.5	3	9.00	0.03	738	0	500	0	0	ER
1000	12	3	4.5	0	2.75	9.00	0.19	1488	0	500	0	0	ER
1000	12	3	4.5	0.75	2.75	9.00	0.19	1113	0	500	0	0	ER
1000	12	3	4.5	1.5	2.75	9.00	0.19	738	0	500	0	0	ER
1000	12	3	6.75	0	2.45	9.00	0.38	1488	0	500	0	0	ER
1000	12	3	6.75	0.75	2.45	9.00	0.38	1113	0	500	0	0	ER
1000	12	3	6.75	1.5	2.45	9.00	0.38	738	0	500	0	0	ER
1000	12	6	0.75	0	5.95	6.00	0.03	2972	0	500	0	0	ER
1000	12	6	0.75	1.5	5.95	6.00	0.03	2222	0	500	0	0	ER
1000	12	6	0.75	3	5.95	6.00	0.03	1472	0	500	0	0	ER
1000	12	6	3	0	5.45	6.00	0.19	2972	0	500	0	0	ER
1000	12	6	3	1.5	5.45	6.00	0.19	2222	0	500	0	0	ER
1000	12	6	3	3	5.45	6.00	0.19	1472	0	500	0	0	ER
1000	12	6	4.5	0	4.9	6.00	0.38	2972	0	500	0	0	ER
1000	12	6	4.5	1.5	4.9	6.00	0.38	2222	0	500	0	0	ER
1000	12	6	4.5	3	4.9	6.00	0.38	1472	0	500	0	0	ER
1000	12	9	0.375	0	8.9	3.00	0.03	4389	0	500	0	0	ER
1000	12	9	0.375	2.25	8.9	3.00	0.03	3264	0	500	0	0	ER
1000	12	9	0.375	4.5	8.9	3.00	0.03	2139	0	500	0	0	ER
1000	12	9	1.5	0	8.2	3.00	0.19	4389	0	500	0	0	ER
1000	12	9	1.5	2.25	8.2	3.00	0.19	3264	0	500	0	0	ER
1000	12	9	1.5	4.5	8.2	3.00	0.19	2139	0	500	0	0	ER
1000	12	9	2.25	0	7.3	3.00	0.38	4389	0	500	0	0	ER
1000	12	9	2.25	2.25	7.3	3.00	0.38	3264	0	500	0	0	ER
1000	12	9	2.25	4.5	7.3	3.00	0.38	2139	0	500	0	0	ER
5000	4	1	0.375	0	0.55	19.03	0.46	268	96	40	339	121	SP
5000	4	1	0.375	0.25	0.65	18.14	0.36	160	57	53	276	170	SP
5000	4	1	0.375	0.5	0.75	20.47	0.26	76	29	58	207	236	SP
5000	4	1	1.5	0	0.55	15.82	0.47	277	88	73	312	115	SP
5000	4	1	1.5	0.25	0.65	15.76	0.36	166	52	82	254	164	SP
5000	4	1	1.5	0.5	0.9	19.01	0.19	89	1	79	143	279	CP
5000	4	1	2.25	0	0.8	17.18	0.38	323	3	87	255	157	CP
5000	4	1	2.25	0.25	0.8	20.24	0.38	223	3	74	263	162	CP
5000	4	1	2.25	0.5	0.8	24.64	0.38	123	3	61	272	167	CP

Parameters					Decision Variables			Profits		Sales			Eql.
m	**v**	**p**	**k**	**c**	**w**	**t**	α	Π_m	Π_r	**Direct**	**Retailer**	**Lost**	**Type**
5000	4	2	0.25	0	1.1	14.20	0.46	532	194	36	340	125	SP
5000	4	2	0.25	0.5	1.3	13.55	0.36	315	115	48	278	175	SP
5000	4	2	0.25	1	1.55	14.75	0.23	150	47	56	189	256	SP
5000	4	2	1	0	1.05	12.22	0.49	548	201	61	330	109	SP
5000	4	2	1	0.5	1.3	11.78	0.36	326	106	73	258	169	SP
5000	4	2	1	1	1.8	14.26	0.19	174	2	70	146	284	CP
5000	4	2	1.5	0	1.6	12.88	0.38	642	6	78	261	161	CP
5000	4	2	1.5	0.5	1.6	15.18	0.38	442	6	66	269	166	CP
5000	4	2	1.5	1	1.6	18.48	0.38	244	6	54	276	170	CP
5000	4	3	0.125	0	1.55	20.22	0.49	768	345	12	363	125	SP
5000	4	3	0.125	0.75	1.9	18.39	0.37	441	197	17	295	187	SP
5000	4	3	0.125	1.5	2.25	20.25	0.25	201	91	20	215	266	SP
5000	4	3	0.5	0	1.55	16.03	0.49	777	336	23	354	123	SP
5000	4	3	0.5	0.75	1.9	15.68	0.37	447	192	27	288	185	SP
5000	4	3	0.5	1.5	2.7	19.01	0.19	238	4	26	160	313	CP
5000	4	3	0.75	0	2.4	17.18	0.38	935	10	29	291	180	CP
5000	4	3	0.75	0.75	2.4	20.24	0.38	643	10	25	294	181	CP
5000	4	3	0.75	1.5	2.4	24.64	0.38	352	10	20	297	183	CP
5000	8	2	0.75	0	2	6.00	0.03	861	0	500	0	0	ER
5000	8	2	0.75	0.5	2	6.00	0.03	611	0	500	0	0	ER
5000	8	2	0.75	1	2	6.00	0.03	361	0	500	0	0	ER
5000	8	2	3	0	1.85	6.00	0.19	861	0	500	0	0	ER
5000	8	2	3	0.5	1.85	6.00	0.19	611	0	500	0	0	ER
5000	8	2	3	1	1.85	6.00	0.19	361	0	500	0	0	ER
5000	8	2	4.5	0	1.65	6.00	0.38	861	0	500	0	0	ER
5000	8	2	4.5	0.5	1.65	6.00	0.38	611	0	500	0	0	ER
5000	8	2	4.5	1	1.6	6.16	0.38	361	0	487	8	5	CP
5000	8	4	0.5	0	3.95	4.00	0.03	1688	0	500	0	0	ER
5000	8	4	0.5	1	3.95	4.00	0.03	1187	0	500	0	0	ER
5000	8	4	0.5	2	3.95	4.00	0.03	687	0	500	0	0	ER
5000	8	4	2	0	3.65	4.00	0.19	1688	0	500	0	0	ER
5000	8	4	2	1	3.65	4.00	0.19	1187	0	500	0	0	ER
5000	8	4	2	2	3.65	4.00	0.19	687	0	500	0	0	ER
5000	8	4	3	0	3.25	4.00	0.38	1688	0	500	0	0	ER
5000	8	4	3	1	3.25	4.00	0.38	1188	0	500	0	0	ER
5000	8	4	3	2	3.2	4.62	0.38	693	2	433	42	26	CP
5000	8	6	0.25	0	4	3.79	0.37	1827	262	167	240	94	SP
5000	8	6	0.25	1.5	4.5	3.86	0.28	1167	138	196	178	126	SP
5000	8	6	0.25	3	4.85	4.79	0.21	602	82	177	140	183	SP
5000	8	6	1	0	3.75	3.87	0.42	1922	262	209	211	80	SP
5000	8	6	1	1.5	4.25	3.93	0.33	1235	148	227	163	110	SP
5000	8	6	1	3	5.4	4.75	0.19	669	4	210	98	192	CP
5000	8	6	1.5	0	4.85	4.37	0.38	2117	1	229	168	103	CP
5000	8	6	1.5	1.5	4.85	5.16	0.38	1469	1	194	189	117	CP
5000	8	6	1.5	3	4.85	6.31	0.38	833	1	159	211	130	CP

Parameters					Decision Variables			Profits		Sales			Eql.
m	**v**	**p**	**k**	**c**	**w**	**t**	α	Π_m	Π_r	**Direct**	**Retailer**	**Lost**	**Type**
5000	12	3	1.125	0	3	9.00	0.03	1438	0	500	0	0	ER
5000	12	3	1.125	0.75	3	9.00	0.03	1063	0	500	0	0	ER
5000	12	3	1.125	1.5	3	9.00	0.03	688	0	500	0	0	ER
5000	12	3	4.5	0	2.75	9.00	0.19	1438	0	500	0	0	ER
5000	12	3	4.5	0.75	2.75	9.00	0.19	1063	0	500	0	0	ER
5000	12	3	4.5	1.5	2.75	9.00	0.19	688	0	500	0	0	ER
5000	12	3	6.75	0	2.45	9.00	0.38	1438	0	500	0	0	ER
5000	12	3	6.75	0.75	2.45	9.00	0.38	1063	0	500	0	0	ER
5000	12	3	6.75	1.5	2.45	9.00	0.38	688	0	500	0	0	ER
5000	12	6	0.75	0	5.95	6.00	0.03	2861	0	500	0	0	ER
5000	12	6	0.75	1.5	5.95	6.00	0.03	2111	0	500	0	0	ER
5000	12	6	0.75	3	5.95	6.00	0.03	1361	0	500	0	0	ER
5000	12	6	3	0	5.45	6.00	0.19	2861	0	500	0	0	ER
5000	12	6	3	1.5	5.45	6.00	0.19	2111	0	500	0	0	ER
5000	12	6	3	3	5.45	6.00	0.19	1361	0	500	0	0	ER
5000	12	6	4.5	0	4.9	6.00	0.38	2861	0	500	0	0	ER
5000	12	6	4.5	1.5	4.9	6.00	0.38	2111	0	500	0	0	ER
5000	12	6	4.5	3	4.9	6.00	0.38	1361	0	500	0	0	ER
5000	12	9	0.375	0	8.9	3.00	0.03	3944	0	500	0	0	ER
5000	12	9	0.375	2.25	8.9	3.00	0.03	2819	0	500	0	0	ER
5000	12	9	0.375	4.5	8.9	3.00	0.03	1694	0	500	0	0	ER
5000	12	9	1.5	0	8.2	3.00	0.19	3944	0	500	0	0	ER
5000	12	9	1.5	2.25	8.2	3.00	0.19	2819	0	500	0	0	ER
5000	12	9	1.5	4.5	8.2	3.00	0.19	1694	0	500	0	0	ER
5000	12	9	2.25	0	7.3	3.00	0.38	3944	0	500	0	0	ER
5000	12	9	2.25	2.25	7.3	3.00	0.38	2819	0	500	0	0	ER
5000	12	9	2.25	4.5	7.3	3.00	0.38	1694	0	500	0	0	ER
10000	4	1	0.375	0	0.5	42.67	0.51	259	123	16	371	113	SP
10000	4	1	0.375	0.25	0.65	35.70	0.36	150	59	27	282	190	SP
10000	4	1	0.375	0.5	0.75	40.61	0.25	69	30	29	213	258	SP
10000	4	1	1.5	0	0.5	33.02	0.51	263	118	33	357	110	SP
10000	4	1	1.5	0.25	0.65	31.00	0.36	153	57	42	271	187	SP
10000	4	1	1.5	0.5	0.9	38.02	0.19	82	1	39	156	305	CP
10000	4	1	2.25	0	0.8	34.35	0.38	314	3	44	282	174	CP
10000	4	1	2.25	0.25	0.8	40.48	0.38	216	3	37	286	177	CP
10000	4	1	2.25	0.5	0.8	49.28	0.38	119	3	30	290	179	CP
10000	4	2	0.25	0	1.05	29.79	0.48	516	221	16	358	126	SP
10000	4	2	0.25	0.5	1.3	26.73	0.35	298	119	24	283	193	SP
10000	4	2	0.25	1	1.5	30.43	0.25	137	60	26	213	261	SP
10000	4	2	1	0	1.05	23.91	0.48	524	213	32	346	123	SP
10000	4	2	1	0.5	1.25	23.80	0.38	303	132	36	289	175	SP
10000	4	2	1	1	1.8	28.52	0.19	162	2	35	157	308	CP
10000	4	2	1.5	0	1.6	25.76	0.38	627	6	39	285	176	CP
10000	4	2	1.5	0.5	1.6	30.36	0.38	431	6	33	289	178	CP
10000	4	2	1.5	1	1.6	36.96	0.38	237	6	27	293	180	CP

