Is Competition Fair? An Experimental Study

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Abstract

Is competition perceived as a fair mechanism? We report data from laboratory experiments where a powerful buyer can trade with one of several sellers. Sellers who feel shortchanged can engage in counterproductive behavior to punish the buyer. We find that the same unfavorable terms of trade trigger significantly less counterproductive behavior if the buyer uses a competitive auction to determine the terms of trade than if he uses his price setting power to dictate the same terms directly. Our results demonstrate the importance of understanding not only the allocative properties of mechanisms that are used to coordinate economic activity but also the behavioral reactions to the resulting outcomes in order to understand their overall efficiency.

Keywords: Competition, market power, counterproductive behavior, efficiency, fairness
JEL codes: C91, D03, D63

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1 Introduction

Competition in markets is associated with desirable properties such as efficient allocation of resources, free market entry, and the exercise of choice. But do people perceive competition also as a *fair mechanism*? Some scholars assume that this is the case. Hart & Moore (2008), on the one hand, hypothesize that competition is perceived as fair because it "provides a relatively objective measure of what B[uyer] and S[eller] bring to the relationship" (p. 12). Survey evidence reported by Kahneman et al. (1986), on the other hand, documents that many people regard market mechanisms as unfair, for example in scenarios in which a firm exploits an increase in market demand to raise prices.

Understanding fairness perceptions is important in general because many people are willing to retaliate against others whom they blame for unfair outcomes, even if their retaliatory actions are costly and create inefficiencies (e.g., Camerer, 2003; Fehr & Fischbacher, 2003). Given the central role that competition plays in markets, business life, and many realms of society at large, it is of particular importance to understand the fairness perceptions associated with competitive mechanisms.

Our paper provides evidence that competitive mechanisms can attenuate inefficient counterproductive reactions to unequal distributive outcomes—relative to other mechanisms such as the exercises of market power or the use of hierarchies and authority in organizations. More broadly, our data show that it is not only important to understand the allocative properties of mechanisms that are used to coordinate economic activity in order to understand their overall efficiency but also their "behavioral properties"—in the sense of the amount of inefficient counterproductive behavior that they provoke in reaction to inequality.

To see the relevance of such fairness perceptions, consider the following example from the supply chain literature. Firms sourcing intermediate goods or business services from outside suppliers increasingly rely on online procurement auctions to obtain the best price in the market. While many studies find that the use of these highly competitive auctions has substantially reduced the purchase prices of materials and services, several researchers in the operations management literature caution that the increased reliance on competitive sourcing might lead to perceptions of opportunism and undermined trust, so that suppliers might be induced to lower levels of service and product quality (see, e.g., the discussion in Carter & Kaufmann, 2007). Indeed, the authors provide survey evidence suggesting that "increased levels of opportunism harm supplier nonprice performance" (p. 16).

While these findings appear to stand in contrast to our data, the reported opportunistic behavior could be entirely driven by the outcome of the competitive mechanism (e.g., low procurement prices) and not by reactions to the mechanism as such. To separate opportunistic reactions to price setting mechanisms from reactions to distributional outcomes, it is necessary to consider different mechanisms while controlling for distributional outcomes. Conducting a laboratory experiment allow us to achieve this goal.

In this paper, we analyze experimentally the impact of the use of competition—relative to the use of price setting power—on a party's counterproductive behavior in response to an unfavorable distributional outcome. Our experimental design reflects a stylized trading situation where a powerful buyer can trade with one of two possible sellers. The terms of trade—that is, the markup that the buyer pays on top of the seller's cost—are reflected in the number of points that the buyer transfers to one of the sellers. The buyer can choose between two different mechanisms. He can either use his price setting power to set the transfer directly or he can let the transfer be determined in a competitive clock auction. If the seller uses his price setting power he directly approaches one of the sellers and dictates the price. The other seller is not considered and receives nothing. In the competitive mechanism, in contrast, the buyer lets the two sellers compete against each other. The clock auction is designed so that the transfer increases continuously until one of the sellers accepts. The seller who accepts first receives the transfer, the other gets nothing. After the transfer is determined—either by the buyer's price setting power or by competition—the sellers can engage in counterproductive behavior. This is implemented in form of a costly punishment option that allows retaliating against the buyer and/or the other sellers.[1] The observed punishment serves as our measure of perceived fairness violations and responsibility attribution for the distributive outcome resulting under the chosen mechanism.

We find—for given distributive outcomes—that the competitive mechanism triggers less punishment for the buyer compared to the case where he uses his market power to set the price directly. Moreover, we find that using competition leads to a partial shift of the blame. While the buyer is punished less under competition, the sellers punish each other more. Importantly, the increase in mutual punishment of the sellers is smaller than the reduction in the punishment of the buyer. The use of competition thus decreases the total amount of counterproductive behavior, i.e., it decreases the inefficiencies caused by conflicting views about the fairness of the resulting distributive outcome.

Our findings have important implications. First, our data do not support the view that the use of a competitive mechanism increases perceived opportunism and leads to lower

[1]The counterproductive actions in our experiment correspond to what Hart & Moore (2008) call performance shading or what Carter & Kaufmann (2007) mean by opportunism and undermined trust. Counterproductive behavior can occur in various forms. The selected seller can hurt the buyer by lowering the quality of the product or service delivered to the buyer. Lowering the quality may be costly if there is a risk of detection or if the seller himself prefers delivering a high quality product. Another common and potentially powerful form of shading is malicious gossip. This kind of punishment can be used by both selected and rejected parties and may be targeted at both trading partners and competitors.

performance of trading partners. Quite on the contrary, relative to a situation where a powerful buyer simply dictates a low price that leaves, say, just a small markup on top of costs, sellers in our experiment judge the same low prices as more justified when they are competitively elicited and thus engage less in quality shading. Existing work in economics argues that asymmetric information with respect to sellers' production costs is the key reason for the use of procurement auctions (see, e.g., Klemperer, 1999). Our results imply that powerful buyers, who intend to source intermediate products or business services from outside suppliers, should not only use competitive procurement because it helps to elicit sellers' costs, but also because it reduces the inefficiencies caused by counterproductive sellers who feel shortchanged if prices are low.

Second, our study also adds a new angle to the discussion of transaction costs in general. When comparing the benefits and costs of markets and hierarchies, existing work in the incomplete contracting literature emphasizes the trade-off between inefficiencies caused by opportunism in outsourced producer-supplier relations and bureaucracy costs in authority-based, vertically integrated production (Williamson 1975, 1985). Buyers in our experiment are not directly confronted with a make-or-buy decision, but the available options—competition and power—can very naturally also be interpreted as the choice between market and hierarchy. Our results reveal another possible upside of using the market that has—to the best of our knowledge—not been considered before: replacing authority-driven in-house negotiations with a competitive market mechanism may avoid retaliatory actions from trading partners that would have occurred otherwise.

To check the robustness of our results we implemented a set of three additional treatments. In a first treatment we show that our results are not merely a consequence of self-selection of different buyer types into different mechanisms. In this treatment, the mechanism to determine the transfer is no longer selected by the buyer but randomly assigned in every period. We find that exogenous assignment of mechanisms does not alter our results. Our second treatment investigates the role of average transfer levels on retaliatory behavior. It turned out that in our baseline condition average transfers under competition are higher than under price setting power. In reaction to this observation, we modified parameters to reverse this relation and find that our result also hold in a setup in which competition leads to higher average transfers. Third, we add another seller to our game and find that our results are robust to an increase in the intensity of competition

To investigate possible determinants of our results, we implemented another set of three treatment conditions. First, we explores the extent to which our results are driven by the free-entry feature of competition. In our baseline condition only competition grants both sellers the chance to obtain the transfer, while we exclude one seller from receiving the transfer when the buyer uses his price setting power. We find that our results hold even if the two sellers have the same chance to get the transfer under both mechanisms. Second, we study the importance of freedom of choice on the sellers' inclination to retaliate. In the baseline condition sellers make an active acceptance decision under competition, but not when the buyer uses his price setting power. We find that introducing an active acceptance decision also in the latter case does not change our results significantly. Finally, we find that our results do not change if we directly involve the buyer in the competitive price determination by letting him set the sequence of increasing prices in the auction.

