Fairness and the power of competition

Working Paper

Author(s):
Fischbacher, Urs; Fong, Christina M.; Fehr, Ernst

Publication date:
2003

Permanent link:
https://doi.org/https://doi.org/10.3929/ethz-a-004491953

Originally published in:
Working paper / Institute for Empirical Research in Economics 133

Institute for Empirical Research in Economics
University of Zurich

Working Paper Series
ISSN 1424-0459

Working Paper No. 133

Fairness and the Power of Competition

Urs Fischbacher, Christina M. Fong and Ernst Fehr

January 2003

Fairness and the Power of Competition[1]

Urs Fischbacher,* Christina M. Fong,** and Ernst Fehr*

January 30, 2003

Abstract: One of the most basic questions in economics concerns the effects of competition on market prices. We show that the neglect of fairness concerns prevents a satisfactory understanding of how the intensity of competition affects prices. We conduct experiments that demonstrate that introducing even a very small amount of competition to a bilateral exchange situation – by adding just one competitor – induces large behavioral changes among buyers and sellers, causing dramatic changes in market prices. Models that assume that all people are self-interested fail to provide a satisfactory explanation of these changes. In contrast, models taking into account heterogeneous fairness concerns predict the qualitative and quantitative effects of changes in competition correctly. By combining the fairness approach with models of noisy best reply behavior we can predict the entire distribution of prices in many different competitive situations remarkably well.

*Institute for Empirical Research in Economics
University of Zurich
Blümlisalpstrasse 10
CH-8006 Zürich
Email: fiba@iew.unizh.ch; efehr@iew.unizh.ch

**Department of Social and Decision Sciences
Carnegie Mellon University
Pittsburgh, PA 15213
Email: fong2@andrew.cmu.edu

Keywords: Competition, Fairness, Reciprocity, Quantal Response Equilibrium

JEL-Classification:

[1] Ernst Fehr and Urs Fischbacher acknowledge support by the Swiss National Science Foundation (project number 12-67751.02) and the Ludwig Boltzmann Institute for the Analysis of Economic Growth. Christina Fong gratefully acknowledges funding from the Economic Science Laboratory at the University of Arizona, the MacArthur Foundation Network on Inequality, and the MacArthur Foundation Norms and Preferences Network. We thank seminar participants at the Department of Social and Decision Sciences at Carnegie Mellon University for comments and discussion.

I. Introduction

Economists have long been interested in how changes in competition affect market prices. In this paper we argue that no satisfactory answer can be given to this basic question if one neglects the presence of fairness motives.[1] We show, in particular, that models in which all individuals are motivated purely by self-interest prevent a full understanding of how competition affects the behavior of buyers and sellers. As a consequence, the price *level* and basic *comparative static properties* of the price level with regard to changes in the intensity of competition cannot be fully understood.

Our argument is based on the results of laboratory experiments in combination with recently developed fairness models and quantal response equilibrium models.[2] As it turns out, the key to understanding how changes in competition affect prices lies in the interaction between people who do not care at all about fairness and those who – in addition to their material self-interest – do care about fairness. In particular, we show that when there are purely selfish individuals among the players, increases in competition provide incentives for fair-minded individuals to behave as if they were selfish. Thus, even if they have stable preference for fairness, fair-minded individuals behave increasingly like selfish individuals as competition becomes stronger. The reason for this is that increases in competition reduce the payoffs of fair actions relative to more selfish actions.

The starting point of our examination is a bilateral bargaining experiment in which a buyer and a seller bargain over the price of an indivisible good. The monetary valuation of the good by the buyer and the seller is common knowledge. The seller can make exactly one price offer to the buyer, which can be accepted or rejected. If the offer is rejected no trade occurs. If it is accepted trade occurs at the proposed price.[3] To examine the impact of competition on prices we then conduct market experiments in which we add additional buyers to the bilateral game. In the market

[1] There is by now a large body of evidence indicating that a non-negligible number of people care not only about their own material payoff but also about fairness. It has been shown that fairness motives are behaviorally important even under rather high stake levels and in a wide variety of different contexts. For surveys about the role of fairness concerns in strategic interactions see, e.g., Camerer and Thaler (1995) or Fehr and Schmidt (2003).

[2] Recently developed fairness models include Rabin (1993), Levine (1997), Fehr and Schmidt (1999), Dufwenberg and Kirchsteiger (1999), Falk and Fischbacher (1999) and Bolton and Ockenfels (2000). The quantal response equilibrium approach, which captures the idea of noisy best reply behavior, has been pioneered by McKelvey and Palfrey (1995). Goeree and Holt (2000, 2001), Goeree, Holt and Palfrey (2002) and Goeree, Holt and Laury (2002) successfully applied the approach to explain the salient behavioral features of many different games.

[3] In the experimental literature this game is known as the ultimatum bargaining game because the seller can stipulate a take it or leave it offer to the buyer. The first ultimatum bargaining experiment was conducted by Güth, Schmittberger and Schwarze (1982). In the meantime a large number of ultimatum bargaining experiments have been conducted. For a survey of results see Güth and Tietz (1990) and Roth (1995).

experiments, two or five buyers – depending on the treatment – compete for the indivisible good by simultaneously deciding whether to accept or reject the offer. Among the accepting buyers, a random device determines who will ultimately receive the good. The important feature of these experiments is that regardless of whether or not there is competition among the buyers, and regardless of the amount of competition, the seller will always appropriate all of the gains from trade if both the buyers and the seller are exclusively motivated by their material self-interest. Thus, under the self-interest assumption, competition is predicted to have no impact at all on market prices in these experiments.[4]

In sharp contrast to this prediction, we find that even a small amount of competition among the buyers has a striking impact on the behavior of buyers and sellers and, hence, on market prices. In fact, the biggest impact occurs when we move from the bilateral case to a situation with only two competing buyers. This suggests that there is a sharp discontinuity between no competition and a little bit of competition. Whereas in the bilateral case the buyer reaps on average 41 percent of the gains from trade, in the case of two competing buyers the trading buyer receives only 19 percent of the gains from trade. If we increase competition further by having five competing buyers the trading buyer reaps on average only 14 percent of the gains from trade. Thus, competition has a strong and unambiguous impact on market prices and the biggest effect is caused by the introduction of a just one competitor.

Recently developed theories of fairness and reciprocity (Fehr and Schmidt 1999, Falk and Fischbacher 1999, Bolton and Ockenfels 2000) predict that the interaction between selfish and fair-minded players is the key force driving the comparative static impact of competition on market prices.[5] All of these models are based on the assumption that there is a given distribution of selfish and fair individuals. According to these theories, the presence of fair-minded buyers forces the sellers to demand relatively moderate prices in the bilateral case because fair buyers are unwilling to accept unfairly high prices. Therefore even selfish sellers make relatively egalitarian price offers. Why, then, does the existence of fair-minded buyers not ensure equally fair prices when there is

[4] To see this, take first the bilateral experiment. Since any price strictly below the buyer's maximum willingness to pay renders a selfish buyer better off, the buyer will accept any such price. Hence a selfish seller sets a price that completely exhausts the buyer's maximum willingness to pay, i. e., the seller appropriates all gains from trade. Yet, if the seller appropriates all gains from trade already in the bilateral case the introduction of buyer competition cannot generate a higher price. Therefore, the introduction of competing buyers and variations in the degree of competition are predicted to leave the behavior of buyers and sellers unchanged so that the price at which the good is sold remains the same.

[5] The earlier model of Rabin (1993) is not applicable to our setting because it is limited to two-person games.

competition? After all, fair-minded buyers are free to reject unfair offers regardless of the intensity of competition. The answer lies in the existence of the selfish buyers.

In the presence of a non-negligible percentage of selfish buyers the probability that there is at least one selfish individual among the competing buyers increases with the number of buyers. That is, if the number of competing buyers increases, sellers face a lower rejection risk when they demand high prices because the probability that at least one buyer will accept the offer increases. This enables the selfish sellers to appropriate a higher share of the gains from trade. Moreover, the existence of selfish buyers also induces the fair-minded buyers to accept higher prices. If a fair-minded buyer expects that a competing buyer will accept an unfair offer she will also accept the offer because in this case she can neither punish the unfair seller nor ensure an equitable distribution of the gains from trade. That is, rejecting an unfair offer is futile if one expects that a competing buyer will accept the offer. Since an increase in the number of buyers raises the probability that there is at least one selfish buyer among the competitors, the increase in the number of buyers reduces the expectation of the fair-minded buyers that the other buyers will reject an unfairly high price. Therefore, they will themselves be less willing to reject unfair prices.

The beauty of our experimental results consists of the fact that *all* of the crucial mechanisms predicted by the fairness approach to drive the impact of competition on market prices are supported by the data. *First*, in the bilateral case the seller's price-setting power is severely constrained by a considerable willingness to reject unfair price offers. *Second*, the buyers' willingness to reject a given offer decreases substantially if the number of competitors increases. *Third*, this reduction in the willingness to reject can be *fully* explained by the impact of competition on buyers' beliefs about the other buyers' rejection behavior. The higher the number of competing buyers the higher is the probability belief of a given buyer that one of the other buyers will accept the offer. We show that this change in beliefs fully explains the changes in buyer behavior across treatments. *Fourth*, increasing the number of competing buyers causes a large decrease in the rejection risk faced by the sellers. Thus, *all* of the qualitative features of our data can be explained with the help of a fairness approach assuming a stable distribution of fairness preferences across treatments.

Moreover, in Part V of our paper we take the analysis a step further and attempt to *quantitatively* predict the *whole distribution* of price offers *in all three* treatments. For this purpose we combine a fully parameterized version of the Fehr-Schmidt model with the recently developed quantal response model of noisy best reply behavior (McKelvey and Palfrey 1995, Goeree and Holt 2001). The quantal response approach captures the critical fact that there is virtually always some unexplained randomness in players' behavior and that this randomness is inversely related to the payoff costs of deviating from the best reply.[6] When we apply the combined fairness-quantal response approach to our experiments we use exactly the same distribution of fairness preferences that has been assumed by Fehr and Schmidt (1999). Thus, we completely tie our hands with regard to our assumptions about fairness preferences. Nevertheless, the combined model predicts the quantitative distribution of price offers in *all* treatments remarkably well.

Finally, we perform a robustness test of our combined model by introducing competition among the sellers. We were interested in whether the combined model also makes accurate quantitative predictions in the case of seller competition when we use the same parameters as we did to predict the results of the previous experiments. For this purpose we conducted experiments in which two competing sellers faced only one buyer. The sellers simultaneously had to make their offer and the buyer could accept one of the available offers. The standard model based on self-interested agents predicts that the buyer reaps the entire gains from trade because the price-setting sellers face strong overbidding incentives. Yet, the combined model predicts that the buyer will on the average only reap 83 percent of the gains from trade. In fact, the buyers earned on the average 78 percent of the surplus.[7] Moreover, the combined model not only predicts the average price well but the whole distribution of offers is again captured remarkably well by the combined model.

There are a few other experimental papers studying the comparative static impact of changes in competition on prices. In a pioneering study Roth, Prasnikar, Okuno-Fujiwara and Zamir (1991) compare the results of ultimatum games with the results from market games when there are 9 competing sellers and only one buyer who is forced to take the highest offer. Thus, by having 9 competing sellers and by forcing the buyer to always take the highest offer Roth et al. (1991) introduce a very large amount of competition on the sellers' side. In their setting it is, therefore, not possible to study the impact of a small amount of competition. The focus on seller competition also limits the empirical insights into the comparative statics of buyers' rejection behavior. Roth and Erev (1995) show that their results can be explained with a reinforcement learning model that is

[6] All "pure" fairness models are based on the assumption that players' actions do not deviate from their best replies. Thus, they do not capture random deviations from best reply behavior and how these random deviations interact with each other in a strategic game. As a consequence, they tend to predict degenerate distributions of actions. If one aims to predict the whole distribution of actions it is natural to take random deviations from best reply behavior into account.

[7] As in the case of buyer competition we took the observations in the final period to compute this number.

combined with the assumption of purely selfish preferences. For this reason, in Section IV of our paper, we investigate whether or not this model can explain our results. As we will discuss below, the model cannot explain the fact that considerable price differences occur immediately in period 1 of our treatments when learning has not yet taken place. The model also fails to account for another important finding in our paper: a buyer's rejection behavior is strongly affected by her beliefs about the rejection behavior of the other buyers. Güth, Marchand and Rulliere (1997) and Grosskopf (2002) also conducted experiments where they varied the number of competitors. However, none of these papers considers the implications of fairness models and provides a *unified quantitative* interpretation of the data in terms of fairness and noisy best replies.

