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Strategic segmentation using outlet malls

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Abstract

An important phenomenon in recent years has been the growth of low-service manufacturer-operated stores in malls located a significant distance from the shopping districts of major metropolitan areas. For the most part, these “outlet” stores offer minimal service, attractive pricing and a full product line. However, the “outlet” store phenomenon is not universal and there are a number of categories where manufacturers restrict their distribution to primary retailers.

Our objective is to provide a rationale for the popularity of outlet stores in some categories and the absence of outlet stores in others. We build an analytical model with two manufacturers that distribute (a) through primary retailers or (b) with dual distribution (through primary retailers and outlet malls). The manufacturers compete in a market of buyers that are heterogeneous in terms of price and service sensitivity.

The motivation for dual or segmented distribution is certainly related to differences between consumers. However, the attractiveness of retailing through outlet stores and through primary retailers is not a straightforward function of the degree to which consumers are different. It is related to how consumers are different. In particular, when the range of service sensitivity across consumers is high relative to the range of price sensitivity, manufacturers will find that single channel distribution is superior. When the opposite is true, manufacturers have higher profits in a market where dual distribution with outlet stores is utilized. This key result holds because outlet malls attract price-sensitive, non-service-sensitive consumers, leaving more service-sensitive (and less price-sensitive) consumers in the primary market. Decreasing the sensitivity of demand to price in the primary market is a welcome result if and only if the consumers who stay in the primary market are not overly sensitive to service. In sum, the model demonstrates both the value and the danger of segmentation under competitive conditions.

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1. Introduction

In recent years, an important retailing phenomenon has been the growth of outlet malls.¹ These are shopping malls located a considerable distance from the major shopping areas of major metropolitan areas (New York, Chicago, Toronto and Paris for example) where primary tenants are manufacturer-owned outlet stores.² Manufacturer-owned stores have a long history (dating from the early 20th century when factories often had a retail outlet on site); however, their importance in modern retail markets is relatively recent.

Outlet stores originally served the role of allowing manufacturers to liquidate excess inventories of certain product lines as well as allowing cut-rate sale of seconds (these are items that have small visual defects that prevent their being sold in primary retailers). These roles remain important; however, outlet stores are now observed to offer complete lines of merchandise and their stocking procedures appear to “mimic” those of traditional retailers.³ It certainly seems as if more than excess stock liquidation is going on at outlet stores today.

One clue to identifying the role that outlet stores might be playing obtains by examining those categories where outlet store retailing is prevalent

and those where it is rare.⁴ For example, we observe strong activity in outlet store retailing amongst mid-range apparel manufacturers such as Brooks Bros. and Ralph Lauren. On the other hand, higher-range manufacturers such as Ermenegildo Zegna and Armani have significantly less (if any) activity in outlet malls. A similar pattern is observed amongst the manufacturers of women’s clothing. One possible explanation is that the firms that open outlet stores have less skill at forecasting and meeting demand (the outlet mall thus serves as a safety valve for excess stock). However, there is no particular reason why Ermenegildo Zegna and Armani should be any better at forecasting than Brooks Bros. or Ralph Lauren. In addition, as previously mentioned, it does not appear that the main role of the Brooks Bros. and Ralph Lauren outlets is to liquidate excess stock.

It is our belief that the explanation for the presence (or absence) of outlet stores in a market lies in the degree and nature of consumer heterogeneity in the markets served by competing firms. In particular, we show that high levels of consumer heterogeneity create a need for firms to discriminate between different types of consumers. However, because the manufacturers are operating in a competitive context, the net effect of this discrimination can be positive or negative. Our objective is to identify and explain the specific conditions that lead to the profitability of dual distribution through outlet stores.

In particular, following the extant literature (Iyer, 1998; Winter, 1993), consumers are observed to exhibit heterogeneity along two dimensions: the first of which is price sensitivity (the degree to which consumers are different based on their sensitivity to price) and the second of which is the degree to which consumers are different based on their cost of time (some consumers have a very high cost of time and others have plenty of time to shop, for example). While these two dimensions are invariably negatively correlated (people who have a high cost of time tend to be less price-sensitive), the relative importance of these two dimensions varies across markets.

¹ In the 1990s manufacturers’ outlets were the fastest growing segment in U.S. retailing with growth of more than 100% over the 1990–1997 period. Background on outlets is available from Consumer Reports (1998), Ward (1992), Vinocur (1994), Stovall (1995), Beddingfield (1998) and the Prime Retail website. The Prime Retail website also notes that the average driving time to outlet stores is 60 min with malls located between 60 and 80 miles from major urban areas (McGovern, 1993). We focus on outlet stores owned and operated by manufacturers. These account for an average of 73% of all apparel outlet stores in the Chicago area.

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³ Surveys of Chicago-area outlet stores demonstrate that they offer a selection of merchandise that is comparable to primary retailers. In addition, the design and shelving of the outlet stores is such that most items are stocked regularly and re-ordered depending on sales velocity. Interestingly, industry research shows that irregular and damaged merchandise accounts for less than 15% of all sales and the majority of merchandise is first-quality and in-season (Prime Retail Website, 1998).

⁴ Our interest lies in sub-categories of the apparel category (mid-price designer clothing, haute-couture designer clothing, designer sportswear, etc.) which for the purposes of presentation, we treat as different categories.

Outlet malls allow manufacturers to serve consumers through segmented outlets. Consumers who are price-sensitive and have a low cost of time shop at outlet stores. Consumers who have a high cost of time and are less price-sensitive shop at full service high priced primary retailers. The dual strategy effectively segments these two types of consumers because consumers with a high cost of time are unwilling to take the time to make a trip to the outlet mall (where they will find lower priced merchandise, albeit in stores that provide significantly less service than primary retailers).

However, effectively segmenting different consumer types does not necessarily guarantee higher profits in a competitive market. In markets where service is an important element of the “package” that the consumer buys, manufacturers effectively compete across two dimensions (service and price). Because primary retailers provide service to their shoppers, the wholesale price set by manufacturers has a significant effect on the service levels they choose. Naturally, the wholesale price also affects the retail price that is ultimately charged.

Without outlet stores, the wholesale price balances two effects. The first is the downward pressure placed on price levels by consumers who are price-sensitive. The second is the downward pressure these consumers also place on service levels (price-sensitive consumers do not place nearly as high a value on service as those customers who have a high cost of time and are less sensitive to price).

With outlet stores, there is upward pressure on price in primary retail markets due to the fact that the price-sensitive consumers are now served at the outlet stores. However, the primary market also becomes more sensitive to service since the price-sensitive consumers who did not value service no longer shop in the primary market. The shoppers who remain in the primary market are highly service-sensitive. This increases the level of service competition amongst retailers (who bear service costs) in the primary market. These higher levels of service are costly, and depending on the intensity of this effect, manufacturers may have to reduce wholesale prices below the pre-outlet store price level. In sum, when consumers with a high cost of time are highly sensitive to the level of service provided in the primary market, manufacturers may find that profits

are higher when distribution is restricted to primary retailers. Without outlet stores, price-sensitive consumers place downward pressure on pricing in the primary market (leading to reduced profits), but they also attenuate the degree of “service competition” between primary retailers (leading to higher profits). In the analysis that follows, we detail the conditions and mechanism by which dual distribution with outlet malls yields higher (lower) profits to manufacturers. First, however, we provide a brief summary of literature that is related to our topic of study.

2. Literature review

When customers are heterogenous in terms of the value they place on retail service, multiple channels can be effective for meeting customer needs (Bucklin, 1966; Kotler, 2003). The empirical literature considers issues that manufacturers face when multiple channels are used to reach customers. This research recognizes the use and importance of differentiated (or heterogeneous) channels, yet it is almost exclusively focused on channels that are homogenous.⁵

Several analytical articles consider the use of multiple channels to reach customers. Ingene and Parry (1995a,b) consider wholesale pricing decisions in the context of competing retailers who have a degree of market power. However, retailers in this model simply mark up product and do not add service. In contrast, competing retailers in Iyer’s model (1998) make strategic investments in service that affect the benefits obtained by customers. A key insight of this paper is that a manufacturer can optimize its profitability by using a menu of contracts (which are offered to retailers *ex ante*) to induce retail differentiation. Our work differs from these models in that we focus on competitive manufacturers who have the option of operating an additional low-service channel themselves.

Similar to our work, Balasubramanian (1998) considers a model in which consumers obtain products through a regular retail channel and an

⁵ Considerations in this literature include the intensity of distribution (Frazier & Lassar, 1996), territory selectivity (Fein & Anderson, 1997) and governance (Heide, 1994).

alternate channel (a direct electronic channel). However, this work takes channel structure as given. It does not consider the relative advantage of having a dual as opposed to a single channel to serve the market. Bell, Wang, and Padmanabhan (2002) explore a rationale for dual channels where a manufacturer distributes through a wholly owned retail store as well as through independent retailers located in the same mall. The rationale for this structure follows from the ability of the manufacturer to influence the prices and service levels chosen by independent retailers through the wholly owned retail outlet. In contrast, our model considers the role of a wholly owned but geographically distant outlet store as a second channel. Moreover, this question is considered in a context where there is significant competition between manufacturers. In the following section, we present a model that allows us to evaluate the characteristics and profitability of two alternate distribution structures.

3. The model

3.1. Overview

The model consists of two manufacturers who compete in a spatial market where consumers are differentiated in their manufacturer preference, their sensitivity to price and their sensitivity to service. Several market structures are possible. In one, manufacturers only distribute through exclusive retailers in the primary market. In the second market structure, manufacturers distribute through “low service” outlet stores as well as through the exclusive retailers in the primary market. A third possible market structure is one where one manufacturer distributes through a primary retailer and the competitor distributes through both a primary retailer and an outlet store. We find that the asymmetric structure can be stable when the levels of heterogeneity in price and service sensitivity between segments are similar. However, the focus of our analysis is understanding the relative effectiveness of segmentation via distribution strategies when cross-segment heterogeneity in service sensitivity is significantly different from (either more or less intense than) cross-segment heterogeneity in price sensitivity. These are situations where a symmetric distribution strategy is the

equilibrium. As a result, we restrict our analysis to the symmetric distribution structures; however, we revisit this issue in Section 5.

With both symmetric distribution structures, the game has several stages. In the first stage, the manufacturers set wholesale prices. In the second stage, the exclusive retailers set service levels, and in the third stage, the retailers set prices (as do the manufacturers when they have opened outlet stores). In the final stage, consumers make decisions about which products (if any) to buy. First, we describe the market and we then explain the mechanism by which outlet malls can segment consumers.

3.2. The market

The market consists of consumers who are uniformly distributed in their preferences for the manufacturers’ products along a unitary Hotelling (1929) market. Manufacturers deliver products to this market through exclusive retailers or through outlet stores that are located a significant distance from the primary market. The distance to the outlet mall is relatively much more significant for consumers (who live in the primary retail area) than is the distance between primary retailers or the distance between the manufacturers’ outlets at the outlet mall. We assume that the outlet mall is equidistant from all consumers in the primary market.⁶ We denote the firm at the left end of the market as Manufacturer 1 and at the right end as Manufacturer 2. The distance between the manufacturers in this model represents the degree to which the products of the two manufacturers are perceived to be different along an attribute. The products offered by the two manufacturers may be similar physically but branding creates the perceptions that the brands are different. Clearly brands such as Ralph Lauren or Brooks Brothers expend considerable time and resources creating unique images for their

⁶ Clearly, some consumers will be closer to the outlet mall than others but the basic objective here is to reflect the idea that the drive to the outlet mall is a significant cost for a person who lives in the primary market. Most outlet shoppers come from the primary market. For example, metropolitan Chicago’s population (over 5 million people) is almost 40 times greater than that of Kenosha County (128,000), the primary locale for outlet mall activity in the Chicago area.

apparel. To simplify our analysis, the perceived differentiation between the manufacturers is normalized to one.