The remainder of the paper is organized as follows. Section 2 discusses related literature. Section 3 describes the design of our baseline condition and Section 4 presents our main results. Section 5 provides three treatments that show the robustness of the results obtained in the baseline condition. Section 6 provides three further treatments that analyze possible determinants of our results. Section 7 discusses individual heterogeneity in sellers' counterproductive behavior and Section 8 analyzes buyers' optimal and actual choices of mechanism. Section 9 concludes.

2 Related Literature

A recent literature shows that people make more selfish decisions in market environments than in comparable nonmarket environments (Falk & Szech, 2013; Bartling et al., 2015). Even just framing an interaction with market terminology or priming individuals to think of money can reduce the importance of fairness considerations among interacting individuals (e.g., Hoffman et al., 1994; Ross & Ward, 2003; Vohs et al., 2006; Ellingsen et al., 2012; Cappelen et al., 2013). Our paper makes an important contribution to this literature by providing an explanation for these findings. We show that people judge inequality less harshly if it is generated competitively which, in turn, will lead to more selfish behaviors.

Our paper also contributes to the literature on the diffusion of responsibility. Psychological studies show that responsibility is diffused in groups, known as the "bystander effect" (Darley & Latane, 1968), and recent studies in economics show that responsibility diffusion leads to more selfish behavior in economic contexts (e.g., Dana et al., 2007; Hamman et al., 2010; Falk & Szech, 2013). The punishment pattern in our paper is consistent with the idea that responsibility diffusion creates "moral wiggle room" and reduces blame, because the buyer is the only person who makes a decision if he uses his price setting power, while also one of the sellers has to make an active acceptance decision if the buyer chooses competition. Further, Bartling & Fischbacher (2012) show that delegation of a potentially unpopular decision to another person or a random device avoids punishment for unfair outcomes (see also

Coffman, 2011). Our paper reveals that it is possible for economic actors to deflect blame by delegating choice to a competitive mechanism and "let the market decide."

Moreover, our paper is related to experimental studies by Fehr et al. (2009, 2011), who confirm Hart & Moore's (2008) hypothesis that a competitively negotiated ex-ante contract provides a reference point for ex-post trade (see also Bartling & Schmidt, 2015). Fehr et al. take a competitive environment as given and focus on the impact of the buyer's choice between a rigid and a flexible contract on sellers' ex-post counterproductive behavior. In contrast, we focus on the buyer's choice of mechanism—price setting power or competition—on counterproductive behavior by sellers, not on the choice of a contract type.

Further, the idea that the same outcome is judged differently depending on the mechanism or procedure that leads to it is deeply entrenched in psychology (e.g., Thibaut & Walker, 1975). Existing research on procedural fairness in economics largely focuses on the role of biased vs. unbiased random procedures to capture the idea of equal opportunity, "level playing field," or ex-ante fairness (e.g., Bolton et al., 2005; Trautmann, 2009; Krawczyk & Le Lec, 2010; Sebald, 2010; Krawczyk, 2011; Brock et al., 2013; Cappelen et al., 2013). Our paper advances this literature by studying the the important "procedure of competition," which is of particular interest given the central role that competition plays in real life.

Finally, previous work has investigated the effect of competition in ultimatum games (Güth et al., 1998; Marchand, 2001; Grosskopf, 2003; Fischbacher et al., 2009). These studies show that competition among receivers hugely increases their willingness to accept low offers.[2] Fehr & Schmidt (1999) show that the same outcome-based fairness preferences that motivate receivers to reject low offers in the standard ultimatum game can also induce them to accept these offers under competition.[3] Our study differs in two important ways from ultimatum games with receiver competition. First, the acceptance decision and the punishment decision are perfectly linked in ultimatum games. This is not the case in our design. Sellers who have accepted a transfer under competition can still punish the buyer if they perceive the distributional outcome as unfair. In our study, purely outcome-based fairness preferences can therefore not explain why sellers punish less when the same unequal payoff distribution has been determined by competition rather than by the buyer's price setting power. Second, in the studies on receiver competition in ultimatum games it is the experimenter who decides whether the decision environment is competitive or not. In our study, in contrast, the buyer chooses the mechanism under which the transfer is determined.

[2]Roth et al. (1991) conduct an ultimatum game with proposer competition.

[3]The reason is that the presence of competing receivers implies that a single receiver cannot ensure punishment of the proposer by rejecting a low offer. There is always the possibility that another receiver accepts, in which case the rejecting receiver lowers his expected payoff without affecting the proposer's payoff.

3 Experimental Design

Consider the following situation: a single buyer can trade with one of several sellers, either by using his monopsonistic price setting power to simply dictate the selling price or by entering the sellers into price competition with each other. After the terms of trade are settled, sellers who feel shortchanged can engage in costly counterproductive behavior such as sabotage or performance shading. Our experimental strategy is to capture this trading situation in the simplest possible design.

3.1 Baseline Treatment

We implement a three-player game with one buyer and two sellers. The buyer has an endowment of 90 points and the two sellers have an endowment of 10 points each. The buyer implements a transaction with one of the sellers. The transaction is executed simply by transferring an integer amount $t \in [0, 40]$ to one of the two sellers. The transfer can be interpreted as the markup that the buyer pays the seller on top of the seller's cost. The default is that the buyer receives the entire surplus from trade (80 points), represented by his large endowment ($10 + 80 = 90$ points), but he can set a positive transfer—i.e., a price that strictly exceeds the seller's costs—to share parts of the surplus with the seller. The buyer decides whether to use his monosponistic price setting power and set the transfer directly or to let it be determined in a competitive auction. One randomly chosen seller can finally allocate costly punishment points to the buyer and/or the respective other seller. In the following we provide a step-by-step account of the game and describe each player's decisions in detail.

Step 1: *The buyer's choice of mechanism*
The buyer (player A) first decides whether to use his price setting power or to employ a competitive mechanism to determine the transfer t that goes to one of the two sellers (players B and C).

(i) If A chooses to use his price setting power, he determines directly how many points t to transfer to the seller. Importantly, the transfer always goes to B in this case, and C receives nothing.

(ii) If A chooses competition, the transfer is determined by an increasing clock auction. The transfer starts at 0 points and automatically increases by one point each second. The auction stops as soon as one of the two sellers accepts the current transfer. The transfer can thus go to either B or C, depending on who accepts first. Should the clock auction arrive at the maximal transfer of 40 points (after 40 seconds), it does not increase further.[4]

Two important features of our experimental design are worth a discussion at this point. First, participation opportunities are a common feature of competitive mechanisms. Indeed, one defining characteristic of a perfectly competitive market is free market entry. We capture this feature in our experimental design by granting both sellers (B and C) equal chances to receive the transfer under the competitive mechanism. Moreover, we exclude one of the sellers (C) from receiving the transfer if the buyer uses his price setting power in order to clearly differentiate the two mechanisms along the dimension of participation opportunities. This allows us to elicit counterproductive behavior from two different types of sellers and to study whether B and C react differently to given transfers under the two mechanisms. Moreover, in one of our treatment variations that we describe below we implement symmetric participation opportunities for both sellers also when the buyer uses his price setting power, which enables us to study the role of equal participation opportunities in isolation.

Second, real world buyers are free to decide whether they want to run, for example, a procurement auction or employ other ways to determine the price. Providing the buyer with the choice of the price setting mechanism is thus a realistic feature, which we want to capture in our design as well. Note, however, that giving the buyers a choice renders the mechanism endogenous. In another treatment variation, which we describe below, we exogenously impose the mechanism. This allows us to identify the role of the buyer's choice of mechanism for the sellers' counterproductive behavior.

Step 2: *Sellers' acceptance decisions*
If A chooses the competitive mechanism, B and C must independently decide when to click on an "accept" button in order to receive the actual transfer. Accepting early results in receiving a low transfer, but waiting comes with the risk that the respective other seller accepts first. Once one of the sellers accepts, the auction is terminated and the respective other seller cannot make a decision any longer. When the buyer uses his price setting power to set the transfer directly, B cannot decide whether to accept or reject the transfer but simply receives it.

Sellers must actively accept a given transfer in order to receive it under competition by the very nature of the mechanism. Indeed, "freedom of choice" is an important feature of competitive mechanisms in general. Note that we do not give the seller an acceptance choice when the buyer uses his price setting power in order to differentiate the two price setting mechanisms along the dimension of "active acceptance." In one of our treatment variations,

[4]It never took 40 seconds until one of the buyers accepted a transfer in the baseline treatment.

discussed below, we provide symmetric participation opportunities also then the buyer uses his price setting power in order to identify the impact of this feature on counterproductive behavior separately.