Before we move on to the details of our experimental design we would like to point out that competition does not always have such powerful effects. Although competition considerably weakens the impact of fairness concerns in the market environments studied in this paper, there are also other important environments in which competition has little impact. In fact, Fehr and Falk (1999) have shown that competition has little or no impact in markets with incomplete contracts for workers' effort. Despite the fact that workers fiercely underbid the going wage, employers were unwilling to accept workers' low wage bids because they anticipated that workers would consider low wages to be unfair and would retaliate with low effort levels. Therefore, competition among the workers did not push wages towards the competitive prediction – actual market wages were permanently far above the competitive level. Thus, whereas in the present paper the neglect of fairness concerns prevents an understanding of the powerful effects of competition on market prices, the neglect of fairness in the Fehr and Falk experiments prevents an understanding of why competition has little or no effect on prices (wages). The overall lesson from these experiments is, therefore, that one is likely to make important errors on both sides if one neglects fairness concerns: In certain situations one does not understand why competition has no effect – although it should have one according to the self-interest model – whereas in other situations one does not understand that competition has extremely powerful effects – although it should have no effects according to the self-interest model.

II. The Experimental Design

A. Treatment Conditions

To test for the effect of competition on market prices we set up three treatment conditions. In one treatment we conducted a bilateral bargaining game in which competition is completely absent. In the second treatment we introduced a competitor on one side of the market. In the third treatment we increased the number of competitors by 3 additional players so that there are 5 competitors on one side of the market. The comparison between the bilateral game and the treatment with two competitors allows us to study how the *introduction* of competition affects the participants' behavior and market prices. The comparison between the treatments with two and five competitors gives us information about how an *increase* in competition affects behavior and market prices.

In the bilateral bargaining game (henceforth called BG) a buyer and a seller have to agree on the division of a given bargaining surplus of 100 money units. The rules of the game stipulate that the seller offers the buyer an absolute share $s \in \{0, 1, 2, 3, \ldots, 100\}$ of the gains from trade and the buyer then either accepts or rejects this share. For convenience we therefore call the seller a "proposer" and the buyer a "responder". If the offer is accepted, the proposer's share of the surplus is $100 - s$ and the responder's share is s.[8] If the offer is rejected, both players earn zero.

In the market games with responder (buyer) competition we added one or four responders, respectively. In the following we call the treatment with two responders "responder competition with two responders" (RC2) and the treatment with 5 responders "responder competition with 5 responders" (RC5). Since we were interested in the pure effect of just adding one or four additional competitors, respectively, on the responders' side we kept the structure of the game identical to the structure of the BG. Again there is just one proposer who makes a single offer $s \in \{0, 1, 2, 3, \ldots, 100\}$. Then all responders simultaneously accept or reject this offer. If all responders reject, no gains from trade occur and all players earn zero. If at least one responder accepts, trade between the proposer and the accepting responder occurs with the the proposer earning $100 - s$ and the accepting responder earning s. All other responders earn nothing. If several responders accept the offer one of them is randomly chosen to be the one who trades. The winning probability for each of

[8] There is a unique relation between the buyer's share of the gains from trade and the market price p at which the good is sold. Let c denote the cost of the good to the seller while v represents the buyer's monetary valuation of the good. Then the buyer's absolute share s is defined as $s = v - p$ and the sellers' absolute share is p – c. In our experiments we have set c = 0 and v = 100.

the accepting responders is the same. The non-trading responders again all earn zero, whereas the proposer and the randomly chosen responder earn 100 – *s* and *s*, respectively.

B. Procedures

In total we conducted ten experimental sessions. In the BG and in RC2 we performed two sessions each and in RC5 we conducted 4 sessions. All sessions took place in January 1999 and January 2000. We recruited 24 subjects for each session but – due to no-show-ups – we had fewer people in two of the eight sessions.[9] Overall 190 subjects participated in these experiments, with each subject participating in exactly one session. Subjects were students from the University of Zürich and the Federal Institute of Technology (ETH) in Zürich. The experiments were implemented with the help of the experimental software z-Tree (Fischbacher 1999).

Subjects were seated at computer terminals, read written instructions, and entered their decisions without communicating with one another. Anonymity among the players was guaranteed because at no point during (and after) the experiment were subjects provided with information about who they are interacting with. The subjects earned a show-up fee of 10 Swiss francs (CHF) plus earnings based on their decisions during the experiment. Their earnings averaged 23.1, 21.3 and 18.2 Swiss Francs for RC5, RC2 and the BG, respectively. A session lasted approximately 75 to 90 minutes. In order to hold the stake size constant across the treatments, we varied the rate of exchange between experimental money and Swiss Francs. The number of Swiss francs per 100 experimental money units was adjusted so that the gains from trade divided by the number of players was constant at CHF 1.20 across conditions. Thus, the value of 100 experimental money units was CHF 7.20 in RC5, CHF 3.60 in RC2, and CHF 2.40 in the BG.

It is well known that behavior in experimental markets sometimes exhibits large changes over time. Therefore each experimental session lasted 20 periods. In each period subjects were randomly matched with other proposers and/or responders, respectively. Subjects knew nothing about the previous behavior of the subjects with whom they were matched in a period. Random matching and the absence of reputation building opportunities ensured that subjects could not condition their current behavior on the past behavior of their current opponents. Yet, the repetition of the same

[9] In one of the bargaining game sessions we had 22 subjects.

treatment condition over 20 periods gives us the opportunity to observe the convergence properties of behavior in the different treatments.

At the beginning of the session subjects were randomly assigned to the role of a proposer or a responder. They remained in the same role throughout the whole session. In each period, proposers entered an offer, which was sent to the responders. Then the responders simultaneously decided whether to accept or reject the offer. In the RC2 treatment, responders also indicated whether they believed that the other responder would accept or reject the offer. In the RC5 treatment, responders indicated their belief about how many other responders would accept the offer. At the end of each period, the computer screens informed subjects about their own action and payoff as well as their opponents' action and payoff. Subjects received no information about the behavior and the outcome of other players outside of their group.[10]

In the BG and RC2 treatments, we used matching groups in each session. A matching group is a subpopulation of players in a session that interacts independently of the other matching groups. That is, z-Tree randomly matched subjects only with those who belonged to their matching group, and not with players in other matching groups. The advantage of this technique is that it increases the number of independent observations; behavior in each matching group is independent of the behavior in the other matching groups. Without matching groups, an entire session would contain only one independent observation. We had three matching groups per session in the BG, 2 matching groups per session in RC2, and only one matching group per session in RC5. This gives us 6 independent observations for the BG, and 4 independent observations for each of the other treatments.[11]

III. Predictions

A. The Standard Prediction

The standard prediction assuming rational and self-interested players is straightforward. In any equilibrium of the bargaining game or the market games with responder competition the responders

[10] For example, in the BG they were informed about their own action and payoff as well as their opponent's action and payoff but not about what happened in other pairs of players.

[11] We did not tell the subjects that they were in matching groups. The main advantage of using several matching groups per session and not telling subjects about it is that subjects are likely to have the impression that they were matched with subjects drawn from among the entire group of subjects in the room. This is likely to reduce the subjective probability of being rematched with a particular subject and thus foster the one-shot nature of the experiment.

will always get at most an offer of s = 1 and the proposer's offer is always accepted. The intuition behind these equilibrium outcomes is that selfish responders will accept any positive offer so that a selfish proposer can be sure that all responders will accept an offer of 1.[12] An important point about these models is that they do *not* predict a difference in the behavior of proposers and trading responders when we move from the bargaining situation to responder competition.

B. Predictions of Fairness Models

Recently, several fairness models have been developed that capture the idea that a fraction of the subjects is motivated not only by self-interest but also by concerns about equity (Fehr and Schmidt 1999, Bolton and Ockenfels 2000), reciprocity (Rabin 1993, Duwfenberg and Kirchsteiger 1999, Falk and Fischbacher 1999), and sometimes also by efficiency (Charness and Rabin 2002). For our purposes the models capturing equity and reciprocity motives are particularly important because they are consistent with the fact that responders in the bargaining game frequently reject low, unfair, offers, which in turn induces proposers to make fair offers. In the following we apply the model of Fehr and Schmidt (FS) to generate predictions for our experimental treatments. The main reason for this is that the model specifies a simple, tractable, functional form for subjects' preferences that allows the computation of closed form solutions. Our choice of the FS model does not mean that the other fairness models are unable to explain our experimental results. In fact, despite differences in the details, the equity and reciprocity models offer a common intuition as to why competition induces players with fairness motives to behave more like selfish players: competition undermines the ability of fair-minded responders to punish the proposer or to enforce an equitable outcome by rejecting the offer. If a rejection no longer ensures the punishment of the proposer or an equitable outcome the responder has less reason to reject the offer. This in turn is likely to induce the selfish proposers to make lower offers.

The idea behind the FS model is that there are selfish and inequity averse individuals. The inequity averse individuals derive disutility from inequity. In the context of experimental games,

[12] There are two subgame perfect equilibria in the bargaining game and two subgame perfect equilibrium outcomes under responder competition. The two equilibria in the bargaining game are 1) for the proposer to offer one and for the responder to accept all positive offers and reject zero, and 2) for the proposer to offer zero and for the responder to accept all offers. In responder competition one subgame perfect equilibrium outcome is obtained if the proposer makes the minimum positive offer, i.e., s = 1, which is accepted by all responders. In this equilibrium all responders have to reject s = 0. The other equilibrium outcome is sustained by an offer of s = 0 which is accepted by at least one responder.

inequality is often a good proxy for inequity. In laboratory games equal payoffs often provide the relevant reference point for judgments about inequity. Therefore, Fehr and Schmidt assumed that inequality is a good proxy for inequity in these games. A player who exhibits inequity aversion is thus assumed to behave according the following utility function:

$$U_i = \pi_i - \alpha_i \frac{1}{n-1} \sum_{j \neq i} \max \{\pi_j - \pi_i, 0\} - \beta_i \frac{1}{n-1} \sum_{j \neq i} \max \{\pi_i - \pi_j, 0\} \qquad (1)$$

In (1) π_i, i=1,...,n are the monetary payoffs of the n players in the game, α_i is a parameter measuring the disutility of disadvantageous inequality and β_i is a parameter that captures the disutility arising from advantageous inequality. FS also assume that $\alpha_i \geq \beta_i$ and $0 \leq \beta_i < 1$. In the following we first outline the comparative static predictions for the bargaining game and then for the markets with responder competition.[13]

In the BG, responders with a sufficiently high aversion to disadvantageous inequity (α_i) will reject low offers. For every given value of α_i there is a unique acceptance threshold s' such that offers below s' will be rejected whereas offers at or above s' will be accepted. Because the rejection of offers above $s = 50$ is expensive, inequity averse responders will never reject such offers because $\beta_i < 1$. Moreover, because responders are assumed to differ in their aversion to disadvantageous inequity, a proposer who does not know the preferences of the responder exactly, faces a distribution of players with different α_i-values. This means that the probability of rejection declines as the offer increases because more players are willing to accept the higher offer. Proposers who dislike advantageous inequity a lot, i.e., those with $\beta_i > 0.5$, will propose egalitarian offers of $s = 50$. They are not constrained by the distribution of acceptance thresholds because even if they could enforce non-egalitarian offers without any risk of rejection they would not make such offers. Those with $\beta_i < 0.5$ will offer less than s = 50, maximizing their utility against the distribution of acceptance thresholds of the responders. Thus, every force that lowers the responders' willingness to reject low offers induces those proposers with $\beta_i < 0.5$ to take advantage of the responders' weakness and to make lower offers. This observation leads us directly to the analyses of the impact of responder competition on market outcomes because if responder competition reduces the probability that low offers are rejected the model can explain why competition lowers the offers relative to the bargaining game.

[13] Readers who are interested in the full formal derivation of the predictions should consult the proofs of propositions 1 and 3 in Fehr and Schmidt (1999).

In the context of the FS-model there are two reasons why an increase in responder competition implies that the proposer faces a lower risk of not being able to trade, i.e., that all responders reject a given offer.

