

**WHEN IS THE BEST SHIP A LEAKY ONE?
SEGMENTATION, COMPETITION
AND GRAY MARKETS**

by

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Segmentation, Competition and Gray Markets*

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When is the Best Ship a Leaky One?

Segmentation, Competition and Gray Markets

ABSTRACT

A quick scan of today's business press reveals that one of the most pressing issues for global marketers is the existence and persistence of gray markets. Be it Swatch[®] watches, designer clothing or chic apparel items, manufacturers must deal with authorized, branded product leaking into unauthorized channels in high-margin markets as well as products which are truly counterfeit. While the incentive to counterfeit is as old as the Dutch masters, it has been and remains illegal; in contrast, the gray-marketed products we find in the bargain/discount outlets of high-margin markets are authentic and frequently come from the same factory that supplies authorized channels.

Two developments have led to this situation. The first is the opening up of developing markets and the second is the world-wide liberalization of trade. Both of these developments have created incentives for firms to capitalize on brand equity and volume potential by offering similar products across countries. The problem with this strategy, however, is that pricing varies substantially across countries due to differences in exchange rates, purchasing power and supply side factors (for example, distribution, servicing, and taxes). Of course, the minute that price differences exist across boundaries or territories, substantial gains are available through arbitrage. This, in large part, explains the growth of gray markets.

While end-customers frequently gain from the availability of gray goods (due to their lower prices), other members of the channel are circumspect in their attitude towards gray goods. Manufacturers complain because gray goods impair a manufacturer's ability to price discriminate (i.e., to charge different prices in different markets). In addition, if gray goods do not conform to the standards of authorized products in the focal market, then brand equity may suffer. Gray goods may be a concern for manufacturers but frequently the noisiest critics of the escalation in gray marketing are authorized dealers. Gray markets unequivocally erode potential volume for authorized dealers and may place pressure on after-sales service functions. All in all, this suggests that gray markets are generally bad: when it is feasible to intercept and monitor gray goods, it is always in a manufacturer's interest to do so.

This is certainly the flavor of the approach taken by most academics who have studied gray markets. Weigand (1991), Cespedes, Corey and Rangan (1988) and Cavusgil and Sikora (1987) assume that gray markets are a problem for manufacturers and examine the alternatives open to manufacturers to limit both the impact and magnitude of gray goods. Using an analytical approach, Banerji (1990) and Bucklin (1993) focus on issues of price discrimination and demonstrate the problems that gray goods can pose in terms of channel management. Bucklin, in a departure from the conventional wisdom associated with gray goods, identifies the possibility that gray markets are not always negative for manufacturers: price erosion in the home market can be offset by an increase in unit sales. The existing

literature certainly advances our understanding of why gray markets occur and how they can be controlled; however, a significant limitation of the literature is that it does not address the topic of gray markets in the context of competition and the vast majority of gray market activity occurs in highly competitive categories. In addition, there is little evidence of manufacturers taking legal action to limit the proliferation of gray goods, in spite of evidence that such action can reduce or even eliminate gray goods. Our objective is to shed light on this issue first, by analyzing the impact of gray markets in the context of a competitive market and second, by considering the possibility that factors other than market expansion may explain the "tacit" support of gray markets by manufacturers.

We approach this problem utilizing a game theoretic framework and without resorting to an argument of market expansion, we show that it is often in the interest of manufacturers to encourage the availability of gray goods. The rationale for this finding is that gray goods indirectly affect the nature of competition in authorized markets by siphoning away certain types of customers.

We model two competing manufacturers who sell products through exclusive retailers in a differentiated market. A key attribute of this channel is that retailers make decisions about both retail prices and the level of in-store service to provide to customers. The market is stylized with two types of customers who differ in both their sensitivity to price and their valuations for in-store service. As noted by Winter (1993), these two attributes are positively correlated across customers (i.e. customers who are price insensitive place a high value on service because of its time-saving character). Thus, in our model, customers who require high levels of service are also less price sensitive. The gray goods have the effect of removing price-sensitive customers from the market. This has a significant impact on both the incentives for providing service and optimal pricing.

We demonstrate that even if gray goods are leaked at marginal cost to a third party (hence, generating no profit to the manufacturer), gray marketing can increase profits for manufacturers when the differences in price sensitivity between customers are high. However, this effect is mitigated by a tendency of retailers to "over-compete" in terms of service when a market is very responsive to service. In short, when price-insensitive customers are highly service sensitive, competitive retailers have a tendency to "over-invest" in service. In such a situation, manufacturers will try to prevent gray marketing and keep price-sensitive as well as service-sensitive customers in the authorized market. When price-insensitive customers are highly service sensitive, keeping price-sensitive (non-service-sensitive) customers in the authorized market reduces the problem of over-competition in terms of service.

The model also provides a compelling explanation for the growth of gray markets based on the natural evolution of an aging population. An aging population desires more in-store assistance and personalized service and our analysis shows this endogenously leads to an increase in the prevalence of gray marketing. In addition, the model offers a perspective on most likely timing for gray markets within a category, based on the category's maturity.

I. Introduction

A quick scan of today's business press reveals that one of the most pressing issues for global marketers is the existence and persistence of gray markets¹. Gray marketing is the sale of authorized, branded product through unauthorized distribution channels – usually bargain/discount outlets that provide less customer service than the authorized channels do. A great variety of products is sold through gray markets, including Swatch watches, designer clothing, and other chic apparel items. Gray marketing can be contrasted with black marketing, or counterfeiting, which involves selling fake goods as branded ones. Counterfeiting remains illegal in almost all world markets; in contrast, gray marketing is in many cases completely legal (see Weigand 1991 for a discussion of the laws in the United States, and Assmus and Wiese 1995, p. 33, for the European situation).

Several factors create an environment ripe for the development of gray markets. One is the practice of pricing differently to different geographic markets, whether because of taxation or exchange rate differences or simply because of differences in price sensitivity across regions. For example, foreign companies producing and selling in the People's Republic of China sometimes must compete for sales with smugglers who sell branded product that has been exported out of China and then re-imported into China to avoid local taxes (in this case, while the product is authorized branded product, it is categorized as illegally “smuggled” product because of the avoidance of import taxes upon its re-entry into the PRC) (Smith 1995).

Alternatively, it may be that domestic products are sold through high-service, high-price channels at home, opening up an opportunity to introduce gray-marketed goods through discount retailers. The Japanese discount chain, Jonan Denki, has been known to cover all

¹ A small recent sampling of articles on the topic includes “Pasona non grata” (1996); Doyle (1997); “Drug trafficking” (1996); “When the walls come down” (1997); Rice (1995); Hofmeister (1994); and Smith (1995).

the expenses of taking employees on post-Christmas shopping sprees to Europe, where they shop the sales at designer outlets like Louis Vuitton and Chanel, bring the goods back to Japan (legally), and then put them on sale in Jonan Denki stores at a price lower than the prevailing retail prices at authorized outlets in Japan (“Shop tactics in Tokyo” 1994). Another Japanese entrepreneur, Yasuyuki Nambu, runs a chain of off-price designer business clothing retailers in Japan called Designers’ Collezione. He uses a network of worldwide buyers to look for products that are subsequently sold at prices 30-35 percent less than those charged by standard clothing retailers (“Pasona non grata” 1996).

Clearly, a trend toward the development of emerging markets and the world-wide liberalization of trade also favors the growth of gray markets. These economic fundamentals create incentives for firms to capitalize on brand equity and volume potential by offering similar products across different countries. The problem with this strategy, however, is that optimal prices vary substantially across countries due to differences in exchange rates, purchasing power and supply side factors (for example, distribution, servicing, and taxes). Of course, the minute that price differences exist across boundaries or territories, substantial gains are available through arbitrage (Marshall 1998). This, in large part, explains the growth of gray markets.

While consumers frequently gain from the availability of gray goods (due to their lower prices), other members of the channel are often circumspect in their attitude towards them. Manufacturers complain that gray goods impair their ability to charge different prices in different markets. In addition, if service levels provided by gray market retailers are lower than those of authorized dealers, brand equity may suffer. Gray goods may be a concern for manufacturers but frequently the noisiest critics of the escalation in gray marketing are authorized dealers. Gray markets unequivocally erode potential volume for authorized dealers and may place severe pressure on after-sales service functions. All in all, this

suggests that gray markets are generally bad: when it is feasible to intercept and monitor gray goods, it seems always to be in a producer's interest to do so.

Despite the many arguments against gray markets, it is curious that they not only continue to exist but are estimated to be growing at an astonishing rate of 20% per annum categories [Assmus and Wiese (1995) quoting estimates from Cross, Stephans, and Benjamin (1990)]. Further, gray markets seem particularly active in countries like the U.S., Canada, and the European Union, where manufacturers have both the means and in some cases the legal framework to stop them. Mattel Canada, the Canadian marketer of Nintendo, obtained relief in the matter of preventing the importation of gray Nintendo goods by a gray marketer and more recently Heinz Canada obtained an injunction against a gray marketer to halt the importation of “gray market” ketchup from the U.S.² Despite the evidence that manufacturers do have legal recourse to limit the proliferation of gray goods, in most cases, there is limited evidence of their doing so. For example, Banerji (1990) finds a relatively small number of prosecutions of authorized IBM resellers found to have gray-marketed product to unauthorized dealers. There are even indications that manufacturers may be positively disposed towards gray markets. Bucklin (1993, p. 388) cites testimony given to the U.S. Customs Service that manufacturers themselves “find it advantageous to divert sales from their intended destinations” and Assmus and Wiese (1995) cite Maskulka and Gulas (1987) as reporting that large U.S. retailers like K Mart routinely stock items purchased on the gray market. Bic Camera in Japan, with at least seven retail stores, buys everything from “cardigans to contact lenses” from “friendly third parties” to resell at discount; the company “claims that at least one manufacturer, which once viewed the discounter as an enemy, now supplies it” (“Japan shops the Wal-Mart way” 1993). These examples suggest that there may be other incentives at work beyond the negative ones noted above, incentives that temper

manufacturers' negative views toward gray marketing and cause them to fail to suppress gray markets (or even to have an incentive to support them).

