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# Predatory Pricing, Recoupment, and Consumers' Reaction

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**Abstract**

This paper tests two basic assumptions underlying court made or statutory provisions prohibiting predatory pricing. Such prohibitions are usually based on the economic grounds that monopolistic pricing is likely to occur in the long run, causing harm to competition and consumers. The first assumption under scrutiny is that customers will accept monopolistic prices during the subsequent phase of recoupment, even though they have become accustomed to low prices during the price war. The second assumption is that no competitor will (re-)enter the market in this subsequent phase. Our two experiments indicate that both assumptions are not backed up by actual decision making both of consumers and of competitors. Moreover, we find that consumers use their market power in order to maintain long-run competition.

*JEL classification:* C73, C91, L11.
*Keywords:* Predatory Pricing, Recoupment, Market Experiment.

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# 1 Introduction

Predatory pricing describes the behavior of an incumbent firm setting prices below marginal costs or some other measure of costs in order to drive a competing firm out of the market or to deter its entry in advance. Where jurisdictions resort to straightforward prohibitions of predatory pricing, such prohibitions are usually based on the concept that the incumbent is ultimately able to recoup the costs of the price war, thus causing harm to consumers and competition. However, recoupment will in fact only be possible if two further conditions are met: First, consumers, accustomed to low predatory prices, have to accept monopolistic prices afterwards. Second, neither the competitor having left the market, nor any other entrant firm must (re-)enter the market. Both requirements are tacitly assumed by jurisdictions prohibiting predatory pricing without a requirement of likelihood of recoupment. Yet, both assumptions seem questionable from an experimental as well as from an industrial organization perspective and will therefore be tested in this paper.

There is a general convergence in the worldwide development of competition law in the recognition that the primary goal of competition law is the protection of the competitive process as the core of any market driven economy. Furthermore it is fairly safe to say that the protection of consumers is though not necessarily the primary, yet the ultimate goal of competition law. Competitors, on the other hand, may well and will undeniably benefit from the protection of the competitive process, but competition law does not protect competitors by themselves.[1] Straightforward prohibitions of predatory pricing as described above seem to challenge these principles: To the contrary - at least in the short run predatory pricing in fact increases the consumers' surplus, whereas only competitors are suffering. Consequently, prohibitions of predatory pricing can be justified only by making the long run effects, including the predator's recoupment of the costs of the price war which ultimately

[1]For U.S. Competition Law cf. Brown Shoe Co. v. U.S., 370 U.S. 294, 320 (1962); for EU Competition Law cf. the Communication from the Commission of 2-9-2009, Guidance on the Commission's enforcement priorities in applying Article 82 of the EC Treaty to abusive exclusionary conduct by dominant undertakings, COM (2009) 864 final, at para. 6.

prejudices consumers' interests, part of the equation. In other words: The systemic justification of such prohibitions depends upon the possibility and likelihood of recoupment:[2] If predatory pricing almost always resulted in a monopolistic market structure yielding sustained monopoly profits, a per se prohibition would certainly be appropriate. If, however, many or most predatory pricing policies actually failed in the real world, better arguments would have to be forwarded to support these prohibitions. Jurisdictions are split in their assessments: While the European Courts[3] and German competition law like many other competition law regimes endorse plain prohibitions of predatory pricing without a requirement of establishing a likelihood of recoupment, U.S Antitrust Law finds an unlawful monopolization only, if the plaintiff can demonstrate that there is a likelihood that the predatory scheme alleged would cause a rise in prices above a competitive level that would be sufficient to compensate for the amounts expended on the predation, including the time value of the money invested in it.[4] Currently, we can diagnose almost a line of demarcation separating the globe concerning the question: 'Is predatory pricing likely to be successful in terms of recoupment?' The experiment in this paper is designed to help answer this question so crucial for competition policy and enforcement all over the world.

Predatory pricing can be attractive for an incumbent when there are several potential entrants. Assuming asymmetric information, Milgrom and Roberts (1982) show that predation against early entrants might be rational for the incumbent to build a reputation in order to deter later entrants. Isaac and Smith (1985) are the first trying to reproduce predatory pricing in an experiment. They come to the conclusion that predation does not occur in the laboratory, even under very favorable circumstances. Harrison (1988), in contrast, finds evidence for predatory pricing in the laboratory in

[2]This is stated very clearly for the European competition law in the Communication from the Commission of 2-9-2009, Guidance on the Commission's enforcement priorities in applying Article 82 of the EC Treaty to abusive exclusionary conduct by dominant undertakings, COM (2009) 864 final, at para. 70.