Step 3: *Sellers' punishment decisions*
After one of the sellers has received the transfer from A, either B or C is randomly selected with equal probability. The selected seller receives 5 additional points, which he can keep or use (in part or all) to punish the other players. To destroy one point of another player, the selected seller must give up 0.1 points of his own. He can deduct a maximum of 50 points in total from the other two players. Punishments can reduce a player's profit down to 0, but we do not allow for negative profits.

We used the strategy method to elicit punishment decisions from both sellers. First both sellers decided privately how many points, if any, to deduct from the other players. Only thereafter it was randomly determined whether B's or C's decisions were implemented.[5]

In the following we summarize the players' payoffs. Table 1 displays the intermediary payoffs $\tilde{\pi}$ resulting from the game before punishment. Table 2 shows the final payoffs π that result after punishment points p have been assigned by the randomly determined seller. The game was played repeatedly for 12 periods with fixed role assignments and random rematching of players. One period was randomly selected for payment.

3.2 Data Collection and Procedural Details

We conducted the study at the FLEX lab at Goethe-University in Frankfurt, Germany. Participants were recruited from the regular subject pool, covering all fields of study, using ORSEE (Greiner, 2003). The experiments were computerized using z-Tree (Fischbacher, 2007).

We ran 51 sessions with a total of 1,090 subjects. We ran nine sessions of our baseline treatment and seven sessions for each of our six control treatments, which we describe in Sections 5 and 6. We conducted two waves of sessions; the first in June, July, and November 2012 and the second in October and November 2014.[6] Within the two waves of sessions,

[5]We did not grant punishment rights to both sellers simultaneously because this would have created the potential for strategic counter-punishment among the sellers and thus confounded the interpretation of the punishment decisions as a measure for the attribution of blame. Moreover, our design avoids a public goods problem among the sellers with respect to the punishment of the buyer.

[6]Seven sessions of the baseline treatment took place in 2012 and two in 2014 to control for unobserved changes in the subject pool that may have occurred after 2012 (which we do not detect; see footnote 11). The "symmetric participation," "intense competition," and "involvement" treatments were conducted in 2012, the "exogenous mechanism," "acceptance," and "transfer level" treatments in 2014.

Table 1: Intermediate Payoffs before Punishment

	Power	*Competition*	
		B wins	*C wins*
$\tilde{\pi}_A$	$90 - t$	$90 - t$	$90 - t$
$\tilde{\pi}_B$	$10 + t$	$10 + t$	10
$\tilde{\pi}_C$	10	10	$10 + t$

Notes: A has an endowment of 90 points and B and C have an endowment of 10 points each. The intermediate payoffs $\tilde{\pi}$ for A, B, and C are shown as a function of the transfer t that goes from the buyer (A) to the seller (B or C).

Table 2: Final Payoffs

	B can punish	*C can punish*
π_A	$\tilde{\pi}_A - p^A$	$\tilde{\pi}_A - p^A$
π_B	$\tilde{\pi}_B + 5 - 0.1 \cdot (p^A + p^C)$	$\tilde{\pi}_B - p^B$
π_C	$\tilde{\pi}_C - p^C$	$\tilde{\pi}_C + 5 - 0.1 \cdot (p^A + p^B)$

Notes: Final payoffs π are shown as a function of the intermediate payoff $\tilde{\pi}$ and payments relating to punishment. The seller who can punish (B or C) receives 5 points extra. Each punishment point p assigned to another player reduces the punisher's payoff by 0.1 points. Superscripts denote the target of punishment.

treatments were randomly assigned to sessions and participants were randomly assigned to roles. We aimed at 24 subjects per session but some sessions were smaller due to no-shows. One session had 15 subjects only; all other session had at least 18 subjects.

Subjects received detailed written instructions at the beginning of a session and had to correctly answer several control questions before the experiment was started. A summary of the instructions was read aloud to ensure common knowledge of all rules. The experiment was framed neutrally. The roles in the experiment were not labeled as "buyers" and "sellers," instead we simply referred to roles A, B, or C (or D in our intense competition treatment). A translation of the original German instructions for the baseline condition is in Appendix C. Subjects finally answered a questionnaire containing demographics and some personality measures (see our discussion in Section 7). Interactions and earnings were anonymous.

Sessions lasted for 75 to 90 minutes including the reading of the instructions and the final cash payments. Subjects received a show-up fee of 10 EUR and experimental points were converted at a rate of five points per Euro. Average total earnings were 16.42 EUR; 24.06 EUR for subjects in the role of A, and 12.78 EUR for subjects in the role of B, C, or D.

4 Main Results

In this section we analyze the data of the baseline treatment to identify the impact of the price setting mechanism on the sellers' counterproductive behavior.

The grey bars in Figure 1 display the relative frequency of the different transfer levels when the buyer uses his price setting power and the black bars show the transfers under competition. We aggregate transfers in bins of five to smooth random variation. Only transfers of zero are displayed separately as they account for more than half of the observations when the buyer sets it directly, which can be read from the right vertical axis. In contrast, under competition almost 50 percent of the transfers are between 6 and 10. Transfers larger than 15 are grouped together as they are infrequent under both mechanisms. The average transfer amounts to 3.7 when the buyer sets it directly and to 9.5 under competition.

Our main interest is the punishment of the buyer for given transfers under the two mechanisms. The grey solid line in Figure 1 displays this information for price setting power and the black solid line for competition.[7] The figure reveals that the punishment of the buyer for given transfers is lower on average under competition than when the buyer uses his price setting power. For example, it can be read from the left vertical axis that a buyer's punishment for a zero transfer is almost 20 when the buyer sets the price directly but only about a third of this amount under competition. The differences are smaller in the other transfer bins but competition still reduces punishment by 30 to 60 percent. Only in the transfer bin of 6 to 10 does the punishment not differ between the two price setting mechanisms.

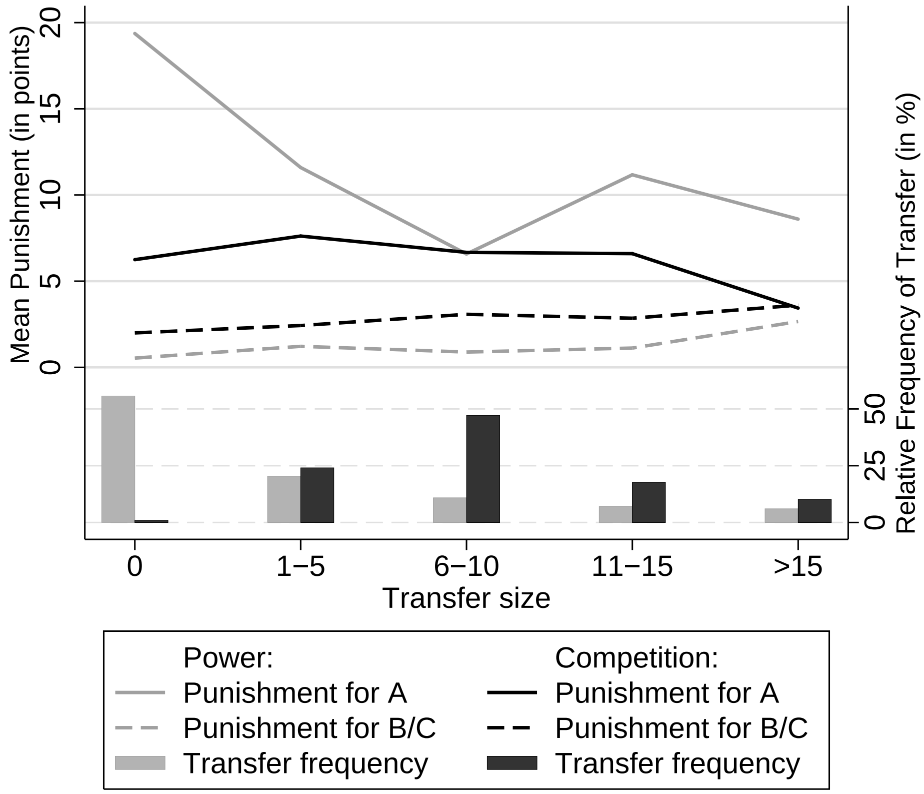
Regression (1) in Table 3 confirms the statistical significance of the difference in counterproductive behavior across mechanisms. The dependent variable is the punishment of the buyers. The use of price setting power is the omitted category and "Competition" is a dummy variable that takes on value 1 if an observation comes from the competitive mechanism and value 0 otherwise. The regression further includes dummy variables for each of our additional treatments and interactions with the competition dummy. We will discuss these variables in Sections 5 and 6. The regression finally controls for the size of the transfer and the period of observation. The negative and significant coefficient of "Transfer" shows that punishment tends to be lower for higher transfers on average over all treatments and mechanisms, which can be seen in Figure 1 for the baseline treatment and in Figure 3 for all other treatments. The negative and significant coefficient of "Period" reveals that punishment generally declines over the course of the 12 periods of the experiment.

