Revista Venezolana de Análisis de Coyuntura
ISSN: 1315-3617
coyuntura@cantv.net
Universidad Central de Venezuela
Venezuela

Contreras, José

A theoretical rationale for high-low price in retailing markets

Revista Venezolana de Análisis de Coyuntura, vol. XI, núm. 1, enero-junio, 2005, pp. 251-274
Universidad Central de Venezuela
Caracas, Venezuela

Revista Venezolana de Análisis de Coyuntura, 2005, Vol. X, No. 1 (ene-jun), pp. 251-274
recibido: 10-11-03 / arbitrado: 11-02-04

A THEORETICAL RATIONALE FOR HIGH-LOW PRICE IN RETAILING MARKETS

José Contreras*
ESCUELA DE ECONOMÍA-UCV

Abstract:

The main goal in this paper is to build an economics environment in a framework of game theory such that the equilibrium solution for prices that the firms set given the optimal strategies of consumers follows patterns of prices that characterize a Hi-Lo pricing system.
This paper proposes a model in which the consumers optimize, for the given prices, their utility function to choose their search strategy ,so that, this model links market structure, consumer characteristics and imperfect information to the nature of HI-LO pricing strategy. It shows that the distribution of consumers who buy at random plays an important role in determining whether or not firms will find it optimal to use price promotions (High-Low pricing strategy). The equilibrium is a unique Perfect Nash Equilibrium in a finitely repeated game.

Key word: Retailing industry, everyday low price, temporary deep discounts, game theory and perfect nash equilibrium in a finitely repeated game.

1 INTRODUCTION

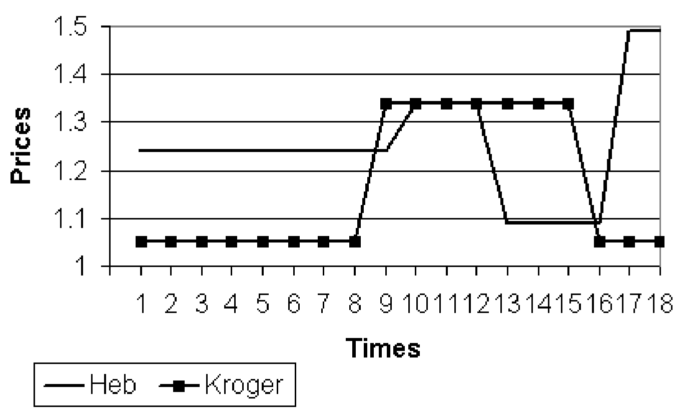
In recent years, retailing industry has become more competitive, as consequence, there has proliferated a variety of pricing formats. Retail pricing strategy is one of the top five priorities in retail management.. Some of the most important price strategies practiced by retailers are EDLP (everyday low price) and HI-LO (Temporary deep discounts).The pricing activities of retailers involve a strategic choice (EDLP or HI-LO) and setting prices. In an EDLP strategy, the retailers maintain a constant price everyday price, with no temporary price discounts. In contrast, in a HI-LO strategy, the retailer charges to high prices on an everyday basis, but then runs frequent promotions in which prices are temporarily lowered some times below the EDLP level.

The following Figure No. 1 shows the price patterns exhibited by some consumer goods from a survey in College Station, a small town in Texas, during September 1 1996 and January 14, 1997 two times a week in four supermarkets, Kroger and HEB, Walmart and Sears . The graphic suggests that the prices were set strategically with some synchronization between the two supermarkets.

* josecontrerasven@yahoo.com

The main goal in this paper is to build an economics environment in a framework of game theory such that the equilibrium solution for prices that the firms set given the optimal strategies of consumers follows a patterns of prices that characterizes a Hi-Lo pricing system similar to that suggested by the Figure No. 1.

Figure No. 1. Iron Kids bread prices



Several interesting researches have focused the HI-LO nature of price strategy. Varian (1980) sates that HI-LO pricing allows the retailer to discriminate between informed and uninformed consumers. Blattberg, Eppen and Lieberman (1981) and Jeuland and Narasimhan (1985) suggest that when heavy users of a product category also have higher inventory costs, retailers can use temporary price cuts to effectively charge them higher average prices. The intuition is that some consumers find it advantageous to stockpile for future consumption. Narasimhan(1988) shows that the behavior of the brand switchers characterizes the HI-LO equilibrium. The idea is that with a HI-LO pricing policy, retailers can attract price sensitive switchers while stores' loyal consumers buy merchandise both on deal and at higher everyday, prices. One conclusion is that those brands with bigger loyal segments promote less frequently than weaker brands.

Jagmohan, Srinivasan and Lal (1990) argue that HI-LO is the result of the difference between competitive brands and local brands. The idea is that high brand loyalty promotes prices when competing with a weak brand loyalty, and the solution is a Perfect Nash Equilibrium in a finitely repeated game.

Lal (1990) analyzes equilibrium pricing strategies of two national brands and a local brand in an infinite horizon repeated game. Lal shows that price promotions is one of the Perfect Nash equilibria strategy pursued by national brands to limit the encroachment by the local brand.