1. The first effect is a *statistical effect* that arises (i) from the assumption that there is a distribution of acceptance thresholds, and (ii) from the fact that if there are more responders, more responders must reject the offer to prevent the proposer from trading. The higher the number of responders the higher is the probability that at least one responder will accept a given offer. For instance, if 50 percent of the responders in the BG, in RC2 and in RC5 have an acceptance threshold of s' = 30 and the other 50 percent exhibit s' = 0, the probability that an offer below *s* = 30 is rejected is .5 in the BG, $(.5)^2$ in RC2 and only $(0.5)^5$ in RC5. Thus, the statistical effect decreases the proposers' risk of not trading even if competition has no effect on the distribution of acceptance thresholds.
2. The second effect is a *belief effect*. Increases in competition do affect the behavior of the responders because they affect the responders' beliefs about the likelihood that the competing responders will reject the offer. Whenever an inequity averse responder believes that another responder will accept the offer with certainty, she will accept the offer too. This is because she can no longer ensure equality by rejecting the offer, and given that there will be inequality no matter what she does, she prefers to have a chance of winning the offer. Hence she accepts the offer. The more responders there are, the more likely it is that there is another responder who will accept the offer, and the more a rational responder will believe that there is at least one other responder who will accept the offer. Therefore, increases in responder competition are predicted to lower the responders' acceptance thresholds.

As in the BG, the predictions for proposer behavior under responder competition depend on β_i. If β_i is sufficiently high, the proposer voluntarily refrains from making an offer below *s* = 50 even if such an offer could be enforced without any risk of rejection. If β_i is not sufficiently high, the proposer maximizes her utility subject to the distribution of acceptance thresholds. To be precise, the proposer will offer s = 50 if $\beta_i > (n-1)/n$, where *n* is the number of players in the game.[14] Hence

[14] If there are *n* players altogether, then giving away one money unit to one of the responders reduces inequality vis à vis the receiving responder by 2 units and vis à vis the other n-2 responders by 1 unit. Therefore, the average reduction in inequality relative to all n-1 other players is (2 + n-2)/(n-1) = $n/(n-1)$ Dollars. Thus, if the non-pecuniary gain for the proposer from this reduction in inequality, $\beta[n/(n-1)]$, exceeds the cost of *1*, i. e., if $\beta > (n-1)/n$, the proposer prefers to give away money to one of the responders. If, instead, $\beta < (n-1)/n$, the proposer is willing to take some risk of being rejected by trading off a higher risk of rejection with the higher earnings from an accepted offer.

the critical value of β_i equals 1/2 in BG, 2/3 in RC2 and 5/6 in RC5 implying that the fraction of inequity averse proposers who are willing to make low offers increases if the number of responders increases. It is also worthwhile to point out that β-values at or above 2/3 are likely to be rather infrequent. If β_i equals 2/3, the proposer in the BG is willing to propose an equal split even if half of the proposer's transfer is lost on the way to the responder.[15] Although one cannot rule out that some players are that generous it seems doubtful that many are.

Thus, the fairness approach predicts that responders are less willing to reject low offers, that proposers face a lower overall rejection risk and that proposers are less likely to make the egalitarian offer if the number of responders increases. Taken together this implies that accepted offers decline if responder competition is introduced or becomes more intense.

IV. Experimental Results

A. The Effect of Competition on Market Prices

In this section we study the comparative static effects of responder competition on accepted offers, i.e., on market prices. Recall that if subjects are selfish and rational, then the average accepted offer should be less than or equal to one in the BG as well as in RC2 and RC5. In sharp contrast to this prediction, we find the following result:

RESULT 1: *The introduction of a small amount of responder competition by moving from the BG to RC2 causes a large reduction of the mean accepted offer. Adding three additional responders by moving from RC2 to RC5 causes a further significant reduction of the mean accepted offer.*

The evidence for this is presented in Figure 1 and Tables 1 and 2. Figure 1 plots the average accepted offer for the BG and the two responder competition treatments by time period. The figure shows that competition has a strong impact. In every time period the mean accepted offer in RC2 is

[15] To be precise, assume that for every dollar that the proposer transfers to the responder in the BG the responder receives only \$$\gamma$ ($\gamma < 1$). Then the proposer's payoff function can be written as $U_p = 100 - s - \beta[(100 - s) - \gamma s]$. Differentiating with respect to s and assuming that $\beta = 2/3$ yields $-1 + (2/3)(1 + \gamma)$. This expression is non-negative for $\gamma \geq ½$. Thus, in the case where half of the money transferred to the responder is lost ($\gamma = ½$) the proposer is indifferent between keeping a Dollar or transferring a Dollar.

lower than it is in the BG. Similarly, in every time period the mean accepted offer is lower in RC5 than in RC2. Table 1 presents the means and standard deviations of accepted offers. The first six rows of columns 1-3 display matching group averages of accepted offers in each treatment over all 20 periods. The first six rows of columns 4-7 show matching group averages of accepted offers in each treatment for the final period. Row 7 shows total averages across matching groups. The average accepted offer, taken over all 20 periods and all matching groups, is 42.7 in the BG; it falls to 25.5 in RC5 and to 16.2 in RC5. In each matching groups of the BG the mean accepted offer is much higher than in each of the four matching groups in RC2. Moreover, in the final period the gap between the BG and the two responder competition treatments has become even bigger. Whereas in the BG the mean accepted offer in the final period is similar to the mean in all periods the offers in the two responder competition treatments decline (see Figure 1). In the final period the trading responders earn on the average 41.1 in the BG but only 18.8 and 13.8 in RC2 and RC5, respectively.

To examine the statistical significance of these treatment differences we conducted non-parametric Mann-Whitney tests with matching group averages as independent units of observation. These tests show that the mean accepted offers in RC2 are significantly lower than in the BG (p = .005). Likewise, the mean accepted offers in RC5 are significantly lower than in RC2 (p = .028). If we perform a non-parametric trend test (nptrend test) for the null hypothesis that there is no trend *across treatments*, we can reject the null hypothesis at all conventional significance levels ($p <$ .001).[16] These results are also supported by the regressions presented in Table 2. This table shows regressions of the mean accepted offer on treatment dummies, the time period, and interactions between the treatments and time period. In the first column of Table 2 we pool all three treatments in all 20 periods. The second column takes the data from all three treatments in the final 10 periods. The third and fourth columns pool the RC2 and RC5 treatments in all 20 periods and the final 10 periods, respectively. In this and all other regressions reported in this paper, we compute robust standard errors and allow for correlated errors within matching groups. Thus all significance tests associated with the regressions allow for dependent observations within matching groups and treat only observations across matching groups as independent.

[16] The advantage of the nptrend test is that it takes the order between the treatments into account (see Cuzick 1985). It is, therefore, the appropriate test for examining our comparative static results. The nptrend test is an extension of the Wilcoxon rank sum test.

In the first two columns of Table 2, the bargaining game is the omitted or baseline category. In the columns 3 and 4, RC2 is the omitted category. To simplify interpretations, we number the time periods from –19 to zero in the first and the third regression, and from –9 to zero in the second and fourth regression, so that one can easily see the effects in the final time period. Thus, in column (1) the coefficient for the constant shows that the mean accepted offer in the final time period of the bargaining game is 42.7 points. The highly significant coefficients for RC2 and RC5 show that the accepted offer in the responder competition treatments is 24.2 and 31.6 units lower than in the BG. The coefficient for RC5 in column 3 indicates that the estimated accepted offers in RC5 are by 7.5 units lower compared to RC2. Columns 2 and 4 show that, in the final 10 periods, the treatment differences have a similar order of magnitude.

In the BG, accepted offers are rather stable from period 2 onwards. This stability is indicated by Figure 1 and regressions 1 and 2 where the estimated coefficient on the variable "time period" is close to zero and insignificant. Figure 1 also reveals that both in RC2 and RC5 the accepted offers fall in the first ten periods but remain fairly stable in the final 10 periods. In RC5, for instance, the mean accepted offer is 13.4 in period 10 and 13.8 in period 20. This picture is also confirmed by the regressions in Table 2. In regression 1 (which uses the data of all 20 periods) the interaction between "time period" and RC2 and RC5 is highly significant. The estimated effect of the time period in this regression is -0.536 in RC5 and -0.750 in RC2.[17] In regression 2 (which uses the data of the final 10 periods) the interactions between "time period" and the RC-dummies are much smaller and insignificant.[18] Regression 2, for instance shows that the estimated effect of the time period is insignificant in the BG and even smaller in magnitude in RC5.

B. *The Effect of Competition on Proposers' Rejection Risk*

The previous section has shown that the introduction of only a small amount of responder competition has dramatic effects on market prices. Towards the end of the session the gains from trade for the trading responder in RC2 is only half of what a responder receives in the BG. Why is it possible for the proposers to enforce such low offers and why are fair-minded proposers willing to

---

[17] The time coefficient in the BG is 0.003. The time coefficient in RC2 (RC5), relative to the BG, is –0.539 (-0.753). This gives "net coefficients" of –0.536 or -0.750, respectively.

[18] We also conducted regression 1 using only the first 10 periods of data. There is no significant time trend in the first 10 periods of the BG whereas in RC2 and RC5 a significant downward trend occurs.

enforce such low offers? According to the fairness approach discussed in Section III responder competition reduces the rejection risk that the proposers face, which enables them to enforce lower accepted offers. In addition, the fairness approach predicts that fewer proposers will be willing to share the gains from trade equally with the trading responder because it requires a stronger fairness motivation to do so when responder competition prevails. Only extremely fair-minded proposers will be willing to share the gains from trade equally under responder competition.

To answer the question of how responders can enforce such low offers under responder competition it is necessary to examine the proposers' risk of having her offer rejected.

RESULT 2: *The introduction of a small amount of responder competition by moving from the BG to RC2 causes a large reduction in the proposers' rejection risk. Adding three additional responders by moving from RC2 to RC5 causes a further significant reduction of the rejection risk. The money-maximizing offer is, therefore, much lower under responder competition than in the BG.*

Support for Result 2 is presented in Figure 2 and Table 3. Figure 2 plots the proposer's rejection risk against the size of the offer. The proposer's rejection risk for a given offer is defined by the number of such offers that are rejected by all responders divided by the total number of such offers made by proposers. We find that the rejection risk dramatically declines when we move from the BG to RC2. For instance, whereas the rejection risk for offers below 25 is between 80 and 100 percent in the BG, the risk for the same offer range varies between 5 and 50 percent in RC2. Figure 2 shows a further substantial decline in the rejection risk if five instead of two responders compete with each other.

Table 3 presents probit estimates of a model predicting whether or not an offer made by a proposer is rejected.[19] The independent variables are the size of the offer made, the treatment, the time period, and interaction terms for each treatment and the time period. The first regression pools all treatments and all periods, and the second regression pools only the responder competition treatments. The results in Table 3 support Figure 2. The probit coefficients on the offer are negative and significant at the 1% level in both regressions. The associated marginal effects (at the

[19] As in Table 2 all standard errors allow for arbitrary error correlations of observations within matching groups and only observations across matching groups are treated as independent.

sample means), presented in column 2 and 4, indicate that an increase in the offer by 10 units decreases the rejection probability between 4 and 10 percent. The coefficients on RC2 and RC5 are also negative and highly significant. Controlling for the size of the offer, the time period, the treatment, and interactions between the treatment and time, the predicted probability of an offer being rejected in RC2 is 21.5 percent lower than in the BG. In RC5 the predicted probability is even 35.7 percent lower than in the BG. The second regression shows that there is also a significant difference between RC5 and RC2. The predicted probability – evaluated at the average offer and time period – of an offer being rejected in RC5 is 9 percent smaller than in RC2.

The large reduction in the proposers' rejection risk is associated with large changes in the expected payoff. In Figure 3 we present the proposers' expected payoff as a function of the offer size across all three treatments. In the BG the expected payoff is maximized at $s = 50$ but for offers slightly below 50 the payoff loss is very small. Both in RC2 and in RC5 the peak of the expected payoff is at much lower offer levels. In RC2 the expected payoff is maximized at $s = 5$ but at $s = 20$ the payoff is only slightly lower. In addition, the very high payoff at s = 5 could well be an artifact of the small number of observations. In RC2 offers of $s = 5$ occurred only in 4 percent of the cases whereas 21 percent of all offers are at $s = 20$. In RC5, however, the peak at $s = 5$ is surely not an artifact because 33 percent of all offers are at $s = 5$. In fact, an offer of $s = 5$ is the mode in RC5. The large reduction in the money-maximizing offer and the fact that even fair-minded proposers are more likely to take advantage of this provides a plausible explanation for why proposers traded at lower offers under responder competition.

C. *The Effect of Competition on Responders' Behavior*

The fairness approach implies that the reduction in the proposers' rejection risk is a consequence of heterogeneous fairness preferences among the responders and the behavioral changes that competition induces among the responders. Recall that preference heterogeneity among the responders means that the proposers face a distribution of acceptance thresholds. This, in turn, implies that the probability that *all* responders reject a given offer declines if the number of responders increases. We have called this the statistical effect because it prevails even if responders do not change their rejection behavior when additional competitors are added. However, one of the salient predictions of the fairness approach is that responders will change their rejection behavior across treatments and that the responders' beliefs about the other responders' rejection behavior is the driving force behind these changes. Therefore, we examine next whether and how the responders changed their rejection behavior in the face of additional competition.