We assume that there are two types of consumers ($j=h,l$) in this market and both are uniformly distributed along the linear market. The two segments differ fundamentally in their cost of time as discussed in the previous section. One segment, the “Highs,” has a high cost of time, while the other segment, the “Lows,” has a lower time cost. We assume that the total number of consumers in the market is one with a fraction λ of consumers being “Highs,” and a fraction $1-\lambda$ being “Lows.” Because of their higher time cost, Highs consider the inconvenience of a long drive to the outlet mall to be much higher. They also value service more than Lows (service produces value by reducing the time cost of shopping). In addition, consistent with empirical evidence, Highs are less price-sensitive and are thus willing to pay more for the brand that best meets their needs.

The manufacturer produces a single product at a constant marginal cost of production, c . Each consumer of type j ($j=h,l$) is identified by an ideal point along the attribute that corresponds to her preferred brand, buys no more than one unit of product and places a value v_j on her ideal product. However, consumers cannot obtain their ideal product. A consumer located a distance x from Manufacturer i ($i=1,2$) obtains a surplus from buying at Manufacturer i related to her location and to the pricing and level of service provided by Manufacturer i . We summarize this as:

$$CS_{j1} = v_j + \theta_j s_1 - x t_j - p_1 \quad (1)$$

$$CS_{j2} = v_j + \theta_j s_2 - (1-x) t_j - p_2 \quad (2)$$

CS_{ji} is the surplus realized by a j type consumer were she to buy Manufacturer i 's product ($i=1,2$), θ_j is the marginal valuation of service by type j consumers, s_i is the level of service provided at the exclusive retailer of Manufacturer i 's products, t_j is the travel cost incurred by a type j consumer due to not consuming a product that matches her taste precisely and p_i is the retail price charged for Manufacturer i 's product.

Consistent with our earlier discussion, we assume that $t_h > t_l$ and $\theta_h > \theta_l$, recognizing the lower price

sensitivity of Highs and their higher valuation of service.⁷ To simplify further without loss of generality, we normalize $\theta_l=0$ and assume that $\theta_h > 0$. In this way, the size of θ_h reflects the degree of service heterogeneity in the market.

If a consumer located at x were to travel to the outlet mall to buy Manufacturer i 's product, her surplus is given by either Eq. (3) or (4):

$$CS_{j1,\text{outlet}} = v_j - x t_j - p_{1,\text{outlet}} - TC_j \quad (3)$$

$$CS_{j2,\text{outlet}} = v_j - (1-x) t_j - p_{2,\text{outlet}} - TC_j \quad (4)$$

where $p_{i,\text{outlet}}$ is the price for Manufacturer i 's product at the outlet store and TC_j is the cost incurred by a type j consumer to travel to the outlet store. Note that the manufacturers' products are differentiated even at the outlet mall. The main difference between the primary retailers and the outlet stores is the complete absence of service. In addition, we assume that $TC_h > TC_l$, recognizing the distaste of Highs for the long drive that is necessary to shop at outlet stores. This assumption is critical because it allows manufacturers to efficiently segment the market between Highs and Lows. In Section 3.5, we discuss in detail the necessary conditions for efficient segmentation.

3.3. Decisions of consumers

Consumers will choose the manufacturer and purchase location that offers the highest surplus and we assume that the surplus offered by the product is sufficient for all consumers to buy. When manufacturers have not opened outlet stores, this involves comparing the surplus available by buying either of the manufacturers' products in the primary retail market. In the channel structure where manufacturers have opened outlet stores, consumers compare the surplus from all four outlets.

When consumers purchase in the primary retail market, the demand for each manufacturer is derived by identifying the consumer in each segment who is indifferent between buying the products of both

⁷ To ensure that a High type obtains at least as much benefit from consuming as a low type, we assume that $v_h - t_h > v_l - t_l$. However, v_h and v_l are assumed to be high enough such that all consumers buy.

manufacturers. Given prices and service levels set by the retailer for each manufacturer, all consumers to the left of the indifferent consumer will shop at Retailer 1 and all consumers to the right of the indifferent consumer will shop at Retailer 2. More specifically, the indifferent consumer in segment j is located at a point x_j^* in the market, where the surplus by buying either product is equal:

$$x_j^* = \frac{t_j + \theta_j(s_1 - s_2) - p_1 + p_2}{2t_j} \quad (5)$$

where $\theta_l=0$ and $\theta_h>0$ (we abbreviate θ_h as θ for the rest of our discussion). In the absence of outlet mall distribution, demand from the Low segment is $(1-\lambda)x_1^*$ (at Retailer 1) and $(1-\lambda)(1-x_1^*)$ (at Retailer 2) and from the High segment is λx_h^* (Retailer 1) and $\lambda(1-x_h^*)$ (Retailer 2).

When the manufacturers open outlet stores, we assume that all Lows shop at the outlet mall, leaving only Highs in the primary market (later we show that as long as the outlet mall is sufficiently far from the primary market but not too far, Lows will travel to the outlet mall and Highs will not). Here the indifferent consumer in each segment is as follows:

$$x_h^* = \frac{t_h + \theta(s_1 - s_2) - p_1 + p_2}{2t_h} \quad \text{and} \\ x_{1,\text{outlet}}^* = \frac{t_1 - p_{1,\text{outlet}} + p_{2,\text{outlet}}}{2t_1} \quad (6)$$

Once a Low has made the trip to the outlet mall, she makes a choice between the manufacturers in the same way she would have in the primary market. Of course, she makes the decision to go to the outlet mall knowing full well that her realized surplus (including the travel cost TC_i) will exceed what she would have realized by shopping the primary market. We now consider the decisions taken by retailers in the two market structures.

3.4. Retailer decisions

The primary retailers are independently owned, and we assume that they set service levels and then retail prices to maximize profits. Retailer i pays a wholesale price of w_i ($i=1,2$) per unit to Manufacturer i and resells at price p_i . The cost of retail service provision is assumed quadratic.

In the absence of outlet mall distribution, primary retailers serve both Highs and Lows, and the profit for each retailer is therefore:

$$\pi_{r1} = (p_1 - w_1)(\lambda x_h + (1 - \lambda)x_1) - s_1^2 \quad (7)$$

$$\pi_{r2} = (p_2 - w_2)(\lambda(1 - x_h) + (1 - \lambda)(1 - x_1)) - s_2^2 \quad (8)$$

where x_j^* is as defined in Eq. (5). When both of the manufacturers open outlet stores, primary retailer profit is based only on sales to Highs, and is given by:

$$\pi_{r1} = (p_1 - w_1)\lambda x_h - s_1^2 \quad (9)$$

$$\pi_{r2} = (p_2 - w_2)\lambda(1 - x_h) - s_2^2 \quad (10)$$

Manufacturers also make simultaneous decisions about pricing in their outlet stores. We assume that manufacturers simply acquire stock at marginal cost for their outlet stores and this implies that the objective functions for both manufacturers at this stage are:

$$\pi_{1,\text{outlet}} = (p_{1,\text{outlet}} - c)(1 - \lambda)x_{1,\text{outlet}}^* \quad (11)$$

$$\pi_{2,\text{outlet}} = (p_{2,\text{outlet}} - c)(1 - \lambda)(1 - x_{1,\text{outlet}}^*) \quad (12)$$

When manufacturers have opened outlet stores, the values of x_j^* are given by Eq. (6). We now consider the decisions taken by the manufacturers that precede decisions in the retail market.

3.5. Manufacturers

Manufacturers are symmetric, produce product at a unit marginal cost of c , and choose the wholesale price at which they will supply product to the primary retailers. Similar to McGuire and Staelin (1983), manufacturers are Stackelberg leaders relative to the primary retailers. When manufacturers operate outlet stores, their cost for supplying product to the outlet store is marginal cost.

When manufacturers do not have outlet stores, Highs and Lows shop in the primary market and the profits earned by the manufacturers depend on the fraction of each segment captured by each primary retailer:

$$\pi_{m1} = (w_1 - c)(\lambda x_h + (1 - \lambda)x_1) \quad (13)$$

$$\pi_{m2} = (w_2 - c)(\lambda(1 - x_h) + (1 - \lambda)(1 - x_1)) \quad (14)$$

Conversely, when manufacturers distribute through outlet malls, only Highs are left in the primary market, so demand in the primary market depends on the

fraction of the High segment captured by each of the primary retailers. Note that branding is as important at the outlet mall (for the Lows who shop there) as it is in the primary market: the key difference between the outlet stores and the primary market is that no service is provided. Manufacturers set prices at the outlet stores according to Eqs. (11) and (12). Because the outlet mall attracts all Lows, manufacturers realize a benefit in the primary market due to a reduction in the intensity of price competition; however, the removal of Lows also affects the strategic incentives to provide service. This in turn affects the wholesale price that manufacturers choose. With a dual distribution structure, the objective functions for each manufacturer are written as follows:

$$\pi_{m1} = (w_1 - c)\lambda x_h + \pi_{1,outlet} \tag{15}$$

$$\pi_{m2} = (w_2 - c)\lambda(1 - x_h) + \pi_{2,outlet} \tag{16}$$

The focus of our analysis is to identify manufacturer profits under these two alternate market structures.

3.6. Extensive form of the game

We assume that consumers maximize utility and retailers and manufacturers maximize profit. Product demand is common knowledge and certain, given price and service levels. The assumption is that no service is provided to consumers at outlet malls and a consumer only buys from a firm if she obtains a positive benefit by doing so and it is the option that provides her with the maximum benefit.

When manufacturers use single channel distribution through primary retailers

1. Manufacturers set wholesale prices simultaneously.
2. Primary retailers choose service levels, given the wholesale prices set in Step 1.
3. Primary retailers choose retail prices given the service levels chosen in Step 2 and wholesale prices of Step 1.
4. After service levels and prices have been set, the market opens and consumers decide where to shop.

When manufacturers use dual distribution

1. Manufacturers set wholesale prices simultaneously (knowing that they will also distribute through an outlet store).

2. Primary retailers choose service levels given the wholesale prices set in Step 1 and also recognizing the expected effect of outlet mall sales.
3. Primary retailers set retail prices and the manufacturers set outlet store retail prices simultaneously given the service levels chosen in Step 2 (by the primary retailers) and wholesale prices of Step 1.
4. After service levels and prices have been set (at the two primary retailers and at the outlet stores), the market opens and consumers decide where to shop.

The model is solved using the concept of subgame perfect Nash equilibrium (SPNE).

3.7. A clean segmentation of Highs and Lows with dual distribution

Outlet malls are located such that Lows find it advantageous to “defect” to the alternate market, but sufficiently far away so that Highs remain in the primary market and buy there.

For a High located at x , defecting to the outlet store requires that $CS_{h,x} < CS_{h,outlet}$. Because the market is symmetric, the wholesale prices, the corresponding retail prices and service levels chosen by primary retailers and the prices at outlet stores should be symmetric in equilibrium. Later we show that this is in fact the case. Consider, for example, a value of x less than 1/2 so that the consumer’s preferred product is made by Manufacturer 1 (symmetric expressions generate identical constraints for Manufacturer 2). Mathematically, this High remains in the primary market rather than shopping at the outlet mall if and only if:

$$\begin{aligned} v_h + \theta s_1 - x t_h - p_1 > v_h - x t_h - p_{1,outlet} - TC_h \\ \Rightarrow TC_h > p_1 - p_{1,outlet} - \theta s_1 \end{aligned} \tag{17}$$

This implies that a High will continue to shop in the primary market as long her gain is less than the cost TC_h of travelling to the outlet mall. In short, the outlet mall must be distant enough to deter Highs from travelling there.