Parameters					Decision Variables			Profits		Sales			Eql.
m	**v**	**p**	**k**	**c**	**w**	**t**	α	Π_m	Π_r	**Direct**	**Retailer**	**Lost**	**Type**
10000	4	3	0.125	0	1.5	42.04	0.50	759	373	5	374	121	SP
10000	4	3	0.125	0.75	1.9	36.58	0.37	431	200	9	297	194	SP
10000	4	3	0.125	1.5	2.25	40.41	0.25	194	93	10	217	273	SP
10000	4	3	0.5	0	1.5	32.50	0.50	764	367	11	369	120	SP
10000	4	3	0.5	0.75	1.9	31.20	0.37	434	197	14	293	193	SP
10000	4	3	0.5	1.5	2.7	38.02	0.19	231	4	13	165	322	CP
10000	4	3	0.75	0	2.4	34.35	0.38	926	10	15	300	185	CP
10000	4	3	0.75	0.75	2.4	40.48	0.38	637	10	12	302	186	CP
10000	4	3	0.75	1.5	2.4	49.28	0.38	348	10	10	303	187	CP
10000	8	2	0.75	0	2	6.00	0.03	722	0	500	0	0	ER
10000	8	2	0.75	0.5	2	6.00	0.03	472	0	500	0	0	ER
10000	8	2	0.75	1	1.7	9.10	0.17	241	13	293	90	117	SP
10000	8	2	3	0	1.85	6.00	0.19	722	0	500	0	0	ER
10000	8	2	3	0.5	1.6	7.40	0.27	476	10	383	66	51	SP
10000	8	2	3	1	1.8	9.51	0.19	260	1	316	62	122	CP
10000	8	2	4.5	0	1.6	8.59	0.38	747	2	349	93	57	CP
10000	8	2	4.5	0.5	1.6	10.12	0.38	518	3	296	126	78	CP
10000	8	2	4.5	1	1.6	12.32	0.38	295	3	244	159	98	CP
10000	8	4	0.5	0	3.95	4.00	0.03	1375	0	500	0	0	ER
10000	8	4	0.5	1	3.95	4.00	0.03	875	0	500	0	0	ER
10000	8	4	0.5	2	3.35	6.92	0.18	455	33	254	105	141	SP
10000	8	4	2	0	2.85	5.31	0.36	1378	65	326	123	51	SP
10000	8	4	2	1	3.05	5.71	0.29	908	43	323	102	75	SP
10000	8	4	2	2	3.6	7.13	0.19	495	2	281	74	145	CP
10000	8	4	3	0	3.2	6.44	0.38	1465	5	311	117	72	CP
10000	8	4	3	1	3.2	7.59	0.38	1015	6	263	146	90	CP
10000	8	4	3	2	3.2	9.24	0.38	576	8	216	175	108	CP
10000	8	6	0.25	0	3.4	9.24	0.45	1650	524	56	325	118	SP
10000	8	6	0.25	1.5	4.05	8.69	0.34	998	286	77	255	168	SP
10000	8	6	0.25	3	4.65	9.90	0.23	487	135	82	183	234	SP
10000	8	6	1	0	3.3	8.05	0.47	1714	505	95	301	105	SP
10000	8	6	1	1.5	3.95	7.90	0.36	1043	281	109	238	153	SP
10000	8	6	1	3	5.4	9.51	0.19	559	6	105	134	261	CP
10000	8	6	1.5	0	4.85	8.73	0.38	1986	1	115	238	147	CP
10000	8	6	1.5	1.5	4.85	10.32	0.38	1375	1	97	249	154	CP
10000	8	6	1.5	3	4.85	12.62	0.38	770	1	79	260	160	CP
10000	12	3	1.125	0	3	9.00	0.03	1377	0	500	0	0	ER
10000	12	3	1.125	0.75	3	9.00	0.03	1002	0	500	0	0	ER
10000	12	3	1.125	1.5	3	9.00	0.03	627	0	500	0	0	ER
10000	12	3	4.5	0	2.75	9.00	0.19	1377	0	500	0	0	ER
10000	12	3	4.5	0.75	2.75	9.00	0.19	1002	0	500	0	0	ER
10000	12	3	4.5	1.5	2.75	9.00	0.19	627	0	500	0	0	ER
10000	12	3	6.75	0	2.45	9.00	0.38	1377	0	500	0	0	ER
10000	12	3	6.75	0.75	2.45	9.00	0.38	1002	0	500	0	0	ER
10000	12	3	6.75	1.5	2.45	9.00	0.38	627	0	500	0	0	ER

Parameters					Decision Variables			Profits		Sales			Eql.
m	**v**	**p**	**k**	**c**	**w**	**t**	α	Π_m	Π_r	**Direct**	**Retailer**	**Lost**	**Type**
10000	12	6	0.75	0	5.95	6.00	0.03	2722	0	500	0	0	ER
10000	12	6	0.75	1.5	5.95	6.00	0.03	1972	0	500	0	0	ER
10000	12	6	0.75	3	5.95	6.00	0.03	1222	0	500	0	0	ER
10000	12	6	3	0	5.45	6.00	0.19	2722	0	500	0	0	ER
10000	12	6	3	1.5	5.45	6.00	0.19	1972	0	500	0	0	ER
10000	12	6	3	3	5.45	6.00	0.19	1222	0	500	0	0	ER
10000	12	6	4.5	0	4.9	6.00	0.38	2722	0	500	0	0	ER
10000	12	6	4.5	1.5	4.9	6.00	0.38	1972	0	500	0	0	ER
10000	12	6	4.5	3	4.9	6.00	0.38	1222	0	500	0	0	ER
10000	12	9	0.375	0	8.9	3.00	0.03	3389	0	500	0	0	ER
10000	12	9	0.375	2.25	8.9	3.00	0.03	2264	0	500	0	0	ER
10000	12	9	0.375	4.5	7.95	3.83	0.14	1162	26	362	58	80	SP
10000	12	9	1.5	0	8.2	3.00	0.19	3389	0	500	0	0	ER
10000	12	9	1.5	2.25	8.2	3.00	0.19	2264	0	500	0	0	ER
10000	12	9	1.5	4.5	8.15	4.25	0.19	1235	1	353	50	97	CP
10000	12	9	2.25	0	7.25	3.86	0.38	3444	2	389	69	42	CP
10000	12	9	2.25	2.25	7.25	4.56	0.38	2394	4	329	106	65	CP
10000	12	9	2.25	4.5	7.25	5.56	0.38	1375	5	270	142	88	CP

Table 5.10: The Numerical Experiments to Span the Parameter Space RW/DO

					RETAILER-ONLY					DIRECT-ONLY		
Parameters					Decision Variables		Profits		Sales	Decision Var.	Profit	Sales
m	**v**	**p**	**k**	**c**	**w**	α	Π_m	Π_r	**Retailer**	**t**	Π_m	**Direct**
1000	4	1	0.375	0	0.5	0.50	250	125	375	3.00	389	500
1000	4	1	0.375	0.25	0.6	0.40	140	80	320	3.00	264	500
1000	4	1	0.375	0.5	0.75	0.25	63	31	219	3.00	139	500
1000	4	1	1.5	0	0.5	0.50	250	125	375	3.00	389	500
1000	4	1	1.5	0.25	0.6	0.40	140	80	320	3.00	264	500
1000	4	1	1.5	0.5	0.9	0.19	75	1	169	3.00	139	500
1000	4	1	2.25	0	0.8	0.38	306	3	309	3.00	389	500
1000	4	1	2.25	0.25	0.8	0.38	210	3	309	3.00	264	500
1000	4	1	2.25	0.5	0.8	0.38	115	3	309	3.00	139	500
1000	4	2	0.25	0	1	0.50	500	250	375	2.00	750	500
1000	4	2	0.25	0.5	1.25	0.37	281	141	305	2.00	500	500
1000	4	2	0.25	1	1.5	0.25	125	62	219	2.00	250	500
1000	4	2	1	0	1	0.50	500	250	375	2.00	750	500
1000	4	2	1	0.5	1.25	0.37	281	141	305	2.00	500	500
1000	4	2	1	1	1.8	0.19	149	2	169	2.00	250	500
1000	4	2	1.5	0	1.6	0.38	612	7	309	2.00	750	500
1000	4	2	1.5	0.5	1.6	0.38	421	7	309	2.00	500	500
1000	4	2	1.5	1	1.6	0.38	229	7	309	2.00	250	500
1000	4	3	0.125	0	1.5	0.50	750	375	375	1.33	563	375
1000	4	3	0.125	0.75	1.85	0.38	422	220	310	1.78	316	281
1000	4	3	0.125	1.5	2.25	0.25	187	94	219	2.67	141	188
1000	4	3	0.5	0	1.5	0.50	750	375	375	1.33	563	375
1000	4	3	0.5	0.75	1.85	0.38	422	220	310	1.78	316	281
1000	4	3	0.5	1.5	2.7	0.19	224	4	169	2.67	141	188
1000	4	3	0.75	0	2.4	0.38	918	10	309	1.33	563	375
1000	4	3	0.75	0.75	2.4	0.38	631	10	309	1.78	316	281
1000	4	3	0.75	1.5	2.4	0.38	344	10	309	2.67	141	188
1000	8	2	0.75	0	1	0.50	500	250	375	6.00	972	500
1000	8	2	0.75	0.5	1.25	0.37	281	141	305	6.00	722	500
1000	8	2	0.75	1	1.5	0.25	125	62	219	6.00	472	500
1000	8	2	3	0	1	0.50	500	250	375	6.00	972	500
1000	8	2	3	0.5	1.25	0.37	281	141	305	6.00	722	500
1000	8	2	3	1	1.8	0.19	149	2	169	6.00	472	500
1000	8	2	4.5	0	1.6	0.38	612	7	309	6.00	972	500
1000	8	2	4.5	0.5	1.6	0.38	421	7	309	6.00	722	500
1000	8	2	4.5	1	1.6	0.38	229	7	309	6.00	472	500
1000	8	4	0.5	0	2	0.50	1000	500	375	4.00	1938	500
1000	8	4	0.5	1	2.5	0.38	563	281	305	4.00	1438	500
1000	8	4	0.5	2	3	0.25	250	125	219	4.00	938	500
1000	8	4	2	0	2	0.50	1000	500	375	4.00	1938	500
1000	8	4	2	1	2.5	0.38	563	281	305	4.00	1438	500
1000	8	4	2	2	3.6	0.19	299	5	169	4.00	938	500
1000	8	4	3	0	3.2	0.38	1224	13	309	4.00	1938	500
1000	8	4	3	1	3.2	0.38	841	13	309	4.00	1438	500
1000	8	4	3	2	3.2	0.38	459	13	309	4.00	938	500