The important observation for our purposes is that the coefficient of the competition dummy is large in size, negative, and highly significant ($p < .001$).[8] This confirms that competition reduces counterproductive behavior for given transfer levels. The regression

[7] Recall that we use the strategy method to elicit punishment. The numbers shown are the averages of all punishment decisions, irrespective of the actual implementation of a seller's punishment decision.

[8] Unless otherwise noted, p-values are always from OLS regressions based on standard errors clustered on the session level.

Figure 1: Punishment patterns in the baseline treatment



constant shows that punishment is at a level of 18.7 points for zero transfers when the buyer uses his price setting power and the coefficient of "Competition" reveals that punishment is about 6.5 points less under competition, hence a reduction of about a third on average.[9] We summarize these findings in our first result.

> **RESULT 1:** For given transfer levels, sellers punish the buyer less if the transfer is determined competitively rather than by use of the buyer's price setting power.

We next turn to the sellers' mutual punishment. The grey dashed line in Figure 1 displays the average punishment that the sellers inflict upon each other when the buyer uses his price setting power and the black dashed line displays this information under competition. The figure reveals that the sellers punish each other more under competition. The statistical significance of this increase is confirmed by regression (2) in Table 3. The dependent variable is the punishment for the respective other seller; otherwise regressions (1) and (2) are equivalent. The important observation in regression (2) is that the coefficient of the

[9]The size and significance of the effect is robust to alternative regression models. Table A1 in the online appendix provides a Tobit model and Tables A2 and A3 present a two-part hurdle model. The later analysis reveals that the competitive mechanism affects both the frequency and conditional amount of punishment.

Table 3: OLS Regression results for effects on punishment

	(1) Punishment for A	(2) Punishment for B/C/(D)	(3) Total Punishment
Competition	-6.503^{***}	1.589^{***}	-4.914^{***}
	(1.359)	(0.413)	(1.393)
Exogenous Mechanism	-1.140	-0.236	-1.376
	(2.185)	(0.231)	(2.211)
Competition X Exogenous Mechanism	1.328	-0.126	1.202
	(2.102)	(0.580)	(2.201)
Transfer Level	-0.770	0.081	-0.689
	(1.949)	(0.563)	(2.077)
Competition X Transfer Level	1.108	0.341	1.450
	(1.882)	(0.624)	(1.951)
Intense Competition	-4.036^{**}	0.419	-3.618^{*}
	(1.960)	(0.438)	(1.993)
Competition X Intense Competition	2.084	0.456	2.539
	(1.694)	(0.695)	(1.667)
Symmetric Participation	1.987	0.088	2.076
	(2.573)	(0.274)	(2.573)
Competition X Symmetric Participation	0.904	0.596	1.500
	(1.866)	(0.549)	(1.920)
Acceptance	0.858	0.518	1.376
	(1.846)	(0.358)	(1.908)
Competition X Acceptance	1.317	0.100	1.417
	(1.427)	(0.571)	(1.557)
Involvement	2.644	-0.438^{*}	2.206
	(2.258)	(0.225)	(2.284)
Competition X Involvement	0.383	0.786	1.168
	(1.573)	(0.535)	(1.546)
Transfer	-0.365^{***}	0.086^{***}	-0.280^{***}
	(0.032)	(0.011)	(0.035)
Period	-0.305^{***}	-0.014	-0.318^{***}
	(0.052)	(0.017)	(0.057)
Constant	18.651^{***}	0.599^{**}	19.250^{***}
	(1.649)	(0.228)	(1.630)
R^2	0.071	0.059	0.037
Observations	8868	8868	8868

$^{*}p < .10$, $^{**}p < .05$, $^{***}p < .01$

Notes: Robust standard errors in parentheses, clustered by 51 sessions. Dependent variables are the number of punishment points for the buyer (model 1), the respectively other seller(s) (model 2), or in total (model 3). For the intense competition treatment, the dependent variable in (2) corresponds to the sum of punishment assigned to the other two sellers. Post-estimation Wald tests show that competition significantly increases punishment for A in all treatments ($p < .001$; except in Exogenous Mechanism, where $p = .002$). The decrease in punishment for B/C/(D) is also significant in all treatments ($p < .001$), as is the overall decrease in total punishment (Exogenous Mechanism: $p = .030$, Transfer Levels: $p = .016$, Intense Competition: $p = .007$, Symmetric Participation: $p = .013$, Acceptance: $p < .001$, and Involvement: $p < .001$).

competition dummy is positive and highly significant ($p < .001$). The size of the effect is again large: the average mutual punishment increases by more than 1.5 points on average, while the regression constant is 0.6 points only. Hence, under competition, there is a shift of the blame from the buyer to the respective other seller. We summarize this finding in our second result.

> **RESULT 2:** For a given transfer level, sellers punish each other more if the transfer is determined competitively rather than by the buyer's price setting power.

Given the opposite effects of competition on the punishment targeted at the buyer and the respective other seller, the question arises whether total punishment increases or decreases. A comparison of the effect sizes displayed in Figure 1 suggests that competition reduces total punishment for given transfers. This is confirmed by regression (3) in Table 3. The dependent variable is total punishment; otherwise regression (3) is equivalent to regressions (1) and (2). The coefficient of the competition dummy is negative and highly significant ($p = .001$).[10] We summarize this finding in our third result.[11]

> **RESULT 3:** For a given transfer level, overall punishment—the sum of punishment targeted at the buyer and the punishment targeted at the respective other seller—is lower under the competitive mechanism than when the buyer uses his price setting power.

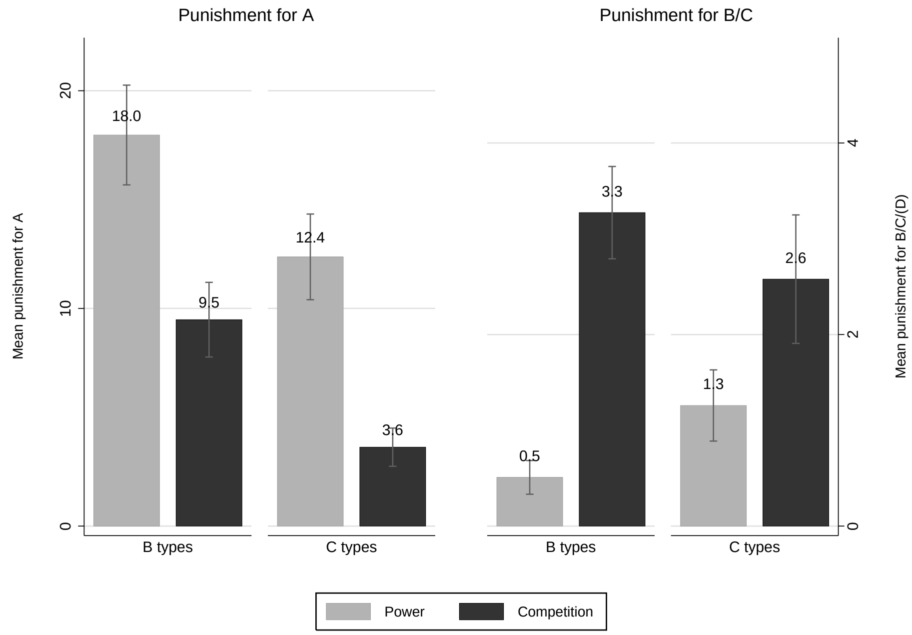
4.1 Robustness across Seller Types

Recall that sellers B and C have different participation options when the buyer uses his price setting power. In this case always B types receive the transfer, and C types have a chance to receive the transfer only when the buyer chooses competition. Hence, Cs benefit from a positive expected transfer when the buyer chooses competition, while they never receive the transfer otherwise. For Bs, in contrast, competition creates an additional risk. When the buyer uses his price setting power, they receive a transfer with certainty (though it might be zero), but under competition they only receive a transfer if they accept first. This asymmetry

[10] Tables A1 to A3 in the online appendix show that Results 2 and 3 are robust in Tobit and two-part hurdle models.

