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Price Discrimination and Fairness Concerns✦

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Abstract

We analyze the profitability of third degree price discrimination under consideration of consumers' fairness concerns within an experiment and explain the results within a theoretical framework. We find that with an increase in the price differential negative reciprocal reactions by disadvantaged consumers become stronger compared to positive reciprocal reactions by advantaged consumers. Consequently, the profit maximizing price differential lies below the one predicted to be optimal by standard theory. Further, profitability increases when consumers who are regarded as poorer are charged lower prices compared to when the wealth of the different consumer groups is unknown.

Keywords: price discrimination, reciprocal fairness, inequity aversion, experimental economics
JEL classification: D11, D12, E3

1 Introduction

Standard theory suggests that firms can substantially improve profitability through third degree price discrimination. But standard theory does not take into account that consumers might perceive it "unfair" to charge different prices to different consumer groups. Due to consumers' fairness concerns, the profitability of third degree price discrimination might be adversely affected. Amazon.com, for instance, antagonized its customers by charging different prices for the same DVD titles. Customers were so outraged that Amazon.com abolished its price discriminating strategy within only three days. It claimed that the price differences were the result of a random "price test" and refunded all customers who paid the higher prices.

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In the present paper, we seek to examine carefully how the profitability of third degree price discrimination is affected by consumers' fairness concerns. Besides the optimal price discriminating tariff, we are interested in whether the provided contextual information matters. In particular, we want to find out whether firms obtain higher profits when consumers know that those consumers who are poorer are charged lower prices compared to when consumers do not know the wealth of the other consumers. This question is motivated by the observation that consumers seem to object price discrimination based on income differences, e.g., student discounts, less than other forms of price discrimination, e.g., price discrimination on the internet based on consumers' purchasing history.

In the first part of this paper, we analyze the profitability of third degree price discrimination within a laboratory experiment. Subjects are split into groups of three, consisting of one firm, one h-consumer and one l-consumer. H-consumers' demand is less price elastic, so they are charged higher prices than l-consumers under price discrimination. They are also assigned a higher income. First, firms can choose between two different price menus. Thereafter, consumers can spend their income on the firms' product. For each purchasing decision consumers can make, they are informed about their own material payoff and that of the firms.

We analyze firms' profits when charging the discriminating tariff that is optimal under standard theory (denoted *spd* for strong price discrimination), when charging a weaker discriminating tariff *wpd*, and when charging a non-discriminating tariff *npd*. Further, we inquire whether firms' profits are affected when consumers know other consumers' price and income (treatment *i2*) compared to when they only know other consumers' price (treatment *i1*).

If consumers had no fairness preferences, firms would maximize their profits by charging the discriminating tariff *spd*. As a main result we find, however, that the weaker discriminating tariff *wpd* yields on average 5% higher profits than *spd* in treatment *i1* and 7% higher profits in treatment *i2*. Even the non-discriminating tariff *npd* yields on average 2% higher profits than *spd* in treatment *i1*. Thus, firms can increase profitability by choosing a *weaker* discriminating tariff than the one predicted to be optimal under standard theory.

We gain more insight by estimating the effect of consumers' reciprocal reactions on firms' profits. We find that firms' profits from h-consumers are adversely affected by h-consumers' reciprocal reactions under price discrimination, implying that the disadvantaged h-consumers punish firms by reducing their demand. In contrast, firms' prof-

its from l-consumers are positively affected, implying that the advantaged l-consumers reward firms by enhancing their demand. In line with empirical evidence of other studies, the *negative reciprocity effect* on firms' profits from h-consumers is strong and *significant*, whereas the *positive reciprocity effect* on firms' profits from l-consumers is weak and *not significant*. Consequently, firms' overall profits are negatively affected when choosing one of the discriminating tariffs, *wpd* or *spd*. Since the negative reciprocity effect intensifies compared to the positive reciprocity effect when firms choose the stronger price differential *spd*, firms obtain on average higher profits when choosing *wpd* than when choosing *spd*.

Furthermore, we find that the negative and positive reciprocity effects decrease when consumers know other consumers' income. Because the decrease of the negative reciprocity effect is stronger, firms obtain on average 1% higher profits when choosing *spd* and 3% higher profits when choosing *wpd*.

In the second part of this paper, we adopt the model by Falk and Fischbacher (2006) on reciprocity to explain the results of our experiment. We argue that consumers judge firms' pricing decisions by comparing the material payoff they can achieve by purchasing from the firms with the material payoff they believe *other consumers* can achieve. When they know other consumers' income they adjust their price fairness judgment and correct for the income difference. Since h-consumers are charged higher prices than l-consumers under price discrimination, h-consumers believe that the material payoff they can obtain is lower than that of l-consumers. Consequently, they regard firms' pricing decisions as unfair. Their perception of price unfairness intensifies when the price difference gets larger, and it diminishes when they learn that they have a higher income. Accordingly, l-consumers, who are charged lower prices, regard firms' pricing decisions as fair. Their perception of price fairness intensifies when the price difference gets larger, and it diminishes when they learn that they have a lower income. The model ascertains that in reaction to perceived price unfairness h-consumers punish firms by reducing their demand and in reaction to perceived price fairness l-consumers reward firms by enhancing their demand. To the extent that h-consumers' negative reactions are stronger than l-consumers' positive reactions, the model predicts that the profitability of third degree price discrimination will be adversely affected when the price differential increases, and the adverse effect will diminish when consumers know other consumers' income

The remainder of the paper is organized as follows. The paper continues in Section 2 with a summary of the previous literature. Section 3 provides a detailed description

of the experimental design. Section 4 highlights the main results of the experiment. In Section 5, we lay out a model on reciprocity in the context of third degree price discrimination based on Falk and Fischbacher (2006). Finally, Section 6 concludes and points out directions for future research.

2 Previous Literature

Price discrimination is an important strategic instrument for firms in many product markets. Not surprisingly, a great deal of theoretical work has been devoted to analyze the *optimal price discriminating tariff*, both under monopoly and oligopoly. For surveys on this literature see, e.g., Armstrong (2006) or Stole (2007). Empirical evidence on the issue is relatively scarce. While some studies have analyzed the profitability of second degree price discrimination, e.g., Nevo and Wolfram (2002) or Busse and Rysman (2005), there is only very little evidence on the profitability of third degree price discrimination. Leslie (2004) analyzes the effectiveness of discount mail coupons targeted to consumers with lower willingness to pay, using data from a Broadway play. Verboven (1996) and Goldberg and Verboven (2001) provide evidence of international price discrimination in the European car market. Borenstein (1991) shows that the differences in retail margins for leaded and unleaded gasoline are correlated with income and availability of leaded gasoline in a particular area.

A large literature studies the profitability of *price increases* under the consideration of consumers' fairness preferences. Kahneman, Knetsch, and Thaler (1986a,b) find that consumers are concerned with firms' intention behind price increases. They propose the *dual entitlement principle*, according to which consumers feel entitled to the terms of their reference transaction but acknowledge that firms are entitled to the terms of their reference transaction as well. Following this, consumers regard price increases as unfair if these price increases are not justified by increased costs and lead to an increase in firms' reference profit. Their arguments are illustrated within a formal model by Rotemberg (2005, 2011), verified by Franciosi et al. (1995), and complemented by Martins and Monroe (1994), Campell (1999), and Bolton, Warlop, and Alba (2003). In this literature, it is presumed that consumers compare their payoff of the current period with that of previous periods (self/self comparisons) and with that of firms (internal self/other comparisons).

Surprisingly little research has been devoted to the question how consumers' fairness preferences impact the effectiveness of *third degree price discrimination*. Rotemberg

(2011) offers a start in the analysis. He argues that consumers object third degree price discrimination in case it demonstrates *insufficient firm altruism*. He shows within a theoretical model that altruistic firms would price discriminate based on the income of different consumer groups, charging higher prices to consumers with a higher income. Therefore, selfish firms could profit by mimicking altruistic firms, also adopting price discrimination based on income differences while avoiding price discrimination based on demand elasticities. By contrast, in our model consumers do not judge firms' pricing decisions by their altruistic intentions but by the outcome, which is the material payoff the consumers can obtain by purchasing from the firms compared to the material payoff they believe *other consumers* can obtain (external self/other comparisons). Hence, consumers only object price discrimination when they are charged higher prices than other consumers. They even approve price discrimination when they are charged lower prices. Different profit implications arise. However, similar to Rotemberg (2011) we find that firms obtain higher profits when consumers know that those consumers with a higher income are charged higher prices compared to when the wealth of the different consumer groups is unknown.