However, outlet malls must be sufficiently close to the primary market or else Lows will not be willing to

make the trip. Lows find shopping at the outlet mall attractive if and only if:

$$v_1 - xt_1 - p_1 < v_1 - xt_1 - p_{1,outlet} - TC_1$$

$$\Rightarrow TC_1 < p_1 - p_{1,outlet} \tag{18}$$

Note that these constraints can always be satisfied in a context where $TC_h > TC_l$. Even when the difference in the cost of travelling to the outlet mall between Highs and Lows is small, the Lows will be more willing to go to the outlet mall because they do not value the service that is provided in primary retailers.⁸ However, if the outlet mall is located too far from the primary market, then the cost TC_l might be high enough to violate constraint (18). Perhaps that is why outlet malls are located roughly one hour away from primary markets but not further.

4. Analysis and discussion

In this section, we derive the equilibrium prices, service levels and equilibrium profits for manufacturers both with and without outlet stores. We also consider the question of whether retailers are better or worse off when manufacturers open outlet stores.

4.1. Equilibrium prices and service with and without outlet stores

Wholesale prices, retail prices, retail service levels, the second-order conditions and the profits for both market structures are reported in Table 1. Because of symmetry, the optimal decisions for each manufacturer are identical (to simplify the presentation, $\tau = \lambda t_l + (1 - \lambda)t_h$).

Table 1 shows that service levels and retail prices at primary retailers are higher with outlet stores than without them. This obtains because Lows do not shop in the primary market when manufacturers have

⁸ A second condition required for a clean segmentation of Lows is that primary retailers not have an incentive to cut price to keep Lows in the primary market. Because the marginal cost for retailers is the wholesale price (and not the marginal cost c as it is for the manufacturers' outlets), it is not feasible for primary retailers to do this. We demonstrate this in the technical appendix.

Table 1

Equilibrium prices and service with and without outlet store distribution

Outcome	Single channel	Dual channel ^a
Retail prices	$\frac{4t_h t_l}{\tau} - \frac{\theta^2 t_l^2 \lambda^2}{3\tau^2} + c$	$4t_h - \frac{2\theta^2}{3} + c$
Wholesale prices	$\frac{3t_h t_l}{\tau} - \frac{\theta^2 t_l^2 \lambda^2}{3\tau^2} + c$	$3t_h - \frac{2\theta^2}{3} + c$
Service levels	$\theta t_l \lambda / 6\tau$	$\theta \lambda / 6$
Second-order conditions	$\theta < \frac{3}{\lambda} \left(\frac{t_h \tau}{t_l} \right)^{\frac{1}{2}}$	$\theta < 3 \left(\frac{t_h}{\lambda} \right)^{\frac{1}{2}}$
Manufacturer profit	$\frac{3t_h t_l}{2\tau} - \frac{\theta^2 t_l^2 \lambda^2}{6\tau^2}$	$\frac{3\lambda t_h}{2} - \frac{\lambda^2 \theta^2}{6} + (1 - \lambda) \frac{t_l}{2}$
Retailer profit	$\frac{t_h t_l}{2\tau} - \frac{\theta^2 t_l^2 \lambda^2}{36\tau^2}$	$\frac{\lambda t_h}{2} - \frac{\lambda^2 \theta^2}{36}$

^a Dual channel implies that both manufacturers distribute through outlet stores as well as in the primary market.

opened outlet stores.⁹ When both Lows and Highs are served in the primary retail market, retail pricing and service levels strike a balance between their needs. Since Lows do not value service and have a lower cost of brand-switching, downward pressure on both service and retail price levels is exerted by their presence in the primary retail market. With outlet stores, however, only the Highs are served in the primary retail market, and hence service and retail price levels rise. This finding echoes Gatty (1985), who reports on a revised (higher-service) focus taken by primary retailers when they face competition from outlet malls.

When both firms employ dual distribution, only Lows shop at the outlet mall. As a result, competition at the outlet mall is simple price competition between two retailers located at either end of a linear market where consumers have a travel cost of t_l . Straightforward calculations show that the equilibrium price at the outlet mall will be $p_{i,outlet} = t_l + c$. This result leads to the manufacturer and primary retailer profits under each structures also in Table 1.

Despite the fact that outlet stores allow (a) manufacturers to capture the entire margin earned on

⁹ We restrict the analysis to situations where second-order conditions are satisfied under both structures, i.e. $\theta < 3 \left(\frac{t_h}{\lambda} \right)^{\frac{1}{2}}$.

Lows and (b) prices to rise in the primary market, there are conditions where manufacturers are better off serving the entire market through a single channel. This is summarized in Proposition 1.

Proposition 1. *When manufacturers have symmetric distribution channels and $\theta < \theta_1$ where*

$$\theta_1 = \left(3\tau \frac{-3t_h\lambda\tau - t_1\tau + t_1\tau\lambda + 3t_h t_1}{\lambda^2(-\tau^2 + t_1^2)} \right)^{1/2}$$

and τ is as defined in Table 1, manufacturers have a profit incentive to sell through outlet stores as well as through primary retailers.¹⁰

Proposition 1 defines the necessary and sufficient conditions for superior manufacturer profitability with dual channel distribution. Specifically, it establishes that for low values of θ , the dual channel structure is more profitable. That is, the increase in profits created by price increases in the primary market more than makes up for the lower profit made on each Low (there is reduced competition for Lows when they remain in the primary market).¹¹ Further, the proposition underlines an important finding: it is not always optimal to segment the market.¹² Instead, there are conditions under which manufacturers are better off when they serve all consumers through the primary channel alone. This occurs even when the segments are discernibly different in their price and service sensitivities.

An interesting aspect of Proposition 1 is that when Highs place a high value on service ($\theta > \theta_1$), manufacturers are better off with single channel distribution even when t_h is significantly bigger than t_l . One would think that when the difference between t_h and t_l is large, manufacturers should gain by segmenting the market with two channels. They could induce Lows to

shop at outlet stores and thereby benefit from high equilibrium prices for Highs who remain in the primary market. This logic would seem to apply, regardless of the underlying service sensitivity of the Highs.

This intuition is not always right, because retailers in the primary market are prone to over-competition in service. Consider a hypothetical case where retailers could collude in their choice of service levels (but not price).¹³ Were this possible, retailers would set the service levels to zero: this level of service yields the highest profit to retailers (and manufacturers). Because zero service is the optimal collusive choice, it is clear that service levels in a competitive primary market are excessively high. Further, it can be shown that the deviation from the “optimal” collusive service outcome is greater (a) when the market is comprised entirely of Highs (i.e. when Lows are diverted to outlet stores) and (b) when θ , the service sensitivity of Highs, is higher. Thus, when manufacturers utilize dual distribution, primary retailers only sell to Highs and they compete vigorously for them by providing (and paying for) high levels of service. This creates a Prisoners’ Dilemma problem of over-investment in service, which is worse, the more service-sensitive are Highs. Higher service levels eat into channel profit margins and cause the manufacturers to reduce their wholesale prices in equilibrium, reducing manufacturer profits as well.

Thus, it is the balance between price competition and service competition that determines when dual channels with outlet stores are more profitable. One can show that for a given value of θ , outlet store retailing is more likely to be profitable, the greater is the difference in price sensitivity between Highs and Lows (as measured by the ratio of t_h to t_l). Conversely, for a given difference in price sensitivity between segments, outlet store retailing is more likely to be profitable, the smaller is the difference in service sensitivities between segments (i.e. the lower is θ).

¹⁰ θ_1 is positive and real for any value of $t_h > \frac{t_l}{6\tau} (4\lambda + 2 + 2\sqrt{\lambda^2 + 4\lambda + 1})$, i.e. given λ , a minimum difference in the price sensitivities is necessary for the feasibility of outlet mall retailing.

¹¹ In a monopoly situation, Villas-Boas (1998) shows that a key rationale for segmenting a vertically differentiated market is to increase profits on the high valuation segment while still earning positive profits on the low valuation segment. Our model extends this rationale to a competitive context.

¹² Similar to Desai (2001) who considers quality segmentation in a competitive spatial market, there are conditions where it is not optimal to segment a market of high and low valuation consumers.

¹³ We describe a hypothetical situation in which collusive levels of service are chosen by retailers who know that they will compete in prices after the service levels are chosen (the service levels are determined in the same spirit as exercises in defining the “first best pricing” or “first best quality” choices in economic models). The collusive service level for both retailers is zero because all benefits created by service are lost through subsequent price competition.

The attractiveness of a distribution structure that includes outlet stores, versus a structure that does not, revolves around the benefit that outlet stores provide (a reduction in price competition in the primary market) versus the cost of primary retailers over-competing in service provision.

This discussion highlights the incentives of manufacturers to use outlet stores as part of their channel strategy. What about the primary retailers? We next discuss whether they benefit or not from outlet store retailing.

4.2. Retailers and outlet mall distribution: in sync or in conflict?

It is logical to suspect that primary retailers would be hurt by outlet stores that offer the same merchandise as primary outlets and attract the Lows who would otherwise shop in the primary channel. We investigate this idea by examining when the incentives for dual distribution for manufacturers and primary retailers are aligned and when they are not.

It is straightforward to compare the profits earned by primary retailers under the two distribution structures and this leads to Proposition 2.

Proposition 2. *When $\theta < \theta_2$ and*

$$\theta_2 = \frac{3\sqrt{2}}{\lambda} \left(\frac{t_h(1-\lambda)[t_h\lambda - t_l(1+\lambda)]}{\tau^2 - t_l^2} \right)^{\frac{1}{2}},$$

primary retailers realize superior profit in a distribution structure where manufacturers operate outlet stores compared to a structure where product is only sold through primary retailers.

We now compare the boundary of Proposition 1 and the boundary of Proposition 2 to understand the degree of alignment or misalignment between the incentives that manufacturers and primary retailers have for dual distribution. This is an important question because outlet retailing is primarily a strategy for manufacturers and not for retailers; manufacturers can stock outlet stores at marginal cost but retailers must pay the wholesale price (which is higher). Because manufacturers can operate outlet stores unilaterally (without the approval of their retailing partner), there is potential for channel conflict if outlet retailing leads to significantly lower profits for primary retailers.

Proposition 3 summarizes the degree of alignment and misalignment between the profit of manufacturers and primary retailers with regard to dual distribution.

Proposition 3. *When $\frac{t_h}{t_l} \in \left(1, \frac{t_h^*}{t_l}\right)$ and*

$$\frac{t_h^*}{t_l} = -\frac{1}{6\lambda} \left(\lambda\sqrt{2} - 2\lambda - \sqrt{2} - 4 - \sqrt{18\lambda^2 + 8\lambda^2\sqrt{2} + 12\lambda - 4\lambda\sqrt{2} + 18 + 8\sqrt{2}} \right):$$

1. $\theta_2 < \theta_1$.
2. *The profits of manufacturers and primary retailers are higher with dual distribution versus single channel distribution when $\theta < \theta_2$ and lower with dual distribution when $\theta > \theta_1$.*
3. *The profits of manufacturers are higher and primary retailers are lower with dual distribution when $\theta \in (\theta_2, \theta_1)$.*

When $\frac{t_h}{t_l} > \frac{t_h^}{t_l}$*

4. $\theta_2 > \theta_1$.
5. *The profits of manufacturers and primary retailers are higher with dual distribution versus single channel distribution when $\theta < \theta_1$ and lower with dual distribution when $\theta > \theta_2$.*
6. *The profits of manufacturers are lower and primary retailers are higher with dual distribution when $\theta \in (\theta_1, \theta_2)$.*

The two boundaries for Propositions 1 and 2 intersect at $\frac{t_h^*}{t_l}$. Proposition 3 shows that when heterogeneity in price sensitivity is low, i.e. $\frac{t_h}{t_l} < \frac{t_h^*}{t_l}$, there are three potential zones: two where the incentives of manufacturers and primary retailers are *perfectly aligned* and one where manufacturers are more profitable with dual distribution and retailers are less profitable. Conversely, when $\frac{t_h}{t_l} > \frac{t_h^*}{t_l}$, there are also three potential zones: two where the incentives of manufacturers and primary retailers are *perfectly aligned* and one where retailers are more profitable than manufacturers with dual distribution.

