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PRICING STRATEGY AND LEARNING

Na tržištu je neprestano prisutna izmjena i prerada informacija, drugim imenom učenje. Rezultati sve te izmjene informacija odražavaju se na cijeni proizvoda. Cijena može biti posljedica učenja, ili može biti i instrument kojim se nastoji potaknuti učenje. U ovom članku autorica je opisala tu međusobnu povezanost učenja i određivanja cijena.

Introduction

Pricing is one of the most important elements of the marketing mix. It is the only marketing variable that directly determines revenue. Few marketing decisions within a firm have more critical consequences than do pricing decisions.

Price of the product changes over time with the stage in product's life cycle. For a new product, pricing decisions need to be made in advance of the launch. It is common to consider this decision as a part of overall marketing strategy for the product. As the product matures and goes through various stages of its life cycle, the dynamics of this process will be reflected in product's price. In marketing field in past two decades there has been a lot of research done on pricing over time. Although in the beginning this research was mostly focusing on new products, the existing knowledge on life cycle, experience curves and consumer processes of adoption and diffusion have been integrated in this stream of research, producing dynamic models of pricing over life cycle of the product.

Prior to the 1980s pricing research focused predominantly on steady-state situations in which a manufacturer would set product's price by equating marginal revenue and marginal cost. This approach is referred to as myopic strategy. An important assumption in this approach is that market itself and all decision variables that have an effect on price do not change with time. This is a very strong assumption because like everything else, markets, production environments,

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consumers and all the actors in a market evolve with time. Any analysis that fails to recognize that important fact will not yield realistic pricing strategy in the long run. Dynamic approach becomes more important as the planning horizon lengthens. If the time horizon is short, changes are likely to be small and therefore myopic approach would not deviate much from the optimum pricing strategy. However, when planning time horizon is long, an accurate pricing strategy can be obtained only if the temporal changes are recognized and accounted for.

In the real world, markets change continuously. Actors in the market notice the change and react to it. Information is gathered, processed and used for making new decisions. We refer to this process as learning. In this paper we argue that most changes in product's price over time can be viewed as consequence of such learning. For example, over the product's life cycle manufacturers learn by experience how to produce at a lower cost (this phenomenon is referred to as learning curve, experience curve or learning by doing). Firms learn about their consumers, about their demand for goods and about competitor firms. Consumers learn about products in two ways; from other consumers by word of mouth or from their own experience with a product. Consumers also learn about firms. They observe their behavior, and make predictions about their new pricing strategies based on conclusions inferred from the old ones.

In this paper I introduce a novel, learning-centered view of dynamic pricing. Learning in the marketplace is an always-present process. I focus on learning by customers and firms, and the effect of this learning on price. The purpose of this paper is to explore the interrelatedness of price and learning. Price can be a consequence of learning (for example, if a firm learns by experience how to produce at a lower cost, this can be reflected in the price), but price can also be used to induce learning. In particular, we look at price as an instrument that facilitates exchange of information, and through this exchange enables learning. The most obvious purpose of price is to generate profit. But besides this primary role, the price itself is information that is received by other parties in the market (for example consumers or other firms), and is often used in their decision-making. Price generates demand, and through this it controls consumer exposure to the product or service. For example, a very high price will attract only a fraction of the available market, and therefore learning about the product (for example about its quality), through customer exchange of information will be slower.

As mentioned above, this paper offers a new explanation of what determines the optimal pricing strategy. Appropriate literature in dynamic pricing, both from marketing and economics, is reviewed and placed in this new framework that emphasizes interrelatedness of product's price over time and learning of skills or information.

The organization of the paper is as follows: first we focus on pricing in conditions of deterministic learning, i.e. learning without elements of uncertainty. In the second section we review models that explore pricing strategy in face of uncertainty. In the next section we explore the role of price in consumer learning. In subsequent section we focus on firm' learning in monopolistic situation and conse-

quent pricing strategy, and finally in the last section we investigate competitive learning and pricing.

Pricing in presence of deterministic learning: experience curve and diffusion demand

Learning curve phenomenon (also called experience curve) is manufacturer's ability to gain experience in production, and to apply it to decrease production costs. The implications of this phenomenon have been studied extensively in economics by Arrow (1962), Porter (1980), Rosen (1972) and Spence (1981). A consequence of the learning curve effect is that by lowering cost of production, the manufacturer can lower the price without sacrificing profit. The quantity produced is the current period will have impact not only on present byt on future profits as well.