[3]The European Court of Justice explicitly repeated on several occasions that there is no need of recoupment to prohibit sale under costs: ECJ, Case C-333/94 P - Tetra Pak II, [1996] ECR I-5951 at para. 44; Case C-202/07 P - France Télecom, (2009), not yet reported) at para. 110.

[4]Brooke Group Ltd. v. Brown & Williamson Tobacco Corp., 509 U.S. 209, 225 (1993).

a multiple market experiment with eleven sellers acting in five markets. Jung et al. (1994) use a different, very simple design with weak and strong types of incumbent monopolists. Weak monopolists have an incentive to pretend to be strong in order to deter entry in the long run. Their results show that weak incumbents in fact fight entry in early periods. Capra et al. (2000) report on a classroom teaching experiment which uses a facilitated version of Harrison's multi-market experiment, finding mixed evidence regarding incumbents' strategies. Gomez et al. (2008) provide a summary of the different experimental results.

Although predatory pricing in general is a relatively well-studied field in the experimental industrial organization literature, consumer's behavior in these markets has to the best of our knowledge never been explicitly studied. Their reaction to the incumbent's early predatory and later monopolistic pricing, however, is of great importance for the incumbent's strategy. If consumers are unlikely to pay monopoly prices in the later periods of the game, recoupment is unlikely as well. Thus, an informed and rational monopolist might abstain from predatory pricing right from the beginning of the game. The results of fairness experiments showing that subjects reciprocate unkind behavior if they feel treated unfairly (Falk and Fischbacher, 2006), make consumers' willingness to pay monopoly prices appear particularly questionable. Consumers might even be trying to punish the monopolist for the treatment of the entrant, which they observe from the outside and perceive as unfair (Fehr and Fischbacher, 2004). Previous studies on predatory pricing usually simulated demand as a numerical function without taking such behavioral motives into account. Our study aims at closing this gap by having both market sides explicitly played by participants in the experiment.

Let us next consider the second assumption of law that other firms will stay out of the incumbent's market after the predatory pricing phase. From a theoretical industrial organization perspective there are good reasons that the monopolistic situation would not last long, if profitable market entry was possible in the long run. The monopolist cannot afford fighting entry in every period, thus, by backward induction market entry will occur from the beginning on. From a behavioral point of view, however, we might argue that the incumbent's threat has long lasting effects as

in Selten's (1978) chain store game, if the threat is strong enough. There are already some experimental results regarding the reactions of displaced entrants. Capra et al. (2000) report the results from a classroom experiment where they found very different behavior across markets. In their experiment, incumbents only sometimes reach a monopoly position. Our experiment wants to generate additional insights into the reactions of entrants to predatory prices.

We conduct two experimental studies indicating that both assumptions cannot be confirmed by actual decision making both of consumers and of competitors. Competitors re-enter into the incumbents' markets again and again, and consumers reduce their demand in order to make to incumbent reduce prices in the future. Moreover, we find explicit evidence how consumers use their market power in order to maintain competition in the long run.

In section 2 of this paper, we present the market models we use in the experiment. The experimental protocol is described in section 3 along with some behavioral predictions. Section 4 presents the main findings and section 5 concludes.

## 2 Design

Our study comprises two different experimental studies. The first one is a multi-market design similar to Capra et al. (2000), while the second one is a simplified version of this model with firms interacting in only one market and a simpler cost and demand structure.

In the first part of our study, we use a design with three markets (treatment 3MARKETS). In each of the three markets there is one consumer. There is one fixed incumbent firm in two of the three markets, whereas in the third market no firm is present by default. In the beginning of each round, four mobile sellers decide in a random sequential order which market to enter.

Some modifications of the experimental design of Capra et al. (2000) are implemented: Most important we replace the simulated demand function of Capra et al. (2000) with human players of the consumers and induce consumers' willingness to pay with resale values according to their demand function. We then normalize cost and demand functions to avoid the possibility of excessive losses. The mobile sellers are made a little more agressive and dangerous for the fixed sellers by an increased production capacity.[5] We then adjust the demand function to reach a similar competitive equilibrium. Finally, we extend the duration of the experiment from 10 to 15 rounds to see whether behavior stabilizes in the course of the game.