While the above analysis does demonstrate the potential for misalignment of incentives, it shows that when service sensitivity of the High segment is high, both manufacturers and primary retailers benefit from

single channel distribution. But when the service sensitivity of Highs is low, both manufacturers and primary retailers benefit from dual distribution with outlet stores. It is only in an intermediate range of service sensitivity that misalignment can occur.

Interestingly, when $\frac{h_h}{q_l} > \frac{h_h^*}{q_l^*}$, retailers have strictly greater incentive than manufacturers for dual distribution (even though the retailers lose all sales to Lows). Of course, these are conditions where the difference in the price sensitivity of Highs and Lows is substantial. The reason why primary retailers gain so much from outlet mall retailing when heterogeneity in price sensitivity is high relates to the proximity of retailers to customers. Primary retailers are essentially “on the front line” and their profits are strongly related to the transportation costs of customers in the market. Manufacturers on the other hand are more insulated from the price competition due to price shielding effect that is observed in Stackelberg vertical structures (Coughlan, 1985; McGuire & Staelin, 1983). Of course, outlet mall retailing is a manufacturer strategy and not a retailer strategy. In other words, when retailers would benefit from the addition of outlet stores and manufacturers would not, retailers cannot open outlet stores on their own: the retailer’s acquisition cost for product is the wholesale cost (in contrast, a manufacturer supplies its outlet stores at marginal cost).

In contrast, when $\frac{h_h}{q_l} < \frac{h_h^*}{q_l^*}$, manufacturers have a strictly greater incentive than retailers for dual distribution. As a result, there is a region where primary retailers “lose” when dual distribution is employed. When the level of heterogeneity in price sensitivity is low and the fraction of Lows in the market is relatively high, primary retailers suffer losses due to outlet stores. When manufacturers nevertheless operate outlet stores, primary retailers lose all demand from the Low segment. Under these circumstances, the direct saving from reduced price competition for primary retailers (by removing Lows from the market) does not make up for the lost demand. In these conditions, manufacturers are more profitable with outlet distribution and primary retailers are less profitable. Such conditions are more probable, the higher is the fraction of Lows in the market. This is consistent with statements in the popular press about “lost business” in traditional primary retail areas due to the growth of outlet stores (McGovern, 1993; Okell, 1987). An important empirical question is

whether the adverse effect of outlet stores on primary retailers has been highest in markets with low price heterogeneity but with a significant fraction of the market at the more sensitive end of the range.

In summary, Proposition 3 explains why the growth of outlet malls has received little opposition from primary retailers. Given that cross-segment heterogeneity in price sensitivity is an endemic feature of retail apparel markets, primary retailers gain as much from the existence of outlet store retailing as do manufacturers. This channel structure, when optimal, is often a win-win situation for both channel members.

Before concluding, we devote the following section to a brief discussion of the evolution of market structure and how the two alternative distribution structures might arise.

5. The evolution of dual distribution

This paper presents an analysis of the relative profitability of two potential market structures for branded apparel manufacturers that have the option of distributing through outlet malls and primary retailers. A key question is how these different structures might arise and how this issue might be modelled. One possibility is for manufacturers to make simultaneous decisions to distribute through both channels or one of the two channels. Alternatively, the manufacturers might make sequential decisions to be active in each of the two channels. Because of numerous permutations that are possible, we have chosen not to present an analysis of this issue. However, we have analysed two different forms of the distribution game under the following assumptions: (1) manufacturers are obliged to distribute through primary retailers and (2) manufacturers make a choice of whether or not to add outlets to the distribution mix. The first form assumes that manufacturers make the decision to open outlet stores simultaneously and the second form assumes that manufacturers make these decisions sequentially. Both forms of this game require evaluating equilibrium outcomes where one firm chooses dual distribution and the other does not (asymmetric distribution structures). The asymmetric distribution structure leads to explicit but complex reduced form profit expressions that need to be simulated to

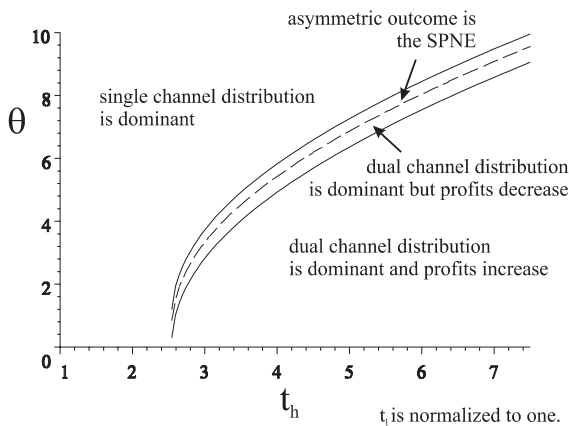


Fig. 1. Distribution structure when firms make sequential decisions about opening outlet stores (as a second channel).

determine the equilibrium outcome. The findings for a market that is equally split between Highs and Lows is shown in Fig. 1.¹⁴

The basic findings from numerical analysis of this game are (1) when service sensitivity is high relative to price sensitivity, single channel distribution (through primary retailers) is a dominant strategy, (2) when service sensitivity is low relative to price sensitivity, dual channel distribution is a dominant strategy, (3) above the boundary of Proposition 1, there is a “Prisoners Dilemma” Zone where both manufacturers open outlet stores even though it makes them strictly worse off and, (4) above the “Prisoners Dilemma” Zone, a slice of the parameter space is characterized by asymmetric outcomes where one firm operates with two channels and the other operates through primary retailers alone. The asymmetric outcome is stable there because (a) the firm with dual distribution gains by having a monopoly-like situation at the outlet mall and (b) the other firm gains due to reduced price competition in primary market.

The fundamental insight of Section 4 is that the equilibrium retail channel structure depends importantly on the extent of cross-segment heterogeneity in service sensitivity relative to that in price sensitivity. Specifically, when service sensitivity differences

between segments are high relative to price sensitivity differences, markets are likely to be characterized by single channel distribution through primary retailers. In contrast, when price sensitivity differences are high relative to service sensitivity differences between segments, a structure where manufacturers open outlet stores and continue to distribute through primary retailers is superior.

5.1. Numerical example

The following numerical example shows how the relative incentive for outlet store distribution changes as a function of the degree of service heterogeneity relative to the degree of price heterogeneity. We consider a situation where the market has an equal proportion of Highs and Lows ($\lambda=1/2$) and a high degree of price heterogeneity ($t_h=4$ and $t_l=1$). We manipulate service sensitivity holding t_h and t_l constant. Consistent with our earlier discussion about travel costs and reservation values, we assume that $TC_l=4$, $TC_h=15$, $v_l=7$ and $v_h=15$. The travel costs for Highs are such that they will not shop at the outlet mall. The travel costs for Lows to travel are significant but low enough such that Lows will shop there if the prices are sufficiently attractive. The marginal cost is normalized to zero. First we consider the case where the service sensitivity of Highs is relatively low (Table 2). When only one manufacturer has an outlet store (say Manufacturer 1), she sets price at the outlet store such that the Low consumer who is least favourably inclined to Manufacturer 1’s product will buy at the outlet mall. Clearly, price is higher at the outlet mall when only one manufacturer opens an outlet store. Simple calculations show that the highest price at the outlet store under asymmetry is $p_{1,\text{outlet}}=v_l-TC_l-t_l$.

Table 2
Numerical example ($\theta=1$)

Manufacturer	No outlets	With outlets	Asymmetric ^a outcomes
π_{m1}	359/150=2.3933	77/24=3.2083	95/24=3.9583
π_{m2}	359/150=2.3933	77/24=3.2083	71/24=2.9583
p_{outlet}	N/A	1	2

^a Firm 1 has two channels.

¹⁴ The form of the findings are unaffected by the level of λ (an increase in λ displaces the boundaries shown in Fig. 1 downwards).

Table 3
Numerical example ($\theta=7$)

Manufacturer outcomes	No outlets	With outlets	Asymmetric ^a
π_{m1}	311/150=2.0733	29/24=1.2083	47/24=1.9583
π_{m2}	311/150=2.0733	29/24=1.2083	10/27=0.95833
p_{outlet}	N/A	1	2

^a Firm 1 has two channels.

The low sensitivity case shows that the manufacturers gain significantly from dual distribution when the heterogeneity in price sensitivity is high relative to the heterogeneity in service sensitivity. Without outlet stores, Lows shop in the primary market and exacerbate the level of price competition substantially. The example also shows that the asymmetric outcome is not an equilibrium. Both firms have incentive to unilaterally open an outlet store. (In a 2×2 normal form game, opening the outlet store would be a dominant strategy.) Distributing solely in the primary market is a sub-optimal response to a competitor's choice to open an outlet store because the single channel manufacturer loses all profits on Lows. The best response to the competitor's opening of an outlet store is to reciprocate.

Second, we consider the case where the service sensitivity of Highs is high (Table 3).¹⁵ When service sensitivity is high, manufacturers are much better off without outlet malls. In addition, the asymmetric outcome is not an equilibrium. Neither firm has an incentive to unilaterally open an outlet store (profits are lower even if a manufacturer obtains the entire Low segment and acts like a monopolist at the outlet mall).¹⁶

The numerical example also demonstrates conditions that make the asymmetric outcome unstable. In conditions of high heterogeneity in terms of price sensitivity (Table 2), either manufacturer has a unilateral incentive to open an outlet store to benefit from (a) higher prices in the primary market and (b) a monopoly position at the outlet mall. However, when

¹⁵ The second-order conditions are satisfied for all $\theta < 3\sqrt{6} \approx 7.35$.

¹⁶ In a game where firms make sequential decisions about opening outlet stores (perhaps the most reasonable game structure), there is one Nash equilibrium (no outlet, no outlet).

either manufacturer adds an outlet store to its distribution mix, the payoff structure is such that the best response of the second manufacturer is to open an outlet store too. Even under conditions of high heterogeneity in terms of service sensitivity (Table 3), the best response of manufacturer to a competitor who has opened an outlet store is also to open an outlet store.¹⁷

6. Extension: what if service levels are set before wholesale prices?

In the base model, manufacturers set wholesale prices before primary retailers choose service levels and prices. This reflects the Stackelberg character of many retail markets where the manufacturers are significantly more powerful than retailers. In addition, our model considers a market where retailers are exclusive to each manufacturer. The contract is thus more than a simple quotation of wholesale prices. In return for a commitment to wholesale prices, the retailer effectively agrees not to sell the competitor's products. The model thus focuses on a standard wholesale pricing contract, with exclusivity, in the channel.¹⁸ However, some aspects of service (labour training and in-store infrastructure) are long-term in nature. Thus, there may be situations where it is reasonable to assume that the retailers' service decisions are taken prior to wholesale pricing decisions. We do not restate the problem here but note that the objective functions for the manufacturers and retailers are identical. The only difference is that the retailer becomes the Stackelberg leader in the revised game by setting service levels before the other decisions are taken (the complete solution is provided in the appendix). The equilibrium values are shown in Table 4 (as before $\tau = \lambda t_1 + (1 - \lambda)t_h$).

¹⁷ Of course in Table 3, neither manufacturer has an incentive to unilaterally open an outlet store. This explains why single channel distribution is the unique equilibrium. When the parameters are such that a clean split of Lows to the outlet store does not happen, the asymmetric outcome may be an equilibrium (in fact, it is a pre-requisite for the asymmetric outcome to be stable).

¹⁸ Investigating the effects of using non-linear prices and/or non-exclusivity would be interesting avenues for future research, but are beyond the scope of this paper.

