

## FREE RIDING AND SALES STRATEGIES FOR THE INTERNET\*

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For many products, Internet sales can free ride off of the promotional effort exerted by brick and mortar retailers, leading manufacturers to attempt to control the availability and pricing of their products over the Internet. We examine three categories of products: fragrances, DVD players, and side-by-side refrigerators. Our evidence suggests that manufacturers that limit distribution in the physical world use various mechanisms to limit distribution online. In particular, these manufacturers generally prevent the sale of their products by Internet retailers that offer deep discounts. Furthermore, manufacturer websites tend to charge high prices, suggesting that manufacturers may internalize free rider issues.

### I. INTRODUCTION

WHILE INTERNET SALES TOTAL only about 1.0% of all retail sales in the United States,<sup>1</sup> the rapid growth of Internet commerce suggests that this sales channel will become a significant factor for many goods. Managing channel conflict between brick and mortar retailers and Internet retailers is an important and growing problem faced by many manufacturers of branded goods. Manufacturers of branded goods have placed a variety of restrictions on their brick and mortar retailers in an effort to control free-riding on the sales and promotional efforts of retailers. The emergence of the Internet as a new distribution channel requires manufacturers to develop restrictions on Internet retailers to control free riding.

In this paper, we investigate empirically the extent to which manufacturers of three types of branded goods appear to control the pricing and

\* We gratefully acknowledge research support from the University of Chicago Graduate School of Business. Tina Lam, Sogol Jahedi, Gregory Pelnar and most especially Chip Hunter provided expert research assistance. This paper was prepared for the NBER E-commerce project. We are grateful for the comments of participants in the project, particularly Luis Garicano, David Genesove, Severin Borenstein, and an anonymous referee. We dedicate this paper to our late colleague, Peter Pashigian, who had great influence on our thinking about the issues in this paper.

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<sup>1</sup> Source: U.S. Department of Commerce estimates for second quarter 2000. All estimates are located at <http://www.census.gov/mrts/www/mrts.html>.

availability of their products over the Internet. We analyze the probable impact of their actions on the promotion and sales incentives of brick-and-mortar retailers.

The rest of the paper proceeds as follows. In the next two sections, we review the standard theory of free riding and its consequences, noting how these theories apply to distribution via the Internet. We derive several conjectures that we test. We then discuss our data for fragrances, DVD players, and side-by-side refrigerators. These industries were chosen on the basis of data availability and the possibility that free riding is a concern. Finally, we report empirical results that document how manufacturers have restricted the availability and price of their branded products over the Internet for these industries. We conclude with some general observations.

## II. FREE RIDING

Free riding amongst retailers has been much studied and is well understood.<sup>2</sup> It occurs when the inputs needed to sell a product—e.g., informed retail sales effort, retail showrooms, retail advertising—cannot be sold separately from the physical product. Hence, it is possible for one retail store to engage in the activity necessary to sell the product, but for a different lower-priced store to make the final sale. If such free riding occurs, it erodes the incentive of any retail store to promote the product. With lower promotion, total sales could fall, to the chagrin of the manufacturer.

Of course, vertical integration, or moving the promotion function upstream, is one solution to the free rider problem. However, this is undesirable if the local retail store possesses knowledge about its customers that allows the retailer to sell the product more effectively than the manufacturer. Common approaches to mitigating the free rider problem include the creation of exclusive sales territories and resale price maintenance. Though resale price maintenance (RPM) is a *per se* violation of the antitrust laws, under the Colgate doctrine,<sup>3</sup> a manufacturer can choose to cease dealing with price cutters.<sup>4</sup> These techniques remove the consumer's incentive to purchase from the firm other than the one providing the sales effort.

Addressing the free rider problem becomes more complicated when consumers differ in their need to obtain service. Providing trained assist-

<sup>2</sup> For a survey, see Rey and Tirole [1986] and Carlton and Perloff [2000], Ch. 12.

<sup>3</sup> *U.S. vs. Colgate and Co.*, 250 US 300 [1919].

<sup>4</sup> When we see no discounting off a relatively uniform retail price, we will say, as a convenient shorthand, that the manufacturer is engaging in RPM. (We are not intending to make any suggestion whatsoever that the pricing policy violates the law.)

ance ultimately raises the retail price that all consumers must pay, including those knowledgeable consumers who don't need the sales service. Ideally, in this circumstance, the manufacturer would like to segment the market, making one low-priced product available to knowledgeable consumers and another higher-priced product available to the others. If arbitrage can be avoided, the manufacturer can succeed in treating the two consumer groups differently. Note that such segmentation is both profitable and efficient, since the cost of serving the two groups differs.

## II. APPLICATIONS OF THE THEORY OF FREE RIDING TO INTERNET SALES

In the absence of vertical restrictions, brick-and-mortar retailers will be vulnerable to free riding on their sales effort by their Internet competitors. Of course, it is possible that brick-and-mortar retailers could also free ride off of the sales effort of Internet retailers. After all, Internet retailers often provide extensive product information and customer reviews on their websites. However, two factors make free riding by Internet retailers a potentially greater problem than free riding in the reverse direction. First, much of the effort of the brick-and-mortar retailers takes the form of a per-customer cost, while Internet retailers are more likely to incur fixed costs in providing support. Second, because the promotional effort of a brick-and-mortar retailer consists of personal interaction between customers and sales consultants, it is much more difficult to verify directly. The manufacturer could use fixed fees to compensate Internet retailers who provide information- or promotion-laden sites.<sup>5</sup> Fixed fees cannot be effectively used to compensate brick-and-mortar retailers for their unverifiable per-customer effort. The most feasible way to compensate brick-and-mortar retailers for sales effort is through a device allowing them to charge high prices. In the absence of vertical controls of Internet retailers, the brick-and-mortar retailers may be vulnerable to free riding by Internet retailers.

