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Abstract

What is the effect of competition on prices in a market where the product is offered at different quality levels? Would the increase in competition reduce the price of high quality good more than the low quality good? These are the questions examined in this paper in the context of the video rental industry. Videos can be classified into DVD and VHS. Firms can also be categorized as branded stores that belong to a major chain and unbranded stores that do not belong to any major national chain. As competition increases prices of both DVD and VHS should decrease, but in theory it is not clear which one will decrease more. Moreover branded and unbranded stores may respond differently to the change in competition. My empirical results indicate that as competition increases, (a) for branded stores, the price of the high quality good (DVD) falls more than that of the low quality good (VHS), (b) for unbranded stores, we observe the opposite effect.

Keywords: Price discrimination, brand effect, differentiated products

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Viswanath Pingali*

1. Introduction

Typically, the Industrial Organization literature interprets second degree price discrimination as *quantity discounts* or *nonlinear pricing mechanisms.* But as Rochet and Stole (2002) point out, even charging different prices for different qualities offered by a firm (not justified by cost concerns alone) constitutes second degree price discrimination, and it is a form of nonlinear pricing.

"…While precisely speaking it is inaccurate to label this variable-quality setting as nonlinear pricing *per se*,… we will use the phrase "nonlinear pricing" through out this paper in the broader sense of variable pricing over the characteristics of final consumption bundle…"[1]

By offering different qualities at different prices, a firm could be trying to screen consumers based on their preference for quality. In such a market, though an increase in competition unambiguously reduces all prices, competition may affect the prices of different qualities differently. It is not clear what the correlation between the quality level and the effect of competition on its price would be. In this paper, I examine this question in the context of the video rental industry. A typical video rental firm offers two kinds of videos: VHS and DVD. On the demand side, a DVD is superior in quality to a VHS[2] and on the cost side it generally lasts longer, enabling a store to circulate it more often.

Video rental stores can also be divided into two categories: (i) branded stores belonging to a major national chain and (ii) unbranded stores that do not belong to any chain. Therefore I can differentiate the competition faced by a firm as well. I use difference-

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[1] Rochet and Stole (2002), page: 278

[2] Extra features like deleted scenes, subtitles, picture clarity, etc undoubtedly make DVD a better alternative

in-difference methods to see how the *nature of competition* faced by the firm influences price dispersion. It is not only possible that the prices of different products at a given firm react differently to changes in competition, but also that these reactions could differ for different types of firms. For example, the change in the difference between the DVD price and the VHS price change due to changes in competition could depend on the type of the store under consideration (branded or unbranded). Moreover, different types of firms could perceive competition from a given type of firm differently. My results indicate that as the competition from a store of similar type increases, the price difference between DVD and VHS decreases (i.e. DVD prices react to competition more than VHS prices), while the opposite occurs when competition from a store of a different type increases.

My paper contributes to the empirical literature on second degree price discrimination in competitive situations. A necessary condition for firms to be able to price discriminate is the presence of market power, though the relationship between price dispersion and competition is ambiguous.[3] Busse and Rysman (2004) study the influence of competition on the menu of prices charged by Yellow Pages. The size of a Yellow Page advertisement and its price are not linearly related. This suggests second-degree price discrimination (quantity discounts). The question addressed in Busse and Rysman (2005) can be summarized as follows: if the competition in a particular market increases, would the Yellow Pages publisher reduce the prices of large advertisements more than the prices of small advertisements? They find that as competition increases, purchasers of larger ads pay relatively less compared to the purchasers of smaller ads. Cohen (2004) proposes a test to identify second degree price discrimination (non-linear pricing) with the help of a

[3] See for example: Carbonneau, McAfee, Mialon and Mialon (2004)

difference-in-difference approach. He finds evidence suggesting that paper towel manufacturers price discriminate by offering different package sizes at different unit prices.

Miravete and Roller (2004) develop a structural model to address a similar question in the case of cell phone markets. Cell phone deals offer consumers a list of options to choose from. These options vary from high fixed fees and low per-minute charges to low fixed fees and a high per-minute charge. Firms design a menu of options to screen consumers, suggesting second-degree price discrimination. The market they consider was a monopoly initially, and they see how prices changed as competition was introduced into the market. They concentrate on the welfare effects of two-part tariffs. To address the effect of competition on price dispersion, Ivaldi and Mortimort (1994) exploit multi-principle incentive theory to develop a theoretical model of competition. They fit the model to the French market for energy distribution. Their results indicate that uncertainty regarding consumer preferences plays a crucial role in determining prices.

One crucial aspect that needs to be considered when characterizing the price – competition relationship is the endogeneity of the two variables. Potential problems associated with ignoring endogeneity are well documented in the Industrial Organization literature. For example, see Mazzeo (2002) and Manuszak and Moul (2006). To summarize the main problem: in a market characterized by high entry costs, we may observe high prices and low competition. Hence a typical price-competition regression may *over-states* the effect of competition on prices. Analogously, a region characterized by high demand and low entry costs may witness high competition and high prices. In such case the regression may *under-state* the effect of competition on prices. The issue is that there are unobserved (by the econometrician) factors that influence both prices and store location. Unobserved factors that influence both demand and market structure could bias regression coefficients. Moreover, firms set prices to not only respond to the current competition, but also to the expected competition. Contestability[4] and in particular, limit pricing arguments are some potential explanations for such a behavior. Hence, in a price – competition regression, the correlation between the error term and competition creates a bias. I use an instrumental variables approach to address the endogeneity problem.

Instrumental variables that are correlated with market structure, but not demand are hard to obtain. Some studies employ structural methods to address the endogeneity issue. In his analysis of motel industry, Mazzeo (2002) estimates equilibrium market structure and uses the predicted equilibrium market structure in a price – competition regression. Watson (2002), using the entry model developed in Seim (2006), addresses variety – competition endogeneity issue in eyeglass market. These studies examine several independent markets and exploit cross – market variation. In this paper, I consider a single market that is divided into several sub-markets that are not independent of one another. Another method that has been proposed to address endogeneity problem is market-specific fixed effects. For example see the Ashenfelter et al (2004), analysis of Staples – Office Depot merger.