Table 4
Equilibrium outcomes when the retailer is a Stackelberg leader

Outcome	Single channel	Dual channel ^a
Retail prices	$(\lambda t_1 c + 4t_h t_1 + t_h c - \lambda t_1 c) / \tau$	$4t_h + c$
Wholesale prices	$(\lambda t_1 c + t_h c - \lambda t_1 c + 3t_h t_1) / \tau$	$3t_h + c$
Service levels	$\frac{1}{18} \lambda t_1 \frac{\theta}{\tau}$	$\frac{1}{18} \lambda \theta$
Manufacturer profit	$\frac{3}{2} t_h \frac{\lambda}{\tau}$	$\frac{3}{2} \lambda t_h + \frac{1}{2} t_1 - \frac{1}{2} t_1 \lambda$
Retailer profit	$\frac{1}{324} t_1 \frac{162\lambda t_h t_h - 162\lambda t_h^2 + 162t_h^2 - \lambda^2 t_1 \theta^2}{\tau^2}$	$\frac{1}{2} \lambda t_h - \frac{1}{324} \lambda^2 \theta^2$

^a Dual channel implies that both manufacturers distribute through outlet stores as well as in the primary market.

Comparing the single and dual channel manufacturer profits in Table 4 leads to Proposition 4.

Proposition 4. *When service levels by retailers are set first, manufacturers earn more profit in a symmetric retail structure with outlet stores than in a symmetric structure without outlet stores when*

$$t_h > \frac{1}{6\lambda} \left(4\lambda + 2 + 2\sqrt{(\lambda^2 + 4\lambda + 1)} \right) t_1.$$

The profitability of the manufacturer under either distribution structure does not depend on the sensitivity of the market to service.

Proposition 4 shows that when services are set first (and are strategic), they act like a sunk cost for the retailer. In fact, with symmetric distribution structures, the manufacturer's wholesale prices and profits are unaffected by the level of service offered by the retailer. Basically, the attractiveness of outlet stores for the manufacturer is driven only by the heterogeneity of price sensitivity between Highs and Lows. In contrast, the retailers' profits are highly affected by the level of services provided.

As a result, when retailers move first as Stackelberg leaders, there is greater likelihood of channel conflict. The two channel members have different objectives (the manufacturer only wants to manage price heterogeneity but the retailer's profit depends on the ratio of price to service heterogeneity). Nevertheless, there is significant consistency in the outcomes of the two games. Generally when the level of service heterogeneity is high and that of price

heterogeneity is low, both manufacturers and retailers prefer single channel retailing. Similarly, when price heterogeneity is high and service sensitivity is low, the dual channel enhances the profits of both manufacturers and retailers.

7. Conclusion

The paper shows that the relationship between customer heterogeneity and the attraction of dual distribution cannot be determined by simply asking how different consumers are. A fundamental source of consumer heterogeneity in many markets is consumers' "cost of time." This manifests itself in two ways, both of which are important. The first is through consumers' price sensitivity. If a consumer has a high cost of time, she will need a significant saving in terms of price to justify a trip to an outlet mall that is far away. In addition, these consumers tend to exhibit a higher degree of brand loyalty than consumers who have a lot of time on their hands. The second way in which the "cost of time" manifests itself is in consumers' valuation of in-store service. Consumers with a high cost of time place a high value on service such as quick checkout, style and size selection, and packaging services because they allow consumers to shop quickly. In contrast, a consumer with a low cost of time is not willing to pay extra for in-store service.

In a competitive market, the relative importance of price versus service sensitivity (as measures of consumer heterogeneity) determines whether manufacturers are more profitable with dual distribution or exclusive distribution through primary retailers. When price sensitivity is the main source of heterogeneity in a market, a distribution structure with outlet stores increases the profits of both manufacturers and primary retailers by facilitating higher prices in the primary market.

In contrast, when the primary dimension of heterogeneity in the market is service sensitivity and not price sensitivity, a distribution structure that includes outlet malls leads to reduced profits for manufacturers and primary retailers. In this situation, the advantage of higher prices (that can be obtained by diverting Lows to an outlet mall) is outweighed by unrestrained efforts in the primary channel to attract the remaining customers with high levels of service.

Surprisingly, manufacturers are less profitable with dual channels that offer different levels of service when the primary dimension of consumer heterogeneity is valuation for that service. The reason is that segmentation intensifies profit-reducing service competition in the high service channel.

Casual intuition (and the business press) suggests that outlet stores are harmful for primary retailers. However, our analysis shows in many situations that primary retailers are also more profitable when manufacturers operate outlet stores. Retailers suffer as much from the adverse affects of price competition (created by Lows) as do manufacturers. On the other hand, primary retailers lose all demand from Lows when they leave the primary market to shop at outlet stores. As a result, when the degree of price heterogeneity in the market is low, it is possible for manufacturers to be more profitable with outlet distribution and primary retailers to be less profitable. This is more likely, the higher is the fraction of Lows in the market. Nevertheless, for the most part, the incentives of manufacturers and primary retailers are aligned: when manufacturers are more profitable with outlet distribution so are primary retailers.

The impact of outlet stores on primary retailers is summarized succinctly by an executive at a large U.S. primary retailer: “We used to try and be all things to all people, but that is not appropriate any more. We are trying to focus on the moderate and better customers who put price as only a piece of the equation” (Gatty, 1985). Our analysis suggests that this is not a simple defensive reaction to the growth of outlet malls, but a retailing strategy that

can lead to increased profits for retailers in downtown locations.

A limitation of our analysis is the assumption that a manufacturer can open an outlet store costlessly. The model may thus overstate the case for outlet malls. The principal costs to open an outlet store are a fixed fee and rental charges. The business press indicates that the contracts written for tenants at outlet malls and those written for tenants at primary retail malls are very similar. For example, the contracts often include royalty payments based on sales, paid to the mall owner, on sales above a pre-agreed level; this type of payment is called “overage rent.” These contracts are interesting on their own account but are unlikely to differentially affect the incentives (or marginal costs) of outlet stores versus primary retailers. Clearly, if the rents are too high at outlet malls, manufacturers will not open them. But the prevalence of outlet malls suggests that mall owners set the rents such that manufacturers do find it attractive to open outlet stores. In addition, the operating revenues and profits are well represented by our model since once an outlet store is opened, the leasing costs are essentially sunk (or fixed).¹⁹

Price has taken on increased importance in many markets as evidenced by the growth of category killers and no frills stores over the last 15 years. We suspect that a parallel increase in the heterogeneity of price sensitivity across consumers has also occurred and this would explain the growth of outlet retailing. We think our analysis is important because it explains why outlet retailing has grown selectively in some categories and not in others.

Appendix A. Derivation of retail prices, service levels, and wholesale prices in the two distribution structures under consideration

The following procedure is used to solve for equilibrium prices and service levels given that (a) both manufacturers operate outlet stores and distribute through exclusive primary retailers and (b) both manufacturers distribute through primary retailers alone.

1. Retailer i maximizes its profits with respect to retail price p_i ; the Nash solution concept produces functions $\pi_{ri}(s_i, s_j, w_i, w_j, \lambda, \theta, t_l, t_h, c)$. In the distribution structure with outlet stores, all Lows defect to the outlet mall.

¹⁹ These issues are fully discussed in Miceli, Sirmans, and Stake (1998), Gerbich (1998), Benjamin, Boyle, and Sirmans (1990), and Colwell and Munneke (1998). Moreover, Hendershott, Hendershott, and Hendershott (2001) note that “while overage rent clauses are found in more than 95% of mall leases, the option is generally set sufficiently out of the money such that less than half of the tenants ever pay overage rents (Eppli, Hendershott, Mejia, & Silling, 2000).”

2. The best-response functions for primary retail prices are substituted into the retailers' profit functions, and retailer i maximizes its profit with respect to service, s_i , in a Nash fashion. Solving the two retailers' first-order conditions simultaneously produces service levels of the form $s_i(w_i, w_j, \lambda, \theta, t_1, t_h, c)$.
3. The best-response functions for primary retail prices and retail service levels are substituted into the manufacturers' profit functions, and manufacturer i maximizes its profit in a Nash fashion with respect to w_i . Solving the two manufacturers' first-order conditions simultaneously produces equilibrium wholesale prices of the form $w_i^*(\lambda, \theta, t_1, t_h, c)$.
4. The equilibrium wholesale prices are used to evaluate equilibrium retail service, retail prices, manufacturer profits and primary retailer profits.

A.1. With no outlet malls

Note that $x_h = \frac{p_2 - p_1 + t_h + \theta(s_1 - s_2)}{2t_h}$ and $x_1 = \frac{p_2 - p_1 + t_1}{2t_1}$. The manufacturers' profit functions are given by:

$$\pi_{m1} = (w_1 - c)(\lambda x_h + (1 - \lambda)x_1)$$

$$\pi_{m2} = (w_2 - c)(\lambda(1 - x_h) + (1 - \lambda)(1 - x_1))$$

And the retailers' profit functions are given by:

$$\pi_{r1} = (p_1 - w_1)(\lambda x_h + (1 - \lambda)x_1) - s_1^2$$

$$\pi_{r2} = (p_2 - w_2)(\lambda(1 - x_h) + (1 - \lambda)(1 - x_1)) - s_2^2$$

Substituting into π_{r1} and differentiating with respect to p_i ($i=1, 2$), we obtain:

$$\frac{\partial \pi_{r1}}{\partial p_1} = \frac{1}{2} \frac{\lambda t_1 p_2 - 2\lambda t_1 p_1 + \lambda t_1 \theta s_1 - \lambda t_1 \theta s_2 + p_2 t_h - 2t_h p_1 + t_h t_1 - p_2 \lambda t_h + 2t_h \lambda p_1 + w_1 \lambda t_1 + w_1 t_h - w_1 t_h \lambda}{t_h t_1} = 0$$

and

$$\frac{\partial \pi_{r2}}{\partial p_2} = -\frac{1}{2} \frac{2\lambda t_1 p_2 - \lambda t_1 p_1 + \lambda t_1 \theta s_1 - \lambda t_1 \theta s_2 - t_h t_1 + 2p_2 t_h - t_h p_1 - 2p_2 \lambda t_h + t_h \lambda p_1 - w_2 \lambda t_1 - w_2 t_h + w_2 \lambda t_h}{t_h t_1} = 0.$$

These expressions can be stated compactly as:

$$\frac{\partial \pi_{r1}}{\partial p_1} = \frac{\tau p_2 - 2\tau p_1 + \tau w_1 + \lambda t_1 \theta (s_1 - s_2)}{2t_h t_1} = 0$$

and

$$\frac{\partial \pi_{r2}}{\partial p_2} = \frac{\tau p_1 - 2\tau p_2 + \tau w_2 + \lambda t_1 \theta (s_2 - s_1)}{2t_h t_1} = 0$$

where $\tau=(1-\lambda)t_h+\lambda t_1$. The numerators of these two conditions represent a system of two equations and two unknowns (p_1, p_2). Solving, we obtain

$$p_1 = \frac{1}{3} \frac{-\lambda t_1 \theta s_2 + w_2 \lambda t_1 + 2w_1 \lambda t_1 + \lambda t_1 \theta s_1 + 3t_h t_1 - w_2 \lambda t_h - 2w_1 t_h \lambda + w_2 t_h + 2w_1 t_h}{\lambda t_1 + t_h - \lambda t_h}$$

and

$$p_2 = -\frac{1}{3} \frac{\lambda t_1 \theta s_1 - \lambda t_1 \theta s_2 - 3t_h t_1 - 2w_2 \lambda t_1 - 2w_2 t_h + 2w_2 \lambda t_h - w_1 \lambda t_1 - w_1 t_h + w_1 t_h \lambda}{\lambda t_1 + t_h - \lambda t_h}.$$

Similarly, these expressions can be written compactly as:

$$p_1 = \frac{t_h t_1}{\tau} + \frac{2\tau w_1 + \tau w_2 + \lambda t_1 \theta (s_1 - s_2)}{3\tau}$$

and

$$p_2 = \frac{t_h t_1}{\tau} + \frac{2\tau w_2 + \tau w_1 + \lambda t_1 \theta (s_2 - s_1)}{3\tau}.$$

We now substitute these expressions back into the retailer’s objective functions and differentiate with respect to service.