Using these facts about Internet sales and our knowledge of free riding, we can make the following observations:

1. Internet sales sites increase the free rider problem for manufacturers. We hypothesize that manufacturers that rely strongly upon sales effort that is necessarily physical may limit the availability of their products on the Internet.

Manufacturers face a tradeoff in that the more exclusively a manufacturer distributes a good, the more consumers there are who are

<sup>5</sup> Gertner and Stillman [2001] offer evidence suggesting that manufacturers do contract with retailers regarding the presentation of information about the manufacturer's product on the retailer's website.

outside of the feasible sales area of any brick-and-mortar retailer. Thus, manufacturers of exclusively distributed products may authorize Internet retailing but use other vertical control mechanisms to control free-riding.

The first goal of our empirical work, then, is to document the availability of products over the Internet. Is the availability of products over the Internet positively or negatively correlated with their availability in the physical world?

2. In a competitive market with search costs, price dispersion may arise. Although search costs seem low on the Internet, significant price dispersion for identical products has been documented by other researchers. We expect manufacturers of branded items that are heavily promoted at the retail level to be concerned about price dispersion since heterogeneous prices encourage free riding.

In our empirical work, we examine the magnitude of price dispersion across Internet retailers. Is there evidence that manufacturers of promotion-intensive products do not make their product available at Internet sites that engage in discounting?

3. Manufacturers can offer products for sale through their own website, through the website of a retailer, or both. If manufacturers use their own websites to sell products, the manufacturer will set prices that internalize free-rider concerns. Of course, manufacturer site sales may be unattractive if they do not achieve minimum efficient scale in website operation.

We examine the propensity of products to be offered on manufacturer websites. For which types of products are manufacturer sites used? Do manufacturers set a price at least as high as that of brick and mortar retailers so as to mitigate the free rider problem?

4. Manufacturers of exclusively distributed products should be more likely to allow price discounts on Internet sales when the Internet serves to segregate knowledgeable and service-intensive consumers.

We suspect that purchasers of established fragrances are likely repeat buyers who need not try on the product immediately prior to purchase. Are newer fragrances less likely to be sold on the Internet than the older, established fragrances?

5. Brick-and-mortar retailers who distribute a branded product might be given preferential access to that product for Internet sales, since the brick-and-mortar retailer can internalize at least some of the free-riding between Internet and retail stores. This effect can only be important if the brick-and-mortar retail sector is highly concentrated. If it is unconcentrated, Internet sales provide a vehicle for that retailer to free ride off of other retailers' promotional efforts.

Thus, in our empirical work, we ask: in the presence of relatively large brick and mortar stores, do these brick-and-mortar stores

partially internalize the free-rider problem and charge higher prices on the Internet? Do manufacturers appear to source products to these brick-and-mortar retailers that they do not source to pure-Internet retailers?

Of course, many of the free-riding issues that we have identified have already been faced by manufacturers in dealing with mail order catalogs. While we do not have extensive data on mail order catalogs, we do have some that we report to suggest that manufacturers have policies governing catalogs that are similar to those governing Internet retailers.

### III. DATA

We have gathered data on three categories of branded goods: fragrances, DVD players, and side-by-side refrigerators. Fragrances rely on retail support because consumers of expensive fragrances prefer to try them on prior to purchase. DVD players rely on retail support because they can be complex. The features are very different from those offered on a VCR and the hookup procedure is non-trivial if the customer does not have a new DVD-ready television. Side-by-side refrigerators tend to be high-end refrigerators; consumers generally like to examine the attractiveness of high-end appliances and inspect their features.

#### III(i). *Fragrances*

We gathered fragrance data from 17 retail Internet sites plus manufacturer sites. We obtain representatives of four different types of websites: department store sites, upscale beauty sites, drugstore sites, and discount fragrance sites. For department store websites, we obtained listings of the largest department stores in the U.S. and selected all of those that sell fragrances over the Internet (Bloomingdales, Dillards, Macys, Nordstrom, and Nieman Marcus).

We obtained listings of top traffic Internet sites selling beauty products. We eliminated Avon.com and avonorder.com from consideration. Because Avon products are directly distributed by 'Avon representatives' rather than through retail stores, we thought that the channel conflicts created by the Internet site would be quite distinct from those in traditional retailing. The high traffic sites include four upscale beauty sites (ibeautey.com, eve.com, beauty.com, and sephora.com), three drugstore sites (drugstore.com, planetrx.com, and more.com), and Ashford.com, a retailer of a wide variety of luxury goods. For our purposes, we classify Ashford as an upscale beauty site. Finally, we examine four prominent perfume-only sites (fragrancenet.com, parfums-raffy.com, perfumania.com, and parisfragrances.com). These were chosen because they were recommended

by Internet information engines (such as 4anything.com's 4perfume.com). Of these four, fragrancenet.com has the highest traffic according to PCDataonline.com.

During the month of June 2000, we collected all of the prices for all of the women's fragrances carried by these 17 retail sites,<sup>6</sup> resulting in a database of prices for 3156 total products. Most fragrances are available in a variety of size, concentration, and packaging combinations. For our analysis we will consider only the most widely available vehicle-format for each fragrance (most often, the 1.7 oz eau de toilette spray). This results in a dataset of prices for 1106 unique fragrances available for sale on the Internet.