RESULT 3: *The introduction of a small amount of responder competition by moving from the BG to RC2 causes a substantial reduction in individual responders' willingness to reject. A further increase in competition by moving to RC5 causes an additional significant reduction of the willingness to reject. The changes in responders' rejection behavior across treatments can be fully explained by the belief effect.*

The evidence for Result 3 is presented in Figures 4 and 5 and Table 4 and 5. In Figure 4, we show the rejection behavior from the perspective of the responders. We plot the *responder's rejection rate* against the size of the offer. The rejection rate is measured by the number of responders who rejected an offer divided by the total number of responders who received the corresponding offer. In the BG the rejection rate is 100 percent for any offer below 10, i. e., *all* responders reject such offers. This means that the statistical effect cannot become operative in this offer range unless responder competition reduces the willingness to reject of some responders. Therefore, the large reduction in the proposers' rejection risk (in this offer range) observed in Figure 2 is based on the behavioral changes induced by responder competition: In RC2 and RC5 the responders' rejection rate for offers below 10 is much lower than in the BG and varies between 50 and 78 percent (see Figure 4). In all three treatments the responder's rejection rate decreases in the size of the offer but in RC2 and RC5 this decrease already occurs for offers below 10. For all offer intervals below 40 the rejection rate in RC2 is at least 20 percent lower than in the BG. Moreover, in RC5 the rejection rate is for most offer intervals lower than in RC2.

The econometric evidence in column 1 of Table 4 provides further support for Result 3. Table 4 presents coefficients from a probit regression with the responders' rejections as the dependent variable. The independent variables are the offer size, dummies for RC2 and RC5 (BG is the omitted category), the time period and interactions between the treatment dummies and the time period. The regression shows that the coefficient on offer size is negative and highly significant and the treatment dummies for RC2 and RC5 are highly significant and negative. The associated marginal effects indicate that, at the sample means, the rejection probability is 27 percent lower in RC2 than in the BG. The rejection rate (at sample means) in RC5 is a striking 53 percent lower than in the BG. Thus the treatment differences observed in Figure 4 are clearly substantial and statistically significant.

Since the fairness approach does not only predict treatment differences in rejection behavior but also identifies responders' beliefs as the decisive source of these differences we introduced a belief measure into our regression. Recall that in both responder competition treatments the responders told us how many other responders they expected to accept the going offer. This enables us to add a dummy variable indicating whether the responder believes that all other responders will reject the offer or whether she believes that at least one other responder will accept the offer (see Table 5). The variable "all others reject" in the regressions of Table 5 takes on a value of 1 if a responder believes that all other responders reject. If a responder believes that all others reject then she considers herself a decisive player in the sense that she can punish the proposer or maintain equity by rejecting the offer, too. Thus, the fairness approach predicts that this variable has a positive effect on rejection rates. In the first regression in Table 5 we use the same regressors as in Table 4 but we also add the "all others reject" dummy. The coefficient on the offer size is again positive and significant. The "all others reject" dummy is also positive, highly significant, and implies a high marginal effect. If a responder believes she is decisive her rejection rate increases by 37.4 percent! Moreover, the treatment dummies for RC2 and RC5 are now insignificant and rather small relative to the regression in Table 4 suggesting that the treatments per se do not affect rejection behavior if we control for the belief effect. This interpretation is further supported by the second regression in Table 5 where we use only the RC2 and the RC5 data. The "all others reject" dummy is again large and significant indicating an increase in the rejection probability of 41 percent if a responder believes that all others reject, and the treatment dummy for RC5 is close to zero and insignificant. Thus, again the treatment per se has no effect on the rejection behavior when we control for the responders' beliefs.

Recall that the statistical effect on proposers' rejection risk is based on the presence of heterogeneous responders. To examine responder heterogeneity we ran probit regressions for each treatment separately in which we included the offer size, time period and dummies for individual responders. We observed strong evidence for responder heterogeneity in each treatment. Likelihood ratio tests for the joint significance of the individual dummies show that the restricted model (with no individual dummies) is significantly different from the model with individual dummies at all conventional significance levels ($p < .0001$ in each treatment).

The effect of beliefs on rejection behavior is so strong that it can even be detected in the raw data. In Figure 5 we illustrate the responders' rejection probability in RC2 for the case in which the responder believes that the competitor rejects and for the case in which she believes that the competing responder accepts. As one can see, the rejection probability is much higher if the responder believes that the competitor will also reject the offer. Thus, taken together Figure 4 and 5 and the regressions in Tables 4 and 5 provide strong support for the fairness approach because they suggest that the belief effect can fully explain the changes in rejection behavior across treatments.

V. Alternative Explanations – Decision Errors and Learning

The previous sections have shown that the fairness approach organizes our data very well – all comparative static effects are in line with the fairness prediction. In this section we deal with two potentially competing explanations for our comparative static results. We first examine to what extent learning models that rule out fairness preferences are consistent with the observed treatment differences. Then we investigate the extent to which decision errors could have produced our results.

There can be little doubt that learning is important in real life as well as in laboratory experiments. There are many experiments indicating that adjustment towards equilibrium or stable behavioral patterns takes time (e.g. Roth and Erev 1995, Camerer and Ho 1998). In our data there are also signs of adjustment. In particular, during the first 10 periods proposers' and responders' behavior changes over time. For instance, the regression in the first column of Table 2 suggests that accepted offers in RC2 and RC5 decline over time. This stands in sharp contrast to the BG where no such decline can be observed. Similarly, the regressions in Table 4 suggest that the responders' rejection probability in RC2 and RC5 declines over time. A plausible interpretation of these trends is that because the proposers have only imperfect information about the responders' fairness preferences they have to learn how far they can go in lowering their offers. Similarly, the responders do not know the fairness preferences of the other responders exactly, and their beliefs about the competitors' rejection behavior may not be precise. Over time they may learn more precisely what behaviors they can expect from their competitors and this may induce the behavioral adjustments.

Thus, we do not doubt that learning takes place in our experiments, especially during the first 10 periods.[20] However, a pure learning approach that rules out fairness preferences is not compatible with the observed treatment differences.[21] One reason for this is that the comparative static effects already exist in period 1 of our experiment (see Figure 1). If we perform a non-parametric trend test for the null hypothesis that there is no trend *across treatments*, we find a significant trend already in period 1 ($p = 0.04$). Pure learning models cannot account for these initial differences while the fairness approach can. Moreover, a learning approach based on the assumption that subjects have selfish preferences has difficulties explaining why responders are *more likely* to reject a given offer if they believe that all other responders reject. The higher the number of other responders who reject an offer the higher are the expected costs of rejecting the offer for the responder in question. Thus, if anything, a selfish responder should be *less* willing to reject an offer if she believes that a greater number of other responders will reject the offer.

Nor do we doubt that decision errors are important in real life as well as in laboratory experiments. Empirical applications of quantal response equilibrium models, which explicitly formalize the impact of actual and perceived decision errors in strategic environments, have shown that in certain environments decision errors provide powerful explanations of behavior (e. g., Goeree and Holt 2000, 2001; Goeree, Holt and Palfrey 2001). In fact, we will argue below that a full characterization of the distributions of actions across treatments requires a combination of the fairness approach and the quantal response approach. However, as in the case of learning models, an approach that combines decision errors with the assumption of selfish preferences cannot account for the main treatment effects in our data.

To support this claim it is useful to deal in some detail with the quantal response approach, which assumes that people play noisy best replies and expect others to play noisy best replies. For finite decision errors subjects play the best reply to the expected actions of the others with the highest probability, but due to decision errors they also put some probability mass to the other available actions, too. For example, in the BG the best reply for a selfish responder is to accept any positive offer. A quantal response player also rejects with positive probability but positive offers are

[20] Recall from columns 1 and 2 in Table 2 that in the final 10 periods the time trends in RC2 and RC5 are close to zero and no longer significant.
[21] See also Grosskopf (1999) who shows that reinforcement learning cannot account for the evolution of play over time in responder competition experiments.

rejected with probability less than ½.[22] Thus, decision errors can, in principle, explain rejections. It is therefore necessary to check whether this approach is compatible with the comparative static effects on responder and proposer behavior.

In a quantal response equilibrium (QRE) each player is playing a noisy best reply to the other players' noisy best replies. More formally, let $Pr(i)$ and $\pi^e(i)$ denote the probability of taking action i and the expected payoff of action i, respectively, let μ be the parameter that determines the distribution of decision errors and let N denote the number of available actions. Then, under the commonly made assumption that the error is extreme-value distributed (e.g., Goeree, Holt and Palfrey 2001), the quantal (noisy) best replies are given by the conditions

$$\Pr(i) = \frac{\exp(\pi^e(i)/\mu)}{\sum_{j=1}^{N} \exp(\pi^e(j)/\mu)}, \qquad i = 1,\ldots,N. \tag{2}$$

If (2) holds and if, in addition, the subjective probabilities about the actions that enter into the calculation of the expected payoff of action i are the same as the probabilities $\Pr(i)$ that are determined by the expected payoff $\pi^e(i)$, a quantal response equilibrium prevails.

We applied the QRE-concept to derive predictions for the responders' rejection rates in the BG, RC2 and RC5. The predictions are based on the assumption that all players are selfish. Our findings are illustrated in Figure 6 where we plot the responders' rejection rates as a function of the offer. For this figure we assume an error parameter of μ = 0.144 Swiss Francs.[23] However, the qualitative results do not change if we vary the error parameter. Regardless of the assumed (finite) error parameter we always find that, for positive offers below 50, QRE predicts the wrong comparative static results because the rejection rate is predicted to be highest in RC5 and lowest in the BG. This contrasts sharply with the actual data which indicate that rejection rates are highest in the BG and lowest in RC5. Moreover, the QRE rejection rate is never above 50 percent whereas Figure 3 shows that in all treatments the rejection rate is far above 50 percent for sufficiently low offers.

[22] In the case of completely random rejection behavior (i.e., with infinite decision errors) the rejection probability would be ½ for every offer but because rejections of positive offers are costly, a *selfish* QRE-player with *finite* decision errors rejects positive offers with probability less than ½.

[23] Note that we measured the error parameter in units of real money. This is based on the assumption that, in our context, subjects are unlikely to exhibit money illusion. Yet, the comparative static prediction with respect of responders' behavior is the same regardless of whether the error parameter is measured in experimental points or in real money.

The intuition behind the QRE prediction is that at $s = 0$ there is zero cost to rejecting the offer. Therefore, the responders' decisions are completely random. For positive offers rejecting becomes costly and, therefore, the rejection rate falls below 50 percent. The higher the number of other responders who are believed to accept a positive offer the lower is the expected payoff from accepting the offer. Therefore, rejecting is cheaper if a greater number of other responders is believed to accept. As a consequence, a quantal response player exhibits a higher willingness to reject if a greater number of other players accept the offer. This is just the opposite of what the fairness approach predicts. In RC5 the overall probability that an offer will be accepted by one of the other responders is higher and rejecting is cheaper than in the BG or RC2. Hence rejection will be most frequent in RC5. In contrast, in the BG there are no other responders who can accept. Therefore, rejecting an offer is most expensive in this treatment.

Although the QRE concept, when combined with selfish preferences, makes the wrong predictions regarding responder behavior, the concept is appealing because almost all experiments exhibit a lot of unexplained variance that can be plausibly attributed to decision errors. This is also the case in our experiments. To illustrate this we plotted the distribution of the proposers' offers in Figure 7. The figure shows the data from the last ten periods where the proposers' actions remained rather stable over time.[24] Nevertheless, Figure 7 suggests that in all three treatments the proposers' offers exhibit substantial random variation. This randomness is difficult to capture with a pure fairness model. In fact, if we apply the preference parameters used in Fehr and Schmidt (1999) we are not able to predict these distributions. The FS-parameters predict the correct comparative statics across treatments but fail to capture the randomness present in Figure 7. Therefore, we combined the quantal response approach with the FS model to predict the distribution of offers displayed in Figure 7. Note that the QRE approach is mute with regard to the assumptions about preferences and, therefore, it can be combined with a fairness approach. Moreover, by combining the quantal response approach with the fairness approach we correct the wrong comparative static predictions regarding responder behavior.

To predict the distribution of offers we completely tied our hands with regard to the choice of parameters for the FS-model by using the same parameters as in Fehr and Schmidt (1999).[25] The

[24] Recall that the regressions in column 2 of Table 2 indicate that there is no time trend in offers in the last 10 periods in any of the treatments.