Rao, Ram C. (1991) illustrates the nature of competition between a national brand and private label. In equilibrium, the national brand performs promotions to ensure that the private label does not try to attract consumers away from the national brand. Morever, private lavel does not perform promotions.

In models such as those above assume that consumers are in two exogenous groups, for example, Varian (1980) the consumers are either informed or uninformed and therefore the firm's promotional strategy has no effect on consumer behavior.

This paper proposes a model in which the consumers optimize, for the given prices, their utility function to choose their search strategy, so that, this model links market structure, consumer characteristics and imperfect information to the nature of HI-LO pricing strategy. It shows that the distribution of consumers who buy at random plays an important role in determining whether or not firms will find it optimal to use price promotions (High-Low pricing strategy). The equilibrium is a unique Perfect Nash Equilibrium in a finitely repeated game.

The structure of the paper is as follows. Section 2 sets out the model and finds the perfect Nash equilibrium including its properties. The effects of the distribution of random buyers, and searching costs on prices and benefits, and a rationale for HI-LO pricing is studied in section 3. Finally, the paper discusses the conclusions.

2 THE MODEL

There are two firms and each sells homogeneous goods at constant marginal cost, henceforth, zeros without loss of generality. Firm i charges price pi , R+ and locates at xi , R+, where x_1=0 and x_2=1.

Consumers are evenly distributed over [x_1, x_2] with density one. Each consumer buys one unit of the product from the firm charging the lower delivered price. Firms choose prices p_1 and p_2 (which are the same irrespective of consumers ' locations) and pass on the consumers the total transportation cost [This transportation cost is interpretated as the decrement of utility from not consuming the ideal product]. Firms do not have access to the same transportation technology; denoted by $t_i > 0$.

Consumers demand either zero or one of the good, and are indexed by variable “z”. A good purchased from either firm yields any consumer a surplus of v. The consumers’ valuation, v, is assumed to be sufficiently large so that the entire market is served. There are costs associated with searching for a lower price, and consumers with a higher searching cost refrain from looking for information on lower prices. This is, they are not willing to invest the necessary resources to monitor the prevailing price at each firm. So the consumers with higher searching costs choose between stores based on the price they would expect to pay at a randomly occurring point in time. In contrast, consumers with lower search cost are not only price vigilant, but also opportunistic for searching for information on price, and they choose among stores on the basis of the minimum price. Firms have incomplete information about the consumers in relation with their the type of searching cost, but they have information about cost and have power on prices.

Without loss of generality suppose that $p_1 < p_2$, and consumers have preferences as follows:

If a consumer searches for the lowest price

$$u = v - p1 - (s + t1)z$$

If a consumer buys at random at the two stores.

$$u = v - \frac{p_1 + p_2}{2} - \frac{t_2(1-z) + t_1 z}{2}$$

Where the parameter “s” measures the cost of searching for the lowest price.

2.1 Timing of the game

Stage 1: Firms simultaneously choose prices.

Stage 2: Buyers decide to buy at random or look for te lowest price.

2.2 Solution

The game will be solved by backward induction. First, solve stage 2. The consumers optimize the utility function to choose if they buy at random or look for the lowest price, and therefore, they define the firm's demand functions. In order to do so, it is determined the marginal consumers, that is; the consumers are indifferent between buying by looking for the lowest price or at random. The equation is the following.

$$p_1 + (s + t_1)z = \frac{p_1 + p_2}{2} + \frac{t_2(1-z) + t_1 z}{2}$$

Solving the above equation for z and "1-z" and denoting t1:=t1/2 and t2:=t2/2, the following expressions result:

$$z = \frac{p_2 - p_1}{2(s + t_1 + t_2)} + \frac{t_2}{s + t_1 + t_2}.$$

and it implies that

$$1 - z = \frac{p_1 - p_2}{2(s + t_1 + t_2)} + \frac{s + t_1}{s + t_1 + t_2}.$$

As p1 < p2, it implies that "z" consumers buy at firm 1, but "1-z "consumers buy at random at the two firms. Suppose that the distribution of these consumers is such that a portion of "d" buys at firm 1 and "1-d" buys at firm 2. Therefore:

$$z1 = \frac{p_2 - p_1}{2(s + t_1 + t_2)} + \frac{t_2}{s + t_1 + t_2} + d\left[\frac{p_1 - p_2}{2(s + t_1 + t_2)} + \frac{s + t_1}{s + t_1 + t_2}\right] =$$
$$\frac{(1-d)(p_2 - p_1)}{2(s + t_1 + t_2)} + \frac{t_2 + d(s + t_1)}{s + t_1 + t_2}.$$

So that firm 1 sells for all "z1" consumers. On the other hand, firm 2 sells for the "z2" consumers where :

$$z2 = (1-d)[\frac{p_1 - p_2}{2(s+t_1+t_2)} + \frac{s+t_1}{s+t_1+t_2}].$$

The firms' profit functions are the following:

$$\Pi 1 = \left[\frac{(1-d)(p_2 - p_1)}{2(s+t_1+t_2)} + \frac{t_2 + d(s+t_1)}{s+t_1+t_2} \right] p_1$$

$$\Pi 2 = (1-d)\left[\frac{p_1 - p_2}{2(s+t_1+t_2)} + \frac{s+t_1}{s+t_1+t_2} \right] p_2$$