The methodology described above does not allow us to investigate whether or not there are fragrances that are not available for sale over the Internet but are available for sale at brick and mortar retail locations. To investigate this, we used information from the Fragrance Foundation to obtain a list of fragrances that might or might not be available on the Internet. The Fragrance Foundation ([www.fragrance.org](http://www.fragrance.org)) presents annual awards, called the Fifi awards. These are given for the best new fragrances in various categories, as well as for an established classic fragrance that is inducted into the 'hall of fame'. Using the list of all award nominees for 1998 and 1999, and the list of winners for 1972–1997, we matched our list of 132 award nominees/winners to the list of fragrances for sale on the Internet. A research assistant shopper verified the availability of these 132 fragrances at Chicago-area brick and mortar stores; the 15 fragrances that our research assistant could not find were dropped from consideration.

Finally, as part of the annual Fragrance Foundation awards, nominees are asked to certify which of the following categories of brick-and-mortar distribution their fragrances fall into: for sale in limited specialty and department stores (to department and specialty stores totaling less than 500 doors), for sale in department stores generally, for sale in chain/mass market stores, for sale exclusively through non-store venues, and for sale only in private label stores. We examine fragrances in the first three categories, and use this information as a proxy for the extent to which the manufacturer uses exclusive distribution arrangements in the brick-and-mortar world.

The data on the exclusiveness of distribution tend to be the same for all of the perfumes within a designer. Because these data appear to be consistent within designers, we infer the availability of any perfume by a designer if we have data from the Fragrance Foundation for a particular perfume in that designer's line. Thus, for example, Estee Lauder's

<sup>6</sup> That is, we gathered data for perfumes, colognes, etc. We did not gather data for 'home fragrances', creams, powders, or aromatherapy products.

'Pleasures' has been nominated for a Fifi award, but not Estee Lauder's 'Knowing'. We assume that 'Knowing' is distributed to the same type of outlets as 'Pleasures'.<sup>7</sup> Thus, while we have Internet pricing and Internet availability data for 1,106 unique fragrances, we will investigate some questions only for the subsample of 570 for which we have Fragrance Foundation information about distribution practices in brick and mortar stores.

We also searched exhaustively to determine whether the award-nominated manufacturers in our database of fragrances sold fragrances directly over the Internet. For any manufacturer site that we found that sold fragrances, we recorded the prices.

### III(ii). *DVD players*

Using various search engines and site listings, we obtained a list of 39 high-traffic Internet retail sites. Using Dealerscope Magazine, a trade journal for consumer electronics retailers, we identified the top-selling brands of DVD players. Every one of these major manufacturers of DVD players had a website describing their models, although only two of these manufacturers sold players directly through their sites. Thus we were able to compare the universe of DVD models to the products available for sale at existing Internet retail sites. We obtained information from manufacturer websites and from trade publications listing all authorized dealers of the manufacturer's products. For manufacturers who provided a 'complete authorized dealer list', we were able to infer that other retailers selling that manufacturer's products were not authorized to sell them.<sup>8</sup> We will look separately at the behavior of unauthorized and authorized retailers.

### III(iii). *Appliances: Side-by-Side Refrigerators*

The third category of products that we analyze is side-by-side refrigerators. We narrowed our focus to only side-by-side refrigerators because side-by-side refrigerators are large in scale, are designed for home and restaurant buyers, and are relatively expensive. We identified the major appliance manufacturers by consulting industry data from the Association of Home Appliance Manufacturers (AHAM), the Homebuilders Financial Network (HFN), and Dealerscope magazine.

<sup>7</sup> We make this inference at the 'designer', not the manufacturer level. The Estee Lauder companies, for example, own Tommy Hilfiger, which makes fragrances called 'Tommy Girl' and 'Freedom'. We do not infer anything about the distribution of 'Tommy Girl' using information on the distribution of 'Pleasures.'

<sup>8</sup> While manufacturers do not list unauthorized retailers on their websites, the trade literature frequently contained discussions about the non-authorized retailers, allowing us to confirm our inferences about retailer authorization.

We also sought a measure of the ‘exclusiveness’ of an appliance. We suspect that the free rider problem is less pronounced for ‘standard’ appliances in standard sizes and more pronounced for more ‘custom’ type appliances. That is, while it is possible that one could purchase a standard-sized refrigerator for an apartment without first inspecting it personally, it is probably unthinkable to purchase a commercial-quality Subzero refrigerator without doing so. We identified ‘professional’ appliances by searching through every page of a set of ‘high-end’ magazines, including several magazines targeted to gourmet cooks (‘high-end’ magazines were identified using reader demographics in the Fall 1999 *Mediamark Magazine Pocketpiece*). We identified 5 manufacturers of side-by-side refrigerators that have advertisements in those magazines: GE, JennAir, KitchenAid, SubZero, and Viking.

We searched for appliance retail sites. Despite extensive searches, we found only a few Internet sites selling appliances and even fewer shipping nationally. In October 2000, we collected pricing and availability information for all nationally shipping appliance Internet sites that carried any side-by-side refrigerators.

#### IV. EMPIRICAL FINDINGS

##### IV(i). *Fragrances*

*Availability:* Our most basic question is whether some manufacturers do not make their products available on the Internet and if they do, whether they limit which Internet sites distribute their products. Table I examines the propensity of the fragrances to be available on the Internet. As mentioned above, the propensity of fragrances to be sold over the Internet

TABLE I  
FRAGRANCE FOUNDATION AWARD NOMINEES: SUMMARY STATISTICS

	Overall	Exclusive distribution department stores < 500	Distribution through department stores > 500	Distribution via chain stores/mass merchants
Fraction available at Internet retail websites	0.79	0.85	0.84	0.47
Fraction available at manufacturer websites	0.21	0.18	0.17	0.42
Fraction available at any Internet website	0.87	0.95	0.88	0.63
Fraction available exclusively at manufacturer websites	0.09	0.11	0.02	0.16
Average price	\$48.72	\$58.85	\$47.82	\$20.24
Number of observations	117	57	41	19

can be estimated only for those fragrances nominated for a Fragrance Foundation award. The vast majority of these perfumes are available over the Internet at some type of site, as the third row of Table I demonstrates. Interestingly, the least exclusively distributed perfumes offline (those sold through chain stores and mass market outlets) are the least likely to be offered for sale on the Internet. One potential reason for this is the economic unsuitability of these fragrances for shipping. As Table I illustrates, the average price of the chain store perfumes is less than half the average price of a department store perfume. Table I suggests that manufacturers are not, for the most part, responding to the potential for free-riding with the most draconian solution—keeping their products off of the Internet entirely. In subsequent tables, we examine whether manufacturers are possibly using some other type of control to limit free-riding from Internet sales.

