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Retail channel price discrimination

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ABSTRACT

This paper examines price differentials of identical items across retail channels. Many consumer packaged goods are sold through both grocery and drug stores. Liquor is unique in that in much of the country there is a third retail channel of distribution, liquor stores. If consumers in each retail channel differ in their willingness to pay for certain items, then sellers can exploit those differences and charge different prices for the same items in each channel. We examine a unique data set of pooled cross sectional retail scanner data on wine to test whether sellers use retail channel to identify heterogeneous consumer market segments and engage in price discrimination. We begin by presenting a model of price discrimination by retail channel along with behavioural assumptions regarding shoppers in each channel. Next we examine sales by retail channel and find persistent price differentials for the same item across retail channel after controlling for sample selection bias and seasonality. Lastly, we estimate the price elasticity of demand correcting for endogeneity and find differences across channel consistent with the price differentials. The extent of price differential, however, differs significantly with respect to price point.

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1. Literature review

This paper investigates the difference in price of identical items across retail channel. We argue that these retail channel price differentials are a form of first degree or market segmented price discrimination in which consumers, who differ in their price elasticities of demand, self-select themselves into each retail channel. Modern concepts of price discrimination in non-competitive markets go back at least to Pigou (1920), whose categorization of price discrimination into first, second and third degree is still used today. Robinson (1933) elaborated on the conditions required for firms to engage in effective third degree price discrimination, namely that there exist identifiable market segments that differ in their price elasticities of demand. Using this background, Blattberg and Sen (1974, 1976) and Blattberg et al. (1978) show how market segmentation based on identifiable demographic characteristics can be effectively exploited. More recently, Hoch et al. (1995) use scanner data to show how demographic characteristics can be used to price discriminate by store location. Where differences in price elasticity are not easily identifiable, Moorthy (1984) provides a model where firms exploit differences in consumer preferences across market segments by offering product variants at different prices, allowing consumers to self-select among those products. More generalized models of price discrimination in contestable markets with differentiated products have been developed by Salop and Stiglitz (1977), Narasimhan (1984), Borenstein (1985) and Holmes (1989). The type of consumer behavior closest to that examined in this paper is that of Narasimhan (1984), who presents a model of coupon use as a form of price discrimination for identical goods. Specifically, Narasimhan presents a model in which consumers, who differ in their price elasticity of demand, self-select themselves into coupon use based on comparing the savings associated with using coupons with the opportunity cost of using coupons. We extend this model by allowing consumers to compare the savings associated with one retail outlet with the associated opportunity cost as defined in Kahn and Schmittlein (1989) and Bell et al. (1998). Finally, with respect to retail channel, Gerstner et al. (1994) examine price discrimination by retail channel, however, their paper concentrates on the effect of retailer mark-up on the size of discount offered, while Park and Keh (2003) look at the effect of manufacturers utilizing both the traditional retail channel as well as selling direct to consumers. Our paper, on the other hand, provides a unique perspective on the use of retail channel itself as a means of price discrimination.

2. A model of price discrimination

We model retail channel as a form of market segmentation. Just as coupons serve as a means of consumers self-identifying

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themselves into market segments according to their price elasticities of demand (Narasimhan, 1984), retail channel can serve a similar function. From the consumer's perspective, purchasing some goods at a lower cost retail channel provides an alternative as long as the savings associated with shopping at that channel are greater than the costs. In this context, choice of retail channel is consistent with Narasimhan's (1984) model of coupon usage on several dimensions. First, both coupon usage and retail channel are decisions of self-selection by rational utility maximizing consumers. Second, consumers will decide to purchase a specific product at a lower priced retail channel as long as the savings is greater than the opportunity cost required to search, travel to, and shop at that channel for the specific good in question. This is analogous to the model of coupons where usage depends on the savings being greater than the opportunity cost in time required to search, clip (print etc.), store, organize, retrieve and use coupons. Finally, both coupon usage and choice of retail channel are decisions consumers make based on the potential savings on individual products and not overall savings on all products. Specifically, we do not assume that some retail channels are more or less expensive for all or even most products, but rather that some retail channels are more or less expensive for one particular product.

From the firms' perspective, it will engage in price discrimination as long as the marginal revenue from price discrimination is greater than the marginal cost. While price discrimination is generally associated with monopolistic or oligopolistic industries, models of price discrimination in differentiated product markets have been developed by Borenstein (1985) and others.

In its simplest form, given “i” different market segments, which differ in their price elasticities of demand, and for whom arbitrage among the market segments is costly, we can investigate discriminatory behavior by examining the firms’ profit function,

$$\Pi = \sum_{i=1}^{n} TR_i(Q_i) - TC(Q),$$

where:

i denotes the different market segments identified by the firm.
$TR_i(Q_i)$ represents total revenue in market i from unit sales Q_i.
$TC(Q)$ represents total cost of production across all three channels so that $Q = \sum_{i=1}^{n} Q_i$.