Mathematically, the most common representation of experience curve is $MC(E(t)) = C_1(E(t))^{-\alpha}$, where $MC(E(t))$ is the cost of producing the E-th unit of output, $E(t)$ is the cumulative output at time t, C_1 is the cost of producing the first unit, and $\alpha > 0$ is the learning rate parameter.

On consumers' side evolution of demand is modeled by a diffusion process (Bass 1969, Bass et al. 1994). By diffusion we refer to various phenomena that cause the likelihood of purchase to increase as a result of higher market penetration. This theory addresses how a new good, an idea or a service is assimilated into a social system over time. In its simplest form, Bass diffusion process is represented by the equation ,

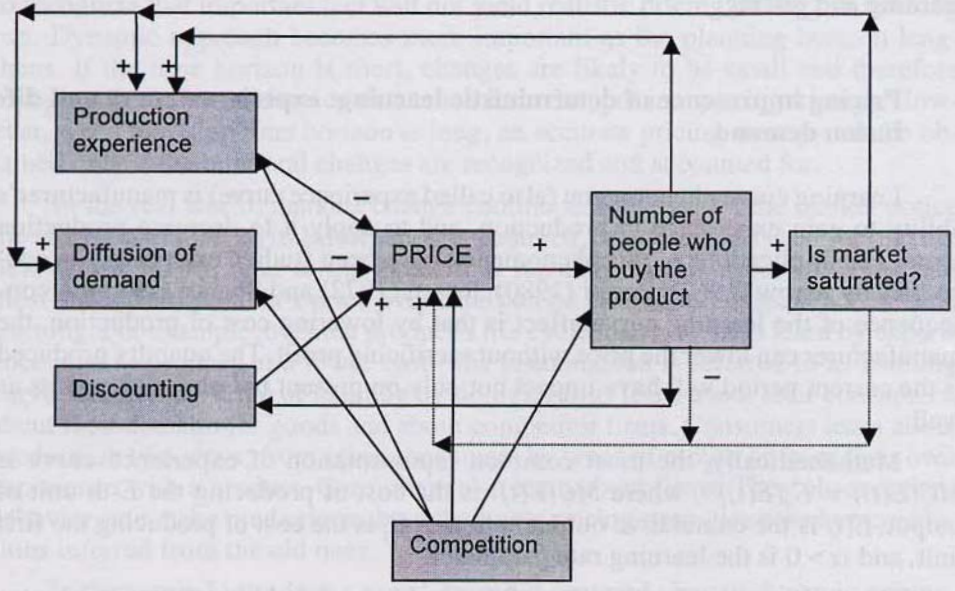
$$S(t) = p\left(m - Y(t)\right) + q\frac{Y(t)}{m}\left(m - Y(t)\right),$$

where $Y(t))$ is the cumulative number of adopters to date, $S(t)$ is the number of adopters at time t, m is the ultimate number of adopters, q represents the effect of each adopter on each non-adopter (imitation effect), and p represents individual's propensity to innovate.

Diffusion has been studied in depth by scientists from different disciplines, including sociologists, economists and marketers. This phenomenon incorporates consumers' learning about the product in the following way: as cumulative sales increase, purchase becomes more likely because more consumers learn about the product by being exposed to it, or by being in contact with someone who had been exposed. Learning happens mostly by word of mouth communication or product's self advertising.

There are five factors that influence price path. These are learning curve effect (or cost effect), diffusion of demand, market saturation, profit discounting and competition. Their impact on price is represented below.

Figure 1.



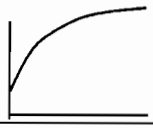
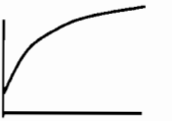
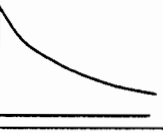
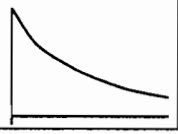
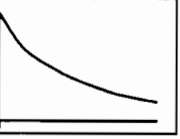
These five factors can produce various pricing patterns, depending on which effects dominate. In the beginning of product's life learning curve effect and diffusion of demand are prevailing, while at the end saturation becomes the driving force. Discount factor is present constantly. Competition can be present throughout the planning period or can enter at an exogenously determined time.