Conditional on selling products over the Internet, manufacturers have several options as to how to sell them. The most restrictive possibility is that the manufacturer could sell their products exclusively through their own site, thereby completely controlling the distribution of the product. A less restrictive policy would be to allow retailers to sell the product on the Internet, but authorize sales only by those retailers that adhere to a no-discounting policy. The least restrictive option would be to allow any type of Internet retailer to sell the product. Table I provides some evidence that manufacturers do address the free rider concerns raised by Internet sales by controlling the type of Internet site at which their product is sold. For example, the fourth row suggests that those perfumes with restricted distribution among brick and mortar retailers have a greater propensity to be made available only at a manufacturer Internet site.

Using data on the 570 products sold over the Internet for which brick and mortar distribution data is available, Table II provides insight into the type of Internet policy that different manufacturers are choosing. In the first two columns, we examine the choice between selling products through Internet retail sites and selling products exclusively through a manufacturer Internet site. Here, the dependent variable takes the value of one if the product is sold exclusively through a manufacturer Internet site and zero if the product is available for sale at some retail Internet site.

The right hand side variables are proxies for the potential for free riding. We include measures of the exclusiveness of a fragrance's distribution offline in the physical stores. The 'less than 500 doors' variable takes the value of one if the product is reported by the Fragrance Foundation to be distributed offline very exclusively (through department stores less than 500 doors). The 'greater than 500 doors variable' is one if the product is available through a wide number of big department store chains. The omitted variable category is whether the fragrance is available through chain/mass market stores.

TABLE II  
 PROBIT SPECIFICATIONS OF INTERNET RETAIL. SAMPLE CONSISTS OF ALL FRAGRANCES WITH  
 OFFLINE DISTRIBUTION INFORMATION THAT ARE AVAILABLE ON THE INTERNET.  
 ROBUST STANDARD ERRORS ARE IN PARENTHESES.

Independent variables	(1)		(2)		(3)		(4)	
	Probit coefficients	% point difference						
'Exclusive distribution' to department stores with < 500 doors	1.052 (0.393)	11.8 (5.6)			1.319 (0.581)	44.1 (19.8)		
Department stores > 500 doors	-0.461 (0.490)	-0.5 (5.5)			-0.379 (0.427)	-14.0 (15.0)		
1999 introductions	0.803 (0.365)	16.9 (9.9)			-0.154 (0.380)	-5.8 (14.3)		
fragrance offline price	-0.035 (0.010)				-0.0014 (0.0015)			
constant	-0.594 (0.372)				-0.977 (0.348)			
Observations		570				570		

We also include a dummy variable that takes the value of one if a perfume is a new introduction. Older established perfumes are likely to be largely bought by repeat purchasers who will not need to try the perfume on before purchasing. New perfumes, on the other hand, may be very reliant on retailer inputs, because consumers may only purchase the perfume once they have recently tried it on in a retail outlet. Complicating any such analysis, however, is the fact that younger women are probably more likely to both use the Internet to shop and are more likely to use newly introduced perfumes.

We also include in the specification a measure of the perfume's price as a right hand side variable. This is measured using the price our research assistant shopper found in brick and mortar stores, when available.<sup>9</sup> We include this because, separate from exclusivity considerations, it may simply be cost-ineffective for retailers to ship low value perfumes.

Table II reports probit coefficients as well as the implied change in the probability that a fragrance is available on the Internet when the right hand side variable increases from 0 to 1 (holding other variables at their

<sup>9</sup> We only have the physical store price for a subset of fragrances. For the others, we used their mean selling price on the Internet as our price measure.

means). Standard errors are corrected for correlation of the error terms across perfumes within a particular designer.<sup>10</sup> The results of Table II provide statistically significant support for the proposition that manufacturers control Internet sales so as to mitigate free riding.

Exclusively distributed department store fragrances are 12 percentage points more likely to be available exclusively through manufacturer sites. Controlling for offline exclusivity, low value fragrances (for which shipping costs are disproportionately high) are more likely to be sold exclusively through manufacturer sites. New introductions, for which free riding might be considered to be of greatest concern, are more likely to be available exclusively at manufacturer sites. These results are statistically significant. The propensity of general department store fragrances and chain store fragrances to be available exclusively from manufacturer sites is not statistically significant.

Selling a fragrance only through the manufacturer site is the most restrictive distribution policy that a manufacturer could have. However, even manufacturers who sell through retail sites might limit the type of sites through which they sell. The third and fourth columns of Table II utilize the same basic specification as the first two columns, but estimate the probability that a fragrance is sold only through non-discount sites. The dependent variable takes the value of one if the fragrance is sold only through a manufacturer or non-discount retailer websites. It takes the value of zero if the fragrance is sold through any discount website. The results strongly support the notion that manufacturers are controlling the free rider problem by their Internet strategy. Table II shows that the exclusive distribution fragrances are much less likely to be available at a discount site than are either the chain-distributed fragrances or the general department store-distributed fragrances. Surprisingly, new product introductions are not less likely to be available on discount sites; the coefficient for 'new introductions' is negative and insignificantly different from zero at standard confidence levels.

