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**ΤΙΤΛΟΣ**

**Behavioral – based Price Discrimination**

**ΟΝΟΜΑΤΕΠΩΝΥΜΟ**

**ΚΕΝΤΡΩΤΑ ΑΝΑΣΤΑΣΙΑ**

**Διατριβή υποβληθείσα προς μερική εκπλήρωση  
των απαιτήτων προϋποθέσεων  
για την απόκτηση του  
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**Εγκρίνουμε τη διατριβή της Κεντρωτά Αναστασίας.**

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## Summary

In the first chapter of the thesis, we will refer to some pricing practices and their effects on consumers' behavior. Even though the classical economic theory suggests that people will act rationally using benefit and cost analysis to make a decision, scientific research shows that this is not the case. People do not have the ability to recognize and evaluate all the available information in today's complex environment. So we will refer to drip pricing, opt-in/opt-out, reference pricing, the use of word 'free', bait pricing, complex pricing and time limited offers.

In the next chapter, I'm going to discuss how the collection of customer data can be used in price discrimination and how this can affect the profitability of the firm. We will examine homogenous, non-durable good duopolies to find out the competitive effects of customer recognition. In this part, we are trying to understand why firms invest in the collection of customer data, how it affects their ability to discriminate and how this is profitable. The advances of technology and the willingness of customers to share their identities make it easier to collect the data that the firms need in order to automatize pricing based on various aspects.

Finally, in the last chapter, we will examine competition in the presence of behaviorally biased or boundedly rational consumers. Consumers' behavior may deviate from the idea of perfect rationality in many different ways. Consumers may suffer from cognitive limitations thus making the comparison of products and prices very difficult. Additionally, consumers may be prone to various behavioral biases, such as being overoptimistic about the future or overconfident concerning their ability to avoid accidents, or being afraid to lose compared to the status quo. However, there are remedies that can improve market outcomes. We will discuss consumer learning and education, reputation building by firms, information leading to improved market transparency and the standardization of information. However, each of these remedies is effective in particular cases. For example, learning and education are used in cases where errors can be detected and realizes ex post. In cases where firms have a motive to exploit errors, there is also a motive to establish a reputation for not engaging in such exploitation. Whenever consumers need to engage in active research before



purchasing, better information is very important. Last but not least, when consumers have cognitive limitations it is not only the available information that matter but also its presentation.



## **Chapter 1: Pricing Practices**

In this first chapter of the thesis, I will present some pricing practices used to influence consumer behavior and decision making. So, we will look into seven pricing practices: drip pricing, opt-in/opt-out, reference pricing, the use of word ‘free’, bait pricing, complex pricing and time limited offers.

### ***1.1 DRIP PRICING***

Drip pricing happens when consumers purchase something only by looking at the price in front of them, but there is also an additional price that reveals as customers go through the purchasing process. A common example is the case of air tickets where you can find a particular price but you have to add taxes or extra charges and you don’t know the exact price until you actually buy the ticket. So, in drip pricing, the total price can be calculated later in the purchasing process. This type of pricing can also be called ‘partitioned pricing’.

We have three types of drips:

- Compulsory drips: when the price of a good is charged with an additional amount of money e.g. airline taxes, processing fees etc. These are usually surcharges.
- Optional drips: when we have product bundling, price bundling or both. It represents different prices for each component of the bundle or a common price for the bundle. Consumers can choose either to buy the product separately or together. The items are usually add-ons.
- Multiple/ single drips: In some cases consumers face a single drip (as in postage and packaging) and in other cases there may be several drips in the process for example tax, booking fee etc.

Drip prices can be shown to customers in the following forms:

- Opt-in: consumers are opted-out of all charges and services and they have to opt-in for each and every one of them.



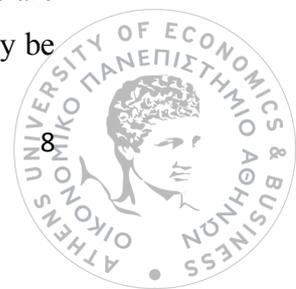
- Opt-out: consumers are opted-in to all charges and services and they have to opt-out of each and every one of them.
- No default: Consumers can either choose to opt-in to a product or service, or opt-out and they cannot move on the next stage of the purchasing process until they decide on each element of the drip.

According to Tversky and Kahneman's theory (1974), a buyer concentrates on the information he thinks is more important and then adjusts insufficiently for one or more items thus underestimating the total price. Moreover, when he encounters more than one prices, he has to use his mental effort more. This makes some customers ignore surcharges completely by not noticing, or when they do notice them, they don't incorporate surcharges into the base price. Additionally, drip pricing, may result in a reduction to the extent that people search, once they start the purchasing process. According to the evidence, partitioning surcharges are beneficial for sellers whereas partitioning add-on products are more complex and depend on an aspect of the add-ons which may or may not benefit the sellers. So, there is no answer whether partitioning, optional or compulsory products are harmful for consumers.

### ***1.2 OPT-IN/ OPT-OUT***

When examining the decision-making process and the psychology of people in similar cases, we discover that these practices may affect people's decisions. It is proven that when default is chosen, people are stuck in this option without considering the consequences. According to Johnson and Goldstein (2003), when you change the policy concerning organ-donation from opt-in to opt-out, this can result in an increase of donor rate.

According to Madrian and Shea (2001), default is presented as recommendation and for this reason people are stuck with this option. Another reason why people prefer the default option may be the cognitive effort in decision-making. Another reason could be the fact that people are afraid of taking action in order not to have losses. Finally, the people's tendency to maintain the current or the previous state of affairs may also be a reason of using the default option. In general, people are stuck with the default option, even though this can have harmful effects. This may be



caused because they prefer inaction to action thus avoiding mental effort, or because of the status quo. So the default option may be harmful in cases where opt-out is used to make consumers purchase more goods or services, even though they don't need them.

Limitations in this case include methodological issues such as the ability to generalize some results due to laboratory conditions, the use of student samples and the limited amount of data concerning behavior. Another limitation is that consumers cannot see whether multiple drip pricing reduces the extent they try to resort to other options because of time.

### ***1.3 REFERENCE PRICING***

Reference price is a price which is concerned to be normal, most commonly thought by consumers. We can find three types of reference pricing practices: (a) comparing an advertised price to the price the retailer has charged before, (b) comparing an advertised price to the price charged by other retailers in the same trade area and (c) comparing an advertised price to the manufacturer's suggested retail price. Comparative prices supplied by a retailer are often referred to as external reference prices (ERPs), or advertised reference prices (ARPs), because they provide an external reference against which an offered price can be compared. Prices recommended by a manufacturer are called a Recommended Retail Price (RRP). Reference pricing could work because during the decision process, an initial value serves as a benchmark for estimating the real value. For this reason, a reference price could serve as an anchor that consumers adjust to in order to estimate the price. However, it is very difficult for the consumers to know the extent to which the benchmark influences their estimates because these effects take place unconsciously.

There is evidence proving that advertised reference prices (ARPs) affect consumers' behavior (for example the perceptions for fair price, normal price, purchase value) and also decrease additional search effort. Urbany, Beardon and Weilbaker (1988) examined whether consumers can observe ARPs with skepticism but still be influenced by them. They conclude that an advertisement with a plausible reference price increased consumers' estimates of the product's price and the



perceived offer value, as compared to an advertisement which had no reference price. They also showed that an exaggerated reference price has the same positive effect among all skeptical consumers.

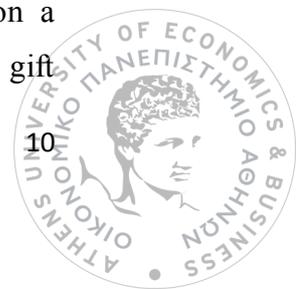
So, in general, there is variety of evidence showing that the presence of reference prices increases consumers' deal evaluations and purchase intentions, and they can lower their search intentions as compared to the case when we have no reference price. Additionally, reference prices can influence consumers even when these are high and when consumers doubt their truthfulness. So, the sellers may be able to exploit reference prices in order to harm consumers. The latter can be harmed if prices aren't genuine or have been there for short periods of time and then abandoned. Prices may be misleading because they exceed the average competitive price or because consumers may not be able to compare them in the long run to an industry price.

Even if the advertised reference price is misleading or a genuine offer, it could result in consumers spending more or failing to buy from the supplier with the lowest cost. Consumers may fail to search because they believe they had already been given a good offer. Thus, while reference prices can be beneficial for consumers, it may be difficult to monitor the use of misleading reference prices as well as the use of ARPs in cases where comparisons are more difficult to make.

#### ***1.4 THE USE OF WORD FREE***

We can use the word free in many cases, for example, 'buy one and get another one for free' or 'win a mobile for free after purchasing a specific connection program'. Several theories support that a product offered for free can affect a consumer's behavior because of the certainty effect which means that free things can escape from consumers' regret because they spend nothing on it. This results in overvaluing everything that is given for free. Another theory points out that people want to gain without calculating discounts which need effort for example. Free is an absolute price and there is no fear of loss.

Until now, there are no studies examining the effect of word free on a consumer's behavior. However some studies have examined the effect of free gift



offers. Among those studies, however there are some which have positive evaluations and some that have negative evaluations. For example Raghurir (2004) said that once a free product is bundled together with another product and offered for one price, consumers are willing to pay less for the free product when this is sold alone. On the contrary, other studies have shown positive evaluations of the overall bundle when one of the items is described as free, as opposed to when it is offered with a discount (Dark and Chung 2005). This difference generate an uncertainty concerning the effect of the word free.

So, the available evidence on the effect of offering a product for free is ambiguous. While some studies claim that this practice increases consumer valuation and demand, others claim that it does not increase the consumer's willingness to pay for the bundle.

### ***1.5 BAIT PRICING***

This pricing practice refers to consumers who are attracted by a discount but finally purchase a more expensive product because there are no available products at the discount price. Psychologists support that once people commit to an action, then they will stick to that specific action. This commitment and consistency comes from three sources: (a) it makes the daily life simpler, (b) it provides a valuable shortcut into the complexity of modern existence and (c) it is highly valued by the society. Being consistent reduces the need to re-think all the relevant information in similar cases in the future. Bait sales may harm consumers when they have been attracted by discounts and are unwilling to continue searching elsewhere.

There are some studies that have examined the effect of the separate components of a bait sale: (a) the bait which is the discount offer and (b) the unavailability of the good. According to Ellison (2009) the practice of 'bait and switch' has a strong effect on consumer behavior. However, the limited amount of direct evidence doesn't allow us to have a proper conclusion since more direct evidence is needed. Evidence coming from the examination of (a) independent effects of discount offer, and (b) consumer behavioral patterns in stock-out situations make it possible to conclude that the 'bait and switch' practices can harm consumers,

especially in cases when employees encourage consumers to switch to a higher value product. Even though we don't know the result in sales, baits harm consumers as far as wasted time and effort are concerned.

### ***1.6 COMPLEX PRICING***

Complex pricing includes a range of practices which make it more difficult for consumers to assess or compare prices. These practices include:

- Volume offers: In this case we have practices like '3 for 2' or '5 for 3 euros'.
- Multi-part pricing: when the product or service includes two or more parts with a separate unit price for each of them (for example mobile phone packages that may charge different prices for calls, texts, internet access, etc).
- Comparative bundles: when a comparison is made over a bundle or a basket of goods. We can have pure or mixed bundling. Pure bundling is when the firm sells only the bundle and not the products separately. Mixed bundling is when consumers can purchase the bundle or the products separately.
- Adverts: In this case, pricing depends on specific conditions (such as thresholds or inter-temporal price differences), which do not relate to the underlying nature of the product.

Volume offers are used as mental shortcuts for numerical or quantity decisions. However, bundle offers may be preferable because a single larger loss is less punishing than multiple separate losses and they signify savings. Moreover, when people bombarded with a lot of information, they search for solutions in order to economize mental effort, which results in a decrease in the quality of decisions taken. We can find many a research concerning volume and bundle offers plus their effects on consumer behavior. However, there is less academic literature concerning complex pricing practices and their effects. The various complex pricing practices below are divided into three parts: (a) volume offers, (b) comparative bundles and (c) complex prices.

### Volume offers:

Manning and Sprott (2007) examined the conditions under which multi-unit pricing is most effective. They proved that multiple units offered in the bundle increased the consumers' intentions to purchase more, compared to a single unit discount. However, this result was significant only for large unit bundles. More importantly, the presence of single unit price in a bundle didn't change this effect. Foubert and Gijsbrechts (2007) proved that a bundle discount increases the probability of switching to the bundle, more than in the case of discounts per unit. Additionally, they found that a bundle discount is enough to attract consumers' attention to the promoted items.

### Comparative (mixed) bundles:

According to investigations, it is shown that multiple unit price promotions and bundle offers are often effective, due to several causes such as the inferred saving heuristic and the lower cognitive effort provided by bundles.

### Complex pricing signals:

Research concerning the effect of complex prices is limited. However, according to some industry reports, complex pricing may harm consumers because these practices can discourage consumers from analyzing the benefits and costs in order to choose the best option.

So, to sum up, evidence suggests that people may be urged to purchase higher quantities because of certain complex pricing practices. Volume offers can increase the quantity that consumers purchase to a greater extent than would be expected by single unit promotions. This effect can be important. Moreover, bundle discounts can increase switching the bundle items, compared to per unit discounts, even when consumers may not buy enough product to qualify for the discount and for this reason the result is loss. The results of buying bundle products are explained by confusion because generally speaking consumers believe that a bundle offers a discount even when it doesn't, no matter if such information isn't presented at all. Mixed bundling can have an impact on consumers' search intentions as it decreases their cognitive

effort. So, it may be important for regulators to control certain pricing practices. More specifically, multiple unit offers or bundles that do not offer discounts may need special attention as they may change consumers' choices. Finally, the size of volume offers may need control because it is quite possible to bias consumers in order to buy a higher quantity of products.

### ***1.7 TIME LIMITED OFFERS***

This pricing practice refers to offers which only last during the period of negotiation and the customer is told that the specific price will not be available after some time. Time limited offers are based on the psychological principle called scarcity. According to this, people overvalue the opportunities when they are less available. This happens because things which are difficult to be found are in general more valuable so when a product is not widely available, free choice is limited. For these reasons consumers want the product more than they would have otherwise. Moreover, people are more motivated when they think they will lose something, than when they think they will gain something of equal value.

After a series of experiments, Inman, Peter and Raghurir (1997) proved that imposing a time limited offer on a product results in (a) an increase in choice probability and (b) in the perceived deal value of the product. Moreover, Swan, Hannah and Abendroth (2006) examined three mechanisms with which time restrictions affect consumers' choices. They prove that limited time offers generate a sense of urgency, resulting in higher purchase intentions. They said that by giving consumers more time to think, they cause a delay and for this reason it is preferable to offer time limited offers. However, if the latter becomes a standard policy, it may increase consumers' perception of inconvenience which could result in lower evaluations and lower purchase intentions.

So, it is shown that the hypothesis of scarcity has an important effect on a consumer's purchasing behavior. Under conditions in which time-limited offers do trigger the feelings of scarcity, consumers are likely to overestimate the product quality, lower the intentions to search, and have higher intentions of buying the product.



## **Chapter 2: Behavior-based price discrimination**

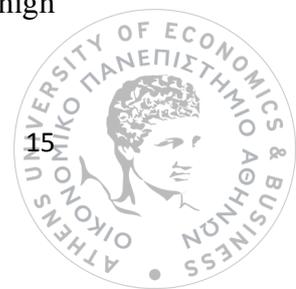
When we are discriminating based on the customer's data about past purchases, then we're doing Behavior-based price discrimination. The data refers to whether the customer is new or recurring. If all the customers buy at every period, then all new customers must have bought from the rival the previous period.

Behavior-based price discrimination (BBPD) can give two different kinds of profits compared to uniform price. Firstly, because the firm knows the rivals' and its own customers, it can lower the price only for the rival's customers and finally gain poaching profits. Secondly, the firm can exploit this knowledge by setting a higher price to its own customers due to their preferences. This way two profits can be achieved if the firm discriminates based on the purchase history of customers. Because the firms can segment the market, based on visible aspects,( e.g. purchase history), we can say that BBPD is a type of third degree discrimination. On the other hand, there are some constraints. If customers have a strong sense of fairness, they refuse to buy in an unfair price. Additionally, the ability of customers to stay anonymous is another key to revealing price discrimination.

We have two types of data that the firm can collect about customers:

- Vertical information: refers to the customers' preferences for the goods e.g. quantity or quality. For instance a firm would like to know who prefers high quality or those who prefer low quality if the price is lower too.
- Horizontal information: shows the brand preference or loyalty that the customer has for one but not for the other firm.