Cost effect, diffusion effect, discount and saturation are so complexly intertwined that it is extremely difficult or impossible to obtain closed form solutions for optimal price paths in situations when all four factors are significant. However, if restrictions are imposed, problem becomes more tractable. Namely, if demand is assumed to be separable, then price over time can be determined. Here we summarize findings from Robinson and Lakhani (1975), Bass and Bultez (1982), Dolan and Jeuland (1981) and Jeuland and Dolan (1982) and Clarke, Darough and Heineke (1982).

Teng and Thompson 1983, Thompson and Teng 1984; Eliashberg and Jeuland 1986, Hauser and Shugan 1983, Clarke and Dolan 1984, Wernerfelt (1986) and Dockner and Jorgensen 1988 extended these models to include competition. As in the monopolist's case, it is very hard to obtain any analytical general rules about pricing in oligopoly in this framework, although most numerical simulations indicate that competition drives price down (Teng and Thompson 1983, Thompson and Teng 1984; Eliashberg and Jeuland 1986, Hauser and Shugan 1983), although under some special conditions competition can result in non-declining price paths (Clarke and Dolan 1984).

Figure 2.

OPTIMAL PRICE PATHS

	No repeat purchases		Repeat purchases	
	No discount Any cost	Profits discounted Declining cost	Medium repurchase rate	Strong repurchase rate
Positive word of mouth Short horizon		Ambiguous		
Positive word of mouth Long horizon		Ambiguous		
Weak word of mouth (Demand monotonically decreasing)			Repeat purchases insignificant	

The most important practical problem of this "experience-diffusion" framework lies in its attempt to describe the ever-changing environment without accounting for its randomness. We know that random changes in the environment will affect both firms and consumers. Raman 1988, and Chen and Jain 1992 have addressed this issue by introducing a random element into the sales function. In particular, they assumed that $S(t) = f(x(t), p(t), r(t))$, where $x(t)$ represents experience curve effect, $p(t)$ is the price, and $r(t)$ represents random change in the environment. The random change is modeled by stochastic process, namely by Weiner process in the former paper, and by Poisson process in the later paper.

To summarize, the "experience-diffusion" paradigm is very appealing because it is grounded in behavioral and economical theory. However, although very elegant, this framework suffers from certain rigidity in the way it models learning. Namely, learning for consumers and firm happens according to a previously specified process (diffusion on the consumer side and experience curve at the firm's side). In order to account for complexity of the market, different models were developed that were better adapted to explore other facets of this mutual interconnection of learning and pricing.

Consumer Learning Influences Pricing Strategy

In monopoly the emphasis is on interaction of consumers and a firm. Both parties possess only limited information about the other party. They decide on their

actions according to available information, and they compare the outcome with the expectations that preceded it. This comparison makes it possible to learn from error before taking another action.