Our theory that consumers form their price fairness judgments by comparing their material payoff with that of other consumers and not with that of firms seems natural as consumers often do not know firms' payoff. Also, other consumers are more comparable due to higher similarity. Our theory is supported by the results of a field study by Anderson and Simester (2008). The authors analyze consumers' reaction to premium prices for larger sizes of women's apparel. From a firm's perspective such premium prices for larger sizes of apparel are justified by higher material costs. Thus, when consumers compared their material payoff with that of firms, they should accept such premium prices. The authors find, however, that consumers who demand larger sizes react unfavorably to paying a higher price.

The main difference between the field experiment by Anderson and Simester (2008) and our laboratory experiment lies in firms' motivation for charging varying prices. While in the field experiment firms charge varying prices because of different production costs, in our laboratory experiment firms charge varying prices because consumers differ with respect to their demand elasticities.

In another related study, Shor and Oliver (2006) investigate the effect of couponing on consumers' purchasing probabilities. Couponing can be seen as a device to price discriminate. The authors find that consumers, who do not posses a coupon but are prompted for a coupon on a web site, are less likely to purchase. They partly ex-

plain this adverse effect with consumers' belief that they will also be able to obtain a coupon when searching on the internet. Such an effect does not arise in our setting, in which price discrimination is based on consumers' characteristics. In our setting, it is predetermined which consumers will have to pay higher prices.

Price fairness assessments are usually a comparative phenomenon. Specifically, consumers usually use *reference prices* as a basis for their price fairness judgments. A closely related research stream therefore asks how consumers actually form reference prices. Lichtenstein, Bloch, and Black (1988) and Janiszewski and Lichtenstein (1999) propose that consumers use internal memory-based references. Other authors stress the importance of external references, in particular of prices charged by competitors (see, e.g., Büyükkurt, 1986, Urbany, Bearden, and Weilbaker, 1988, Lichtenstein and Bearden, 1989, Alba et. al, 1994, and Dholakia and Simonson, 2005). We stipulate that under third degree price discrimination especially prices charged to other consumers contribute to the formation of consumers' reference prices.

The main contribution of this work is to provide empirical evidence and a theoretical explanation for how the profitability of third degree price discrimination is affected by consumers' fairness concerns. In our setting, different consumer groups are charged varying prices based on their characteristics and the motivation for charging varying prices is that consumers differ in their demand elasticities. As a new explanation for consumers' behavioral reactions we propose that they form their price fairness judgments by comparing the material payoff they can obtain by purchasing from a firm with the material payoff that other consumers can obtain. Thus, we look at a three-player setting, stressing the importance of external self/other comparisons in the context of third degree price discrimination. With this framing we can explain the empirical findings that firms obtain higher profits by charging a weaker price differential than the one predicted to be optimal under standard theory, and further that firms' profitability increases when consumers know that those consumers who are charged lower prices have a lower income compared to when they do not know other consumers' income.

3 Experimental Procedures and Design

The experiment was computer-based and conducted at the experimental laboratory MELESSA of the University of Munich in August 2010, using the experimental software z-Tree (Fischbacher, 2007) and the organizational software Orsee (Greiner, 2004). In

total, 192 participants were randomly recruited for 8 experimental sessions (graduate students were excluded). In any of the 8 experimental sessions 24 subjects participated. No subject could attend more than one session. On average, subjects earned 13.00 euro (including 4 euro show-up fee, with a minimum of 6.00 euro and a maximum of 21.40 euro) for a duration of approximately 50 minutes.

Upon arrival, subjects were seated at computer terminals in a large room that contains 25 terminals. The computer terminals are partitioned from each other by blinds, so that no subject could see the terminal screen of another participant. Subjects received three-pages instructions that were read aloud by the experimenter.[2] The instructions were framed in terms of a transaction in order to make the experiment less abstract and easier to understand. Before the experiment started subjects were asked to answer test questions that showed whether they understood the scenario, the tasks, and, in particular, the material payoff determination. The experiment started on the computer screen only after everybody had answered the test questions correctly and there were no further questions.

At the beginning of the experiment subjects were randomly assigned a type: *firm*, *h-consumer* or *l-consumer*. By experimental design, h-consumers' demand was less price elastic, so that they were charged higher prices than l-consumers under price discrimination. Further, h-consumers were assigned income $I_h = 400$ EP and l-consumers income $I_l = 200$ EP, where EP (Experimental Points) was the experimental currency, with an exchange rate such that 1 EP corresponded to 1 euro-cent. Everybody knew that each subject had the same chance to be assigned either type. Subjects kept their type in all parts of the experiment.

The main part of the experiment consisted of three rounds. At the beginning of each round, subjects were randomly put together into groups of three, with one firm, one h-consumer and one l-consumer. In every following round they were randomly reassigned to a new group.[3] Subjects were completely anonymous and not identifiable, i.e., it was impossible for them to build reputations over the three rounds.

In each round a one-shot game was played. The sequence of actions was the following. First, the firm was asked to choose one out of two price menus, where the choice of price menus varied across treatments. The firm was informed about her expected

[2]A translation of the experimental instructions is provided in Appendix B.

[3]Since in each session 24 subjects participated (8 firms, 8 h-consumers and 8 l-consumers), the number of group combinations was 120. Hence, the chance that subjects were assigned to the same group two times in three rounds was 0.0069%. The chance that consumers were assigned with one particular firm in one group two times in three rounds was 1.37%.

profits under standard theory, i.e., about her expected profits under the assumption that consumers solely maximize their material payoff. The firm's choice $(p_h,\ p_l)$ was made public to consumers, whereupon consumers could spend their income on the firm's product, making a purchasing decision. Consumers were informed about their material payoff when choosing quantities q_h and q_l, which was equal to

$$\pi_h = 400 + 32q_h - 0.8q_h^2 - p_h q_h,$$
$$\pi_l = 200 + 16q_l - 0.2q_l^2 - p_l q_l.$$

Next to the information on their own material payoff, consumers received information about the firm's material payoff, which was equal to

$$\pi_f = \begin{cases} 0 & \text{if } q_h = 0,\ q_l = 0, \\ p_h q_h + 500 & \text{if } q_h > 0,\ q_l = 0, \\ p_l q_l + 500 & \text{if } q_h = 0,\ q_l > 0, \\ p_h q_h + p_l q_l + 1000 & \text{if } q_h > 0,\ q_l > 0. \end{cases}$$

To account for the additional losses that firms usually incur when consumers switch to other firms, we determined that firms only obtained 500 EP extra when consumers did not "switch", that is, when they did not purchase nothing $(q_i = 0)$.

Consumers received the material payoff information as exemplified in Table 1. The tables provided consumers clear insights which quantity they had to choose in order to maximize their own material payoff and, if they deviated from that choice, how this would affect their own material payoff and the firm's material payoff. All subjects knew that they would be paid according to the outcome generated by one of their choices, to be selected at random from the three rounds.

Table 1: Information provided to consumers

Quantity	Benefit from purchasing	Expenditure	Your Payoff	Sellers' payoff from selling to you
⋮	⋮	⋮	⋮	⋮
8	205	128	477	628
9	223	144	479	644
10	240	160	480	660
11	255	176	479	676
12	268	192	476	692
13	279	208	471	708
⋮	⋮	⋮	⋮	⋮

The objective of the experiment was to learn which price menu firms should choose in order to maximize their profits. Specifically, we wanted to find out whether consumers indeed exhibit no fairness preferences in the context of third degree price discrimination, so that firms can maximize their profits by choosing the price menu predicted to be optimal under standard theory. Therefore, we analyzed firms' profits when choosing the price menu predicted to be optimal under standard theory, in our example $p_h = 16$ and $p_l = 8$ (denoted *spd* for strong price discrimination), when choosing a weaker discriminating price menu *wpd* with $p_h = 14$ and $p_l = 10$, and when choosing a non-discriminating price menu *npd* with $p_h = 12$ and $p_l = 12$. In each round firms could choose between one of these three price menus and an alternative price menu *apd* with $p_h = 40$ and $p_l = 20$. That is, each of the price menus *npd*, *wpd* and *spd* came up in one round of the experiment, always together with *apd*. The sequence in which the price menus came up varied across subjects.

The price menus *npd*, *wpd* and *spd* yielded positive profits under standard theory, whereas the price menu *apd* yielded zero profits under standard theory. We chose *apd* such that firms would in expectation obtain relative low profits because we were only interested in comparisons between *npd*, *wpd* and *spd* and thus we wanted to assure that firms would mainly choose *npd*, *wpd* and *spd* instead of *apd*.

Hence, firms' choice of price pairs was rather limited. As will become clearer in Section 5, when we outline the model, if consumers anticipated that firms' choice of price pairs was rather limited, this would have caused them to act less reciprocally. In practice, firms' choice of price pairs is of course unlimited. Thus, in practice consumers' behavioral reactions might be stronger than in our experimental setting.