*Selection and pricing of Internet retailers:* While most fragrance manufacturers are apparently willing to have their products sold on the Internet, manufacturers may place restrictions on the way that their products are sold. In particular, as discussed above, it is well known that resale price maintenance (RPM) is a way to control the free-rider problem. While manufacturers may encounter legal difficulties with RPM per se, manufacturers are free to supply only retailers with a 'no discounting' policy.

<sup>10</sup> In the case of heteroskedasticity, the probit procedure is a pseudo maximum likelihood procedure. Properties of the particular estimator that we use are described in Arminger and Schoenberg [1989].

We examine the pricing and availability of products at different types of sites in Table III. The first panel of Table III compares the prices at different types of Internet sites. The entry in Table III shows the price of the row site minus the price of the column site, divided by the price of the row site. The second from last column contains comparative price data for manufacturer websites (the manufacturer column only contains information on the 570 fragrances in the in the Fragrance Foundation award-nominated designer subsample). The shaded area shows the price relationships between the 'upscale beauty websites' and department store websites, on the one hand, and drugstore and discount fragrance websites, on the other. The price difference is calculated using only fragrances common to both websites. If there are zero or one fragrance-size-type-vehicle combinations in common between the two websites, then the table entry is 'NA'.

The upper left of Table III shows striking price homogeneity amongst the 'upscale beauty' and department store prices. The limited information that we have on manufacturer's suggested retail prices (MSRP) suggests that these stores are almost uniformly charging the MSRP for their products. In contrast, as the shaded area shows, the price disparity between the upscale beauty/department store websites and the drugstore/discount perfume websites can be enormous. Paris Fragrance, the cheapest competitor, charges approximately 37% less than the upscale beauty and department stores websites, on average. Shipping cost information is given in the last row of the table. This appears to be, if anything, positively correlated with the prices charged at the websites.

These results inform not only our study of vertical relations, but also are informative with regard to previous papers studying price dispersion on the Internet such as Brynjolfsson and Smith [2000] and Clay, Krishnan, Wolff, and Fernandes [2000]. Our findings are consistent with the previous literature in that it shows a very large amount of price dispersion across websites over the Internet.

Tables I and II showed that those fragrances that are most exclusively distributed offline are more likely exclusively to use manufacturer websites for Internet sales. We hypothesized that this allows the manufacturer better control over the extent of free riding between Internet and brick and mortar retailers. The second to last column of Table III confirms this hypothesis. The results here are unambiguous; the manufacturer's average price is greater than or equal to the price of each of the 17 retailers in our study. Furthermore, manufacturers charge high shipping rates on average. Thus, manufacturers appear to mitigate channel conflicts by charging high prices for their products on their own Internet websites.

The manufacturer website prices also seem to be high by the standards of brick and mortar retailing. For a subsample of 99 fragrances, we compared manufacturer website prices to the prices charged at brick-and-

TABLE III  
DIFFERENCES IN PRICE LEVELS/PRODUCT AVAILABILITY ACROSS WEBSITES.

Table entry in the first panel is the row stores price minus the column store's price divided by the row store's price. For two prices to be compared, the two stores must carry the same size, type, and vehicle of the fragrance. Shaded cells show price relationship between upscale/department store websites (i.e., 'exclusive' sites) and discount/drugstore sites. The last column in the pricing panel shows prices for manufacturer websites. The final row shows the shipping costs for two \$50 1.7 oz. EDT sprays at each website. The shipping figures for the manufacturers is the average across websites. The last column shows the fraction of products at the row site that are also available at some discount/drugstore site.

	Pricing																		Overlap
	Ashford	Beauty	Eve.com	Ibeauty	Sephora	Bloomingdales	Dillard's	Macys	NeimanMarcus	Nordstrom	Parfumsraffy	ParisFrag	Perfumania	Fragrancenet	Drugstore	More	PlanetRx	Manufacturer	Discount sites
Ashford		0.00	0.00	0.00	0.01	NA	0.00	-0.01	NA	NA	0.27	0.41	0.32	0.17	0.07	0.06	0.15	0.00	0.64
Beauty			-0.01	0.00	0.00	0.00	0.00	-0.02	NA	NA	0.26	0.44	0.40	0.21	0.10	0.11	0.13	0.00	0.53
Eve.com				-0.01	0.00	0.00	0.00	-0.02	0.00	NA	0.26	0.42	0.37	0.20	0.08	0.08	0.20	0.00	0.64
Ibeauty					0.00	NA	0.00	0.00	0.00	NA	0.27	0.44	0.40	0.21	0.09	0.02	0.12	-0.01	0.76
Sephora						0.00	0.00	-0.01	0.00	0.00	0.24	0.41	0.37	0.19	0.07	0.04	0.17	0.00	0.44
Bloomingdales							0.00	0.01	0.00	NA	0.21	0.36	0.30	0.14	NA	0.05	0.12	NA	0.88
Dillard's								-0.01	NA	NA	0.25	0.32	0.31	0.11	0.04	0.08	0.11	-0.01	0.90
Macys									0.00	NA	0.18	0.29	0.28	0.13	0.06	0.08	0.13	-0.01	0.92
NeimanMarcus										NA	0.12	0.36	0.18	0.22	NA	NA	NA	NA	0.40
Nordstrom											NA	NA	NA	NA	NA	NA	NA	NA	0.81
Parfumsraffy												0.29	0.27	-0.02	NA	NA	-0.04	-0.14	
ParisFrag													-0.02	-0.38	-0.36	-0.36	-0.15	-0.45	
Perfumania														-0.33	-0.42	-0.33	-0.27	-0.42	
Fragrancenet															-0.08	-0.10	-0.01	-0.03	
Drugstore																-0.03	0.06	NA	
More																		0.12	-0.15
PlanetRx																			
Ship Cost (\$)	0.00	3.95	0.00	0.00	0.00	10.95	8.95	4.00	10.00	9.95	0.00	3.99	4.90	0.00	3.95	0.00	3.95	5.64	

mortar department stores in the Chicago metropolitan area. In every case, we found that the price at the department stores was identical to the price at the manufacturer websites. However, while the brick-and-mortar department stores were sometimes offering 'free gift' promotions, these promotions appear to be unavailable at manufacturer websites.