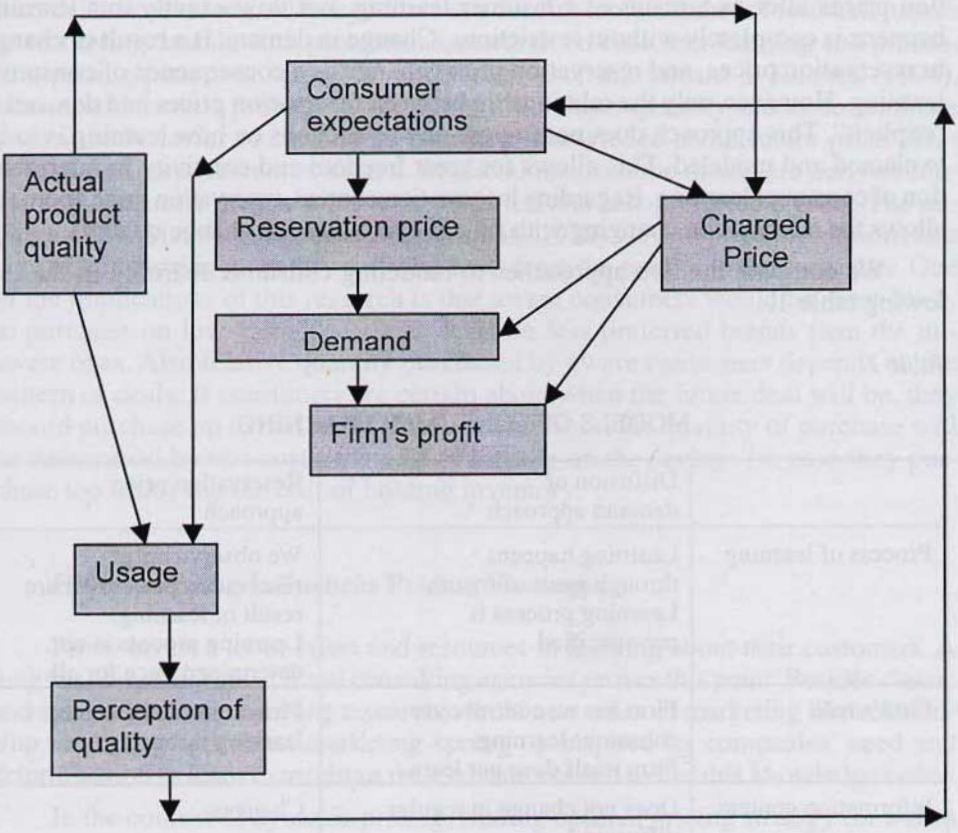
Consumers constantly learn about products, both through the exchange of information and from own experience with the product. An important feature of a product is its quality. The firm knows the quality of the product it sells, but the consumers have only partial, if any, information about it. They form their opinion on the basis of that information, which influences their reservation price. Reservation price is the highest price a customer is willing to pay for the product. It has a direct impact on firm's pricing policy, because the more people are prepared to pay, the higher the firm can price the product. In other words, the higher the reservation price is, the higher the actual charged price can be. (For the sake of precision, we have to stress that heterogeneous buyer population will have different reservation prices, so in the market-level analysis we deal with distributions of reservation prices rather than a single reservation price. In marketing, this problem can be somewhat circumvented by use of segmentation strategy.)

Consumers learn about the product's quality through their experience with the product. One of the first papers that were concerned with modeling of such consumer learning is Grossman, Kihlstrom and Mirman (1977). They devised rather sophisticated model to compute expected utility of purchase given certain beliefs about the product. In their model time is divided in periods. Consumers enter each period with expectations based on their experience in the preceding period. Consumers' beliefs are expressed by a density function (i.e. consumers believe they know what is the probability that product has a particular level of observed attribute, in this case quality). After they gain experience about how their expectations conform to reality, consumers form a new set of probabilities and thus a new density function. Technically this is modeled through Bayesian updating. In their paper Grossman, Kihlstrom and Mirman were concerned with the optimal strategy of a consumer who wants to maximize his/her expected utility.

As we mentioned, consumer learning will influence firm's pricing strategy. This issue is investigated in Goering (1986, 1987) and Shapiro (1983). Their models are very similar conceptually, except that Shapiro assumes that product quality is perfectly revealed to purchasers through usage, and Goering allows for the fact that consumers are not able to acquire perfect information about product quality. This happens because of quality variation among individual units of product. This is particularly characteristic of services because the quality of service generally depends on many factors, which are difficult to reproduce always in the exactly same measure. The idea of imperfect rather than perfect learning about quality through usage due to variations in quality originates from Smallwood and Conlisk (1979). Another difference between models of Shapiro and Goering is that Shapiro considers infinite time horizon, and Goering limits her investigation on only two periods. Both Shapiro and Goering prove that firm's profit maximizing pricing strategy depends on the actual average quality of the product. By adjusting the product price firm can control the rate of consumer learning.

The following diagram shows how consumer learning about quality affects demand and price.

Figure 3.



If the product quality is high, the firm would want as many people as possible to learn about it. Firm can encourage this learning by charging lower price. In this way more consumers will use the product and consequently learn about its quality. This will raise consumers' reservation prices for the product and make it possible for the firm to charge higher price in the future. On the other hand, if the product quality is low, consumer learning reduces future demand. In this case purchasers lower their reservation prices after evaluating the quality of purchased sample. To extract more consumer surplus and reduce the number of consumers who lower their reservation prices, firm will price higher than its optimal myopic price. In this way firm can control consumer learning.