$$\frac{\partial \pi_{r1}}{\partial s_1} = -\frac{1}{9} \frac{-\lambda^2 t_1 \theta^2 s_1 + \lambda^2 t_1 \theta^2 s_2 - w_2 \lambda^2 t_1 \theta + w_1 \lambda^2 t_1 \theta - 3\lambda t_1 \theta t_h - \lambda \theta w_2 t_h + \lambda^2 \theta w_2 t_h + \lambda \theta w_1 t_h - \lambda^2 \theta w_1 t_h + 18s_1 t_h^2 + 18\lambda t_1 s_1 t_h - 18\lambda s_1 t_h^2}{t_h(\lambda t_1 + t_h - \lambda t_h)} = 0$$

$$\frac{\partial \pi_{r2}}{\partial s_2} = \frac{1}{9} \frac{\lambda^2 t_1 \theta^2 s_2 - \lambda^2 t_1 \theta^2 s_1 + 3\lambda t_1 \theta t_h - w_2 \lambda^2 t_1 \theta - \lambda \theta w_2 t_h + \lambda^2 \theta w_2 t_h + w_1 \lambda^2 t_1 \theta + \lambda \theta w_1 t_h - \lambda^2 \theta w_1 t_h - 18s_2 t_h^2 - 18\lambda t_1 s_2 t_h + 18\lambda s_2 t_h^2}{t_h(\lambda t_1 + t_h - \lambda t_h)} = 0$$

Solving, we obtain $s_1 = \frac{1}{6} \lambda t_1 \theta \frac{\lambda t_h - \lambda t_1 + s_1}{\lambda t_1 + t_h - \lambda t_h}$ and $s_2 = -\frac{1}{6} \lambda t_1 \theta \frac{-1 + \lambda t_h - \lambda t_1 + s_1}{\lambda t_1 + t_h - \lambda t_h}$. We then substitute back into the manufacturers’ objective functions and differentiate with respect to wholesale prices:

$$\begin{aligned} & \lambda^2 t_1^2 \theta^2 + 6\lambda^2 t_1^2 w_1 - 9\lambda t_1^2 t_h - 12t_h^2 \lambda w_1 - 3\lambda^2 t_1^2 w_2 \\ & - 3t_h^2 w_2 + 12t_h w_1 \lambda t_1 + 6t_h^2 \lambda w_2 + 6t_h^2 w_1 - 12\lambda^2 t_1 t_h w_1 \\ & - 6t_h w_2 \lambda t_1 - 3\lambda^2 t_h^2 w_2 - 9t_h^2 t_1 + 6\lambda^2 t_h^2 w_1 + 6\lambda^2 t_1 t_h w_2 \\ \frac{\partial \pi_{m1}}{\partial w_1} = & \frac{1}{2} \frac{-3ct_h^2 - 3c\lambda^2 t_1^2 + 6c\lambda t_h^2 - 3c\lambda^2 t_h^2 - 6c\lambda t_1 t_h + 6c\lambda^2 t_1 t_h + 9t_h^2 \lambda t_1}{(\lambda^2 t_1 \theta^2 - 9\lambda t_1 t_h + 9\lambda t_h^2 - 9t_h^2) t_1} = 0 \end{aligned}$$

$$\begin{aligned} & \lambda^2 t_1^2 \theta^2 - 3\lambda^2 t_1^2 w_1 - 9\lambda t_1^2 t_h + 6t_h^2 \lambda w_1 + 6\lambda^2 t_1^2 w_2 \\ & + 6t_h^2 w_2 - 6t_h w_1 \lambda t_1 - 12t_h^2 \lambda w_2 - 3t_h^2 w_1 + 6\lambda^2 t_1 t_h w_1 \\ & + 12t_h w_2 \lambda t_1 + 6\lambda^2 t_h^2 w_2 - 9t_h^2 t_1 - 3\lambda^2 t_h^2 w_1 - 12\lambda^2 t_1 t_h w_2 \\ \frac{\partial \pi_{m2}}{\partial w^2} = & \frac{1}{2} \frac{-3ct_h^2 - 3c\lambda^2 t_1^2 + 6c\lambda t_h^2 - 3c\lambda^2 t_h^2 - 6c\lambda t_1 t_h + 6c\lambda^2 t_1 t_h + 9t_h^2 \lambda t_1}{(\lambda^2 t_1 \theta^2 - 9\lambda t_1 t_h + 9\lambda t_h^2 - 9t_h^2) t_1} = 0 \end{aligned}$$

The solution of these two equations is

$$w_1 = -\frac{1}{3} \frac{\lambda^2 t_1^2 \theta^2 - 3c\lambda^2 t_h^2 - 9\lambda t_1^2 t_h - 3c\lambda^2 t_1^2 + 6c\lambda t_h^2 - 6c\lambda t_1 t_h + 6c\lambda^2 t_1 t_h + 9t_h^2 \lambda t_1 - 3c t_h^2 - 9t_h^2 t_1}{\lambda^2 t_1^2 - 2\lambda t_h^2 + 2\lambda t_1 t_h + t_h^2 - 2\lambda^2 t_1 t_h + \lambda^2 t_h^2}$$

and

$$w_2 = -\frac{1}{3} \frac{\lambda^2 t_1^2 \theta^2 - 3c\lambda^2 t_h^2 - 9\lambda t_1^2 t_h - 3c\lambda^2 t_1^2 + 6c\lambda t_h^2 - 6c\lambda t_1 t_h + 6c\lambda^2 t_1 t_h + 9t_h^2 \lambda t_1 - 3c t_h^2 - 9t_h^2 t_1}{\lambda^2 t_1^2 - 2\lambda t_h^2 + 2\lambda t_1 t_h + t_h^2 - 2\lambda^2 t_1 t_h + \lambda^2 t_h^2}.$$

Note that we can manipulate the denominator in these expressions to restate as: $\lambda^2 t_1^2 - 2\lambda t_h^2 + 2\lambda t_1 t_h + t_h^2 - 2\lambda^2 t_1 t_h + \lambda^2 t_h^2 = (\lambda t_1 + t_h - \lambda t_h)^2$ (or the square of τ as defined in the paper). These expressions can therefore be rewritten as: $w_1 = w_2 = (3t_h t_1 / \tau) - (\lambda^2 t_1^2 \theta^2 / 3\tau^2) + c$. The remaining equilibrium values for the no outlet stores case in Table 1 are obtained by substituting the equilibrium values of w_1 and w_2 and simplifying.

A.1.1. The second-order conditions for the no outlet case

$$\frac{\partial^2 \pi_{r1}}{\partial p_1^2} = \frac{\partial^2 \pi_{r2}}{\partial p_2^2} = -\frac{\lambda}{t_h} - \frac{1-\lambda}{t_1} < 0, \quad \frac{\partial^2 \pi_{r1}}{\partial p_1 \partial p_2} = \frac{\partial^2 \pi_{r2}}{\partial p_1 \partial p_2} = \frac{\lambda}{2t_h} + \frac{1-\lambda}{2t_1}$$

$$\det \begin{vmatrix} \frac{\partial^2 \pi_{r1}}{\partial p_1^2} & \frac{\partial^2 \pi_{r1}}{\partial p_1 \partial p_2} \\ \frac{\partial^2 \pi_{r2}}{\partial p_1 \partial p_2} & \frac{\partial^2 \pi_{r2}}{\partial p_2^2} \end{vmatrix} = \frac{3}{4} \left(\frac{\lambda}{t_h} + \frac{1-\lambda}{t_1} \right)^2 > 0.$$

Thus, SOC's and the Routh–Herwitz conditions are met for retail prices.

The second-order conditions for service require that:

$$\frac{\lambda^2 t_1 \theta^2 - 18t_h \tau}{9t_h \tau} < 0 \Rightarrow \theta < \frac{3}{\lambda} \left(\frac{2t_h \tau}{t_1} \right)^{\frac{1}{2}}$$

where $\tau = \lambda t_1 + (1-\lambda)t_h$. Meanwhile the SOC for wholesale price requires that:

$$\frac{3t_h^2 \tau^2 (\theta^2 t_1 \lambda^2 - 9t_h \tau)}{t_1} < 0 \Rightarrow \theta < \frac{3}{\lambda} \left(\frac{t_h \tau}{t_1} \right)^{\frac{1}{2}},$$

a stricter condition.

A.2. With outlet malls

Note that $x_h = (p_2 - p_1 + t_h + \theta(s_1 - s_2)) / 2t_h$ and $x_{1,\text{outlet}} = (p_{2,\text{outlet}} - p_{1,\text{outlet}} + t_1) / 2t_1$. Manufacturer profit functions are given by:

$$\pi_{m1} = (w_1 - c)\lambda x_h + (p_{1,\text{outlet}} - c)(1 - \lambda)x_1$$

$$\pi_{m2} = (w_2 - c)\lambda(1 - x_h) + (p_{2,\text{outlet}} - c)(1 - \lambda)(1 - x_1)$$

Retailer profit functions are given by:

$$\pi_{r1} = (p_1 - w_1)\lambda x_h - s_1^2$$

$$\pi_{r2} = (p_2 - w_2)\lambda(1 - x_h) - s_2^2$$

At the outlet mall with a clean separation of Lows, we have:

$$\frac{\partial \pi_{m1}}{\partial p_{1,outlet}} = \frac{(1-\lambda)}{2t_1} (-2p_{1,outlet} + p_{2,outlet} + t_1 + c) = 0$$

$$\frac{\partial \pi_{m2}}{\partial p_{2,outlet}} = \frac{(1-\lambda)}{2t_1} (-2p_{2,outlet} + p_{1,outlet} + t_1 + c) = 0$$

Solving yields $p_{1,outlet}=p_{2,outlet}=t_1+c$. We now substitute for x_h into the retailer profit function to determine optimal prices as a function of service levels and wholesale prices.

$$\frac{\partial \pi_{r1}}{\partial p_1} = \frac{1}{2} \lambda \frac{p_2 - 2p_1 + t_h + \theta s_1 - \theta s_2 + w_1}{t_h} = 0$$

and

$$\frac{\partial \pi_{r2}}{\partial p_2} = -\frac{1}{2} \lambda \frac{-t_h + 2p_2 - p_1 + \theta s_1 - \theta s_2 - w_2}{t_h} = 0.$$

Solving, we obtain $p_1=t_h+(1/3)\theta s_1-(1/3)\theta s_2+(2/3)w_1+(1/3)w_2$ and $p_2=t_h-(1/3)\theta s_1+(1/3)\theta s_2+(1/3)w_1+(2/3)w_2$.

We now substitute these expressions back into the retailer’s objective functions and differentiate with respect to service.

$$\frac{\partial \pi_{r1}}{\partial s_1} = -\frac{1}{9} \frac{\lambda \theta^2 s_2 - 3\theta \lambda t_h + \lambda \theta w_1 - \lambda \theta w_2 - \lambda \theta^2 s_1 + 18s_1 t_h}{t_h} = 0$$

$$\frac{\partial \pi_{r2}}{\partial s_2} = \frac{1}{9} \frac{-\lambda \theta^2 s_1 + 3\theta \lambda t_h + \lambda \theta w_1 - \lambda \theta w_2 + \lambda \theta^2 s_2 - 18s_2 t_h}{t_h} = 0$$

Solving we obtain $s_1 = \frac{1}{6} \lambda \theta \frac{\lambda \theta^2 - 9t_h + 3w_1 - 3w_2}{\lambda \theta^2 - 9t_h}$ and $s_2 = \frac{1}{6} \lambda \theta \frac{-9t_h - 3w_1 + 3w_2 + \lambda \theta^2}{\lambda \theta^2 - 9t_h}$.

We then substitute back into the manufacturers’ objective functions and differentiate with respect to wholesale prices:

$$\frac{\partial \pi_{m1}}{\partial w_1} = \frac{1}{2} \lambda \frac{\lambda \theta^2 - 9t_h + 6w_1 - 3w_2 - 3c}{\lambda \theta^2 - 9t_h}$$

$$\frac{\partial \pi_{m2}}{\partial w_2} = \frac{1}{2} \lambda \frac{-9t_h - 3w_1 + 6w_2 + \lambda \theta^2 - 3c}{\lambda \theta^2 - 9t_h}$$

The solution to these two equations is $w_1=3t_h-(1/3)\lambda \theta^2+c$ and $w_2=3t_h-(1/3)\lambda \theta^2+c$. The remaining equilibrium values for the dual channel case in Table 1 are obtained by substituting the equilibrium values of w_1 and w_2 and simplifying.