For the reasons discussed earlier, the websites of brick-and-mortar retailers may be expected to obtain exclusive Internet access to some products because these retailers will partially internalize the effects of free rider issues. Indeed, as shown in Table III, the brick-and-mortar department stores do uniformly charge high prices for the fragrances that they sell over the Internet. However, the department store websites tend to offer a very small number of perfumes.<sup>11</sup> Only 134 of the 1,106 fragrances available over the Internet are available at these department store websites. However, a substantial 19% of those fragrances offered at department store sites appear to be available at retail sites *only* at the brick-and-mortar department store websites. Surprisingly, considering the potential for free-riding in new introductions, however, no new fragrance introductions are exclusively carried on the department store websites.

From this evidence of enormous price dispersion across Internet sites, one might be tempted to leap to the conclusion that cross-price elasticities of demand are extremely low. However, we do not have data on the quantities sold. We find it plausible that the upscale beauty websites are not selling large amounts of those fragrances that 'overlap' with the less expensive websites but *are* selling significant amounts of those fragrances that do not 'overlap'. The last column of Table III shows the fraction of each 'upscale' site's fragrances that are found at any discount/drugstore website. The table reveals that consumers have no choice on the Internet except upscale beauty/department store websites for many products. Thus, while there is tremendous price dispersion for some products, there is effectively zero price dispersion for those products that cannot be found at drugstore or discount websites.

Recall that, due to the legal status of RPM, the manufacturer may not contractually bind the retailer to charge the MSRP. However, manufacturers may be willing to supply 'exclusive' products to retailers who adopt an across-the-board 'no discounting' policy.

Our findings for fragrances address several of the hypotheses that we put forth above. First, the vast majority of perfumes are available for sale over the Internet; if distribution is limited, it is largely through a mechanism other than a complete prevention of Internet sales. However, we find that goods that rely on exclusive distribution offline are likely tightly

<sup>11</sup> Our small survey of department store retailers suggests that this finding of high prices and limited availability extends not only to the Internet operations of department store retailers, but also to their catalog operations.

to control distribution on the Internet by avoiding discount retail Internet sites or by selling only through high-priced manufacturer websites. Restrictions on availability are also somewhat more likely for newer products, for which free-riding may be more of a problem. While significant price dispersion for some fragrances exists on the Internet, we find that there are many fragrances—especially those for which exclusive distribution occurs in the brick and mortar sector—for which there is no price dispersion. Lastly, there is some evidence that the websites of brick-and-mortar stores receive favorable sourcing of products by manufacturers. We do find some potential evidence of internalization of the free-rider problem for the websites of brick and mortar department stores, as these stores do not engage in significant discounting on the Internet.

#### IV (ii). *DVD Players—Availability and Pricing*

The second category of product that we examine is DVD players. Manufacturers use authorized dealer networks to distribute DVDs; the trade press suggests that receiving retail authorization is nontrivial. Also, DVD players are a relatively new category of product. Properly hooking up and operating a DVD player can be difficult and thus, substantial product support at the retail level might be expected.<sup>12</sup> Nonetheless, the demographics of DVD player purchasers seem to be a very strong match for Internet retailing. Dealerscope magazine estimates that 4.9% of DVD players were sold online in 1999, as compared 0.6% of all VCRs.

Availability of DVD players online is even more widespread than fragrance availability. Using the information section of the websites of the ten largest DVD manufacturers, we were able to identify all current model DVD players of these manufacturers. We then examined 39 retail websites and were able to locate every current model DVD player for sale on some retail website. Of course, many retail websites carried not only current model DVD players but prior generation models as well. Furthermore, we could not detect any evidence that the websites of brick-and-mortar stores had some models for sale that were unavailable at pure Internet retailers. Nothing in the data suggests product sourcing practices favoring the Internet sites of brick-and-mortar retailers.

Manufacturer websites do not appear to be an important sales channel for DVD players as yet. Of the 34 brands of DVD players that we identified, only two of these manufacturers had websites through which direct sales were made. Interestingly, the two manufacturers were Sony and RCA, the two manufacturers identified by Dealerscope as having the

<sup>12</sup>Of course, some product support occurs after the sale is made. This sales effort cannot be free-ridden upon and the Internet might serve as a device to separate consumers who forecast needing support from technophiles who forecast not needing support.

TABLE IV  
DVD PLAYER SUMMARY STATISTICS

	Overall	Manufacturer sites	Websites of Authorized retailers	Websites of brick and mortar retailers
Number of sites surveyed	39	2	*	8
Number of unique models for sale	201	11	36	74
Number of total offerings	997	11	92	145
Mean price	\$488.57	\$571.73	\$588.92	\$491.11
Price std. dev.	349.15	391.38	460.04	393.73
Fraction of models current	0.89	1.00	0.89	0.87

\* A site can be an authorized retailer for some manufacturers and an unauthorized retailer for others.

two largest sales shares of DVD players in the U.S. Summary statistics for DVD player sales over the Internet are contained in Table IV.

An interesting feature of the distribution for DVD players is our ability to identify authorized versus unauthorized retailers. A survey of the business and trade press suggests that manufacturers of DVD players have recently tightened the restrictions placed on retailers regarding sales of their product over the Internet. Most manufacturers have authorized a limited number of retailers to sell their products over the Internet. Some manufacturers, such as Sony, post a notice on their websites cautioning consumers against purchasing from unauthorized retailers.