[11] Figure 1 and Table 3 include the data from all nine sessions of the baseline treatment, seven of which were conducted in 2012 and two in 2014. We ran regressions equivalent to regressions (1)-(3) in Table 3 but with the baseline data only and included a dummy for the sessions conducted in 2014 and its interaction with competition. We find that the coefficients of the 2014 dummy and of the interaction term are both insignificant in all three regressions ($p > .10$, standard errors clustered by individual, not session, as we have nine baseline sessions only), suggesting that no major changes in the subject pool.

Figure 2: Punishment by seller type



Notes: Error bars represent plus/minus one standard error of the mean, clustered by individual.

between seller types may create different punishment motives. One might, for instance, suspect that the higher punishment for A when he uses his price setting power is predominantly driven by punishment from Cs who punish A for not having chosen competition.

We address this question in Figure 2 that displays the average punishment under the two price setting mechanism separately for the two seller types. The left panel of the figure reveals that the effect of competition on the punishment for A is not only driven by Cs. Both seller types punish A more harshly on average when he uses his price setting power than when he chooses the competitive mechanism to determine the transfer. Moreover, the right panel of Figure 2 reveals that the increase in punishment of the respective other seller(s) also stems from both seller types—though the effect is much smaller for Cs.[12] In fact, irrespective of the seller type, the increase in punishment for the other seller(s) is mainly driven by the loser under the competitive mechanism. When examining punishment behavior for competition winners and losers separately, we find that the losers punish the respective other seller(s) more than the winners ($p < .001$). In contrast, we find no significant difference in punishment for A between competition winners and losers ($p > .10$); see Table A8 in the online appendix.[13]

[12] In the online appendix we provide additional regression analyses confirming these findings. Tables A4 to A7 report regressions equivalent to the regressions in Tables 3 and A1 for both seller types separately. Results 1-3 hold for both seller types separately, with the only exception that the increase in sellers' mutual punishment is not significant for Cs.

[13] While our design is not intended to differentiate between different model of social preferences, in Sec-

5 Robustness

In this section we discuss three treatment variations to analyze the robustness of our main results. First, we exogenously assign mechanisms to buyers to separate the role of the buyer's choice from the effect of the mechanism itself. Second, we implement a treatment where we reverse the relative levels of the average transfer that result under power and competition in the baseline treatment. Finally, we study the robustness of the effect of the mechanism on counterproductive behavior by varying the intensity of competition.

5.1 Exogenous Mechanism

The fact that the buyer chooses the price setting mechanism could give rise to selection effects. For example, if sellers update their beliefs about a buyer's "type" by observing the buyer's choice of mechanism, differences in punishment between the two mechanism could stem from sellers' reactions to different types of buyers rather than from their reactions to different mechanisms (e.g., Levine, 1998).

The *exogenous mechanism treatment* removes the buyer's choice of mechanism. Instead, a random device selects for each buyer and in each round with equal probability either the mechanism under which the buyer uses his price setting power or the competitive mechanism. The baseline and exogenous mechanism treatments are identical in all other respects. The exogenous mechanism treatment thus allows us to separate the effect of (i) the mechanism itself and (ii) the buyer's choice of the mechanism on counterproductive behavior.

Figure 3 displays transfers and punishment in all our additional treatments. Panel A shows the data for the exogenous mechanism treatment. Looking at transfers first, it is evident that there are only about half as many cases, relative to to the baseline condition, in which the buyer directly sets a transfer of zero. The average transfer when the buyer uses his price setting power in the exogenous mechanism treatment amounts to 9.00, while it is 4.32 in the baseline treatment only. This difference is highly significant ($p < .001$) and it suggests that different types of buyers indeed self-select into the different mechanisms in the baseline condition: buyers who want to ensure a small transfer use their price setting power rather than the competitive mechanism.

Importantly, however, Panel A of Figure 3 reveals that the punishment pattern remains qualitatively unchanged. This is confirmed by Table 3. The regression models include treatment dummies and interactions of the treatment dummies with the "Competition" dummy.

tion B of the online appendix we explore the extent to which different punishment motives, such as, e.g., inequity aversion or intention-based reciprocity, can predict the punishment pattern we observe in our baseline condition.

The interaction measures whether the impact of the use of the competitive mechanism on the sellers' counterproductive behavior is different from its impact in the baseline condition. The table shows that the interaction "Competition X Exogenous Mechanism" is not significant in either regression model, showing that punishment behavior does not significantly differ between the baseline and the exogenous mechanism treatment.

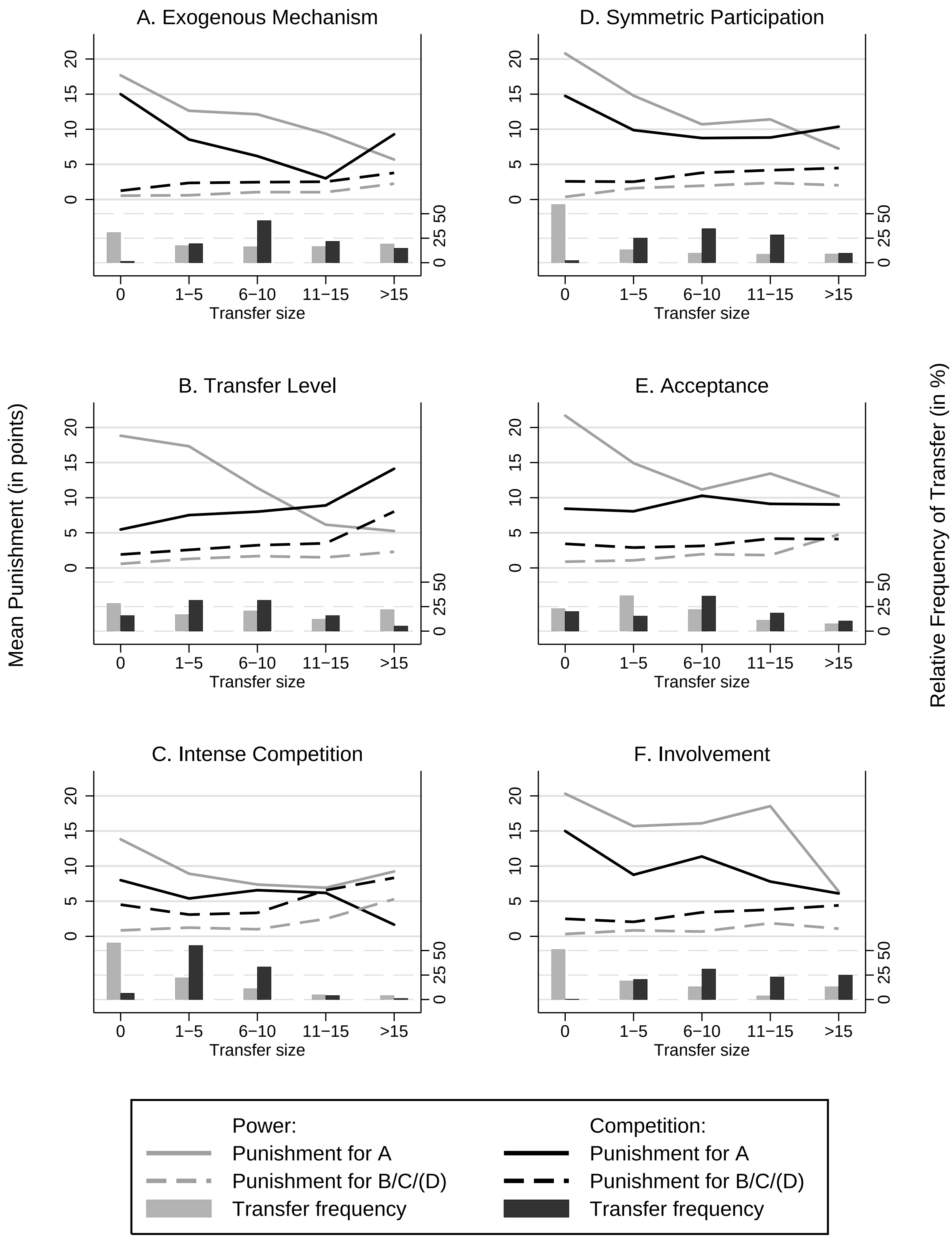
5.2 Transfer Level

The transfer levels when the buyer uses his price setting power are determined by the buyers' generosity and the sellers' threat of punishment, the ones under competition are determined by the intensity with which sellers compete with each other. Which mechanism generates higher transfers depends on a number of parameters and there is no generic reason why the average level of the transfer should be higher or lower under one or the other mechanism. The transfers are higher on average under competition than under price setting power in our baseline condition (9.46 vs. 3.69). We cannot a priori exclude that this difference in average transfers has partially determined sellers' counterproductive behavior under the two mechanism. For example, it is possible that sellers have judged buyers who chose to use their price setting power as less kind due to the lower average transfer (e.g., Rabin, 1993; Dufwenberg & Kirchsteiger, 2004; Falk & Fischbacher, 2006).