					RETAILER-ONLY					DIRECT-ONLY		
Parameters					Decision Variables		Profits		Sales	Decision Var.	Profit	Sales
m	**v**	**p**	**k**	**c**	**w**	α	Π_m	Π_r	**Retailer**	**t**	Π_m	**Direct**
1000	8	6	0.25	0	3	0.50	1500	750	375	2.00	2750	500
1000	8	6	0.25	1.5	3.75	0.38	844	422	305	2.00	2000	500
1000	8	6	0.25	3	4.5	0.25	375	188	219	2.00	1250	500
1000	8	6	1	0	3	0.50	1500	750	375	2.00	2750	500
1000	8	6	1	1.5	3.75	0.38	844	422	305	2.00	2000	500
1000	8	6	1	3	5.4	0.19	448	7	169	2.00	1250	500
1000	8	6	1.5	0	4.85	0.38	1855	1	309	2.00	2750	500
1000	8	6	1.5	1.5	4.85	0.38	1281	1	309	2.00	2000	500
1000	8	6	1.5	3	4.85	0.38	707	1	309	2.00	1250	500
1000	12	3	1.125	0	1.5	0.50	750	375	375	9.00	1488	500
1000	12	3	1.125	0.75	1.85	0.38	422	220	310	9.00	1113	500
1000	12	3	1.125	1.5	2.25	0.25	187	94	219	9.00	738	500
1000	12	3	4.5	0	1.5	0.50	750	375	375	9.00	1488	500
1000	12	3	4.5	0.75	1.85	0.38	422	220	310	9.00	1113	500
1000	12	3	4.5	1.5	2.7	0.19	224	4	169	9.00	738	500
1000	12	3	6.75	0	2.4	0.38	918	10	309	9.00	1488	500
1000	12	3	6.75	0.75	2.4	0.38	631	10	309	9.00	1113	500
1000	12	3	6.75	1.5	2.4	0.38	344	10	309	9.00	738	500
1000	12	6	0.75	0	3	0.50	1500	750	375	6.00	2972	500
1000	12	6	0.75	1.5	3.75	0.38	844	422	305	6.00	2222	500
1000	12	6	0.75	3	4.5	0.25	375	188	219	6.00	1472	500
1000	12	6	3	0	3	0.50	1500	750	375	6.00	2972	500
1000	12	6	3	1.5	3.75	0.38	844	422	305	6.00	2222	500
1000	12	6	3	3	5.4	0.19	448	7	169	6.00	1472	500
1000	12	6	4.5	0	4.85	0.38	1855	1	309	6.00	2972	500
1000	12	6	4.5	1.5	4.85	0.38	1281	1	309	6.00	2222	500
1000	12	6	4.5	3	4.85	0.38	707	1	309	6.00	1472	500
1000	12	9	0.375	0	4.5	0.50	2250	1125	375	3.00	4389	500
1000	12	9	0.375	2.25	5.6	0.38	1266	642	306	3.00	3264	500
1000	12	9	0.375	4.5	6.75	0.25	563	281	219	3.00	2139	500
1000	12	9	1.5	0	4.5	0.50	2250	1125	375	3.00	4389	500
1000	12	9	1.5	2.25	5.6	0.38	1266	642	306	3.00	3264	500
1000	12	9	1.5	4.5	8.15	0.19	681	2	169	3.00	2139	500
1000	12	9	2.25	0	7.25	0.38	2772	11	309	3.00	4389	500
1000	12	9	2.25	2.25	7.25	0.38	1912	11	309	3.00	3264	500
1000	12	9	2.25	4.5	7.25	0.38	1052	11	309	3.00	2139	500
5000	4	1	0.375	0	0.5	0.50	250	125	375	6.67	113	225
5000	4	1	0.375	0.25	0.6	0.40	140	80	320	8.89	63	169
5000	4	1	0.375	0.5	0.75	0.25	63	31	219	13.33	28	113
5000	4	1	1.5	0	0.5	0.50	250	125	375	6.67	113	225
5000	4	1	1.5	0.25	0.6	0.40	140	80	320	8.89	63	169
5000	4	1	1.5	0.5	0.9	0.19	75	1	169	13.33	28	113
5000	4	1	2.25	0	0.8	0.38	306	3	309	6.67	113	225
5000	4	1	2.25	0.25	0.8	0.38	210	3	309	8.89	63	169
5000	4	1	2.25	0.5	0.8	0.38	115	3	309	13.33	28	113

					RETAILER-ONLY					DIRECT-ONLY		
Parameters					Decision Variables		Profits		Sales	Decision Var.	Profit	Sales
m	**v**	**p**	**k**	**c**	**w**	α	Π_m	Π_r	**Retailer**	**t**	Π_m	**Direct**
5000	4	2	0.25	0	1	0.50	500	250	375	5.00	200	200
5000	4	2	0.25	0.5	1.25	0.37	281	141	305	6.67	113	150
5000	4	2	0.25	1	1.5	0.25	125	62	219	10.00	50	100
5000	4	2	1	0	1	0.50	500	250	375	5.00	200	200
5000	4	2	1	0.5	1.25	0.37	281	141	305	6.67	113	150
5000	4	2	1	1	1.8	0.19	149	2	169	10.00	50	100
5000	4	2	1.5	0	1.6	0.38	612	7	309	5.00	200	200
5000	4	2	1.5	0.5	1.6	0.38	421	7	309	6.67	113	150
5000	4	2	1.5	1	1.6	0.38	229	7	309	10.00	50	100
5000	4	3	0.125	0	1.5	0.50	750	375	375	6.67	113	75
5000	4	3	0.125	0.75	1.85	0.38	422	220	310	8.89	63	56
5000	4	3	0.125	1.5	2.25	0.25	187	94	219	13.33	28	38
5000	4	3	0.5	0	1.5	0.50	750	375	375	6.67	113	75
5000	4	3	0.5	0.75	1.85	0.38	422	220	310	8.89	63	56
5000	4	3	0.5	1.5	2.7	0.19	224	4	169	13.33	28	38
5000	4	3	0.75	0	2.4	0.38	918	10	309	6.67	113	75
5000	4	3	0.75	0.75	2.4	0.38	631	10	309	8.89	63	56
5000	4	3	0.75	1.5	2.4	0.38	344	10	309	13.33	28	38
5000	8	2	0.75	0	1	0.50	500	250	375	6.00	861	500
5000	8	2	0.75	0.5	1.25	0.37	281	141	305	6.00	611	500
5000	8	2	0.75	1	1.5	0.25	125	62	219	6.00	361	500
5000	8	2	3	0	1	0.50	500	250	375	6.00	861	500
5000	8	2	3	0.5	1.25	0.37	281	141	305	6.00	611	500
5000	8	2	3	1	1.8	0.19	149	2	169	6.00	361	500
5000	8	2	4.5	0	1.6	0.38	612	7	309	6.00	861	500
5000	8	2	4.5	0.5	1.6	0.38	421	7	309	6.00	611	500
5000	8	2	4.5	1	1.6	0.38	229	7	309	6.00	361	500
5000	8	4	0.5	0	2	0.50	1000	500	375	4.00	1688	500
5000	8	4	0.5	1	2.5	0.38	563	281	305	4.00	1188	500
5000	8	4	0.5	2	3	0.25	250	125	219	4.00	688	500
5000	8	4	2	0	2	0.50	1000	500	375	4.00	1688	500
5000	8	4	2	1	2.5	0.38	563	281	305	4.00	1188	500
5000	8	4	2	2	3.6	0.19	299	5	169	4.00	688	500
5000	8	4	3	0	3.2	0.38	1224	13	309	4.00	1688	500
5000	8	4	3	1	3.2	0.38	841	13	309	4.00	1188	500
5000	8	4	3	2	3.2	0.38	459	13	309	4.00	688	500
5000	8	6	0.25	0	3	0.50	1500	750	375	2.00	1750	500
5000	8	6	0.25	1.5	3.75	0.38	844	422	305	2.22	1013	450
5000	8	6	0.25	3	4.5	0.25	375	188	219	3.33	450	300
5000	8	6	1	0	3	0.50	1500	750	375	2.00	1750	500
5000	8	6	1	1.5	3.75	0.38	844	422	305	2.22	1013	450
5000	8	6	1	3	5.4	0.19	448	7	169	3.33	450	300
5000	8	6	1.5	0	4.85	0.38	1855	1	309	2.00	1750	500
5000	8	6	1.5	1.5	4.85	0.38	1281	1	309	2.22	1013	450
5000	8	6	1.5	3	4.85	0.38	707	1	309	3.33	450	300

					RETAILER-ONLY					DIRECT-ONLY		
Parameters					Decision Variables		Profits		Sales	Decision Var.	Profit	Sales
m	**v**	**p**	**k**	**c**	**w**	α	Π_m	Π_r	**Retailer**	**t**	Π_m	**Direct**
5000	12	3	1.125	0	1.5	0.50	750	375	375	9.00	1438	500
5000	12	3	1.125	0.75	1.85	0.38	422	220	310	9.00	1063	500
5000	12	3	1.125	1.5	2.25	0.25	187	94	219	9.00	688	500
5000	12	3	4.5	0	1.5	0.50	750	375	375	9.00	1438	500
5000	12	3	4.5	0.75	1.85	0.38	422	220	310	9.00	1063	500
5000	12	3	4.5	1.5	2.7	0.19	224	4	169	9.00	688	500
5000	12	3	6.75	0	2.4	0.38	918	10	309	9.00	1438	500
5000	12	3	6.75	0.75	2.4	0.38	631	10	309	9.00	1063	500
5000	12	3	6.75	1.5	2.4	0.38	344	10	309	9.00	688	500
5000	12	6	0.75	0	3	0.50	1500	750	375	6.00	2861	500
5000	12	6	0.75	1.5	3.75	0.38	844	422	305	6.00	2111	500
5000	12	6	0.75	3	4.5	0.25	375	188	219	6.00	1361	500
5000	12	6	3	0	3	0.50	1500	750	375	6.00	2861	500
5000	12	6	3	1.5	3.75	0.38	844	422	305	6.00	2111	500
5000	12	6	3	3	5.4	0.19	448	7	169	6.00	1361	500
5000	12	6	4.5	0	4.85	0.38	1855	1	309	6.00	2861	500
5000	12	6	4.5	1.5	4.85	0.38	1281	1	309	6.00	2111	500
5000	12	6	4.5	3	4.85	0.38	707	1	309	6.00	1361	500
5000	12	9	0.375	0	4.5	0.50	2250	1125	375	3.00	3944	500
5000	12	9	0.375	2.25	5.6	0.38	1266	642	306	3.00	2819	500
5000	12	9	0.375	4.5	6.75	0.25	563	281	219	3.00	1694	500
5000	12	9	1.5	0	4.5	0.50	2250	1125	375	3.00	3944	500
5000	12	9	1.5	2.25	5.6	0.38	1266	642	306	3.00	2819	500
5000	12	9	1.5	4.5	8.15	0.19	681	2	169	3.00	1694	500
5000	12	9	2.25	0	7.25	0.38	2772	11	309	3.00	3944	500
5000	12	9	2.25	2.25	7.25	0.38	1912	11	309	3.00	2819	500
5000	12	9	2.25	4.5	7.25	0.38	1052	11	309	3.00	1694	500
10000	4	1	0.375	0	0.5	0.50	250	125	375	13.33	56	113
10000	4	1	0.375	0.25	0.6	0.40	140	80	320	17.78	32	84
10000	4	1	0.375	0.5	0.75	0.25	63	31	219	26.67	14	56
10000	4	1	1.5	0	0.5	0.50	250	125	375	13.33	56	113
10000	4	1	1.5	0.25	0.6	0.40	140	80	320	17.78	32	84
10000	4	1	1.5	0.5	0.9	0.19	75	1	169	26.67	14	56
10000	4	1	2.25	0	0.8	0.38	306	3	309	13.33	56	113
10000	4	1	2.25	0.25	0.8	0.38	210	3	309	17.78	32	84
10000	4	1	2.25	0.5	0.8	0.38	115	3	309	26.67	14	56
10000	4	2	0.25	0	1	0.50	500	250	375	10.00	100	100
10000	4	2	0.25	0.5	1.25	0.37	281	141	305	13.33	56	75
10000	4	2	0.25	1	1.5	0.25	125	62	219	20.00	25	50
10000	4	2	1	0	1	0.50	500	250	375	10.00	100	100
10000	4	2	1	0.5	1.25	0.37	281	141	305	13.33	56	75
10000	4	2	1	1	1.8	0.19	149	2	169	20.00	25	50
10000	4	2	1.5	0	1.6	0.38	612	7	309	10.00	100	100
10000	4	2	1.5	0.5	1.6	0.38	421	7	309	13.33	56	75
10000	4	2	1.5	1	1.6	0.38	229	7	309	20.00	25	50