A.2.1. The second-order conditions with outlet stores

$$\frac{\partial^2 \pi_{r1}}{\partial p_1^2} = \frac{\partial^2 \pi_{r2}}{\partial p_2^2} = -\frac{\lambda}{t_h} < 0, \frac{\partial^2 \pi_{r1}}{\partial p_1 \partial p_2} = \frac{\partial^2 \pi_{r2}}{\partial p_1 \partial p_2} = \frac{\lambda}{2t_h}$$

$$\det \begin{vmatrix} \frac{\partial^2 \pi_{r1}}{\partial p_1^2} & \frac{\partial^2 \pi_{r1}}{\partial p_1 \partial p_2} \\ \frac{\partial^2 \pi_{r2}}{\partial p_1 \partial p_2} & \frac{\partial^2 \pi_{r2}}{\partial p_2^2} \end{vmatrix} = \frac{3}{4} \left(\frac{\lambda}{t_h} \right)^2 > 0.$$

Thus, SOC’s and the Routh–Herwitz conditions are met for retail prices.

The second-order conditions for service requires that: $\frac{\lambda \theta^2 - 18t_h}{9t_h} < 0 \Rightarrow \theta < 3 \left(\frac{2t_h}{\lambda} \right)^{\frac{1}{2}}$. Meanwhile the SOC for wholesale price requires that: $\frac{3\lambda}{\theta^2 \lambda - 9t_h} < 0 \Rightarrow \theta < 3 \left(\frac{t_h}{\lambda} \right)^{\frac{1}{2}}$, a stricter condition. Further note that $\theta < 3(t_h/\lambda)^{(1/2)}$ is a stricter constraint than the analogous one from the “no outlet stores” case $(3/\lambda)(t_h \tau / t_1)^{(1/2)}$.

A.3. Details supporting footnote 8

This calculation shows that in the feasible parameter space neither primary retailer has an incentive to deviate to capture Lows that are shopping at the outlet mall. We focus on the situation that is most attractive: $TC_1=0$ and $TC_h=\infty$ (if the deviation is not attractive when it is potentially most attractive then it will not be attractive for all other parameter combinations). The retailer profit from serving only Highs is $\pi_r=(\lambda t_h/2)-(\lambda^2\theta^2/36)$. Were a primary retailer to unilaterally drop price to the outlet store level (i.e. t_1+c), but still face the manufacturer's wholesale price of $(3t_h-(\lambda\theta^2/3)+c)$, its highest potential deviation payoff would occur were it to capture all Lows from the outlet mall and all Highs (i.e. the entire market). The profit by dropping price to serve Lows when $TC_1=0$ would be $\pi_{\text{defect}}=t_1-3t_h+(1/3)\lambda\theta^2-(1/36)\theta^2\lambda^2$ (the price offered by the retailer would have to be at least as attractive as the equilibrium retail price of t_1+c). To be assured that the retailer has no unilateral incentive to deviate from the outlet-store equilibrium, we need $\pi_r-\pi_{\text{defect}}>0$ for all feasible parameter combinations. Note that $\pi_r-\pi_{\text{defect}}=(1/2)\lambda t_h-t_1+3t_h-(1/3)\lambda\theta^2$; $(\partial(\pi_r-\pi_{\text{defect}})/\partial\theta)<0$, and therefore the minimum value occurs at the maximum value of θ , i.e. when

$$\theta = \left(3\tau \frac{-3t_h\lambda\tau - t_1\tau + t_1\tau\lambda + 3t_h t_1}{\lambda^2(-\tau^2 + t_1^2)} \right)^{1/2}.$$

This is the maximum value where of θ where outlet mall distribution will be observed (shown later in Proposition 1). Therefore,

$$\min(\pi_r - \pi_{\text{defect}}) = \frac{1}{2} \frac{\lambda^2 t_h \tau^2 - \lambda^2 t_h t_1^2 + 2t_1^3 \lambda - 6\lambda t_h t_1^2 - 2t_1 \tau^2 + 6\tau t_h t_1}{\lambda(\tau^2 - t_1^2)}.$$

This expression is positive if the numerator is positive (the denominator is positive by inspection). Since $\tau=\lambda t_1+(1-\lambda)t_h$, we can express the numerator as: $(\lambda^2 t_h \tau^2 - \lambda^2 t_h t_1^2 + 2t_1^3 \lambda - 6\lambda t_h t_1^2 - 2t_1 \tau^2 + 6\tau t_h t_1) = [\lambda^2 t_h (\tau^2 - t_1^2) - 2t_1 (-1+\lambda)(\lambda t_1^2 + \lambda t_h^2 - 2t_1 \lambda t_h + 2t_h^2)]$. Here the first term is positive. The second term is $-2t_1(-1+\lambda)(\lambda t_1^2 + \lambda t_h^2 - 2t_1 \lambda t_h + 2t_h^2)$. If $\lambda t_1^2 + \lambda t_h^2 - 2t_1 \lambda t_h + 2t_h^2 > 0$, the second term is positive because $2t_h^2 > 2t_1 \lambda t_h$ for all allowable t_h , t_1 and λ , the numerator is strictly positive and $(\pi_r - \pi_{\text{defect}}) > 0$ in the allowable range. This implies that in the range where dual distribution is optimal, the retailer does not have an incentive to defect.

Proof of Proposition 1. When manufacturers have symmetric distribution channels and $\theta < \theta_1$ where

$$\theta_1 = \left(3\tau \frac{-3t_h\lambda\tau - t_1\tau + t_1\tau\lambda + 3t_h t_1}{\lambda^2(-\tau^2 + t_1^2)} \right)^{1/2}$$

and τ is as defined in Table 1, manufacturers have a profit incentive to sell through outlet stores as well as through primary retailers.

From Table 1, set $\pi_{m,\text{no outlet}} = \pi_{m,\text{outlet}}$, i.e.

$$\frac{3t_h t_1}{2\tau} - \frac{\theta^2 t_1^2 \lambda^2}{6\tau^2} = \frac{3\lambda t_h}{2} - \frac{\lambda^2 \theta^2}{6} + (1-\lambda) \frac{t_1}{2}.$$

Setting these profits equal and solving for θ yields two boundaries, one of which is positive: i.e.

$$\theta_1 = \left(3\tau \frac{-3t_h\lambda\tau - t_1\tau + t_1\tau\lambda + 3t_h t_1}{\lambda^2(-\tau^2 + t_1^2)} \right)^{1/2}.$$

This function is an increasing function of t_h with a positive root at

$$t_h = \frac{1}{6\lambda} \left(4\lambda + 2 + 2\sqrt{\lambda^2 + 4\lambda + 1} \right) t_1.$$

It is straightforward to show that this root is strictly greater than t_1 and is increasing in λ . When $\theta > \theta_1$, $\pi_{m, \text{no outlet}} > \pi_{m, \text{outlet}}$. When

$$t_h < \frac{1}{6\lambda} \left(4\lambda + 2 + 2\sqrt{\lambda^2 + 4\lambda + 1} \right) t_1, \pi_{m, \text{no outlet}} > \pi_{m, \text{outlet}}$$

independent of θ . □

A.4. Details supporting footnote 13 and associated text

Consider a hypothetical case where retailers could collude in their choice of service levels (but not price). Were this possible, retailers would set the service levels to zero: this level of service yields the highest profit to retailers (and manufacturers). Because zero service is the optimal collusive choice, it is clear that service levels in a competitive primary market are excessively high. . . .

The collusive service level for primary retailers is determined as follows.

- Primary retailer i maximizes its profits with respect to retail price p_i ; the Nash solution concept produces functions $p_i(s_i, s_j, w_i, w_j; \lambda, \theta, t_1, t_h)$.
- These best-response functions are substituted back into the primary retailers' profit equations, and service levels, s_i , are chosen to maximize joint (i.e. the sum of retailer 1's and retailer 2's) profits. The result are functions $s_i(w_i, w_j; \lambda, \theta, t_1, t_h)$.
- These functions for primary retail prices and retail service levels are substituted into the manufacturers' profit functions, and manufacturer i maximizes its profit in a Nash fashion with respect to w_i . Solving the two manufacturers' first-order conditions simultaneously produces equilibrium wholesale prices of the form $w_i^* = w_j^* = w_{ii}^*(\lambda, \theta, t_1, t_h)$.
- This equilibrium wholesale price is then substituted back into the best-response functions for retail service and primary retail price to produce equilibrium reduced-form expressions for these as well as for manufacturer and primary retailer profits.

With outlet mall distribution, equilibrium service levels as functions of w_i and w_j are: $s_i(w_i, w_j; \lambda, \theta, t_1, t_h)$ where $s_i = (\lambda\theta(w_i - w_j)) / (2\lambda\theta^2 - 9t_h)$, and without outlet mall distribution, the equilibrium service levels are: $s_i(w_i, w_j; \lambda, \theta, t_1, t_h)$ where $s_i = (\lambda\theta\tau(w_i - w_j)) / (2\lambda\theta^2 t_1 - 9t_h\tau)$.

Since in both situations, $w_i = w_j$, equilibrium values of service are indeed zero when collusion on service is possible. Simple algebraic comparison of optimal levels of service in the collusive case with those in the outlet store and no outlet store cases provides support for the footnote.

Proof of Proposition 2. When $\theta < \theta_2$ and

$$\theta_2 = \frac{3\sqrt{2}}{\lambda} \left(\frac{t_h(1 - \lambda)[t_h\lambda - t_1(1 + \lambda)]}{\tau^2 - t_1^2} \right)^{\frac{1}{2}},$$

primary retailers realize superior profit in a distribution structure where manufacturers operate outlet stores compared to a structure where product is only sold through primary retailers.

Primary retailers earn higher profits in a market with dual distribution system if: $\pi_{r,outlet} > \pi_{r,no outlet}$. From Table 1, this happens when

$$\frac{\lambda t_h}{2} - \frac{\lambda^2 \theta^2}{36} > \frac{t_h t_1}{2\tau} - \frac{\theta^2 t_1^2 \lambda^2}{36\tau^2} \Rightarrow \theta < \frac{3\sqrt{2}}{\lambda} \left(\frac{t_h(1-\lambda)[t_h\lambda - t_1(1+\lambda)]}{\tau^2 - t_1^2} \right)^{\frac{1}{2}}. \quad \square$$

Proof of Proposition 3. When

$$\frac{t_h}{t_1} \in \left(1, \frac{t_h^*}{t_1} \right)$$

and

$$\frac{t_h^*}{t_1} = -\frac{1}{6\lambda} \left(\lambda\sqrt{2} - 2\lambda - \sqrt{2} - 4 - \sqrt{18\lambda^2 + 8\lambda^2\sqrt{2} + 12\lambda - 4\lambda\sqrt{2} + 18 + 8\sqrt{2}} \right):$$

1. $\theta_2 < \theta_1$.
2. The profits of manufacturers and primary retailers are higher with dual distribution versus single channel distribution when $\theta < \theta_2$ and lower with dual distribution when $\theta > \theta_1$.
3. The profits of manufacturers are higher and primary retailers are lower with dual distribution when $\theta \in (\theta_2, \theta_1)$.

When $\frac{t_h}{t_1} > \frac{t_h^*}{t_1}$:

4. $\theta_2 > \theta_1$.
5. The profits of manufacturers and primary retailers are higher with dual distribution versus single channel distribution when $\theta < \theta_1$ and lower with dual distribution when $\theta > \theta_2$.
6. The profits of manufacturers are lower and primary retailers are higher with dual distribution when $\theta \in (\theta_1, \theta_2)$.