[25] Like Fehr and Schmidt (1999) we assumed that 30 percent of the subjects exhibit $\alpha = \beta = 0$; 30 percent exhibit $\alpha = 0.5$ and $\beta = 0.25$; 30 percent have an α-value of 1 and a β-value of 0.6, and 10 percent an α-value of 4 and a β-value of 0.6.

only free parameter was therefore the error parameter μ. In Figure 7 we also show the predicted offer distribution of the combined QRE-Fairness model when the same error parameter as in Figure 6 is assumed. A comparison of the predicted and the actual offer distributions indicates that the combined model makes remarkably precise quantitative predictions. In each treatment the location of the predicted distribution is very close to the location of the actual distribution. For instance, in RC5 the large mass of the offers is predicted to be in the interval [0,10] and this is in fact the case. Likewise, in RC2 the large mass of the observations is predicted to be in the interval [15,25] which is also the case. Finally, for the BG 73.4 percent of the offers are predicted to be in the interval [40,50] and, in fact, 69.1 percent of the offers are in this interval. This shows that the combination of the fairness approach and the QRE-approach is remarkably good in explaining the qualitative and the quantitative aspects of our data.[26]

VI. A Robustness Check – Proposer Competition

In this section we perform a robustness check of the combined QRE-Fairness approach by applying the model to a different market situation. So far competition took place among the responders. In this section we introduce competition among the proposers, i.e., among the price setting agents. For this purpose we conducted an experiment in which two proposers simultaneously made competing offers $s_i \in \{0, 1, 2, 3, \ldots, 100\}$, $i = 1,2$ to one responder. Since there are two competing proposers we denote this treatment in the following PC2. The responder was free to accept the preferred offer. If the responder accepted s_i his income was s_i and the proposer who made the offer earned 100 - s_i. The proposer whose offer was not accepted earned nothing. This game implements Bertrand competition among proposers.

Like the RC2 treatment this game is interesting because it adds just a little bit of competition to the game but this small amount of competition may have dramatic effects on market outcomes. In fact, if the rationality and the selfishness of all players is common knowledge then (almost) the whole surplus in this game is reaped by the responder. In all subgame perfect equilibria of PC2 the

[26] We did *not* fit the error parameter to generate the best prediction. Instead we used a rough trial and error method to generate our predictions. Yet, this makes the accurateness of our results even more remarkable because by choosing the best predicting error parameter we might even be able to improve the fit relative to Figure 7.

responder earns at least 98 percent of the surplus.[27] Thus, whereas in the BG the proposer reaps (almost) the whole surplus, in PC2 the responder earns (almost) the whole surplus in an equilibrium with selfish preferences.

The combined QRE-Fairness approach predicts, in contrast, that the proposers will not overbid each other to such an extent that the responder reaps virtually the whole gains from trade. The reason is two-fold. First, sufficiently fair-minded responders or responders who make mistakes will not always take the higher of the two offers. This dilutes the proposers' incentives for overbidding. Even a rather small percentage of responders, who behave in this way, contribute to the removal of some extreme equilibria. Assume, for instance, that in 5 percent of the cases the responders take the lower offer. Then, both proposers offering 99 is no longer an equilibrium because, if a proposer deviates by proposing 50, her expected gain is 2.5 while if she stays at 99 she earns only 1 unit with probability 0.5. Second, there is a snowballing effect between the proposers' actions that pushes their offers away from the extreme values that give the responder (almost) the whole surplus. If, e.g., proposer 1 offers with positive probability considerably less than 100, the noisy best reply of proposer 2 also puts probability weight on offers that are considerably less than 100. However, as we will see below, the combined QRE-Fairness approach also predicts that, due to proposer competition, the offers in PC2 will be above the offers in the BG.

Except for the introduction of proposer competition the experimental set-up in PC2 was identical to the set-up in the other experiments. Subjects were again randomly matched within matching groups and the experiment lasted 20 periods. The exchange rate between experimental money and real money was identical to the one in RC2. In total we conducted 2 sessions with 4 matching groups in the PC2-treatment. We obtained the following results.

RESULT 4: *The introduction of a small amount of proposer competition by moving from the BG to PC2 causes a substantial increase in the proposers' offers but the average offer remains considerably below the extreme prediction of the standard model with selfish preferences. The combined QRE-Fairness model provides a good explanation of the distribution of offers.*

[27] There is an equilibrium in which both proposers offer $s_i = 99$ and the responder accepts one of these offers, but there are also other equilibria. Both proposers offering 100, or both offering 98 can also be part of an equilibrium. If both offer 98 their expected payoff is 1 unit and overbidding with $s_i = 99$ also yields 1 unit of payoff.

Support for Result 4 is given in Figure 8 and Figure 9. Figure 8 shows the evolution of accepted average offers per period. For purposes of comparison we also plotted the average offers in the BG. The figure shows that the accepted offers in PC2 are already in period 1 higher than in the BG. Moreover, the offers in PC2 increase considerably during the first 10 periods from 58 in period 1 to 69 in period 10. From period 11 onwards the offers remain rather stable – fluctuating between 70 and 75 on the average. This contrasts sharply with the BG where accepted offers fluctuated between 40 and 45.

In Figure 9 we present the actual distribution of offers in the final 10 periods of PC2. In addition, Figure 9 shows the distribution of offers predicted by the combined QRE-Fairness model. Note that in order to generate a prediction for PC2 we did not adjust the parameters of our model relative to the previous section. We used exactly the same parameters as for the predictions in Figure 7. Figure 9 indicates that the bulk of the actual offers is around 70 and the mode of the predicted offers is also around 70. More precisely, the model predicts that 64.5 percent of the offers are in the interval between 60 and 80 and, in fact, 61 percent of the offers are in this interval. Thus, Figure 9 also suggests that, although we had zero degrees of freedom to generate our predictions for PC2, the combined QRE-fairness model captures the actual distribution of offers rather well.

VII. Conclusions

The main message of this paper is that elementary effects of competition on the behavior of market participants cannot be satisfactorily explained with models relying exclusively on self-interested agents. In our setting the self-interest model makes the counterintuitive prediction that competition has no impact on prices. Yet, our experiments show that even a very small amount of competition – just adding one competing buyer or seller to a bilateral exchange situation – induces large behavioral changes among buyers and sellers and thus causes large changes in market prices. The reason for this failure of the self-interest model is that it neglects the existence of a non-negligible number of people who are also motivated by concerns for fairness and reciprocity.

Fairness models predict that the interaction between fair types and self-interested types is a key for understanding the effects of competition in our experiments. In competitive situations selfish responders induce fair responders to accept unfair offers. Therefore, increases in responder competition make it easier for selfish proposers to appropriate a larger share of the gains from trade. The experimental results indicate that all major qualitative predictions derived from the interaction between fair and selfish types are supported by the data. Moreover, by combining the fairness approach with the quantal response equilibrium approach we were able to provide a rather accurate quantitative picture of the whole distribution of prices in each of our 4 different conditions.

It is ironic that the self-interest assumption precludes a satisfactory understanding of the workings of competition. Intuitively, many effects of competition seem to be driven by self-interest. Yet, as the fairness approach makes clear, competition also has an effect on the extent to which fair-minded people behave like selfish people. In our setting increases in competition increase the incentive for fair-minded responders to behave like selfish responders. Thus, one could argue that it is not only the case that self-interested behavior drives many effects of competition but that competition also drives the extent to which people behave in a self-interested manner.

Taken together, we believe that our results suggest that the effects of competition on the behavior of market participants and, hence, on market outcomes can be considerably better understood if one explicitly considers the existence of selfish as well as fair-minded individuals. As economists we have reasons to be proud that our micro-models allow for heterogeneity in people's tastes. However, why should we only allow for heterogeneity in people's tastes for coffee, tee or bananas? Why not take the much more important heterogeneity in people's taste for fairness into account? In addition, we believe that the quantal response equilibrium approach also offers considerable insights. In fact, if one is interested in quantitative characterizations of the whole distribution of prices the combined fairness-quantal response approach seems very promising.

References

Bolton, G. and Ockenfels, G., 2000. "ERC: A Theory of Equity, Reciprocity and Competition." *American Economic Review* 90(1):166-193.

Camerer, C. and Thaler, R., 1995. "Ultimatums, Dictators and Manners." *Journal of Economic Perspectives* 9(2), 209-219.

Camerer, C. and Ho T., 1999. "Experience-Weighted Attraction Learning in Normal Form Games," *Econometrica* 67(4), 827-874.

Charness, G. and Rabin, M. (2002), "Understanding Social Preferences with Simple Tests." *Quarterly Journal of Economics* 117, 817-869.

Dufwenberg, M. and Kirchsteiger, G., 1999. "A Theory of Sequential Reciprocity." Discussion Paper, CentER, Tilburg University.

Falk, A. and Fischbacher, U., 1999. "A Theory of Reciprocity." Working paper Nr. 6, Institute for Empirical Economic Research, University of Zurich.

Fehr, E. and Falk, A.,1999. "Wage Rigidity in a Competitive Incomplete Contract Market." *The Journal of Political Economy* 107(1), 106-134.

Fehr, E. and Schmidt, K., 1999. "A Theory of Fairness, Competition and Cooperation." *Quarterly Journal of Economics* 114:817-868.

Fehr, E., Schmidt, K. 2003. „Theories of Fairness and Reciprocity – Evidence and Economic Applications." forthcoming in: M. Dewatripont, L. Hansen and St. Turnovsky (Eds.), *Advances in Economics and Econometrics* - 8th World Congress, Econometric Society Monographs.

Fischbacher, U. (1999). "Z-Tree: A Toolbox for Readymade Economic Experiments." IEW Working Paper No. 21, University of Zurich.

Goeree, J. K. and Holt, Ch. A., 2000. "Asymmetric Inequality Aversion and Noisy Behavior in Alternating-Offer Games." *European Economic Review* 44, 1079-1089

Goeree, J. K. and Holt, Ch. A., 2001. "Ten Little Treasures of Game Theory and Ten Intuitive Contradictions." *American Economic Review* 91(5), 1402-1422

Goeree, J. K. and Holt, Ch., and Laury, S. K., 2002. "Private Costs and Public Benefits: Unraveling the Effects of Altruism and Noisy Behavior." *Journal of Public Economics* 83(2), 255-276.

Goeree, J. K., Holt, Ch. A., and Palfrey, T. R, 2002. "Quantal Response Equilibrium and Overbidding in Private-Value Auctions" *Journal of Economic Theory* 104(1), 247-272.

Grosskopf, B., 2002. "Reinforcement and Directional Learning in the Ultimatum Game with Responder Competition", Mimeo, Harvard Business School

Güth, W., Schmittberger R., and Schwarze B., 1982. "An Experimental Analysis of Ultimatum Bargaining," *Journal of Economic Behavior and Organization,* 3, 367–388.

Güth, W., Marchand, N. and Rullière, J.L. 1997. “On the Reliability of Reciprocal Fairness – An Experimental Study.” mimeo Humboldt University at Berlin.

Güth, Werner, and Tietz, R., 1990. “Ultimatum Bargaining Behavior – A Survey and Comparison of Experimental Results.” *Journal of Economic Psychology* 11, 417-449.

Levine, D., 1998. “Modeling Altruism and Spitefulness in Experiments.” *Review of Economic Dynamics* 1, 593-622.

McKelvey and Palfrey, 1995. “Quantal Response Equilibria for Normal Form Games.” *Games and Economic Behavior* 10: 6-38.

Rabin, M., 1993. “Incorporating Fairness into Game Theory.” *The American Economic Review.* 83 (5), 1281-1302.

Roth, A., 1995. “Bargaining Experiments.” in Kagel, J., and Roth, A. (eds.) *The Handbook of Experimental Economics*. (Princeton: Princeton University Press)

Roth, A., and Erev, I., 1995. “Learning in Extensive Form Games: Experimental Data and Simple Dynamic Models in the Intermediate Term.” *Games and Economic Behavior* 8:164-212.

Roth, A., Prasnikar, V., Okuno-Fujiwara, M. and Zamir, S. 1991. “Bargaining and Market Behavior in Jerusalem, Ljubljana, Pittsburgh, and Tokyo: An Experimental Study.” *American Economic Review* 81(5), 1068-1095.