According to Armstrong (2006), when we have symmetric information, vertical information plays no role in pricing decisions among competitive firms. This happens because assuming homogenous goods with vertical information refer to customer's preferences, so this type of information cannot differentiate the firms. Only information that differentiates firms can be used for discriminating in competitive settings. For this reason, BBPD discusses horizontal information such as brand preference, switching cost and loyalty. Switching cost examines the brand reference because it shows the customer's resistance towards the rival and customers with high switching costs are very resistant and thus loyal to the incumbent firm.



In this chapter of the thesis, brand preferences show whether customer likes firm A or firm B. Loyalty shows the extent to which customers prefer either firm, for example, for a group of customers that prefer firm A, there are some that prefer it more than the others. Switching cost is viewed from the same perspective as brand preference. However, in the case of asymmetric demand and asymmetric information, switching cost is considered to be a synonym of loyalty, because high switching costs induce customers to tolerate larger discrepancies between firms.

If we have information asymmetry, that means that only one of the firms recognizes the customers. In this case the firm may be able to create higher profits without being exposed to poaching.

We will now examine different models of BBPD and we will show that we have different outcomes depending on symmetry assumptions. The model of Thisse and Vives will be used concerning customer recognition under perfect discrimination, the model of Fudenberg and Tirole concerning brand preferences and finally Chen's model about switching costs.

### ***2.1 BBPD UNDER SYMMETRIC INFORMATION & DEMAND***

- Symmetric horizontal information: refers to the ability of the firm to recognize customers' brand preferences.
- Demand symmetry: the firms have similar number of customers, despite the fact that those customers have different characteristics.

We will examine the case of a duopoly under perfect information. We will use the model of perfect discrimination by Thisse and Vives (1988) and then Armstrong's (2006). After these, we will move on to models of imperfect information and we will see the outcomes when firms share imperfect information about symmetric demand.

## PERFECT DISCRIMINATION

According to the Hotelling model (1929), we have two competing firms A and B under horizontal differentiation. They produce homogenous goods and we have uniformly distributed customers. Hotelling, (supposing that firms can choose their location), supports that both firms would like to be in the middle to take as many customers as they can. With no customer information, firms have to minimize horizontal differentiation which means the distance between them. Thisse and Vives (1988) use this to examine what happens when we have perfect information with differentiated firms.

Let's assume firms A and B are located at the opposite ends of Hotelling line and customers are uniformly distributed. All customers have transportation costs from their location to the firm's location ( $x$ ). This shows that there is a cost advantage for A and B for half the customers accordingly. In this case we have a non-durable good and no second-hand market. Thisse and Vives model the distances. The transportation cost is larger the further the customer is located from the seller. There is also a transportation parameter that shows the willingness of a customer to buy from another seller due to some characteristics. So, the consumer's surplus from buying from firm A is:  $CS = Value_A - Price_A - parameter \times distance$

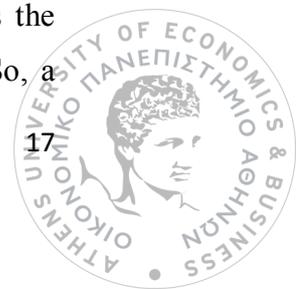
$$U_A = V - P_A - t \times d_A \quad (1)$$

If the locations are between  $[0, 1]$  then  $d_A = x$  and  $d_B = 1 - x$   
So, the consumer buys from firm A if:  $P_A + X_t \leq P_B + (1-x) \times t \quad (2)$

The smaller the cost of transportation is, the more indifferent the customers are.

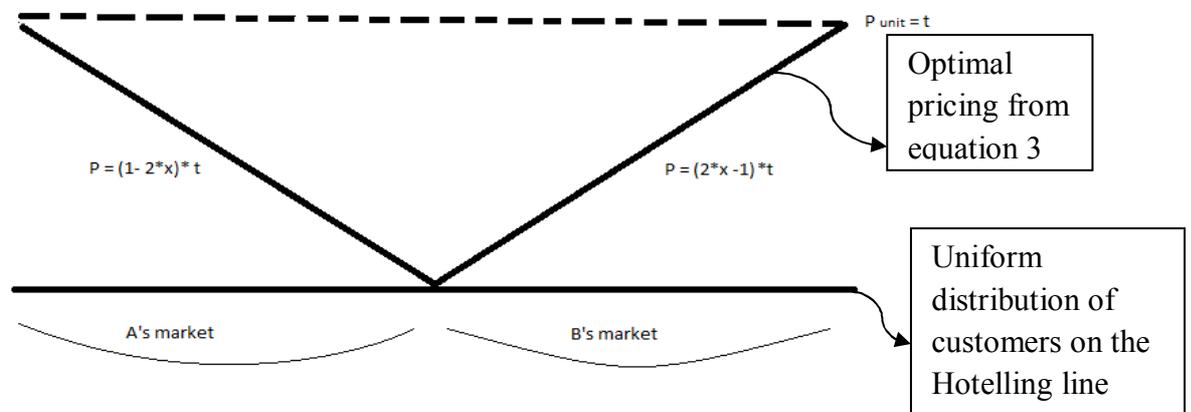
Thisse and Vives show that price discrimination is a dominant strategy for both firms. If  $x$  is close to zero, we have larger substitute's cost. So, for firm A what is important is to set a higher price to the customers that are the nearest. If B has higher transportation cost, then it cannot compete against prices below the customer's total cost of buying from A.

Under perfect information, Hotelling (1929) shows that price discrimination is the best choice. Customers located in the middle are offered the lowest prices due to price competition that increases, once the total cost for either firm approaches the other's. When we have less differentiated firms, the firms compete in prices. So, a



lower price is offered to the customer with the higher transportation cost, while higher prices are offered to customers with low transportation cost. So, the price for each customer depending on location is:  $P_x = (1 - 2 \times x) \times t$ , when  $x \leq 1/2$  and  $P_x = (2 \times x - 1) \times t$ , when  $x \geq 1/2$  (3)

The uniform price, by solving best responses, would be equal to transportation parameter  $t$ . When comparing prices with discrimination, all customers are at least as well off under discrimination as they are under uniform pricing (customers at  $x=0$  and  $1$  are indifferent).



*Figure 1: Price paths under discrimination and uniform pricing.*

Figure 1 shows the price paths when we have discrimination and uniform pricing. On the vertical axis the graph shows the distance of each customer to the substitute. This is regarded as the measure of horizontal differentiation between the firms. Horizontal axis depicts the uniform distribution of customers on the Hotelling line, while the lines represent the optimal pricing from equation 3. The graph thus, captures the negative effect of personalized pricing. Both firms will get  $1/2$  profits per period under uniform pricing and only  $1/4$  if they target prices based on distance. The result is efficient because all the customers purchase from their nearest firm. However, because the competition is intensified, the surplus will shift from the suppliers to the customers.

Discrimination is a dominant strategy for both firms. We have a classic prisoner's dilemma that cannot be solved without cooperation. In this model, the firms have symmetric horizontal information. This changes the way that firms react, because of the competition on each customer and on the whole market. This results in intensified competition and in prisoner's dilemma.

## BRAND PREFERENCE

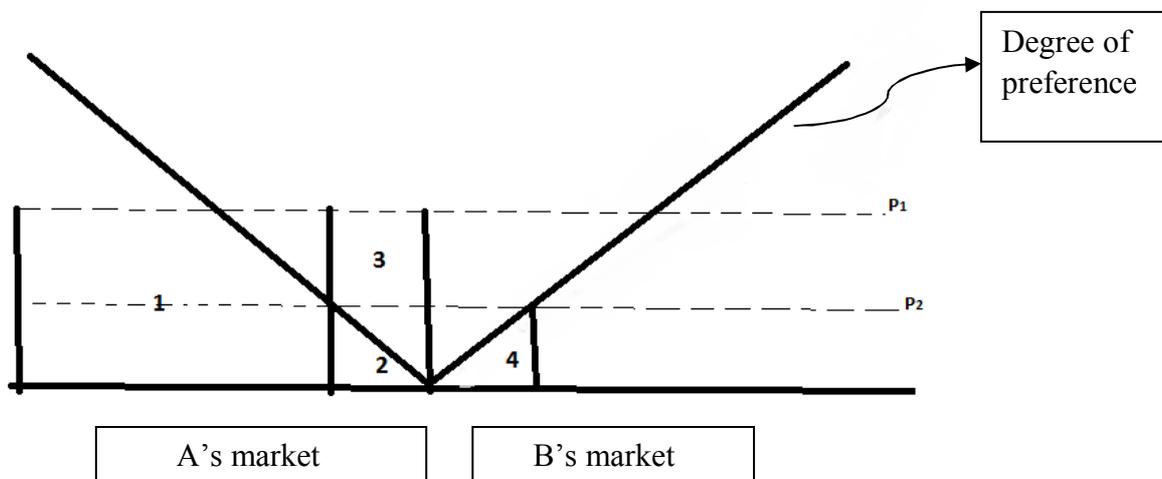
In this section, we will examine how imperfect information about customer preferences affects market outcomes. Now firms discriminate on segment- basis and not individually.

In the first period, we don't know anything about customers so, we use uniform prices. In this period we learn what's happening, and in the second period we use this information. In this part we will examine a two- period duopoly model with continuous preferences by Fudenberg and Tirole (2000) and then Chen and Zhang's model (2009) with discrete types.

### Continuous preferences

Based on the model of Fudenberg and Tirole (2000), we have firms A and B with the same costs which are located on the Hotelling line. Customers are uniformly distributed, similar to Thisse and Vives (1988). There is unit consumption per period which means that every customer buys only from one firm each time. The average customer is indifferent. We denote preferences with  $\theta$  so we have  $\theta_A$  for those who prefer firm B and assumed constant over time, while the firm's pricing is assumed to be below reservation prices to ensure unit demand in each period.  $\Theta$  has the same meaning as distance in the model of Thisse and Vives but unlike them, firms cannot see  $\theta$  explicitly. The only thing that firms learn is whether the customers prefer the firm or not, but not how strong the preference is.

In the following figure, we see what happens under symmetric information about brand preferences. In the first period, uniform price is set equal to the second period's price to its own customers, whereas, in Fudenberg and Tirole's model the firms have to lower their prices in order to gain more customers.



*Figure 2: Distribution of profits between firm A and B in the first and in the second period.*

In the first period, we set uniform price  $P_1$  to all customers. After a purchase is done in the first period, the firms learn the customer's brand preferences. Those customers who buy from firm A have  $\theta$  close to  $\theta_A$  and those who buy from firm B have  $\theta$  close to  $\theta_B$ . In this case, firms don't observe the lines showing the degree of preference, they only observe where the customers are located in the Hotelling line. The firms know now who the customers are and who buy from the rival's firm so the optimal strategy is to lower the price in the second period only for them, in order to get these customers and have poaching firms.

As a result, in the second period we have  $P_1$  for their own customers and  $P_2$  for the rival's customers. Areas 1, 2, 3 are firm A's profits in the first period from setting price  $P_1$ , and owning half of the market. In the second period A keeps  $P_1$  for its own customers and also sets  $P_2$  to the rival's customers thus winning area 4 from firm B. But as firms A and B are identical, B will set  $P_2$  too, and will gain area 2 from firm A. Firm A can only keep customers who in the first period have preferences above  $P_2$  and gains area 1 from them. So, A gains in the second period area 1 and 4 and loses area 2.

Customers who switch from A to B and vice versa get the goods at a lower price. However, not all of area 3 is shifted to the consumers since part of it is lost

because of inefficient switching. To show the welfare loss, let's consider the marginal switcher. The last person is indifferent between firm A and B or in other words is staying at a higher price and switching for a lower price. That customer gets the same utility from these two actions, but the firm with the poaching price makes smaller profits.

According to Fudenberg and Tirole there are also some other interesting outcomes. To begin with, prices are higher than prices under uniform pricing. Secondly, the price in the second period is lower than the uniform price would be. A high price difference between firm A's price for its customers and B's poaching price for the same customers, would make customers switch. It is in the firm's best interest to minimize this difference by lowering the price that is charged to its own customers. Fudenberg and Tirole find that the best price for its own customers in the second period is  $2/3$  and the best poaching price is  $1/3$ . That makes  $1/3$  of the customers to switch.

The meaning of higher prices in the first period is a little bit complicated. According to Fudenberg and Tirole, customers who are far-sighted, can see in the first period that the rival firm will set a lower poaching price in the second period. This is very crucial for the first period prices. The marginal customer is indifferent between buying from A now at  $P_1$  or buying from B tomorrow at  $P_2$ . For this reason, the marginal consumer is less price sensitive in the first period. Armstrong (2006) finds that higher difference between the first period price and the poaching price in second period, forces customers to switch. Since switching is beneficial for customers, they prefer large difference prices in the first period.

On the other hand, Villas-Boas (1999) shows that the prices of the first period are higher because of firms and not because of customers. The bigger the market share is in the first period, the smaller the poaching market in the second period is, and as a result poaching profits are smaller. The more the firm wants poaching profits, the less it cares about market share in the first period. When firms are competing less intensively, prices are higher in the first period than prices under uniform pricing. In both cases, the lower prices for switching customers in the second period increase the total consumer surplus comparing to uniform pricing.

In general, Fudenberg and Tirole result that behavior-based price discrimination is not a method that firms want, because in the second period, switching is inefficient due to poaching causes. BBPD creates a welfare loss. The negative effect is created because of poaching. Firms worsen off, because they have a motive to lower prices for the rival's customers and not because of segmentation of customers. Best response asymmetry generates poaching, which is a harmful situation, not a discrimination as such. Moreover, because of symmetric demands, both firms have similar customers and poaching is profitable for both of them. Lower prices in all markets, is what results in worse outcomes in the fully symmetric models. With symmetric information, the rival can optimize its poaching price which in turn, forces the incumbent to set lower price on its own customer too, to face poaching. Extraction and poaching profits decrease under symmetric information.

### Discrete preferences

We will use Chen and Zhang's model (2009) to face the problem of discrete preferences. Let's assume there are three types of customers contrary to the case of uniform distribution: loyal customers to firm A, loyal customers to firm B and indifferent customers. In this case we have symmetric demand as in previous models, and firms A and B are assumed to have equal amount of loyal customers.

Chen and Zhang support that it is crucial that the firms gain additional information about customer types. To find out which customers are loyal and who are indifferent, the firms will set high prices in the first period to ensure who are the loyal ones. Also if the indifferent customers were to buy from a firm, no information with which to discriminate against would be gained about the market. This drives both firms to set prices higher than the uniform price in the first period. The reduced price competition makes both firms better off while consumer surplus is reduced. It is observed that the first period conclusion is in agreement with the models of symmetric preferences by Villas- Boas (1999) and Fudenberg and Tirole.

However, even if Villas- Boas and Fudenberg and Tirole explicitly conclude that behavior-based price discrimination harms firms because of poaching in the second period, Chen and Zhang result is the opposite. The Zhang and Chen's model assumes that a loyal segment is fully locked-in, which makes sure that the next period's profits will be higher than profits from uniform pricing. The poaching market



is diminished because only one part of the market can be poached, whereas in the models examined before all parts of the market could be poached. Because poaching worsens off firms, any actions that reduce poaching, benefit the firm. The extraction profits are higher than in the previous models because of profitable discrimination. However, Chen and Zhang's model makes it necessary to find out whether high switching costs lead to similar outcomes.

## SWITCHING COST

There are models in which discrimination is based on customer characteristics such as location or brand preference. However, there are also those who are based on switching costs. In switching cost literature, the customers are indifferent between firms and transportation cost takes place in the second period as switching cost.

Switching costs are in general costs created because of a change in supplier. For example there are psychological costs (e.g. search or learning costs), monetary costs (e.g. exit fees) or costs of losing benefits (e.g. loyalty discounts). Switching cost measures customer's brand preferences because it shows the resistance to poaching. For this reason, switching cost has a similar effect on a firm's best choices on brand preferences. However, switching costs create different price dynamics.

Chen (1997) studied the impact of switching costs in behavior based pricing. The model is basically the same with the model of Fudenberg and Tirole (2000) with the exception of customers being indifferent between firms in the first period. However, in the second period, customers are not indifferent because of switching costs. In the case of brand preference, the customer doesn't have costs due to switching. It is assumed that customers have higher and lower costs of switching but firms know only the switching cost or, in other words, switching costs are uniformly distributed.

In the first period customers buy from the firm with the lowest price. When we have symmetric firms, both of them set equal prices. After that, customers change firms only if the price of the rival firm is lower than the incumbent's price plus the switching cost.