In the previous section we assumed that consumer learning happens through pre-specified diffusion process. Adopters learn about the product, and through social interaction disseminate this knowledge among other consumers. This is usu-

ally referred to as word of mouth. In this section we have shown that firm through choice of pricing strategy can control consumer learning. This reservation price approach allows for more freedom in modeling of consumer learning. Changes in demand are explained as a consequence of changes in reservation prices. Reservation prices alter as a result of consumer learning, but how exactly this learning happens is completely without restrictions. Change in demand is a result of change in reservation prices, and reservation prices change as a consequence of consumer learning. However, only the relationship between reservation prices and demand is "explicit". This approach does not impose any restrictions on how learning is to be explained and modeled. This allows for great freedom and creativity in interpretation of consumer learning. Regarding information content, reservation price approach allows for information changing with time (i.e. product can change quality).

We compare the two approaches to modeling consumer learning in the following table 1.

Table 1.

MODELS OF CONSUMER LEARNING

	Diffusion of demand approach	Reservation price approach
Process of learning	Learning happens through word of mouth. Learning process is pre-specified.	We observe only reservation prices that are result of learning. Learning process is not determined once for all.
Firm's role	Firm has no control over consumer learning. Firm itself does not learn.	Firm controls customer learning through price.
Information content	Does not change in regular diffusion. Changes in stochastic diffusion.	Changes

Although reservation price approach is more suitable for problems where consumer learning is complicated and needs to be modeled explicitly, it would be incorrect to dismiss diffusion framework as useless. For example, reservation price approach does not explicitly acknowledge market saturation in the way that diffusion process does.

In reality, learning is a "two-way-street". Namely, when firm changes a certain price, consumers are not just passive recipients of this pricing strategy. Rather, they learn about firm's pricing pattern. This problem of how to price to consumers who learn from past price changes has been recognized as an important problem in marketing field. This issue is most visible in the situations of price promotions and coupons (these tactics, very popular in the US in the past two decades, have re-

cently been adopted by leading Croatian retail chains). If consumers can anticipate firm's pricing pattern and learn to expect price deals, this would have serious implications on firm's pricing policy. If their predictions are accurate, consumers can stock up on the product in the period when deals are available, and wait until the next deal comes along. Although there is a considerable number of research papers in marketing dealing with promotions, research on customer learning and promotion pricing pattern is scarce. A representative of this stream is Krishna (1994), who examines this problem by building a purchase quantity model to compare normative behavior of consumers who have knowledge about future price deals with that of consumers who do not. Implications from the model are derived concerning consumer response for their preferred and less preferred brands. The author accepts Blattberg, Eppen and Lieberman (1978) view of price promotions as a way of transferring inventory carrying costs from the retailer to the consumer. One of the implications of this research is that aware consumers would be more likely to purchase on low-value deals and deals on less preferred brands than the unaware ones. Also relative quantity purchased by aware consumers depends on the pattern of deals. If consumers are certain about when the future deal will be, they should purchase up to that time. If they are not sure, the quantity of purchase will be determined by two costs, the cost of loosing on the savings (in case they purchase too little) and the cost of holding inventory.

Firm Learning Influences Pricing Strategy

Firms invest a lot of effort and resources in learning about their customers. A long list of market research and consulting agencies proves this point. Besides classic and state-of-the-art marketing research, whole new areas of marketing like relationship marketing and direct marketing sprang up inspired by companies' need and determination to learn more about their consumers and to use this knowledge better.

In the context of dynamic pricing, finding optimal pricing strategy for a firm that gathers information about its customers and learns from it is a technically difficult problem. Research papers in this area are not numerous. One stream of research is done entirely by economists. These models consider firm's learning in similar way as consumer learning explained in Grosmann, Kihlstrom and Mirman (1977). Some of the most representative papers in this line of research are Prescot (1972), Fusselman and Mirman (1989) and Mirman, Samuelson and Urbano (1989) and Trefler (1993), Trefler's being the most general. In all the above models only firm learns. To deal with the complexity of the model, some simplification assumptions were introduced, for example consumers are assumed to be governed only by product's present price. In Trefler's model monopolist posts a price, consumers observe the price and decide whether to buy or not. Since this decision depends only on price, the demand process is Poisson. The firm seeks to learn the inverse relationship between the price and customer flow. To gain that knowledge, firm must experiment. After every action firm updates its expectations. Firm can