Firm 1 takes p2 as given and chooses p1 that maximizes Π1 and firm 2 takes p1 as given and chooses p2 that maximizes Π2. The best response functions come from the fact that:

$$\frac{\partial \Pi 1}{\partial p_1} = \frac{(1-d)(p_2 - 2p_1)}{2(s+t_1+t_2)} + \frac{t_2 + d(s+t_1)}{s+t_1+t_2} = 0$$

$$\frac{\partial \Pi 2}{\partial p_2} = \frac{(1-d)(p_1 - 2p_2)}{2(s+t_1+t_2)} + \frac{(1-d)(s+t_1)}{s+t_1+t_2} = 0$$

Theorem 1 (Complete solution of the game). Under the conditions given for construction of Π1 and Π2 follow that:

1 There exists an unique pure stable Nash equilibrium.

2 The ratio of prices that the two firms set depends on a function f that varies according to the values of the variable d. This function is increasing in d and exists a value d* in the interval [0 1] such that f(d*)=1.

$$\frac{p_1}{p_2} = f(d)$$

where

$$d > \frac{s + t_1 - t_2}{2(s + t_1)} \Leftrightarrow f(d) > 1$$

and

$$f(d) = \frac{(s + t_1)(1 + d) + 2t_2}{(s + t_1)(2 - d) + t_2}.$$

$$f'(d) > 0.$$

3 The ratio of profits between the two firms is

$$\frac{\Pi 1}{\Pi 2} = \left(\frac{p_1}{p_2}\right)^2.$$

Proof.

By solving both equations the following expression are obtained for p_1 from first equation and p_2 from second equation, and from there to find the Nash equilibrium.

$$p_1 = \frac{p_2}{2} + \frac{t_2 + d(s + t_1)}{1 - d}$$

$$p_2 = \frac{p_1}{2} + s + t_1$$

$$p_1 = 2p_2 - 2(s + t_1).$$

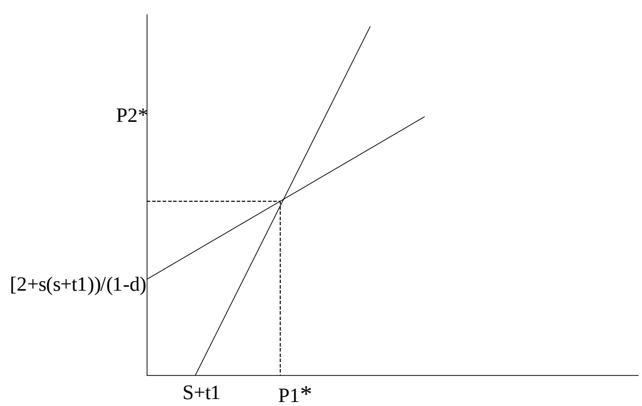
Solving the system, the price Nash equilibrium is :

$$p_1^* = \frac{(s + t_1)(2 + 2d) + 4t_2}{3(1 - d)}$$

$$p_2^* = \frac{(s + t_1)(4 - 2d) + 2t_2}{3(1 - d)}$$

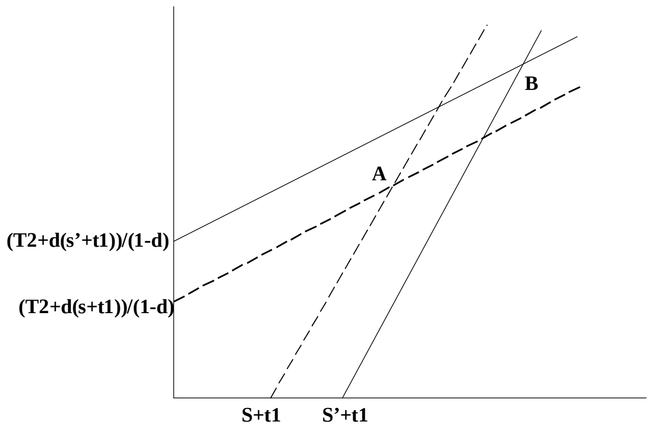
The solution is illustrated in the following Figure No. 2.

Figure No. 2. Solution for the nash equilibrium



If the agents have rational expectations, they will play only those strategies that constitute a Nash Equilibrium in a finitely repeated game. For example, suppose that “s” increases. Graphically, we have the following situation as illustrated in Figure No. 3.

Figure No. 3. Increases in s and the new nash equilibrium



Here the players will play "B" when "s" increases. Another possible outcome is by assuming that the agents use rules of thumb to adjust their strategies in continuous time. For example, suppose that each agent increases the value of her strategy if and only if her marginal payoff is positive. The following definition 2.1 and proposition 2.1will be useful.