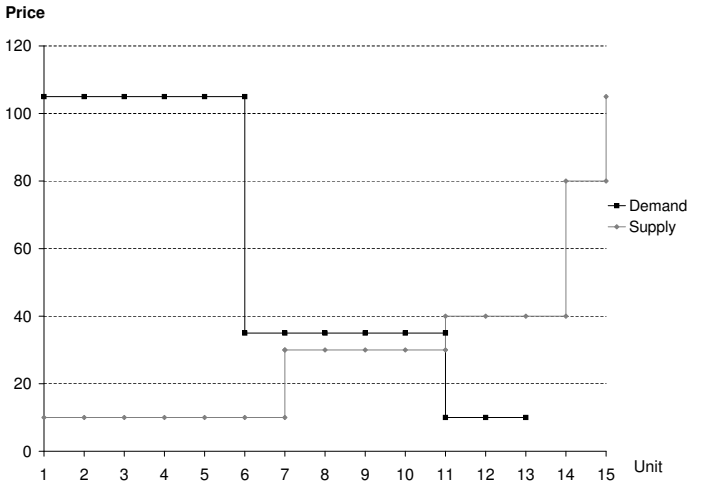


**Figure 1:** Cost and Demand Structure

Figure 1 summarizes the cost and demand structure in our experiment. Fixed sellers can sell up to 10 units and mobile sellers can sell up to 5 units. Marginal costs for

[5]This final modification seemed meaningful, after a pilot experiment had not generated predatory behavior of the fixed sellers. However, it did not help enhancing predatory pricing. It did not change market behavior at all, except the mobile sellers lowering their prices in each of the three markets, which does not seem to have an impact on the fundamental strategies of the three types of market participants, however. Therefore, we include the pre-test with lower capacities of the mobile sellers into the analysis as well.

a fixed seller are 10 for the first 7 units and 40 for another 3 units. For a mobile seller marginal costs are 30 for the first 4 units and 80 for the 5th unit produced. Consumers' willingness to pay is induced with a three-step function of resale values: the first 6 units are worth 105 points, another 5 units are worth 35 points, and two more units are worth 10 points. Fixed sellers receive an initial payment of 400 points to cover eventual losses if they choose prices below their own marginal costs in the very beginning of the experiment. Mobile sellers and consumers do not receive a show-up fee.

The timing in each round of the game is as follows. First mobile firms select in random order which market to enter. Each entrant is informed about the previous entry decisions of the other mobile firms in this round before deciding itself. In a second step all sellers and buyers are informed about the market choices of the mobile sellers. Then, fixed and mobile sellers decide simultaneously about the price they would like to set in the current round and the maximum quantity they are willing to sell at this price. They only have to bear costs for the units they actually sell, there are no capacity installation costs. Consumers are informed about the offers of all firms in their market and can decide how many units to buy from which firm. We, thus, relax the assumption of efficient rationing that was made in Capra et al. (2000). Each consumer can buy up to 13 units per round.

In this experiment, consumers have a very strong market position as there is only one consumer in each market deciding between buying at different competing sellers. This will cause some interesting behavioral patterns worth to be studied a little closer. In a second experiment, we therefore focus on consumers' decision making depending on their market power. In this second experiment, we use a simpler market design comprising only the main features of the first one. The main difference to the first experiment is that we now compare markets with only one buyer (treatment 1Buyer) and markets with two buyers (treatment 2Buyers) to see whether buyers' market power was crucial for their decisions in the first experiment. The remaining details are as follows: buyers are again identical and there are two different types of sellers. The markets, in which groups of buyers and sellers are interacting, are fixed. In each market, there is one low-cost sellers by default and either one buyer or two

buyers. In each round, the high-cost seller can decide whether to enter the market. If the high-cost seller does not enter, he receives a fixed payoff $s = 60$ roughly equal to the average earnings of mobile sellers in the first experiment. We restrict cost and demand functions to the first six units of those in the first experiment, because only very few trades in the first experiment included more than six units. Finally, we further extend the capacity of the high-cost sellers to six units so that we do not need to define a procedure how to proceed if aggregate demand for one seller in the two-buyer treatment exceeds supply. All participants in the second experiment receive a show-up fee of 4 euros.