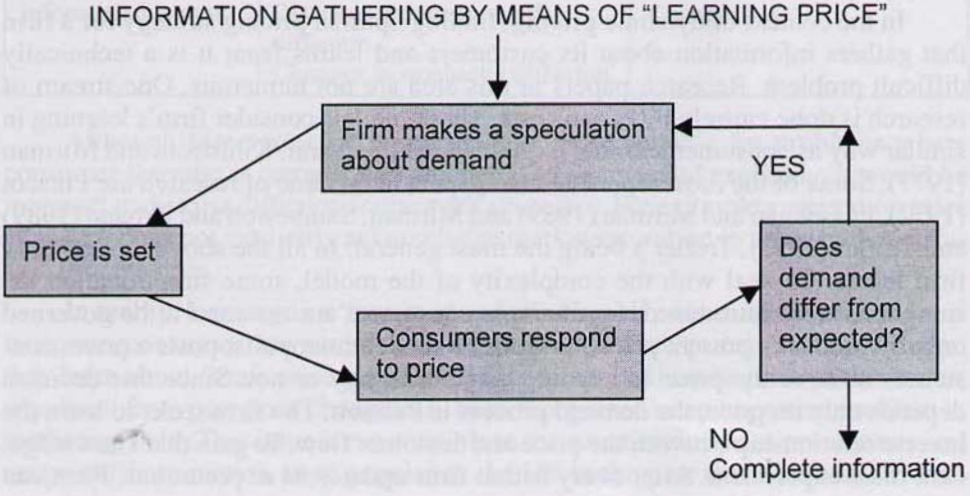
experiment with price or with quantity, namely by changing price while quantity is constant and observing the change in demand, or by keeping price constant and offering larger quantity. It is in interest of firm's survival to learn quickly. In other words, firm has to gather most information with as few experiments as possible and with suffering as little loss as possible.

The question that firm faces is the following: if experimenting with price, what price produces more information? The contribution of Trefler's paper lies in a characterization of the expected value of information. As a consequence of this he proved that the direction of that experimentation is always increasing if the pricing rule is linear, namely that higher price provides more information. In particular, according to Trefler, monopolist should always price higher if uncertain of demand. This result agrees with findings in Lazear (1986).

Braden and Oren (1994) argue that it is not always true that higher price elicits more information. They prove that optimal "learning" price depends on type of product (commodity or durable) and pricing rule. Braden and Oren investigate situation when a firm prices according to a nonlinear pricing rule and when it faces a market with stochastic demand. They assume that consumers are heterogeneous with respect to taste, income or other characteristics. These differences are captured through random variable θ. Reservation prices are also random and they depend on θ, time period, and quantity that will be purchased. Consumers act to maximize their surplus. Firm seeks to discover distribution of θ. Firm's aim is to maximize its expected profit. Braden and Oren show that in general it is optimal to produce information by lowering price, and that the optimal pricing policy in general is the same as for a myopic firm.

The above research reveals an extremely interesting nature of price in this framework, as shown in the following figure 4.

Figure 4.



Again price is revealed here as not merely means for achieving profit, but also as an instrument of learning. Problem of optimal "learning price", price charged with the purpose of finding out about demand, is very sensitive. "Learning price" will have impact on the entire future profit. Error in determining this "learning price" will produce double mischief: firm will not acquire correct information, and it can seriously undermine its entire profit.

The result about "learning" price is extremely interesting because it explains a mechanism through which the firm controls its own rate of learning. To understand why the dynamics of firm's learning and pricing differs with repeat purchases, it is important to consider the following. Namely, if we want to determine unknown parameters of a function whose value is received as a signal in response to an input we provide, larger difference in signal for the same incremental change of input will give us more information about the parameters. In this case, sharper difference in demand for an incremental change in price will provide more information than a slight change in demand for the same incremental change. Distribution of reservation prices is usually such that higher the price, the more pronounced difference in demand. (For example, for a dress, D($100)-D($90) is greater than D($30)-D($20).) This means that higher prices produce larger differences in demand and therefore more information. At the same time, there is an opposite effect at work. If a product is of a frequently purchased type, low price will influence consumers to buy larger quantity of product. Than it can happen that this shear volume overwhelms the effect of reservation prices, and that differences in demand become larger when price is smaller.

Competitive Learning

Determining pricing strategy in oligopoly is a complicated problem, especially when we want to account for the effect of competitive learning.