The video rental industry is the subject of several papers. The welfare effects of the policy shift from fixed fees to revenue sharing between retailers and the studios are explored in Dana and Spier (2001). Their theoretical model shows that revenue sharing contracts encourage stocking up inventories by suppliers. They further show that unlike two-part tariffs, revenue sharing achieves the first best outcome by softening retail-price

[4] See Baumol, Panzar and Willig (1988)

competition without distorting the retailer inventory decision. Using a proprietary dataset, Mortimer (2003) estimates the effect of revenue-sharing contracts on consumer welfare and firms' profits, relative to linear contracts. Her results indicate that upstream and downstream profits increase and consumers are substantially better off under revenue sharing contracts. Seim (2006) estimates a model of entry of video rental stores. Using a nested fixed-point algorithm, she characterizes the locational choices of video rental firms. Seim assumes that the type of store (branded or unbranded) is immaterial to making entry decisions. My paper contends that the type of competition has an influence.

The rest of the paper is organized as follows: in section 2, I briefly describe the existing theoretical literature on competitive second degree price discrimination and present an example to derive the testable hypotheses. In section 3, I present the details of the dataset used in this paper and describe the industry structure. Section 4 contains the empirical model and discussion of the results. Finally, section 5 concludes with a few ideas for future research.

2. Testable Hypotheses

Several studies extend the monopoly nonlinear pricing literature to competitive environments. But the effect of competition on second degree price discrimination is ambiguous. To my knowledge Oren, Smith and Wilson (1983) were the first to establish the feasibility of nonlinear pricing in a competitive environment. In an *n* symmetric firm quantity setting game (*a la* Cournot), where there are discrete types of consumers, they show that nonlinear pricing is the equilibrium strategy. As number of firms in the market tends towards infinity all prices tend towards marginal production cost, but it is not clear from their model as to which price adjusts to the competition faster. Similar results were found in

Spulber (1989) in a price-setting game where consumers vary in their preference for a particular brand.

Some studies point out that, if quality levels are exogenously fixed, competition has no effect on the difference between the various prices charged. Armstrong and Vickers (2001) show that a standard oligopoly problem can be redefined as one where firms compete on providing utility to consumers. Characterizing competitive outcomes in several dimensions (for example multidimensional screening models) can be computationally intensive and often intractable. They overcome this problem by modeling firms supplying utility directly to the consumers. They further show that in a competitive environment where consumers have private information about their tastes, a *two part tariff* is the unique equilibrium outcome. They consider a standard Hotelling model where consumers differ according to taste parameters. Each firm produces *n* different goods with different marginal costs ($c_i, i = 1, 2, \ldots n$). Consumers choose different goods at different quantities, ($q_i, i = 1, 2, \ldots n$) depending on their taste parameter. They show that the equilibrium tariff for basket of goods consumed is $T\left(\bar{q}\right) = t + k + \sum_{i=1}^{n} c_i q_i$, where $\bar{q}$ is the basket of goods purchased, *t* is the transportation cost of the consumer per unit distance traveled (the degree of product differentiation) and *k* denotes any additional costs incurred by the firm for a given buyer.[5] Therefore the price charged to the consumer with unit demand for only one type of good (whose marginal cost is *c*) is $T(q) = t + k + c$. This implies that competition, as represented by *t*, influences prices of all goods in the same manner.

[5] Proposition 5, page 600 in Armstrong and Vickers (2001)

Rochet and Stole (2002) study price discrimination in a multi-quality competitive market where consumer participation is *less than perfectly elastic*.[6] That is, they assume that the consumers' outside option is a random variable. For any given price level, only the probability of a given consumer purchasing is known. They show that in equilibrium, firms offer contracts such that the price equals *marginal cost of providing a quality level plus fixed fees*. Even when firms are identical, it is possible that the fixed fee varies across firms. This result holds true when the characteristic set of consumers is either discrete or continuous.[7] In this case, the difference between the prices of various quality levels is the difference in their marginal costs. When the quality levels are exogenously fixed, competition faced by the store has no effect on the difference between prices in a given store.

Screening of consumers based on quality is also considered in the finance literature. Villas-Boas and Schmidt-Mohr (1999) model banks screening the consumers into high risk and low risk by offering different combinations of interest rates and collateral. They show that as competition increases, firms compete less aggressively for the most profitable customers. I now construct two examples to derive some testable hypotheses. The first one is straightforward, while the second one is based on the model of Villas-Boas and Schmidt-Mohr (1999).

Consider a linear city of unit length (*a la* Hotelling). Two firms are located on either end point. Consumers are distributed uniformly on the line. Consumers belong to either of two types: high or low. Each firm sells two types of goods: D and V. Good D is of superior quality for all consumers. I assume that the high type consumers have high transportation costs and a higher preference for quality (their marginal utility with respect to quality is

[6] Page 278, Rochet and Stole (2002)
[7] Proposition 2 (for discrete types) and proposition 6 (for continuous types) in Rochet and Stole (2002)

high), whereas low types have zero transportation costs and are indifferent between the products. That is, low types prefer the cheapest good available and if prices are equal they select at random. In this situation, Bertrand competition dictates that the price of V is zero and the standard Hotelling model yields the price of D is *t.* As *t*, the degree of competition between the stores, tends towards zero, the price difference between D and V in a given store tends towards zero.

The second example differs from the traditional non-linear pricing models. The literature often assumes that the quality levels available to firms are fixed exogenously. In contrast, I allow firms to choose the quality they offer. In the video rental industry, firms choosing quality can be justified on two grounds: 1) the stores decide on how many times they allow a given DVD and VHS to circulate, and 2) they decide on the type and amount of inventory they carry (the number of titles in the store and the number of copies of each title).[8] The underlying assumption is that a consumer who visits a particular store ends up renting a video from that store (even if his first choice video is not available). Therefore the bigger the variety and stock of movies, the better the quality the consumer expects to receive *ex ante* (before visiting the store).