We investigate the genesis of these incentives, proposing an alternative perspective for gray markets in a game theoretic framework. Without resorting to the argument that gray marketed products are sold at a positive profit for the manufacturer, we demonstrate that it can be in the interest of manufacturers to encourage the availability of gray goods. The rationale for this finding is that gray goods indirectly affect the nature of competition in authorized markets by siphoning away certain types of consumers.

We model two competing manufacturers who sell products through exclusive retailers in a differentiated market. A key attribute of this channel is that retailers make decisions about both retail prices and the level of in-store service to provide to consumers. The market is stylized with two types of consumers who differ in both their sensitivity to price and their valuations for in-store service. As noted by Winter (1993), these two attributes are negatively correlated across consumers (i.e. relative to price-sensitive consumers, consumers who are price insensitive place a higher value on service because of its time-saving character). Foot with Stoffman (1997) further underline the negative relationship between price and in-store service:

“A young person has little money and lots of time...she checks out every store in town because every dollar saved is important and, what's more, she has plenty of time to hunt for bargains....A middle-aged person has more money but less time....He is not going to spend his precious time doing comparison shopping....He may even pay extra (for service)... because the time saved is worth more than the additional cost” (p.81).

We use this logic in our model to assume that consumers who require high levels of service are also less price sensitive. The gray goods have the effect of removing price-sensitive consumers from the market. This has a significant impact on both the incentives for providing service and optimal pricing.

² See *Mattel Canada Inc. vs. Pierce* [1989] 27 C.P.R. (3d) 552 and *H.J. Heinz Co. of Canada vs. Edan Food*

We demonstrate that even if gray goods are leaked at marginal cost to a third party (hence, generating no incremental profit to the manufacturer), gray marketing can increase profits for manufacturers when the differences in price sensitivity between consumers are high relative to the differences in service sensitivity. When consumer segments differ greatly in their price sensitivity, the gray market serves the valuable role of attracting price-sensitive consumers, leaving price-insensitive customers in the authorized market. This reduces price competition between manufacturers in the authorized market, thus creating an opportunity for increased profits. However, this benefit is eliminated when the price-insensitive consumers left in the authorized market are extremely service-sensitive because retailers have a tendency to "over-compete" in service when the market is very responsive to service. In this situation, price-sensitive consumers have positive effects on authorized market competition because they reduce retailers' tendency to "over-compete" in service. Thus, when the between-segment differences in service sensitivity are great relative to the between-segment differences in price sensitivity, the benefit of reduced price competition (by attracting price-sensitive consumers to the gray market) is outweighed by the cost of losing the profit associated with these customers and the cost of increased service competition. In such a situation, manufacturers will not support the creation of gray markets as it is more profitable to keep all consumers in the authorized market.

Our model also provides an explanation for the recent increase in the quantity of gray marketing of luxury/fashion goods in western developed countries. A pervasive characteristic of western developed countries is the aging of their populations. As noted by demographers, this leads to an increase in the size of the segment of the population desiring higher quality and personalized service³. As manufacturers shift their distribution emphasis to smaller shops meeting these desires, our model shows how this endogenously leads to an increase in the

Sales Inc. [1991] 35 C.P.R. (3d) 213.

prevalence of gray marketing.

In what follows, we first position our work relative to the existing literature on gray markets and then describe our model structure and solution methods. We report the analytic results from the model, illustrated with some numerical examples. We discuss some insights for the management of gray markets under changing demographic conditions.

II. Review of the Literature

In general, academics have approached the topic of gray markets from an institutional perspective. Weigand (1991), Cespedes, Corey and Rangan (1988) and Cavusgil and Sikora (1987) take the position that gray markets are a problem for manufacturers for a number of reasons that include losing control of distribution, a decreased ability to price discriminate and the potential erosion of brand equity. The authors examine the alternatives open to manufacturers to limit both the impact and magnitude of gray goods in focal markets. The business press, many examples of which are cited in the Introduction, also takes the point of view that gray markets are a negative force in distribution channel management and seek to identify ways to prevent gray marketing from occurring.

Banerji (1990) and Bucklin (1993) consider the impact of gray markets using analytical models. Banerji (1990) models a monopolist's price-discrimination motivation for gray marketing and shows winners and losers in the channel. A limitation of this analysis is that substantial gray marketing occurs in the context of a competitive industry. Similarly, Bucklin (1993) approaches the market from the perspective of a monopolistic manufacturer who chooses between various distribution policies in the context of gray marketing. Interestingly, Bucklin identifies the possibility that gray markets are not always negative for manufacturers: price erosion in the home market is frequently offset by an increase in unit

³ A thorough discussion of these demographic changes is provided by Foot with Stoffman (1996).

sales. Nonetheless, these conclusions are made in the absence of competitive factors and it is here that we will attempt to broaden our understanding of gray markets.

In summary, most of the literature focuses on negative aspects of gray marketing and suggests that gray marketing only benefits the manufacturer if (a) it expands the market for the product, thus generating incremental profits for the manufacturer, (b) it enhances the manufacturer's ability to price discriminate between consumer segments, or (c) it helps the manufacturer dispose of unwanted extra inventory.

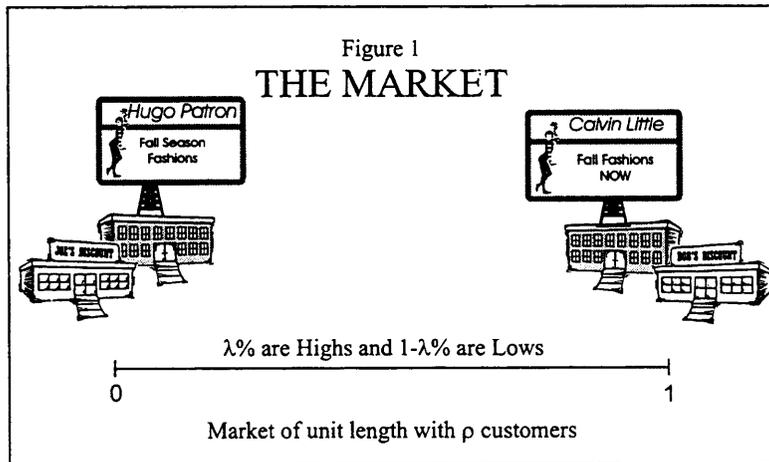
Our model controls for the profit motive in gray marketing by assuming that any product sold to the gray market by the manufacturer is done so at marginal cost, eliminating incremental profits as a motive. Further, all consumers are modeled as willing to buy the product even when it is offered only in the authorized market, so one cannot argue that our results derive from an expansion of the market. Excess inventory is also known to provide a basis for gray goods⁴; however, we wish to focus on the competitive incentives for gray marketing and as such, we develop a model where inventory does not play a role. Finally, price discrimination remains a factor in our market, but the ability of the gray market to enhance price discrimination is shown to be an insufficiently strong incentive to foster the gray market in all situations. Instead, it is the combined effects of price-sensitivity differences *and* service-sensitivity differences that are critical in determining the attractiveness of a gray-marketing strategy for the manufacturer. Our results thus enhance our understanding of the forces supporting and encouraging the growth and existence of gray markets by accounting for competitive and segmentation factors, along with channel relationships.

⁴ Digital Equipment Corporation sells product at the end of each quarter to resellers, not all of whom are authorized (Doyle 1977).

III. Model Structure and Solution Method

A. Structure of the Market and the Rules of the Game

We use a location-modeling format to structure the market. As in Hotelling (1929), consumers are assumed to be distributed uniformly along a line of unit length, and we assume that one authorized retailer is positioned at either end of the line (see Figure 1).



Each authorized retailer is exclusive to one manufacturer, and each manufacturer sells through only one authorized retailer; hence the two manufacturers' product offerings are positioned at the ends of the unit line. We assume that the retailers are each located inside a shopping mall, in which a discount retailer (who might sell gray-marketed goods) also is located. Thus, if a manufacturer chooses to gray-market its goods, the gray-marketed products will reach the discount retailers at both ends of the unit line.⁵

The products offered by the two manufacturers are assumed to be physically undifferentiated, so that there is no quality (vertical) differentiation based on physical product design; but there is locational (horizontal) differentiation in the form of different physical locations of the retail stores. In addition, the two channels can also compete in non-price service offered along with the product (service provision can be viewed as a form of vertical differentiation of the total offering in the market). Consumers value low price, low transportation costs, and high service levels, although the marginal valuations for these varies

across segments in the market. Each consumer buys at most one unit of the product.