# 3 Experiment

## 3.1 Procedures

For the 3Markets experiment, we have observations from nine experimental matching groups with nine market participants each: two incumbent firms, four potential entrants, and three consumers. For the second experiment, we have eight observations for 1Buyer markets and ten observations for 2Buyer markets. The information provided to the participants in our experiment imitates the information sets of real firms and consumers. The fixed sellers have complete information about consumers' demand and all firms' costs reflecting their maximum market power and their incumbent status with experience in the market. The mobile sellers are new entrants in the market, they only know their own costs.[6] Consumers know their willingness to pay, but not the firms' costs.

The experiments were computerized using Fischbacher's (2007) z-tree software. A total of 145 subjects participated in the experiments, 55 as buyers, 36 as (fixed) low-cost sellers, and 54 as (mobile) high-cost sellers. Subjects were students of the University of Konstanz recruited via ORSEE (Greiner 2004). The experiment

[6]In the second experiment, they also know the buyers' willingness to pay.

took place in *lakelab*, the laboratory for experimental economics at the University of Konstanz. All sessions lasted less than two hours. Before the experiment, subjects received instructions about the experiment. After the actual experiment participants filled out a short questionnaire.[7]

## 3.2 Behavioral predictions

Let us start with our predictions regarding the decision making in the first experiment. In the one-shot game the competitive market equilibrium would be achieved at a price between 30 and 35 and a traded quantity of 11, with the fixed seller trading 7 units and the mobile seller trading 4 units. In the competitive case a fixed seller makes a profit in the range of $[140; 175]$ and a mobile seller makes a profit in the range of $[0; 20]$. As a monopolist the fixed seller will sell 6 units at a price of 105, yielding a profit of 570. The collusive equilibrium in all markets also yields an industry profit of 570.

Fixed sellers will set the monopoly price if no entry occurs. If another firm enters the market, the fixed firm can either accommodate or fight entry. If it accommodates, it can set a price of 79 selling at least two units due to the entrant's capacity limit, and thereby make a profit of 138 points at minimum. If it fights the entrant in order to deter further entry, it will set a competitive price below the marginal cost of the mobile sellers of 30. This restricts the mobile seller to sell no more than one unit with a negligible profit of 5 points at maximum.

Rational and selfish consumers will buy every unit at a price below their willingness to pay, starting with the cheapest available offer. However, different categories of social preferences suggest that in the real world they might refuse to pay relatively high prices. In particular, we assume that they might buy less than 6 units at the monopoly price, if they experienced lower prices in the past.

[7] An english translation of the instructions is available from the authors upon request.

**Hypothesis 1** *Consumers buy $q_t < 6$ units from the incumbent firm in round $t$, if the incumbent is a monopolist and $p_t > p_{t-1}$.*

Buying less from an expensive incumbent monopolist implies that consumers abstain from payoffs they could get today in order to increase their expected payoffs tomorrow due to lower future prices. In rounds, in which not only the incumbent, but also another seller is present in the market, a similar reasoning might make consumers intentionally pay a higher price to the low-cost seller. Buying from the more expensive high-cost seller increases the likelihood that this seller enters the market again in future rounds, hoping to sell some units to this buyer again. Competition then has a disciplining effect on the prices of a low-cost seller, who otherwise would have enjoyed monopolistic market power. Thus, a consumer buying today from an expensive high-cost seller again increases expected payoffs tomorrow.

This effect, however, depends crucially on the number of buyers in the market. In our first experiment, we have only one buyer per market. This consumer has strong incentives to make the mobile seller enter the market again in the future, because he himself fully benefits from future seller competition. With two buyers in one market, as implemented in the second experiment, the picture changes: losses today still only have an impact on the consumer himself while lower prices in the future now also benefit the other consumers. Due to this externality, we might expect that consumers buying from a more expensive high-cost seller become rare if there are other buyers in the market. This question is the major focus of our second experiment, where we compare markets with one buyer and markets with two buyers.