When a firm recognizes its customers in the second period, it knows that these customers tolerate larger price differences due to switching cost. On the other hand, the rival firm knows that in order to gain the other firm's customers, it has to diminish the switching cost. Here, incumbent's own customers are charged a higher price than the rival's customers. Under uniform pricing, switching costs results in second period prices being higher than the first period prices to all customers. So, a market with switching costs faces the problem of best response asymmetry as the model of brand preferences.

Chen shows that there are exogenous switching costs that make the firm compete intensively in the first period. Because larger customer base in the first period shows the existence of more locked-in customers, the prices drop lower from the marginal cost according to Chen's model. Moreover, in this case, the customer's far-sightedness is irrelevant, what is important here for the pricing, is that the customer's lock-in price will be similar to the case of myopic customers. So, in the case of switching cost, prices are higher over time. However, the outcome is still the same; the ability to recognize customers makes the firm worsen off.

To solve the problem of rival's poaching, it would be ideal to lock-in customers in the second period. This would exist with high switching cost in order to deter switching. To achieve this, the firm could offer long-term contracts according to Fudenberg and Tirole (2000). However, Fudenberg and Tirole support the idea that you can never offer long-term contracts only because firms foresee great extraction profits, when they force both the low and the high switching cost customer to the same contract type. So, a fraction on the market buys only short-term contract and poaching occurs in the second period. Offering long and short-term contracts is similar to discrete preferences of Chen's and Zhang's model (2000). Even though both models incorporate captive customers and switchers in the second period, the model differs in the first period dynamics.

In Chen and Zhang's model, there are high first period prices because of screening. On the other hand, in Fudenberg and Tirole's model, customers are not inherently loyal. Moreover, the outcomes differ both in the brand preference and the switching cost model. In the brand preference model, the price in the first period is higher, while in the switching cost model, the price is lower than the uniform price.

Because the second period is the same in these two models, differences in the first period will determine the total profitability.

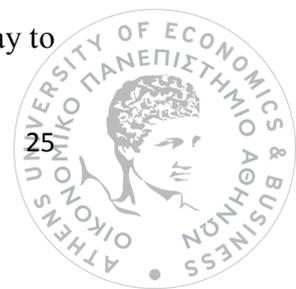
There is also another difference in the information context. In Chen and Zhang's model it is assumed that firms know the brand preference and its degree that is how loyal the customers are. By setting high prices, firms want to find customers who are closest to them. However, according to the outcome of Thisse and Vives (1988), firms won't be better off even with more information. While in Thisse and Vives's model all customers are assumed to be switchers, in Chen and Zhang's model, only one group of the market is willing to switch. When a group of customers is captive without this imposing a cost to the firms, behavior-based price discrimination can be profitable. When more complex information about the customer is collected, the interaction between the customer and the firm grows. In the following part, we will use less restrictive assumptions about symmetry and enlarge the information that firms can find. We will use homogenous, non-durable goods. We will start by discussing asymmetric demand, keeping at the same time symmetric information between the firms.

## ***2.2 BBPD UNDER ASYMMETRIC DEMAND***

In the models of asymmetric demand loyalty, varies among customers and firms are different. In other words, some people are pickier than others or some customers prefer A than B. Typically, firms differ and for this reason asymmetric demand is a realistic assumption. According to Armstrong (2006), firms could beneficially discriminate, based on loyalty. In this part of the thesis we will examine whether firms with different demands could beneficially practice behavior-based price discrimination.

### **ASYMMETRIC LOYALTY**

Shaffer and Zhang (2000) assume asymmetric demand that originates from different customer loyalties. They show that it is optimal to give discounts to one's customers instead of the rival's customers. To understand why it is optimal to 'pay to

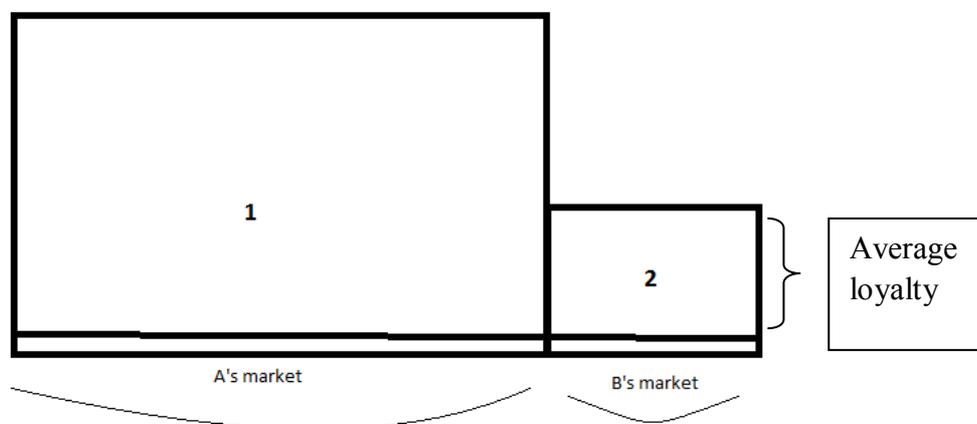


stay' or to 'pay to switch', they assume that the market is unequally distributed between the firms. In this case, they don't have information collection periods and our model is static. The interest is in the customer's loyalty. We denote loyalty with an  $l$  and

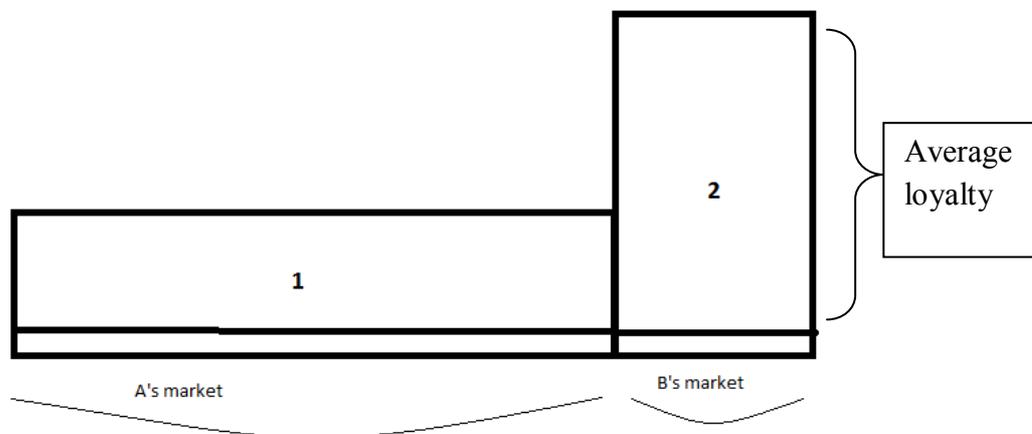
$l_A$  = average loyalty of market's A customers and  
 $l_B$  = average loyalty of market's B customers.

Pricing decisions are affected by differences in loyalty because they represent differentiated switching costs for the customer segments. In Thisse and Vives model, the segments have different transportation parameters (here we have loyalty) and customers are not uniformly distributed.

Shaffer and Zhang find that under certain loyalty profiles, firms avoid intensified competition. The result is that firms should set a low price to the customer segment with the highest cross-elasticity for the firm's product. In other words, if the rival's customers have higher price elasticity, the firm should pay to switch. On the other hand, if their own customers have higher price elasticity, the incumbent should pay to stay. So, both firms will poach when the difference between loyalties is low when we have symmetric demand. When the incumbent's own customers are more elastic for one firm and not for the other, the first pays to stay while the other tries to poach the rival.



*Figure 3(a): 'Pay to stay' graph in both firms.*



*Figure 3(b): 'Pay to stay' and 'pay to switch' graph.*

The boxes show how high is the average loyalty of each firm's customers.

In figure 3(a), firm A has larger market share and highly loyal customers. In this case, B has to compete intensively in order to gain poaching profits. This makes firm A to want to compete intensively too by lowering the price to its own customers. Additionally, A wants to gain poaching profits from B's market because B's customers have low loyalty. Here, we have a 'pay to stay' strategy. Figure 3 (a) shows the asymmetric best response as we found it in models with symmetric demands.

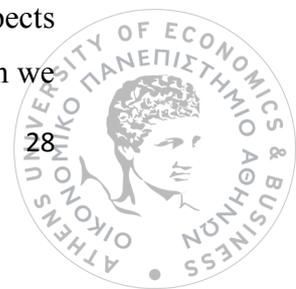
In figure 3 (b) we see that firm B has loyal customers. This firm knows that its rival firm A hasn't got loyal customers and want to gain poaching profits from these customers. Firm A competes aggressively in order to protect her market share. In this case, A follows the 'pay to stay' strategy to keep its customers, which makes prices go down. However, firm B can increase the price on its own market and also gain poaching profits from A's market because of behavior-based price discrimination. So, A has to lower its price in both markets. In this case, A pays to stay and B pays to switch. Shaffer and Zhang show that under BBPD there can be such loyalty that both firms can benefit. When B's customers are more loyal than A's, B wants to exploit its customers preferences and not lower the price for them.

Shin and Sudhir (2010) examine the option ‘pay to stay’ or ‘pay to switch’. In this case, firms have different strategies due to the assumed preference. They show that if there are no strong fixed preferences, then we can have profitable behavior-based price discrimination. If we had random preferences, that would have rendered customer data useless. However, fixed preferences made poaching aggressive in the previous models. When we have customers with constant preferences, firms have to put a low price in the beginning in order to make customers switch. Shin and Sudhir also added a stochastic shock term to consumers’ preferences. When the shock term is small, only inframarginal consumers’ preferences change. If the stochastic shock term is bigger, preferences change for a bigger group of customers. According to Shin and Sudhir, a firm pays to switch in cases when we have low preference stochasticity. However, firms follow the ‘pay to stay’ strategy when customers change preferences in different periods. When customers are beginning to prefer the rival, the incumbent firm keeps its customers because of the low price even though they don’t really prefer the firm. High stochasticity may mean a firm’s probability to have less loyal customers. If customers are not loyal, the incumbent give discounts to its customers whereas, when customers are loyal, the incumbent wants to poach the rival. The result of Shin and Sudhir’s article is that a firm’s motive to set low prices declines when stochasticity increases. Because a group of customers will switch in the second period, both the incumbent and the rival firm will reduce poaching. When customers think of switching firm in the next period, the firm will lower its prices in the first period. Under certain values of preference stochasticity, profits can increase under behavior-based price discrimination.

In general, when a small group of customers is the most loyal to a firm, it is this group that will lose the most if we compare it with uniform pricing. The biggest group of customers, (who are the least loyal), is better off, but this can also worse off if the loyalty discrepancy is very large.

### **ASYMMETRIC FIRMS**

Even though Shaffer and Zhang (2000) helped us understand a firm’s strategies under behavior-based price discrimination, the model may include aspects as those with switching costs because competition is not taken into account. When we



have dynamic models, the decision we take in the first period is affected by the outcome of the second period. In BBPD models with switching costs, firms understand that the outcome of the second period depends on the market share of the first period. In other words, the firms differ in specific characteristics that make the customers prefer one firm over the other. This asymmetry in a firm's characteristics highly affects the outcomes.

For this reason, in this part we will examine dynamic models with asymmetric firms. According to Pazgal and Soberman (2008), it is assumed that the rival firm has the advantage of adding benefits to customers in the second period. Because these benefits will be lost if customers switch in the second period, so this means that one of the firms has high switching costs. Thus, the firms are not similar. Pazgal and Soberman show that a high difference between switching costs would force the weaker firm to abandon price discrimination. In this case, the firm that uses the price discrimination, gains from it. Behavior-based price discrimination is beneficial for the firm that can implement it.

Moreover, Chen (2008) support that difference in a firm's marginal costs makes discrimination beneficial. The common thing between Chen and Pazgal and Soberman is that only one firm can discriminate. However, Chen says that what is important here is the ability to make predatory pricing. The stronger firm can exclude the weaker by setting prices lower than the marginal cost. The important thing in Chen, Pazgal and Soberman's models is that the firms are identical. Another important aspect in Chen's paper is that discrimination is beneficial because at the end, the firm that discriminates becomes a monopoly. Both Villas-Boas (2004) and Acquisti and Varian (2005), find that monopoly is worsen off by recognizing customers, if we compare it with uniform pricing. They find that strategic behavior of customers create a similar problem to the problem we find in durable-goods monopoly. This means that the monopoly has to lower its price if it wants more profits or a wider market. This motivates customers to unite for the next period in order for the prices to lower. Customers won't reveal their preferences in the first period because otherwise, in the future, the firms will discriminate and they will worse off. The monopoly faces the disadvantage of customers delaying their purchases to find lower prices in the next period.

Acquisti and Varian (2005) conclude that price discrimination is beneficial for monopoly only when customers have different preferences. Despite the fact that in models where we have duopoly, preferences differ between the firms, in monopoly cases they must differ on services offered to recur customers. Or, to put it in another way, monopoly is profitable if customers appreciate some services more than others and the value of the services depends on information that the firm share in the first period. The monopoly can attract customers by finding their identities.

In general, dynamic cases result in profitability while Shaffer and Zhang (with their static case) argue that incumbent and rival firms benefit from behavior-based price discrimination. For this reason it would be useful to know whether or not the latter outcome derives from excluding the first period effects.

### ***2.3 BBPD UNDER ASYMMETRIC INFORMATION***

Behavior-based price discrimination can be harmful when we have full asymmetry even though it is the best choice for all the firms. Discrimination can be beneficial when we have asymmetric demand. However, we have to examine if changing the other part of the symmetry has similar effects. In this part we will see what happens when we have asymmetric information, which means that firms can have private information. We can have information asymmetry because of two reasons: firstly, the firm cannot gather information because of incomplete addressability, according to Esteves (2009) or secondly the firms can have information concerning their own customers invisible to the rival. In the first case asymmetry is endogenously created, whereas in the latter case customer characteristics result in asymmetry.

Most papers consider BBPD a profitable method because of asymmetric demand or lock-in. The discriminating firms benefit by categorizing own customers to highly valuable and low valuable. According to Shy and Stenbacka (2011), information asymmetry is crucial when we have no captive customers. If one firm has symmetric information about customers' loyalties, then the rival firm had better focus on poaching offers. So, in general, it's the information asymmetry that can result in

profitable discrimination, even in the situation of previous discrimination being harmful.

### ENDOGENOUS ASYMMETRY

Because behavior based pricing is beneficial only when firms can practice it, firms have a motive to create asymmetry information. This is crucial when the rival's and their own firm serve the total market in the first period or when one of the firms cannot see the poaching market and separate it from its customers because of limited addressability.

We will now look into behavior-based price discrimination and the limited addressability according to Esteeves (2009). She considers marketing as a way to inform customers about prices. When there is no advertisement, customers cannot see the prices of the firms and can be more captive. The other customers that use advertisements from the firms can become potential switchers. In this model, prices only can affect a customer's decision. This makes marketing crucial for the firms. The firm that uses advertisements (showing its lowest price) gains all customers. The rest of the customers are those who haven't received advertisements and therefore are purchasing in a higher price from the rival firm. So, the high price firm can segment its own customers and the poaching market, whereas, the low price firm can only see its own customers. This results in information asymmetry.

Moreover, the firms have to choose the extent of their marketing activities. If the firms send advertisements to all customers, this results in a prisoner's dilemma problem. For this reason, own and rival firms maximize marketing coverage in order not to intensify competition for the shared customers. Both firms want a large poaching market and a large extraction market. According to Villas-Boas (1999), when we have a firm with a large market share, it is less aggressive in its poaching market. This, in general, says that neither firm wants the entire market because this intensifies the competition as it does with larger poaching market according to Villas-Boas.

Behavior based pricing increases prices in the first period and decreases competition in the second period. For this reason both firms benefit. The reduction in competition results in poaching profits for the high price firm, and increasing uniform

prices to a larger market for the low price firm. The larger the marketing coverage is, the larger the competition and the switching in the second period is.

Even though we have endogenous information asymmetry, Esteeves' model has some common characteristics with the model of Chen and Zhang (2009) with symmetric information. In both models, what makes the discrimination profitable is screening. Additionally, a part of the market is captive and this results in reduction in poaching. This shows that profitability of behavior-based price discrimination in Esteeves model may derive from screening and captivity, not only from information asymmetry. In the next part, we will examine models in which customers are potential switchers and information asymmetry is exogenous and not endogenous.

## EXOGENOUS ASYMMETRY

Perfect information about loyalty and brand preferences, results in a prisoner's dilemma problem. In this part we will examine the situation where firms have private information about loyalty and symmetric information between firms and brand preferences.