Definition 2.1. Let

$$T_i(p_i, p_{-i}) = \frac{\partial \Pi\, i(p_i, p_{-i})}{\partial\, p_i}$$

the marginal payoff of agent i. The gradient dynamics system is given by Where " ' " denote derivative.

$$p_i' = T_i(p_i, p_{-i})$$

Proposition 2.1. If the following conditions are satisfied

i.- $T_i(p_i, p_{-i})$ is strictly decreasing on p_i

ii.- $\left|\dfrac{\partial^2 \Pi_i(p_i, p_{-i})}{\partial^2 p_i}\right| > \left|\dfrac{\partial^2 \Pi_i(p_i, p_{-i})}{\partial p_i \partial p_{-i}}\right|$

iii.- $\dfrac{\partial^2 \Pi_i(p_i, p_{-i})}{\partial p_i \partial p_{-i}} > 0.$ Then the gradient dynamics is globally stable.

Proof. The proof is a direct consequence of the proposition 1.11 from Luis Corchon (1996).

Therefore, the existence and unicity are consequence of the fact that the best response functions have different slopes whose interception is in the positive quarter and the stability is a direct application of proposition 2.1. In fact.

$$\frac{\partial^2 \Pi_i}{\partial^2 p_i} = \frac{-(1-d)}{(s+t_1+t_2)}$$

and

$$\frac{\partial^2 \Pi_i}{\partial p_i \partial p_{-i}} = \frac{(1-d)}{2(s+t_1+t_2)}$$

And the conditions i.,ii and iii from proposition 2.1 are satisfied, therefore, the Nash Equilibrium is stable.

For the proof of ii, it is sufficient from the fact that:

$$\frac{p_1}{p_2} = \frac{(s+t_1)(1+d)+2t_2}{(s+t_1)(2-d)+t_2} =: f(d).$$

and

$$f'(d) = \frac{3(s+t_1)(s+t_1+t_2)}{\left[(s+t_1)(2-d)+t_2\right]^2} > 0.$$

On the other hand

$$f(d) < 1 \Leftrightarrow d < \frac{s + t_1 - t_1}{2(s + t_1)}.$$

Finally for iii, we can substitute

p_1^* and

p_2^* in the expression

Π_1 and

$\prod_2$. The following outcomes result:

$$\Pi_1 = \frac{2\left[(1 + d)(s + t_1) + 2t_2\right]^2}{9(s + t_1 + t_2)(1 - d)}$$

$$\Pi_2 = \frac{2\left[(2 - d)(s + t_1) + t_2\right]^2}{9(s + t_1 + t_2)(1 - d)}$$

and

$$\frac{\Pi_1}{\Pi_2} = \left[\frac{p_1}{p_2}\right]^2$$

3 RESULTS

This section will analyze some of the results of the model.

Result 1 The derivatives

Π_{is},

p_{is} are defined positive.

Proof. By computing the derivatives, we have the below expression:

$$p_{1s} = \frac{2(1+d)}{3(1-d)}$$ and

$$p_{2s} = \frac{4-2d}{3(1-d)}$$

$$\Pi_{1s} = \frac{2[(1+d)^2(s+t_1)^2 + 2(1+d)^2(s+t_1)t_2 + 4d\,t_2^2]}{9(1-d)(s+t_1+t_2)^2}$$

$$\Pi_{2s} = \frac{2[(2-d)^2(s+t_1)^2 + 2(2-d)^2(s+t_1)t_2 + (3-2d)t_2^2]}{9(1-d)(s+t_1+t_2)^2}$$

Since $0 \leq d \leq 1$ it implies that

$$p_{is} > 0$$
$$and$$
$$\Pi_{is} > 0$$

Intuition. If "s" increases, the number of consumers "z" looking for the lowest price decreases, but the number of consumers buying at random "1-z" increases. The decrease in the number of people looking for the lowest price is compensated with the number of people buying at random. The idea is that when "s" increases the demand for market 1 has inelastic behavior, therefore, the firm

1 has incentive to increase the price to improve benefits. In contrast, market 2 increases demand [people buying at random increases], so p2 goes up.

Conclusion 1. In an oligopoly market where consumers do not have complete information about prices, and as consequence a searching costs, increases in searching cost give the firms more monopoly power. Therefore, firms have incentive to design mechanisms that increase the searching cost for the consumers. For example, Bergen and Steven (1996) suggest that as branded variants increase, some consumers experience an increased cost of shopping for a branded product. It encourages more retailers to carry branded products. The intuition is the following: Manufactures make branded variants in many ways such as colors, flavors, styles, etc. A consumer must remember to evaluate a large variety of product features to make acceptable comparisons. The greater the variety the most costly it is to make these comparisons across firms. For Example, it is nearly impossible to shop across retailers to find a particular model of vacuum cleaner at the best price because each firm sells a variety of models even of the same brand. So product variety is an example of a device to increase searching cost.

A second example, Prentice and Hugh (1996) taste the hypothesis that by increasing of, apparently independents stores it controls, a firm can discourage consumer search and increases its market power.

Result 2. Effect of consumer information

Assuming perfect information, we have the classical Bertrand Nash equili brium solution or first best. That is; for s=0 then d=0.