Mobile sellers can decide if they want to compete with a fixed seller in market I or II or whether they want to enter the 'exit' market III, where they meet up to three other mobile sellers. If the mobile sellers expect predatory prices by a fixed seller, whenever they enter market I or II, they should resort to market III. However, if they do not manage to collude,[8] only two mobile sellers can make positive profits in

[8]Note that collusion is unlikely in markets with three or four sellers, see Huck et al. (2004).

this market. Since market III is thus too small for all four mobile sellers to enter, there is a considerable incentive for at least one or two mobile sellers to try entry into markets I and II. From a behavioral perspective, inequity averse mobile sellers might also become envious if they realize that the incumbents make high profits whenever they are in a monopoly position. Be entering into the market, the mobile sellers can reduce their disadvantageous income difference to the fixed seller. We therefore expect that mobile firms will repeatedly enter into markets I and II, even if they experienced predatory prices in the past.

**Hypothesis 2** *Mobile firms cannot be squeezed out of a market permanently by the fixed firm.*

To test whether repeated market entry even after predatory prices is not only an artifact of our experimental design forcing mobile sellers to enter the fixed sellers' markets again and again because they cannot survive in market III, we used a different outside option for the mobile sellers in the second experiment. Here, they have the opportunity to receive a risk-neutral alternative payoff if they decide to stay out of the fixed seller's market. This alternative payoff is a little higher than the expected profit in case of entry, such that risk-neutral and risk-averse high-cost sellers should never enter the market. Our second experiment therefore provides a robustness check for mobile sellers' market entry decisions.

# 4 Results

The results of the first experiment reflect the complex structure of the multimarket design with explicitly modelled supply and demand side with market conduct being much more differentiated than one simple theory might predict. We observe a wide variety of strategies of all three types of market participants. Nevertheless, actual behavior and the answers given by the participants in the post-experimental questionnaire clearly demonstrate that the different strategies follow an underlying logic

in accordance with the rules of the game.[9] Table 1 summarizes the average payoffs in euros of buyers and sellers in both experiments.

| Treatment | Buyer | Fixed Seller | Mobile Seller |
|---|---|---|---|
| 3Markets | 30.88 | 21.70 | 6.23 |
| | (7.76) | (5.90) | (3.33) |
| 1Buyer | 26.58 | 23.57 | 4.90 |
| | (6.73) | (7.36) | (1.20) |
| 2Buyers | 17.18 | 18.74 | 5.23 |
| | (2.77) | (4.78) | (1.37) |

**Table 1:** Average payoffs (in euros), excluding showup fees. Standard deviation in parentheses.

## 4.1 Predatory Pricing

We start with the analysis of the fixed sellers' behavior in the first experiment. Their decision space in very similar in both experiments. Accordingly, results do not differ much.[10] For a detailed comparison of low-cost sellers' behavior in the two experiments see Table 2.

First of all, our findings are in line with previous research rarely exposing evidence for the existence of predatory prices.[11] Predatory pricing according to the definition of prices below marginal costs occurs very rarely in the experiment. Although the experimental design facilitates predatory prices, the fixed firms also set prices below the mobiles' marginal costs only in exceptional cases. Only 17% of the fixed sellers in the first experiment ever chose a price below the mobile sellers' marginal costs.

[9]We explicitly asked participants in the post-experimental questionnaire whether they perceived the instructions as being comprehensible and 98 percent of them agreed that this was the case.

[10]There is only one surprising difference between the experimental treatments 1Buyer and 2Buyers: prices of the low-cost sellers are significantly lower when there are two buyers in the market ($p^{LowCost} = 50.92$) than when they is only one buyer $p^{LowCost} = 62.87$ (Wilcoxon rank sum test, $p - value = 0.0058$). We would have expected the opposite, that lower market power of two buyers leads to higher rather than lower prices. We do not have an explanation for this.

[11]See Gomez et al. (2008).

| | 3Markets | 1Buyer | 2Buyers |
|---|---|---|---|
| $p^{Monopolist}$ | 73.12 | 79.41 | 56.34 |
| $p^{Competition}$ | 51.96 | 48.39 | 46.88 |
| $q^{Monopolist}$, $p \geq 90$ | 4.13 | 4.14 | 4.50 |
| $q^{Monopolist}$, $p < 90$ | 5.76 | 5.26 | 5.47 |
| Low-cost ever set $p \geq 100$? | 27.8% | 50.0% | 30.0% |
| Low-cost ever set $p \leq 35$? | 55.6% | 87.5% | 70.0% |

**Table 2:** Low-Cost Sellers Prices and Quantities (in Points).

Nevertheless, fixed sellers obviously condition their prices on their relative position in the market. Their prices are significantly higher when they enjoy a monopolistic position than when they have to share the market (Wilcoxon signed rank test, $p-value < 0.0001$). Higher prices of monopolists are also reflected in higher profits.