To study whether the sellers' counterproductive behavior is driven by the relative level of the average transfer in our baseline treatment, rather than by genuine features of the two mechanisms, we conduced the *transfer level treatment*.[14] To eliminate or reverse the difference between average transfers across the two mechanism, we implemented the following two changes. First, the seller who does not receive the transfer obtains five points only, instead of 10 points in the baseline under both mechanisms. Under competition, this increases the pressure to accept low transfers because immediately accepting a transfer of zero in the clock auction makes a seller better off (10 points) than not obtaining a transfer at all (5 points). Second, the buyers who use their price setting power in the baseline treatment determined the transfer by way of a scroll bar, where the default was set to zero (see the instructions in Appendix C). In the transfer level treatment we replaced the scroll bar with an entry field were buyers had to enter the desired transfer and where no default was indicated. The distribution of transfers displayed in Panel B in Figure 3 shows that, as intended, transfers under competition were reduced and transfers were increased when buyers used their price setting power such that, overall, average transfers in the transfer level treatment are now lower under competition than under price setting power (6.89 vs. 9.59).

[14]We devised this treatment ex-ante, after observing the results of the baseline condition.

Figure 3: Transfers and punishment patterns in the treatment conditions



Notes: For the intense competition treatment (panel C) the dashed lines represent the sum of punishment assigned to the respectively other two sellers.

Importantly, Panel B of Figure 3 shows that this adjustment of average transfers does not change our main results. For small transfers (up to 10 points), the punishment targeted at the buyer is clearly lower under competition than under price setting power in the transfer level treatment as well. This part of the transfer distribution contains the vast majority of our observations (72.4 percent). Because higher transfers decrease punishments much more strongly when the buyer sets the transfer directly than when it is set under competition, the solid lines cross for transfers greater than 10 points. The interaction of effects between transfer size and mechanism is also present in the other treatments.[15] The reasons behind this interaction can be understood when considering that the buyer fully determines the transfer size when he uses his price setting power. Consequently, the buyer is punished less if he shows himself to be more generous. Under competition, in contrast, it is not the buyer who determines the transfer that is finally realized, hence punishment does not decrease as much when a competitive transfer turns out to be relatively large.[16]

The results presented in Table 3 show that the interaction "Competition X Transfer Level" is not significant in either regression model, showing that punishment behavior does not significantly differ between the baseline and the transfer level treatment, indicating that Results 1 to 3 also hold if transfers are on average lower under competition.

5.3 Intense Competition

A decisive characteristic of any competitive mechanism is its intensity. The more intense the competition between sellers, the lower is the expected transfer. The intensity of competition might thus be an important determinant of the perceived fairness of a competitive mechanism. To study the influence of this factor on counterproductive behavior, we increase the number of sellers in the *intense competition treatment* by adding a player D, who is a "clone" of C in every respect. Thus, if A chooses competition, there are now three sellers—B, C, and D—who compete for receiving the transfer. If A chooses to use his price setting power, the rules are as in the baseline treatment in that the transfer always goes to B.[17]

Comparing the distribution of the transfers under competition in the intense competition treatment as shown in Panel C in Figure 3 with the distribution in the baseline condition reveals that the increased competition in the intense competition treatment leads to lower

[15] An additional interaction term "Competition X Transfer" entered in regression (1) of Table 3 is positive and highly significant ($p < .001$) indicating that the interaction is present when pooling all treatments together. On the treatment-level we find a significant "Competition X Transfer" interaction in the baseline ($p = .004$), symmetric participation ($p = .018$), acceptance ($p < .001$), intense competition ($p = .022$), and transfer level ($p < .001$) treatments, but not in the involvement treatment ($p = .119$).

[16] Moreover, the average transfer in the transfer bin "> 15" is lower under competition in all our treatments.

[17] Recall that we use the strategy method to elicit punishment decisions. The presence of player D means that the probability that a given seller's punishment decision is implemented is reduced from 1/2 to 1/3.

transfers under competition than in the baseline. The average competitive transfer amounts to 5.88 in the intense competition treatment, which is significantly lower than the average competitive transfer of 9.46 in the baseline ($p = .001$). This indicates that competition for transfers is indeed harsher when a third seller is present.

Importantly, however, the punishment pattern shown in Panel C in Figure 3 is again qualitatively identical to the baseline condition, which is confirmed by the insignificance of the the interaction term "Competition X Intense Competition" in Table 3. This shows that Results 1 to 3 hold under intense competition.

6 Potential Determinants

In this section we discuss three additional treatment variations to analyze potential determinants of our results, such as the sellers' participation opportunities, active acceptance decisions, and the buyer's involvement in the competitive mechanism.

6.1 Symmetric Participation

To identify the impact of the participation asymmetry when the buyer uses his price setting power in the baseline condition on counterproductive behavior, we provide symmetric participation opportunities under both mechanisms in the *symmetric participation treatment*. Specifically, if the buyer uses his price setting power in the symmetric participation treatment, he first sets the transfer and it is then randomly determined, with equal probability, whether B or C receives the transfer. If the buyer chooses competition, the rules are exactly as in the baseline condition.

Our analysis in Section 4.1 revealed that the punishment pattern observed in the baseline condition is not driven by one particular seller type. This does, however, not necessarily exclude that the asymmetry between B and C types is an important driver of our results. It is possible, for example, that the buyer's use of his price setting power is perceived as relatively unfair because it favors player B and prohibits player C from getting a transfer. The symmetric participation treatment allows us to identify the importance of the participation argument.

Panel D of Figure 3 shows that also in the symmetric access treatment the punishment pattern is very similar to the baseline. The regression results in Table 3 confirm that punishment in the symmetric access treatment does not significantly differ from the baseline. The interaction of the treatment variable "Symmetric Access" with "Competition" is not significant in any of the regression models.

6.2 Acceptance

Freedom of choice is an integral feature of any competitive mechanism. On the one hand, it means that everybody is free to reject given terms of trade—even if this implies not trading at all. On the other hand, it means that a transaction always involves an active decision to accept the terms of trade—even if these terms are unattractive. The feature of freedom of choice is mirrored in our experimental design as it is the sellers' choice whether or not to click on an "accept" button to receive the actual transfer under the competitive mechanism. In contrast, B does not have a choice when the buyer uses his price setting power in our baseline treatment because the transfer is simply dictated by the buyer.

The *acceptance treatment* introduces an acceptance decision also when the buyer uses his price setting power. If A uses his price setting power in the acceptance treatment, B receives the transfer only if he accepts it by clicking on an "accept" button—exactly as under competition. If B does not accept, the transfer goes automatically to C, who then automatically accepts.[18] The competitive mechanism is identical to the baseline treatment.

In our baseline condition we find that B players punish A players less if a given transfer has been determined competitively rather than by the buyer's price setting power (see Section 4.1). The acceptance treatment is intended to identify the extent to which this difference in punishments across mechanisms is driven by the fact that B makes an explicit acceptance decision under competition, but is forced to accept the transfer if the buyer sets it directly. If sellers are more likely to not retaliate once they have explicitly accepted a certain payoff distribution, this difference between the two mechanisms might be an important driver of our results.

Panel E in Figure 3 and the regression results in Table 3 show that when we consider data from B and C types jointly, sellers' punishment behavior in the acceptance treatment does not differ significantly from the baseline condition. However, since the acceptance decision is only held constant for B types, we also run regressions with only the data from the B types.[19] Also these estimations do not reveal any significant differences between the two treatments. The coefficient for the "Competition X Acceptance" interaction term is non-significant, and the effect of competition is thus the same as in the baseline when it comes to the punishment for the buyer ($p = .289$), the punishment for the other seller ($p = .650$), or total punishment

[18] We did not give C the option to reject the transfer in order not to affect A's price setting incentives. Since C cannot reject, A knows that the directly determined transfer will be implemented—exactly as in the baseline treatment.