We model consumers, retailers, and manufacturers as rational and maximizing actors (the consumers maximizing consumer surplus, and the retailers and manufacturers maximizing profits). We assume full information is available in the market, thus abstracting away from factors like future demand uncertainty that could cause manufacturers to be “surprised” when demand is less than forecast, leaving them with inventory to get rid of (potentially in the gray market). Here, by contrast, any gray market activity is purposefully planned for and is based on profit-maximizing behavior by manufacturers.

The market we consider has two periods in which product can be made available through authorized dealers. In period 1, *only* authorized dealers offer the product for sale. Gray market goods cannot become available until period 2; thus, anyone willing to buy gray market goods must be willing to wait to do so until the second period. Later in the paper we discuss the significance of this assumption. Further, we assume that gray marketers offer no service to the consumers of their goods. While there could be some service offered in a real-world gray marketing retail operation, empirically gray marketers are renowned for being less service-oriented than authorized retailers. These assumptions are particularly realistic in many fashion goods markets, where gray marketers gain access to designer-label goods at the end of a season or in the next season and support low prices with low service levels.

All players are assumed to be fully informed and fully rational, and Nash competition prevails at each level of the channel. Manufacturers are assumed to Stackelberg-lead retailers. Further, consumers’ decisions are assumed to be both individually rational and incentive-compatible. Individual rationality implies that consumers will only participate in the market if doing so provides them with a positive benefit. Incentive compatibility means that each consumer in the market will purchase from the retailer (or discounter) that provides

⁵ We clarify the mechanism by which gray-marketed goods reach the retail level later in the paper.

him/her with the maximum benefit.

The market unfolds in three stages as follows:

Stage 1: manufacturers decide their gray market policy, i.e. they decide whether or not to “leak” product to the gray market.

Stage 2: authorized market competition occurs in period 1. In particular, manufacturers pick wholesale prices, authorized retailers pick service levels and retail prices, and the authorized market opens and consumers decide where and when to shop.

Stage 3: (occurs only if there is a gray market): the gray market opens in period 2. Discounters sell gray goods and consumers (if they have not already bought) choose whether to buy in the gray market.

In solving the model, we use the concept of subgame perfection, and hence solve the game recursively from the last stage forward.

A. Structure of Demand

While there are many types of consumers in the real world, we consider a stylized market with two consumer segments, which provides sufficient richness to examine the incentives for gray marketing. 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, which is often correlated with a high income level. The other segment, the “Lows,” has a lower time cost. We assume that a proportion λ of consumers are “Highs,” and $(1-\lambda)$ are “Lows.” There are ρ consumers in total in the market.

Because of their overall higher time cost, Highs face a higher cost of travel to shop for bargains. They also value service more highly than Lows, because service tends to produce value by lowering the time cost of shopping. Consider, for example, the “personal shoppers” now available at many upscale department and specialty stores; these shoppers (who are retail store employees) choose clothes and accessories before their time-constrained, price-insensitive clients arrive at the store, thus saving the consumer the time and effort necessary to find merchandise. While there is no extra charge for using a personal shopper, consumers who do so typically pay full retail price and get current-season fashions. Such consumers are

prototypical “Highs.” Highs are also more likely to value consuming a product sooner rather than later, again because of the high opportunity cost of not having the product for a period of time. But the Lows may be more willing to wait to get a product, because their valuation of the product may be low enough that early consumption does not generate enough utility to compensate for the costs of doing so, which include incurring purchase and travel costs earlier and paying for unwanted service.⁶

More formally, the following functions describe the consumer surplus enjoyed by a High-type consumer, located at point x on the unit line, and shopping at authorized retailer 1 and authorized retailer 2, respectively (where retailer 1 is located at the point labeled 0 in Figure 1, and retailer 2 is located at the point labeled 1 in Figure 1):

Surplus Function for Highs at Authorized Retailers

$$CS_{H1} = V_H + \theta S_1 - x t_H - p_{1A} + \delta V_H \quad (1)$$

$$CS_{H2} = V_H + \theta S_2 - (1-x) t_H - p_{2A} + \delta V_H \quad (2)$$

V_H is the per-period utility to a High consumer of consuming the product (thus, second-period consumption is discounted at rate δ). S_i ($i=1,2$) is the level of service provided by authorized retailer i , and θ (>0) is the marginal valuation of service by High consumers. The parameter t_H is the unit cost of travel for a High, and p_{iA} ($i=1,2$) is the retail price at authorized retailer i .

If a High located at x were to wait until the second period to consume gray market goods, her consumer surplus from discounter 1 or 2, respectively, would be:

Surplus Function for Highs at Discounters offering Gray Goods

$$CS_{H1,GM} = \delta (V_H - x t_H - p_{1,GM}) \quad (3)$$

$$CS_{H2,GM} = \delta (V_H - (1-x) t_H - p_{2,GM}), \quad (4)$$

⁶ Note that it is certainly possible for Lows to have a high enough valuation for a product to want it immediately rather than being willing to wait. If all consumers value the product so highly that none are willing to wait for a product, gray-marketed goods that appear later will not find a ready market of buyers. We focus here instead on the interesting case where the Lows are willing to wait and identify the conditions associated with that case.

where $p_{i,GM}$ is the retail price at gray market retailer i . Remember that buying gray market product means waiting until period 2 to consume, and also means buying with no associated service. However, the gray market price is paid instead of the authorized-dealer price. We assume that no High will wait for gray market product to appear in stores in period 2. Formally, this means that $CS_{HI} > CS_{HI,GM}$ if buying from a retailer located at $x=0$ on the unit line (an analogous condition holds for retailers located at $x=1$ on the line):

$$(1 + \delta) V_H + \theta S_1 - x t_H - p_{1A} > \delta (V_H - x t_H - p_{1,GM}) \Rightarrow \Rightarrow.$$

$$V_H + \theta S_1 > (p_{1A} - \delta p_{1,GM}) + [(1 - \delta) x t_H] \quad (5)$$

The left-hand side of the inequality above is the incremental benefit to a High of consuming in the authorized market, and consists of the valuation for the product, V_H , plus the value of service consumption in period 1, θS_1 . The right-hand side is the incremental benefit for a High-type consumer were she to wait to consume in the gray market. This gain consists of the difference in (discounted present value of) price between the authorized and gray markets, plus the difference in (discounted present value of) travel costs when buying in the authorized versus gray markets. Only if the incremental benefit of consuming in the authorized market outweighs that of consuming in the gray market will Highs wait. We assume that V_H is high enough to guarantee that this condition holds for the limiting case of a consumer located at $x=1/2$ (at $x=1/2$, travel cost savings of buying in the gray market are maximized).

Meanwhile, a Low located at point x on the unit line would derive consumer surplus from shopping at authorized retailers 1 and 2, respectively, of:

Surplus Function for Lows at Authorized Retailers

$$CS_{L1} = V_L - x t_L - p_1 + \delta V_L \quad (6)$$

$$CS_{L2} = V_L - (1 - x) t_L - p_2 + \delta V_L \quad (7)$$

Without affecting the qualitative nature of our results, we specify the assumption of lower

marginal valuation on service by Lows by assuming that that marginal valuation is in fact zero. Further, the transportation cost per unit traveled for Lows, t_L , is assumed to be less than t_H , the analogous cost for Highs, consistent with the difference in their time valuations. Finally, we assume that $V_L < V_H$, that is, that Lows place an overall lower valuation on the product than do Highs. As previously discussed, this assumption is based on the general observation across markets that people who are price-insensitive are willing to pay more for products.

Similarly, a Low located at point x on the unit line derives consumer surplus from shopping at gray-market discounters 1 and 2, respectively, of:

Surplus Function for Lows at Discounters offering Gray Goods

$$CS_{L1,GM} = \delta (V_L - x t_L - p_{1,GM}) \quad (8)$$

$$CS_{L2,GM} = \delta (V_L - (1-x) t_L - p_{2,GM}) \quad (9)$$

As with the Highs, a Low who chooses to buy gray marketed products waits until period 2 to consume, but pays the gray market price rather than the authorized-market price.

We assume that consumers choose where and when to shop to maximize their consumer surplus. This means that both the choice of which end of the market to shop at, and the choice of whether to shop now in the authorized market or to wait until the second period to shop in the gray market, are subject to consumer deliberation and choice. In particular, it is useful to represent mathematically the consumer in each segment who is just indifferent between shopping at authorized retailer 1 and authorized retailer 2, given prices and service levels, since all consumers closer to retailer 1 than the indifferent consumer will in fact shop at authorized retailer 1 (unless they shop in the gray market), and all consumers closer to retailer 2 than the indifferent consumer will in fact shop at authorized retailer 2 (unless they shop in the gray market). The indifferent consumer in segment j ($j=H$ for Highs and $j=L$ for Lows), located at some point on the line denoted by x_j^* , equates the consumer surplus from

shopping at authorized retailer 1 with that from shopping at authorized retailer 2, and is thus defined by:

$$x_j^* = \frac{t_j + \theta_j (S_1 - S_2) - p_1 + p_2}{2 t_j} \quad (10)$$

where $\theta_j = \theta$ for $j=H$ and $\theta_j = 0$ for $j=L$.