Interestingly though, fixed sellers only very rarely (in less than 2% of their decisions) set a price of 100 or more. Even when they are in a monopoly position, their prices are still far below consumers' induced willingness to pay, which is known to the fixed sellers. We think that such moderate prices are driven by similar motives like the proposers in an ultimatum game which offer almost half of the pie to the responder.[12] Fixed sellers are fair minded as well as anticipating that consumers would not be willing to pay very high prices.[13]

## 4.2 Entrants' Strategies

The mobile firms are the poor dogs in this experiment. Equipped with a disadvantageous cost function and a lower production capacity than the fixed firms, they cannot seriously compete with them. Furthermore, there are too many mobile sellers to realize satisfying payoffs in the 'exit' market III.

[12]See Chapter 2 in Camerer (2003).

[13]This explanation for such moderate pricing anecdotically occurs also in the participants' answers in the questionnaire.

Referring to hypothesis 2 we find that low prices of the incumbent only have an effect for one round. Since predatory pricing in its strict definition occurs rarely in the experiment, we broaden the definition of what a *low* price is to all prices that are at or below 35, $p^{low} = \{p|p \leq 35\}$.[14] We then compare the number of competitors of a fixed seller in rounds with $p > 35$ in the current and the two preceeding rounds to the number of competitors in rounds where the fixed seller set $p \leq 35$ one or two rounds before. If a fixed seller set $p \leq 35$ in several subsequent rounds, we consider the mobile seller's reaction in the two rounds after the last round of the series with $p \leq 35$. The number of competitors an incumbent firm faces in round $t+1$ after the last low price $p_t$ is $N_{t+1} = 0.27$, compared to $N = 0.90$ competitors in rounds where the incumbents did not choose a low price in the current and the two preceeding rounds (see Figure 2). Only one round later the difference between the numbers of competitors in situations with and without preceeding low prices almost completely disappears.

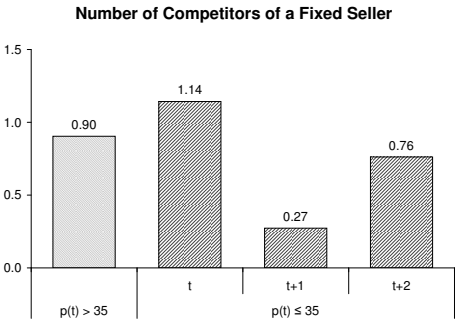


**Figure 2:** Number of Entrants Before and After Low Prices of the Incumbent in 3Markets.

**Result 1** *Incumbents cannot push entrants out of the market for more than one round.*

[14]From the experimental data we observe that 35 seems to be a lower bound of mobile sellers' prices. Such a lower bound might be driven by a predetermined minimum profit goal of the mobile sellers.

As explained in the behavioral predictions, this results could be seen as an artifact of our experimental design, providing mobile sellers no actual alternative to repeated entry into market I or II in the first experiment as competition in market III is too strong to make reasonable profits there. In the second experiment, we therefore introduce a fixed alternative payoff $s = 60$ which low-cost sellers can get in each round if they decide not to enter the low-cost seller's market. The amount of $s$ matches the mobile sellers' average profits in the first experiment. We find that this riskless alternative does not prevent market entry. Even though average profits of low-cost sellers in case of market entry are remarkably lower than $s$ (34.92 in 1Buyer and 39.23 in 2Buyers), they repeatedly choose to enter. However, we also see that the number of entrants is decreasing over time in the 1Buyer treatment, but not in the 2Buyers treatment of the second experiment (see Figure 3).