					RETAILER-ONLY					DIRECT-ONLY		
Parameters					Decision Variables		Profits		Sales	Decision Var.	Profit	Sales
m	**v**	**p**	**k**	**c**	**w**	α	Π_m	Π_r	**Retailer**	**t**	Π_m	**Direct**
10000	4	3	0.125	0	1.5	0.50	750	375	375	13.33	56	38
10000	4	3	0.125	0.75	1.85	0.38	422	220	310	17.78	32	28
10000	4	3	0.125	1.5	2.25	0.25	187	94	219	26.67	14	19
10000	4	3	0.5	0	1.5	0.50	750	375	375	13.33	56	38
10000	4	3	0.5	0.75	1.85	0.38	422	220	310	17.78	32	28
10000	4	3	0.5	1.5	2.7	0.19	224	4	169	26.67	14	19
10000	4	3	0.75	0	2.4	0.38	918	10	309	13.33	56	38
10000	4	3	0.75	0.75	2.4	0.38	631	10	309	17.78	32	28
10000	4	3	0.75	1.5	2.4	0.38	344	10	309	26.67	14	19
10000	8	2	0.75	0	1	0.50	500	250	375	6.00	722	500
10000	8	2	0.75	0.5	1.25	0.37	281	141	305	6.00	472	500
10000	8	2	0.75	1	1.5	0.25	125	62	219	6.67	225	450
10000	8	2	3	0	1	0.50	500	250	375	6.00	722	500
10000	8	2	3	0.5	1.25	0.37	281	141	305	6.00	472	500
10000	8	2	3	1	1.8	0.19	149	2	169	6.67	225	450
10000	8	2	4.5	0	1.6	0.38	612	7	309	6.00	722	500
10000	8	2	4.5	0.5	1.6	0.38	421	7	309	6.00	472	500
10000	8	2	4.5	1	1.6	0.38	229	7	309	6.67	225	450
10000	8	4	0.5	0	2	0.50	1000	500	375	4.00	1375	500
10000	8	4	0.5	1	2.5	0.38	563	281	305	4.00	875	500
10000	8	4	0.5	2	3	0.25	250	125	219	5.00	400	400
10000	8	4	2	0	2	0.50	1000	500	375	4.00	1375	500
10000	8	4	2	1	2.5	0.38	563	281	305	4.00	875	500
10000	8	4	2	2	3.6	0.19	299	5	169	5.00	400	400
10000	8	4	3	0	3.2	0.38	1224	13	309	4.00	1375	500
10000	8	4	3	1	3.2	0.38	841	13	309	4.00	875	500
10000	8	4	3	2	3.2	0.38	459	13	309	5.00	400	400
10000	8	6	0.25	0	3	0.50	1500	750	375	3.33	900	300
10000	8	6	0.25	1.5	3.75	0.38	844	422	305	4.44	506	225
10000	8	6	0.25	3	4.5	0.25	375	188	219	6.67	225	150
10000	8	6	1	0	3	0.50	1500	750	375	3.33	900	300
10000	8	6	1	1.5	3.75	0.38	844	422	305	4.44	506	225
10000	8	6	1	3	5.4	0.19	448	7	169	6.67	225	150
10000	8	6	1.5	0	4.85	0.38	1855	1	309	3.33	900	300
10000	8	6	1.5	1.5	4.85	0.38	1281	1	309	4.44	506	225
10000	8	6	1.5	3	4.85	0.38	707	1	309	6.67	225	150
10000	12	3	1.125	0	1.5	0.50	750	375	375	9.00	1377	500
10000	12	3	1.125	0.75	1.85	0.38	422	220	310	9.00	1002	500
10000	12	3	1.125	1.5	2.25	0.25	187	94	219	9.00	627	500
10000	12	3	4.5	0	1.5	0.50	750	375	375	9.00	1377	500
10000	12	3	4.5	0.75	1.85	0.38	422	220	310	9.00	1002	500
10000	12	3	4.5	1.5	2.7	0.19	224	4	169	9.00	627	500
10000	12	3	6.75	0	2.4	0.38	918	10	309	9.00	1377	500
10000	12	3	6.75	0.75	2.4	0.38	631	10	309	9.00	1002	500
10000	12	3	6.75	1.5	2.4	0.38	344	10	309	9.00	627	500

					RETAILER-ONLY					DIRECT-ONLY		
Parameters					Decision Variables		Profits		Sales	Decision Var.	Profit	Sales
m	**v**	**p**	**k**	**c**	**w**	α	Π_m	Π_r	**Retailer**	**t**	Π_m	**Direct**
10000	12	6	0.75	0	3	0.50	1500	750	375	6.00	2722	500
10000	12	6	0.75	1.5	3.75	0.38	844	422	305	6.00	1972	500
10000	12	6	0.75	3	4.5	0.25	375	188	219	6.00	1222	500
10000	12	6	3	0	3	0.50	1500	750	375	6.00	2722	500
10000	12	6	3	1.5	3.75	0.38	844	422	305	6.00	1972	500
10000	12	6	3	3	5.4	0.19	448	7	169	6.00	1222	500
10000	12	6	4.5	0	4.85	0.38	1855	1	309	6.00	2722	500
10000	12	6	4.5	1.5	4.85	0.38	1281	1	309	6.00	1972	500
10000	12	6	4.5	3	4.85	0.38	707	1	309	6.00	1222	500
10000	12	9	0.375	0	4.5	0.50	2250	1125	375	3.00	3389	500
10000	12	9	0.375	2.25	5.6	0.38	1266	642	306	3.00	2264	500
10000	12	9	0.375	4.5	6.75	0.25	563	281	219	3.00	1139	500
10000	12	9	1.5	0	4.5	0.50	2250	1125	375	3.00	3389	500
10000	12	9	1.5	2.25	5.6	0.38	1266	642	306	3.00	2264	500
10000	12	9	1.5	4.5	8.15	0.19	681	2	169	3.00	1139	500
10000	12	9	2.25	0	7.25	0.38	2772	11	309	3.00	3389	500
10000	12	9	2.25	2.25	7.25	0.38	1912	11	309	3.00	2264	500
10000	12	9	2.25	4.5	7.25	0.38	1052	11	309	3.00	1139	500

Table 5.11: Dual Channel Strategy in the m/c Plane, v=8, p=4, k=1

Parameters		Decision Variables			Profits		Sales			Eql.
m	**c**	**w**	**t**	α	Π_m	Π_r	**Direct**	**Retailer**	**Lost**	**Type**
0	0	0	1.00	1.00	2000	0	500	0	0	ER
0	0.25	3.05	1.69	0.48	1875	0	500	0	0	ER
0	0.5	3.05	1.69	0.48	1750	0	500	0	0	ER
0	0.75	3.05	1.69	0.48	1625	0	500	0	0	ER
0	1	3.05	1.69	0.48	1500	0	500	0	0	ER
0	1.25	3.05	1.69	0.48	1375	0	500	0	0	ER
0	1.5	3.05	1.69	0.48	1250	0	500	0	0	ER
0	1.75	3.05	1.69	0.48	1125	0	500	0	0	ER
0	2	3.05	1.69	0.48	1000	0	500	0	0	ER
0	2.25	3.05	1.69	0.48	875	0	500	0	0	ER
0	2.5	3.05	1.69	0.48	750	0	500	0	0	ER
0	2.75	3.05	1.69	0.48	625	0	500	0	0	ER
0	3	3.05	1.69	0.48	500	0	500	0	0	ER
0	3.25	3.4	2.36	0.30	375	0	500	0	0	ER
0	3.5	3.5	2.61	0.25	250	0	500	0	0	ER
0	3.75	3.75	3.46	0.13	125	0	500	0	0	ER
2500	0	3.9	4.00	0.07	1844	0	500	0	0	ER
2500	0.25	3.9	4.00	0.07	1719	0	500	0	0	ER
2500	0.5	3.9	4.00	0.07	1594	0	500	0	0	ER
2500	0.75	3.9	4.00	0.07	1469	0	500	0	0	ER
2500	1	3.9	4.00	0.07	1344	0	500	0	0	ER
2500	1.25	3.9	4.00	0.07	1219	0	500	0	0	ER
2500	1.5	3.9	4.00	0.07	1094	0	500	0	0	ER
2500	1.75	3.9	4.00	0.07	969	0	500	0	0	ER
2500	2	3.9	4.00	0.07	844	0	500	0	0	ER
2500	2.25	3.9	4.00	0.07	719	0	500	0	0	ER
2500	2.5	3.9	4.00	0.07	594	0	500	0	0	ER
2500	2.75	3.9	4.00	0.07	469	0	500	0	0	ER
2500	3	3.9	4.00	0.07	344	0	500	0	0	ER
2500	3.25	3.9	4.00	0.07	219	0	500	0	0	ER
2500	3.5	3.85	5.52	0.07	106	0	362	18	120	CP
2500	3.75	3.85	10.57	0.07	29	1	189	41	270	CP
5000	0	3.9	4.00	0.07	1688	0	500	0	0	ER
5000	0.25	3.9	4.00	0.07	1563	0	500	0	0	ER
5000	0.5	3.9	4.00	0.07	1438	0	500	0	0	ER
5000	0.75	3.9	4.00	0.07	1313	0	500	0	0	ER
5000	1	3.9	4.00	0.07	1187	0	500	0	0	ER
5000	1.25	3.9	4.00	0.07	1063	0	500	0	0	ER
5000	1.5	3.9	4.00	0.07	937	0	500	0	0	ER
5000	1.75	3.9	4.00	0.07	813	0	500	0	0	ER
5000	2	3.9	4.00	0.07	688	0	500	0	0	ER
5000	2.25	3.9	4.00	0.07	562	0	500	0	0	ER
5000	2.5	3.9	4.00	0.07	438	0	500	0	0	ER
5000	2.75	3.7	4.72	0.10	318	2	418	20	62	SP
5000	3	3.65	5.81	0.10	215	6	338	36	125	SP

Parameters		Decision Variables			Profits		Sales			Eql.
m	**c**	**w**	**t**	α	Π_m	Π_r	**Direct**	**Retailer**	**Lost**	**Type**
5000	3.25	3.85	7.48	0.07	130	0	268	30	202	CP
5000	3.5	3.85	11.05	0.07	65	1	181	42	277	CP
5000	3.75	3.85	21.15	0.07	18	1	95	53	352	CP
7500	0	3.9	4.00	0.07	1531	0	500	0	0	ER
7500	0.25	3.9	4.00	0.07	1406	0	500	0	0	ER
7500	0.5	3.9	4.00	0.07	1281	0	500	0	0	ER
7500	0.75	3.9	4.00	0.07	1156	0	500	0	0	ER
7500	1	3.9	4.00	0.07	1031	0	500	0	0	ER
7500	1.25	3.9	4.00	0.07	906	0	500	0	0	ER
7500	1.5	3.9	4.00	0.07	781	0	500	0	0	ER
7500	1.75	3.9	4.00	0.07	656	0	500	0	0	ER
7500	2	3.55	4.86	0.14	538	7	393	42	65	SP
7500	2.25	3.5	5.54	0.15	432	12	343	57	100	SP
7500	2.5	3.5	6.30	0.14	334	14	303	64	133	SP
7500	2.75	3.5	7.35	0.14	244	17	260	71	168	SP
7500	3	3.55	8.79	0.12	164	15	221	69	210	SP
7500	3.25	3.85	11.21	0.07	100	1	178	42	280	CP
7500	3.5	3.85	16.57	0.07	51	1	121	50	330	CP
7500	3.75	3.85	31.72	0.07	14	1	63	57	380	CP
10000	0	3.9	4.00	0.07	1375	0	500	0	0	ER
10000	0.25	3.9	4.00	0.07	1250	0	500	0	0	ER
10000	0.5	3.9	4.00	0.07	1125	0	500	0	0	ER
10000	0.75	3.9	4.00	0.07	1000	0	500	0	0	ER
10000	1	3.25	5.22	0.23	880	32	335	96	70	SP
10000	1.25	3.25	5.57	0.22	769	34	315	100	85	SP
10000	1.5	3.25	6.00	0.22	663	36	294	105	101	SP
10000	1.75	3.25	6.51	0.22	560	39	272	109	118	SP
10000	2	3.3	7.00	0.20	463	35	258	104	137	SP
10000	2.25	3.35	7.65	0.18	371	31	241	100	160	SP
10000	2.5	3.4	8.55	0.16	285	28	219	96	186	SP
10000	2.75	3.45	9.83	0.15	207	25	193	92	215	SP
10000	3	3.55	11.66	0.12	139	18	167	78	255	SP
10000	3.25	3.85	14.95	0.07	85	1	134	48	318	CP
10000	3.5	3.85	22.09	0.07	44	1	91	54	356	CP
10000	3.75	3.85	42.29	0.07	12	1	47	59	393	CP
12500	0	2.7	6.90	0.37	1256	146	205	211	84	SP
12500	0.25	2.8	6.81	0.34	1139	120	218	193	90	SP
12500	0.5	2.85	6.94	0.33	1026	110	219	185	96	SP
12500	0.75	2.9	7.12	0.31	915	101	218	178	104	SP
12500	1	3	7.18	0.28	808	81	226	160	114	SP
12500	1.25	3.05	7.47	0.27	705	74	222	153	125	SP
12500	1.5	3.1	7.85	0.25	605	67	216	147	137	SP
12500	1.75	3.15	8.33	0.24	510	60	208	140	152	SP
12500	2	3.2	8.95	0.22	419	55	197	135	169	SP
12500	2.25	3.3	9.62	0.19	335	42	189	119	192	SP