We assume that the utility offered by the product is great enough for all consumers to buy, i.e., individual rationality is satisfied for all consumers, so there are no consumers who are deterred from purchase. With a symmetric outcome, the Low consumer located at $x=1/2$ is the least likely to buy in the authorized market, because her transportation cost is highest and she gets no utility from service⁷. If her consumer surplus from consuming in the authorized market is positive, then there will be no “holes” in the market. Formally, this condition is met when $V_L \geq V_{MIN}$, where V_{MIN} is given by:

$$V_{MIN} = \left(\frac{1}{1 + \delta} \right) \left(\frac{t_L}{2} + p_A \right) \quad (11)$$

and p_A is the retail price prevailing at authorized retailers when gray market product is unavailable.

Given our assumption that each consumer buys one unit of product, and that a proportion λ of all consumers are Highs, authorized retailer 1 gets sales of $\lambda \rho x_H^*$ units from Highs and in the absence of a gray market, $(1-\lambda) \rho x_L^*$ units from Lows. Authorized retailer 2 gets sales of $\lambda \rho (1-x_H^*)$ units from Highs and in the absence of a gray market, $(1-\lambda) \rho (1-x_L^*)$ units from Lows.

B. Authorized Retailer Characteristics

Authorized retailers are assumed to choose both the service level and the retail price

⁷ Our solution is not restricted to symmetric outcomes but we specify a priori the conditions associated with symmetric competition. We show later that the unique pure strategy equilibrium in this model is symmetric.

for their product in order to maximize their 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.

If there is no gray market, the authorized retailers serve both Highs and Lows, and their profit is therefore:

Authorized Retailer Profit with No Gray Market

$$\Pi_{R1} = \rho \cdot (p_1 - w_1) \cdot [\lambda \cdot x_H^* + (1-\lambda) \cdot x_L^*] - (S_1)^2 \quad (12)$$

$$\Pi_{R2} = \rho \cdot (p_2 - w_2) \cdot [\lambda \cdot (1 - x_H^*) + (1-\lambda) \cdot (1 - x_L^*)] - (S_2)^2 \quad (13)$$

where x_j^* (as defined above) is the consumer in segment j ($j=H$ being the Highs and $j=L$ being the Lows) who is just indifferent between shopping at retailer 1 and retailer 2.

We show below that if there is a gray market, it is optimal for either of the manufacturers to supply enough product to serve *all* the Lows, so that only Highs remain in the authorized market. In this case, authorized retailer profit is based only on sales to Highs and can therefore be expressed as:

Authorized Retailer Profit with Gray Market

$$\Pi_{R1} = \rho \cdot (p_1 - w_1) \cdot [\lambda \cdot x_H^*] - (S_1)^2 \quad (14)$$

$$\Pi_{R2} = \rho \cdot (p_2 - w_2) \cdot [\lambda \cdot (1 - x_H^*)] - (S_2)^2 \quad (15)$$

C. Manufacturer Characteristics

Manufacturers are also assumed to be profit-maximizers, and act as Stackelberg leaders relative to the retailers. Manufacturers choose the wholesale price at which they will supply product to the authorized market. We assume that if manufacturers supply the gray market, they do so at marginal cost. As discussed above, we make this assumption so that any gray marketing predicted by the model is clearly understood to arise from strategic and

competitive factors and not from market-expansion factors or gray-market profits per se.⁸

Both manufacturers face a constant marginal cost of c . In the case where manufacturers decide not to supply gray-market product, they make profit from both Lows and Highs, and their profits are:

Manufacturers' Profit with No Gray Market

$$\Pi_{M1} = \rho \cdot (w_1 - c) \cdot [\lambda \cdot x_H^* + (1 - \lambda) \cdot x_L^*] \quad (16)$$

$$\Pi_{M2} = \rho \cdot (w_2 - c) \cdot [\lambda \cdot (1 - x_H^*) + (1 - \lambda) \cdot (1 - x_L^*)] \quad (17)$$

Meanwhile, if they do choose to supply product to the gray market, they make profits only on sales to the Highs in the authorized market, and their profits are:

Manufacturers' Profit with Gray Market

$$\Pi_{M1} = \rho \cdot (w_1 - c) \cdot [\lambda \cdot x_H^*] \quad (18)$$

$$\Pi_{M2} = \rho \cdot (w_2 - c) \cdot [\lambda \cdot (1 - x_H^*)] \quad (19)$$

Manufacturers weigh the profitability of supplying or not supplying the gray market by comparing the profit functions above, understanding the implications of their choices for retail prices and service levels. While supplying the gray market means losing profits on Lows in the authorized market, the strategic question is what impact that will have on the prices and service levels (and hence the profitability) of serving the Highs in the authorized market.

D. Gray Marketers and the Workings of the Gray Market

Gray marketing is generally facilitated by gray marketers, who are independent exporters or agencies, whose business is that of trans-shipping and supplying product obtained at advantageous costs. A recent trade magazine contains advertising for a company

⁸ Market expansion with product priced at marginal cost yields no benefit to the manufacturers.

that offers to buy manufacturers' product in exchange for trade credits on advertising; the company, Tradewell, then sells the product into alternate channels.

“At Tradewell, our policy is to complement, not compete with, our clients' established distribution methods. To accomplish this, we have developed a wide range of channels of trade worldwide. The client's guidelines always determine where the products will be re-marketed. The products are shipped directly from your warehouse to our ultimate customer.”

Examples of the routes gray goods follow before reappearing in the focal market are discussed by Stern, El-Ansary and Coughlan (1996). Many firms are engaged in this activity, so we assume that rents (i.e., profits beyond a normal rate of return) in this activity are competed away. These gray marketers in turn sell to discount retailers, who possess a degree of price-setting ability due to their locational advantage in serving the retail trading area associated with their shopping mall. Consumers close to a mall will pay more in order not to have to travel the extra distance to a mall further away. As a result, gray market discount retail prices of $p_{GM}=(c+t_L)$ will be observed, yielding small but positive profits for discount retailers at the end of the gray-market channel.⁹

At this price level, two things must be true for gray marketing to be feasible. First, Highs must be unwilling to wait until the second period to consume at the low gray-market price. As discussed in the demand section above, this condition is satisfied for high enough values of V_H . The other condition for gray marketing to be feasible is that Lows must *prefer* to wait until the second period to consume at the gray-market price. Formally, this condition must hold for all Lows in the market given the pricing policies that discounters will adopt. Assuming that the equilibrium in the gray market is symmetric, we identify the following condition for the discounter located at $x=0$ (an analogous condition holds for the discounter located at $x=1$):

$$\delta \cdot (V_L - x t_L - p_{1,GM}) > (1 + \delta) \cdot V_L - x t_L - \hat{p}_{1A} \Rightarrow \Rightarrow$$

⁹ See the Technical Appendix for a derivation of the gray-market retail price.

$$V_L < V_{MAX} \equiv \left[\hat{p}_{1A} - \delta \cdot p_{1,GM} \right] + \left[(1-\delta) \cdot x t_L \right] \quad (20)$$

where $p_{1,GM}$ = retail price for gray goods at discounter 1 = $c+t_L$ and \hat{p}_{1A} is the most attractive price a Low would observe in the authorized market¹⁰. The first square-bracketed term above is the difference in the (discounted present value of) retail price paid at the authorized and gray-market outlets, and the second square-bracketed term is just the difference in the (discounted present value of) transportation costs from buying in period 1 in the authorized market versus in period 2 from the gray market. Thus, the condition guaranteeing the Lows' willingness to wait is that the advantages of shopping in the gray market – namely, lower pricing and delayed traveling expenses – must exceed the benefit of getting an extra period's worth of consumption in period 1 in the absence of a gray market. In particular, the condition is most binding for the consumers located at either end of the market where travel costs are zero (and hence there is no benefit of delaying travel). We assume in what follows that the condition holds even at its most binding.

Note that these are necessary, but not sufficient, conditions for the occurrence of gray marketing. Because gray marketing is a choice variable for manufacturers, it will only occur when both these conditions hold *and* manufacturers make more profit by supplying the gray market.

Thus, in the discussion of model results below, we first examine the constraints defining feasibility of the gray market, and then show the conditions under which gray marketing is profitable, given that it is feasible.

IV. Analytic Results from the Model

In this section, we first calculate and contrast the equilibrium prices, service levels, and profits without a gray market and with a gray market in which all Lows buy, for

manufacturers and retailers. We use the equilibrium prices calculated to show the existence of regions in which gray marketing is in fact feasible, that is, where (a) the participation constraint is satisfied (all consumers buy); (b) the waiting constraint is satisfied (Lows are willing to wait until period 2 to consume gray-market product); and (c) Highs are unwilling to wait until period 2 to consume gray-market product. This analysis establishes the *feasibility* of gray marketing: that is, when gray-market product is supplied, all Lows will in fact buy in the gray market and all Highs will not. Given such a feasible region, it still remains to be established whether gray marketing is in fact *profitable* for the manufacturers. We first show the existence of conditions under which gray marketing to all Lows is more profitable than not to have a gray market at all – thus gray marketing can be profitable from the manufacturers’ standpoints. We next show that whenever it is profitable to supply product to the gray market, it is in manufacturers’ best interests to supply enough gray market product to serve *all* Low-type consumers.

A. Characterization of Equilibrium With and Without the Gray Market

Equilibrium values of wholesale prices, retail prices, retail service levels, and manufacturer and retailer profits, for these two polar cases, are reported in Table 1 below, and the solution process is described in the Technical Appendix. The symmetry of the problem generates equal values of these variables for both products.