If $t_1 = t_2 = 0$ then

$$p_1^f = p_2^f = \Pi_1^f = \Pi_2^f = 0$$

If $t_1 = t_2 = t \neq 0$ then

$$p_1^f = p_2^f = \Pi_1^f = \Pi_2^f = t$$

If $t_1 \neq t_2 \neq 0$

then we have the following expressions.

$$p_1^f = \frac{2[t_1 + 2t_2]}{3} \quad \text{and} \quad \Pi_1^f = \frac{2(t_1 + 2t_2)^2}{9(t_1 + t_2)}$$

$$p_2^f = \frac{2[2t_1 + t_2]}{3} \qquad \Pi_2^f = \frac{2(2t_1 + t_2)^2}{9(t_1 + t_2)}.$$

Now suppose asymmetric Information Problems, that is;

$$s \neq 0 \Rightarrow d \neq 0 \cdot$$

The solution is:

$$p_1 = \frac{(s + t_1)(2 + 2d) + 4t_2}{3(1 - d)} \quad \text{and} \quad \Pi_1 = \frac{2\left[(1 + d)(s + t_1) + 2t_2\right]^2}{9(s + t_1 + t_2)(1 - d)}$$

$$p_2 = \frac{(s + t_1)(4 - 2d) + 2t_2}{3(1 - d)} \qquad \Pi_2 = \frac{2\left[(2 - d)(s + t_1) + t_2\right]^2}{9(s + t_1 + t_2)(1 - d)}$$

Result 3 Studies the effect of parameter “s “ on the Nash equilibrium, now let’s study the effects of parameter “d” (the distribution of consumers who buy at random between the two firms) on the Nash equilibrium. There are no reasons to find any relationship between “s” and “d”, that is; when $s \neq 0$, there is a group of consumers that buy at random, but the parameter “s” says nothing about the distribution of this group between the two sellers. For example, sellers compete for shares of random buyers (sellers have incomplete information about type of consumers). Prices are unknown to the consumers, but when the purchase of the product is subject to repetition, it is likely that over time, consumers form expectations about some store’s prices. Therefore, the learning capabilities of potential consumers should deliver certain information for consumers, changing the distribution of random consumers between the two firms.

Comparing the benefits with information problems to full information, we have the following expression.

$$\frac{\Pi_1}{\Pi_1^f} = \frac{(t_1 + t_2)\left[\frac{(1+d)^2(s+t_1)^2}{1-d} + \frac{2(1+d)(s+t_1)+2t_2}{1-d} + \frac{4t_2^2}{1-d}\right]}{(t_1+2t_2)^2(s+t_1+t_2)}$$

$$\frac{\Pi_2}{\Pi_2^f} = \frac{(t_1 + t_2)\left[\frac{(2-d)^2(s+t_1)^2}{1-d} + \frac{2(2-d)(s+t_1)t_2}{1-d} + \frac{t_2^2}{1-d}\right]}{(t_1+2t_2)^2(s+t_1+t_2)}$$

Proposition 2. The functions $\frac{\Pi_1}{\Pi_1^f}, \frac{\Pi_2}{\Pi_2^f}, p_1, p_2$ are increasing in “d” and

$$\frac{\frac{\partial p_1}{\partial d}}{\frac{\partial p_2}{\partial d}} = 2$$

Proof. The proof is a consequence from the fact that the functions

$$\frac{(2-d)^2}{1-d}, \frac{(2-d)}{1-d}, \frac{1}{1-d}$$

are increasing in “d”.

On the other hand, from the fact that

$$\frac{\partial p_1}{\partial d} = \frac{4[s+t_1+t_2]}{(1-d)^2}, \frac{\partial p_2}{\partial d} = \frac{2[s+t_1+t_2]}{(1-d)^2}$$

It implies that when d

$\uparrow$ then

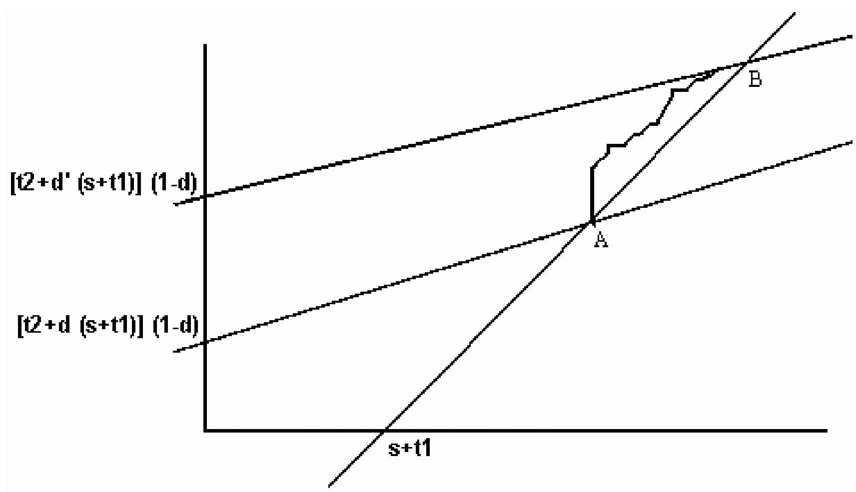
p_1 increases faster than

p_2.

Graphically, it possible to illustrate the new equilibrium.