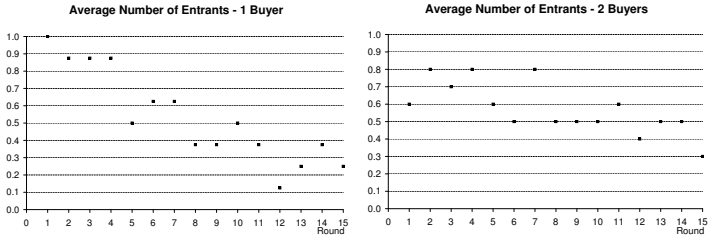


**Figure 3:** Number of Entrants in both Treatments of the Second Experiment

In an OLS regression we test for the duration of the deterring effect of incumbents' low prices. We combine the entry data from the three treatments, using two dummy variables indicating whether an observation originates from the first or from the second experiment and whether one or two buyers are present in the market. In the regression, we explain the number of entrants as a function of the prices of the two preceeding rounds, a round index, and two dummy variables $p_{t-1} \leq 35$ and $p_{t-2} \leq 35$ indicating whether the price of the incumbent in the two preceeding rounds was smaller than or equal to 35. The dummy variable $p_{t-2}$ takes the value 1 only if not only $p_{t-2} \leq 35$ but also $p_{t-1} > 35$. The results show that past prices in general do not explain entry, but a price below 35 in fact leads to significantly less entry in the consecutive round. If the price below 35 is followed by a larger price, entry rates recover immediately: $p_{t-2} \leq 35$ is not significant. The regression also

shows that entry rates decrease over time and that there is more entry in the first experiment. This last result is not surprising as there are four potential entrants facing two fixed sellers compared to one one potential entrant per market in the second experiment.

| Number of Entrants | | |
|---|---|---|
| $p_{t-1}$ | -0.0010 | (0.0017) |
| $p_{t-2}$ | 0.0021 | (0.0016) |
| $p_{t-1} \leq 35$ | -0.2343** | (0.1026) |
| $p_{t-2} \leq 35$ | -0.0673 | (0.0847) |
| Round | -0.0234*** | (0.0072) |
| Dummy 3 Markets | 0.4077*** | (0.1032) |
| Dummy 1 Buyer | -0.0832 | (0.1195) |
| Constant | 0.7378*** | (0.1975) |

**Table 3:** Regression Coefficients: Number of Entrants. Standard Error in Brackets. *** Denotes Significance at the 1% Level, ** at the 5% Level and * at the 10% Level.

## 4.3 Consumers' Strategies

Let us next consider consumers' decisions and start again with the observations from the first experiment. We cannot say much about consumers' reaction to actual monopoly prices, because firms rarely set them. Alternatively we consider consumers' reaction to high prices larger or equal to 90: in the first experiment there are 15 of such high prices set by a monopolist. In these cases, monopolists in the first experiment sell only 4.13 units on average compared to 5.76 units of monopolists with prices below 90.[15] The values for the second experiment are very similar (see Table 2).

To validate this descriptive result, we again estimate a simple OLS regression explaining the quantity sold by a monopolist with the monopolist's price, a dummy

[15]Nevertheless, setting $p > 90$ pays off for the monopolist, although not statistically significant. Average profits with $p \geq 90$ are higher (344.67 points) than with $p < 90$ (318.24 points).

variable indicating whether this price is above or below 90, and two dummy variables separating the treatments (see Table 4). The results show a price at or above 90 has a weakly significant negative effect on the quantity sold, whereas there is no general relationship between the price and the sold quantity. The treatment dummies have no significant effect here.

| Sold Quantity | | |
|---|---|---|
| Constant | 5.8636*** | (0.5805) |
| Price | -0.0070 | (0.0082) |
| $p \geq 90$ | -1.1039* | (0.5899) |
| Dummy 3 Markets | 0.3250 | (0.4174) |
| Dummy 1 Buyer | -0.0566 | (0.4072) |

**Table 4:** Regression Coefficients: Sold Quantity of an Incumbent Monopolist. Standard Error in Brackets. *** Denotes Significance at the 1% Level, ** at the 5% Level and * at the 10% Level.

**Result 2** *Consumers buy less than predicted by the market equilibrium when a monopolist charges them a high price even if the price is below their willingness to pay.*

This evidence, however, does not refer to monopoly prices occurring immediately after predatory prices but to relatively high prices in general. In a next step, we therefore consider more specifically the reaction of consumers to price increases of the incumbent monopolist after low competitive prices in the past. To test this hypothesis we again use a weaker definition of low prices ($p \leq 35$) instead of strictly predatory prices.