TABLE 1

Mean accepted offers

Matching group	All periods BG mean (s.d.)	All periods RC2 mean (s.d.)	All periods RC5 mean (s.d.)	Final period BG mean (s.d.)	Final period RC2 mean (s.d.)	Final period RC5 mean (s.d.)
1	43.2 (7.8)	26.4 (17.4)	13.6 (8.9)	45.5 (4.2)	14.3 (15.4)	12.0 (12.4)
2	44.2 (8.4)	23.5 (8.6)	23.5 (20.0)	46.5 (4.7)	18.0 (8.5)	21.3 (22.5)
3	39.7 (4.0)	29.6 (15.7)	17.1 (14.9)	40.0 (0.0)	25.3 (13.4)	14.0 (10.7)
4	48.0 (10.7)	22.3 (10.0)	10.9 (8.8)	37.7 (14.3)	17.8 (3.3)	7.8 (2.1)
5	42.4 (6.2)			42.0 (7.0)		
6	38.1 (8.7)			31.7 (2.9)		
Mean	42.7 (8.6)	25.5 (13.7)	16.2 (14.5)	41.1 (7.8)	18.8 (10.8)	13.8 (13.5)

Note: Standard deviations are in parentheses. BG denotes Bargaining Game, RC2 denotes the market game with two competing responders, RC5 denotes the market game with 5 competing responders.

TABLE 2

Pooled regressions predicting accepted offers

	Dependent variable: accepted offer			
	BG, RC2, and RC5 Pooled		RC2 and RC5 Pooled	
	all periods	final 10 periods	all periods	final 10 periods
RC2	-24.167***	-22.366***		
	(2.868)	(2.649)		
RC2*time period	-0.753***	-0.237		
	(0.200)	(0.197)		
RC5	-31.616***	-28.994***	-7.449	-6.628*
	(3.994)	(3.560)	(4.094)	(3.476)
RC5*time period	-0.539***	0.050	0.214	0.287**
	(0.179)	(0.192)	(0.190)	(0.108)
Time period	0.003	-0.142	-0.750***	-.379***
	(0.138)	(0.180)	(0.150)	(0.083)
Constant	42.737***	42.435***	18.570***	20.069***
	(2.047)	(2.038)	(2.070)	(1.743)
R^2	0.487	0.574	0.163	0.088
N	941	493	592	305
F-value	30.93	35.93	15.39	8.97
p-value	0.000	0.000	0.002	0.009

Note: Numbers reported are ordinary least squares coefficients. Robust standard errors are in parentheses. Errors are treated as independent across matching groups whereas within matching groups we allow for arbitrarily correlated errors. Time periods are numbered from –19 to 0 in columns 1 and 2 and from –9 to 0 in colums 3 and 4. ***, **, and * denote significance at the 1-, 5-, and 10-percent level, respectively.

TABLE 3

Probit model predicting the proposer's rejection risk

	Dependent variable equals 1 if the proposer's offer is rejected *Proposers* are the units of observation			
	BG, RC2, and RC5 pooled		RC2 and RC5 pooled	
	coef. (rob. s.e.)	marginal effects	coef. (rob. s.e.)	marginal effects
Offer	-0.084***	-.010	-0.083***	-0.004
	(0.012)		(0.023)	
RC2	-2.682***	-.215		
	(0.412)			
RC2*time period	-0.058***	-.007		
	(0.021)			
RC5	-4.135***	-.357	-1.443***	-0.090
	(0.451)		(0.367)	
RC5*time period	-0.057**	-.007	0.000	0.000
	(0.029)		(0.031)	
Time period	-0.014	-.002	-0.072***	-0.004
	(0.012)		(0.020)	
Constant	2.343***		-0.358	
	(0.459)		(0.395)	
N	1100		640	
Wald χ^2	248.92		55.75	
Prob > χ^2	0.000		0.000	

Note: Numbers reported are probit coefficients. Robust standard errors are in parentheses. Errors are treated as independent across matching groups whereas within matching groups we allow for arbitrarily correlated errors. The 20 time periods are numbered from –19 to 0. Marginal effects are calculated at sample means. ***, **, and * denote significance at the 1-, 5-, and 10-percent level, respectively.

TABLE 4

Pooled Probit model predicting the responder's rejection probability

Dependent variable equals 1 if the responder rejects the offer (Responders are the units of observation) BG, RC2, RC5 pooled		
	coef. (rob. s.e.)	marginal effects
Offer	-0.065*** (0.007)	-0.020
Responder's belief to receive offer in case of acceptance		
RC2	-1.076*** (0.263)	-0.268
RC2*time period	-0.023 (0.014)	-0.007
RC5	-1.666*** (0.292)	-0.532
RC5*time period	-0.029*** (0.011)	-0.009
Time period	-0.019* (0.011)	-0.006
Constant	1.574*** (0.297)	
N	2700	
Wald χ^2	289.42	
P	0.000	

Notes: Numbers reported are probit coefficients. Robust standard errors are in parentheses. Errors are treated as independent across matching groups whereas within matching groups we allow for arbitrarily correlated errors. The 20 time periods are numbered from –19 to 0. Marginal effects are calculated at sample means. ***, **, and * denote significance at the 1-, 5-, and 10-percent level, respectively.

TABLE 5

Pooled Probit models predicting the responder's rejection probability

	Dependent variable: = 1 if the responder rejects the offer Observation unit: each *responder* is an observation			
	BG, RC2, and RC5 pooled		RC2, and RC5 pooled	
	coef. (rob. s.e.)	marginal effects	coef. (rob. s.e.)	marginal effects
Offer	-0.055*** (0.007)	-0.017	-0.049*** (0.006)	-0.016
Believe that all others reject (dummy variable)	1.089*** (0.139)	0.374	1.118*** (0.138)	0.411
RC2	-0.236 (0.278)	-0.072		
RC2*time period	-0.013 (0.018)	-0.004		
RC5	-0.272 (0.296)	-0.088	0.033 (0.186)	0.011
RC5*time period	-0.014 (0.011)	-0.004	-0.000 (0.013)	-0.000
Time period	-0.021** (0.010)	-0.007	-0.031*** (0.014)	-0.010
Constant	0.087 (0.293)		-0.256 (0.166)	
N	2700		2240	
Wald χ^2	199.72		170.43	
P > χ^2	0.000		0.000	

Notes: Numbers reported are probit coefficients. Robust standard errors are in parentheses. Errors are treated as independent across matching groups whereas within matching groups we allow for arbitrarily correlated errors. The 20 time periods are numbered from –19 to 0. Marginal effects are calculated at sample means. ***, **, and * denote significance at the 1-, 5-, and 10-percent level, respectively.