Consider a market where firms choose both qualities offered as well as prices for each quality. The firms are denoted by *Left* (L) and *Right* (R). Firm L is located at the point zero while Firm R is located at 1 on the unit interval. Consumers are distributed uniformly on the line. The consumer's location is denoted by *x*, the distance between the consumer and the firm L. The distance between the consumer located at *x* and firm R is 1-*x*. I denote

[8] For example, most of the branded stores like Blockbuster and Hollywood video do not carry movies rated above R. Moreover, branded stores tend to carry multiple copies of a same title to ensure availability to consumers. As most branded stores also specialize in selling used videos, it can be argued that they withdraw a movie from circulation faster than unbranded stores would.

t_H and t_L to be the cost of traveling a unit distance for high type and low type consumers respectively. Transportation cost $(t_i, i \in \{H, L\})$ can be interpreted as the degree of product differentiation. In the video rental industry, firms differentiate from their competitors in two dimensions: their location and the inventory they carry.

If the transportation cost *t* is zero, then spatial competition is irrelevant and the market is perfectly competitive. Price setting (*a la* Bertrand) will then result in price equaling marginal cost for both commodities. I further assume that consumers vary in their preference for quality. Preference for quality is represented by θ. For simplicity I assume that θ is one of two types: $\theta \in \{\theta_1, \theta_2\}$, such that $\theta_1 > \theta_2$. A fraction α of consumers are type 1 whereas the rest are type two. The location and type of consumer is the private information of the consumer, while the distribution of consumers' type is common knowledge. I assume consumer location and type are independently distributed.

Firms (L and R) sell products at two different quality levels, q_1 and q_2 (to be determined by the firms). The net utility of a consumer of type $\theta > 0$, buying quality *q* and paying price *p* before paying transportation costs is given by the following function:

$$U(\theta, p, q) = \theta q - p + M$$

where *M* [9] is an *sufficiently* large number.

Consumer utility is strictly increasing in the quality of the good purchased. High type consumers (θ_1) value quality more than low type consumers (θ_2). This is the single crossing

[9] *Sufficiently large M* ensures that, in equilibrium, all potential consumers in the market want the good. Another way to ensure full participation is to assume that the utility associated with no purchase is $-\infty$

condition of adverse selection models, $\frac{\partial^2 U}{\partial q \partial \theta} = 1 > 0$. The utility function is similar to that of Mussa and Rosen (1978) and Rochet and Stole (2002).

Finally, the total utility of a consumer located at *x* net of transportation costs is given by $U(\theta, p, q) - d$, where *d* is the transportation cost incurred. It takes the value $t_i x$ if the consumer buys from the firm L and $t_i(1-x)$ if he buys from firm R instead $(i \in \{H, L\})$. The consumer has an outside option that yields a utility of zero.

The incentive compatibility (IC) constraint within the firm does not dependent consumer location. *Sufficiently large M* guarantees that transportation cost plays a role only in choosing a store but not in the product choice. The IC constraint solves the following equation:

$$U(\theta) = U(\theta, p(\theta), q(\theta)) = \max_{\bar{\theta}} U(\theta, p(\bar{\theta}), q(\bar{\theta})) \qquad \text{(IC)}$$

Characterizing the individual rationality (IR) or participation constraint is not so straightforward. The participation constraint should satisfy two parts. The utility the consumer visiting firm *i* receives must exceed his reservation value (assumed to be zero) and the utility obtained from visiting store *j* where $j \neq i$ and $i, j \in \{L, R\}$.

A consumer of type θ located at point *x* consumes from firm *L* if the following condition holds:

$$U(\theta) - tx \geq U^R(\theta) - (1-x)t$$

where $U^R(\theta)$ is the utility promised by the firm *R*.

Firm *L* takes the utility provided by the firm *R* as fixed. This implies:

$$x \leq \frac{t+U(\theta)-U^{R}(\theta)}{2t}$$

Competition in utility space is studied in detail in Armstrong and Vickers (2001).

For the present I assume that the cost of producing either quality is zero for both firms. Therefore firm *L*'s profit from a consumer of type θ located at *x* is given by:

$$\begin{aligned}\pi\left(\theta, p(\theta), q(\theta), x\right) &= p(\theta) \text{ if } x \leq \frac{t+U(\theta)-U^{R}(\theta)}{2t} \\ &= 0 \text{ otherwise}\end{aligned}$$

The problem for firm *L* can be summarized as follows:

$$\max_{p_1, p_2, q_1, q_2} \alpha p_1 x(\theta_1) + (1-\alpha) p_2 x(\theta_2) \quad \textbf{(Max)}$$

subject to the following two incentive compatibility constraints:

$$q_1\theta_1 - p_1 \geq q_2\theta_1 - p_2 \qquad \textbf{(IC 1)}$$

and

$$q_2\theta_2 - p_2 \geq q_1\theta_2 - p_1 \qquad \textbf{(IC 2)}$$

$$p_1, p_2 \geq 0$$

$$0 \leq \min\{q_1, q_2\} \leq \max\{q_1, q_2\} \leq Q \qquad \textbf{(Quality Restrictions)}$$

$x(\theta_1)$ and $x(\theta_2)$ represent the locations of indifferent consumer of types θ_1 and θ_2 respectively. IC 1 and IC 2 represent incentive compatibility constraints for type 1 and type 2 respectively. I also assume that the maximum quality offered by the firm is *Q.* It is costless to provide quality and the profit function is increasing in quality. Hence at least one of the qualities would approach infinity without this restriction.

The firm's profit function is increasing in quality provided. Moreover, it is costless to provide quality. Therefore in equilibrium, at least one of the types is assured the highest possible quality level. Hence the high type's quality is fixed at *Q*, the highest possible level. Given that the high type's quality level is fixed at *Q*, the incentive compatibility constraint of the high type binds. Otherwise the firm can increase q_2 (IC 2 still binds) and increase its profits. Therefore the quality level of the low type, as a function of p_1 and p_2, is given by:

$$q_2 = Q - \frac{p_1 - p_2}{\theta_1} \qquad (1)$$

From equation (1), it is straightforward to check that the incentive compatibility of low type is satisfied as long as $\theta_1 > \theta_2$.