Parameters		Decision Variables			Profits		Sales			Eql.
m	**c**	**w**	**t**	α	Π_m	Π_r	**Direct**	**Retailer**	**Lost**	**Type**
12500	2.5	3.35	10.76	0.17	256	37	172	114	214	SP
12500	2.75	3.45	12.22	0.15	186	28	156	99	246	SP
12500	3	3.55	14.54	0.12	124	19	134	84	282	SP
12500	3.25	3.85	18.69	0.07	76	1	107	51	342	CP
12500	3.5	3.85	27.62	0.07	40	1	72	56	372	CP
12500	3.75	3.85	52.86	0.07	11	1	38	60	402	CP
15000	0	2.5	9.05	0.41	1208	220	145	257	97	SP
15000	0.25	2.6	8.90	0.38	1091	188	155	241	105	SP
15000	0.5	2.7	8.82	0.36	978	159	164	223	113	SP
15000	0.75	2.8	8.81	0.33	870	133	171	206	123	SP
15000	1	2.85	9.09	0.32	765	123	170	199	131	SP
15000	1.25	2.95	9.24	0.29	664	101	174	182	144	SP
15000	1.5	3	9.69	0.27	568	92	170	175	155	SP
15000	1.75	3.1	10.08	0.24	477	74	170	158	172	SP
15000	2	3.2	10.65	0.22	391	59	166	142	192	SP
15000	2.25	3.25	11.66	0.20	311	53	155	135	210	SP
15000	2.5	3.35	12.85	0.17	237	40	145	119	236	SP
15000	2.75	3.45	14.63	0.14	171	29	130	103	266	SP
15000	3	3.55	17.42	0.12	113	20	112	87	301	SP
15000	3.25	3.85	22.43	0.07	70	1	89	54	357	CP
15000	3.5	3.85	33.14	0.07	37	1	60	58	382	CP
15000	3.75	3.85	63.44	0.07	10	1	32	61	407	CP
17500	0	2.4	10.98	0.43	1176	265	116	281	103	SP
17500	0.25	2.5	10.79	0.40	1058	230	123	265	112	SP
17500	0.5	2.6	10.68	0.38	946	197	130	248	121	SP
17500	0.75	2.7	10.66	0.35	838	168	137	232	132	SP
17500	1	2.8	10.73	0.32	735	141	142	215	143	SP
17500	1.25	2.9	10.90	0.30	636	118	146	198	157	SP
17500	1.5	3	11.21	0.27	542	96	148	181	172	SP
17500	1.75	3.05	11.90	0.25	454	88	142	173	185	SP
17500	2	3.15	12.57	0.23	371	70	139	157	204	SP
17500	2.25	3.25	13.54	0.20	294	55	133	140	227	SP
17500	2.5	3.3	15.14	0.18	223	49	121	133	245	SP
17500	2.75	3.4	17.21	0.16	160	37	110	117	273	SP
17500	3	3.5	20.46	0.13	106	26	94	100	305	SP
17500	3.25	3.85	26.17	0.07	66	1	76	55	368	CP
17500	3.5	3.85	38.66	0.07	35	1	52	59	390	CP
17500	3.75	3.85	74.01	0.07	10	1	27	62	411	CP
20000	0	2.35	12.75	0.44	1152	291	98	294	108	SP
20000	0.25	2.45	12.52	0.41	1035	254	105	278	117	SP
20000	0.5	2.55	12.39	0.39	922	220	111	262	127	SP
20000	0.75	2.65	12.36	0.36	815	188	116	245	138	SP
20000	1	2.75	12.43	0.33	713	160	121	229	151	SP
20000	1.25	2.85	12.64	0.31	615	134	124	212	164	SP
20000	1.5	2.95	12.99	0.28	523	111	125	195	180	SP

Parameters		Decision Variables			Profits		Sales			Eql.
m	**c**	**w**	**t**	α	Π_m	Π_r	**Direct**	**Retailer**	**Lost**	**Type**
20000	1.75	3.05	13.53	0.25	436	91	125	178	197	SP
20000	2	3.1	14.55	0.24	355	82	119	170	211	SP
20000	2.25	3.2	15.66	0.21	281	65	114	154	232	SP
20000	2.5	3.3	17.26	0.18	213	50	107	137	257	SP
20000	2.75	3.4	19.65	0.16	153	38	96	120	284	SP
20000	3	3.5	23.37	0.13	101	27	83	102	315	SP
20000	3.25	3.85	29.91	0.07	63	1	67	57	376	CP
20000	3.5	3.85	44.19	0.07	34	1	45	59	395	CP
20000	3.75	3.85	84.58	0.07	10	1	24	62	414	CP
22500	0	2.3	14.61	0.45	1135	317	84	305	111	SP
22500	0.25	2.4	14.34	0.42	1017	278	90	290	120	SP
22500	0.5	2.5	14.18	0.40	904	242	95	274	131	SP
22500	0.75	2.6	14.13	0.37	797	209	100	258	142	SP
22500	1	2.7	14.21	0.34	696	179	104	241	155	SP
22500	1.25	2.8	14.44	0.32	599	151	107	225	169	SP
22500	1.5	2.9	14.83	0.29	508	126	108	208	184	SP
22500	1.75	3	15.43	0.26	423	104	108	191	201	SP
22500	2	3.1	16.31	0.24	344	84	106	174	220	SP
22500	2.25	3.2	17.57	0.21	271	67	102	156	242	SP
22500	2.5	3.3	19.39	0.18	205	52	95	139	266	SP
22500	2.75	3.4	22.08	0.15	147	38	86	122	293	SP
22500	3	3.5	26.27	0.13	97	27	74	104	322	SP
22500	3.25	3.85	33.64	0.07	60	1	59	58	383	CP
22500	3.5	3.85	49.71	0.07	33	1	40	60	400	CP
22500	3.75	3.85	95.15	0.07	9	1	21	63	416	CP
25000	0	2.25	16.57	0.46	1121	342	73	316	112	SP
25000	0.25	2.4	15.82	0.42	1003	282	82	293	126	SP
25000	0.5	2.5	15.65	0.39	890	245	86	277	137	SP
25000	0.75	2.6	15.61	0.37	783	212	91	261	149	SP
25000	1	2.7	15.71	0.34	682	182	94	244	162	SP
25000	1.25	2.8	15.97	0.32	587	154	97	228	176	SP
25000	1.5	2.9	16.41	0.29	497	129	98	211	191	SP
25000	1.75	3	17.09	0.26	412	106	98	193	209	SP
25000	2	3.1	18.08	0.23	334	86	96	176	228	SP
25000	2.25	3.2	19.49	0.21	263	68	92	159	250	SP
25000	2.5	3.3	21.51	0.18	199	53	86	141	273	SP
25000	2.75	3.4	24.51	0.15	142	39	77	123	299	SP
25000	3	3.5	29.17	0.13	93	28	66	105	328	SP
25000	3.25	3.85	37.38	0.07	59	1	54	58	388	CP
25000	3.5	3.85	55.24	0.07	32	1	36	61	403	CP
25000	3.75	3.85	105.73	0.07	9	1	19	63	418	CP

Table 5.12: RW/DO Strategy in the m/c Plane

		RETAILER-ONLY					DIRECT-ONLY		
Parameters		Decision Variables		Profits		Sales	Decision Var.	Profit	Sales
m	**c**	**w**	α	Π_m	Π_r	**Retailer**	**t**	Π_m	**Direct**
0	0	2	0.50	1000	500	375	4.00	2000	500
0	0.25	2.1	0.47	879	451	362	4.00	1875	500
0	0.5	2.25	0.44	766	383	342	4.00	1750	500
0	0.75	2.35	0.41	660	340	327	4.00	1625	500
0	1	2.5	0.38	563	281	305	4.00	1500	500
0	1.25	2.6	0.35	472	245	289	4.00	1375	500
0	1.5	2.75	0.31	391	195	264	4.00	1250	500
0	1.75	2.85	0.29	316	165	246	4.00	1125	500
0	2	3	0.25	250	125	219	4.00	1000	500
0	2.25	3.1	0.23	191	101	200	4.00	875	500
0	2.5	3.25	0.19	141	70	170	4.00	750	500
0	2.75	3.35	0.16	97	53	149	4.00	625	500
0	3	3.5	0.13	63	31	117	4.00	500	500
0	3.25	3.85	0.07	41	1	65	4.00	375	500
0	3.5	3.85	0.07	24	1	65	4.00	250	500
0	3.75	3.85	0.07	7	1	65	4.00	125	500
2500	0	2	0.50	1000	500	375	4.00	1844	500
2500	0.25	2.1	0.47	879	451	362	4.00	1719	500
2500	0.5	2.25	0.44	766	383	342	4.00	1594	500
2500	0.75	2.35	0.41	660	340	327	4.00	1469	500
2500	1	2.5	0.38	563	281	305	4.00	1344	500
2500	1.25	2.6	0.35	472	245	289	4.00	1219	500
2500	1.5	2.75	0.31	391	195	264	4.00	1094	500
2500	1.75	2.85	0.29	316	165	246	4.00	969	500
2500	2	3	0.25	250	125	219	4.00	844	500
2500	2.25	3.1	0.23	191	101	200	4.00	719	500
2500	2.5	3.25	0.19	141	70	170	4.00	594	500
2500	2.75	3.35	0.16	97	53	149	4.00	469	500
2500	3	3.5	0.13	63	31	117	4.00	344	500
2500	3.25	3.85	0.07	41	1	65	4.00	219	500
2500	3.5	3.85	0.07	24	1	65	5.00	100	400
2500	3.75	3.85	0.07	7	1	65	10.00	25	200
5000	0	2	0.50	1000	500	375	4.00	1688	500
5000	0.25	2.1	0.47	879	451	362	4.00	1563	500
5000	0.5	2.25	0.44	766	383	342	4.00	1438	500
5000	0.75	2.35	0.41	660	340	327	4.00	1313	500
5000	1	2.5	0.38	563	281	305	4.00	1188	500
5000	1.25	2.6	0.35	472	245	289	4.00	1063	500
5000	1.5	2.75	0.31	391	195	264	4.00	938	500
5000	1.75	2.85	0.29	316	165	246	4.00	813	500
5000	2	3	0.25	250	125	219	4.00	688	500
5000	2.25	3.1	0.23	191	101	200	4.00	563	500
5000	2.5	3.25	0.19	141	70	170	4.00	438	500
5000	2.75	3.35	0.16	97	53	149	4.00	313	500
5000	3	3.5	0.13	63	31	117	5.00	200	400