Figure 1: Average accepted offer in bargaining and market experiments

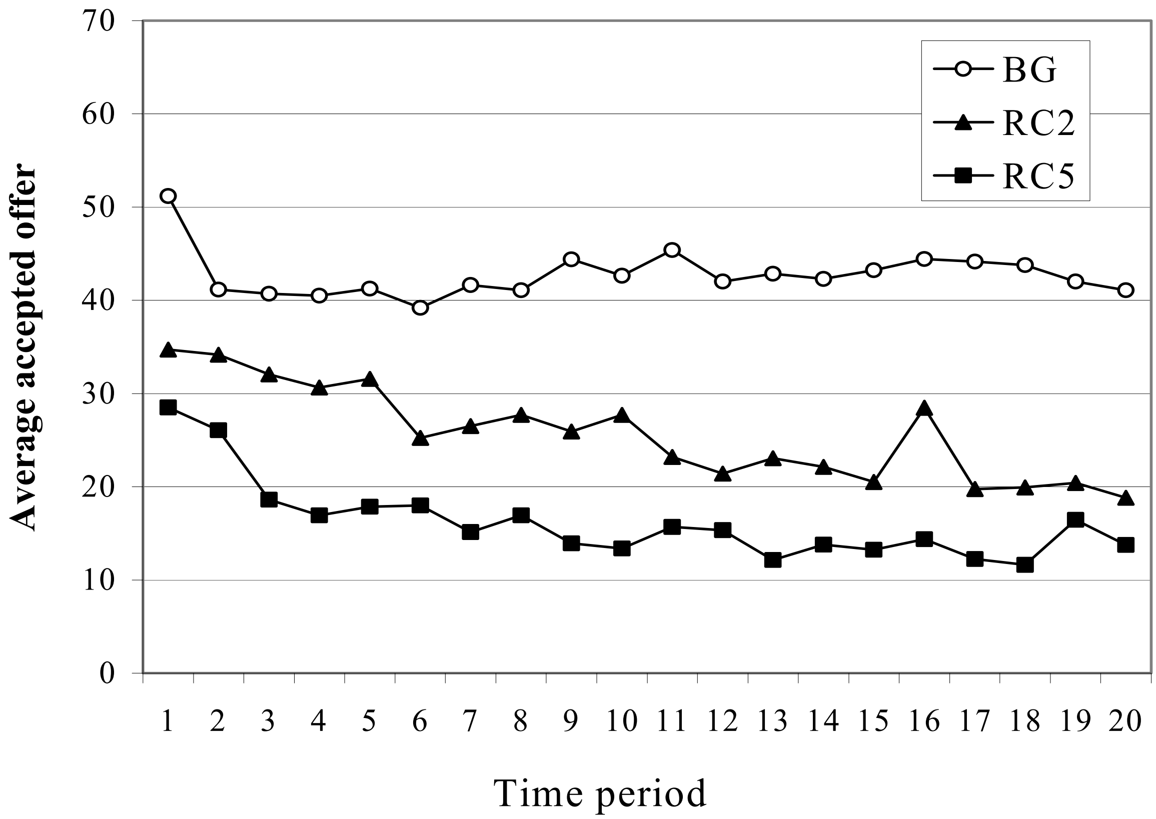


Figure 2: Proposers' rejection risk conditional on offers

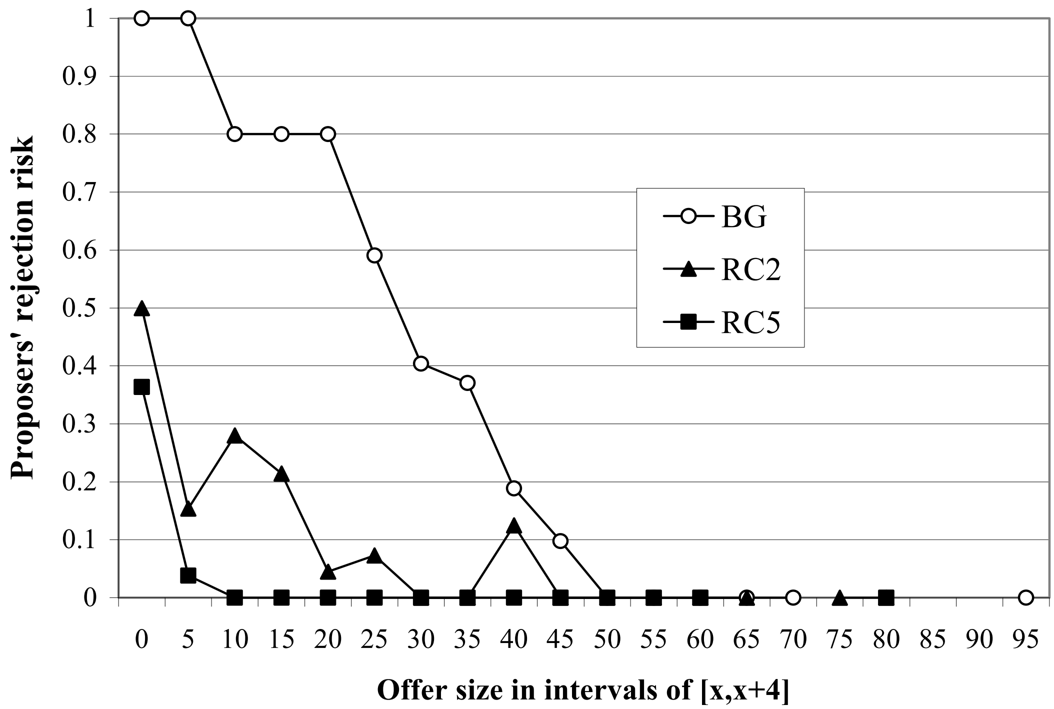


Figure 3: Proposers' expected payoff as a function of offer size

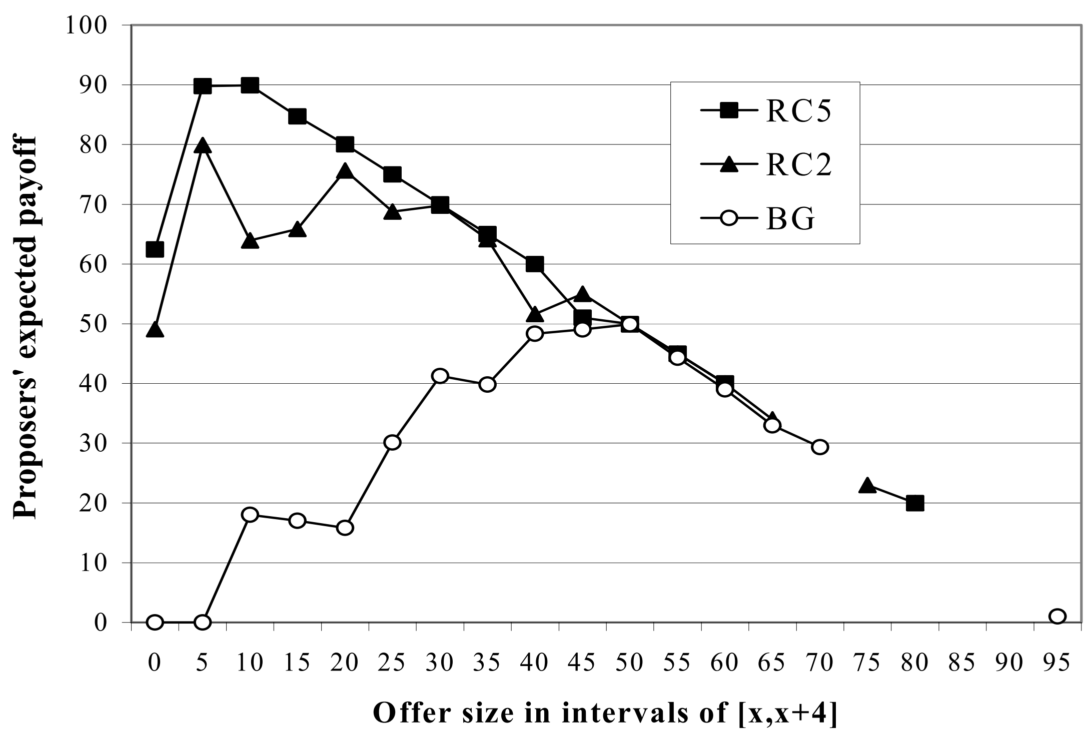


Figure 4: Responders' rejection rate conditional on offer size

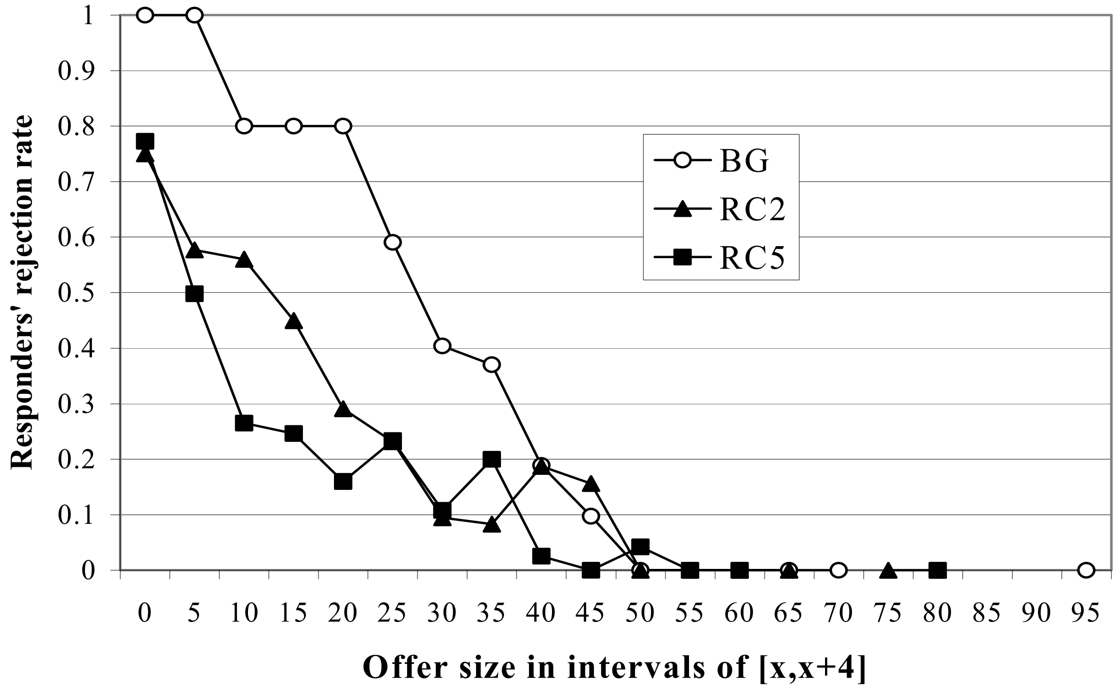


Figure 5: Responders' rejection rate in RC2 conditional on offer size and beliefs about the other responder's behavior

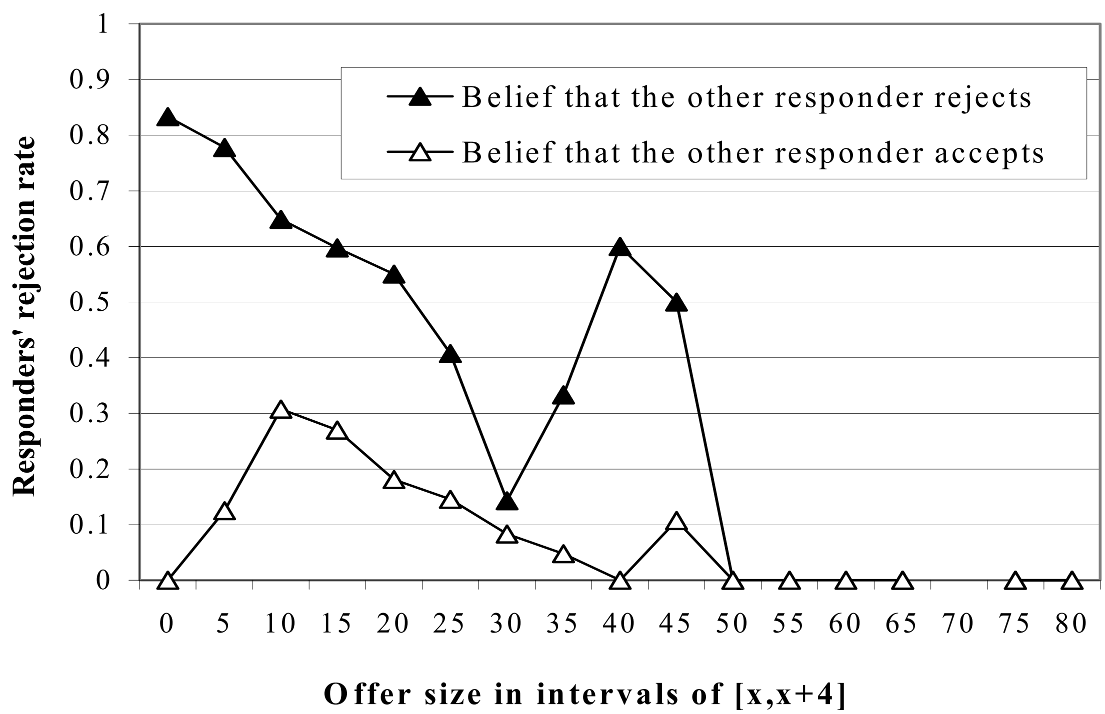


Figure 6: Predictions of responders' rejection rate according to the quantal response equilibrium approach

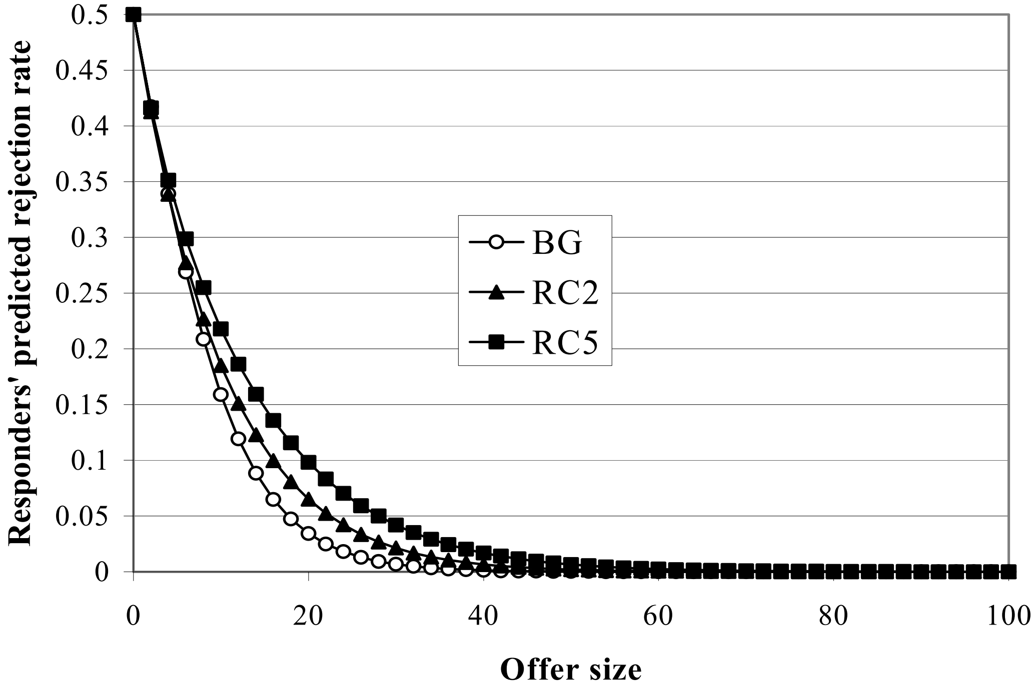


Figure 7: Actual and predicted offer distribution in bargaining and market experiments based on the combined Fairness – QRE approach