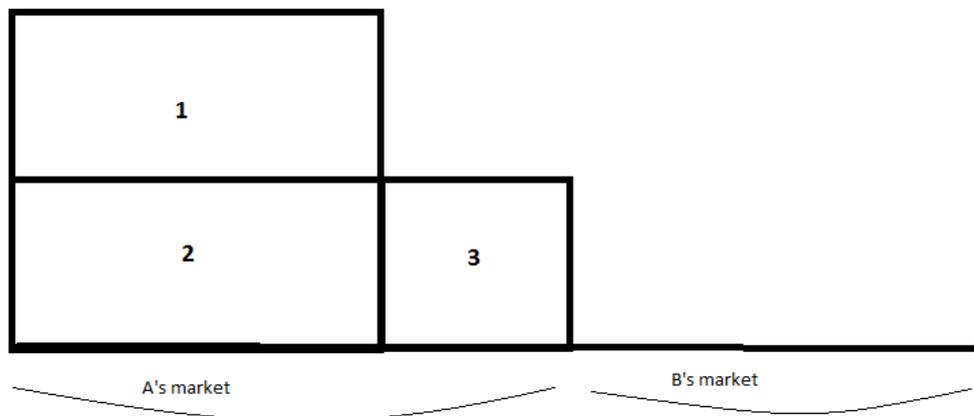
We will use the model of Shin and Sudhir (2010) that examine the result of asymmetric horizontal information. They assume fixed preferences but they also introduce preference stochasticity. However, their model is different from the typical BBPD in a particular aspect. They assume that customers differ in terms of both horizontal and vertical preferences with respect to quantity demand. We have four types of customers; high demand customers that prefer A, high demand customers that prefer B, low demand customers for A and low demand customers for B. We have uniformly distributed horizontal preference so that demands are symmetric. So, benefits from BBPD are not due to large differences in demands as we saw previously.

Information concerning quantity is completely different from information concerning loyalty. High demand customers are not resistant to the rival firm as in the case of low demand customers. As we said before, duopolies cannot use discrimination method based on vertical information. In order to do so, firms have to offer discounts to make high demand customers switch. By using this method, high

demand customers are very resistant and become loyal whereas low demand customers are indifferent. When a firm offers discounts, it makes the rivals stay away from the incumbent's profitable customers. The 'pay to stay' method can derive from the need of an horizontal differentiation to exist between the two firms. So, in this case, the ability to discriminate is created due to loyalty discounts.

Differences in the demand quantities and in the loyalty discounts create a problem for the poaching firm. When customers with low demand are more likely to be poached, the rival faces a problem. According to Shin and Sudhir, the least valuable customers are, the more likely they are to switch. Fudenberg and Tirole (2000) show that poaching may not be lucrative in multiple period models because customers who switch are more likely to switch again in the following period. For this reason, the best customers, or in other words the loyal customers, stay indifferent to poaching, and only the least valuable customers switch.

The problem the firm faces is called 'lemons' problem'. The lemons' characteristic is what determines the result in Shin and Sudhir's model. When there is large difference between high and low demand customers, the rival has to poach low demand customers. So, the rival becomes less aggressive concerning his poaching method and this enables the incumbent and the rival firm to have higher price for the low demand customers. Both firms make profits when there is reduced competition in one segment and increasing extraction profits in other segments.



*Figure 4: Distribution of profits between firm A and Firm B.*

The height of the boxes shows the switching cost of customers. A can't see B's customers and the only thing that he knows is their brand preferences (for example half customers buy from the rival under uniform distribution). A is more informed about its own customers than in the models of pure brand preference information. B cannot disintegrate A's market to parts, but the only thing that could be done is set a price there. However, in the first period firm A can set two prices depending on demand quantities. This makes A gain extraction profits. It takes area 3 from the high demand part except for 1 and 2 that it already has.

In this case, the rival cannot set poaching prices which will reduce the size of poaching market contrary to Thisse and Vives model. Then firm B is more likely to gain the low demand types and will not drop the price. Firm A reacts in the same way as B. So, both firms are setting higher prices in low demand types without competing in them. The firms should set lower prices to their high demand types, in order to create sufficient switching costs. For this reason, Shin and Sudhir restrict the high-types' demand to be sufficiently large to make sure that they are always more valuable than low-types. The difference in demand quantities has to be big to make switching costs worth. Moreover, there must be a large group of high-demand customers in order to have profitable discrimination.

On the other hand, Shy and Stenbacka (2011) reach the opposite conclusion. They examine the case of firms learning about their customers' loyalties in order to find out if they purchase from the rival or not. In this case, loyalty is exogenous. Additionally, Shy and Stenbacka's model is static contrary to Shin and Sudhir's model (2010). According to Shy and Stenbacka, asymmetric information concerning loyalties is better than symmetric information. This happens because of what Thisse and Vives find harmful in perfect discrimination. Under symmetric information, there is no additional benefit because both firms want to gain customers by setting low prices. Moreover, perfect information makes firms worsen off because the rival firm learns about poaching prices too. Under asymmetric segment recognition, firms can increase extraction profits without the danger of competition. So, it is never the optimal option for the firm to share information under best response asymmetry. What is more, Shy and Stenbacka show that uniform pricing is the best option, and behavior-based price discrimination worsens off the firms. They also show the contrasting results without offering a clue on where the difference comes from.

While dynamic models assume uniform pricing in the first period and efficient allocation of customers, Shy and Stenbacka's model assume inefficient allocation. That means that they assume that customers are mismatched. This can have a consequence in efficient allocation if there are no constant preferences, firms have random pricing (as in Esteeves 1010), or we have incomplete addressability (Esteeves 2009). The assumption of a mismatch creates additional costs to this model, contrary to the other models. It would be interesting to examine the model without the customer's mismatch in order to see the effect on the outcome. This affects the probability of switching, so mismatch loss affects poaching prices and for this reason profitability of behavior-based price discrimination as well.

In general, the models offer encouraging but divergent outcomes and require reinforcement. Endogeneity of asymmetry isn't as important as outcomes obtained from symmetric information, but endogenous switching costs are important. Shin and Sudhir (2010) create a model that includes how loyalty is created.

## ***2.4 CONSTRAINTS ON DISCRIMINATION***

In the previous parts we have discussed a firm's incentive to discriminate. However, there are some aspects that affect the firm's ability to discriminate. The most important constraint for discrimination is the second-hand markets. A problem faced by a firm when it discriminates on prices, is that if there is a second-hand market for the goods, there will also be arbitrage. Customers can purchase the good at a low price and then sell it for a higher price in the second-hand market, thus gaining profits.

However, behavior-based price discrimination offers protection against second-hand markets. When the firm collects data about customers' purchases, it can use the information to ensure that the same customer uses the product (according to Odlyzco 2003). For example, management pricing of airlines depends on the ability to make the customer identify himself at the time of purchase thus destroying all second-hand markets. In other examples, customers' recognition may not be as complete as in the previous example, but the identification restricts the existence of second-hand markets. In general, firms who want to discriminate based on customer behavior, need the information to see customers' willingness not only to pay but also to restrict second-hand markets.

However, there are some constraints in behavior-based price discrimination. Firstly, we have the customers' ability to anonymize himself. This leads price discrimination to becoming less profitable because of arbitrage as with second-hand markets. We face anonymization in online environments. Customers can delete IP-addresses and cookies in order not to be recognized by firms. Secondly, a customer's moral objection to being discriminated against may be so important that could deter firms from discriminating. Amazon's experiment on customer-based pricing of DVD's is an example of that. Customers' outrage forced firms to refund them and withdraw the experiment. Next, we are going to analyze two constraints of behavior-based price discrimination: fairness and anonymization.

## FAIRNESS

Assuming that customers are far-sighted, they will recognize that they can be charged different prices due to their present purchases. Firstly, fairness is a very important constraint. According to Kahneman et al (1986) some customers evaluate fairness in trade by benchmarking the features against some reference transaction. In other words, people compare transaction against some benchmark from their own or their friends' experiences. According to Haws and Bearden's experiments (2006), pricing is unfair for people when the price differs from customer to customer or when the price changes in a particular period even though the conditions of trade are the same. Kahneman et al also confirm this inclination. Moreover, it is proved that customers are willing to pay the cost in order to punish unfair behavior.

Additionally, the firms may regard the public outrage as a way to avoid harmful discrimination. Odlyzco (2003) present the US railway case as an example of customers and firms agreement to ban price discrimination. In the beginning of the last century, US railway price discrimination was banned due to public objection to unfair pricing practices. In the same way, firms that face the prisoner's dilemma problem (because of customer's recognition) might wish the government banned discrimination. As a result, a universal ban ameliorates all firms.

In general, not only the people find behavior-based price discrimination unfair, but they also want to punish this unfair behavior even if this is costly for them. However, even if something is unfair now, it may be fair tomorrow. This happens because benchmark transaction changes day by day and what seemed previously unjust, later it could be considered as common practice and fair as well.

## ANONYMIZATION

Another important constraint for behavior-based price discrimination is anonymization. Anonymization is about customer's willingness and ability to hide their identities. When they cannot hide their identities, they may be forced to share private information. Privacy is something very important as it may includes for example moral hazard of firms due to their under-protected databases against hacking.



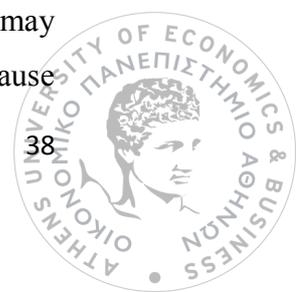
In this part we will examine aspects of anonymization and privacy, related to behavior-based price discrimination.

Anonymization is very important especially in electronic environments where firms are able to recognize customers without their approval. For example there are many programs used by online stores that find the items each customer sees. Or, nowadays it is very easy to see what website the customer visits the most, by using Google search results. Firms are also able to find customers by cookies that are added on the web-browsers of customers. All these are important information for the firms. When a customer visits a store, this means that he might be less sensitive concerning prices than a customer that googled the product. Moreover, the sites that a customer visits indicate what he is interested in or how loyal he is depending on the frequency of the visits he makes.

However, recognition is not confined in an online environment. ‘Offline’ recognition using loyalty cards or ID-cards is a common practice. Anonymization is the only difference. Having a loyalty card on the wallet is less sophisticated than removing cookies from web-browsers. Since data collection is invisible to customers online, anonymization is easier offline than online.

According to Acquisti and Varian (2005), monopoly always makes anonymization more difficult for customers. When a customer pretends to be new, monopoly can lower the price to those who haven’t purchased anything in the previous period without having to lower the price for everyone. According to Esteeves (2009) some captive customers of the high price firm may wish not to purchase in the first period to appear as if they bought from the rival. In the same way, customers could buy from the less preferred firm in the first period, to make the preferred firm believe they are low-valuation customers.

Acquisti (2004) supports the idea that a huge problem is created by a firm’s willingness to offer technologies that support to customers that worry about their identities’ anonymization because they will refrain from purchasing if they are not offered the technologies that help them hide their identities. In spite of the fact that on the one hand firms have a motive to restrict anonymization, on the other hand there is a growing need to offer mechanisms for anonymization. For example, Amazon may let customers decide whether they want to provide their private information because



they fear losing sales. Taylor (2004) says that customers with a strategy have a motive to misinform firms when they think that firms exchange data about them. For example, customers can make firms think that they are low-valuation types by postponing purchases. This harms both the data that the firm collects through lost sales and the validity of the data collected.

Under best response symmetry, firms gain from information exchange according to Armstrong (2005). When customers cannot anonymize, they help firms share information profitably. An example would be from the banking sector, where banks set higher prices for high risk customers and vice versa. In other words, there is best response symmetry. Moreover, customers have to identify themselves when they enter a bank, eliminating anonymization in this way. It is also profitable for the banks to share information. So, only in the case of best response symmetry and myopic customers, can firms gain from sharing customer data. In cases where coordination removes selection problems, anonymization may be harmful.

In general, anonymization may have advantages and disadvantages for the firms. On the one hand, anonymization can deter discrimination or make it more difficult for the firms, but on the other hand it can result in losing sales. Moreover, whether the information exchange is desirable or not depends on the effects on the consumer's welfare.

### **Chapter 3: Consumer Biases**

In this last chapter of the thesis we will see how a consumer's choice can be diverged from rational behavior. It seems that there are three aspects that are influenced by biases:

Willingness to pay: in this category, consumers may be willing to pay more for a specific quantity of a good.

Search: consumers may not buy the cheapest product because they haven't examined rationally the other products' prices.



Quantity: in this case, consumers may buy goods that don't fill their needs or haven't got the best quality.

We can subcategorize these three aspects in order to analyze the biases more. For each of the three aspects we will present two subcategories of choice bias, which means we will have six categories in total:

### ***Willingness to pay and reference point effects***

The consumer can be affected by his evaluation of the good which may depend on past experiences or expectations. As a result these points can affect his willingness to pay. The loss aversion can make the reference points important. For example, if a customer tries a product with a specific beautiful color, his willingness to pay for this product in another color is less, because he has found the perfect color for him. Another example is when we have a consumer with reference price of 5 Euros. If he finds the product at six Euros, he won't buy it, but if he finds it at 4 Euros, he will.

### **Willingness to pay and the misperception of future desired quantities**

Consumers may be willing to pay more for a specific product or service if they misperceive their future demand. For example, when they go to the supermarket, they buy more food if they are hungry. Or another example is when someone thinks that he will go to the gym more often than he really does, he will pay more. However, there are cases where consumers under-predict their need to buy, for example they use credit cards to purchase things that they cannot afford in reality.

### **Search and inertia**

In this case, consumers may not search enough because of high search costs, which can be caused by different sources. For example, consumers may purchase from a specific supplier even when the same products are available by different suppliers. Another reason could be unwillingness to cross crowded streets to search for goods with a lower price. In these cases high search cost is a matter of reference.

## Search and misjudgment of prices

In this case of search bias, consumers do search but they might misjudge prices due to complex pricing or to the seller's complex presentation.

## Quality and misperception of desired product attributes

In this case, consumers may not know what product fulfills their needs, so they think that specific characteristics of the product are more important to them, so they misperceive horizontal quality differences between products.

## Quality and misjudgment of vertical quality

In this case, where the same products have a different quality, consumers may misjudge the quality of a good and finally purchase a good with poor quality.

<b>QUALITY BIASES</b>
- Misperception of desired attributes
- Misjudgment of quality
<b>WILLINGNESS TO PAY</b>
- Misperception of desired quantities
- Reference points and loss aversion
<b>SEARCH BIASES</b>
- Misjudgment of prices
- Inertia

*Table 1: Behavioral biases according to how they affect choice*

We can group these six categories based on their source. We have two groups: a) those that come from errors in decision making and b) those that occur because of preference. Biases that come from errors in decision making can be misjudgment of demand in future quantities, misperception of product characteristics, misjudgment of product quality and misjudgment of price. Biases that come from preference formation can be reference point effects, loss aversion and inertia.

<b>ERRORS IN DECISION MAKING</b>
- Misperception of desired attributes
- Misperception of desired quantities
- Misjudgment of quality
- Misjudgment of prices
<b>PREFERENCE FORMATION</b>
- Reference points and loss aversion
- Inertia

*Table 2: Behavioral biases grouped according to their source*

We can think the biases on the basis as being the source of a consumer's particular choice. Choice is very interesting to start from, however preferences and beliefs are observable. Additionally, findings concerning the sources of biases and remedies can be organized along the previous categories.

### **Types of behavioral biases**

In this chapter we will examine the six types of behavioral biases. Firstly, we will see the reference point effects. Then, we will examine the misperception of demand. Next we will examine inertia and misjudgment of prices and finally, we will see the misjudgment of quality required and the misperception of demand in particular product characteristics.

#### **3.1 WILLINGNESS TO PAY BIAS 1: REFERENCE POINT EFFECTS**

Let's assume that consumers don't have constant preferences. According to Kahneman and Tversky (2000), decision makers may estimate products based on specific reference points. The idea is the following; the status quo is compared to future outcomes. If the status quo changes, valuation will change too. Additionally, there is symmetry in the perception of gain and loss, loss is larger than gains, and this is called loss aversion. When consumers think about how much they are willing to pay, their decision is based on some reference effects. References might come from

expectations and past experiences. If consumers are loss averse in the price dimension, this means that it is harmful to move from a cheap good to an expensive one and this results in intensified competition. When consumers are loss averse in product dimension, it means that it is harmful to move from a product that fits their needs to a product that fits their needs less, and this softens the competition similarly to an increased product differentiation. So, loss aversion is like a magnifier of the product and the price differences.