Service levels and retail prices are clearly higher with gray marketing than without it. This is a direct result of the withdrawal of Lows from the authorized market under gray marketing. When both Lows and Highs are served in the authorized market (i.e. gray goods are unavailable), retail pricing and service levels must strike a balance between the two segments’ demands; since Lows do not value service, and have a lower cost of store-

¹⁰ In the authorized market, the lowest price possible occurs when *all* Lows remain in the authorized market.

switching, downward pressure on both service and retail price levels is exerted when they are present in the market. But under gray marketing, only the Highs need be served, and hence service and retail price levels can rise. Similarly, authorized retail margins $(p_i - w_i)$ under gray marketing (equal to t_H per unit) exceed those in the absence of gray marketing (equal to $t_H t_L / \tau$ per unit), but interestingly, neither retail margin is influenced by θ (the service sensitivity of demand of Highs) or c (the marginal cost of production).

TABLE 1: Equilibrium Values Under No Gray Marketing and Gray Marketing

VARIABLE	EQUILIBRIUM VALUE UNDER:	
	NO GRAY MARKETING	GRAY MARKETING
Wholesale prices ($w_1 = w_2$)	$\frac{3t_H t_L}{\tau} - \frac{\theta^2 t_L^2 \lambda^2}{3\tau^2} + c$	$3t_H - \frac{\lambda \theta^2}{3} + c$
Authorized retail prices ($p_1 = p_2$)	$\frac{4t_H t_L}{\tau} - \frac{\theta^2 t_L^2 \lambda^2}{3\tau^2} + c$	$4t_H - \frac{\lambda \theta^2}{3} + c$
Authorized service levels ($s_1 = s_2$)	$\frac{\theta t_L \lambda}{6\tau}$	$\frac{\theta \lambda}{6}$
Manufacturer profit ($\Pi_{M1} = \Pi_{M2}$)	$\frac{3t_H t_L}{2\tau} - \frac{\theta^2 t_L^2 \lambda^2}{6\tau^2}$	$\frac{3t_H \lambda}{2} - \frac{\theta^2 \lambda^2}{6}$
Authorized retailer profit ($\Pi_{R1} = \Pi_{R2}$)	$\frac{t_H t_L}{2\tau} - \frac{\theta^2 t_L^2 \lambda^2}{36\tau^2}$	$\frac{t_H \lambda}{2} - \frac{\theta^2 \lambda^2}{36}$

Notes: $\tau = \lambda t_L + (1 - \lambda) t_H$.

ρ is normalized to equal 1 in profit expressions in this Table.

Although the retail price in the gray-market case is always higher than in the no-gray-market case, the same is not true of wholesale prices. The following Lemma establishes the relative position of the wholesale prices (where w_{NGM} and w_{GM} denote wholesale prices in the no-gray-market case and the gray-market case, respectively):

Lemma 1. *Wholesale prices in the gray-market and no-gray-market cases have the following*

$$\text{relationship: } w_{GM}^* \geq w_{NGM}^* \text{ as } \theta \leq \theta_1, \text{ where } \theta_1 = 3 \cdot \left[\frac{t_H \tau (\tau - t_L)}{\lambda (\tau^2 - \lambda t_L^2)} \right]^{\frac{1}{2}} \text{ and}$$

$\tau = \lambda t_L + (1 - \lambda)t_H$. *Further, both wholesale prices are positive for this value of θ .*

We investigate further below how this result is both explained by, and helps explain, our results on the profitability of gray marketing itself.

B. Gray Marketing as an Equilibrium Channel Strategy: Feasibility and Profitability

At these price and service levels, is gray marketing in fact feasible? To answer this, we need to check the participation and waiting constraints outlined above and verify that parameter ranges exist that guarantee that Lows prefer to shop in the gray market if it is available, while Highs prefer to shop in the authorized market. We already know that a high enough value of V_H will guarantee that Highs always prefer to shop in the authorized outlets. However, Lows must both be willing to buy ($V_L > V_{MIN}$), and wish to wait until the second period's gray market to do so ($V_L < V_{MAX}$). Combining these two constraints after substituting in the equilibrium values for retail prices in authorized and gray-market outlets, we arrive at the following:

Proposition 1. *If $\theta < \theta_2$, there exists a range of values into which V_L can fall such that gray marketing is feasible (meets both the participation and waiting constraints), where τ is*

$$\text{as defined in Lemma 1 and } \theta_2 = \frac{\tau}{t_L \lambda} \cdot \left\{ \frac{12 t_H t_L}{\tau} - 3 \delta c - 3 \left[1 + \delta + \frac{1}{2\delta} \right] t_L \right\}^{\frac{1}{2}}.$$

Intuitively, this criterion is more likely to be satisfied, the higher is t_H given a value of t_L , i.e., the greater is the discrepancy in price-sensitivity of Highs and Lows. It is also evident that the value of second period consumption is affected by the discount rate δ as well as the

prices. In fact, a minimal discount rate $\delta_{\text{MIN}} = \frac{4t_H t_L - \tau t_L - (16t_H^2 t_L^2 - 8t_H t_L^2 \tau - t_L^2 \tau^2 - 2t_L \tau^2 c)^{1/2}}{2\tau(t_L + c)}$ is

necessary for θ_2 to be a real positive number. Later in this section, we clarify the relationship of the discount rate to θ_2 using a numerical example. When θ satisfies the condition of Proposition 1, the range $\{V_{\text{MIN}}, V_{\text{MAX}}\}$ exists and we can further state that as the ratio of t_H to t_L increases so does the size of the range. Given the existence of the range, we now show when $V_{\text{MIN}} < V_L < V_{\text{MAX}}$ and gray goods are made available by manufacturers, the stable and unique equilibrium is for all Lows to purchase in the gray market.

Lemma 2. *If manufacturers create a gray market and $V_{\text{MIN}} < V_L < V_{\text{MAX}}$, all Lows will purchase in the gray market and it is a stable and unique market outcome.*

Assuming that the market conditions are such that Lows will unanimously choose to buy in the gray market if it exists, we now investigate the key issue: whether it is *profitable* for manufacturers to supply the gray market. To give some intuition into the problem, we first establish a Lemma concerning service provision in authorized dealerships:

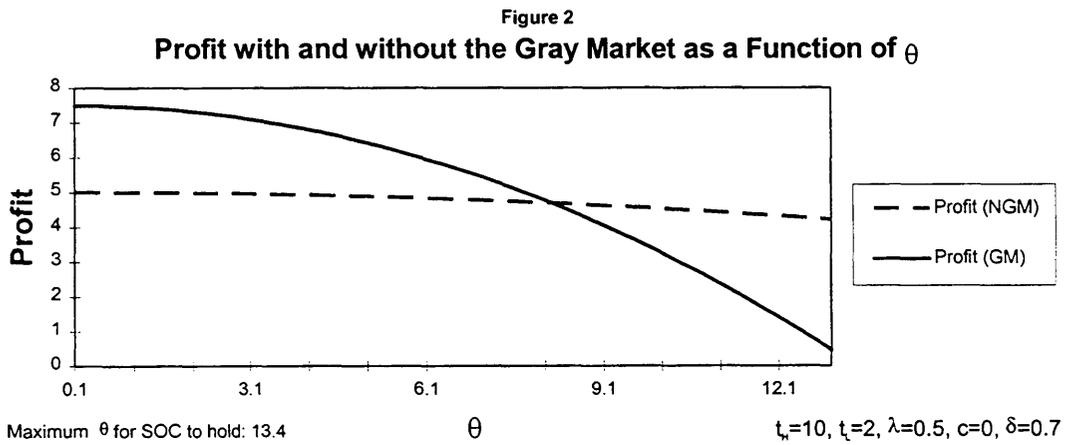
Lemma 3. *The optimal service level if collusion on service is possible is zero. Service levels in a competitive duopoly without a gray market are inefficiently high relative to the collusive level, and service levels in a competitive duopoly with a gray market are even higher than those without a gray market. Further, the departure from collusive service levels increases with θ , the service sensitivity of the High segment.*

Intuitively, gray marketing removes the least service-sensitive consumers from the authorized market, leaving only service-sensitive consumers in the market. The more service-sensitive these Highs are, the greater are authorized dealers' private incentives to provide service, exacerbating the previously noted tendency to over-invest in service.

Given this insight into service-provision incentives with and without a gray market, we now directly compare manufacturer profits in the two situations. Interestingly, despite the incentive to over-invest in service, and the loss of all profits from the Low segment, we demonstrate that there are still conditions under which a gray market is optimal:

Proposition 2. When $\theta < \theta_3$, where $\theta_3 = \frac{3}{\lambda} \cdot \left[\frac{\tau^2 \lambda t_H - \tau t_H t_L}{\tau^2 - t_L^2} \right]^{\frac{1}{2}}$ and τ is as defined in Lemma 1, manufacturers have a profit incentive to supply goods to the gray market and do little to prevent its existence¹¹.

We demonstrate the essence of Proposition 2 using a parametric example. In Figure 2, at low levels of θ , manufacturer profits with a gray market clearly exceed the profits earned without a gray market. However once θ exceeds θ_3 (in this example $\theta_3 \approx 8.22$), there is a switch and the profits without a gray market are higher.