Propositions 1 and 2 indicate the regions for the dominance of profits for single channel distribution over dual distribution for manufacturers and primary retailers, respectively. Setting $\theta_1 = \theta_2$ yields the following expressions for t_h .

$$t_h = -\frac{1}{6\lambda} \left(\lambda\sqrt{2} - 2\lambda - \sqrt{2} - 4 - \sqrt{18\lambda^2 + 8\lambda^2\sqrt{2} + 12\lambda - 4\lambda\sqrt{2} + 18 + 8\sqrt{2}} \right) t_1$$

and

$$t_h = -\frac{1}{6\lambda} \left(\lambda\sqrt{2} - 2\lambda - \sqrt{2} - 4 + \sqrt{18\lambda^2 + 8\lambda^2\sqrt{2} + 12\lambda - 4\lambda\sqrt{2} + 18 + 8\sqrt{2}} \right) t_1.$$

The first root is strictly positive and the second root is strictly negative. Thus the relevant root is the first since transportation costs are restricted to positive values. The expression $\theta_2 - \theta_1$ is given by:

$$3(-\lambda t_1 - t_h + t_h \lambda) \frac{-3t_h\sqrt{2}\lambda t_1 + 3\lambda\sqrt{2}t_h^2 - 3\sqrt{2}t_h t_1 - 3t_h^2\lambda + 4\lambda t_1 t_h - \lambda t_1^2 + 2t_1 t_h}{(\lambda t_1^2 + t_h^2\lambda - 2\lambda t_1 t_h - t_h^2 + t_1^2)\lambda^2}.$$

Note that the first two terms are equal to $-3((1-\lambda)t_h + \lambda t_1) < 0$. The denominator is equal to $\lambda^2(t_h - t_1)(\lambda t_h - t_h - \lambda t_1 - t_1) < 0$.

As a result, $\theta_2 - \theta_1$ is an upward facing parabola because $(3\sqrt{2}\lambda - 3\lambda)$, the coefficient of t_h^2 (in the denominator), is strictly positive. As a result, $\theta_2 < \theta_1$ for all

$$t_h < -\frac{1}{6\lambda} \left(\lambda\sqrt{2} - 2\lambda - \sqrt{2} - 4 - \sqrt{18\lambda^2 + 8\lambda^2\sqrt{2} + 12\lambda - 4\lambda\sqrt{2} + 18 + 8\sqrt{2}} \right) t_1$$

and $\theta_2 > \theta_1$ for all

$$t_h > -\frac{1}{6\lambda} \left(\lambda\sqrt{2} - 2\lambda - \sqrt{2} - 4 - \sqrt{18\lambda^2 + 8\lambda^2\sqrt{2} + 12\lambda - 4\lambda\sqrt{2} + 18 + 8\sqrt{2}} \right) t_1.$$

The rest of the proposition follows straightforwardly from these observations. □

Proof of Proposition 4. When service levels by retailers are set first, manufacturers earn more profit in a symmetric retail structure with outlet stores than in a symmetric structure without outlet stores when

$$t_h > \frac{1}{6\lambda} \left(4\lambda + 2 + 2\sqrt{(\lambda^2 + 4\lambda + 1)} \right) t_1.$$

The profitability of the manufacturer under either distribution structure does not depend on the sensitivity of the market to service.

A.5. With no outlet malls

Note that $x_h = \frac{p_2 - p_1 + t_h + \theta(s_1 - s_2)}{2t_h}$ and $x_1 = \frac{p_2 - p_1 + t_1}{2t_1}$.

Manufacturers' profits are given by:

$$\pi_{m1} = (w_1 - c)(\lambda x_h + (1 - \lambda)x_1)$$

$$\pi_{m2} = (w_2 - c)(\lambda(1 - x_h) + (1 - \lambda)(1 - x_1))$$

Retailers' profits are given by:

$$\pi_{r1} = (p_1 - w_1)(\lambda x_h + (1 - \lambda)x_1) - s_1^2$$

$$\pi_{r2} = (p_2 - w_2)(\lambda(1 - x_h) + (1 - \lambda)(1 - x_1)) - s_2^2$$

These are the same as we have used earlier, because the last stage of the game is identical to that in the base model. We know from our earlier model solution that

$$p_1 = \frac{1}{3} \frac{-\lambda t_1 \theta s_2 + w_2 \lambda t_1 + 2w_1 \lambda t_1 + \lambda t_1 \theta s_1 + 3t_h t_1 - w_2 \lambda t_h - 2w_1 t_h \lambda + w_2 t_h + 2w_1 t_h}{\lambda t_1 + t_h - \lambda t_h}$$

and

$$p_2 = -\frac{1}{3} \frac{\lambda t_1 \theta s_1 - \lambda t_1 \theta s_2 - 3t_h t_1 - 2w_2 \lambda t_1 - 2w_2 t_h + 2w_2 \lambda t_h - w_1 \lambda t_1 - w_1 t_h + w_1 t_h \lambda}{\lambda t_1 + t_h - \lambda t_h}.$$

We now substitute these expressions back into the manufacturer's objective functions and differentiate with respect to wholesale price.

$$\frac{\partial \pi_{m1}}{\partial w_1} = \frac{1}{6} \frac{-2w_1\lambda t_1 + \lambda t_1 c - 2w_1 t_h + t_h c + 2w_1 t_h \lambda - \lambda t_h c - \lambda t_1 \theta s_2 + w_2 \lambda t_1 + \lambda t_1 \theta s_1 + 3t_h t_1 - w_2 \lambda t_h + w_2 t_h}{t_h t_1} = 0$$

$$\frac{\partial \pi_{m2}}{\partial w_2} = -\frac{1}{6} \times \frac{2w_2 \lambda t_1 - \lambda t_1 c + 2w_2 t_h - t_h c - 2w_2 \lambda t_h + \lambda t_h c - \lambda t_1 \theta s_2 - w_1 \lambda t_1 + \lambda t_1 \theta s_1 - 3t_h t_1 + w_1 t_h \lambda - w_1 t_h}{t_h t_1} = 0.$$

Solving we obtain

$$w_1 = \frac{1}{3} \frac{-\lambda t_1 \theta s_2 + 3\lambda t_1 c + \lambda t_1 \theta s_1 + 9t_h t_1 - 3\lambda t_h c + 3t_h c}{\lambda t_1 + t_h - \lambda t_h}$$

and

$$w_2 = -\frac{1}{3} \frac{-3\lambda t_1 c - 3t_h c + 3\lambda t_h c - \lambda t_1 \theta s_2 + \lambda t_1 \theta s_1 - 9t_h t_1}{\lambda t_1 + t_h - \lambda t_h}.$$

We then substitute back into the manufacturers' objective functions and differentiate with respect to service:

$$\frac{\partial \pi_{r1}}{\partial s_1} = -\frac{1}{81} \frac{t_1 \lambda^2 \theta^2 s_2 - t_1 \lambda^2 \theta^2 s_1 + 162t_1 \lambda s_1 t_h - 9\lambda t_1 \theta t_h - 162s_1 t_h^2 \lambda + 162s_1 t_h^2}{t_h(\lambda t_1 - \lambda t_h + t_h)} = 0$$

$$\frac{\partial \pi_{r2}}{\partial s_2} = -\frac{1}{81} \frac{-t_1 \lambda^2 \theta^2 s_2 + t_1 \lambda^2 \theta^2 s_1 - 9\lambda t_1 \theta t_h + 162t_1 \lambda s_2 t_h - 162s_2 t_h^2 \lambda + 162s_2 t_h^2}{t_h(\lambda t_1 - \lambda t_h + t_h)} = 0.$$

The solution of these two equations is $s_1=s_2=(1/18)\lambda t_1(\theta/(\lambda t_1-\lambda t_h+t_h))$. Because the denominator in these expressions $(\lambda t_1+t_h-\lambda t_h)$ is simply equal to τ , these expressions can be rewritten as: $s_1=s_2=(1/18)\lambda t_1(\theta/\tau)$. The remaining equilibrium values for the no outlet stores case in Table 4 are obtained by substituting the equilibrium values of s_1 and s_2 and simplifying.

A.6. With outlet malls

Note that $x_h = \frac{p_2 - p_1 + t_h + \theta(s_1 - s_2)}{2t_h}$ and $x_{1,\text{outlet}} = \frac{p_{2,\text{outlet}} - p_{1,\text{outlet}} + t_1}{2t_1}$.

Manufacturers' profit functions are given by:

$$\pi_{m1} = (w_1 - c)\lambda x_h + (p_{1,\text{outlet}} - c)(1 - \lambda)x_1$$

$$\pi_{m2} = (w_2 - c)\lambda(1 - x_h) + (p_{2,\text{outlet}} - c)(1 - \lambda)(1 - x_1)$$

Retailer profit functions are given by:

$$\pi_{r1} = (p_1 - w_1)\lambda x_h - s_1^2$$

$$\pi_{r2} = (p_2 - w_2)\lambda(1 - x_h) - s_2^2$$

As in the base model,

$$p_{1,\text{outlet}} = p_{2,\text{outlet}} = t_h + c; p_1 = t_h + \frac{1}{3}\theta s_1 - \frac{1}{3}\theta s_2 + \frac{2}{3}w_1 + \frac{1}{3}w_2;$$

and

$$p_2 = t_h - \frac{1}{3}\theta s_1 + \frac{1}{3}\theta s_2 + \frac{1}{3}w_1 + \frac{2}{3}w_2.$$

We now substitute these expressions back into the manufacturer's objective functions and differentiate with respect to wholesale price.

$$\frac{\partial \pi_{m1}}{\partial w_1} = \frac{1}{6}\lambda \frac{3t_h + \theta s_1 - \theta s_2 - 2w_1 + w_2 + c}{t_h} = 0$$

$$\frac{\partial \pi_{m2}}{\partial w_2} = -\frac{1}{6}\lambda \frac{-3t_h + \theta s_1 - \theta s_2 - w_1 + 2w_2 - c}{t_h} = 0.$$

Solving, we obtain $w_1 = 3t_h + \frac{1}{3}\theta s_1 - \frac{1}{3}\theta s_2 + c$ and $w_2 = 3t_h - \frac{1}{3}\theta s_1 + \frac{1}{3}\theta s_2 + c$. We then substitute back into the manufacturers' objective functions and differentiate with respect to service:

$$\frac{\partial \pi_{r1}}{\partial s_1} = -\frac{1}{81} \frac{-9\lambda t_h \theta - \lambda \theta^2 s_1 + \lambda \theta^2 s_2 + 162s_1 t_h}{t_h} = 0$$

$$\frac{\partial \pi_{r2}}{\partial s_2} = -\frac{1}{81} \frac{-9\lambda t_h \theta + \lambda \theta^2 s_1 - \lambda \theta^2 s_2 + 162s_2 t_h}{t_h} = 0.$$

The solution of these two equations is $s_1 = s_2 = (1/18)\lambda\theta$. The remaining equilibrium values for the outlet stores case in Table 4 are obtained by substituting the equilibrium values of s_1 and s_2 and simplifying.

From Table 4, $\pi_{m,\text{no outlet}} = \frac{3}{2}t_h \frac{t_1}{\tau}$ and $\pi_{m,\text{outlet}} = \frac{3}{2}\lambda t_h + \frac{1}{2}t_1 - \frac{1}{2}t_1 \lambda$. The difference between the two profits is

$$\pi_{m,\text{outlet}} - \pi_{m,\text{no outlet}} \equiv \Delta = \frac{3}{2}\lambda t_h + \frac{1}{2}t_1 - \frac{1}{2}t_1 \lambda - \frac{3}{2}t_h \frac{t_1}{\tau}.$$

They are equivalent at

$$t_1 = \frac{t_h}{\frac{1}{6\lambda} \left(4\lambda + 2 + 2\sqrt{(\lambda^2 + 4\lambda + 1)} \right)}.$$

Substituting the critical value for t_1 into Δ and differentiating with respect to t_h , the proposition obtains easily. \square

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