		RETAILER-ONLY					DIRECT-ONLY		
Parameters		Decision Variables		Profits		Sales	Decision Var.	Profit	Sales
m	**c**	**w**	α	Π_m	Π_r	**Retailer**	**t**	Π_m	**Direct**
5000	3.25	3.85	0.07	41	1	65	6.67	113	300
5000	3.5	3.85	0.07	24	1	65	10.00	50	200
5000	3.75	3.85	0.07	7	1	65	20.00	13	100
7500	0	2	0.50	1000	500	375	4.00	1531	500
7500	0.25	2.1	0.47	879	451	362	4.00	1406	500
7500	0.5	2.25	0.44	766	383	342	4.00	1281	500
7500	0.75	2.35	0.41	660	340	327	4.00	1156	500
7500	1	2.5	0.38	563	281	305	4.00	1031	500
7500	1.25	2.6	0.35	472	245	289	4.00	906	500
7500	1.5	2.75	0.31	391	195	264	4.00	781	500
7500	1.75	2.85	0.29	316	165	246	4.00	656	500
7500	2	3	0.25	250	125	219	4.00	531	500
7500	2.25	3.1	0.23	191	101	200	4.29	408	467
7500	2.5	3.25	0.19	141	70	170	5.00	300	400
7500	2.75	3.35	0.16	97	53	149	6.00	208	333
7500	3	3.5	0.13	63	31	117	7.50	133	267
7500	3.25	3.85	0.07	41	1	65	10.00	75	200
7500	3.5	3.85	0.07	24	1	65	15.00	33	133
7500	3.75	3.85	0.07	7	1	65	30.00	8	67
10000	0	2	0.50	1000	500	375	4.00	1375	500
10000	0.25	2.1	0.47	879	451	362	4.00	1250	500
10000	0.5	2.25	0.44	766	383	342	4.00	1125	500
10000	0.75	2.35	0.41	660	340	327	4.00	1000	500
10000	1	2.5	0.38	563	281	305	4.00	875	500
10000	1.25	2.6	0.35	472	245	289	4.00	750	500
10000	1.5	2.75	0.31	391	195	264	4.00	625	500
10000	1.75	2.85	0.29	316	165	246	4.44	506	450
10000	2	3	0.25	250	125	219	5.00	400	400
10000	2.25	3.1	0.23	191	101	200	5.71	306	350
10000	2.5	3.25	0.19	141	70	170	6.67	225	300
10000	2.75	3.35	0.16	97	53	149	8.00	156	250
10000	3	3.5	0.13	63	31	117	10.00	100	200
10000	3.25	3.85	0.07	41	1	65	13.33	56	150
10000	3.5	3.85	0.07	24	1	65	20.00	25	100
10000	3.75	3.85	0.07	7	1	65	40.00	6	50
12500	0	2	0.50	1000	500	375	4.00	1219	500
12500	0.25	2.1	0.47	879	451	362	4.00	1094	500
12500	0.5	2.25	0.44	766	383	342	4.00	969	500
12500	0.75	2.35	0.41	660	340	327	4.00	844	500
12500	1	2.5	0.38	563	281	305	4.17	720	480
12500	1.25	2.6	0.35	472	245	289	4.55	605	440
12500	1.5	2.75	0.31	391	195	264	5.00	500	400
12500	1.75	2.85	0.29	316	165	246	5.56	405	360
12500	2	3	0.25	250	125	219	6.25	320	320
12500	2.25	3.1	0.23	191	101	200	7.14	245	280

		RETAILER-ONLY					DIRECT-ONLY		
Parameters		Decision Variables		Profits		Sales	Decision Var.	Profit	Sales
m	**c**	**w**	α	Π_m	Π_r	**Retailer**	**t**	Π_m	**Direct**
12500	2.5	3.25	0.19	141	70	170	8.33	180	240
12500	2.75	3.35	0.16	97	53	149	10.00	125	200
12500	3	3.5	0.13	63	31	117	12.50	80	160
12500	3.25	3.85	0.07	41	1	65	16.67	45	120
12500	3.5	3.85	0.07	24	1	65	25.00	20	80
12500	3.75	3.85	0.07	7	1	65	50.00	5	40
15000	0	2	0.50	1000	500	375	4.00	1063	500
15000	0.25	2.1	0.47	879	451	362	4.00	938	500
15000	0.5	2.25	0.44	766	383	342	4.29	817	467
15000	0.75	2.35	0.41	660	340	327	4.62	704	433
15000	1	2.5	0.38	563	281	305	5.00	600	400
15000	1.25	2.6	0.35	472	245	289	5.45	504	367
15000	1.5	2.75	0.31	391	195	264	6.00	417	333
15000	1.75	2.85	0.29	316	165	246	6.67	338	300
15000	2	3	0.25	250	125	219	7.50	267	267
15000	2.25	3.1	0.23	191	101	200	8.57	204	233
15000	2.5	3.25	0.19	141	70	170	10.00	150	200
15000	2.75	3.35	0.16	97	53	149	12.00	104	167
15000	3	3.5	0.13	63	31	117	15.00	67	133
15000	3.25	3.85	0.07	41	1	65	20.00	38	100
15000	3.5	3.85	0.07	24	1	65	30.00	17	67
15000	3.75	3.85	0.07	7	1	65	60.00	4	33
17500	0	2	0.50	1000	500	375	4.38	914	457
17500	0.25	2.1	0.47	879	451	362	4.67	804	429
17500	0.5	2.25	0.44	766	383	342	5.00	700	400
17500	0.75	2.35	0.41	660	340	327	5.38	604	371
17500	1	2.5	0.38	563	281	305	5.83	514	343
17500	1.25	2.6	0.35	472	245	289	6.36	432	314
17500	1.5	2.75	0.31	391	195	264	7.00	357	286
17500	1.75	2.85	0.29	316	165	246	7.78	289	257
17500	2	3	0.25	250	125	219	8.75	229	229
17500	2.25	3.1	0.23	191	101	200	10.00	175	200
17500	2.5	3.25	0.19	141	70	170	11.67	129	171
17500	2.75	3.35	0.16	97	53	149	14.00	89	143
17500	3	3.5	0.13	63	31	117	17.50	57	114
17500	3.25	3.85	0.07	41	1	65	23.33	32	86
17500	3.5	3.85	0.07	24	1	65	35.00	14	57
17500	3.75	3.85	0.07	7	1	65	70.00	4	29
20000	0	2	0.50	1000	500	375	5.00	800	400
20000	0.25	2.1	0.47	879	451	362	5.33	703	375
20000	0.5	2.25	0.44	766	383	342	5.71	613	350
20000	0.75	2.35	0.41	660	340	327	6.15	528	325
20000	1	2.5	0.38	563	281	305	6.67	450	300
20000	1.25	2.6	0.35	472	245	289	7.27	378	275
20000	1.5	2.75	0.31	391	195	264	8.00	313	250

		RETAILER-ONLY					DIRECT-ONLY		
Parameters		Decision Variables		Profits		Sales	Decision Var.	Profit	Sales
m	**c**	**w**	α	Π_m	Π_r	**Retailer**	**t**	Π_m	**Direct**
20000	1.75	2.85	0.29	316	165	246	8.89	253	225
20000	2	3	0.25	250	125	219	10.00	200	200
20000	2.25	3.1	0.23	191	101	200	11.43	153	175
20000	2.5	3.25	0.19	141	70	170	13.33	113	150
20000	2.75	3.35	0.16	97	53	149	16.00	78	125
20000	3	3.5	0.13	63	31	117	20.00	50	100
20000	3.25	3.85	0.07	41	1	65	26.67	28	75
20000	3.5	3.85	0.07	24	1	65	40.00	13	50
20000	3.75	3.85	0.07	7	1	65	80.00	3	25
22500	0	2	0.50	1000	500	375	5.63	711	356
22500	0.25	2.1	0.47	879	451	362	6.00	625	333
22500	0.5	2.25	0.44	766	383	342	6.43	544	311
22500	0.75	2.35	0.41	660	340	327	6.92	469	289
22500	1	2.5	0.38	563	281	305	7.50	400	267
22500	1.25	2.6	0.35	472	245	289	8.18	336	244
22500	1.5	2.75	0.31	391	195	264	9.00	278	222
22500	1.75	2.85	0.29	316	165	246	10.00	225	200
22500	2	3	0.25	250	125	219	11.25	178	178
22500	2.25	3.1	0.23	191	101	200	12.86	136	156
22500	2.5	3.25	0.19	141	70	170	15.00	100	133
22500	2.75	3.35	0.16	97	53	149	18.00	69	111
22500	3	3.5	0.13	63	31	117	22.50	44	89
22500	3.25	3.85	0.07	41	1	65	30.00	25	67
22500	3.5	3.85	0.07	24	1	65	45.00	11	44
22500	3.75	3.85	0.07	7	1	65	90.00	3	22
25000	0	2	0.50	1000	500	375	6.25	640	320
25000	0.25	2.1	0.47	879	451	362	6.67	563	300
25000	0.5	2.25	0.44	766	383	342	7.14	490	280
25000	0.75	2.35	0.41	660	340	327	7.69	423	260
25000	1	2.5	0.38	563	281	305	8.33	360	240
25000	1.25	2.6	0.35	472	245	289	9.09	303	220
25000	1.5	2.75	0.31	391	195	264	10.00	250	200
25000	1.75	2.85	0.29	316	165	246	11.11	203	180
25000	2	3	0.25	250	125	219	12.50	160	160
25000	2.25	3.1	0.23	191	101	200	14.29	123	140
25000	2.5	3.25	0.19	141	70	170	16.67	90	120
25000	2.75	3.35	0.16	97	53	149	20.00	63	100
25000	3	3.5	0.13	63	31	117	25.00	40	80
25000	3.25	3.85	0.07	41	1	65	33.33	23	60
25000	3.5	3.85	0.07	24	1	65	50.00	10	40
25000	3.75	3.85	0.07	7	1	65	100.00	3	20

Table 5.13: Dual Channel Strategy in the p/k Plane, m=7500, v=8, k=1

Parameters		Decision Variables			Profits		Sales			Eql.
p	**k**	**w**	**t**	α	Π_m	Π_r	**Direct**	**Retailer**	**Lost**	**Type**
2.00	0.75	2	6.00	0.03	292	0	500	0	0	ER
2.00	1.25	1.95	6.00	0.05	292	0	500	0	0	ER
2.00	1.75	1.95	6.00	0.08	292	0	500	0	0	ER
2.00	2.25	1.8	6.57	0.15	292	1	449	19	32	SP
2.00	2.75	1.8	6.76	0.16	294	1	444	17	39	CP
2.00	3.25	1.75	7.34	0.21	299	1	409	35	57	CP
2.00	3.75	1.7	8.06	0.27	305	2	372	60	68	CP
2.00	4.25	1.65	8.99	0.34	315	1	334	94	72	CP
2.00	4.75	1.55	9.46	0.43	320	3	317	123	60	CP
2.00	5.25	1.45	9.79	0.54	323	1	306	153	40	CP
2.25	0.75	2.25	5.75	0.03	398	0	500	0	0	ER
2.25	1.25	2.2	5.75	0.06	398	0	500	0	0	ER
2.25	1.75	2.15	5.75	0.09	398	0	500	0	0	ER
2.25	2.25	2.15	5.75	0.13	398	0	500	0	0	ER
2.25	2.75	2.05	5.90	0.17	398	0	487	4	9	CP
2.25	3.25	1.95	6.39	0.23	400	1	450	20	30	CP
2.25	3.75	1.9	7.21	0.29	407	1	399	51	51	CP
2.25	4.25	1.8	7.95	0.37	416	3	361	84	55	CP
2.25	4.75	1.7	8.85	0.47	426	3	325	126	49	CP
2.25	5.25	1.55	9.06	0.61	428	2	317	155	27	CP
2.50	0.75	2.5	5.50	0.03	502	0	500	0	0	ER
2.50	1.25	2.45	5.50	0.06	502	0	500	0	0	ER
2.50	1.75	2.4	5.50	0.09	502	0	500	0	0	ER
2.50	2.25	2.35	5.50	0.14	502	0	500	0	0	ER
2.50	2.75	2.3	5.50	0.19	502	0	500	0	0	ER
2.50	3.25	2.15	5.84	0.25	503	1	471	12	16	CP
2.50	3.75	2.1	6.81	0.32	511	0	404	51	45	CP
2.50	4.25	1.95	7.50	0.41	520	5	367	87	47	CP
2.50	4.75	1.8	8.28	0.53	530	8	332	130	38	CP
2.50	5.25	1.6	8.48	0.71	533	2	324	161	14	CP
2.75	0.75	2.75	5.25	0.03	603	0	500	0	0	ER
2.75	1.25	2.7	5.25	0.06	603	0	500	0	0	ER
2.75	1.75	2.65	5.25	0.10	603	0	500	0	0	ER
2.75	2.25	2.55	5.25	0.15	603	0	500	0	0	ER
2.75	2.75	2.5	5.25	0.20	603	0	500	0	0	ER
2.75	3.25	2.35	5.55	0.27	604	0	473	12	14	CP
2.75	3.75	2.25	6.48	0.35	613	2	405	54	40	CP
2.75	4.25	2.1	7.52	0.45	628	4	349	105	46	CP
2.75	4.75	1.9	8.45	0.60	642	7	311	159	31	CP
2.75	5.25	1.35	5.44	1.00	603	1	482	18	0	CP
3.00	0.75	2.95	5.00	0.03	700	0	500	0	0	ER
3.00	1.25	2.9	5.00	0.07	700	0	500	0	0	ER
3.00	1.75	2.85	5.00	0.11	700	0	500	0	0	ER
3.00	2.25	2.8	5.00	0.16	700	0	500	0	0	ER
3.00	2.75	2.7	5.00	0.22	700	0	500	0	0	ER