Despite these restrictions, the number of 'unauthorized' retailers abounds. For example, while Amazon.com is an authorized retailer of Philips products, it is not an authorized retailer of Sony products. Nonetheless, many Sony products are for sale on Amazon's site. Sony's official statement to the trade press is that it was 'surprised' to see Sony products for sale on Amazon.com.

While availability of products over the Internet appears not to be a major issue for DVD players, as in fragrances, we identified substantial price dispersion across retailers. However, the pattern of price dispersion across websites for DVD players is very different than for fragrances. In fragrances, there were several retailers who sold at exactly the manufacturer's suggested retail prices, leading to zero price dispersion across those websites. For DVD players, there are no instances of two retailer websites charging identical prices for all of their offerings.

The characteristics of price levels are investigated systematically in regression specifications in Table V. The left hand side variable in Table V is the log price. Each observation a specific model of DVD player at a specific retailer or manufacturer website. The independent variables are dummy variables coding the websites of brick-and-mortar retailers, manu-

TABLE V  
 DVD PLAYER PRICES. OBSERVATIONS ARE PRICE OBSERVATIONS FOR DIFFERENT MODELS  
 AT DIFFERENT ONLINE RETAILERS. THE DEPENDENT VARIABLE IS THE LOG PRICE.  
 STANDARD ERRORS ARE IN PARENTHESES.

	All models coefficients	Current models coefficients
Brick-and-mortar store	0.045 (0.017)	0.051 (0.019)
Authorized retailer	0.112 (0.018)	0.11 (0.020)
Manufacturer site	0.224 (0.037)	0.225 (0.037)
Model fixed effects?	Yes	Yes
Observations	709	550
R <sup>2</sup>	0.974	0.974

facturer websites, and whether the retailer is an authorized retailer. Model fixed effects are included so that the coefficients only represent price differences across websites for given models. The data include observations only from those manufacturers for whom we could determine the identity of authorized vs. unauthorized retailers.

The results suggest that brick-and-mortar retailers charge 5% higher prices at their websites compared to non-brick unauthorized retailers. Authorized retailers charge 11% more than unauthorized ones and manufacturer's charge 22% more than unauthorized non-brick retailers. These coefficients are statistically significant at least at the 5% level. The results accord with our basic beliefs about free riding. The higher prices at the websites of authorized retailers may reflect either manufacturer restrictions or the reputation benefits of manufacturer authorization (or both). However, absent the free-riding explanation, one would be hard-pressed to explain why manufacturers like Sony would not authorize retailers such as Amazon.<sup>13</sup>

Prices are not only higher at the websites of authorized dealers, but price dispersion across the web sites of authorized dealers is lower than price dispersion across unauthorized dealers. We examined the 18 models of DVD players sold by at least 2 authorized dealers and at least 2 unauthorized dealers. We calculated the standard deviation of the Internet price for the set of authorized dealers and for the set of unauthorized dealers for each model. These average \$61 for unauthorized retailers and \$18 for authorized retailers.

<sup>13</sup> On its website, Sony lists some criteria that authorized Internet retailers must meet, such as 24 hour response time to customer emails. These all appear to be criteria that Amazon.com would meet.

These findings leave open the question of why manufacturers of DVDs do not work harder to prevent sales by 'unauthorized websites'. This contrasts with fragrances where manufacturers have been active in litigation against unauthorized retailers. However, we have seen a flurry of articles in the trade press suggesting that DVD player manufacturers are paying increasing attention to the free rider problem and are working harder to stop the diversion of supply to unauthorized retailers.<sup>14</sup>

The higher Internet prices of brick-and-mortar stores like Best Buy might also be attributable to reputation, although it is difficult to argue that Best Buy has a much better reputation than a major retailer such as Amazon. Again, partial internalization of the free-rider problem by a relatively large brick-and-mortar retailer seems like a likely explanation for the brick-and-mortar retailer's higher prices.

Thus, our results for DVD players are in part similar to and in part different from our results for fragrances. We do not find any products that are completely unavailable on the Internet, nor do we find any available solely at manufacturer websites. However, as in perfumes, we do find evidence that manufacturers attempt to control the extent of price discounting on the Internet. Manufacturers charge high prices at their own sites and those retailers whose sales are 'authorized' by the manufacturer charge higher prices as well. Consistent with our findings for fragrance, we find that the websites of brick-and-mortar retailers charge somewhat higher prices than pure Internet retailers.

#### IV (iii). *Side-by-side Refrigerators—Availability and Pricing*

The third category of product that we examine is side-by-side refrigerators which use authorized dealer networks and whose quality varies widely. In sharp contrast to DVD players and fragrances, we found very few websites selling side-by-side refrigerators and even fewer that would ship nationally. Given the large economies of scale in the logistics of shipping refrigerators, the paucity of sellers is not, perhaps surprising. The largest selection of products available over the Internet seems to be offered by the brick-and-mortar retailers (Sears, Abt,) and US Appliance, a brick-and-mortar distributor. These brick-and-mortar retailers are the only ones who carry the upscale brand Jenn-Air. The only pure Internet retailer with a large selection of products is helpfindit.com (the other pure Internet retailer, Shop4.com, has a very narrow selection of products).

<sup>14</sup> See, for example, 'Harman's Strict Web Policy Gets Stricter', *Audio Week*, August 16, 1999 and 'Toshiba to Roll out Authorized Dealer Policy', *Consumer Electronics*, April 24, 2000. In contrast, Parfumsnet.com shut down (at least temporarily) its website in France after having been sued by at least 16 different perfume manufacturers (see C. Brothers, 'Litigious Luxury Firms Force Cyber-Perfumer Off Web', *Yahoo! News*, November 6, 2000).