I further assume the following condition that ensures separating equilibrium:

$$1 > \alpha > \frac{\theta_2 t_H}{\theta_1 \left(t_H - t_L\right)} \qquad \textbf{(T1)}$$

Condition **(T1)** is guaranteed only if the following condition is true:

$$\frac{t_L}{t_H} < \frac{\theta_1 - \theta_2}{\theta_1} \qquad \textbf{(T2)}$$

First order conditions for profit maximization routine are given by:

$$p_1 = t_H \left[1 - \frac{1-\alpha}{\alpha} \frac{\theta_2}{\theta_1} \frac{p_2}{t_L}\right] \qquad \text{(FOC w.r.t. } p_1\text{)}$$

$$p_2 = \frac{t_L \theta_1}{\left(\theta_1 - \theta_2\right)} \qquad \text{(FOC w.r.t. } p_2\text{)}$$

Conditions **(T1** and **T2)** and a *sufficiently large* ***Q*** along with the first order conditions yield the following equilibrium price – quality combinations:

$$p_1 = t_H \left[\frac{\alpha\theta_1 - \theta_2}{\alpha\left(\theta_1 - \theta_2\right)}\right] \qquad p_2 = \frac{t_L \theta_1}{\left(\theta_1 - \theta_2\right)}$$

$$q_1 = Q \qquad\qquad q_2 = Q - \frac{p_1 - p_2}{\theta_1}$$

The regularity conditions, **(T1** and **T2)** ensure that the price of high type good (*p_1*) is not only positive, but also higher than the price of low type good (*p_2*). If these conditions are not satisfied, a separating equilibrium does not exist. These results differ slightly from those of Villas–Boas and Schmidt–Mohr (1999) because…

Competition changes with either t_H or t_L. To separate three cases, I assume $t_H = t.H$ and $t_L = t.L$ where $H > L$. I consider changes in *t*, *H* and *L*. Price difference is given by:

$$p_1 - p_2 = t\left[\frac{\alpha\theta_1(H-L) - \theta_2 H}{\alpha(\theta_1 - \theta_2)}\right] \qquad \textbf{(2)}$$

From equation (2) it is straightforward to check that (given the regularity conditions), as *t* increases the price difference increases. If only *H* increases, that is if competition for the high type good decreases, price difference increases. On the other hand, if *L* increases, that is competition for the low type good decreases, the price difference decreases. Therefore, if the competition from a firm of the same type (branded or unbranded) increases, price difference should decrease. If branded stores concentrate on DVD and unbranded ones on VHS, an increase in competition from a different store type increases the price differences at that firm.

3. Industry Structure and Data

Video rental industry is well suited to answer the question posed for several reasons. There are two distinct varieties of products available: DVD and VHS. Again, each of the products is further divided into new releases and old releases (called library collection). Prices vary significantly across these products in a single store and across the stores. Even among the stores that belong to same brand (Blockbuster, Hollywood etc) prices differ. I present more detailed description of the data in the latter part of this section. Stores can also be divided into two distinct types: branded and unbranded stores.

I use an original dataset to analyze the question addressed in this paper. The unit of observation is the price of a good in the store. The market I consider for the analysis is Cook County, IL. The choice of the market is for the reason of convenience. Discussions with market experts suggest that the firms' decisions are very much similar across geographical areas.

I obtain a list of video rental stores from Yahoo Yellow Pages. Yahoo Yellow Pages, a part of Yahoo! Inc is a reliable source of information for the local telephone directory. For the purposes of this paper, I consider the list of stores provided by Yahoo Yellow Pages as the total stores present in Cook County, IL. Yahoo provides exact location and telephone number of all the video rental stores in every city in the county. These stores are generally secretive regarding the data they provide. For that reason, quantity data (data on number of videos rented) is hard to get.[10] On the other hand, pricing data is relatively easy to get as the econometrician can pose as a consumer and enquire after the prices.

Using the phone number provided in the Yellow Pages, I called each store and posed as a potential consumer and asked for prices of various categories of videos available in the store. Questions asked to the store included the following: 1) prices of new and old DVD and VHS, 2) if the store carries video games and if it did what the prices are, 3) Number of days

[10] I was told by Blockbuster employees that these quantity data are proprietary.

one gets to keep the video without incurring late fees,[11] 4) Whether the prices reported are the final prices or if there was an additional sales tax and finally 5) if the store also rented ethnic movies and if they did, which ethnic movies they carried. If a particular store did not respond, I called the store couple of times more at different times on different days before ignoring the presence of the store.

I identify the census tract that each store belongs to from the census website by using the exact location of each store provided in the Yellow Pages.[12, 13] This helps me identify local demographics of each store. Each county is divided into several census tracts for easing the organization of collection of data. *Census tracts are small, relatively permanent geographical entities within the counties…When first established, census tracts are to be as homogenous as possible with respect to population characteristics, economic status and living conditions… When delineating the census tracts, the Census Bureau requires that the average population of all the tracts in the country be four thousand people (fifteen hundred housing units) with individual census tracts ranging from two thousand five hundred to eight thousand inhabitants.*[14] Again, from the census web pages, I collect demographic information for each store. Given the size of each tract, demographics of the tract in which a store is located could be a good indicator of the overall demographic characteristics of the market the store considers.

[11] In January 2005, Blockbuster introduced a controversial "No Late Fees" policy, according to which consumers do not pay late fees subject to certain conditions. The data for this paper, however, were collected in October 2004 itself.

[12] Literature varies in this regard. While some studies suggest the use of census block (e.g. Thomadsen (2003)), some other studies suggest tracts (e.g. Seim (2003)). Several studies use zip codes as well (e.g. Mortimer (2003)).