In addition, given the condition on θ governing the optimality of gray marketing, we can also show the following result:

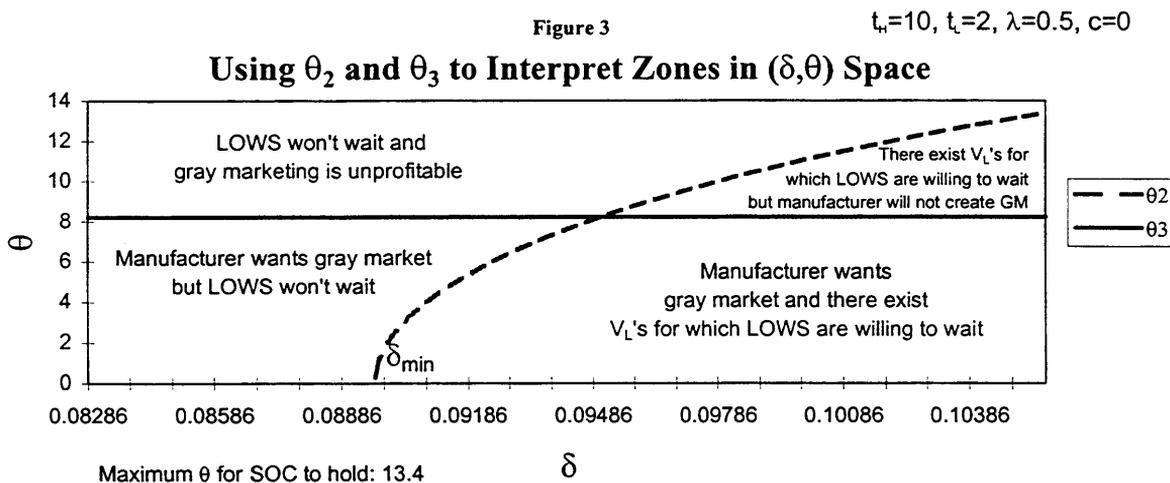
Lemma 4. $\theta_1 > \theta_3$, so that gray-market wholesale prices exceed no-gray-market wholesale prices whenever a gray market is optimal for the manufacturers. However, there is also a range where gray marketing is not optimal for manufacturers, even though wholesale prices under gray marketing exceed those under no gray marketing.

For gray marketing to actually occur, it is of course necessary both for Lows to prefer gray-market purchasing, and for manufacturers also to prefer supplying gray-market goods over restricting themselves to an authorized channel. Thus, gray marketing is an equilibrium channel strategy in our model only if the conditions in Propositions 1 and 2 simultaneously hold:

¹¹ θ_3 is positive and real for any value of $t_H > [(1+\lambda)/\lambda]t_L$, i.e. given λ , a minimum difference in the price sensitivities is necessary for the feasibility of gray markets.

Proposition 3. For θ a real number and $\theta < \theta_4$, gray marketing is the manufacturers' equilibrium distribution channel strategy, where $\theta_4 = \min\{\theta_2, \theta_3\}$, and where θ_2 is as defined in Proposition 1 and θ_3 is as defined in Proposition 2.

Thus, it is possible for consumers in the Low segment to prefer to shop in the gray market, but to be frustrated in their search for a lower-service, lower-price alternative to authorized product (when $\theta_3 < \theta < \theta_2$). Conversely, it is possible for manufacturers to be thwarted in their desire to sell in the gray market by Lows who are unwilling to wait to buy gray-market product (when $\theta_2 < \theta < \theta_3$). This situation, while rare, can occur when levels of δ are extremely low. In Figure 3, we use a simple parametric example to illustrate how these scenarios sub-divide (δ, θ) space into “zones”.



Our key result, Proposition 3, establishes that for low enough values of service sensitivity among High-type consumers, gray marketing can be optimal, even when it involves losing all profits on the Lows. The Lemmas augment our understanding of this result by showing that (a) gray-market wholesale prices exceed wholesale prices without a gray market only if service sensitivity is low enough; as service sensitivity increases, the difference between gray-market wholesale prices and no-gray-market wholesale prices diminishes and finally becomes negative (Lemma 1); (b) a necessary but not sufficient condition for gray markets is that wholesale prices in the context of a gray market exceed

those observed in the absence of a gray market (Lemma 4); and (c) inefficient over-provision of service is worse under gray marketing than without gray marketing, and worsens for both systems as service sensitivity increases (Lemma 3).

Putting these results together, we gain a fuller intuitive understanding of when and why gray markets can be optimal. First of all, for gray marketing to be profitable, manufacturers must be able to make at least as high a margin under gray marketing as without it, because of the need to compensate for the loss of sales and profits from the Lows. This explains the result in Lemma 4. However, Lemma 4 also implies that a higher manufacturer margin under gray marketing is not a sufficient condition for the superior profitability of gray marketing, since there are regions where gray-market wholesale prices exceed those without the gray market, yet gray marketing is not a profitable channel strategy for the manufacturers. The missing ingredient is the extent of pressure on authorized retailers to compete in service provision (for the Highs) when there exists a gray market. Here, Lemma 2 is helpful. It shows that over-provision of service is a problem regardless of whether or not there is a gray market; but it becomes a more severe problem when Lows are removed from the authorized market (i.e. when there is a gray market), because authorized retailers then serve only the service-sensitive Highs, and competitive pressures force the authorized retailers to increase service levels. The more service-sensitive are Highs (i.e. the higher is θ), the worse the inefficiency becomes and the higher service levels climb. As equilibrium levels of service in the authorized channel increase, the cost of providing that service also increases, putting pressure on profit margins. The optimal response at the manufacturer level is to take lower and lower wholesale margins, i.e. to lower wholesale prices. As wholesale prices drop, the profitability of gray marketing as a whole also falls, until for θ high enough, gray marketing is simply not worthwhile.

Thus, there are really two effects warring against one another in the battle for optimal

channel structure: differences in service sensitivity between segments, and differences in price sensitivity between segments. Lemma 5 clarifies the relationship between the profitability of gray marketing and the relative importance of price sensitivity and service sensitivity:

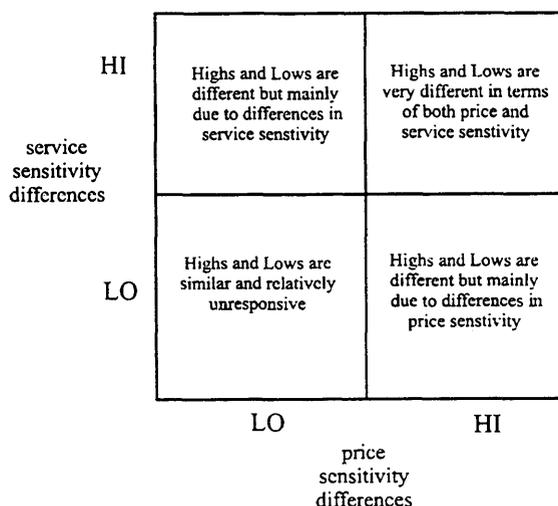
Lemma 5. *For a given value of θ , gray marketing is more likely to be profitable, the greater is the difference in price sensitivity between Highs and Lows (as measured by the ratio of t_H to t_L). Conversely, for a given difference in price sensitivity between segments, gray marketing is more likely to be profitable, the smaller is the difference in service sensitivities between segments (i.e., the lower is θ).*

The tension that occurs when gray marketing is used in the channel revolves around the desirability of a gray market to reduce price competition, counterbalanced by the tendency to overcompete in service provision. Further, there is the fact that gray marketing literally removes any profitable sales from the Low segment; so not only must the benefit of reducing price competition be stronger than the cost of overcompeting in service, but it must be strong enough to overcome the incremental loss of the profits on a segment of consumers. The benefit of reducing price competition through gray marketing is clearly greater, the greater is the difference in price sensitivity of Highs and Lows. Similarly, the loss that gray marketing brings through overcompetition in service is the least, the smallest is the difference in service sensitivities between Highs and Lows. We intuitively summarize this result with the help of Figure 4.

In the southeast quadrant of Figure 4, Lows are much more price-sensitive than Highs, but the two segments do not differ much in service sensitivity. Our results above indicate that this quadrant is most amenable to gray marketing, both because gray marketing offers strong benefits in terms of reduced price competition and because gray marketing means little worsening of service overcompetition. In contrast, in the northwest quadrant, Lows and Highs have very different service sensitivities, but are not very different in price sensitivity. This is the worst combination for gray marketing, because it combines the evils of

overcompetition in service with a relatively small benefit of reduced price competition. In the northeast and southwest quadrants, it is ambiguous whether or not gray marketing will be more profitable than serving all consumers through the authorized market, because in each of these quadrants, each channel strategy has one factor favoring it.

Figure 4
A Map of Customer Characteristics



C. Authorized Retailers and the Gray Market: Unwitting Victims or Willing Participants?

It is almost always argued in the business press literature that authorized retailers are hurt by the gray market. We can examine whether this contention is borne out in the context of our model, and in particular, investigate whether the manufacturers and authorized retailers are hurt by, or benefit from, the gray market in the same market situations. Proposition 4 below establishes that not only are the incentives for gray marketing unequal between manufacturers and authorized retailers, but also that authorized retailers benefit from the gray market whenever manufacturers do (and even at times when manufacturers do not!):

Proposition 4. *When $\theta < \theta_5$, where $\theta_5 = \sqrt{2} \cdot \theta_3$ and θ_3 is as defined in Proposition 3, authorized retailers prefer a channel that includes gray marketing to one with only authorized retailing.*

Since $\theta_5 > \theta_3$, the condition for authorized retailers to prefer gray marketing is strictly less

binding than that for manufacturers to prefer gray marketing. Thus, whenever manufacturers benefit from gray marketing, so do authorized retailers. Further, there are even parametric conditions (i.e., where $\theta_4 < \theta < \theta_5$) when the authorized retailers prefer to allow gray marketing but the manufacturers do not!