We were also interested in whether firms can obtain higher profits by providing consumers information about other consumers' income. Consumers therefore received either information about other consumers' price (treatment *i1*), or information about other consumers' price *and* income (treatment *i2*). We kept the information levels constant over the three rounds. Table 2 provides an overview of the different treatments.

Table 2: Treatments

	i1 (p_j)	i2 (p_j, I_j)
no price discrimination ($p_h = 12,\ p_l = 12$)	*npd_i1*	*npd_i2*
weak price discrimination ($p_h = 14,\ p_l = 10$)	*wpd_i1*	*wpd_i2*
strong price discrimination ($p_h = 16,\ p_l = 8$)	*spd_i1*	*spd_i2*

Having finished the main part of the experiment, subjects were asked to play the

standard trust game.[4] The purpose was to verify whether consumers' reciprocal behavior in the experiment is correlated to their reciprocal behavior in the trust game. At last, subjects were asked to answer a short questionnaire about their socio-economic characteristics. Before subjects left, their earnings were paid to them in private by a person that was not the experimenter.

4 Experimental Results

In this section, we describe our experimental results. We first report which profits firms obtain on average in the different treatments. We then estimate how these profits are affected by consumers' reciprocal reactions. Further, we briefly examine the impact of self/self price comparisons over time. Finally, we show, as a robustness check, to what extent consumers' behavioral reactions to price discrimination are correlated to their behavioral reactions in the trust game.

4.1 Firms' Average Profits

Table 3 provides an overview of the average profits that firms obtain in the different treatments (in EP). We compute the percentage differential between firms' average profits in the experiment and firms' profits under standard theory in parentheses. Firms' profits under standard theory are the profits firms would obtain when consumers had no fairness preferences, i.e., when consumers always chose the quantities that maximized their own material payoff. Hence, a larger percentage differential reported in parentheses shows a larger impact of consumers' behavioral reactions on firms' profits. We report firms' profits from h-consumers, firms' profits from l-consumers, and firms' overall profits.

The results computed in Table 3 show that the price differential *spd*, which standard theory predicts to be optimal, yields on average 5% lower profits than the weaker price differential *wpd* in treatment *i1* and 7% lower profits in treatment *i2*.[5] In fact, it even yields on average 2% lower profits than the non-discriminating tariff *npd* in treatment *i1*. This suggests that the effectiveness of third degree price discrimination is deterred by negative consumer reactions, especially when the price differential is large. Firms

[4]For further information on the trust game see Section 4.4.

[5]Using a Mann Whitney U test or a Wilcoxon signed-rank test, we find no statistically significant evidence that firms' average profits differ across treatments. That is, we find no statistically significant evidence that *spd* yields higher profits than *wpd* or *npd*.

Table 3: Firms' average profits

Firms' average profits		npd	wpd	spd
from l-consumers	(i1)	512 (-17%)	605 (-7%)	620 (-6%)
	(i2)	517 (-17%)	598 (-8%)	606 (-8%)
from h-consumers	(i1)	648 (-2%)	591 (-10%)	516 (-20%)
	(i2)	584 (-12%)	629 (-4%)	540 (-16%)
overall	(i1)	1160 (-8%)	1195 (-8%)	1136 (-14%)
	(i2)	1101 (-13%)	1227 (-6%)	1146 (-13%)

Notes: Percentage differentials between firms' average profits and firms' profits under standard theory are reported in parentheses.

can obtain higher profits by choosing a weaker price differential than the one predicted to be optimal under standard theory.

As standard theory suggests, firms' average profits from l-consumers are higher when choosing *spd* than when choosing *npd*. Contrary thereto, firms' average profits from h-consumers are *lower* when choosing *spd* than when choosing *npd*. This indicates that the gains from third degree price discrimination are deterred by *h*-consumers' negative reciprocal reactions.

Another finding is that price discriminating firms obtain on average higher profits in *i2*-treatments than in *i1*-treatments. That is, firms' profitability is higher when consumers know other consumers' income (conditional on consumers with a less price elastic demand, who are charged a *higher* price, also having a *higher* income). This indicates that in practice firms can obtain higher profits when they price discriminate based on income differences, charging consumers who are generally regarded as poorer, like students or the elderly, lower prices, compared to when they price discriminate on characteristics that do not reveal consumers' wealth.[6]

4.2 Reciprocity Effect on Firms' Profits

In this section, we examine the impact of consumers' reciprocal reactions on firms' profits under third degree price discrimination. We find, in line with the existing

[6]The large profit differential in treatment *npd_i2* (-13%) compared to treatment *wpd_i2* (-6%) suggests that firms might be able to gain profits by charging consumers who are generally regarded as poorer a lower price, even if the demand of these poorer consumers is not more price elastic.

literature, that the degree of reciprocity is highly heterogeneous across consumers. 55% of consumers have no reciprocal preferences and choose in all three rounds the quantities that maximize their material payoff. The proportion of material payoff maximizing consumers is higher among l-consumers than among h-consumers (59% vs. 50%) and higher among women than among men (62% vs. 44%). In 10% of all purchasing decisions consumers choose *not* to purchase from the firm, i.e., to punish the firm maximally.

We conduct a multivariate OLS analysis to estimate how firms' profits are affected by consumers' reciprocal reactions. As dependent variable we use the percentage differential between firms' actual profits and firms' profits under standard theory.

In assessing the impact of consumers' reciprocal behavior on firms' profits, we face the following difficulty. If consumers reduce their demand, this can either be seen as inequality-reducing behavior (following consumer/firm comparisons) or as reciprocal punishment (following consumer/consumer comparisons), given the firm price discriminated and charged these consumers higher prices than other consumers. Similarly, when consumers increase their demand, this can either be seen as social-surplus-increasing behavior or as reciprocal reward, given the firm price discriminated and charged these consumers lower prices than other consumers.[7,8] While inequality-reducing behavior and social-surplus-increasing behavior may arise under both, price discrimination and non-price discrimination treatments, reciprocal behavior may only arise under price discrimination treatments. We want to focus on the reciprocity hypothesis and its ability to explain deviations from standard theory. Thus, in order to isolate the reciprocity effects we include dummy variables for all treatments as dependent variables into the regression with the exception of *npd_i1* (see Table 2). The regression then shows the additional behavioral effects that arise in the price discrimination treatments compared to the non-price discrimination treatment *npd_i1*. We will interpret these additional effects as reciprocity effects.[9]

As control variable we include a gender dummy variable which equals one if a consumer is female. Further, we include a variable denoted *trustgeneral* that is obtained

[7] In our setting social surplus-increasing behavior is unlikely as the benefit of firms when consumers increase their demand is only slightly higher than the loss consumers incur by doing so.

[8] Charness and Rabin (2002) provide an interesting analysis on the difference between the mentioned social preferences.

[9] Inequality reducing behavior would not be singled out entirely if consumer/firm comparisons varied across treatments. That would, for instance, be the case if h-consumers believed that firms obtain much higher profits when charging *spd* than when charging *npd*, and in consequence reduced their quantity choice by more when being charged *spd*. The effects we report as reciprocity effects would then be overestimated as they would consist of reciprocity *and* inequity aversion effects.

from consumers' answers of the questionnaire at the end of the experiment. There, subjects were asked to what extent they would confirm that one can generally trust others, with possible answers ranging from zero for "trusting" to three for "not trusting". We also include a dummy variable *apd*, which indicates whether a consumer was charged the alternative price menu *apd* in a previous round. Under *apd* subjects are exposed to comparatively high prices and may therefore perceive subsequent price offers, be it *npd*, *wpd* or *spd*, as less unfair/more fair. So, we expect the coefficient for *apd* to be positive, implying that consumers punish less or reward more after they have been exposed to relatively high prices under *apd* before. Furthermore, we adjust standard errors for 64 clusters in consumers' identity.

The regression results are presented in Table 4. Again, we distinguish between firms' profits from h-consumers, firms' profits from l-consumers and firms' overall profits. The coefficients of interest are the coefficients of the price discrimination treatments. A negative treatment coefficient, for instance, indicates that firms' profits are negatively affected by consumers' reciprocal reactions.

The estimation shows that the difference between firms' actual profits from h-consumers and firms' profits from h-consumers under standard theory, denoted $\Delta\pi_f$ (h-consumers), is 12.74 percentage points lower in treatment *wpd_i1* than in treatment *npd_i1* (see column 1 of Table 4). This suggest that under price discrimination firms' profits from h-consumers are negatively affected due to negative reciprocity.