Even if loss aversion changes the consumers' willingness to pay, we take as a fact that consumers estimate outcomes based on a reference point because it is something they prefer. These preferences may not be constant but they still are preferences. However, there are motives for the firm to alter consumers' willingness to pay. For example, we have a consumer who wants to buy a bottle of wine. There are two bottles on the shelf: one of a medium quality and price and one more expensive and of higher quality. In this case, the reference point effects show that the choice of the bottle depends on the preferences of the other bottles. If there also was another bottle of poor quality and of lower price on the shelf, this would make the consumer think which bottle to choose from. The third choice affects the consumer's reference point and downgrades the quality which is concerned as a loss, whereas upgrading the quality is concerned as gain. So, if the reference point is shifted upwards (by putting an expensive bottle on the shelf), the consumer would avert the loss. On the other hand, if the reference point is shifted downwards (by putting a poor quality bottle on the shelf), the consumer's willingness to pay would be smaller. This explains why there are very expensive goods in the supermarkets' shelves that nobody buys, since these expensive goods change the consumers' reference points.

Even though there are some models of risk aversion there are recent attempts to model competition among the firms in which there are loss averse consumers. These models make the same assumption about loss aversion even though they differ to some reference points. There are horizontally differentiated products and consumers can be loss averse concerning prices and products.

Heidhues and Koszegi (2008) compare the products that are found in the market to the expectations they had about the market. They assume that consumers have rational expectations about prices. If the good has a higher price or it is less

suitable to what the customer expected, he suffers a loss. In the study below, we will ignore the loss aversion effect. Moreover, in the literature concerning price competition and consumer loss aversion, the unit strength of loss aversion is exogenously given, but the firms' choice of prices will affect the distance between the reference point and the actual price thus influencing how much the consumers suffer from a loss.

They show that equilibrium is created when firms charge a uniform price even though the costs are different. This is caused due to loss aversion in price dimension. Let's assume that consumers expect a uniform price. Then increasing the price by an increment, will affect demand more than in the case of reducing the price by the same increment. This is caused because of the loss aversion we assumed before. Consumers react more to loss because of the increased price, than to gains because of the price reduction. This creates an outward twist in the demand curve with the twist located at the expected price, or, to put it differently, price stickiness is less when there is an increased number of firms.

Additionally, there is Karle's and Peitz's model (2009, 2010) that assumes expectation as a reference point too. However, they also assume that there are consumers with no loss aversion because they are fully informed. In addition, not fully informed customers firstly observe prices and then examine how well the product fits their needs. They show that Heidhues and Koszegi's outcome concerning price stickiness isn't immune to such changes but price differences increase the number of loss averse consumers. Moreover, they examine the possibility of the firm's motive to educate consumers, for example, by informing them through advertisements for the nature of the good. This could lead to avoiding of loss aversion. However, they show that only by informing consumers will prices get higher. The firms could have the incentive to 'de-bias' consumers through advertisements. In the end, Karle and Peitz prove that loss aversion in price makes competition stronger, whereas loss aversion in quality softens the competition.

Zhou (2008), also reaches the same conclusion. However, he assumes that reference points are created during the consumer's search process. He supports that the good a consumer identifies with firstly, is the reference point for the second good he finds. He pays attention to the duopoly case, in which he assumes the order in

which consumers search the two firms is a fact. The firm which is more prominent is the reference point for the consumers as they visit it first. Moreover, he also concludes that loss aversion amplifies competition in the price dimension and weakens competition in the quality dimension. Additionally, Zhou's model shows that consumer loss aversion can increase price dispersion. If the dominant firm charges a lower price than its rival, the consumer will consider this price as a reference point and loss aversion makes them more competitive to the other firm's high price, thus leading to an increase in the dominant firm's demand. So, the demand curve of the dominant firm is steeper when it has a lower price and has an inward twist to the rival's price. As a result, the dominant has a motive to randomize its price between a low and a high price. In this model, the pricing strategy of the firm can influence the consumer's reference point. On the contrary, according to Heidhues and Koszegi's model, the pricing strategy cannot affect the reference point. The rational expectation of the market is the reference point. So, on the one hand we have price dispersion but on the other hand we have price stickiness.

In general, according to the literature concerning competition under reference point effects, we see that the model's prediction is sensitive to the way reference points are created. Moreover, loss aversion in quality dimension softens the competition and this makes firms not have a motive to take measures in order to reduce loss aversion, such as advertisements concerning the good's characteristics. However, loss aversion in price dimension intensifies competition this benefits consumers because they have complete information about a product's characteristics. Finally, the more the number of firms increases, the more the consumers benefit.

### ***3.2 WILLINGNESS TO PAY BIAS 2: MISPERCEPTION OF DEMAND***

In this part, we will examine how the consumers' errors concerning demand, can destroy the market equilibrium. They can overestimate or underestimate the demand or mistake the quantity they need. In these cases, these mistakes can arise from psychological sources. In the following part we will examine basic mechanisms of misperception using two models. Then we will show policy-relevant implications.

We assume a simple model in which the monopolist uses linear pricing and the consumer overestimates the quantity he needs. Let's examine the following case.

### Case 1: A model where consumers overestimate future demand

Let's consider a simple market where consumers buy according to their perceived demand  $x^d = \lambda - p$  (with  $\lambda > 1$ ), whereas their actual demand at the time of consumption is  $x^c = 1 - p$ . Supposing there is a monopolist in this market who faces constant marginal costs of  $c$  and no fixed costs. Moreover, supposing that the monopolist can do better with two-part tariffs for expositional reasons, we will simplify our model and we use the linear pricing case.

We also assume that the consumer will be delivered of the demanded items. The assumption is very appealing in the case of services when additional units are not requested. But we should keep in mind that consumers might want to cancel part of the order if they find out that they don't need the entire quantity.

The monopolist sells  $\lambda - p$  units but produces  $1 - p$  units so that the profits' function is:

$$\Pi(p) = p \times (\lambda - p) - c \times (1 - p)$$

The first order condition of the profit maximization problem gives:

$$P^m = (\lambda + c) / 2$$

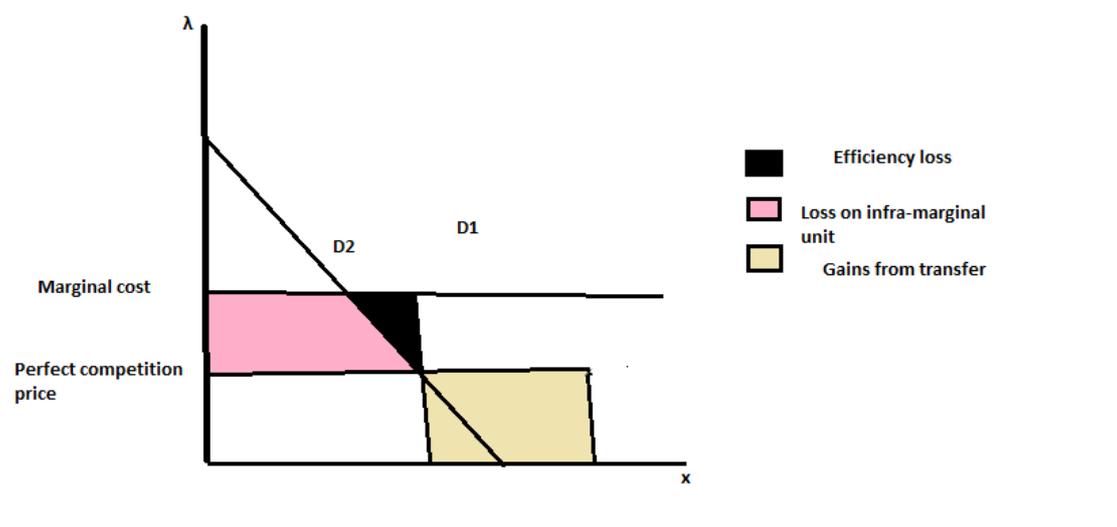
The price is increasing both in costs and in the degree of overestimation. Consumers will purchase the amount  $x^d = \frac{1}{2} \times (\lambda - c)$  but consume only  $x^c = \frac{1}{2} \times (2 - \lambda - c)$ . The price paid on the difference  $p^m \times (x^d - x^c) = \frac{1}{2} \times (\lambda + c) \times (\lambda - 1)$  is a pure transfer from consumers to the monopolist. The monopolist's profit is  $\frac{1}{4} \times (\lambda + c)^2 - c$ , the consumer rent is  $\frac{1}{8} \times (\lambda - c)^2 - \frac{1}{2} \times (\lambda^2 - 1)$ , and the dead weight loss increases by  $\frac{1}{8} \times (\lambda - c)^2$  which is increasing in  $\lambda$ .

Compared to the standard case in which consumers predict their demand correctly, we find that the monopolist makes an extra profit of  $\frac{1}{2} \times c \times (\lambda - 1) + \frac{1}{4} \times (\lambda^2 - 1)$ ,



the consumer's rent falls by  $c/4 \times (\lambda - 1) + 3/8 \times (\lambda^2 - 1)$ ; and the dead weight loss increases by  $1/8 \times (\lambda^2 - 1) - c/4 \times (\lambda - 1)$ .

Perfect competition cannot eliminate these inefficiencies. If the price was equal to the marginal cost, firms would still make a profit stemming from the pure transfer that consumers pay for unused units. This profit will only be competed away for prices below marginal cost so that the loss on the inframarginal units  $(c - p^*) \times (1 - p^*)$  equals the profit from the sold but never supplied units  $p^* (\lambda - 1)$ , which determines the perfect competition price  $p^* = 1/2 \times (\lambda + c - \sqrt{(\lambda + c)^2 - 4 \times c})$ . Now, there is an efficiency loss due to overproduction equal to  $1/2 \times (c - p^*)^2$ .



*Figure 5: Overestimated future demand scenario.*

The key in this case is the large quantity that the consumers order even though they don't need it in reality. So the demand shifts outwards. It is also assumed that the firms will send the exact quantity required and not the quantity ordered. This says that the price paid for the units of the unused good, becomes a transfer of surplus from the consumer to the firm. For physical goods, we assume that consumers would take delivery of the goods ordered if these were of free disposal. However, there are also goods, (bricks for example) that the consumer would be happy not to take delivery of the units he doesn't need. The model proves that the monopolist's price increases both in costs and in the degree of overestimation.

We should also examine the case where we have perfect competition. The simple model proves that allocative inefficiencies arise. This happens for the following reason. If prices were equal to marginal costs, firms would have a profit, which would be the transfer of money from consumers to firms which would stem from the payment of units that the firms don't deliver. So, under perfect competition, prices would decrease lower than marginal costs and there would be inefficiency due to overproduction. Sources of misperception could be the fact that consumers focus on the present or the thought that they can live better than they actually do. Another source could be unawareness of or limited attention to the cases of bundle goods. These biases may affect consumers and make them misperceive the quantity of products they want to consume. Firms are concerned about the sources of misperception because these affect demand. We may think that firms can use consumers that overestimate the quantity they use but it might be less intuitive to see why consumers can suffer from under-predicting future demand. On the other hand, consumers may think that they need less quantity than they actually do, and we may think the firm can exploit this fact, but the quantity demanded becomes insufficient, and the consumers will come back to demand more.

### Case 2: A model in which consumers underestimate future demand

Let's consider the same model as in the previous case but now with  $1 > \lambda > c$ . When the actual demand is achieved, consumers will purchase additional units. As a consequence, the monopolist who employs linear pricing can sell twice as much to the consumer and the profit function becomes:  $\Pi(p_1, p_2) = p_1 \times (\lambda - p_1) + p_2 \times (1 - p_2 - (\lambda - p_1)) - c - (1 - p_2)$ .

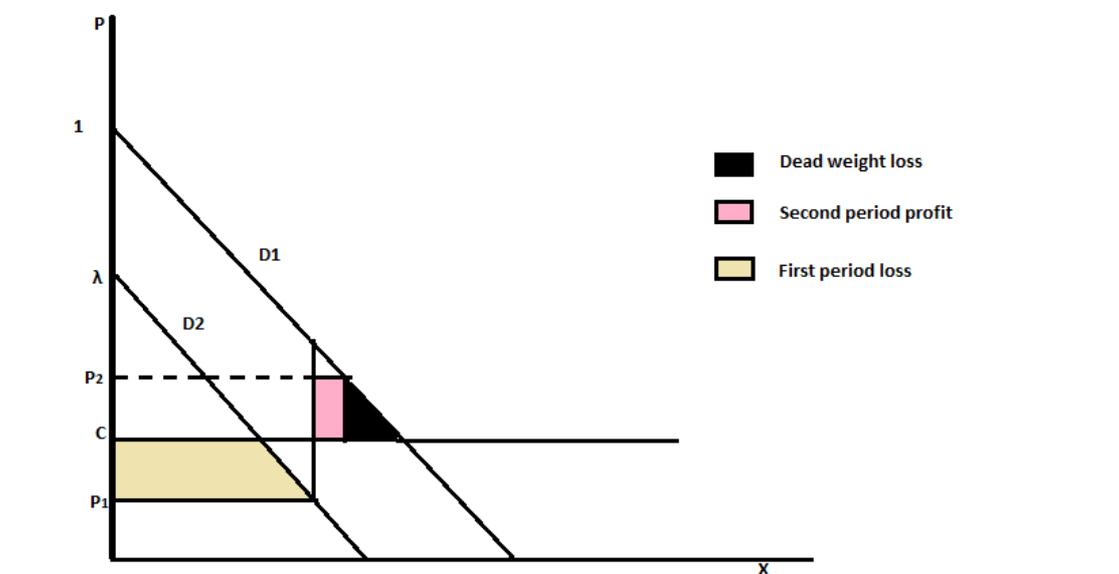
The first-order conditions of the profit maximization problem are:  $\lambda - 2 \times p_1 + p_2 = 0$  and  $1 - 2 \times p_2 - (\lambda - p_1) + c = 0$ . So, the monopolist charges  $p_1 = 1/3 \times (1 + c + \lambda)$  in the first period and  $p_2 = 1/3 \times (2 + 2 \times c - \lambda)$  in the second period. We have two observations to make:

- (i)  $p_1 > p_2$  whenever  $2 \times \lambda > 1 + c$ . So, whether the firm charges a higher price in the first period or not depends on the size of underestimation.

- (ii) Even if  $\lambda$  is close to 1,  $p_1 \neq p_2$ . This is because this model allows the firm to discriminate the price intertemporally and consumers are supposed to be short-sighted.

Consumers purchase a total quantity of  $\frac{1}{3}(1+\lambda-2 \times c)$  for which they pay  $\frac{1}{3}(1-\lambda+\lambda^2-c^2)$ . The monopolist's profit is  $\frac{1}{3}(1-c+c^2-\lambda+\lambda^2-c \times \lambda)$ . The dead weight loss is  $\frac{1}{18}(2-c-\lambda^2)$ . Thus, the total efficiency can be higher if consumers underestimate their demand because the monopolist can sell larger quantities. However, the dead weight loss is decreasing in  $\lambda$ , which means the more accurately consumers predict their demand, the smaller the efficiency loss is.

When the firms commit to price profiles  $(p_1, p_2)$  and consumers commit to one supplier for both periods, competition doesn't eliminate inefficiencies. In the fully competitive equilibrium, firms will choose  $p_1 < c$  and then offer the monopoly price with respect to the consumer's residual demand in the second period so that the first period loss will just be covered by the second period gain. The consumer will consider this a very attractive deal as he will consider the high second period price  $p_2$  irrelevant. Therefore, the allocation distortion will not vanish, even in the perfect competition case.



*Figure 6: Underestimated future demand scenario.*

Della Vigna and Malmendier's study (2004) has presented a model of misperception due to behavioral bias. The concept of their study is that consumers never intend to suffer but always want to enjoy pleasures at present. This is true for those who think about the future but in this case consumers are very extreme concerning the weight they put on the present. This results in inconsistencies in behavior and increase in behavioral patterns. However, if consumers are unaware of their biases, they will misperceive their demand for particular goods. A consumer that is a hyperbolic discounter (the present is always too important), and knows it, will understand that what he will do is not what he should actually do. So, he is not as vulnerable to the bias as someone who is unaware. Goods that offer pleasure now and pain later (for example credit cards), make an hyperbolic discounter underestimate his demand. These goods are called 'leisure goods' according to Della Vigna and Malmendier. Goods that offer pain now and pleasure later make the hyperbolic discounter overestimate his demand. These goods are called 'investment goods'.

The most important finding of Della Vigna and Malmendier's study is that the firms create contracts that fulfill this consumer's misperception. When we have overestimation, firms set high fees and low charges per use in order to make the consumer who overestimates his demand pay more than he has thought. On the other hand, in the case of underestimated demand, firms set low fees and high price per-use which is higher than marginal costs. In this case consumers may know they are biased and may change the good they use. However, unaware customers will intend to buy a luxury good even though they cannot actually afford it.

As far welfare is concerned, it is very important that we see that the distortions in the contract design are beneficial for the more sophisticated consumers. They can avoid additional charges by paying the bills on time. Because firms compete in order to fulfill consumers' misperceptions, competition can decrease the allocation inefficiency in this kind of markets. However, consumers are able to benefit from the increasing competition. For example, profits from high marginal costs, for a luxury good, can be balanced with negatively fixed fees. Whether this is going to happen or not, depends on the parameters of the market such as the extent to which there is product differentiation.