Because in these situations the manufacturers will not voluntarily move product to the gray market, the question arises whether the authorized retailers can themselves profitably do so. If we maintain the hypothesis that the gray market goods are supplied at marginal cost, then authorized retailers should have the option of passing product to gray marketers at a transfer price of w_{NGM}^* , the equilibrium wholesale price in the no-gray-market case. We have identified areas of parameter space where it is possible for authorized retailers to increase their profits through such a transfer (given w_{NGM}). However, this observation does not affect the optimal channel policy for manufacturers. Even if the conditions were such that retailers decided to supply gray marketers when manufacturers did not, manufacturers' profits would be unchanged assuming they maintained a wholesale price of w_{NGM}^* .¹² In any case, the incentive for the manufacturers to leak product to the gray market is reduced when authorized dealers decide to create the gray market themselves. Not only do manufacturers benefit from reduced price competition in the authorized market but they also have the Lows buying product at full wholesale price (i.e. not at marginal cost).

Given these insights, it should come as no surprise that manufacturers, or even authorized retailers, fail to completely suppress gray marketing, since in reality it may be even more profitable than suggested by our analysis.

¹² In equilibrium, the optimal wholesale price would in fact exceed w_{NGM}^* , and manufacturers' profits would strictly increase.

D. Authorized Retailers Get Product First

An important assumption we make is that gray goods are only available (if at all) after consumers have had a chance to consider purchasing them from authorized retailers. In this section, we discuss the basis for this assumption and second, we demonstrate that the intuition for our results obtains not from the two-period nature of the model but because of the manner in which gray markets affect competition in the authorized market.

The main reason that we model gray goods as appearing in discounters after product has been available for some time in authorized retail outlets is that it is consistent with empirical observation. Be it fashion clothing, perfume or *Swatch*® watches, if a consumer wants to be the first in town to have the latest release, her best bet is to shop at the authorized retailers.

Second, gray marketing is invariably associated with the trans-shipment of products from other geographic territories (Stern, El-Ansary and Coughlan 1996). In addition, title to the product typically also passes through several middlemen before reappearing in the focal market. In order for gray goods to compete with authorized product in the first period, a necessary but dubious assumption is that these additional transfers occur instantaneously.

Third, perhaps the only alternative for a manufacturer wishing to create a gray market in the first period would be to deliver cut-rate product directly to discounters (in the same way that he supplies the authorized channel, with the only difference being the price that is charged). Here, however, we run into trouble in the form of anti-trust law. As noted by Stern, El-Ansary and Coughlan (1996), the Robinson-Patman Act does not classify the charging of two competitors in the same territory different prices for the same product as *per se* illegal; however, a manufacturer implementing such a policy must be able to justify different prices on the basis of cost, obsolescence or competitive pressure. Other anti-trust legislation provides somewhat clearer guidance on the legality of such a pricing policy. For

example, the Canadian Competition Act (1985) classifies “delivered pricing as a restrictive trade practice” and “delivered pricing means the practice of refusing a customer...delivery of an article at any place in which the supplier engages in a practice of making delivery of the article to any other of the supplier’s customers on the same trade terms that would be available to the first mentioned customer...”. While the literature and legal decisions in this area are complex, it is safe to say that a manufacturer that overtly attempts to create a gray market by restrictively offering cheap product to a specific channel member would run into problems. Even were he to escape the long arm of the law, he would undoubtedly suffer the wrath of authorized dealers who are expected to pay substantially more for the same product.

In summary, the assumption that gray goods appear after product has been available in authorized channels for some time seems reasonable both empirically and theoretically, as well as from a legal perspective.

On the other hand, it is interesting to ask whether the delayed availability of gray goods is a complete explanation for their attractiveness. We find that the delay certainly increases the probability that gray goods increase profit for manufacturers; however, it is not a necessary condition, as demonstrated in Proposition 5.

Proposition 5. *If gray-market product is permitted to be sold alongside authorized product in period 1, gray marketing is profitable if and only if $\theta \in \{\theta_6, \theta_3\}$, where $\theta_6 = \lambda^{-1/2}(8t_H - 2t_L)^{1/2}$.*

This proposition underlines the importance of a time delay in creating an environment that is attractive for gray marketing. First, the condition is more restrictive than the condition identified for gray marketing in Period 2 (i.e. $\theta < \theta_3$). This obtains because the price in the authorized market must be sufficiently low in order for Highs to remain in the authorized market. Second, the range $\{\theta_6, \theta_3\}$ does not exist (i.e. $\theta_6 > \theta_3$) unless the difference in price sensitivity between Highs and Lows (i.e. t_H minus t_L) is large. Thus, first period gray marketing can be profitable but this situation only occurs in a thin slice of the parameter

space. Essentially, we observe the same effects in the one period model as we do in the two period model. When price sensitivity differences between Highs and Lows are large, gray marketing is attractive because of the way it affects competition and pricing in the authorized market. Nonetheless, the likelihood of gray marketing in a single period model is much lower because defecting to the gray market is much more attractive to Highs (and if Highs defect to the gray market nobody is left in the authorized market!).

E. Gray Markets: An Artifact of Decentralization?

Another interesting hypothesis that warrants investigation is whether or not gray marketing is attractive solely because of the decentralized nature of the channel. Perhaps, vertically integrated manufacturers who sell directly to customers (like Polo Ralph Lauren, Liz Claiborne and Anne Klein) do not have incentives to engage in gray marketing, since they control both the service function and retail pricing¹³.

Equilibrium values of wholesale prices, retail prices, and retail service levels in a vertically integrated channel under no gray marketing and gray marketing are reported in Table 2.

TABLE 2: Equilibrium Values Under Vertically Integrated Competition

VARIABLE	EQUILIBRIUM VALUE UNDER:	
	NO GRAY MARKETING	GRAY MARKETING
Authorized retail prices ($p_1=p_2$)	$\frac{t_H t_L}{\tau} + c$	$t_H + c$
Authorized service levels ($s_1=s_2$)	$\frac{\theta t_L \lambda}{6\tau}$	$\frac{\theta \lambda}{6}$
Manufacturer profit ($\Pi_{M1}=\Pi_{M2}$)	$\frac{t_H t_L}{2\tau} - \frac{\theta^2 t_L^2 \lambda^2}{36\tau^2}$	$\frac{t_H \lambda}{2} - \frac{\theta^2 \lambda^2}{36}$

Notes: $\tau = \lambda t_L + (1-\lambda) t_H$; ρ is normalized to equal 1 in profit expressions in this Table.

¹³ Lewison (1997) refers to several top fashion apparel manufacturers who sell products directly to consumers through company owned stores.

Several observations can be made when comparing these results with those of Table 1. First, equilibrium service levels are equal across the two channel structures; however, retail prices are strictly lower in the vertically integrated structure. Second, the margins enjoyed by manufacturers are independent of level of θ ; in the case of no gray markets the margin is $\frac{t_H t_L}{\tau}$ and in the case of gray marketing, it is t_H . These results are used to understand when (if at all) vertically-integrated manufacturers have an incentive to gray-market their goods. Proposition 6 shows that vertically integrated manufacturers in fact, have *stronger* incentives to supply gray markets than manufacturers operating in a decentralized channel.

Proposition 6. *When $\theta < \theta_5$, where $\theta_5 = \sqrt{2} \cdot \theta_3$ and θ_3 is as defined in Proposition 3, vertically integrated manufacturers prefer a channel that includes gray marketing to one with only authorized distribution.*

Because θ_3 is the limit for the attractiveness of gray marketing in the decentralized channel, the area in which gray marketing is attractive for vertically integrated manufacturers is strictly larger. This implies that one is more likely to observe gray marketing when channels are vertically integrated. The intuition for this result obtains by remembering that a key benefit provided by gray marketing is a reduction in price competition. In a decentralized channel, the benefits of reduced price competition accrue to both authorized retailers and manufacturers. In other words, the manufacturer is not the full beneficiary of the creation of a gray market in a decentralized channel: the authorized retailers benefit too. In contrast, when a manufacturer is vertically integrated, he is the full beneficiary of his creating a gray market and this explains why the “gray marketing” zone is larger under vertical integration.

The perceptive reader may have noticed that the area of preference for gray markets by vertically integrated manufacturers is identical to the area of preference for gray markets by authorized retailers in a decentralized structure. Ostensibly, this result seems unusual;

however, the previously mentioned invariance of manufacturer margins to the level of θ provides us with a basis for explaining it.