When "d" increases, the new Nash Equilibrium is "B" as shown in the Figure No. 4.

Figure No. 4. Increases in d and the new nash equilibrium



The intuition is the following: If "d" increases, the demand for seller 1 shifts up. To reach the new equilibrium, p_1 increases. On the other hand, as "d" increases "1-d" decreases and therefore demand for seller 2 shifts down, but such decrease is compensated by the fact that when p_1 increases the demand function for seller 2 shifts up, hence the demand for seller 2 behaves as inelastic. Therefore, p2,A2,p1,A2 increase.

Conclusion 2. When searching costs exist, two groups of consumers appear and one of them buys at random distributed as "d" and "1-d", respectively. The conclusion is that the sellers have incentives to send signals that change the distribution among consumers. For example, price promotion. In fact, d=prom(p1) and function prom is decreasing. That is; p1 decreases and any promotion d increases.

Result 4. *Patterns of prices from the model*

We know that

$$\frac{p_1}{p_2} = f(d) := \frac{(s+t_1)(1+d)+2t_2}{(s+t_1)(2-d)+t_2}$$

and

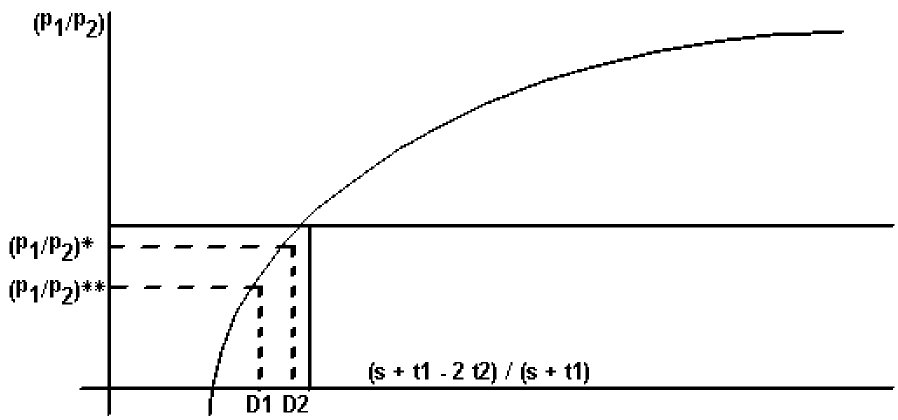
$$\frac{p1}{p2} < 1 \Leftrightarrow d < \frac{s+t1-t2}{2(s+t1)}$$

From the expression of $\frac{p_1}{p_2}$

we can conclude that the solution is a price dispersion pure Nash equilibrium. If s=0 then d=o the result is the same as in Gabszewicz and Garella (1987) and others. A very important question is how such price dispersion can be sustained over time, that is; is it possible that the price dispersions persist as a perfect Nash equilibrium over time in a finitely repeated Bertrand game?.In other words, since the products are identical, the only piece of information that the consumer is interested in is price. Would information gathering costs be sufficient to explain the existence of a stable price equilibrium that persist over time, in which unit prices of identical products differ from one store to another? The intuition is that consumers would learn from the experience, and therefore the equilibrium must be the competitive equilibrium.

Let's consider the following Figure No. 5 to explain the device that firms have to price variation equilibrium over time in the model.

Figure No. 5. Nash equilibrium and changes in d



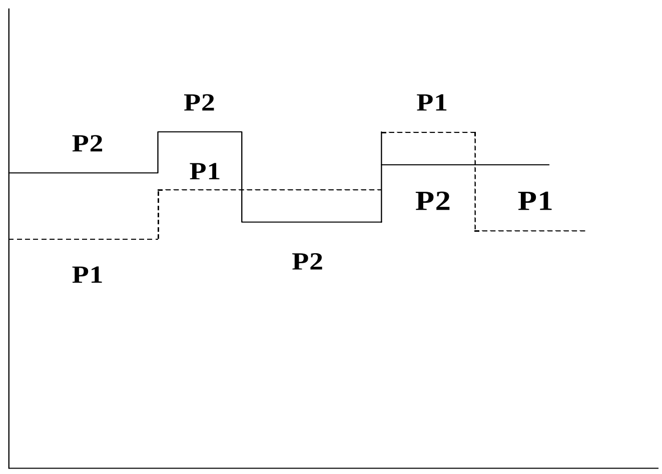
Let's depart from one shoot game where d<d* and therefore p1<p2 [The Nash equilibrium]. Firm 1 has incentives to signal the consumers that she has the lowest price by using marketing devices and consumers by using learning process. The expected result is that the distribution of consumers that buy at random will be biased toward market 1 (d increases to d2 as depicted in the graph.) As the agents have rational expectations, they will play the new Nash equilibrium where both firms are better off. That is; they will play (p1/p2)* in the graph) . But firm1 still offers lower price. When d increases over $\frac{s+t_1-2t_2}{2(s+t_1)}$ firm 2 losses benefits, as consequence, firm 2 has incentives to lower the price p2<p1 and gain a distribution of consumers biased toward market 2. Therefore "1-d" increases and since the agents have rational expectations they know then that they will play the new Nash equilibrium. Summarizing, we have the following result:

suppose that d<d*, therefore, market 1 promote, so that p1<p2 and from promotion d increases, d>d*.