By contrast, the difference between firms' actual profits from l-consumers and firms' profits from l-consumers under standard theory, denoted $\Delta\pi_f$ (l-consumers), is 9.83 percentage points *higher* in treatment *wpd_i1* than in treatment *npd_i1* (see column 2 of Table 4). This implies that under price discrimination firms' profits from l-consumers are positively affected due to positive reciprocity. The *positive reciprocity effect* on firms' profits from l-consumers is, however, *smaller than the negative reciprocity effect* on firms' profits from h-consumers, and it is not significant.

That positive reciprocity is a comparatively weak factor has also been found in other recent experimental studies. Consumers seem to react more when price differences are unfavorable to them, implying that they count negative deviations from the reference outcome more than positive deviations. Xia, Monroe, and Cox (2004) explain this finding with the different emotions that consumers have in the two states. In the context of third degree price discrimination the disadvantaged h-consumers presumably have *strong* negative feelings such as anger or disappointment, while the advantaged l-consumers may have *weak* positive feelings such as egoism-based pleasure or satisfac-

Table 4: Reciprocity impact on firms' profits

VARIABLES	$\Delta\pi_f$ (h-consumers)	$\Delta\pi_f$ (l-consumers)	$\Delta\pi_f$ (overall)
npd_i2	-11.34*	-0.796	-6.338
	(5.705)	(9.417)	(5.481)
wpd_i1	-12.74**	9.832	-2.013
	(6.040)	(7.258)	(4.688)
wpd_i2	-7.429*	7.524	-0.248
	(4.440)	(8.310)	(4.117)
spd_i1	-24.17***	10.76	-7.197
	(8.122)	(9.010)	(5.603)
spd_i2	-19.62***	6.969	-6.202
	(6.734)	(8.271)	(4.832)
gender_h	16.55***		9.851**
	(5.245)		(3.799)
trustgeneral_h	-16.37***		-7.833**
	(4.667)		(3.301)
apd_h	14.22**		12.98***
	(5.934)		(3.245)
gender_l		9.494*	3.543
		(5.060)	(3.246)
trustgeneral_l		-1.007	-0.416
		(2.784)	(2.204)
apd_l		4.609	2.186
		(5.803)	(5.174)
Constant	13.27**	-21.43**	-5.014
	(6.511)	(8.479)	(6.324)
Observations	181	181	181
R-squared	0.223	0.049	0.138

Notes: The table reports coefficients of OLS regressions. The dependent variables are the percentage differentials between firms' actual profits (from h-, l-, h- and l-consumers) and firms' profits (from h-, l-, h- and l-consumers) under standard theory. The treatment *npd_i1* is the baseline. Robust standard errors are reported in parentheses. The regressions are clustered by consumers and therefore control for individual fixed effects. *** denotes p<0.01, ** denotes p<0.05, and * denotes p<0.1.

tion.

Because the negative reciprocity effect on firms' profits from h-consumers is higher than the positive reciprocity effect on firms' profits from l-consumers, firms' overall profits are negatively affected by consumers' reciprocal reactions. Specifically, the overall profit differential, denoted $\Delta\pi_f$ (overall), is 2.01 percentage points lower in treatment *wpd_i1* than in treatment *npd_i1* (see column 3 of Table 4). This negative reciprocity effect on firms' overall profits is also not significant.

The results shown in Table 4 further reveal that $\Delta\pi_f$ (h-consumers) is even lower in treatment *spd_i1* than in treatment *wpd_i1*, implying that the negative reciprocity effect intensifies with the size of the price differential. Compared to treatment *npd_i1*, the profit differential is 12.74 percentage points lower in treatment *wpd_i1* and 24.17

percentage points lower in treatment *spd_i1*.[10]

The positive reciprocity effect also seems to increase with the size of the price differential. Compared to treatment *npd_i1*, the profit differential is 9.83 percentage points higher in treatment *wpd_i1* and 10.76 percentage points higher in treatment *spd_i1*. Clearly, the increase in the positive reciprocity effect is weaker than the increase in the negative reciprocity effect, and it is not significant.

Because *the negative reciprocity effect* on firms' profits from disadvantaged consumers *intensifies with the size of the price differential compared to the positive reciprocity effect* on firms' profits from advantaged consumers, the negative reciprocity effect on firms' overall profits is higher in treatment *spd_i1* than in treatment *wpd_i1*. In particular, the negative reciprocity effect on firms' overall profits is 2.01 percentage points in treatment *wpd_i1* and 7.20 percentage points in treatment *spd_i1*. The increase in the negative reciprocity effect on firms' overall profits is, however, not significant.[11]

The estimation further shows that the negative reciprocity effect on firms' profits from h-consumers is lower in *i2*-treatments than in *i1*-treatments. Specifically, the negative reciprocity effect decreases from 12.74 percentage points in treatment *wpd_i1* to 7.43 percentage points in treatment *wpd_i2* and from 24.17 percentage points in treatment *spd_i1* to 19.62 percentage points in treatment *spd_i2*.[12] This suggests that h-consumers punish firms less for charging them a higher price, when they know that they have a higher income.

The positive reciprocity effect on firms' profits from l-consumers is also lower in *i2*-treatments than in *i1*-treatments, suggesting that l-consumers reward firms less for charging them a lower price when they know that they have a lower income. In particular, the positive reciprocity effect decreases from 9.83 percentage points in treatment *wpd_i1* to 7.52 percentage points in treatment *wpd_i2*, and from 10.76 percentage points in treatment *spd_i1* to 6.97 percentage points in treatment *spd_i2*.[13]

So, the negative as well as the positive reciprocity effect are lower in *i2*-treatments than in *i1*-treatments. Since the negative reciprocity decreases by more, *firms' overall*

[10]The ANOVA results show no significant difference between treatments *wpd_i1* and *spd_i1* (Prob > F = 0.20) but between treatments *wpd_i2* and *spd_i2* (Prob > F = 0.08).

[11]The ANOVA results show that the difference between treatment *wpd_i1* and treatment *spd_i1* with regard to firms' overall profits is not significant (Prob > F = 0.358).

[12]The ANOVA results show that the differences between *i1*- and *i2*-treatments with regard to firms' profits from h-consumers are not significant. For *wpd* we obtain Prob > F = 0.384, and for *spd* we obtain Prob > F = 0.729.

[13]The ANOVA results show that the differences between *i1*- and *i2*-treatments with regard to firms' profits from l-consumers are not significant. For *wpd* we obtain Prob > F = 0.864, and for *spd* we obtain Prob > F = 0.761.

profits are less negatively affected in i2-treatments than in *i1*-treatments. In particular, the negative reciprocity effect on firms' overall profits decreases from 2.01 percentage points in treatment *wpd_i1* to 0.25 percentage points in treatment *wpd_i2*, and from 7.20 percentage points in treatment *spd_i1* to 6.20 percentage points in treatment *spd_i2*.[14] Thus, firms seem to obtain higher profits when consumers know that disadvantaged consumers have a higher income. However, the differences in reciprocity effects between *i2*- and *i1*-treatments are not significant.

Interestingly, the estimations reported in Table 4 also show that firms obtain significantly higher profits from *female* consumers, suggesting that female h-consumers punish significantly less and that female l-consumers reward significantly more. Similarly, firms obtain significantly higher profits from h-consumers who rather confirm in the questionnaire that they generally trust others.

4.3 Self/Self Price Comparisons Over Time

The experiment was designed such that not only self/other price comparisons arise but also self/self price comparisons over time. Clearly, self/self price comparisons over time might influence consumers' price fairness perceptions. When consumers were previously charged a lower price, they might feel entitled to this lower price and perceive subsequent higher prices as less fair/more unfair. Likewise, when they were previously charged a higher price, they might perceive subsequent lower prices as more fair/less unfair. In this section, we account for self/self comparisons by including dummy variables $p_{-1|low}$ and $p_{-1|high}$ in the regression of the reciprocity impact on firms' profits. These dummy variables indicate whether a consumer was charged a lower price in the previous round ($p_{-1|low} = 1$), whether a consumer was charged a higher price in the previous round ($p_{-1|high} = 1$), or none of these cases for observations in the first round ($p_{-1|low} = p_{-1|high} = 0$). Results are shown in Table 6 in Appendix A.

We find no statistically significant influence of self/self price comparisons over time. This supports an argument made by Xia, Monroe, and Cox (2004) that self/other comparisons are likely to have a greater effect on consumers' price fairness judgments than self/self comparisons. However, sign and size of the coefficients $p_{-1|low}$ and $p_{-1|high}$ suggest that firms obtain lower profits when consumers were previously charged a lower price, implying that a lower price in the previous round causes consumers to punish

[14] The ANOVA results show that the differences in means between the *i1*- and *i2*-treatments with regard to firms' overall profits are not significant. For *wpd* we obtain Prob > F = 0.640 and for *spd* we obtain Prob > F = 0.901.

more or reward less in the actual round. By contrast, firms seem to obtain higher profits when consumers were previously charged a higher price, implying that a higher price in the previous round causes consumers to punish less or reward more in the actual round. These effects are, however, not significant.