[13] http://factfinder.census.gov/servlet/AGSGeoAddressServlet?_lang=en&_programYear=50&_treeId=420&_sse=on

[14] *Source:* http://www.**census**.gov/geo/www/GARM/Ch10GARM.pdf

I classify any store that belongs to a major national chain as a branded store. The list includes three types of stores: Blockbuster Video, Family Video and Hollywood video. I consider all non-chain stores as unbranded. Table 1 gives details of the various types of stores. Among the branded stores, Blockbuster has more stores than the other brands. It is not surprising given the fact that Blockbuster Video has substantially more market share (for the entire market) than the second biggest player in the market, Hollywood Video. Table 2 presents market shares of the major players in the market. In the US, Blockbuster Video enjoys substantially higher market share (around 40%) than Hollywood Video (the second biggest player in the market with around 11% market share).

I present the details of price differences across various types of firms in tables 3 and 4. Table 3 shows that a new DVD is the most expensive of products available at a store whereas old VHS is the lease expensive. Moreover, new DVD has the least standard deviation while old DVD has the highest standard deviation. Table 4 shows that major stores charge different prices for old DVD and VHS, whereas they do not differentiate (in terms of prices) between DVD and VHS for new releases. Though the rental rate for old and new DVD is same in major stores, the length of time of the rental differs. Blockbuster typically allows two day rental for new releases whereas they allow seven days for old releases.

Conversations with industry experts reveal that the industry is very local in nature, with an average consumer willing to commute no more than three miles round trip for renting a video.[15] This is the average figure for all of America and it could be much lower in the urban areas. This suggests that one measure of competition faced by the store is the distance from the nearest neighbor.

[15] Seim (2003)

Stores differentiate themselves from their rivals on several counts. For example their location and the amount of inventory they carry are the strategic decisions of the firms. Branded stores manage better deals with the studios and so one can say that they contain better inventory than the unbranded ones. For this paper, I assume that all the branded stores carry same kind of inventory. I have data on prices charged by the firms for all the products. So to isolate the effect of the brand of competition on price variation, I estimate how price dispersion changes because of both branded and unbranded competition. The difference between the effects of these two types of competition could be attributed to the "brand effect", i.e. the brand of the competition/ quality of competition.

Each store has two products: VHS and DVD. Many stores also carry video games. Between the DVD and VHS many stores differentiate across new and old releases. All the branded stores charge same price for all the new releases, irrespective of it being DVD or VHS. More than a third of the stores in my dataset do not carry video games. For that reason, I do not consider videogames prices in the analysis. Not all households in a tract have the ability to play a VHS or a DVD. Tract level information on number of households having DVD and VHS players is not available. This information is not available to the stores as well. However household purchase decisions of durable goods depend on household characteristics.[16] As long as I control for demographics, the lack of information on DVD and VHS players would not bias the influence of competition on prices.

The next issue is to define competition faced by a store. As mentioned earlier, I consider distance from the next nearest store as the measure of competition. Seim (2003), for a similar market, proposes another measure of competition by drawing the distance

[16] Though it is not their main focus, Gowrisankaran and Rysman (2005) characterize the affect of household demographics on purchase decisions in durable consumer goods market. They show that…

bands across stores and counting out number of stores in each band. While such a measure of competition might be appropriate while analyzing entry decisions of the firm, it is not the case while analyzing prices (especially when the firms are price setters). The argument becomes clear if we consider the following two scenarios. In the first case there are two firms on a same geographical location (for example, two very close stores in a shopping complex) and no other firm in a mile's radius from that spot. The distance to the next nearest neighbor is almost close to zero. In the second case, consider a firm that has n firms in a mile's neighborhood, n>1, but the nearest neighbor being half a mile away. In the first case Bertrand competition forces the firms to charge price equal to marginal cost, where as in the second case the firm under consideration enjoys market power. If we consider number of firms as a measure of competition, we find that the firm in the second case has more competition than the first one. And any analysis with such a measure of competition could be biased. Distance from the nearest neighbor is measured using Yahoo maps. I use two metrics for measuring this distance. One is the driving distance from the nearest neighbor and the other is driving time. The reason why I use driving time is because people in urban neighborhoods where driving times (given a distance) tend to be longer people are more sensitive to driving time.

Another important issue to be addressed here is the case of franchisee stores. A nation wide chain might franchise some of its stores and in such cases, these franchise stores may act substantially different from the non-franchised stores. Hollywood Video does not franchise its stores. The other brand store, Family Video's presence in the market under consideration is negligible. There are around six Family Video stores in the entire Cook County where the total number of stores is well over four hundred (table 1). The problem is with Blockbuster Video. Blockbuster corporate website claims that the interest in franchising is increasing.[17] To further understand the issue of franchising, I contacted Blockbuster and Hollywood Video as a potential franchisee. The information I received was that I should locate a location that does not have any Blockbuster store in ten miles radius. Blockbuster refused to reveal any information on negotiability of the terms of franchising contracts. Hollywood Video, on the other hand, informed me very clearly that it does not encourage any franchising. In the dataset I have, there is no Blockbuster store that does not contain another Blockbuster store in ten miles radius. Therefore I assume that all the Blockbuster video stores in my dataset to be corporate – owned stores. I attach both the emails in the appendix.

One final issue that needs to be addressed is Netflix. Netflix has around 2.5% of market share in this industry in 2004. Their customer based increased by about 60% in 2005. With more than fifty five thousand titles and five million subscribers in 2005, Netflix is fast turning out to be one of the biggest players in the video rental market.[18] As Netflix is movie rental by United States Postal Service, it can be considered 'omnipresent' and influences demand for all the stores. [19] So the demand faced by the firms can be considered as residual demand for movie rentals. The underlying assumption is that it affects all the stores in a similar way. This might not be a realistic assumption. According to some industry studies, the chief goal of Netflix is "*edge out traditional rental brands, and Blockbuster in particular.*"

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[17] http://www.blockbuster.com/corporate/displayAboutBlockbusterDetails.action?articleId=1082957&cctr=AboutBlockbusterLeftNav

[18] Source: Netflix Fact sheet of 2005

[19] There are other online movie websites as well, like www.cinemanow.com etc. Also, Pay-Per-View cinema via cable TV is also another major competitor to video rental firms. But the argument of '*omnipresence*' applicable to Netflix is applicable to these cases as well.