Parameters		Decision Variables			Profits		Sales			Eql.
p	**k**	**w**	**t**	α	Π_m	Π_r	**Direct**	**Retailer**	**Lost**	**Type**
3.00	3.25	2.55	5.46	0.29	702	0	458	21	21	CP
3.00	3.75	2.4	6.46	0.38	715	2	387	70	43	CP
3.00	4.25	2.2	7.61	0.50	735	7	328	130	42	CP
3.00	4.75	1.9	8.13	0.70	744	13	308	175	17	CP
3.00	5.25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
3.25	0.75	3.2	4.75	0.04	793	0	500	0	0	ER
3.25	1.25	3.15	4.75	0.07	793	0	500	0	0	ER
3.25	1.75	3.1	4.75	0.12	793	0	500	0	0	ER
3.25	2.25	3	4.75	0.17	793	0	500	0	0	ER
3.25	2.75	2.9	4.75	0.24	793	0	500	0	0	ER
3.25	3.25	2.7	5.43	0.32	798	1	437	34	29	CP
3.25	3.75	2.55	6.79	0.43	823	1	350	101	50	CP
3.25	4.25	2.3	8.45	0.58	856	3	281	180	39	CP
3.25	4.75	1.6	6.02	1.00	807	5	395	105	0	CP
3.25	5.25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
3.50	0.75	3.45	4.50	0.04	880	0	500	0	0	ER
3.50	1.25	3.4	4.50	0.08	880	0	500	0	0	ER
3.50	1.75	3.3	4.50	0.13	880	0	500	0	0	ER
3.50	2.25	3.2	4.50	0.19	880	0	500	0	0	ER
3.50	2.75	2.95	4.68	0.28	879	1	477	13	10	SP
3.50	3.25	2.85	5.61	0.35	894	2	401	58	41	CP
3.50	3.75	2.65	7.32	0.48	934	1	308	141	52	CP
3.50	4.25	2.25	8.49	0.69	961	16	265	212	23	CP
3.50	4.75	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
3.50	5.25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
3.75	0.75	3.7	4.25	0.04	960	0	500	0	0	ER
3.75	1.25	3.6	4.25	0.08	960	0	500	0	0	ER
3.75	1.75	3.5	4.25	0.14	960	0	500	0	0	ER
3.75	2.25	3.4	4.25	0.20	960	0	500	0	0	ER
3.75	2.75	3.2	4.77	0.29	965	0	446	27	27	CP
3.75	3.25	3	6.10	0.40	998	0	349	97	55	CP
3.75	3.75	2.7	8.21	0.56	1056	2	259	194	48	CP
3.75	4.25	1.85	6.72	1.00	1016	9	316	184	0	CP
3.75	4.75	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
3.75	5.25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
4.00	0.75	3.95	4.00	0.05	1031	0	500	0	0	ER
4.00	1.25	3.85	4.00	0.09	1031	0	500	0	0	ER
4.00	1.75	3.7	4.00	0.15	1031	0	500	0	0	ER
4.00	2.25	3.5	4.08	0.23	1031	0	489	6	6	SP
4.00	2.75	3.35	5.05	0.32	1052	0	396	56	48	CP
4.00	3.25	3.05	6.59	0.45	1104	7	304	138	59	CP
4.00	3.75	2.65	9.43	0.67	1187	5	212	256	32	CP
4.00	4.25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
4.00	4.75	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
4.00	5.25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Table 5.14: RW/DO Strategy in the p/k Plane

		RETAILER ONLY					DIRECT ONLY		
Parameters		Decision Variables		Profits		Sales	Decision Var.	Profit	Sales
p	**k**	**w**	α	Π_m	Π_r	**Retailer**	**t**	Π_m	**Direct**
2.00	0.75	1.5	0.25	125	62	219	6	292	500
2.00	1.25	1.5	0.25	125	62	219	6	292	500
2.00	1.75	1.5	0.25	125	62	219	6	292	500
2.00	2.25	1.5	0.25	125	62	219	6	292	500
2.00	2.75	1.8	0.16	130	6	150	6	292	500
2.00	3.25	1.75	0.21	159	8	190	6	292	500
2.00	3.75	1.7	0.27	190	8	234	6	292	500
2.00	4.25	1.65	0.34	222	3	283	6	292	500
2.00	4.75	1.55	0.43	236	9	337	6	292	500
2.00	5.25	1.45	0.54	245	3	396	6	292	500
2.25	0.75	1.6	0.29	173	94	247	5.75	398	500
2.25	1.25	1.6	0.29	173	94	247	5.75	398	500
2.25	1.75	1.6	0.29	173	94	247	5.75	398	500
2.25	2.25	1.6	0.29	173	94	247	5.75	398	500
2.25	2.75	2.05	0.17	183	1	159	5.75	398	500
2.25	3.25	1.95	0.23	217	10	202	5.75	398	500
2.25	3.75	1.9	0.29	263	6	250	5.75	398	500
2.25	4.25	1.8	0.37	297	12	302	5.75	398	500
2.25	4.75	1.7	0.47	330	9	360	5.75	398	500
2.25	5.25	1.55	0.61	337	6	425	5.75	398	500
2.50	0.75	1.75	0.30	225	112	255	5.5	502	500
2.50	1.25	1.75	0.30	225	112	255	5.5	502	500
2.50	1.75	1.75	0.30	225	112	255	5.5	502	500
2.50	2.25	1.75	0.30	225	112	255	5.5	502	500
2.50	2.75	2.25	0.19	233	3	169	5.5	502	500
2.50	3.25	2.15	0.25	283	10	216	5.5	502	500
2.50	3.75	2.1	0.32	349	1	267	5.5	502	500
2.50	4.25	1.95	0.41	386	17	324	5.5	502	500
2.50	4.75	1.8	0.53	420	23	387	5.5	502	500
2.50	5.25	1.6	0.71	428	5	459	5.5	502	500
2.75	0.75	1.85	0.33	278	147	274	5.25	603	500
2.75	1.25	1.85	0.33	278	147	274	5.25	603	500
2.75	1.75	1.85	0.33	278	147	274	5.25	603	500
2.75	2.25	1.85	0.33	278	147	274	5.25	603	500
2.75	2.75	2.45	0.20	292	5	181	5.25	603	500
2.75	3.25	2.35	0.27	360	9	231	5.25	603	500
2.75	3.75	2.25	0.35	434	8	287	5.25	603	500
2.75	4.25	2.1	0.45	495	14	349	5.25	603	500
2.75	4.75	1.9	0.60	537	18	419	5.25	603	500
2.75	5.25	1.35	1.00	350	25	500	5.25	603	500
3.00	0.75	2	0.33	333	167	278	5	700	500
3.00	1.25	2	0.33	333	167	278	5	700	500
3.00	1.75	2	0.33	333	167	278	5	700	500
3.00	2.25	2	0.33	333	167	278	5	700	500
3.00	2.75	2.65	0.22	360	5	194	5	700	500

		RETAILER-ONLY					DIRECT-ONLY		
Parameters		Decision Variables		Profits		Sales	Decision Var.	Profit	Sales
p	**k**	**w**	α	Π_m	Π_r	**Retailer**	**t**	Π_m	**Direct**
3.00	3.25	2.55	0.29	451	4	249	5	700	500
3.00	3.75	2.4	0.38	535	10	309	5	700	500
3.00	4.25	2.2	0.50	606	21	377	5	700	500
3.00	4.75	1.9	0.70	631	34	455	5	700	500
3.00	5.25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
3.25	0.75	2.1	0.35	389	203	291	4.75	793	500
3.25	1.25	2.1	0.35	389	203	291	4.75	793	500
3.25	1.75	2.1	0.35	389	203	291	4.75	793	500
3.25	2.25	2.1	0.35	389	203	291	4.75	793	500
3.25	2.75	2.85	0.24	439	3	209	4.75	793	500
3.25	3.25	2.7	0.32	543	10	269	4.75	793	500
3.25	3.75	2.55	0.43	660	3	335	4.75	793	500
3.25	4.25	2.3	0.58	751	6	411	4.75	793	500
3.25	4.75	1.6	1.00	600	25	500	4.75	793	500
3.25	5.25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
3.50	0.75	2.25	0.36	446	223	293	4.5	880	500
3.50	1.25	2.25	0.36	446	223	293	4.5	880	500
3.50	1.75	2.25	0.36	446	223	293	4.5	880	500
3.50	2.25	2.25	0.36	446	223	293	4.5	880	500
3.50	2.75	3	0.26	521	11	227	4.5	880	500
3.50	3.25	2.85	0.35	656	10	292	4.5	880	500
3.50	3.75	2.65	0.48	794	4	366	4.5	880	500
3.50	4.25	2.25	0.69	857	34	451	4.5	880	500
3.50	4.75	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
3.50	5.25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
3.75	0.75	2.35	0.37	504	261	304	4.25	960	500
3.75	1.25	2.35	0.37	504	261	304	4.25	960	500
3.75	1.75	2.35	0.37	504	261	304	4.25	960	500
3.75	2.25	2.35	0.37	504	261	304	4.25	960	500
3.75	2.75	3.2	0.29	635	3	247	4.25	960	500
3.75	3.25	3	0.40	796	1	319	4.25	960	500
3.75	3.75	2.7	0.56	945	4	401	4.25	960	500
3.75	4.25	1.85	1.00	850	25	500	4.25	960	500
3.75	4.75	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
3.75	5.25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
4.00	0.75	2.5	0.38	563	281	305	4	1031	500
4.00	1.25	2.5	0.38	563	281	305	4	1031	500
4.00	1.75	2.5	0.38	563	281	305	4	1031	500
4.00	2.25	3.5	0.23	566	11	201	4	1031	500
4.00	2.75	3.35	0.32	758	2	271	4	1031	500
4.00	3.25	3.05	0.45	931	19	351	4	1031	500
4.00	3.75	2.65	0.67	1102	9	445	4	1031	500
4.00	4.25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
4.00	4.75	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
4.00	5.25	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Table 5.15: Dual Channel Strategy in the m/v Plane, p=4, k=1, c=1