4.4 Correlation Between Consumers' Behavior in the Experiment and in the Trust Game

Following the main part of the experiment, subjects were asked to play the standard trust game. In the trust game responders positively reciprocate by rewarding a sender based on both the gains from exchange to the responder as well as the responder's belief about the intention motivating the action of the sender. We assigned consumers the role of responders in order to be able to test whether their (reciprocal) behavior in the experiment is correlated to their reciprocal behavior in the trust game. Firms, in the role of senders, received 20 EP and could send any amount between 0 and 10 EP to *two* consumers.[15] The amount they sent was tripled by the experimenter. Thereupon, consumers had a contingent choice (strategy method of elicitation) to send any amount, they potentially received, back to the firms. They were informed that their decision only affected the outcome of the firms if the firms opted to give them that choice.

We measure the strength of the linear relationship between consumers' reciprocal behavior in the experiment and in the trust game using the Pearson Correlation Coefficient. As an indicator for consumers' reciprocal behavior in the experiment, we use the percentage of material payoff consumers are willing to give up to punish or reward firms ($\Delta\pi_h$ and $\Delta\pi_l$). And as an indicator for consumers' reciprocal behavior in the trust game we use the standard deviation of amounts that consumers choose to send back to firms dependent on the firms' choices (std_tg).[16] Table 5 shows the results.

Since consumers presumably do not behave reciprocally in the non-price discrimination treatments *npd* we find no statistically significant linear correlations between $\Delta\pi_h$ (npd) and $\Delta\pi_l$ (npd) on the one hand and std_tg on the other hand. In contrast, we do find statistically significant linear correlations between $\Delta\pi_h$ (wpd) and $\Delta\pi_h$ (spd) on the one hand and std_tg on the other hand, with a stronger relationship between $\Delta\pi_h$ (spd) and std_tg than between $\Delta\pi_h$ (wpd) and std_tg. This supports the result that h-consumers behave reciprocally under third degree price discrimination, and that they

[15]The conversion rate changed to 1 EP = 10 euro-cent.

[16]The results would be similar when we used the average amount that consumers send back as indicator for consumers' reciprocal behavior in the trust game.

Table 5: Pearson Correlation Coefficients

	$\Delta\pi_h(npd)$	$\Delta\pi_h(wpd)$	$\Delta\pi_h(spd)$	$\Delta\pi_l(npd)$	$\Delta\pi_l(wpd)$	$\Delta\pi_l(spd)$
std_tg	0.004	-0.256**	-0.320**	-0.072	-0.158	-0.146
	(0.975)	(0.048)	(0.012)	(0.586)	(0.229)	(0.262)

Notes: The table reports Pearson Correlation Coefficients between subjects' reciprocal behavior in the experiment (captured by $\Delta\pi$) and in the trust game (captured by std_tg). Significance levels are reported in parentheses; *** denotes p<0.01, ** denotes p<0.05, and * denotes p<0.1.

do so the more, the stronger the degree of price discrimination is. Since we already found a weaker and not significant positive reciprocity effect on firms' profits from l-consumers, unsurprisingly we also find weaker and not significant linear correlations between $\Delta\pi_l$ (*wpd*) and $\Delta\pi_l$ (*spd*) on the one hand and *std_tg* on the other hand.

5 A Simple Model of Reciprocity in the Context of Third Degree Price Discrimination

Our experimental results suggest that consumers exhibit social preferences when being price discriminated. Depending on the price they are charged compared to other consumers they either regard price discrimination as fair or unfair. In reaction to perceived price fairness or unfairness consumers behave reciprocally, raising or lowering firms' profits by raising or lowering their demand. In this section, we formalize *reciprocity* in the context of third degree price discrimination, adapting the framework developed by Falk and Fischbacher (2006).[17] Our goal is to explain formally (i) how consumers react to price discrimination when they are charged higher and when they are charged lower prices than other consumers, (ii) how their reactions alter when the price differential increases, (iii) how their reactions alter when they get to know not only the price but also the income of other consumers, and most importantly (iv) to what extent the profitability of third degree price discrimination is affected by consumers' fairness concerns.

An extensive literature studies *reciprocity* of economic agents in decision making (for surveys see, e.g., Sobel, 2005 or Fehr and Schmidt, 2006). In Fehr and Schmidt (1999)

[17]For simplification we neglect in our framework that consumers might also be motivated to reduce the difference between their material payoff and that of the firm by reducing their demand (see, e.g., Fehr and Schmidt, 1999), and further that consumers might be willing to increase social surplus, i.e., the joint payoff with the firm, by enhancing their demand (see, e.g., Charness and Rabin, 2003).

and Bolton and Ockenfels (2000) fairness evaluations are based upon interpersonal payoff comparisons. Players reciprocate in order to reduce inequity in payoffs. On the other hand, in Rabin (1993) and Dufwenberg and Kirchsteiger (2004) reciprocity is driven by intentions and not necessarily as a desire to reduce inequity.[18] Players positively reciprocate fair intentions and negatively reciprocate unfair ones. In Falk and Fischbacher (2006) both concepts are combined. Our framework differs from the previous ones in one dimension. While the previous models consider the case in which two players evaluate the intention and/or the outcome of the other player's action and react reciprocally toward the other, our model involves three players, a firm and two consumers. A consumer judges the *intention* behind a firm's pricing decision by its *outcome*, which is *not* the difference between her material payoff and that of the firm but rather the difference between the material payoff she can obtain by purchasing from the firm and the material payoff she believes the other consumer can obtain. While in Fehr and Schmidt (1999) and Bolton and Ockenfels (2000) players reciprocate toward a second player to *reduce* inequity between them, in our model players reciprocate toward a second player *because of* inequity between them and a third player, which is, however, caused by the second player. Thus, in our model reciprocity is driven by intentions and intentions are evaluated by caused inequity. We could adapt any of the intention-based reciprocity models to explain our experimental results on reciprocity in the context of third degree price discrimination. However, for our purposes the Falk and Fischbacher (2006) model is particularly suitable as it considers both the role of intentions *and* inequity aversion as sources of reciprocal behavior.

As in the experiment we consider a one stage game between three agents: a firm, an h-consumer and an l-consumer.[19] Firm F moves first, charging prices p_h and p_l to consumers h and l, whereupon the consumers purchase quantities q_h and q_l from F. Let h-consumers have a higher income than l-consumers, that is, $I_h > I_l$, and let their demand be less price elastic. According to standard theory F then optimally sets $p_h > p_l$, provided price discrimination is feasible.

We account for reciprocity by allowing the utility of consumer i ($i \neq j,\ i,j = h,l$) when choosing quantity q_i to depend not only on her *material payoff* $\pi_i(q_i)$, as standard theory would suggest, but also on her *reciprocity utility*. The reciprocity utility consists

[18] Fehr and Schmidt (1999) emphasize that the outcome of an action to some extent also reveals its underlying intention.

[19] The model by Falk and Fischbacher (2006) actually considers n-stages. To provide an understanding of the nature of reciprocity in the context of third degree price discrimination we concentrate on the one stage game.

of a reciprocity parameter $\rho_i \geq 0$ which measures consumer i's *individual reciprocal preferences*, a kindness term $\varphi_i(\cdot)$ which measures the *kindness* of the firm's pricing decision as perceived by consumer i, and a reciprocation term $\sigma_i(q_i)$ which measures consumer i's *reciprocal response* to the perceived kindness.

Consumer i's utility when choosing quantity q_i is defined as:

$$U_i(q_i) := \pi_i(q_i) + \rho_i \, \varphi_i(\cdot) \, \sigma_i(q_i).$$

The higher the *individual reciprocity parameter* ρ_i, the more weight puts consumer i on her reciprocity utility as compared to her material payoff. In the following, we derive the kindness term $\varphi_i(\cdot)$ and the reciprocation term $\sigma_i(q_i)$.