As d>d*, market 2 has to promote, so that p2<p1 and from promotion d decreases to d< d* and then.

The following Figure No. 6 describe the pattern followed by the prices.

Figure No. 6. HI-LO price patterns



Conclusion 3. The presence of searching costs divides consumers in two groups: Those who look for the lowest price "z" and those who buy at random "1-z". It is important to notice that the ratio z/1-z is a function of p_1,p_2,t1,t_2,s. Therefore, z/1-z is variable over time when the game is repeated.

If the game is finitely repeated, the learning processes of the rational consumers affect the demand functions at each store. This would drive both to a perfect market competition or force them to price promotions by offering a greater percentage off the higher original price, i.e., the perfect Nash equilibrium consistent with the distribution of consumers between the two stores. Kaufman, Smith and Ortmeyer (1994)] argue that each promotional price gives a bump in sales and then it appears that consumers respond to "the sale" message even if competitive prices could be found elsewhere.

Blattberg, Briesch and Fox (1995) suggest that the most important generalization for business practice is that promotions significantly increase sales, and that the majority of promotional volume comes from switchers in complementarities or substitution between firms.

Rockney (1991) concludes that purchases of products in one store, as result of price promotions, may lead to decreases in sales of similar products in another store. Also, retail price promotions conducted on a brand have a significant positive impact on sales of the promoted brand and negative impact on sales of a brand in a competing store.

Therefore, it is possible to conclude that price promotion is the device that firms use for price dispersion to be sustained. This price promotion generates a High-Low pricing pattern (i.e., setting prices at high levels for the time where the firm has a signal of increasing in the proportion of buyers that buy at random (‘d”) and then discounting the merchandise to low price consistently with the lower perfect Nash equilibrium when lower “d”. For example, suppose a situation in where $d < \frac{s + t_1 - t_2}{2(s + t_1)}$ therefore, the Nash equilibrium is such that p1(d)<p2. After n repeated purchases, some consumers learned about the lowest price (price promotion), then the portion of random buyers that buy at market 1 increases (d increases) . Because the sellers have rational expectations, they know the new future distribution of those random buyers, as a consequence, seller1 increases the price (at P1(d1)). It makes that market 2 observes a declining in the benefits, and therefore they play the new perfect Nash equilibrium where p2 is lower than before (That is; price promotions) by offering a greater discount off the higher original price. Therefore, in this case p2<p1. In conclusion, in a duopolistic market (where agents have rational expectations; consumers have searching costs and sellers do not have perfect information about type of consumers) intensive price promotions constitute a perfect Nash equilibrium that generates a price pattern of High-Low price in either of the two markets, that is; the best response pricing strategy is a High-Low price. These conclusions are contrary to those from Bester and Petrakis (1996) in which price promotion increase competition and reduce benefits.

4 CONCLUSIONS

This paper examines a theoretical rationale for High-Low price in retailing markets by proposing a model that links market structure, consumer characteristics, and imperfect information to the nature of HI-LO pricing strategy. This study shows that the distribution of consumers who buy at random plays an important role in determining whether or not firms will find it optimal to use price promotions, so as the frequence and the depth of the discounts. The resulting HI-LO pricing strategy is the unique perfect Nash Equilibrium in a finitely repeated game. The mass of consumers who buy at random depends on prices, searching cost and transportation cost, Therefore, this group of consumers changes when those variables change. Prices and benefits increase as searching cost increase, so the firms have incentives to design mechanisms that increase those costs for consumers. For example, increasing product variety or increasing the number of stores that it controls.

Morever, this paper shows that there exists a d*

$\in [0,1]$ such that for any d

$\in [0,d*]$ the best response for firm 1 is to make a deep discount (That is; Price promotion). In contrast, for any d

$\in [d*,1]$ the best response for firm 2 is to make a deep discount. In finitely repeated game, this optimal price discounts is such the new price is a perfect Nash Equilibrium. Therefore, price promotion acts as a device that force a Hi-Lo pattern in the equilibrium prices.

REFERENCES

Band, Robert, (1991), *Creating value for customers*, John Wiley & sons New York.

Bell, D. R., and James M. Lattin (1998), “Shopping behavior and consumer preference for store price format: why ‘large basket’ shoppers prefer EDLP”, *Marketing Science*, Vol.17.

Bergemann, D., and Jauso Valimaki (1996), “Learning and strategic pricing”, *Econometrica*, Vol. 64.

Bergen Mark (1996), “Shantanu dutta and steven shugan. Branded variants: A retail perspective”, *Journal of marketing research*, Vol. 33.

Bester Helmut and Petrakis Emmanuel (1996), “Coupons and oligopolistic price discrimination”, *International journal of industrial organization*, Vol.14.

Blattberg, R.C., Gary D. Eppen and Joshua Lieberman (1981), “A theoretical and empirical evaluation of price deals for consumers nondurable”, *Journal of marketing,* Vol. 45.

Blattberg, Robert C., Richard Briesch and Edward J. Fox (1995), “How promotions work”, *Marketing Science,* Vol.14.