With this weaker definition and taken all three treatments together, we find 39 cases which fulfill the following conditions: In round $t$ a consumer was offered the product at a price $p_t \leq 35$ by any firm. In round $t+1$ this market is a monopoly and the monopolist charges a higher price in $t+1$ than the lowest price that was set in this market in $t$ either by the incumbent or any entrant. Our first hypothesis implies that consumers buy less than 6 units in such situations. This is not the case. In only 18%

of these situations consumers buy less than 6 units. Thus, buyers only relatively rarely react to the price increase after a low price with an immediate reduction of demand.

**Result 3** *Consumers do not condition their demand on lower prices in the immediate past.*

Finally we find very interesting evidence for consumers' strategies which are not covered by standard theory. First of all, we observe 83% of the consumers in markets I and II in the treatment 3Markets regularly buying from the more expensive firm. Such expensive trades occur in 18.5% of the buyer decisions. If consumers decide to buy some units from a more expensive high-cost firm, they spend on average about 18 points more than if they had bought the same quantity from the (cheaper) fixed seller. In the post-experimental questionnaire, 44.4% of the consumers acting in markets I or II explain this as their strategy to make the mobile firms enter the market again in order to enforce competition.

| | 3Markets | 1Buyer | 2Buyers |
|---|---|---|---|
| Buy expensive? | 83.3% | 62.5% | 60.0% |
| Mentioned in questionnaire? | 44.4% | 12.5% | 70.0% |
| Extra expenses $= q * \Delta p$ | 18.03 | 17.01 | 18.21 |

**Table 5:** Buyers Decisions

The above result does not change substantially when we consider the data from the second experiment. The share of consumers buying from the more expensive firm is 62.5% in the one-buyer treatment and 60.0% in the two-buyers treatment. Neither the difference between the one-buyer treatment and the first experiment, nor the difference between the two treatments of the second experiment is statistically significant in a Wilcoxon rank-sum test at any reasonable significance level. Also the comparison of losses due to expensive trades (see Table 5) shows no significant difference.

**Result 4** *Consumers are willing to pay a higher price to the mobile firms to maintain long run competition.*

# 5 Conclusion

We conducted two experiments testing two common assumptions regarding the likelihood of recoupment of losses after an incuments' predatory pricing. In particular, we consider consumers' and entrants' reaction if the incumbent monopolist returns to high prices after a phase of predatory pricing. Our data shows that consumers are in fact foresighted and willing to sacrifice some of their short run welfare in order to enhance competition over time. To some extend, they refuse to buy at monopolistic prices. Entrants react only in the very short run to predation by leaving the market but enter soon again. For a good part our experiment made use of the subjects in their real life quality as consumers. Thus, our core results referring to consumers' behavior can taken relatively literally. We recommend our results about firms' behavior rather as a starting point to find out more about real life decision making.

The first key result regarding consumers reducing the quantity bought from a monopolist charging them a high price seems to contradict economic conventional wisdom and the definition of willingness to pay itself. Yet, it seems plausible that consumers develop a sense for an 'appropriate' price for commodities they are familiar with. Even if they would be willing to pay more in general, they would not want to pay more than this appropriate price. This explanation may be backed by the perceivable stability of prices of certain consumer goods such as computers, where price levels seem to remain constant over times despite sometimes spectacular changes in performance, quality or technology. A second explanation relates to the results of ultimatum games already mentioned above: consumers form realistic beliefs about the firms' costs and, thus, about the difference between these costs and their own willingness to pay. If the monopolist then charges a price that implies a very unfair distribution of this difference, consumers' reluctance to buy is in line with responder behavior in ultimatum games rejecting very unequal offers.

The result that consumers are ready to pay a higher price to the mobile firms to maintain long run competition might be driven by the strong market power of consumers in our experiment as there are only one or two of them in one market. The situation in our laboratory experiment, however, corresponds quite well with the situation in many professional markets: suppliers in business-to-business trade relationships are often confronted with a demand side comprising only a few large buyers. Such buyers then in fact have strong incentives to maintain long-run competition at the supply side.

Finally, our experiment generally motivates further research in market behavior. Even though the structure of the experimental markets in the first of our two experiments is far from trivial we find that participants are well able to make rational decisions in this framework. This hopefully encourages further experimental research in complex situations with several differently informed and equipped agents.

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