Falk and Fischbacher (2006) define the *kindness term* as $\varphi_i := \upsilon_i \Delta_i$, where the *intention factor* υ_i captures whether individuals have choice alternatives or not. For instance, if F chooses a price pair that is disadvantageous for consumer i, consumer i will perceive F's pricing decision as less unkind if F could only choose between price pairs that are disadvantageous for consumer i, compared to when F could also have chosen price pairs that are advantageous for consumer i. A restriction in F's choice alternatives is captured by $\upsilon_i < 1$. Since in the context of third degree price discrimination consumers are likely to perceive firms' pricing decisions as fully intentional as firms usually have unrestricted choice alternatives when deciding on prices, we assume that $\upsilon_i = 1$.[20]

Consequently, the kindness of F's pricing decision as perceived by consumer i is measured by the *outcome of F's pricing decision* (Δ_i) only. The outcome of F's pricing decision is the *material payoff that consumer i can obtain* by purchasing from F compared to a *reference standard*. This reference standard could be the payoff that F obtains by selling to consumer i (internal self/other comparison). However, consumers usually do not know which payoff firms obtain. Other consumers are also more comparable than firms as other consumers have more similarities. Therefore, we assume that consumer i compares the material payoff that she can obtain being priced p_i with the material payoff that she believes consumer j can obtain being priced p_j (external self/other comparison).

[20]In the experiment, however, firms could only choose between *two* price pairs, and one of these price pairs, *apd*, was clearly inferior to the other. If consumers anticipated that firms had a restricted choice, this would have caused them to perceive firms' pricing decisions as less unkind/kind (since $\upsilon_i < 1$ then) and thus to reciprocate less. The reciprocity effects we observed in the experiment would then be lower than the reciprocity effects to be observed in real market environments.

The outcome term Δ_i is defined as:

$$\Delta_i := \pi_i(p_i, \overline{q}_i) - \pi_j(p_j, \overline{q}_j) + \gamma_i(I_i - I_j),$$

where $\pi_i(p_i, \overline{q}_i)$ denotes consumer i's maximally achievable material payoff, $\pi_j(p_j, \overline{q}_j)$ denotes consumer i's belief about consumer j's maximally achievable material payoff, I_i denotes consumer i's income, I_j denotes consumer i's belief about consumer j's income, and $\gamma_i \in [0, 1)$ captures by how much consumer i accounts for the believed income difference in her price fairness evaluation.

We assume, when consumer i receives no information to the contrary, she believes that consumer j has identical characteristics, i.e., she believes that $\pi_j(p_j, \overline{q}_j) = \pi_i(p_j, \overline{q}_i)$ and $I_j = I_i$. This implies that consumer i forms her price fairness judgment by comparing the material payoff that she can maximally achieve being priced p_i with the material payoff she could maximally achieve when she was priced p_j. The outcome term Δ_i will then be negative and she will regard F's pricing decision as unkind, when her price is higher than that of consumer j ($p_i > p_j$). If, on the other hand, she is charged a lower price than consumer j, the outcome term Δ_i will be positive and she will regard F's pricing decision as kind.

The higher the price consumer i is charged compared to consumer j, the lower she will believe is her maximally achievable material payoff compared to that of consumer j, and thus she will regard F's pricing decision as more unkind (Δ_i decreases $p_i - p_j > 0$). Vice versa, the lower the price consumer i is charged compared to consumer j, the higher she will believe is her maximally achievable material payoff compared to that of consumer j, and thus she will regard F's pricing decision as more kind (Δ_i increases with $p_i - p_j < 0$). This means, the disadvantaged h-consumers will perceive F's pricing decision as more unfair when the price differential increases, while the advantaged l-consumers will perceive F's pricing decision as more fair when the price differential increases.

We allow for implicit price comparisons by incorporating $\gamma_i(I_i - I_j)$ into the outcome term. The term $(I_i - I_j)$ denotes the difference between consumer i's income and consumer i's belief about consumer j's income. The parameter γ_i captures the extent to which consumer i accounts for the believed income difference in her price fairness judgment. If consumer i does not know consumer j's income, she believes that consumer j has the same income, so that the term $\gamma_i(I_i - I_j)$ cancels out. The correction of consumer i will then be zero. If, however, consumer i knows consumer j's income,

she will accept a higher price more when she has a higher income than consumer j (i.e., Δ_i will be higher if $I_i - I_j > 0$), and *she will feel more entitled to a lower price when she has a lower income* than consumer j (i.e., Δ_i will be lower if $I_i - I_j < 0$). The model therefore predicts that with the income information h-consumers will accept a higher price more, whereas l-consumers will accept a lower price less. The larger the income difference, the more it will influence consumers' price fairness judgments.

We now derive the *reciprocation term* σ_i, which captures how consumer i alters her quantity choice (q_i) and thus F's payoff in response to the experienced kindness.

The reciprocation term σ_i is defined as:

$$\sigma_i(q_i) := \begin{cases} \pi_f(q_i) - \pi_f(\overline{q}_i) & \text{if } \Delta_i \leq 0 \\ \alpha_i \left[\pi_f(q_i) - \pi_f(\overline{q}_i)\right] & \text{if } \Delta_i > 0 \end{cases},$$

where $\pi_f(q_i)$ denotes F's material payoff when consumer i purchases q_i. Further, $\overline{q}_i$ denotes the quantity choice that would maximize consumer i's material payoff, and $\alpha_i \in [0, 1)$ denotes an individual discount factor for positive reciprocity.

When $\Delta_i < 0$ holds and consumer i perceives F's pricing decision to be unfair, she can increase her utility by negatively reciprocating, i.e., by choosing a lower quantity than $\overline{q}_i$, thereby lowering F's profit. By contrast, when $\Delta_i > 0$ holds and consumer i perceives F's pricing decision to be fair, she can increase her utility by positively reciprocating, i.e., by choosing a higher quantity than $\overline{q}_i$, thereby enhancing F's profit. While in the former case the reciprocation term σ_i will be negative, in the latter case it will be positive. The more unkind consumer i perceives F's pricing decision, i.e., the lower Δ_i, the more will consumer i be able to increase her utility by negatively reciprocating, choosing a lower quantity than $\overline{q}_i$. Vice versa, the more kind consumer i perceives F's pricing decision, i.e. the more positive Δ_i, the more will consumer i be able to increase her utility by positively reciprocating, choosing a higher quantity than $\overline{q}_i$.

The empirical evidence from our experiment suggests that consumers count negative deviations from the reference outcome more than positive deviations. Thus, when consumer i's individual reciprocity parameter ρ_i is positive, her utility loss from a disadvantageous price differential is presumably larger than her utility gain from an equally sized advantageous price differential. We account for that by incorporating α_i into the reciprocation term, which discounts the utility that consumer i can obtain by positively reciprocating. This implies that negative consumer reactions will be stronger

than positive consumer reactions.

The assumption that $\alpha_i < 1$ has important implications for the profitability of third degree price discrimination. It implies that the profitability of third degree price discrimination will be *negatively* affected by consumers' reciprocal reactions, especially when Δ_h is high. That is, the more unfair the disadvantaged h-consumers perceive F's pricing decision the more negatively profits will be affected due to reciprocity. To which extent h-consumers perceive F's pricing decision as unfair depends first of all on the price differential. *The higher the price h-consumers are charged compared to l-consumers, the stronger will be h-consumers' negative reactions compared to l-consumers' positive reactions, averting the profitability of third degree price discrimination.* Thus, the negative effect on the profitability of third degree price discrimination will increase with the price differential $|p_i - p_j|$.

Further, the extent to which h-consumers perceive F's pricing decision as unfair depends on the disclosure of income information. If h-consumers know that they have a higher income than l-consumers, they perceive a higher price as less unfair and in reaction punish less. L-consumers, on the other hand, perceive a lower price as less fair and in reaction reward less. Due to the assumption that $\alpha_i < 1$, the positive acceptance effect on the side of h-consumers will have stronger profit implications than the negative entitlement effect on the side of l-consumers. Put differently, when consumers are informed about other consumers' income, the gains that F obtains from h-consumers due to increased acceptance of a higher price will be larger compared to the losses that F incurs from l-consumers due to decreased appreciation of a lower price. Thus, the negative effect on the profitability of third degree price discrimination will be lower when consumers are informed about other consumers' income (and the consumer group with the less price elastic demand has a higher income).

As argued by Rotemberg (2011), consumers might perceive F's *intention behind price discrimination* as more benevolent when they obtain the income information. H-consumers will then perceive F's pricing decision as less unfair (in line with the positive acceptance effect put forward in our model), while l-consumers will then perceive F's pricing decision as more fair (in contrast with the negative entitlement effect put forward in our model). The results of our experiment suggest that even if l-consumers perceived F's intention behind price discrimination to be more benevolent when they obtain the income information, the negative entitlement effect (as described in our model) would still prevail. This is because the positive reciprocity effect on firms' profits from l-consumers is *lower* in *i2*-treatments than in *i1*-treatments.