[20] However lack of data from Netflix necessitates me to make this assumption. This would imply that I would be over-measuring the competition faced by a branded store vis-à-vis unbranded store.

4. Empirical Specification and Results

4.1 Empirical Specification:

To answer the research question posed, I propose the following empirical specification. The price of a product *g*, $g \in \{D,V\}$, in store *s* of type *b*, $b \in \{U,B\}$, located at point *t* is given by the following equation:

$$\begin{aligned} P_{gstb} &= X_t\beta + \mu time_g + \delta_1 D_g + \delta_2 New_g + \delta_3 B_b + \gamma_1 Cbr_s \\ &+ \gamma_2 Cubr_s + \theta_1 D_g * B_b + \theta_2 D_g * Cbr_s + \theta_3 D_g * Cubr_s \\ &+ \lambda_1 Cbr_s * D_g * B_b + \lambda_2 Cubr_s * D_g * B_b + error_{gs} \end{aligned} \qquad \textbf{(*)}$$

The explanation of the variables is given below:

X- A vector of characteristics of location t

Time- Rental Period

D- Takes value 1 if the product considered is DVD

NEW- Takes value 1 if it is a new release

B- Takes value 1 for Branded store

Cbr- Competition from a branded store, measured as either driving distance or driving time from the nearest branded rival

[20] "Netflix analyzed via Value Framework": Levy and Cormia (2002)

Cubr- Competition from unbranded store, measured as either driving distance or driving time from the nearest unbranded rival

The demographics I control for are:

Population: Number of people (in thousands) in the census tract the store is located in

Income: Median annual household income (in thousands of dollars)) of all the households in the tract

Rent: Median rent (in hundreds of dollars)

Child: Number of children in the tract (in hundreds)

Retd: Number of retired people in the tract (in hundreds)

From the above equation we can derive:

$$\Delta P_B = \delta_1 + \theta_1 + (\theta_2 + \lambda_1)Cbr_s + (\theta_3 + \lambda_2)Cubr_s \qquad \text{(A)}$$

$$\Delta P_U = \delta_1 + \theta_2 Cbr_s + \theta_3 Cubr_s \qquad \text{(B)}$$

$$\Delta P_B - \Delta P_U = \theta_1 + \lambda_1 Cbr_s + \lambda_2 Cubr_s \qquad \text{(C)}$$

where ΔP_b represents the price difference in the store of type $b \in \{B,U\}$.

When the competition from a branded store changes, price difference in a branded store changes by $\theta_2 + \lambda_1$ while it changes by θ_2 in an unbranded store. Similarly when the competition from unbranded store changes, the price difference changes by $\theta_3 + \lambda_2$ in a branded store and by θ_3 in an unbranded store. Therefore when the quality of competition faced changes, the price difference changes by $(\theta_2 + \lambda_1) - (\theta_3 + \lambda_2)$ in a branded store and by $\theta_2 - \theta_3$ in an unbranded store.

I estimate equation (*) by both OLS and Feasible Generalized Least Squares (FGLS). (Right now I assume that the variance of the error term depends not only on the store, but also on the product. This is a restrictive assumption. I am working on alternative forms of heteroscedasticity. For example, it is possible that the error of various products in a given store could be related to each other).

Instruments:

I address the issue of price-competition endogeneity with the instrumental variables. Ideal instruments are the ones correlated with competition, but not with prices. Economic theory suggests that fixed costs are a barrier to entry and hence they would determine the competition faced by a store. But they do not have any effect on the prices charged by the store. Rent paid (foregone rent where the store is owned by the party that owns the property as well) is a fixed cost. Higher rents imply lower profit margins for the stores and hence less entry potential. If I assume that the stores are located at a given locality for "sufficiently long time" then marginal rent for additional movie sold is negligible. Therefore rents do not affect prices.

Another instrument is the competition faced by the nearest neighbor. This concept is illustrated by a picture given below:

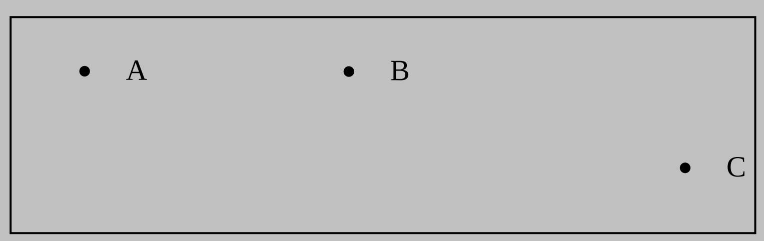

Figure 1

Location decision of store A influences the location of store B. Hence it influences the competition faced by store C. But by assumption, in this paper, prices in a given store are only influenced by the proximity of the nearest rival. Therefore prices in store C are not correlated to the distance between A and B, but the distance between A and B is correlated to the distance between B and C. *(I am still working on this part)*

4.2 Results

While estimating (*), I use two dependent variables: the price charged at the store and per day price charged at the store. Tables 5, 5', 6 and 6' present the regression results. In tables 5 and 5' I measure the competition faced by total driving time taken to the next nearest store. In tables 6 and 6' the measure of competition is the driving distance. While tables 5 and 6 present OLS regressions, 6 and 6' present the results from FGLS regressions. I use two dependent variables: price charged by a store and price charged by a store divided by the time for which the product is lent out.

Results indicate that when the household income increases by a thousand dollars, the price charged increases significantly by around two cents. As can be expected, increase in population increases the price. If the population of the locality of the store increases by a thousand people, the price significantly increases (from around one cent to as high as four cents). Total rent also has a positive effect on prices. A rent increase of one hundred dollars increases prices by around two cents. Industry sources reveal that children and retired people are a major source of demand. Therefore in theory one should expect that increase in children or retired people should increase prices. However, the results indicate that the increase in number of children and retired people has a significant negative impact on prices (by around two cents for an increase of one hundred children or retired people).