Profit maximization results in the usual first order conditions:

$$\frac{\partial TR_i}{\partial Q_i} = \frac{\partial TC_i}{\partial Q_i}\frac{\partial Q_i}{\partial Q}; \quad \forall i$$

If we assume costs are common to all markets $\left(\frac{\partial Q_i}{\partial Q} = 1\right)$ we can rewrite the optimizing condition as,

$$\frac{\partial TR_i}{\partial Q_i} = \frac{\partial TC}{\partial Q}; \quad \forall i$$

which produces the familiar condition that $MR_i = MC$.

Since

$$TR_i = P_i Q_i$$

$$\frac{\partial TR_i}{\partial Q_i} = MR_i = P_i + Q_i \frac{\partial P_i}{\partial Q_i}; \quad \forall i$$

which can be rewritten to express in elasticity form,

$$MR_i = P_i(1 + \frac{1}{\varepsilon_i}); \quad \forall i$$

For our three-market (channel) scenario, this results in

$$P_1\left(1 + \frac{1}{\varepsilon_1}\right) = P_2\left(1 + \frac{1}{\varepsilon_2}\right) = P_3\left(1 + \frac{1}{\varepsilon_3}\right).$$

In this form we see that the price in each market is inversely proportionate to the absolute value of the price elasticity of demand in that market. That is, $P_1 < P_2 < P_3$, if $|\varepsilon_1| > |\varepsilon_2| > |\varepsilon_3|$.

3. A model of consumer behavior

We view channel price discrimination similar to that of coupon usage in which consumers self-identify themselves for coupon usage by comparing the marginal cost with the marginal benefit. We propose that consumers self-select themselves into each retail channel (drug, food and liquor store) based on demographic characteristics and shopping intent. As with coupons, shoppers then compare the cost and benefit of searching out a lower priced good, in this case, a bottle of wine.

Consider first, drug store shoppers, who can be characterized as one of two groups. Drug store shoppers can be considered category specific shoppers, ostensibly shopping for goods other than wine. In this case, wine may be considered an unplanned purchase, which Bucklin and Lattin (1991) show have a relatively high price elasticity of demand. Drug store patrons may also consist of quick or fill-in shoppers, who as Kahn and Schmittlein (1989) show, tend to have “smaller-sized families, lower incomes … and more retired”, a group that we would expect to purchase relatively lower priced wines and to have a relatively high price elasticity of demand. For drug store shoppers, both shopping intent and demographic characteristics would lead to greater price sensitivity.

In contrast to drug store shoppers, for whom wine may be an impulse good, wine morel likely to be part of a larger shopping list or basket of goods for grocery store shoppers who make more infrequent regular shopping trips. Kahn and Schmittlein (1989) and Bucklin and Lattin (1991) show that these types of shoppers tend to be from a larger family, which would increase search costs, and from families with a higher incomes, which would decrease price sensitivity.

Liquor store shoppers on the other hand have a specific shopping intent. Category specific shopping of this type tends to reduce search cost and decrease price sensitivity (Bell et al., 1998).

Based on the search costs, shopping intent and demographic characteristics we expect drug store patrons to be the most price sensitive, followed by grocery store shoppers and liquor store shoppers: $|\varepsilon_{Drug}| > |\varepsilon_{Grocery}| > |\varepsilon_{Liquor}|$. If this is the case, then we should observe prices for the identical wines to cheapest at drug stores, more expensive at grocery stores and most expensive at liquor stores: $P_{Drug} < P_{Grocery} < P_{Liquor}$.

4. Data

We use scanner data of retail purchases of wine in the US to investigate price differentials across three retail channels: Drug stores, food or grocery stores and liquor stores. Retail scanner data, provided by proprietors such as Information Resources Incorporate (IRI) and the Nielsen Company, is increasingly becoming the primary source of data for analytics in the consumer packaged goods industry due to the ready availability of data at the item level on factors such as price, quantity, promotional activity and sales channel. In this paper, we use Nielsen *Scantrack* data to construct a pooled cross section of data on point of sale purchases of wines from major U.S. retail chains, for the years 2007–2010. The data consist of national sales of all wines, foreign and domestic, purchased from major retail chain stores, defined as those with sales of over 2 million dollars per year. The data are aggregated for all markets and include the price paid, quantity sold, store keeping unit (SKU) and retail channel of each item. For uniformity, we concentrate on wine purchases of standard 750 ml

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