6 Concluding Remarks

We conducted an experimental study which showed that the profitability of third degree price discrimination is negatively affected by consumers' fairness concerns. The higher the price differential that firms charge, the stronger are negative reactions by disadvantaged consumers compared to positive reactions by advantaged consumers. As a consequence, firms obtain higher profits by charging a weaker price differential than the one predicted to be optimal under standard theory. Furthermore, we found that price discriminating firms obtain higher profits when consumers are informed about other consumers' income. This is because the disadvantaged consumers, who have a higher income in our setting, react less negative and the advantaged consumers react less positive. Overall, the negative reactions attenuate compared to the positive reactions.

We explained these results within a theoretical framework, that is based on Falk and Fischbacher (2006). The model stipulates the following. When consumers have no reciprocal preferences, then, regardless of whether they perceive firms' pricing decisions as fair or not, they will optimally choose the quantity that maximizes their material payoff. If, on the other hand, they have reciprocal preferences, then, depending on whether they perceive firms' pricing decisions as fair or unfair, they will optimally choose a higher or lower quantity than the quantity that maximizes their material payoff, thereby either rewarding or punishing the firms. Whether consumers regard firms' pricing decisions as fair or unfair depends on the price they are charged compared to other consumers. If they are charged a higher price they will generally regard the pricing decision as unfair. However, when they know that they also have a higher income than the other consumers they will regard it as *less* unfair. Vice versa, consumers who are charged lower prices than other consumers will regard the pricing decision as fair and less so when they know that they have a lower income. Negative consumer reactions will be stronger than positive consumer reactions, in particular when the price differential is large. Thus, the negative reciprocity effect on the profitability of third degree price discrimination will increase with the price differential and it will be lower when consumers are informed about other consumers' income.

Future research should explore the impact of consumers' fairness concerns on the profitability of third degree price discrimination more broadly and consider a number of other individual and contextual factors, such as short-term versus long-term customer/seller relationships, or consumers' switching options. Consumers in long-term

customer/seller relationships might feel entitled to lower prices and therefore punish firms more when being negatively price discriminated. Further, the adverse effects on the profitability of third degree price discrimination might aggravate when consumers do not suffer high losses when they switch to other firms.

A limitation of our study is that it focuses on short-run profit implications. It would be very interesting to also explore the long-run profit implications. It could well be possible that disadvantaged consumers only initially perceive higher prices as unfair and accept them *over time*, so that higher price differentials become more profitable over time.

A Regression Results

Table 6: Reciprocity impact on firms' profits considering self/self comparisons

VARIABLES	$\Delta\pi_f$ (h-consumers)	$\Delta\pi_f$ (l-consumers)
spd_i1	-20.97**	7.936
	(8.187)	(10.06)
spd_i2	-15.48*	2.864
	(9.009)	(9.543)
gender_h	16.20**	
	(6.912)	
trustgeneral_h	-15.82**	
	(6.333)	
apd_h	15.92*	
	(8.818)	
$p^h_{-1\|low}$	-6.857	
	(10.86)	
$p^h_{-1\|high}$	2.048	
	(5.825)	
gender_l		11.77*
		(6.100)
trustgeneral_l		-3.798
		(3.547)
apd_l		0.941
		(9.560)
$p^l_{-1\|low}$		-7.022
		(12.77)
$p^l_{-1\|high}$		-1.416
		(8.249)
Constant	11.62	-14.38
	(8.956)	(11.67)
Observations	90	90
R-squared	0.228	0.070

Notes: The table reports coefficients of OLS regressions. The dependent variables are the percentage differentials between firms' actual profits (from h- or l-consumers) and firms' profits (from h- or l-consumers) under standard theory. The treatment *npd_i1* is the baseline. Robust standard errors are reported in parentheses. The regressions are clustered by consumers and therefore control for individual fixed effects. *** denotes p<0.01, ** denotes p<0.05, and * denotes p<0.1.

Here, we only include the treatment variables *spd_i1* and *spd_i2* and compare them to the treatment *npd_i1*. This is because the experiment was designed in such a way that in the first rounds only *npd* and *spd* treatments came up, not *wpd* treatments. Thus, we do not have observations for *wpd_i1* or *wpd_i2* in the first rounds, where $p_{-1|low} = p_{-1|high} = 0$. So, if we included the treatment variables *wpd_i1* and *wpd_i1* in the regressions, we would not have a base category against which the dummy variables $p_{-1|low}$ and $p_{-1|high}$ would be assessed, which would lead to perfect multicollinearity.

B Translation of the Instructions

General Information about the Course of the Experiment

This experiment analyses economic behavior in markets. During the experiment you and the other participants can earn money by making decisions. The amount of money you earn depends on your own decisions as well as on the decisions of the other participants and is determined by the rules that will be explained in the following in detail.

The entire experiment takes about 60 minutes. At the beginning you will receive detailed instructions. If you have questions after these instructions, please raise your hand. The experimenter will then come to you and answer your questions privately. Each participant is given a number by which he may be identified during the course of the experiment. Due to linguistic simplicity, we only use male terms in these instructions. These are supposed to be understood gender neutral.

Anonymity

The main part of the experiment consists of 3 rounds. At the beginning of each round you will be randomly assigned to a group consisting of 3 participants. You will not learn the identity of the participants that you are in a group with, neither during nor after the experiment. Also other participants will not learn about your role, your decisions and how much you earned. We will analyze the data from the experiment only **anonymously**. At the end of the experiment, you must sign an acknowledgment of the receipt of payoff. But this is only for the accounting.

Groups

At the beginning of the experiment you are randomly assigned the role of a seller or the role of a buyer. This role you will keep over all three rounds. At the beginning of each round you will be randomly assigned to a group, consisting of one seller and two buyers. In each subsequent round, your group will be randomly re-assembled.

Payoffs

Your payoffs will be paid to you at the end of the experiment. We randomly choose the result of one of the three rounds of the main part of the experiment. Following the main part of the experiment, you will be asked to make further decisions and to provide additional information. For this, you will receive additional payment.

During the experiment the currency is not euros but experimental points (EP). Your earnings in the course of the experiment will be calculated in EP. At the end of the experiment, all EP that you earned will be converted into euros. The conversion rate is: 1 experimental point = 1 euro-cent.

The payoff of a seller arises from the sale of a good, and the payoff of a buyer arises from the purchase of that good. A **seller** must choose in each round a pair of prices at which he wants to sell the good to the two buyers. He can offer the two buyers different prices. **A seller's payoff is equal to the quantities that the buyers purchase, multiplied by the prices he has set.** So depending on how much the buyers buy to the prices he set his payoff rises or falls. A seller receives an extra payment from the experimenter of 500 EP if he sells a positive quantity to a buyer. A positive quantity means a quantity greater than zero.

Consider the following example. A seller sets buyer 1 a price of 30 EP per unit, and buyer 2 a price of 20 EP per unit. Buyer 1 buys 10 units, and buyer 2 buys 15 units. The total payoff of the seller in this example is:

$$\underbrace{30 \text{ EP}}_{\text{price 1}} \cdot \underbrace{10}_{\text{quantity 1}} + \underbrace{500 \text{ EP}}_{\text{extra payment 1}} + \underbrace{20 \text{ EP}}_{\text{price 2}} \cdot \underbrace{15}_{\text{quantity 2}} + \underbrace{500 \text{ EP}}_{\text{extra payment 2}} = \underbrace{1600 \text{ EP}}_{\text{payoff}}$$

Buyers receive at the beginning of each round a budget from the experimenter which they can use to buy the good. Each buyer can only buy exactly as many units of the good as he can afford with his budget. A table, as in the example below, shows a buyer what his benefits and his expenditures are when purchasing a certain quantity. **The payoff of a buyer is the difference between benefits and expenditures of the quantity he chooses, plus his budget.**

Consider the following example, which refers to the table below. A seller sets a price of 10 EP. Buyer 1 receives a budget of 100 EP, and may thus buy a maximum of 10 units. He chooses the quantity 8, so that his benefit from purchasing the goods is 96 EP and his expenditure 80 EP. Hence, his payoff in selecting quantity 8 is:

$$\underbrace{96 \text{ EP}}_{\text{benefit}} - \underbrace{80 \text{ EP}}_{\text{expenditure}} + \underbrace{100 \text{ EP}}_{\text{budget}} = \underbrace{116 \text{ EP}}_{\text{payoff}}$$

Buyer 1's expenditures correspond to the set price multiplied by the quantity he purchases (see column 3). If the seller set a higher price than 10 EP, buyer 1's expenditures per quantity would increase and thus his payoff would decrease.

The right column of the table indicates which payoff the seller obtains from selling

to buyer 1. Note that the seller's total payoff is composed of the payoff from the sale to buyer 1 and of the payoff from the sale to buyer 2.