Eliaz and Spiegler (2006) assume the market has different extents of naivety and allows complicated tariffs. They show that firms offer different contracts to screen consumers. A contract will commit consumers to a particular profile and will be purchased by the relatively sophisticated. The other contract will use the more naïve consumer's misperception in the same way as the contracts according to Della Vigna and Malmendier. The contract includes a non-linear pricing with a low price for a specific action and a high price for another one. Consumers that are biased would think that they will pay the low price, but they will choose the expensive option. Even though in this case they focus on monopoly, it seems that competition will not decrease allocative inefficiencies. Moreover, naïve consumers benefit from competition between firms because they are attracted by lower prices.

Another paper, that refers to markets with consumers with self-control problems, is the paper of Heidhues and Koszegi (2010). They refer to a credit market where there is perfect competition. In this case, the consumers underestimate the demand for liquidity and overestimate their ability to pay back loans. As a result, banks offer cheap loans if they get paid on time, or expensive if they don't. Even though biased consumers think they will pay back the loan on time, they fail to do so. Because they underestimate the true costs of the loan, they borrow more than they should, which leads to welfare losses.

According to Grubb (2009), consumers only underestimate the variety of demand and not the expected demand. They are optimistic about the ability to predict their demand. Firms can use this optimism by offering three-part tariffs; a fixed fee, low price for the first units and high prices for more units. In this way, when the demand is low, the consumers will pay the fixed fee, and when the demand is high the consumers will pay the extra units. In both cases, the average price per unit paid is higher than the medium demand where a fixed fee is spread among units of consumption.

Over optimism or to put it in another way overconfidence, as a source of misperception is examined by Sandroni and Squintani's (2007) study concerning insurance markets. They examine the case where there are three types of consumers: the low-risk consumers, the high-risk consumer and the biased consumer who is at

high-risk but mistakenly thinks he is at low-risk and misperceives the demand for insurance.

The fact that a behavioral type exists has important effects on the whole market because insurers cannot observe low-risk types and overconfident types. There is not a sign with the help of which they could identify the biased consumer. However, if there was such a sign or if companies could identify the bias, this would change the market. But because there is no such sign, the fact that we cannot distinguish overconfident from low-risk consumers will increase insurance premium for low-risk contracts and this will harm the true low-risk consumer. So, the insurer want to cover his actual average costs from the contract and the biased consumers will have bigger claims than the low-risk consumers.

We will end this part with another study, this of Gabaix and Laibson's (2006) who point out the case of misperception of own demand or in other words, the case where consumers don't have a clue that they demand for a specific good. For ordinary goods, firms cannot exploit the unawareness. However, they will use informative advertising to overcome it.

If the good that the consumer doesn't know at all, has a strong complement, the consumer will want to purchase and the case changes. The consumer may understand his desire only when he buys the strong complement. According to Gabaix and Laibson, the firms always advertise the price of the good. However, they have the ability to choose whether to advertise add-on price or not. There are consumers that believe there are add-on prices even though these are not advertised. There are also biased consumers that are firstly unaware of the add-on but they would know their existence if these were advertised. So, sophisticated consumers can avoid add-on whereas biased consumers consume the add-on when they buy the product which triggers the add-on's discovery for which there is no complement.

To conclude this study, if there are many unaware consumers, firms will prefer not to advertise the add-on. On the contrary, they will offer low prices for basic goods and charge inflated prices for the add-on. This means that they will exploit unawareness by charging low prices for the basic good and higher prices for the add-on. This happens for the following reason. Sophisticated consumers won't buy an expensive add-on and the advertisement of the price will make a biased consumer

become sophisticated. Moreover, the firm doesn't have a chance to create a different pricing strategy which means, for example advertising a low priced add-on and compensate for that with a higher base price, because sophisticated consumers would want to purchase from the firm with the lower base price. In this case, both biased consumers and sophisticated ones are cross subsidiaries and the sophisticated consumers can find substitutes for the add-on, while they take the basic good at low price. Because of the competition, the base price will lower since sophisticated and naïve consumers compare sellers according to the base price, but doesn't have an impact on the add-on price. To what extent competition can decrease base price depends on the differentiation of base products among sellers.

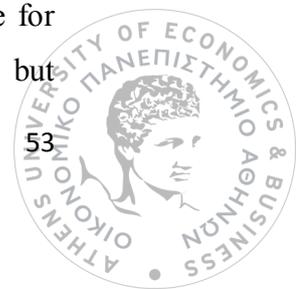
Whether or not rational consumers, who can predict their demand, benefit from the biased consumers is something that hasn't been answered yet. Rational consumers could suffer from the misperception of the other such as in the case where high risk consumers underestimate the insurance they need and this increases the price of insurance for the low risk consumers.

Consequently, only time will make consumers able to predict correctly their demand. In this case, pricing strategies shouldn't be prevalent in markets with constant inflow of not-sophisticated first-time buyers or in markets with new products.

### ***3.3 INERTIA BIAS***

The bias we are going to examine next is the bias of inertia. There are many papers that refer to models where consumers tend to buy from the first shop they enter in or in the case of buying a product repeatedly, they stick to the same supplier. Economics literature focuses on this kind of models, supposing that consumers have searched and are aware of switching costs. Sometimes these costs seem to be material costs that the consumers undertake every time they want to move from one supplier to another. Moreover, there are papers that show that high levels of search costs come from inertia.

In this section we will see the most important outcomes in the literature for example discovering why an increase in the number of firms facilitates firms but



could have the opposite effect on consumers. The reason of this outcome could be the fact that because consumers don't search in a proper manner, firms have no motive to compete with better deals. Additionally, firms could offer products or services of a lower price to consumers who don't search properly.

### Classic search papers

According to Salop and Stiglitz's paper (1977), it is assumed that search is simultaneous. They examine why consumers with high search costs may have negative externalities than those with low search costs, especially when the inertia of some consumers leads to average cost pricing as in the case of monopolistic competition. There are many types of market equilibriums and consumers with low search costs can benefit from those that display price dispersion. In equilibriums with price dispersion, consumers with low search costs find firms that offer low prices.

In cases with price dispersion, firstly, we observe that cutting the high price a little bit doesn't result in more demand for consumers that don't search. Secondly, marginal price increases don't necessary result in reduction of demand and this makes prices raise. Finally, if prices are high, when there is a reduction, more consumers with low search costs could be attracted. So, firms may need to increase prices or undercut them to generate price dispersion.

We also find price dispersion in Varian's search model in which there are perfectly informed consumers and completely uninformed consumers. Firms have to balance their willingness to compete for informed consumers and their willingness to exploit inert consumers. Now, we will present a simple model of the Varian-type search.

### **Case 3: A simple search market**

Let's consider a search market with a continuum of consumers of mass 1. There are two types of consumers. Those consumers who search and hence are fully informed of market prices, and those who are ignorant and do not search at all. The former have mass  $q$  and the latter  $1 - q$ .



There are two firms who can either charge a low price  $p$  or a high price  $P$ . The high price is indeed so high that the informed consumers prefer not to buy at all when there is no cheaper option. In that case, if both firms charged  $P$ , so each firm will simply sell to half the ignorant consumers. If both firms charged the low price  $p$ , they would share the consumers equally. If they charged different prices, the low price firm would attract all the informed consumers and half of the ignorant consumers. There are no production costs. This creates the following game.

$(1-q) \times P/2,$	$(1-q) \times P/2,$
$(1-q) \times P/2$	$(1+q) \times p/2$
$(1+q) \times p/2,$	$p/2, p/2$
$(1-q) \times P/2$	

It is easy to see that for  $1/(1-q) < P/p < (1+q)/(1-q)$  this game has no symmetric pure strategy equilibrium. If the other firm charges a low price, it pays to avoid cut-throat competition and sells only to the ignorant at a high price. On the other hand, if the other firm charges a high price, it is profitable to gain all informed consumers through the lower price. So, there will be price dispersion either in the form of asymmetric pure strategy equilibriums (in which one firm earns  $(1+q) \times p/2$  and the other earns  $(1-q) \times P/2$ ), or in the form of mixed-strategy equilibriums in which each firm earns an expected profit  $(1-q) \times P/2$ .

In these kind of models, the urgency to balance is what generates price dispersion. According to Varian's model, there are no symmetric pure strategy equilibriums because firms could slightly reduce and win all the informed consumers at every level of price, rather than share them. This makes prices reduce, but at low prices firms would have a motive to charge a high price in order to gain more from uninformed inert consumers. To put it differently, setting the same price as the competitor is never the best option. If your rival sets a high price, what you want is a marginal reduction, but if he charges a lower price you want to set a higher price. So, in the case where all firms set the same price, there are no equilibriums.

In these two classic search papers, we assume that there is a zero-profit condition to make all the rents from uninformed consumers compete away. However there is the possibility of inefficiencies being created due to the fact that small firms may produce with decreasing average costs which make the total output produce more efficiently by altering it to larger firms.

What the effect of inertia on the informed consumer's welfare is ambiguous and depends on the nature of equilibriums. According to Varian's model, more uninformed consumers entering the market means an increase in price dispersion which is beneficial for the informed consumers. There are more firms that set lower prices which can be observed by informed consumers. In Salop and Stiglitz's model the competitive price will be set by firms that can be spotted by the informed consumers.

Moreover, there are more realistic models that suppose sequential search (with the consumers paying finite search costs every time they search for another supplier) instead of particular search cost (paid only once to observe the exact prices that suppliers charge). According to Stahl's paper (1989), there are two types of consumers, those with zero search costs who are called "shoppers" and those who consider search a costly activity. His paper is very important because he shows how Bertrand's paradox and Diamond's paradox can be obtained smoothly by varying population parameters. When there are zero search costs for everyone, firms will lower the prices in order to reach equilibrium prices marginal cost (Bertrand paradox). If there is a positive search cost for everyone, then the firms will set the monopoly price and consumers will try only one firm (Diamond paradox). This happens because if a firm sets a price lower than the monopolistic, then it has a motive to increase slightly the price with an amount smaller than the search cost and so no one will leave the firm and the firm will gain more from the existing consumers.

Another reason which makes this paper important is that it proves that if the number of firms increases, prices can also increase. This happens because when the number of rivals increases, firms confront a smaller probability of being the cheapest among the other firms which in turn results in reduction of motive to set low prices. Moreover, in this model, the welfare effect of increased competition is ambiguous. Fully informed consumers gain from the existence of more firms whereas those who

consider search costly worsen off. In these cases, what happens is due to price dispersion. The more price dispersion makes the prices for the informed consumers observable whereas it is less effective for the others. So, the total welfare effect depends on the number of fully informed consumers and the number of consumers that consider search costly. Last but not least, another reason supporting the importance of this paper is that it operates as a basis for the recent studies, some of which confront non-standard consumer behavior.

### Inflated search costs and complexity

The most interesting models built on the classic search papers are those that suppose that firms can affect search costs. While in these papers it is assumed that all agents' choices are rational, the fact that firms may have the ability to affect search costs (through the appearance of their stores for example) has a behavioral core. When a consumer is rational, he is indifferent to comparing two prices in the same or in different ways and he doesn't get bored by searching for a long time.

According to Ellison and Wolitzky (2009), firms have the ability to make the in-search process for the non-shoppers costly by increasing the complexity of prices. It is assumed that non-shoppers get bored as the search procedure becomes more costly because for example the consumer has paid a higher search cost in the first shop and then he pays more when he visits a second one. The most significant outcome of Ellison and Wolitzky's paper concerns comparative statics referring to the variance in search costs among stores. For example, a search would be easier if there were search engines. Ellison and Wolitzky prove that when we are in equilibrium, firms will balance the reduction in search costs between stores by increasing the price complexity in them and will finally neutralize the influence of easy search between stores. In this model, it is assumed that consumers aren't able to find out the in-store search cost and they can observe it only if they visit the shop. Because they think that the search costs are the same between firms, they will visit stores in a random order.

Moreover, Carlin's paper (2009) is another paper in which firms decide about prices and their complexity at the same time. However in this case, it is assumed that some consumers search all the market and become fully informed, whereas there are

those who don't search at all. The firm's decision concerning the price complexity is what affects consumers' search costs. This means that, if there is a great price complexity, search process becomes more difficult. And because it becomes more difficult, many consumers finally decide to stay uninformed. So, firms can soften the competition by using price complexity. Another important aspect in this paper is that when there are more firms that increase competition, firms have a motive to create more complex pricing programs. As a result, prices in equilibrium may increase in the number of rivals. Additionally, according to Carlin, in equilibrium, there is a correlation between price complexity and price. And uninformed consumers cannot come to a conclusion from the price which means that they cannot understand that complex prices seem to be high prices.

Even though it is assumed that price and price complexity are chosen in the same time in Ellison and Wolitzky's and Carlin's papers, Wilson (2010) assumes that firms firstly choose price complexity and then prices, when the rivals have observed the price complexity. Consumers decide the order they search for suppliers only after they have observed the price complexity. In the case of duopoly, Wilson proves that asymmetric equilibrium happens when a firm obfuscates but the other doesn't. In order not to attract consumers with high search costs, competition softens for the remaining informed consumers because the competing firm has a motive to charge a higher price. In this study consumers are able to decide the search order because firms are different concerning the complexity or the accessibility of the prices.

#### Non- random consumer search

When we have models of random search, asymmetric results come from a symmetric equilibrium of mixed strategy, which means that asymmetries are shown ex post as outputs of the randomization. This contrasts to persistent asymmetries where specific firms for example are more prominent than other firms.

Armstrong, Zhou and Vickers (2009), face the matter of prominence in the search frame. It is assumed that consumers begin their search with the prominent firm. This happens because for example consumers would firstly observe the goods of the prominent firm in the market or because, they would click on the top option while

searching the net. They also assume a search frame with horizontally differentiated products, where consumers search for products with the highest product suitability and the lowest price. They prove that if there are no differences in quality between the firms, the prominent firm charges a lower price than its competitors and this harms both consumers and the total welfare. Because consumers search for horizontally differentiated products, firms understand that if a consumer visits a non-prominent firm, he will probably be dissatisfied with the offer of the prominent firm. The fact that the consumer is not satisfied by the prominent's offer, gives little monopoly power to the non-prominent firm and this is why the prominent firm has to lower its price.

When a firm becomes more prominent than others, the total welfare and the consumer surplus decrease because the non-random consumer search leads to unequal prices among the firms and so results in the reduction of the match efficiency because consumers stop searching too early. In other words, consumers often stop searching in the prominent firm due to its low price even if they haven't found a satisfactory good. However, when a firm becomes prominent, it creates profits in the industry sector that are unequally shared among the firms, with the prominent gaining the largest share. Industry profits are created because the non-prominent firms charge higher prices than the price set by the prominent firm.

In this model of non-random search with prominence, consumer welfare ameliorates when the number of firms increases. This is not only because firms are obliged to lower their prices, but also because when the price discrepancy among prominent and non-prominent firms gets smaller, it restricts the match efficiency loss.

When there are no negligible search costs, all firms have a motive to be the first the consumer visits. As a result, firms may compete in other aspects to make the consumers change the search order. The welfare outcome depends on the nature of competition. If sellers are trying to gain more consumers by offering another good cheaply, then an amount of the extra profits that search costs transports to the firms will be distributed to the consumer again. On the contrary, if firms compete in order to gain consumers through advertising, this may result in no additional gain for the consumers.

### Repeated purchase and inertia

Selten (1965) presented a model of oligopoly with inertia in demand. In his model, firms compete in a continuous basis for a finite number of periods for the same consumers. Consumers stay with the same firms as long as the difference in prices is low which means that consumers only change supplier when they are dissatisfied by the prices. He proves that when firms exploit their customers' inertia, they intensively compete early on. However, they make more profits in the case of inertia than in the case of no inertia.

It would be also important to refer to the reference point effects. When consumers search consecutively, a loss averse consumer won't probably continue the search if he finds a product that fits well. So, loss aversion results in inertia. What is different however, is the fact that loss averse consumers may not buy an ex ante attractive choice if it is presented to them for free after they have observed the first good.

When we have loss averse consumers, competition is not affected by lowering the search costs. However, it ameliorates the performance of the market. If search procedure becomes easier, many consumers will find out better deals which would create a competitive pressure for the firms. But firms may make in-store search more difficult in response to these improvements. Moreover, it is found that the increasing number of firms can hurt consumers in the case of inertia even though this hasn't been proven to be possible for loss aversion.