TABLE VI  
SIDE-BY-SIDE REFRIGERATOR PRICE DISPERSION AND PRODUCT AVAILABILITY

Table shows relative prices of side-by-side refrigerators at Internet appliance sites, the number of models carried by each sites, and the availability of high end/professional quality brands. Shipping costs equal the cost of shipping a \$1500 refrigerator to the 60637 area code (in Chicago). Note that Abt is headquartered in the Midwest; shipping to the East or West Coast is not free. In the left top panel, the table entry is the row store's price, minus the column store's price, divided by the row store's price.

	Number of models	Abtelectronics.com	helpfindit.com	netmarket.com	sears.com	shop4.com	us-appliance.com	MSRP	Sell GE	Sell Jenn-Air	Sell Kitchenaid	Sell Subzero	Sell Viking
Abtelectronics.com	85		-0.41	0.04	-0.11	0.19	-0.04	-0.13	Y	Y	Y	N	N
helpfindit.com	315			0.31	0.20	0.40	0.30	0.19	Y	N	Y	N	N
netmarket.com	46				-0.12	0.08	-0.09	-0.12	Y	N	N	N	N
sears.com	327					0.19	0.06	-0.03	Y	Y	Y	N	N
shop4.com	22						-0.32	-0.21	Y	N	N	N	N
us-appliance.com	154							-0.07	Y	Y	Y	N	N
Ship Cost (\$)		0.00	0.00	0.00	35.0	0.00	39.00						

In contrast to fragrances and DVD players, we found no examples of direct sales by manufacturers over the Internet. This is probably largely due to the logistics issues involved in shipping refrigerators, though one could imagine outsourcing the logistics to local retailers.

Table VI shows price dispersion and product availability data for each of the Internet retailers in our sample. Price dispersion is very low once *helpfindit* is excluded from consideration. Since *helpfindit* typically charges above the manufacturer suggested retail price for its products, it is hard to see how it stays in business. The lowest prices are recorded by *Shop4.com*. The small selection of models at *Shop4.com* suggests that that site is fulfilling a 'closeout' role.

The right hand columns of Table VI show the availability of high end/professional quality brands at each website. Sub-Zero and Viking, brands that we identified as the two most expensive brands, are unavailable for sale at any Internet site. Since it seems quite unlikely that a consumer would purchase these items without first visiting a retail store, free rider considerations may explain the absence of these products. Thus, for appliances, the most promotion-intensive products appear to be completely unavailable for sale over the Internet.

Dealerscope estimates Sears's share of the overall appliance sales in the U.S. as exceeding that of the next twelve largest competitors combined. Thus, appliances might be a category in which a very high share retailer completely internalizes the free rider problem. Sears's average Internet prices, only 3% below the MSRP in our sample, supports that interpretation.

## V. CONCLUSION

Our research indicates that channel conflict is and should be a serious concern for manufacturers. Where exclusivity is used in offline brick-and-mortar retailing to control free riding, some comparable restraint is needed to control Internet websites. The two most common restraints are pricing (with no discounts allowed) and, less frequently, the restriction of available supply to only certain Internet websites (such as only a manufacturer's or a selected retailer's website). Other forms of restriction do not appear to be prevalent. For example, interestingly, we did not find evidence of manufacturers limiting the geographic area to which Internet retailers could ship.

The most striking empirical regularities in our data are two. First, fragrance and DVD manufacturers do appear to attempt to keep their products from being sold at discount sites. For DVD players, we see this in the price difference between authorized and unauthorized retailers. For fragrances, we note the unavailability of many exclusively distributed products at discount retail sites. The second compelling regularity is that

manufacturers appear not to use their Internet websites to undercut the prices of their retailers.

We regard any conclusions that we draw as preliminary, since retailing over the Internet is in its infancy. The patterns that we observe today could well change as Internet penetration alters the characteristics of the marginal consumer. It appears to us, from examining both the trade press and trends in litigation, that there is a growing recognition that uncontrolled Internet sales through unauthorized websites are not always in a manufacturer's best interest where free riding can occur and sales service is important. Accordingly, in the future, we expect to see manufacturers paying more attention to channel conflict and further restricting Internet pricing and availability for products where sales service is important.

#### REFERENCES

- Arminger, G. and Schoenberg, R. J., 1989, 'Pseudo Maximum Likelihood Estimation and a Test for Misspecification in Mean and Covariance Structure Models', *Psychometrika*, 54, pp. 409–425.
- Brynjolfsson, E. and Smith, M., 2000, 'Frictionless Commerce? A Comparison of Internet and Conventional Retailers', *Management Science*, forthcoming.
- Carlton, D. and Perloff, J., 2000, *Modern Industrial Organization*, Addison Wesley.
- Clay, K., Krishnan, R., Wolff, E. and Fernandes, D., 2000, 'Retail Strategies on the Web: Price and Non-Price Competition in the Online Book Industry', Heinz School Working Paper, Carnegie Mellon University.
- 'DVD Players 1999 Share Estimates', 2000, *Dealerscope*, August, <http://www.dealerscope.com/articles/0800/0800dvd.html>.
- Klein, B. and Murphy, K., 1988, 'Vertical Restraints and Contract Enforcement', *Journal of Law and Economics*, 31, pp. 265–297.
- Rey, P. and Tirole, J., 'Vertical Restraints from a Principal-Agent Viewpoint', in L. Pellegrini and S. Reddy (ed.), *Marketing Channels: Relationships and Performance*, Lexington, MA: Lexington Books.
- 'VCRs: 1999 Brand Share Estimates', 2000, *Dealerscope*, August, <http://www.dealerscope.com/articles/0800/0800vcr.html>