Parameters		Decision Variables			Profits		Sales			Eql.
m	**v**	**w**	**t**	α	Π_m	Π_r	**Direct**	**Retailer**	**Lost**	**Type**
0	5	1	1.00	1.00	1500	0	500	0	0	ER
0	5.5	3.05	1.26	0.48	1500	0	500	0	0	ER
0	6	3.05	1.34	0.48	1500	0	500	0	0	ER
0	6.5	3.05	1.43	0.48	1500	0	500	0	0	ER
0	7	3.05	1.51	0.48	1500	0	500	0	0	ER
0	7.5	3.05	1.60	0.48	1500	0	500	0	0	ER
0	8	3.05	1.69	0.48	1500	0	500	0	0	ER
2500	5	2	10.00	1.00	1025	0	50	450	0	CP
2500	5.5	3.35	4.25	0.30	854	8	176	167	156	CP
2500	6	3.05	2.86	0.29	908	43	323	102	75	SP
2500	6.5	3.75	2.50	0.13	1100	0	500	0	0	ER
2500	7	3.8	3.00	0.10	1222	0	500	0	0	ER
2500	7.5	3.85	3.50	0.08	1296	0	500	0	0	ER
2500	8	3.9	4.00	0.07	1344	0	500	0	0	ER
5000	5	2	20.00	1.00	1012	0	25	475	0	CP
5000	5.5	3.35	8.50	0.30	785	10	88	213	199	CP
5000	6	2.7	5.91	0.35	738	154	148	213	140	SP
5000	6.5	2.9	4.69	0.31	820	91	228	162	111	SP
5000	7	3.8	3.00	0.10	944	0	500	0	0	ER
5000	7.5	3.85	3.50	0.08	1092	0	500	0	0	ER
5000	8	3.9	4.00	0.07	1187	0	500	0	0	ER
7500	5	2	30.00	1.00	1008	0	17	483	0	CP
7500	5.5	3.35	12.75	0.30	762	11	59	228	213	CP
7500	6	2.6	8.92	0.37	681	203	96	248	156	SP
7500	6.5	2.75	7.19	0.34	734	147	144	212	143	SP
7500	7	2.9	5.90	0.31	802	99	209	173	118	SP
7500	7.5	3.3	4.38	0.22	891	24	359	80	62	SP
7500	8	3.9	4.00	0.07	1031	0	500	0	0	ER
10000	5	2	40.00	1.00	1006	0	13	487	0	CP
10000	5.5	3.35	17.00	0.30	750	11	44	235	220	CP
10000	6	2.6	11.78	0.36	652	213	73	258	169	SP
10000	6.5	2.65	9.77	0.36	692	188	104	242	154	SP
10000	7	2.75	8.17	0.34	741	149	145	216	139	SP
10000	7.5	2.95	6.66	0.30	801	91	214	168	118	SP
10000	8	3.25	5.22	0.23	880	32	335	96	70	SP
12500	5	2	50.00	1.00	1005	0	10	490	0	CP
12500	5.5	3.35	21.25	0.30	743	12	35	240	225	CP
12500	6	2.55	14.82	0.37	634	236	58	272	170	SP
12500	6.5	2.65	12.09	0.35	666	195	84	249	167	SP
12500	7	2.7	10.27	0.34	705	172	114	234	152	SP
12500	7.5	2.8	8.73	0.33	752	136	156	208	136	SP
12500	8	3	7.18	0.28	808	81	226	160	114	SP
15000	5	2	60.00	1.00	1004	0	8	492	0	CP
15000	5.5	3.35	25.50	0.30	739	12	29	243	228	CP
15000	6	2.55	17.72	0.37	622	240	48	276	176	SP

Parameters		Decision Variables			Profits		Sales			Eql.
m	**v**	**w**	**t**	α	Π_m	Π_r	**Direct**	**Retailer**	**Lost**	**Type**
15000	6.5	2.6	14.66	0.36	649	217	69	263	169	SP
15000	7	2.65	12.45	0.35	681	194	93	249	158	SP
15000	7.5	2.75	10.57	0.33	719	157	127	225	148	SP
15000	8	2.85	9.09	0.32	765	123	170	199	131	SP
17500	5	2	70.00	1.00	1004	0	7	493	0	CP
17500	5.5	3.35	29.75	0.30	736	12	25	245	230	CP
17500	6	2.55	20.61	0.37	614	243	42	279	180	SP
17500	6.5	2.6	17.03	0.36	637	221	59	266	175	SP
17500	7	2.65	14.44	0.35	664	198	81	253	166	SP
17500	7.5	2.7	12.49	0.34	697	177	106	239	155	SP
17500	8	2.8	10.73	0.32	735	141	142	215	143	SP
20000	5	2	80.00	1.00	1003	0	6	494	0	CP
20000	5.5	3.35	34.00	0.30	733	12	22	247	231	CP
20000	6	2.55	23.51	0.37	607	246	36	281	182	SP
20000	6.5	2.6	19.40	0.36	627	224	52	269	179	SP
20000	7	2.6	16.73	0.36	651	218	69	265	167	SP
20000	7.5	2.7	14.18	0.34	680	181	94	243	163	SP
20000	8	2.75	12.43	0.33	713	160	121	229	151	SP
22500	5	2	90.00	1.00	1003	0	6	494	0	CP
22500	5.5	3.35	38.25	0.30	731	12	20	248	232	CP
22500	6	2.55	26.41	0.37	602	248	33	283	185	SP
22500	6.5	2.55	22.12	0.37	620	243	45	279	176	SP
22500	7	2.6	18.76	0.36	642	221	61	267	171	SP
22500	7.5	2.65	16.20	0.35	667	200	81	255	165	SP
22500	8	2.7	14.21	0.34	696	179	104	241	155	SP
25000	5	2	100.00	1.00	1002	0	5	495	0	CP
25000	5.5	3.35	42.50	0.30	730	12	18	249	233	CP
25000	6	2.55	29.30	0.37	598	249	29	284	187	SP
25000	6.5	2.55	24.53	0.37	614	245	41	281	178	SP
25000	7	2.6	20.78	0.36	634	223	55	269	175	SP
25000	7.5	2.65	17.93	0.35	656	202	73	257	170	SP
25000	8	2.7	15.71	0.34	682	182	94	244	162	SP

Table 5.16: RW/DO Strategy in the m/v Plane

		RETAILER-ONLY					DIRECT-ONLY		
Parameters		Decision Variables		Profits		Sales	Decision Var.	Profit	Sales
m	**v**	**w**	α	Π_m	Π_r	**Retailer**	**t**	Π_m	**Direct**
0	5	2	1.00	1000	0	500	1.00	1500	500
0	5.5	3.35	0.30	716	12	258	1.50	1500	500
0	6	2.5	0.38	563	281	305	2.00	1500	500
0	6.5	2.5	0.38	563	281	305	2.50	1500	500
0	7	2.5	0.38	563	281	305	3.00	1500	500
0	7.5	2.5	0.38	563	281	305	3.50	1500	500
0	8	2.5	0.38	563	281	305	4.00	1500	500
2500	5	2	1.00	1000	0	500	3.33	225	150
2500	5.5	3.35	0.30	716	12	258	2.22	506	338
2500	6	2.5	0.38	563	281	305	2.00	875	500
2500	6.5	2.5	0.38	563	281	305	2.50	1100	500
2500	7	2.5	0.38	563	281	305	3.00	1222	500
2500	7.5	2.5	0.38	563	281	305	3.50	1296	500
2500	8	2.5	0.38	563	281	305	4.00	1344	500
5000	5	2	1.00	1000	0	500	6.67	113	75
5000	5.5	3.35	0.30	716	12	258	4.44	253	169
5000	6	2.5	0.38	563	281	305	3.33	450	300
5000	6.5	2.5	0.38	563	281	305	2.67	703	469
5000	7	2.5	0.38	563	281	305	3.00	944	500
5000	7.5	2.5	0.38	563	281	305	3.50	1092	500
5000	8	2.5	0.38	563	281	305	4.00	1188	500
7500	5	2	1.00	1000	0	500	10.00	75	50
7500	5.5	3.35	0.30	716	12	258	6.67	169	113
7500	6	2.5	0.38	563	281	305	5.00	300	200
7500	6.5	2.5	0.38	563	281	305	4.00	469	313
7500	7	2.5	0.38	563	281	305	3.33	675	450
7500	7.5	2.5	0.38	563	281	305	3.50	888	500
7500	8	2.5	0.38	563	281	305	4.00	1031	500
10000	5	2	1.00	1000	0	500	13.33	56	38
10000	5.5	3.35	0.30	716	12	258	8.89	127	84
10000	6	2.5	0.38	563	281	305	6.67	225	150
10000	6.5	2.5	0.38	563	281	305	5.33	352	234
10000	7	2.5	0.38	563	281	305	4.44	506	338
10000	7.5	2.5	0.38	563	281	305	3.81	689	459
10000	8	2.5	0.38	563	281	305	4.00	875	500
12500	5	2	1.00	1000	0	500	16.67	45	30
12500	5.5	3.35	0.30	716	12	258	11.11	101	68
12500	6	2.5	0.38	563	281	305	8.33	180	120
12500	6.5	2.5	0.38	563	281	305	6.67	281	188
12500	7	2.5	0.38	563	281	305	5.56	405	270
12500	7.5	2.5	0.38	563	281	305	4.76	551	368
12500	8	2.5	0.38	563	281	305	4.17	720	480
15000	5	2	1.00	1000	0	500	20.00	38	25
15000	5.5	3.35	0.30	716	12	258	13.33	84	56
15000	6	2.5	0.38	563	281	305	10.00	150	100

		RETAILER-ONLY					DIRECT-ONLY		
Parameters		Decision Variables		Profits		Sales	Decision Var.	Profit	Sales
m	**v**	**w**	α	Π_m	Π_r	**Retailer**	**t**	Π_m	**Direct**
15000	6.5	2.5	0.38	563	281	305	8.00	234	156
15000	7	2.5	0.38	563	281	305	6.67	338	225
15000	7.5	2.5	0.38	563	281	305	5.71	459	306
15000	8	2.5	0.38	563	281	305	5.00	600	400
17500	5	2	1.00	1000	0	500	23.33	32	21
17500	5.5	3.35	0.30	716	12	258	15.56	72	48
17500	6	2.5	0.38	563	281	305	11.67	129	86
17500	6.5	2.5	0.38	563	281	305	9.33	201	134
17500	7	2.5	0.38	563	281	305	7.78	289	193
17500	7.5	2.5	0.38	563	281	305	6.67	394	263
17500	8	2.5	0.38	563	281	305	5.83	514	343
20000	5	2	1.00	1000	0	500	26.67	28	19
20000	5.5	3.35	0.30	716	12	258	17.78	63	42
20000	6	2.5	0.38	563	281	305	13.33	113	75
20000	6.5	2.5	0.38	563	281	305	10.67	176	117
20000	7	2.5	0.38	563	281	305	8.89	253	169
20000	7.5	2.5	0.38	563	281	305	7.62	345	230
20000	8	2.5	0.38	563	281	305	6.67	450	300
22500	5	2	1.00	1000	0	500	30.00	25	17
22500	5.5	3.35	0.30	716	12	258	20.00	56	38
22500	6	2.5	0.38	563	281	305	15.00	100	67
22500	6.5	2.5	0.38	563	281	305	12.00	156	104
22500	7	2.5	0.38	563	281	305	10.00	225	150
22500	7.5	2.5	0.38	563	281	305	8.57	306	204
22500	8	2.5	0.38	563	281	305	7.50	400	267
25000	5	2	1.00	1000	0	500	33.33	23	15
25000	5.5	3.35	0.30	716	12	258	22.22	51	34
25000	6	2.5	0.38	563	281	305	16.67	90	60
25000	6.5	2.5	0.38	563	281	305	13.33	141	94
25000	7	2.5	0.38	563	281	305	11.11	203	135
25000	7.5	2.5	0.38	563	281	305	9.52	276	184
25000	8	2.5	0.38	563	281	305	8.33	360	240

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