### ***3.4 MISJUDGEMENT OF PRICES DUE TO LIMITED MEMORY AND FRAMING EFFECT***

When consumers have to choose between two identical goods simultaneously, it is assumed that they will choose the cheaper one. However, when they have to participate in a search to find out about prices, it is assumed that they will learn the prices and choose the one that make the sum of expected price and the expected search costs smaller. For example, if a consumer has searched the whole market, he will either choose the last one that he has seen or the cheapest one on condition that the extra costs balance the price difference.



There are two important barriers concerning this approach. Firstly, the comparison of prices may not be such an easy process. Prices may be presented in a more complex way, which makes the comparison trickier than the comparison of two simple numbers. For example, the case of partitioned pricing the comparison is more complicated. Secondly, in order to perform sequential search, it is obligatory to have the ability to memorize, but many consumers cannot remember the exact prices they had observed previously. The problem becomes bigger when the prices are complicated.

In this part, we will examine models of competition in which the consumer searches, but this search is obstructed by some bounded rationality. Here, firms use strategies that are adjusted to the consumers' biases.

In the following model, firms have to decide between two different price frames. If they choose the same price frames, it will be very easy for the consumers to compare and the result will be Bertrand competition with low prices. On the contrary, if firms decide to choose different price frames, they will achieve higher prices and more profits.

#### **Case 4: Competition with price framing**

Let's consider a market with a continuum of consumers of mass 1 that is served by two firms who can charge a low price  $p$  or a high price  $P$ . Firms can choose between two different price frames A and B. There are two types of consumers; the ones who can effectively compare the prices even if these are in different frames, and the ones who will choose randomly when they face two different frames. The former have mass  $q$  and the latter  $(1-q)$ . However, all consumers can compare prices correctly if the both firms use the same frame. We assume that the high price is quite high for the standard consumers, while those consumers who compare the prices are willing to pay.

Let's consider the case in which firms firstly choose price frames and then engage in price competition. If they choose identical frames, they face the following game in price setting stage:

0, 0	0, p
p, 0	p/2, p/2

This price subgame has an only one equilibrium where each firm charges the low price  $p$  and earns  $p/2$ . However, if firms choose different price frames, the price setting game is the same with the one examined in case 3 and both firms are strictly better off in the equilibrium played in that game. Consequently, all subgame perfect equilibriums will involve some form of price dispersion, either through asymmetric pure strategy equilibrium or in mixed strategy equilibrium, and price dispersion. However, for consumers who find it difficult to compare prices, things will become worse if the number of firms increases.

Piccione and Spiegler (2009) focused on markets where consumers are willing to switch firms. Some of them may switch when they find a better price, there may be a part of consumers that would switch only if the price of the rival was better and framed in the same way as the price of the current firm. As a result, firms can avoid this kind of competition by choosing different price frames. Basically, this is the same as an artificial product differentiation that softens the competition.

According to them, in the duopoly case when there is equilibrium, firms randomize over prices and frames. In cases where both firms choose the same price frames, price competition intensifies and obviously it would be profitable for a firm to deviate and opt for a different price frame. In this case they would choose different price frames and higher prices would be a motive for the firms to choose the same frame with the rivals and lower prices. So, only in mixed strategy equilibrium can each firm randomize its frame and make the rival guess. Piccione and Spiegler prove that regulatory interventions can fail in this occasion. For example, if a regulator reinforces the ability to compare two slightly different frames, firms may switch to completely different frames and this could worsen off consumers because it would be very difficult to compare. If the regulator could enhance full comparability, this would lead to the elimination of the problem but would also result in intensified competition.

In their study, Chioveanu and Zhou (2009) examine markets with an arbitrary number of firms and two sources of price misperception. Firstly, consumers may encounter some difficulties concerning the comparison of the different frames.

Secondly, they are concerned errors that come from the frames' complexity because these may mean that consumers won't choose the cheapest firm because the frame is incomprehensible. For example, consumers may commit errors during the process of adding base prices to shipping fees. They prove that increased competition makes things worse for consumers because they are unable to make precise comparisons. The more firms there are, the more difficult it is for the firms to differentiate their frames. So, they will resort to more complicated frames in order to reinforce the second source of consumer error. Consequently, firms have a motive set higher prices and this is bad for the consumers. Kalayci and Potters analyze the results of Piccione and Spiegler and Chioveanu and Zhou' studies and contemplate on that the results occur in the market besides the theorists' models. By using two experimental studies they prove that firms prefer complex pricing strategies whenever this is possible. Additionally they show that these strategies reduce the consumers' quality in decision making and increase the firm's gains.

Chen, Iyer and Pazgal (2010) generate a third type of consumer who has the ability to remember only in which category previously seen prices belong to, that is he can remember whether a price is high or low when we have these two categories. Consumers are able to create a particular number of categories and it is assumed that they can choose the cut-offs that separate the categories rationally.

The authors examine two different cases. Firstly, there are those consumers who have limited memory codes and those consumers who can only remember the first price and compare it to the price found in the second firm. In the latter case, the expected prices can rise with thinner memory partitions. This means that consumers with better memory can harm them because with thinner categories, if one firm undercuts, then the competitor will set a slightly lower price which limits the firm's motive to undercut in the first place. Finally, according to Chen et al, consumers have an incentive to invest in better memory resources when encoding lower prices. Even though there may be few memory categories, he proves that the expected price the consumers pay and their surplus resemble the case of perfect recall. So, the limited memory of consumers may not be a problem in this occasion. However, in this model, the consumer's ability to choose the best categorization is very high and for this reason the result must be taken into consideration.

### ***3.5 MISPERCEPTION OF VERTICALLY DIFFERENTIATED PRODUCTS***

In some cases, consumers may try hard to find out products of high quality in markets. If the quality of the good is not observable at the time of purchase, consumers will have to generate some beliefs about the quality of a good when they see the good and because of full rationality these beliefs will be correct. These asymmetric information problems come in two flavors. There are the experienced goods whose quality is observed during the consumption and the credence goods whose quality will never be observed (e.g. a patient will never know if an expensive scan was necessary for his diagnosis). However, in the markets for such products, consumers will never face bad surprises. They won't buy a product of low quality or they will be perfectly informed about the risk of a good when they purchase it.

However, we assume that rational expectations are problematic thoughts because they are cognitively demanding and it is observed that people do experience surprises. The literature of this part, offers multiple ways of thinking about how consumers choose among products of different quality.

Bohnet, Harmgart, Huck and Tyran (2005), have examined markets for experienced goods in a laboratory environment. These markets fail in the absence of facilities that allow for reputation building. Firms' consumers succumb to moral hazards and they don't purchase at all. Huck, Lunser and Tyran (2006 and 2007) reproduce these results and also examine the competition too. They prove that competition enlarges the effect of reputation building. They also compare monopolies and oligopolies with free pricing with a fixed price above marginal costs too.

When fixed prices are set, consumers are very careful concerning the firm's track records and they abandon sellers that offer products of a low quality. This results in high concentration, making the sellers of high-quality products take over the biggest market shares. However, when the prices become more flexible, the decision problem for the consumers becomes more complex too. Consumers now examine two kinds of information: past track records and price. The majority of the consumers pay attention to the prices which leads to a Bertrand-type competition. This means lower prices and low quality of the products. Prices are so low that high-quality production is hardly sustainable for the firms and the low quality goods are almost acceptable by

consumers. Moreover, the total welfare is lower under price competition of fixed price.

Even though a consumer's bounded rationality is concerned as an obstacle to the market performance, Huck and Tyran (2007) prove in a theoretical analysis that decision heuristics can ameliorate the market performance as far as experienced goods are concerned. They study in particular the case of a market that would collapse if all the consumers were fully rational. This would happen because in front of moral hazard, the rational consumers would think that if they trust the seller, the seller will have no motive to offer high quality. If consumers demand an experience good repeatedly, a reasonable heuristic would be purchasing from the same supplier as long as he offers high quality. Huck and Tyran prove that such consumers generate a positive externality to all the consumers. Because firms want to keep the loyal consumers, they will still offer high quality to all consumers simply because they cannot observe the two types of consumers. They have to choose to sell high quality for several periods than selling low quality for one period followed by zero profits the next periods. So mutuality among the consumers can be used as a substitute for the reputation building of firms.

Moreover, we have Dulleck's, Ketschbamer's and Sutter's study (2010) that analyzes markets for credence goods in a laboratory experiment. They examine the role of competition and reputation and the role of verifiability and liability. The data show that verifiability doesn't improve the market's outcomes. Liability has an important efficiency-reinforcing effect but it excludes under-treatment which is the situation in which the consumer's problem of finding a supplier remains unsolved. On the other hand there is the problem of overtreatment in which the consumer's problem is solved with the anticipation of an expensive good or service.

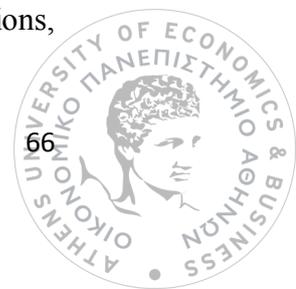
Contrary to markets for experienced goods, in the case of credence goods, reputation building doesn't work well and competition cannot improve welfare. However it shifts profits from firms to consumers.

When the quality of the good is ambiguous, consumers confront another complexity when they form their beliefs concerning the quality of the product. Spiegler (2006) analyzes the case in which every consumer has only one observation for each product in the market and assumes that this observation is the best estimator

for the true quality. So, for each product, every consumer thinks that it is definitely of high quality or of a poor quality. In the first case the consumer's evaluation about the product is positive and in the latter one the consumer's evaluation is zero. This generates artificial product differentiation which means that consumers think that identical products are of different quality.

If consumers knew about the true technology, we would have a Bertrand market where firms would set prices equal to marginal cost. However, now the rule for a consumer's decision is buying the cheapest good that won't break down. As a result of this rule, firms may set prices above marginal costs in equilibrium. In this case, the equilibrium will include price dispersion as firms will randomize over a range of prices. This is because setting a very high price, gives an improbable high payoff, while setting a low price gives highly probable small profits. In equilibrium, these expected profits equate.

An important finding of Spiegelger's analysis (2010) is that consumers can be harmed because of the intensified competition. The more the, the more likely the consumers will hear a positive anecdote, and as a result more consumers will enter the market and purchase an overpriced good. To say it differently, when there are many firms, it is more likely for any breakdown not to be observed easily. So, higher prices can be set. This model slightly differentiates from other models in which consumers don't fully understand the price. In this case consumers understand the price but their expectation concerning the quality is biased. So, in Spiegelger's model, a disappointed consumer would say that the product purchased isn't of the quality he expected, and not that he hadn't fully understood the supplier's price. Moreover, Spiegelger analyses more complex products. In this case, firms offer products with multiple features. Every firm sets different prices for every dimension of the product. For ordinary consumers, it is very difficult to estimate a multi-dimensional price scheme. So to make it more simple, it is assumed that consumers examine only one dimension each time and compare the offers by this particular dimension. However in the end consumers will pay for all the dimensions. As a result, firms randomize their prices in each dimension. The intuition is that by charging low prices in particular dimensions they may attract those consumers who happen to compare products based on these dimensions. Then, the firm makes profits by setting higher prices in other dimensions, as the consumers finally pay for all the dimensions.



When there is intensified competition, firms set lower prices in specific dimensions, but in order to balance them they set higher prices in other dimensions. This results in more variable prices for each dimension. Spiegler proves that by increasing the number of the firms doesn't alter the price in each dimension, it only increases the variance. This may happen because the firm will face the intensified competition by obfuscating consumers. If consumers are risk averse, this reduces their welfare. Finally, we have Spence's study (1977). He examines the case in which consumers underestimate the probability of a product to be defective because they are very optimistic. Even a competitive market won't provide efficient quality because markets will satisfy consumers' beliefs and preferences, even if these are biased or not.

### ***3.6 MISPERCEPTION OF DEMAND FOR PRODUCT ATTRIBUTES***

This category includes a significant area of the map of competition with behaviorally biased consumers. Many goods have a great number of characteristics. For the ordinary consumers it is very difficult to evaluate these characteristics in a proper way. Zhou studies a model where the firm can use a single-attribute advertising that focuses only on one characteristic of the product to manipulate the way that consumers estimate the product. To be more specific, naïve consumers that don't have enough knowledge will overestimate the importance of the product advertised and underestimate the importance of the unadvertised one. For example, consumers may think that the number of pixels of a camera is more important than another attribute because of an advertisement concerning the number of pixels.

The firm has a motive to design different goods to find out which consumers are naïve and who the sophisticated ones who are immune to advertising. Zhou proves that the product designed for the naïve consumers is of top quality in the advertisement and of bad quality in the unadvertised dimension while the opposite happens for the sophisticated consumers. The result is that the naïve consumers will consume a product which has an extremely good attribute but has a poor performance, while the sophisticated consumers won't find the exact good they want because of the negative externalities created by the naïve consumers. Finally, the naïve type will get what he wants, but his demand is distorted due to misperception. Competition can

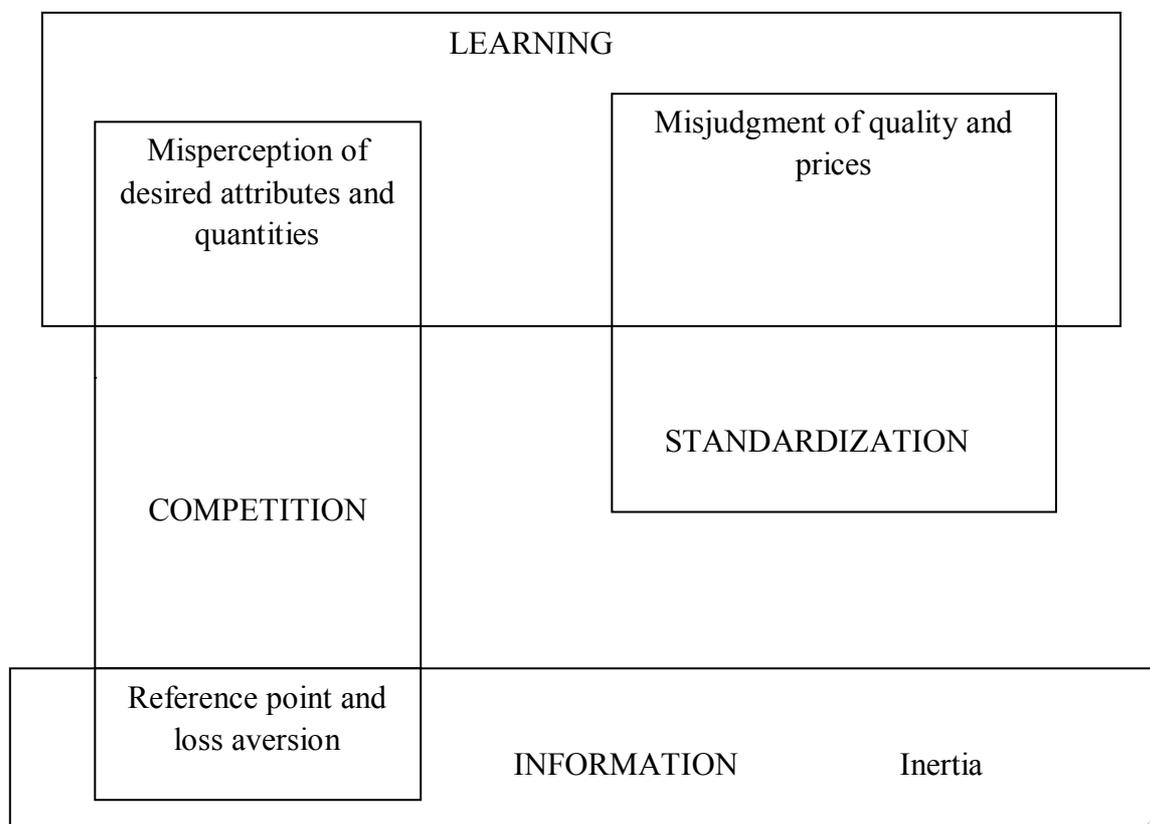
eliminate these distortions but this depends on a number of assumptions, for example a fully covered market and the symmetry between firms. If these assumptions are violated, then distortion may survive even under competition.

### 3.7 POLICY RECOMMENDATIONS

In general, according to this survey, markets don't work well when there are behaviorally biased consumers. So, it would be natural to ask if there are any solutions, remedies or mechanisms that could ameliorate the quality of consumers' decisions and ultimately the market outcomes.

In the following figure we can see an overview of the remedies used in order to ameliorate the outcomes for consumers depending on the bias and its root cause. Some of the remedies may work for specific biases but not for all biases. For example, learning could be a remedy for misperception and misjudgment biases whereas, competition is a remedy for misperceptions only.