Caplin, A., Nalbuff, B. (1991), “Aggregation and Imperfect equilibrium: On the existence of equilibrium”, *Econometrica*, Vol. 59.

Corchon, Luis (1996), *Theories of imperfectly competitive markets,* Lecture notes in economics and mathematical systems, Springer.

Gabszewicz J.J and P Garella (1987), “Price research and spacial competition”, *European economic review*, Vol. 31.

Ho,Teck-Hua, Christopher S. Tang and David R. Bell (1998), “Rational shopping behavior and the option value of variable pricing”, *Management science*, Vol. 44.

Hoch, Stephen J., Xavier Dreze and Mary E. Purk (1994), “EDLP, HI-LO, and margin arithmetic”, *Journal of marketing*, Vol. 58.

Jagmohan S. Raju, V. Srinivasan and Rajil Lal (1990), “ The effects of brand loyalty on competitive price promotional strategies”, *Management science*, Vol.36.

Jeuland, Abel P. and Chakravarthi Narasimhan (1985), “Dealing- temporary prices cuts - by sellers as a buyer discrimination mechanism”, *Journal of business*, Vol.58.

Kalwani , M. U. and C. K. Yim (1992), “Consumer price expectations: An empirical study”, *Journal of marketing research*, Vol. 29.

Kaufman, Patrick J., N. Craig Smith and Gwendolyn K. Ortmeyer (1994), “Deception in retailer high-low pricing: a ‘rule of reason’ approach”, *Journal of retailing*, Vol.70.

Kelly, K. and L. Zinn (1990), “Can ed brennan salvage the sears he designed”, *Business week*, 27 August.

Kerr, K. (1989), “Consumers are confused by sears’new policy”, *Adweek ‘s marketing week*.

Lal, Rajiv (1990), “Price promotions limiting competitive encroachment”, *Marketing science,* Vol. 8.

Lal, Rajiv and Ram Rao (1997), “Supermarket competition: The case of everyday low price”, *Marketing science*, Vol. 16.

Lattin, James and Gwen Ortmeyer (1991), “A theoretical rationale for every day low price by grocery retailers”, *Working Paper* No 1144, Graduate School of Business, Stanford University, Stanford, CA.

Leblanc, Greg. (1998), “Informative advertising competition”, *The journal of industrial economics,* Vol. 46.

Morgenstein, Melvin,and Harriet Stogin (1987), *Modern retailing*, John Wiley & Sons, New York.

Nagle, Thomas T., and Reed K. Holden (1995), *The strategy and tactics of pricing*, englewood cliffs, NJ: Prentice Hall.

Narasimhan Chakravarthi (1998), “Competitive promotional strategies”, *Journal of business*, Vol. 61.

Neven. D. (1986), “On Hotteling’s competition with nonuniform customer distribution” *Economic letters*, Vol. 21.

Nguyen Dung (1997), *Marketing decision under uncertainty*, International series in quantitative marketing, Kluwer Academic Publishers, Boston.

Rao, Ram C. (1991), “Pricing and promotions in asymmetric duopolies “, *Marketing science,* Vol. 10.

Rockney G. Walters (1991), “Assessing the impact of retail price promotions on product substitution, complementary purchase, and interstore sales displacement”, *Journal of marketing*, Vol. 55.

Salop S. C. (1977), “The noisy monopoly: imperfect information, price dispersion and price discrimination”, *Review of economics studies*, Vol. 44.

Salop S. C and J.E Stigliz (1982), “The theory of sales: a simple model of equilibrium price dispersion with identical agents”, *American economic review*, Vol. 72.

Santore, Rudy (1999), “Pricing differentiated products with indifferent consumers”, *Economics letters,* Vol.62 .

Schwadel, F., and M. J Mc Cartly (1989), “New sears strategy on display in wichita”, *Wall street journal*, Vol.17.

Shilony Y. (1981), “Hotteling’s competition with general customer distributions”, *Economic letters*, Vol. 8.

Shy, Oz (1995), *Industrial organization. Theory and applications*, Cambridge: MIT Press

Stigliz, Joseph (1977), “Monopoly, no-linear pricing and imperfect information: The insurance market”, *Review of economics studies*, Vol. 44.

Stokey Nancy (1979), “Intertemporal price discrimination”, *Quarterly journal of economics*, Vol. 93.

Philips, Louis (1988), *The economics of imperfect information*, University Press, *Cambridge*.

Praveen K. Kopalle, Ambar G. Rao and Joao L. Assuncao (1996), “Asymmetric reference price effects and dynamic pricing policies”, *Marketing ,cience,* Vol.15.

Prekopa, A. (1973), “On logarithmic concave measures and functions”, *Acta scientia Mathematica (Szeged),* Vol. 34.

Prentice David and Sibly Hughm (1996), “A search-theoretic interpretation of multi-outlet retailers”, *The Economic Record*, Vol.72.

Varian, H. R. (1980), “A model of sales”, *American economic review*, Vol. 70.

Zwiebach, E. and D. Merrefield (1989), “EDLP gains momentum”, *Supermarket news*, October 9.