Quantity	**Benefit** from purchasing the good	**Expenditure** (price · quantity)	**Payoff** of buyer 1 (budget + benefit - expenditure)	Sellers' payoff from selling to buyer 1 (price · quantity + extra payment)
0	0	100	0	0
1	19	10	109	510
2	36	20	116	520
3	51	30	121	530
4	64	40	124	540
5	75	50	125	550
6	84	60	124	560
7	91	70	121	570
8	**96**	**80**	**116**	**580**
9	99	90	109	590
10	100	100	100	600

Questions

We would like to ask you to answer the following two questions. Suppose you are assigned the role of a buyer and get the information shown in the table above.
o What would be your payoff if you chose as quantity 6?
o What payoff would the seller obtain from selling to you if you chose as quantity 4?

After the main part of the experiment

The conversion rate is now: 1 experimental point = 10 euro-cent. You are assigned as sender or receiver in a group consisting of one sender and two receivers. The sender receives 20 EP from the experimenter. Of these 20 EP the sender can send between 0 and 10 EP to each receiver. The amount must be the same for both receivers. The experimenter will triple the amount sent, which we denote y. The receivers can then return any amount between 0 and $3 \cdot$ y EP to the sender.

Consider the following example. The sender sends the receivers the amount 5 EP. So, y equals 5 in this example. The experimenter triples the sent amount y. The receivers can then return any amount between 0 and $3 \cdot$ y EP, that is, any amount between 0 and 15 EP, to the sender.

References

[1] Alba, Joseph W., Susan M. Broniarczyk, Terence A. Shimp, and Joel E. Urbany (1994), "The Influence of Prior Beliefs, Frequency Cues, and Magnitude Cues on Consumers' Perceptions of Comparative Price Data," *Journal of Consumer Research*, 21, 219-235.

[2] Anderson, Eric T., and Duncan I. Simester (2008), "Does Demand Fall When Customers Perceive That Prices Are Unfair? The Case of Premium Pricing for Large Sizes," *Marketing Science*, 27(3), 492-500.

[3] Armstrong, Mark (2006), "Recent Developments in the Economics of Price Discrimination," in *Advances in Economics and Econometrics: Theory and Applications, Ninth World Congress of the Econometric Society*, eds. R. Blundell, W. Newey, and T. Persson, Cambridge University Press, 97-141.

[4] Bolton, Gary E., and Axel Ockenfels (2000), "A Theory of Equity, Reciprocity and Competition," *American Economic Review*, 90, 166-193.

[5] Bolton, Lisa E., Luk Warlop, and Joseph W. Alba (2003), "Consumer Perceptions of Price (Un)Fairness," *Journal of Consumer Research*, 29, 474-91.

[6] Borenstein, Severin (1991), "Selling Costs and Switching Costs: Explaining Retail Gasoline Margins," *RAND Journal of Economics*, 22(3), 354-369.

[7] Busse, Meghan, and Marc Rysman (2005), "Competition and Price Discrimination in Yellow Pages Advertising," *RAND Journal of Economics*, 36(2), 378-390.

[8] Büyükkurt, B. Kemal (1986), "Integration of Serially Sampled Price Information: Modeling and Some Findings," *Journal of Consumer Research*, 13, 357-373.

[9] Campbell, Margaret C. (1999), "Perceptions of Price Unfairness: Antecedents and Consequences," *Journal of Marketing Research*, 36, 187-99.

[10] Charness, Gary, and Matthew Rabin (2002), "Understanding Social Preferences with Simple Tests," *The Quarterly Journal of Economics*, 117, 817-869.

[11] Dholakia, Utpal M., and Itamar Simonson (2005), "The Effect of Explicit Reference Points on Consumer Choice and Online Bidding Behavior," *Marketing Science*, 24(2), 194-205.

[12] Dufwenberg, Martin, and Georg Kirchsteiger (2004), "A Theory of Sequential Reciprocity," *Games and Economic Behavior*, 47, 268-298.

[13] Falk, Armin, and Urs Fischbacher (2006), "A Theory of Reciprocity," *Games and Economic Behavior*, 54, 293-315.

[14] Fehr, Ernst, and Klaus M. Schmidt (1999), "A Theory of Fairness, Competition and Cooperation," *The Quarterly Journal of Economics*, 114(3), 817-868.

[15] Fehr, Ernst, and Klaus M. Schmidt (2006), "The Economics of Fairness, Reciprocity and Altruism - Experimental Evidence and New Theories," in: Handbook on the Economics of Giving, Reciprocity and Altruism, Vol. 1, Serge-Christophe Kolm, and Jean Mercier Ythier (ed.), Amsterdam: Elsevier, 615-691.

[16] Fischbacher, Urs (2007), "Z-Tree: Zurich Toolbox for Ready-Made Economics Experiments," *Experimental Economics*, 10, 171-178.

[17] Franciosi, Robert, Praveen Kujal, Roland Michelitsch, Vernon Smith, and Gang Deng (1995), "Fairness: Effect on Temporary and Equilibrium Prices in Posted-Offer Markets," *The Economic Journal*, 105, 938-950.

[18] Goldberg, Pinelopi K., and Frank Verboven (2001), "The Evolution of Price Dispersion in the European Car Market," *The Review of Economic Studies*, 68(4), 811-848.

[19] Greiner, Ben (2004), "An Online Recruitment System for Economic Experiments," in K. Kremer and V. Macho, eds., Forschung und wissenschaftliches Rechnen 2003, GWDG Bericht 63, Ges. für Wiss. Datenverarbeitung, Göttingen, Germany, 79-93.

[20] Janiszewski, Chris, and Donald R. Lichtenstein (1999) "A Range Theory Account of Price Perception," *Journal of Consumer Research*, 25, 353-368.

[21] Kahneman, Daniel, Jack L. Knetsch, and Richard Thaler (1986a), "Fairness as a Constraint on Profit Seeking: Entitlements in the Market," *American Economic Review*, 74(4), 728-741.

[22] Kahneman, Daniel, Jack L. Knetsch, and Richard Thaler (1986b), "Fairness and the Assumptions of Economics," *Journal of Business*, 59(4), 285-300.

[23] Leslie, Phillip (2004), "Price Discrimination in Broadway Theater," *RAND Journal of Economics*, 35(3), 520-541.

[24] Lichtenstein, Donald R., and William O. Bearden (1989), "Contextual Influences on Perceptions of Merchant-Supplied Reference Prices," *Journal of Consumer Research*, 16, 55-66.

[25] Lichtenstein, Donald R., Peter H. Bloch, and William C. Black (1988), "Correlates of Price Acceptability," *Journal of Consumer Research*, 15, 243-252.

[26] Martins, Marielza O. B., and Kent B. Monroe (1994), "Perceived Price Fairness: A New Look at an Old Construct," *Advances in Consumer Research*, 21, 75-78.

[27] Nevo, Aviv, and Catherine Wolfram (2002), "Why Do Manufacturers Issue Coupons? An Empirical Analysis of Breakfast Cereals," *RAND Journal of Economics*, 33(2), 319-339.

[28] Rabin, Matthew (1993), "Incorporating Fairness into Game Theory and Economics," *American Economic Review*, 83, 1281-1302.

[29] Rotemberg, Julio J. (2005), "Customer Anger at Price Increases, Changes in the Frequency of Price Adjustment and Monetary Policy," *Journal of Monetary Economics*, 52, 829-852.

[30] Rotemberg, Julio J. (2011), "Fair Pricing," *Journal of the European Economic Association*, 9(5), 952-981.

[31] Shor, Mikhael, and Richard L. Oliver (2006), "Price Discrimination Through Online Couponing: Impact on Likelihood of Purchase and Profitability," *Journal of Economic Psychology*, 27, 423-440.

[32] Sobel, Joel (2005), "Interdependent Preferences and Reciprocity," *Journal of Economic Literature*, 43, 392-436.

[33] Stole, Lars A. (2007), "Price Discrimination and Competition," in: *Handbook of Industrial Organization*, 3(34), eds. M. Armstrong, and R. Porter (eds.), Elsevier, Amsterdam: North-Holland, 2221-2299.

[34] Urbany, Joel E., William O. Bearden, Dan C. Weilbaker (1988), "The Effect of Plausible and Exaggerated Reference Prices on Consumer Perceptions and Price Search," *Journal of Consumer Research*, 15, 95-110.

[35] Verboven, Frank (1996) "International Price Discrimination in the European Car Market," *RAND Journal of Economics*, 27(2), 240-268.

[36] Xia, Lan, Kent B. Monroe, and Jennifer L. Cox (2004), "The Price Is Unfair! A Conceptual Framework of Price Fairness Perceptions," *The Journal of Marketing*, 68(4), 1-15.