[19] The B types accept 76.8 percent of the transfers when the buyer uses his power in the acceptance treatment. Transfers between 1 and 5 are accepted in 82.3 percent of the cases, transfers between 6 and 10 in 95.7 percent of the cases, and transfers between 11 and 15 in 89.7 percent of the cases. Transfers larger than 15 are always accepted. Transfers of zero are accepted in 37.9 percent of the cases, but this is an inconsequential choice.

($p = .257$).[20] Based on these results, we conclude that the active acceptance decision present in the competitive mechanism is not the key driver of Results 1 to 3 that we identify in the baseline condition.

6.3 Involvement

The clock auction that is used to determine the transfer under the competitive mechanism is completely detached from the buyer. In particular, once A has chosen the competitive mechanism, the transfer is determined entirely by the acceptance decisions of B and C—without any further involvement of A. This might help the buyer to "hide" behind the forces of competition and to avoid possible blame for low transfers. In reality, however, buyers often remain involved in the determination of the terms of trade even under competitive mechanisms. Consider, for example, a situation where a buyer simultaneously engages in multiple bilateral negotiations with potential sellers.

We give A an active part in the auction in the *involvement treatment* in order to study whether an involvement of the buyer in the competitive mechanism affects the sellers' counterproductive behavior. In particular, if A chooses competition, he first has to set a sequence of ten strictly increasing transfer offers. If the sequence reaches the maximum transfer of 40 before the tenth offer, it cannot increase further. In the actual auction, A's transfer offers are then shown to B and C in increasing order.[21] As in the baseline treatment, the seller (B or C) who first accepts an offer receives the transfer. If none of A's ten offers is accepted, the highest transfer offer is automatically increased by one point each second (up to the maximum transfer of 40) until one of the seller accepts. If A chooses to use his price setting power the rules are exactly as in the baseline condition.

Including the buyer in the transfer determination slightly increases the transfer level under competition (12.02) relative to the baseline condition (9.46). This difference is marginally significant ($p = .054$). Moreover, we do not detect systematic effects of buyers' offer patterns on punishment.[22]

[20]The p-values stem from OLS regressions, reported in full in Table A4 in the Appendix. Table A5 reports Tobit regressions.

[21]The buyer's sequence of transfer offers was displayed on the sellers' screens before the start of the auction. We nevertheless slowed down the clock auction from 1 second to 1.5 seconds because it is cognitively much more demanding for the sellers to process the buyer's sequence of increasing offers than to follow the standard clock auction with constant increments of 1 point.

[22]Buyers' offer patterns can be characterized by the first offer (the starting point), the last offer (the end point), and the mean offer. When regressing punishment for the buyer on these independent variables and controlling for transfer size and period, the results are the following: first offer = .076 ($p = .692$), mean offer = −.193 ($p = .559$), last offer = .062 ($p = .707$; OLS regression clustered by individual).

Panel F of Figure 3 reveals a very similar punishment pattern in the involvement treatment as in the baseline condition. This is confirmed by the regression analyses in Table 3. The interaction of the treatment variable "Involvement" with "Competition" is not significant in any of the regression models.

7 Individual Heterogeneity of Punishment Decisions

In this section, we analyze individual heterogeneity in punishment decisions. Across all treatments 24.6 percent of the sellers (types B, C, or D) never deduct any points from any other player during the 12 periods of the experiment.

The regressions reported in Table 4 show the extent to which unobserved individual differences explain the variation in punishment decisions. The dependent variable in all regressions is the punishment for the buyer. Model (1) considers "Competition," "Transfer," and "Period" as explanatory variables, and the results confirm our previous findings. A comparison of column (1) with column (2) illustrates that including individual fixed effects does not alter the coalitions much but simply increases the R^2 from about 6 percent to 56 percent. Unobserved individual differences thus explain the largest part of the variance in punishment decisions. However, since the assignment of subjects to roles and treatments is random and interactions were anonymous and one-shot, our experimental design allows for a clean identification of the effect of the choice of mechanism on punishment, despite the presence of large individual heterogeneity.

Regression (3) extends regression (1) by adding a "Female" dummy and its interaction with "Competition" to the explanatory variables. Our sample is relatively balance, with 52.3 percent of our subjects (570 of 1090) being female. We find that our main result—the reduction of the punishment when the buyer chooses competition to set the transfer—is significantly less pronounced for women than for men. This can be seen by the positive sign of the coefficient for the interaction of "Female" and "Competition." Moreover, the negative sign of the "Female" dummy reveals that women punish less than men in general. Regression (4) shows that these results also hold when we control for a number of personality dimensions that are potentially correlated with gender.[23]

We want to stress that we did not hypothesize this gender effect ex-ante, and it should thus be interpreted cautiously. However, the finding that the punishment reducing effect of competition is less pronounced for women than for men nicely resonates with the existing

[23]None of the personality measures included in Model 4 in Table 4 show a significant interaction with the competition dummy. Moreover, the interaction between competition and gender remains significant when we include these additional interaction terms in the regression.

Table 4: Individual heterogeneity in sellers' punishment of the buyer

	DV: Punishment for A			
	(1)	(2)	(3)	(4)
Competition	-5.470^{***}	-5.043^{***}	-7.525^{***}	-7.595^{***}
	(0.476)	(0.376)	(0.728)	(0.722)
Transfer	-0.341^{***}	-0.477^{***}	-0.344^{***}	-0.339^{***}
	(0.033)	(0.032)	(0.033)	(0.031)
Period	-0.303^{***}	-0.316^{***}	-0.301^{***}	-0.301^{***}
	(0.052)	(0.056)	(0.052)	(0.052)
Female			-4.015^{***}	-3.920^{***}
			(1.014)	(1.081)
Female X Competition			3.982^{***}	4.135^{***}
			(0.978)	(0.972)
Agreeableness				-0.951
				(0.758)
Extraversion				-0.401
				(0.532)
Intellect				-1.514^{**}
				(0.679)
Neuroticism				0.056
				(0.613)
Conscientiousness				0.082
				(0.606)
Constant	18.359^{***}	19.260^{***}	20.447^{***}	30.927^{***}
	(0.847)	(0.449)	(0.950)	(5.146)
Individual fixed effects	No	Yes	No	No
R^2	0.059	0.561	0.066	0.072
Observations	8868	8868	8868	8868

$^{*}p < .10$, $^{**}p < .05$, $^{***}p < .01$

Notes: OLS; robust standard errors, clustered by 51 sessions, are in parentheses. The dependent variable is the number of punishment points assigned to the buyer. Big Five traits included in model 4 were measured in the post-experimental questionnaire using a German translation (Streib & Wiedmaier, 2001) of the mini-IPIP scale (Donnellan et al., 2006). Each trait was measured by four items on five-point Likert scales. Cronbach's α indicate the following measurement reliabilities: Agreeableness $\alpha = .660$, Extraversion $\alpha = .750$, Intellect $\alpha = .603$, Conscientiousness $\alpha = .740$, and Neuroticism $\alpha = .701$.

literature showing that women tend to be more reluctant than men to enter into competitive environments (e.g., Niederle & Vesterlund, 2007). Our results suggest that this gender difference with regards to preferences for competition also extends to fairness judgments of outcomes created by a competitive mechanisms.

8 Buyers' Profits and Choice of Mechanism

The fact that the choice of competition reduces the punishment that sellers inflict on the buyer (for a given transfer level) renders competition potentially attractive for buyers. However, giving up power and delegating the transfer determination to a competitive auction also means that the buyer loses control over the resulting transfer. In this section we therefore examine the impact of the buyer's choice of mechanism on profits in our experiment.

Figure 4 allows identifying the optimal strategy for a money-maximizing buyer. The grey line shows the average profit of the buyer as a function of the transfer that buyers choose when they use their price setting power. The black line illustrates the expected profit when the buyer chooses competition; it is horizontal because the buyer can no longer control the transfer level but instead simply faces the expected competitive outcome. The figure reveals that buyers cannot realize higher (expected) profits when they use their price setting power instead of competition. In the treatments depicted in panels A to G, buyers can maximize their expected profit either by using competition or by directly setting a small transfer, slightly greater than zero. In the transfer level treatment (depicted in panel C), in which transfers under competition are on average lower than under price setting power, competition is the dominant profit-maximizing choice for a buyer.