As the time of the rental period increases, the price of a video decreases substantially (by one to two cents for every additional day lent). That is because videos in larger demand (and hence higher price) are lent out for shorter period. As expected, a DVD cost significantly more than VHS (by around twenty to thirty cents). On an average a new release costs fifty cents more than old releases (around twenty cents per day). A major store charges around forty five to fifty cents more for VHS and around eighty cents to a dollar more (when compared to a minor store). But however, per-day prices are lower (both for VHS and DVD) in a major store. This is expected because a typical minor store lends out a new release for a day and an old release for five days. On the other hand, a typical Blockbuster video lends a new release for two days and an old release for a week and Hollywood video lends out all the videos for five days.

Regression results show that as the competition from the branded store decreases (driving time or the driving distance to the nearest branded store increases), the price difference between DVD and VHS increases in a branded store. In particular, if the driving time to a branded store (from a branded store) increases by one minute the price difference increases by around two cents. And if the driving time increases by a mile the price difference increases by around 1.3 cents. When the competition from an unbranded store increases, the price difference in a branded store moves in the opposite direction, though insignificant.

For the unbranded store, when the competition from a branded store increases, the price difference increases significantly. In particular, when the driving time increases by one minute, the price difference decreases by around four to five cents and when the driving distance increases by one mile, the price difference increases by around eight cents. However when the competition from an unbranded store decreases, the price difference seems to increase. A minute's increase in driving time increases the price difference by around two and a half cents (significant at 83%). When the driving distance increases by one mile, the price distance goes up by around 3.3 cents (significant at 77%).

Regression results suggest that the price differential in branded and unbranded stores increases when distance from the nearest firm of the same type increases (competition from the similar type decreases). One possible explanation could be that while the branded stores do not care about the location of unbranded stores, unbranded stores might regard the closeness to branded stores as an advantage. As pointed out in section 2 Stahl (1985b) shows that imperfect substitutes tend to locate close to each other. Therefore a minor store could be considering proximity to a major store as reduction in competition (in other words locating close to a branded store could be beneficial to the minor store than locating close to another minor store).

5. Conclusion

In this paper, using the video rental industry as an illustration, I check how price differentials in a multi-product industry are effected as the competition faced by the firm changes. Video rental stores can be categorized into two types: branded and unbranded stores. This allows me to differentiate between the kinds of competition faced by a given firm. Videos can also be classified into two products: DVD and VHS. The issue analyzed in the paper is how the price difference between DVD and VHS is affected when the competition faced by a store increases. I find that when the competition from a similar store increases the price difference decreases, while competition from a different type of store increases the price difference increases. In comparison, Busse and Rysman (2005) show that as competition increases, bigger sized advertisements react more than the small sized ads. The quality of competition faced by a store plays a role in explaining the price differential.

I conclude the analysis by discussing a few ideas for future research. The first one is to control for the location of the firm. Endogeneity problems between the competition faced by the firm and the prices charged is an issue well explored in the industrial organization literature. Mazzeo (2002), Watson (2004) and Manuszak and Moul (2006) are some examples. A more structural model that accounts for prices as a function of competition faced might explain the effect of competition on price differences better. Data in video rental industry are proprietary and are difficult to obtain (especially the quantity data). Moreover, I consider only a single market with several sub-markets which are not independent of one-another. Thomadsen (2005) faces the similar problem in his analysis of fast food industry in California. One potential extension of this paper is to check how the structural model developed by Thomadsen (2005) extends to the case analyzed here.

Finally a better theoretical explanation is needed to explain why firms react differently to different types of competition they face.

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Tables

Table 1: Division of Stores

Total Stores		353
Number of Branded Stores		166
Blockbuster	114	
Hollywood Video	46	
Family Video	6	
Number of Unbranded stores		187

Source: Personal Dataset, for Cook County Il

Table 2: Market Shares of Major Players

Total Revenue	$20.4 Billion
Blockbuster Video	39.40%
Hollywood Video	11%
Movie Gallery	5.40%
Netflix	2.50%
Family Video	1.70%

Source: Rentrak Corporation for the entire year of 2002

Table 3: Average prices of Varions Products

Product	Average Price	St Dev
Old VHS	2.43	0.77
New VHS	3.36	0.73
Old DVD	3.27	0.85
New DVD	3.44	0.68

Table 4: Price Differentials for Different Types of Stores

Product	Mean	SD
D Old (Old DVD-Old VHS)	0.84	0.74
Major	1.38	0.5
Minor	0.34	0.57
D New (New DVD-New VHS)	0.08	0.25
Major	0.008	0.08
Minor	0.11	0.33
D VHS (New VHS-Old VHS)	0.93	0.74
Major	1.41	0.45
Minor	0.5	0.69
D DVD (New DVD-Old DVD)	0.17	0.45
Major	0.05	0.26
Minor	0.27	0.55

Table 5: Regression Results[a]