Research on the topic of dynamic pricing in oligopoly with uncertainty is very scarce. Coughlan and Mantrala (1992, 1994) present models of dynamic pricing in the situation when competitors have incomplete information about each other. To keep tractability under control, they had to assume that demand does not change, i.e. that consumers do not learn. In both their papers, Coughlan and Mantrala consider a duopoly where each firm makes one product. Firms have perfect information about their own marginal cost and demand function, but they lack corresponding information about their competitor. Time is divided in periods; every new decision marks the beginning of a new period. In period 1 firm i is a monopolist. In period 2 second firm (firm j) enters. Each firm's goal is to maximize expected profit for current and subsequent period.

This is a game theoretical model, which explains competitive learning in a very original way. Learning occurs in cycles, while one firm is gathering information; the other one is using its previously acquired knowledge. Knowledge gives

firm an advantage in dealing with competitor firm. As long as that knowledge is accurate, firm does not need to do anything but exploit it. But during that exploitation cycle competitor is trying to change the balance by making that knowledge obsolete. This is done by acquiring information about the first firm. On the basis of that information second firm changes its policy, so the knowledge of the first firm becomes useless. Now second firm has advantage and enters exploitation cycle. At the same time first firm starts gathering knowledge about the other one in order to shift the balance again.

This simple and elegant model offers some very interesting insights. According to numerical analysis Coughlan and Mantrala conjecture that this learning process is converging, i.e. firms get closer and closer to their expectation until they guess correctly. The approach to ultimate equilibrium occurs faster for products less related in demand. This can be explained in the following way: if the products are more related, they present larger threat to each other. Therefore more information is needed to make a decision, and consequently it takes more time to learn about it. It is interesting that, although equilibrium is always reached, it does not have to be founded on accurate information. In other words, firms can stabilize in wrong perceptions of each other.

Although it is difficult to produce general price paths in this framework, it is possible to notice difference between price path for complements and substitutes. When products are complements the first entrant's price rises and then falls, while second entrant's price first falls and then rises in progression to equilibrium. While products are substitutes, both entrants' prices rise and then fall to the steady state.

Cabral and Riordan (1994) model dynamic price competition with learning curve for a duopoly facing a sequence of buyers with uncertain demands. They explore several strategic implications of the learning curve phenomenon in competitive environment. Namely, by moving down the learning curve faster that its rivals a firm gains a strategic advantage. Recognizing this potential for strategic advantage, firms compete aggressively to move down the learning curve. Strategic advantage that comes as a result of such learning can be so substantial as to drive competitors from the market, creating an incentive for predatory pricing, i.e. pricing below the cost.

We have seen that price can be used to provide a firm with information about uncertain demand. The same use of price as a learning tool exists in a competitive environment. Harrington (1995) explores price setting behavior in duopoly in which firm are uncertain about the demand and degree of product differentiation. Harrington shows that price dispersion is greater in markets with highly substitutable products, but lower in markets with highly differentiated products. The reason is that information is more valuable in the first case and less valuable in the second case. This is an interesting result, which is driven by competition. However, setting price to find out demand is a public experiment in the market place, and the outcome is available not only to the firm which is conducting the experiment, but also to firm's competitors. While the firm can improve its decision and its profit, it

is likely that rivals will use the same information for their benefit. In particular, if rivals respond aggressively to new information, then the net effect on firm's profit can be negative. For example, if a firm finds out that the products are highly substitutable, then it might be optimal for them to lower their price and get larger market share. But the other firm can do the same, and damage the first firm.

However, firms do not always behave in non-cooperative way. In reality implicit cooperative behavior is often observed. Nascimento and Vanhonacker (1993) investigate optimal pricing for differentiated consumer durables in a dynamic duopoly under coalition, competition (Nash equilibrium), price following (instantaneous and delayed) and cost pricing (naive predation). Consumer demand is modeled as diffusion process. Demand functions are interrelated through price and hazard rates, which capture the dynamics of adoption over time and are specified as follows:

$$Q_1'(t) = (PB_1(p_1(t), p_2(t)) - Q_1(t)h_1(Q_1(t), Q_2(t))$$
$$Q_2'(t) = (PB_2(p_1(t), p_2(t)) - Q_2(t)h_2(Q_1(t), Q_2(t))$$