Regardless of whether the channel is vertically integrated or not, the principal force driving pricing in the retail outlets of our model is the price sensitivity of consumers (i.e. t_H and t_L). This obtains due to the highly competitive nature of our market where all consumers buy and the only way to increase share is at the expense of the competitor. As a result, manufacturer margins in a vertically integrated channel are identical to authorized retailer margins in the decentralized channel. Herein lies the explanation for why the areas of preference for gray markets by vertically integrated manufacturers and authorized retailers (in a decentralized structure) are identical. The attractiveness of gray markets obtains from the benefit of reducing price competition at the expense of higher service competition. In some sense this represents a balancing of the added cost of service with the added margin associated with an authorized market comprised solely of Highs. Because both the vertically integrated manufacturers and authorized retailers consider identical margins and identical service cost functions, it follows that their preferences for gray markets should also be identical.

F. The Impact of the Distribution of Consumers on the Attractiveness of Gray Markets

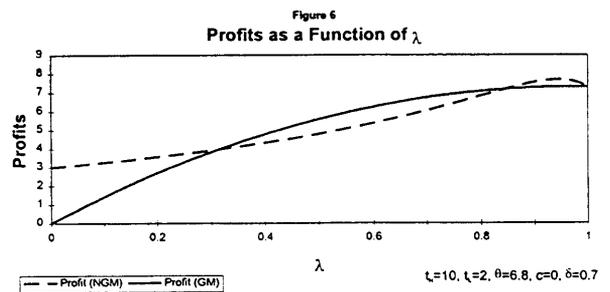
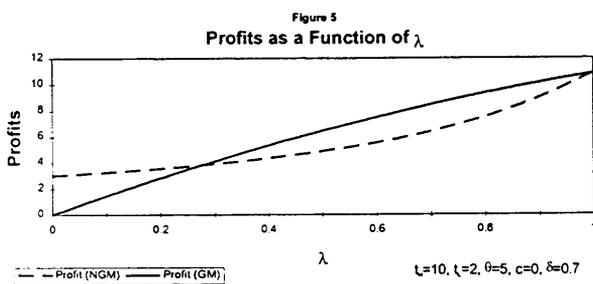
In this section, we consider the effects of changes in λ (the proportion of consumers who are Highs) on gray-market viability. Our analysis shows that the attractiveness of gray markets is heavily dependent on the distribution of consumers in the marketplace. However, Proposition 7 shows that the effect of λ on the attractiveness of gray markets is complex:

Proposition 7. *When $\lambda=0$ (all consumers are Lows), gray marketing is strictly less profitable than selling only through authorized retail channels. When $\lambda=1$ (all consumers are Highs), manufacturer profits are equal with or without gray marketing. If gray marketing is profitable for some interior value λ^* , then there exists a λ' ($0 < \lambda' < \lambda^*$) below which gray marketing is strictly less profitable than is authorized selling alone.*

The results concerning $\lambda=0$ and $\lambda=1$ are quite intuitive. If all consumers are Lows ($\lambda=0$), selling at marginal cost through the gray market is of course strictly less profitable than keeping Lows in the authorized market at positive per-unit profits. And, if all consumers are Highs ($\lambda=1$), the gray market has no role to play, since the profit margin on gray market product is zero and no consumers will shop in gray market outlets even if product is made available there. If we gradually increase the percentage of Highs when a population is made up entirely of Lows, the difference between the profits without gray marketing and the profits with gray marketing will get smaller. Whether or not gray marketing ever becomes profitable as we increase λ depends on the difference in price sensitivity between Highs and Lows (is there sufficient opportunity for gain by creating a gray market) and the level of θ (if θ is too high then gray markets are never attractive because the cost of over-competition in service always exceeds the benefit of reduced price competition).

Figures 5 and 6 illustrate the relationship of manufacturer profits to λ (with and without gray markets) for two sets of parameters θ where at some level of λ *ceteris paribus*, gray markets are advantageous (i.e. there is sufficient spread between t_H and t_L and θ is not too high). The only difference between the two sets of parameters is that $\theta=5$ in Figure 5 and $\theta =6.8$ in Figure 6. As discussed, we observe the phenomenon of gray markets becoming attractive as λ increases from a low value. The intuition for this is that when λ is very small, the market is made up almost of entirely of Lows, so manufacturers cannot afford to send them to the gray market. As λ increases, the Lows make up a smaller percent of the consumer population. As a result, the lost margin associated with Lows going to the gray market is less and the gain associated with serving Highs at higher prices is more attractive (since there are more of them!). In our examples at a sufficiently high λ , the profits associated with gray marketing exceed the profits associated with serving all customers through authorized channels.

However, in Figure 6 (where θ is higher at 6.8), we have an unusual reversal at λ close to 1 where gray marketing is once again unattractive. At first glance, this seems to go against the logic of the previous paragraph. However, if we remember that the force which limits the attractiveness of gray marketing is “over-competition” in service, we can explain the reversal. The degree of “over-competition” is primarily a function of θ but referring to the values in Table 1, it is also affected by λ . When θ is sufficiently high (in this example above ≈ 5.9), as λ gets sufficiently close to 1 “service competition” is sufficiently intense that manufacturers prefer to keep the Lows in the authorized market.



We now use the relationship between λ and the optimal strategy with respect to gray markets to make two observations: one that relates to the overall increase in the pervasiveness of gray markets in luxury/fashion goods in western developed countries and the other which relates to within-category changes. As mentioned previously, in the 1990’s, western developed countries are faced with the aging of their populations. As noted by Foot with Stoffman (1996), “quality and service are the retail watchwords for an older population... a much larger percentage of the population than before will be of the age group that insists on quality and service (p.87).” In a market with few price-insensitive consumers, we might expect stores whose primary emphasis is price (and not service) like *Wal-Mart*, *Price Club* and *Home Depot* to thrive. However, an older population will shift the focus for many products away from mass merchandisers to smaller shops that emphasize quality and personalized service. Foot with Stoffman (1996) mention that “One manufacturer who knows how to prosper in an older marketplace is Armani...Armani understands that the

magic words quality and service apply just as much to clothes as any other product in the retail world of the 1990's" (p.95). In our model, this shift in the needs of the population has a simple interpretation as an increase in λ . Naturally, many manufacturers will shift their emphasis to smaller shops that emphasize quality and personalized service (consistent with the demographic change) and our model shows how this endogenously leads to an increase in the likelihood of gray marketing.

On a category level, the model provides an alternate explanation for the evolution of gray markets. In a new category, Highs might be viewed as "novices," while Lows would be "experts." Early in the life of a category, if few consumers are able to use the product effectively without retail service, the proportion of Highs is likely to be high. As the product matures, however, more and more consumers understand it well, and the need for retail service falls, effectively increasing the proportion of Lows in the total consumer population. In such markets, we might observe significant levels of gray marketing early in the life of a category; however, as a category matures, the percentage of customers who consider themselves "novices" decreases and this reduces the likelihood of gray marketing being encouraged by manufacturers.

VI. Conclusions and Future Research Directions

The main objective of this paper has been to investigate the recent growth of gray markets and further our understanding of them. We seek to understand both the motivation manufacturers have with respect to gray markets and the impact that gray markets have on competition in authorized markets. Our approach first challenges the conventional wisdom that gray markets are bad, and second seeks an explanation for the "relatively inactive" approach that many manufacturers take to eliminate gray goods. Moreover, our intention is to look at a motivation for gray markets that goes beyond the obvious market expansion

argument. While market expansion is important in many cases, our model shows the gray markets are particularly interesting due to the indirect effects that they have on competition in authorized channels. The primary insight of the paper is that customer heterogeneity is the underlying factor which can make gray markets anything but disadvantageous for manufacturers. (Once again, we underline the severity of the assumption in our model that gray markets are supplied with product provided at marginal cost.) The customer characteristic on which our the model turns is “cost of time” and we show how this characteristic manifests itself across segments in terms of both price and service sensitivity. In short, customers with a high cost of time tend to be less price sensitive (because they do not have the time to search for bargains) and more service sensitive (because service is interpreted as primarily “time saving”). Gray markets have the potential to siphon (or leak) price sensitive customers out of the authorized market, giving authorized channels the opportunity to provide more service and charge higher price to those who remain. As long as the remaining customers are not excessively service sensitive, gray markets can increase the profits for competitive manufacturers. A useful analytical extension for future research would be to analyze how the motivation for gray markets is affected by allowing manufacturers to charge prices above marginal cost to gray marketeers. Such an extension would further our understanding of hierarchical decentralized competition in a dynamic context.

From a detailed perspective, we have analyzed a number of model extensions and parametric changes to expand our understanding of the viability and operation of gray markets. Gray goods generally appear long after a product has been introduced through authorized channels. We demonstrate that this is an important factor for understanding why gray markets can be advantageous. We also show that vertically integrated manufacturers have even more incentive to supply gray markets than manufacturers who operate through independent retailers. It is interesting that the role of gray markets is just as important even

when manufacturers have full control of both the service function and retail pricing. The model also provides a compelling explanation for the growth of gray markets on a macro level that is based on the natural evolution of an aging population. In addition, the model offers a perspective on most likely timing for gray markets within a category, based on the maturity of the category. This points to two areas for further research. The first would be to investigate the correlation between the incidence of gray markets and the age or maturity of a selected number of product categories. Of course, a number of factors affect the availability of gray goods, so an alternate approach might be to investigate the incidence of legal applications by manufacturers to impede or prevent the distribution of gray goods through unauthorized channels across categories. Second, cross-category comparisons might also yield useful insights for better understanding the relationship between customer heterogeneity, a customer's "cost of time" and the incidence of gray markets.

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