*Figure 7: Recommendations (OFT 2011)*



By having lower barriers in the entry, we intensify competition because we have many competing firms. This is a solution when we face the problem of improving markets. However, when there are behavioral biases, competition may not always be the solution. To be more specific, we have observed that the possibility of opposite effects in competition comes from the part of the thesis concerning search biases arising from inertia, misjudgment of prices and quality biases arising from misjudgment of vertical quality. On the contrary, in models that analyze willingness to pay biases coming from reference point effects and loss aversion, misperception of future demand and quality biases come from horizontal misperception of quality, and competition was never harmful.

This happens because for half the biases (misperception of desired attributes, misperception of desired quantities and reference point and loss aversion) competition works similarly to the models with distorted demand curves. Reference points create kinks in demand curves and misperception of demand and desired attributes shifts demand curves inward or outward. These biases don't alter the consumers' desire to find the optimal deal. So, increased competition by having more firms will have positive effects even though in some cases, inefficiencies may remain under perfect competition.

On the other hand, we have the other three biases (misjudgment of quality, of prices and inertia). These biases affect consumers' search and decision rules since they may not purchase from the cheapest firm because they do not search enough due to inertia, or because they may find it difficult to compare the prices (arising in misjudgment of prices and quality). In these models, some consumers are indifferent whether goods are expensive or not or whether they are of a high quality or not. In this case, competition may not work because it is not so clear if the firms have a motive to undercut each other.

When the motive to undercut is removed, firms can either set low prices to attract consumers who search a lot to decide correctly, or they can set high prices to attract those consumers who don't search enough or are victims of poor judgment. This tension can neutralize the positive effects of competition. However, in particular cases, it may also generate adverse effects of competition as in Stahl's model where entry reduces the firms' motive to set low prices because consumers probably won't

spot the good offers. Things may become worse when firms make the searching process and judgments harder because the motive to do so increases when the number of firms increase.

In general, competition may not always solve consumers' problems and in specific occasions competition may be harmful. However, as long as firms have a clear motive to undercut or to offer a better deal, competition can ameliorate market outcomes. In cases where firms don't have this motive because some consumers purchase from an expensive firm, competition may harm consumers (OFT 2011).

### **Recommendation 2: Learning**

By using reference points and inertia, we model consumer biases through preferences. There is no point in learning when consumers will augment given their preferences. Preferences may be altered by time and there is evidence that professionals are less prone to reference point effects. Moreover, the interpretation of some models with high search or switching costs is subject to cognitive limitations which can be overcome with more practice. There might be some scope for improving consumers' search behavior with the help of learning and experience. So, if inertia arises because of cognitive limitations resulting in misjudgment of prices, then learning could help.

The other biases are more representative cases of learning to be relevant. This happens because these are models in which consumers are mistaken and often find out about their suboptimal choice. For example if consumers make a mistake concerning their future demand, they will find it out when the actual demand is realized. If their misperception is caused by an underlying bias, then learning requires that the consumer admit he has a problem. An adjustment of behavior is required to stop being naïve. Likewise, consumers want to learn whether the source of their mistakes is a misjudgment of quality or a misjudgment of prices. Moreover, there is the aspect of learning in cases where consumers tend to misjudge prices. Experience in complicated price frames will make it easier for the consumers to see through them. To the extent that some of these errors are due to cognitive skills, there is limited scope for learning.

From the point of cognitive skills and learning, it might be interesting to find out vulnerable consumers in such markets.

### **Recommendation 3: Information and standardization of information**

Information and transparency of markets is predicted to improve market outcomes in all models except for those models concerning misperception of own demand. This type of consumers would need more information concerning their future demands and this may be impossible to improve.

In the case of reference point effects, information has an impact on purpose even if the bias is driven by preferences. However, preferences misrepresent behavior when at the beginning the consumers aren't fully informed about the prices and the characteristics of the products in the market. This is what generates reference point effects. If consumers knew all the offers at the beginning and thought about them at the same time, then their status quo bias and loss aversion wouldn't matter.

The fact that more information concerning prices and the quality of the good improves the markets, in which consumers don't search enough or misjudge the prices, is instinctive. However, there are some exceptions that can arise in these markets. According to Baye, Gatti, Kattuman and Morgan's study (2006), an increased price transparency lowers the search costs for consumers who search but leave the other consumers unaffected. In this case, in equilibrium, prices might be higher because now it is more attractive to exploit inert consumers rather than compete for aware consumers. Moreover, Zhou, (who studies markets in which consumers search for multiple products the same time), shows the adverse effects of lowering search costs. Additionally, when consumers find it difficult to compare products, then standardization may be beneficial for them. However, this standardization could have the opposite effect as we have seen in Piccione and Spiegler's study.

#### **Recommendation 4: Reputation**

In cases when consumers understand that learning can be effective, firms intend to increase their reputation. Consumers may reward the firm's reputation by being loyal or willing to pay. Such reputation building can improve the effects of learning. In particular cases, firms could create their reputation effectively on their own, especially in cases when they have large market shares. For example, an airline that would abandon drip pricing, could gain a reputation for fair pricing or for fair business. In other markets, it is very difficult for firms to build a reputation on their own and the sharing of information among consumers could enhance good or bad reputations.

#### **Recommendation 5: De-biasing and consumer education**

An important aspect is that firms benefit from consumers' biases and in cases where competition cannot limit these benefits, firms don't have a motive to participate in de-biasing activities. Only when these activities help firms to build their reputation for fair treatment, could these activities be part of a firms' strategy. However, Gabaix and Laibson (2006) prove that there are limitations to this, especially when sophisticated and biased consumers are cross-subsidized. The problem is that by educating consumers, the firm will lose the extra profits both from biased consumers and from educated consumers because they would switch to another supplier who still exploits naïve consumers for the benefit of the sophisticated ones. So, whenever the sophisticated consumers benefit from the existence of the naïve consumers, the firms have no motive to de-bias. This leads third parts (for example governments) to press enforce consumer education and these efforts won't have adverse effects.

### ***3.8 EMPIRICAL STRATEGIES***

In the last part of this segment, we will examine how we can identify markets that suffer from the biases discussed above. Specifically, we will examine empirical strategies employed to find out the biases, based on the type of data someone would need for this identification.



## **Firm behavior**

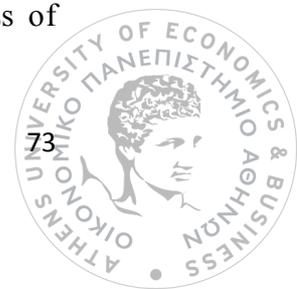
The most traditional approach to examine the performance of the market is supply-side oriented and there are many practices that firms use to serve as indirect proof of biases in consumer behavior. More specifically, using elaborate price frames, like drip pricing (which doesn't actually change the nature of prices), and costly changes to price frames over time, may be a proof that the firms gain from the consumers' biases. Moreover, attempts at obfuscation can be used as virtual proof of problems that consumers face when they try to understand the firms' offers. Even though this isn't evidence of bad behavior, it could be an indication, so markets are interested in investigating further.

Also, there may be other activities which may seem suspicious, but might have their reason in actual consumer preferences. More specifically, very flashy pricing strategies with multi-part tariffs might occur as a type of exploitation of consumer biases but may also occur to better serve rational consumers with diverse needs. These tariffs may result in more detailed investigation. The same stands for products that are sold at cost or below cost to generate more profitable sales or for activities designed to affect consumers' search activity.

Generally, there are clear limits to what the traditional supply-side oriented approach can achieve. In most cases, we can observe two things when we are confronted with activities that arise in markets with biased consumers. According to Della Vigna and Malmendier (2004), this happens because these activities may also arise in markets with heterogeneous sophisticated consumers. There are cases where we have price frames changing the appearance of the price from something easy to understand, to something complicated. In these two cases, there purpose for direct regulation of firm behavior. For example, drip pricing practices could be prohibited without any adverse consequences.

## **Observe consumer choice and market prices**

Price dispersion can be detected in market data and it is indicative of search costs. According to Zhou (2008), these markets can be problematic regardless of



where the search costs come from, because efforts made by standard institutions concerning welfare effects of lowering barriers to entry can go wrong.

Without more data, it would be impossible to learn about the source of high search costs. These high search costs may come from economic opportunity costs that are very high but they could also come from consumer ignorance. The scenario changes when consumers buy goods at an excessive price even though the supplier offers a cheaper variant.

### **Observe consumer choice and consideration set**

A very useful strategy to prove biased decision making or errors in decision making, is to compare the consumer's actual choice with his consideration set which means all the alternative choices the consumer thinks when he made his purchase. This strategy is significant for the markets whose consumers suffer from misjudgment of price and quality. If a consumer buys a product that is dominated from another product of his consideration set, that would probably be a consequence of misjudgment.

Even though this is the clearest type of proof, data on consideration sets might be hard to obtain. Consideration sets cannot be easily observed because it would be necessary to track down the entire consumer's search process. Additionally, consumers are prone to make mistakes during the comparing process and are unlikely to have perfect recall of the goods they have considered before a purchase. So asking consumers about their consideration set is not a promising strategy. An exception could be the case of tracking consumers' search on the internet. Cookies tracking the consumers' search history offer the desired data. As a result studies that are used to track the consumers' internet purchases may be very important for empirical work and it is used to compare choices to their considered alternatives.

Experiments would be also a fruitful method to observe consumers' choices. Controlled economic experiments can isolate mistakes in decision making from a pre-determined set of choices and pay-offs (OFT 2011).

### **Ask the consumer after the purchase**

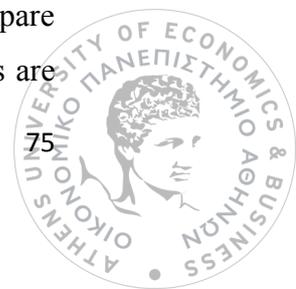
This strategy is based on survey methods and not on choice data. For several of the consumer biases, this is the most efficient empirical strategy. To be more specific, in cases when we have misperception of desired quantities, the consumers should have been able to say that the demand they believed they needed initially was different from the real demand and they made a mistake. Their ability to understand that they initially misperceived their demand is what enhances the consumer's learning.

The strategy of asking the consumers after the purchase is not so efficient in cases of misperceptions of the type of good desired, because it is very difficult for the consumer to learn that he made a mistake. Reference points may not be identified effectively in this method because the consumer doesn't know that his choice is affected by the reference point (Zhou 2008). Controlled economic experiments in this part could be helpful to reveal misperceptions. This changes in cases of vertical quality differences which mean misjudgment of quality. Consumers that expect higher quality may get disappointed when they find out that they have bought a product of low quality.

Finally, let's think about the case of misjudgments of prices. It is questionable whether consumers will recall that they could have paid a lower price when they actually forgot the low price during the purchasing process. However, consumers might get confused during the search process which could be indicative of a real problem but not a proof of it.

### **Elicit the consumer's willingness to pay before the purchase**

Until now, none of the empirical strategies studied above could prove the effect of reference points in markets. This may be not so surprising, because reference point effects are a matter of preferences similar to preferences for a specific type of product. However, as shifting reference point can shift the consumer's willingness to pay, there is a procedure that an empirical economist can employ. He can ask the consumer about his willingness to pay before his search procedure and then compare his response with the paid prices. According to Zhou (2008), if the actual prices are



higher than the willingness to pay, this may mean that there are reference point effects created during the search process.

Even though this method doesn't seem very good, if the researcher asks the consumer about his willingness to pay before entering the shop, then this could change the consumer's behavior because it would make the consumer more aware of his original willingness to pay and so this would reduce the likelihood of reference point shifts and his willingness to pay.

### **Other survey methods and ethnographic studies**

In the case of inertia we have no empirical studies, and the question is whether inertia is rational or not. If the consumer doesn't search or doesn't switch, the most important reason for this might be the real cost of non-searching or non-switching. Consumers might be aware that they give up on better deals. In cases of inertia, the empiricist may have the hardest task: to find out the real sources of inertia to decide whether these sources can be rationalized (OFT 2011).

## **CONCLUSIONS**

To conclude this thesis, in the first chapter, we referred to some pricing practices and their effects on consumer behavior. According to the evidence, partitioning prices harm consumers. As for the opt-in/opt-out practice, people choose the default option for decisions, even if these have major and long-term consequences. The default effect may be harmful for consumers when an opt-out policy is used to get consumers to buy more products that are not necessarily needed. Moreover, the evidence supports that reference prices increase the consumers' perceptions of value. However, the real danger in reference price advertising for consumers, is when the reference price is inaccurate and at this point consumers need protection. As for the word free, there is insufficient evidence available to reach conclusions. Bait pricing is likely to strongly affect consumer behavior and can be harmful for consumers. Additionally, bundle pricing can induce consumers' purchases as consumers overvalue bundles even if the price isn't overvalued. Last but not least, even though we haven't got enough evidence concerning time-limited offers, there is some evidence concerning the effect of scarcity which suggests that time limited offers should increase consumer demand.

Based on what we examined in chapter 2, nowadays price discrimination based on customer recognition is easier than ever. Customers are more willing to share their identities with the firms through loyalty cards, ID cards or online identification. As firms collect data concerning the customer's behavior, it is crucial that economists examine this effect on market dynamics. Moreover, as customers understand the importance of the data collection and its results, they become more sensitive and may change their behavior, thus having a great impact on firms' motives. In general, nowadays, customers are quite concerned about sharing their private information.

According to the literature, behavior-based price discrimination has ambiguous results. On one hand, behavior-based price discrimination enables the extraction of a consumer's surplus but on the other hand it intensifies competition because the firms have a motive to gain poaching profits. However, behavior-based price discrimination is beneficial only if extraction profits can counterbalance the negative effect of intensified competition.



Until now, the literature hasn't proved that incumbent and rivals firms can profitably discriminate symmetric brand preferences or switching costs (when there is symmetric information), except for the cases we have captive customers and stochastic brand preferences. However, it is shown that if we relax the strong symmetry assumptions we can achieve profitable discrimination. When we relax the symmetry restrictions, the extraction and poaching profits change motives. Under symmetry, firms benefit by poaching profits. When we have asymmetric demand, firms have to focus on extraction profits. Subtle information can show who the loyal customers are, and who are the indifferent ones, so it gives access to asymmetric information. With symmetric information we have the prisoner's dilemma whereas asymmetric information is the solution. As a result, a customer's identification is important in increasing extraction profits and in reducing the rival's poaching profits.

We also face some constraints concerning behavior-based price discrimination. Fairness is a more important key for BBPD than it is in other types of discrimination. Customers appear to object to pricing if they see that the price differs from one customer to another without a reason or if the firm exploits customers' private information for its own benefit. But how strong the customers react to behavior based pricing is a different subject.

Another important constraint concerning behavior-based price discrimination is anonymization. When customers have the ability to hide their identities, they can benefit from lower prices or prevent the exploitation that could take place if firms knew their purchase history. Anonymization is a serious threat for the firms whose purpose is to discriminate based on customer information. Even though firms want to ban the customers' ability to hide their identities, it would be better to offer anonymization. Nowadays, technologies which are used to offer anonymization are not very sophisticated, but the general thought of how information can be used, increases the demand for those technologies.

Additionally, behavior-based price discrimination has also ambiguous effects on the welfare and not only on a firm's profits. When there is intensified competition for switchers, there is also a large consumer surplus. Customers who have smaller switching costs benefit more. Welfare loss grows by high switching costs. However

behavior-based price discrimination can be beneficial for the economy in the case of lowering the prices in the poaching market in order to increase demand.

Finally, in chapter 3 we have seen that increasing competition may not always improve the welfare of consumers through fostering entry of more firms. Competition indeed may not always help when there are consumers that not search properly or find it difficult to evaluate quality and prices. When we have this type of consumers, it is no longer clear if firms necessarily have a motive to compete by offering better deals. Instead, they can focus on exploiting biased consumers who are likely to buy from them, regardless of price and quality. These effects can worsen off through the firm's attempt to compare prices and to search more, and inhibits product quality. The motives in such activities are more intense when there are many competitors. In these cases, policies such as learning or standardization of information and frames can help.

On the contrary, competition seems to work as standard intuition states, if biases distort only consumers' demand without affecting their desire to search for better offers that satisfy their demands. While competition cannot eliminate the allocative inefficiencies that arise in response to these distortions, an abundance in the number of firms can never harm but will make them better off.

In the presence of behaviorally biased consumers, markets are sometimes unable to self correct. In some cases, gains from exploiting a certain bias may be competed away through attractive prices for another product in order to attract consumers in the first place. Such effects depend on the fine detail of the market and cannot be taken for granted. We have also seen that firms sometimes have little motive to educate consumers. This is critical if educated or sophisticated customers benefit from the pricing offered by those firms which do not engage in consumer education. However, when learning eliminates consumer biases, firms may have a motive to establish a reputation for fair behavior early on.



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