where $PB_i(p_1(t), p_2(t))$ denote the number of potential buyers at time t for firm i, $Q_i(t)$ denote the cumulative sales by time t for firm i, and $h_i(Q_j(t), Q_2(t))$ denote the hazard rates for the probability of purchasing for firm i. The number of buyers of each product is modeled as a non-stationary variable using the reservation price notion (i.e. each customer in the market has a reservation price for both products). The optimal price paths derived are of three types: monotonically increasing (pure penetration), monotonically decreasing (pure skimming) and first increasing and then decreasing. Under price following behavior, optimal price paths are similar to monopoly prices and are higher than in other modes of competition. Nascimento and Vanhonacker conclude that intelligent price leaders will recoqnize passive behavior of their rivals and will establish implicit coallition, which is consistent with Axelrod's (1984) finding that tit-for-tat leads to cooperation. In the case of cost pricing, optimal price paths are mostly decreasing. Under competition (Nash equilibrium), the optimal price paths tend to be similar to the corresponding optimal monopoly pricing paths.

The reality of competitive environment is much more complicated than any of the presented models can capture. Each model emphasizes some features and downplays others. For example, up to now it was assumed that consumers can determine the quality of the product. However, it is very well known that this is not always true. There are marketing strategies that depend on the fact that it is not easy to determine product's quality in usage. Chintagunta, Rao and Vilcassim (1993) investigate the impact of the aggregate consumer experience on the firm's optimal pricing and advertising strategies. They build a game-theoretic model of dynamic duopoly. Knowledge about the product (generated by usage of the product) influences firm's decision regarding it's pricing and advertising. As consumer experience changes, the demand shifts over time, and firm adjusts its pricing and advertising. Their model does not give closed form solutions for optimal price paths, so

authors resort to numerical solutions and simulations. Some of their results are very interesting. For example, when consumers have low experience level with a firm's product (like in the case of a late entrant), that firm should adopt a penetration pricing strategy coupled with high levels of initial advertising.

Conclusion

In this paper a new, learning-centered view of dynamic pricing is introduced. The purpose of this paper is to explore the interrelatedness of price and learning. Research in dynamic pricing in both marketing and economics, which addresses learning by either consumers or firms, is surveyed and systematized under this new framework.

Learning in the marketplace is an all-pervading process. Firms can learn about production, demand or other firms. Consumers learn about products or firm's pricing policy. This paper focuses on learning by customers and/or firms, and the effect of this learning on price. Price can be a consequence of learning (for example, when a firm learns by experience how to produce at a lower cost), or it can be used to induce learning. By using price the firm can gather information about consumers or other firms. Through use of price the firm can control customers' speed of learning about the product, but it can also control its own speed of learning about the customers.

In reality all of the described learning processes occur together. For the sake of tractability each model in this review concentrates on one, at most two types of learning processes. It has to be pointed out that because of many factors involved, it is hard to develop general formulas for optimal pricing decisions. To be able to give some normative guidance to managers, every model focuses on some aspects and disregards others, as is common in economic modeling. The manager must evaluate his/her particular situation to determine which factors are important and then assess what the best prices should be given those factors.

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STRATAGIJA ODREĐIVANJA CIJENA I UČENJE

Sažetak

U posljednja dva desetljeća u marketinškoj literaturi mnogo se pažnje posvećivalo vremenskom određivanju cijene proizvoda/usluge. Rezultat toga istraživanja su modeli dinamičkog zadavanja cijene, tj. modeli koji opisuju kako se cijena proizvoda/usluge mijenja s vremenom. Ti modeli između ostalog obuhvaćaju kako postojeće znanje o životnom ciklusu proizvoda, tako i teoriju o difuziji novog proizvoda kroz tržište.

Na tržištu je neprestano prisutna izmjena i prerada informacija, drugim imenom učenje. Na primjer, poduzeća uče kako smanjiti cijenu proizvodnje, uče o svojim kupcima i o drugim konkurentskim poduzećima. Potrošači uče o osobinama proizvoda i o njihovim proizvođačima. Rezultati sve te izmjene informacija odražavaju se na cijenu proizvoda. Cijena može biti posljedica učenja, ili može biti instrument kojim se nastoji potaknuti učenje. U ovom članku opisana je ta međusobna povezanost učenja i određivanja cijene.