Variable	Coeff	(1) (OLS)	(2) (OLS)	(3) (FGLS)	(4) (FGLS)
Dependent Variable		**Price** (in $)	**Daily Price** (in $)	**Price** (in $)	**Daily Price** (in $)
Time	$\square$	-0.021**		-0.011	
		(2.23)		(1.43)	
Population (in 000)	$\square_1$	0.039**	0.05*	0.001	0.017
		(2.06)	(1.91)	(0.59)	(0.85)
Income (in 000)	$\square_2$	0.00027	-0.001	0.002	0.001
		(1.52)	(0.29)	(1.46)	(0.91)
Rent (in 00 of $)	$\square_3$	0.017	0.02	0.019**	0.008
		(1.46)	(1.56)	(2.07)	(0.72)
Child (in 00)	$\square_4$	-0.024**	-0.02**	-0.02**	-0.009
		(4.02)	(2.06)	(3.05)	(1.42)
Retd (in 00)	$\square_5$	0.01**	-0.04**	0.004	-0.009
		(2.16)	(4.13)	(0.8)	(1.46)
DVD	$\square_1$	0.281**	0.233**	0.234**	0.235*
		(3.4)	(2.07)	(2.94)	(1.84)
New	$\square_2$	0.531**	0.242**	0.433**	0.701**
		(14.21)	(4.89)	(12.46)	(18.87)
B	$\square_3$	0.46**	-0.818**	0.515**	-0.896**
		(7.92)	(11.18)	(9.97)	(13.81)
Cbr (in minutes)	$\square_1$	0.034**	0.02	0.048**	0.019
		(2.76)	(1.2)	(4.73)	(1.57)
Cubr (in minutes)	$\square_2$	-0.001	-0.009	-0.008	-0.012
		(0.91)	(0.69)	(0.79)	(1.13)
DVD*B	$\square_1$	0.358**	-0.206	0.396**	-0.062
		(3.19)	(1.35)	(4.1)	(0.46)
DVD*Cbr	$\square_2$	-0.045**	-0.033	-0.052**	-0.017
		(2.03)	(1.09)	(2.91)	(0.58)
DVD*Cubr	$\square_3$	0.026	0.008	0.024	-0.003
		(1.32)	(0.32)	(1.27)	(0.11)
DVD*Cbr*B	$\square_1$	0.061**	0.058*	0.043**	0.007
		(2.44)	(1.71)	(2.36)	(0.26)
DVD*Cubr*B	$\square_2$	-0.025	-0.006	-0.039**	0.002
		(1.2)	(0.22)	(2.14)	(0.06)

R-Squared	0.38	0.21	0.45	0.404

[a] Measure of competition is the driving time to the nearest store
In parantheses: t-statistic
Ordinary Least Squares Regression
** 95% significant
* 90% significant
Price= Regular price charged
Daily Price = Reglar Price/Time lent

Table 6: Regression Results[b]

Variable	Coeff	(1) (OLS)	(2) (OLS)	(1) (FGLS)	(2) (FGLS)
Dependent Variable		**Price** (in $)	**Daily Price** (in $)	**Price** (in $)	**Daily Price** (in $)
Time	⍰	-0.021**		-0.017**	
		(2.23)		(2.12)	
Population (in 000)	⍰$_1$	0.039**	0.05*	0.016	0.004
		(2.02)	(1.91)	(0.96)	(0.17)
Income (in 000)	⍰$_2$	0.002	-0.001	0.004**	0.001
		(1.36)	(0.31)	(3.75)	(0.82)
Rent (in 00 of $)	⍰$_3$	0.014**	0.024	0.009	0.01
		(2.11)	(1.51)	(0.91)	(0.92)
Child (in 00)	⍰$_4$	-0.024**	-0.017**	-0.019**	-0.008
		(4.11)	(2.11)	(3.7)	(1.19)
Retd (in 00)	⍰$_5$	0.014**	-0.037**	0.003	0.004
		(2.11)	(4.16)	(0.56)	(0.69)
DVD	⍰$_1$	0.292**	0.22**	0.169**	0.207*
		(3.76)	(2.07)	(2.26)	(1.7)
New	⍰$_2$	0.531**	0.242	0.427**	0.762**
		(14.23)	(4.88)	(12.09)	(20.97)
B	⍰$_3$	0.448**	-0.827**	0.519**	-0.916**
		(7.67)	(11.23)	(9.58)	(13.89)
Cbr (in miles)	⍰$_1$	0.066**	0.043	0.068**	0.012
		(3.17)	(1.54)	(3.87)	(0.67)
Cubr (in miles)	⍰$_2$	-0.012	-0.014	-0.015	-0.028*
		(0.72)	(0.64)	(0.9)	(1.72)
DVD*B	⍰$_1$	0.372**	-0.147	0.379**	0.011

		(3.5)	(1.02)	(4.08)	(0.09)
DVD*Cbr	$\square_2$	-0.083**	-0.035	-0.019	-0.015
		(1.99)	(0.61)	(0.62)	(0.27)
DVD*Cubr	$\square_3$	0.034	-0.003	0.023	-0.006
		(1.11)	(0.08)	(0.75)	(0.13)
DVD*Cbr*B	$\square_1$	0.095**	0.05	0.035	-0.01
		(2.16)	(0.83)	(1.14)	(0.19)
DVD*Cubr*B	$\square_2$	-0.031	0.012	-0.026	0.008
		(0.94)	(0.28)	(0.88)	(0.18)
R-Squared		0.39	0.204	0.45	0.43

[b] Measure of competition is the distance to the nearest store
In parantheses: t-statistic
Ordinary Least Squares Regression
** 95% significant
* 90% significant
Price= Regular price charged
Daily Price = Reglar Price/Time lent

E-mail from Hollywood Video[21]:

Thank you for writing to us regarding franchise information. Hollywood Video is dedicated to providing exceptional guest experiences delivered with genuine warmth and friendliness.

Hollywood Video stores are company owned and managed, not franchised.

We appreciate your membership and if there is anything else we can do for you, please do not hesitate to email us at: E-Mail-Us@hlyw.com or call our Guest Relations department, toll free at 1-877-325-8687. We look forward to serving you again.

Sincerely,
xxxxx
Guest Relations Agent
Hollywood Entertainment

[21] Dated 19th June 2005

E-mail from Blockbuster Video[22]:

Thank you for your interest in Blockbuster Franchising. We do not have an information packet that we send out at this time. We do have a financial requirement of a $400,000 net worth, of which $100,000 is liquid. If you meet this criterion, the next step would be to review the market you are interested in operating. We do not maintain a list of areas specifically open for franchise opportunities. We review them on a case-by-case basis.

You would need to find a location that does not currently have a store in it, with the closest Blockbuster being approx. 10 miles away.

You can use our store locator tool at www.blockbuster.com to assist you in finding where our existing stores are located (essentially, it would be a reverse search tool for you). Please visit our website at www.blockbuster.com and follow the link at the bottom of the page to Franchise Opportunities. There you will find more information about becoming a Blockbuster franchisee as well as a Request for Consideration form you can download and fill out. I can be reached at 214-854-3431, should you have further questions.
Regards,
xxxx
Blockbuster Franchise Development

[22] Dated 6th May 2004