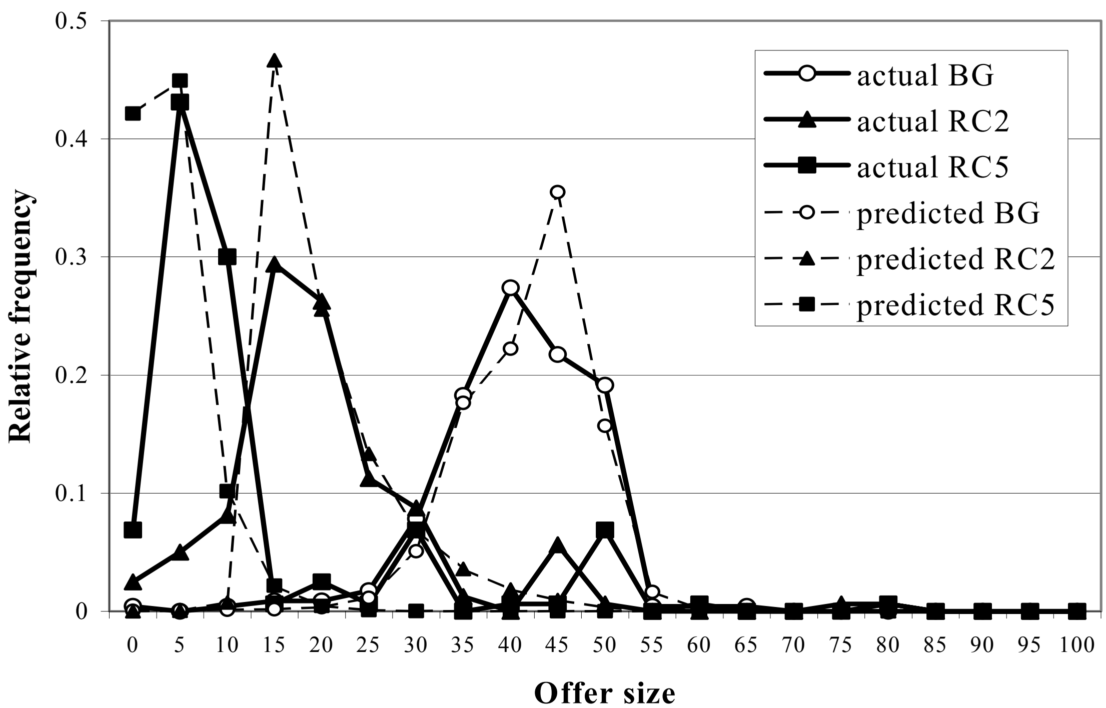


Figure 8: Average accepted offer in market experiment with proposer competition

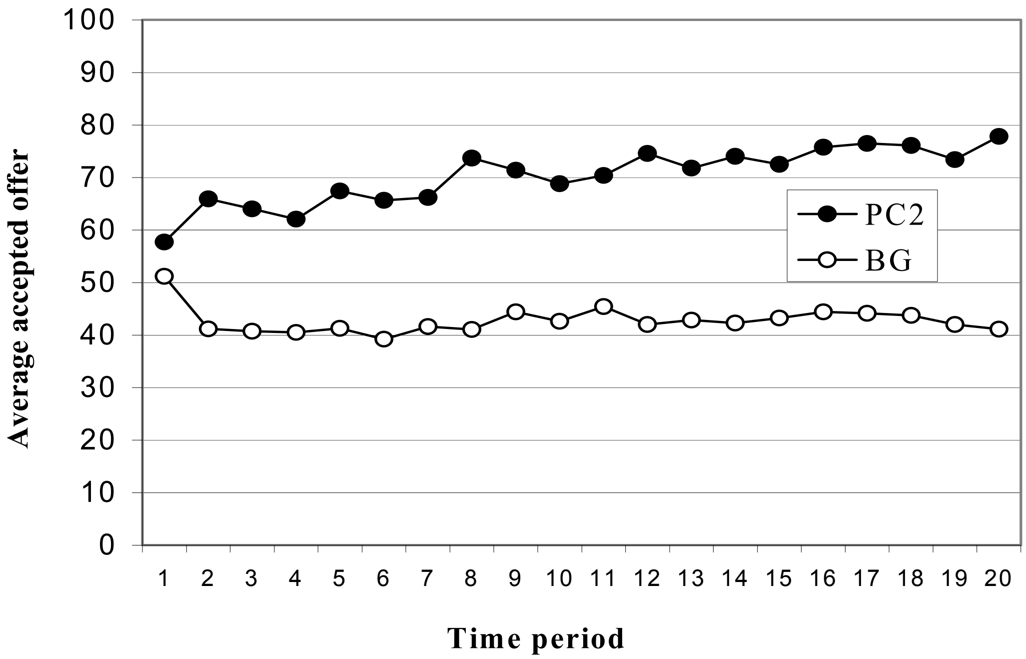
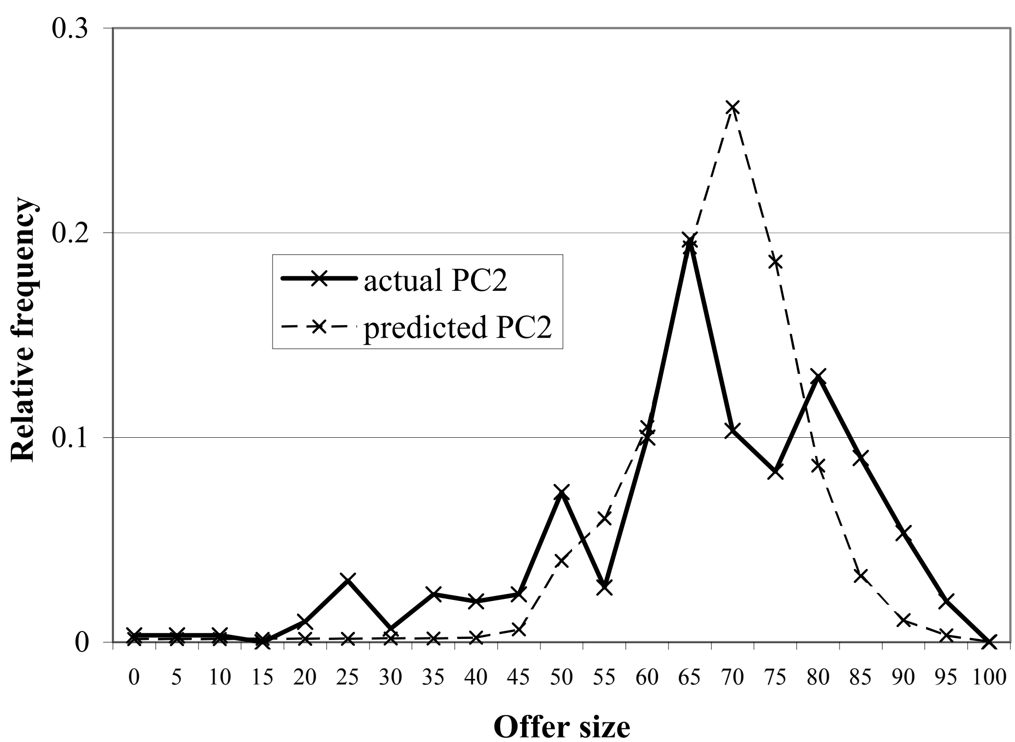


Figure 9: Actual and predicted offer distribution in market experiments with proposer competition based on the combined Fairness – QRE approach



Working Papers of the Institute for Empirical Research in Economics

No.

90 Ralf Becker, Urs Fischbacher and Thorsten Hens: *Soft Landing of a Stock Market Bubble. An Experimental Study,* January 2002
91 Rabah Amir, Igor V. Evstigneev, Thorsten Hens, Klaus Reiner Schenk-Hoppé: *Market Selection and Survival of Investment Strategies,* October 2001
92 Bruno S. Frey and Matthias Benz: *Ökonomie und Psychologie: eine Übersicht,* Oktober 2001
93 Reto Schleiniger: *Money Illusion and the Double Dividend in the Short Run,* October 2001
94 Bruno S. Frey: *Flexible Citizenship for a Global Society,* November 2001
95 Ernst Fehr and Armin Falk: *Psychological Foundations of Incentives,* November 2001
96 Takeshi Momi: *Excess Demand Functions with Incomplete Markets – A Global Result,* January 2002
97 Colin F. Camerer and Ernst Fehr: *Measuring Social Norms and Preferences using Experimental Games: A Guide for Social Scientists,* January 2002
98 Lars P. Feld and Bruno S. Frey: *Trust Breeds Trust: How Taxpayers are Treated,* January 2002
99 Aleksander Berentsen and Guillaume Rocheteau: *Money and Information,* January 2002
100 Aleksander Berentsen and Guillaume Rocheteau: *Money and the Gains from Trade,* January 2001
101 Aleksander Berentsen and Guillaume Rocheteau: *On the Efficiency of Monetary Exchange: How Divisibility of Money Matters,* January 2002
102 Daniel Waldenström and Bruno S. Frey: *How Government Bond Prices Reflect Wartime Events. The Case of the Stockholm Market,* January 2002
103 Bruno S. Frey and Stephan Meier: *Selfish and Indoctrinated Economists?,* January 2002
104 Bruno S. Frey and Stephan Meier: *Two Concerns about Rational Choice: Indoctrination and Imperialism,* January 2002
105 Rafael Lalive and Josef Zweimüller: *Benefit Entitlement and the Labor Market: Evidence from a Large-Scale Policy Change,* January 2002
106 Ernst Fehr and Urs Fischbacher: *Third Party Punishment,* February 2002
107 Bruno S. Frey and Stephan Meier: *Pro-Social Behavior, Reciprocity or Both?*, February 2002
108 Thorsten Hens, Klaus Reiner Schenk-Hoppé and Bodo Vogt: *On the Micro-foundations of Money: The Capitol Hill Baby-Sitting Co-op,* March 2002
109 Anke Gerber and Marc Oliver Bettzüge: *Evolutionary Choice of Markets,* March 2002
110 Rafael Lalive, Jan C. van Ours and Josef Zweimüller: *The Effect of Benefit Sanctions on the Duration of Unemployment,* March 2002
111 Reto Föllmi and Josef Zweimüller: *Structural Change and the Kaldor Facts of Economic Growth,* March 2002
112 Rafael Lalive and Josef Zweimüller: *Benefit Entitlement and Unemployment Duration: The Role of Policy Endogeneity,* April 2002
113 Simon Gächter and Arno Riedl: *Moral Property Rights in Bargaining,* January 2002
114 Simon Gächter and Ernst Fehr: *Fairness in the Labour Market – A Survey of Experimental Results,* April 2002
115 Reto Föllmi and Urs Meister: *Product-Market Competition in the Water Industry: Voluntarily Nondiscriminatory Pricing,* May 2002
116 Bruno S. Frey and Stephan Meier: *Museums between Private and Public - The Case of the Beyeler Museum in Basle,* June 2002
117 Bruno S. Frey: *Publishing as Prostitution? Choosing Between One's Own Ideas and Academic Failure,* June 2002
118 Bruno S. Frey and Matthias Benz: *From Imperialism to Inspiration: A Survey of Economics and Psychology,* May 2002
119 Matthias Benz and Alois Stutzer: *Are Voters Better Informed When They Have a Larger Say in Politics?,* June 2002
120 Ernst Fehr, Urs Fischbacher and Elena Tougareva: *Do High Stakes and Competition Undermine Fairness? Evidence from Russia,* July 2002
121 Enrico De Giorgi: *Reward-Risk Portfolio Selection and Stochastic Dominance,* August 2002
122 Enrico De Giorgi: *A Note on Portfolio Selections under Various Risk Measures,* August 2002
123 Klaus Reiner Schenk-Hoppé*: Resuscitating the Cobweb Cycle,* July 2002
124 Alois Stutzer: *The Role of Income Aspirations in Individual Happiness,* August 2002

The Working Papers of the Institute for Empirical Research in Economics can be downloaded in PDF-format from
http://www.iew.unizh.ch/wp

Institute for Empirical Research in Economics, Blümlisalpstr. 10, 8006 Zurich, Switzerland

Phone: 0041 1 634 37 05 Fax: 0041 1 634 49 07 E-mail: bibiewzh@iew.unizh.ch

Working Papers of the Institute for Empirical Research in Economics

No.

125 Ernst Fehr and Lorenz Götte: *Do Workers Work More if Wages are High? Evidence from a Randomized Field Experiment,* July 2002

126 Anke Gerber, Thorsten Hens and Bodo Vogt: *Rational Investor Sentiment,* December 2002

127 Matthias Benz and Alois Stutzer: *Do Workers Enjoy Procedural Utility?,* September 2002

128 Thorsten Hens, Klaus Reiner Schenk-Hoppé and Martin Stalder: *An Application of Evolutionary Finance to Firms Listed in the Swiss Market Index,* August 2002

129 Bruno S. Frey, Matthias Benz and Alois Stutzer: *Introducing Procedural Utility: Not only What, but also How Matters,* October 2002

130 Ernst Fehr and Jean-Robert Tyran: *Limited Rationality and Strategic Interaction, The Impact of the Strategic Environment on Nominal Inertia,* November 2002

131 Armin Falk, Rafael Lalive and Josef Zweimüller: *The Sucess of Job Applications: A New Approach to Program Evaluation,* November 2002

132 Dirk Engelmann and Urs Fischbacher: *Indirect Reciprocity and Strategic Reputation, Building in an Experimental Helping Game,* November 2002

133 U. Fischbacher, Christina M. Fong and Ernst Fehr: *Fairness and the Power of Competition,* January 2003

134 E. Fehr and John A. List: *The Hidden Costs and Returns of Incentives – Trust and Trustworthiness among CEOs*, November 2002

135 Bruno S. Frey and Matthias Benz: *Being Independent is a Great Thing: Subjective Evaluations of Self-Employment and Hierarchy*, November 2002

136 Bruno S. Frey and Simon Luechinger: *Terrorism: Deterrence May Backfire,* December 2002

137 Bruno S. Frey and Simon Luechinger: *How To Fight Terrorism: Alternatives To Deterrence,* December 2002

138 Thorsten Hens and Bodo Vogt: *Money and Reciprocity,* December 2002

139 Thorsten Hens and Klaus Reiner Schenk-Hoppé: *Markets Do Not Select For a Liquidity Preference as Behavior Towards Risk*, December 2002

140 Ernst Fehr and Joseph Henrich: *Is Strong Reciprocity a Maladaptation? On the Evolutionary Foundations of Human Altruism,* January 2003

141 Ernst Fehr, Urs Fischbacher, Bernhard von Rosenbladt, Jürgen Schupp and Gert G. Wagner: *A Nation-Wide Laboratory Examining trust and trustworthiness by integrating behavioral experiments into representative surveys,* January 2003

142 Reto Foellmi, Manuel Oechslin: *Who Gains From Non-Collusive Corruption?*, January 2003

143 Alois Stutzer and Bruno S. Frey: *Does Marriage Make People Happy, Or Do Happy People Get Married?,* January 2003

The Working Papers of the Institute for Empirical Research in Economics can be downloaded in PDF-format from http://www.iew.unizh.ch/wp/

Institute for Empirical Research in Economics, Blümlisalpstr. 10, 8006 Zürich, Switzerland

Phone: 0041 1 634 37 05 Fax: 0041 1 634 49 07 E-mail: bibiewzh@iew.unizh.ch