Buyers choose competition with increasing frequency over the course of the 12 periods of the experiment. While buyers make use of competition in less than 40 percent of the cases in the first three periods of the experiment, the share increases to levels above 50 percent in the last three periods.[24] On average over all treatments and periods (except the exogenous mechanism treatment), they choose competition in 46.9 percent of all cases.[25]

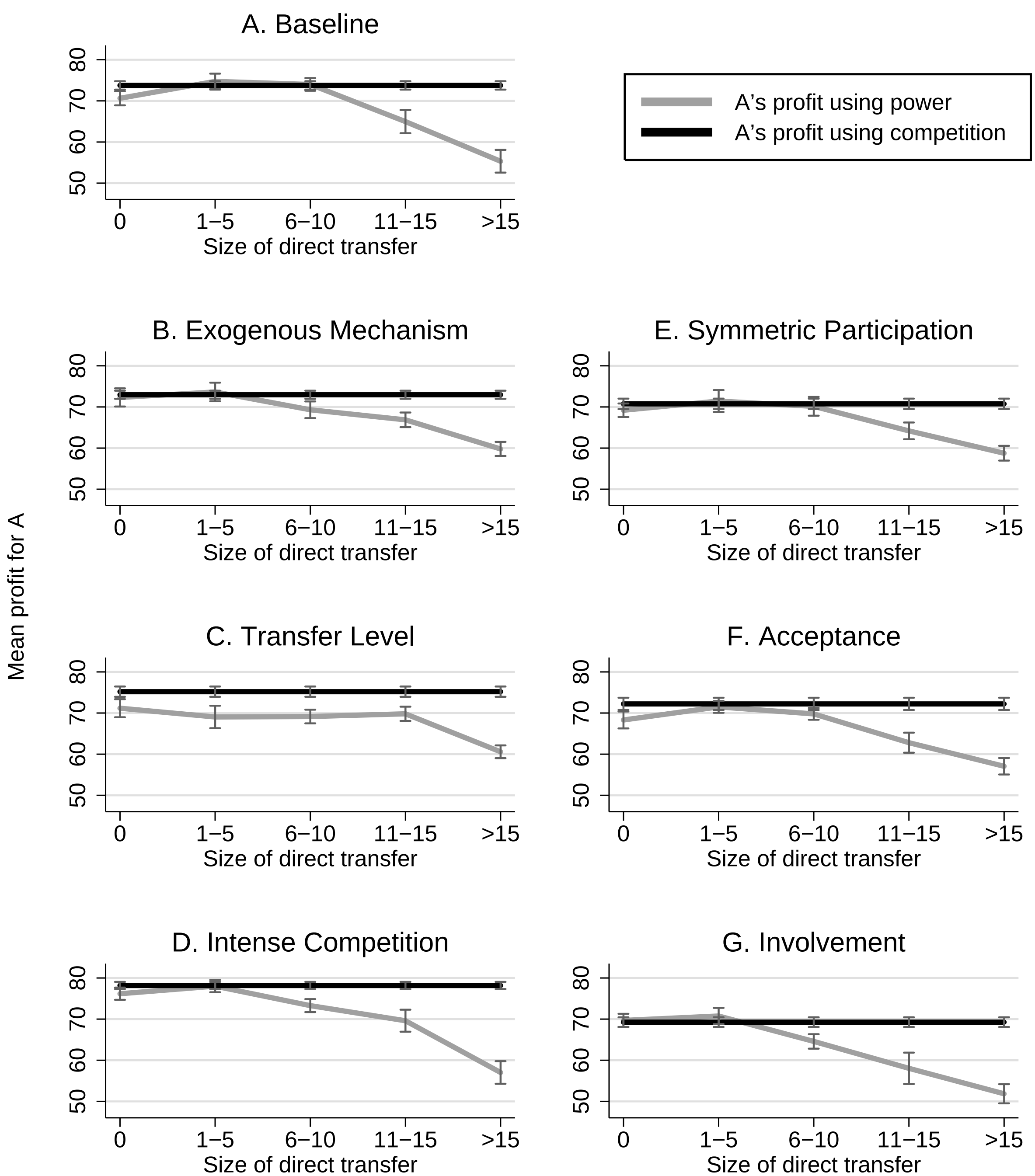
9 Conclusions

This paper shows that a competitive mechanism can attenuate discontent with unequal distributive outcomes, measured by counterproductive reactions to inequality—relative to a situation in which one market side simply uses its price setting power to determine a distribution. Our key finding is that the desirable efficiency properties of competitive mechanisms, such as markets, may well go beyond allocative efficiency. Hence, our broader contribution is to focus attention also on the "behavioral properties" of mechanisms—in the sense of the amount of inefficient counterproductive behavior that they provoke in reaction

[24]The positive time trend is highly significant when pooling all treatments together ($p < .001$). Looking at treatments separately it is at least marginally significant in all but the acceptance treatment.

[25]This percentage does not differ much in the different treatments: 49.4 (baseline), 58.0 (transfer level), 39.2 (intense competition), 43.1 (symmetric participation), 46.1 (acceptance), and 46.4 (involvement).

Figure 4: Buyers' profits by choice of mechanism



Notes: Error bars represent plus/minus one standard error of the mean, clustered by individual.

to inequality—that are used to coordinate economic activity in order to understand their overall efficiency.

To see the implications of our findings, consider for example a large and powerful firm that is in need of inputs from suppliers without market power. The firm may be well advised to set up competitive procurement auctions even if there is no asymmetric information regarding the suppliers' production costs and even if the producer would be powerful enough to simply dictate prices. The reason is that the same prices are likely to trigger fewer counterproductive reactions, such as quality shading, if they are determined competitively rather than imposed by the firm's market power.

Our study also adds a new angle to the discussion of transaction costs in the incomplete contracting literature. Existing work emphasizes the trade-off between hold-up problems in competitive market relations and bureaucracy costs within authority-based firms (Williamson 1975, 1985). Our paper reveals another possible downside of authority that has—to the best of our knowledge—not been considered before: replacing competitive price determination with fiat (i.e., power) may trigger retaliatory actions from trading partners that would not have occurred to this extent in a market environment.

Finally, it is worth emphasizing some limitations and possible extensions of our work. First, our paper investigates how (potential) trading partners react depending on whether a powerful party chooses competition or uses his power to determine the terms of trade. While situations involving a large power differential and very unequal outcomes are of particular importance in this context, it would also be interesting to better understand the role of competition in more balanced relations. In these cases, a possible alternative to a competitive mechanism would be, for example, bilateral bargaining. Second, we focus exclusively on counterproductive behavior in this study. In some situations, however, efficient trade not only necessitates limiting harmful behavior, but also requires inducing voluntary cooperation. In future research it will be interesting to examine whether the use of competition also allows motivating trading partners to engage in helpful and cooperative behavior.

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Online Appendix

A Additional Regression Analyses

Table A1: Tobit regression results for effects on punishment

	(1) Punishment for A	(2) Punishment for B/C/(D)	(3) Total Punishment
Competition	-7.668^{***}	1.589^{***}	-6.112^{***}
	(1.576)	(0.412)	(1.637)
Exogenous Mechanism	-1.630	-0.235	-2.164
	(2.499)	(0.231)	(2.640)
Competition X Exogenous Mechanism	1.818	-0.127	1.823
	(2.363)	(0.580)	(2.536)
Transfer Level	-1.306	0.081	-1.387
	(2.253)	(0.562)	(2.482)
Competition X Transfer Level	1.563	0.342	2.006
	(2.171)	(0.624)	(2.260)
Intense Competition	-4.808^{**}	0.419	-4.512^{*}
	(2.266)	(0.437)	(2.398)
Competition X Intense Competition	2.690	0.456	3.068
	(1.955)	(0.694)	(1.913)
Symmetric Participation	2.116	0.088	2.384
	(2.980)	(0.274)	(3.145)
Competition X Symmetric Participation	0.971	0.596	1.733
	(2.192)	(0.549)	(2.352)
Acceptance	0.574	0.518	1.148
	(2.131)	(0.358)	(2.275)
Competition X Acceptance	1.695	0.100	1.861
	(1.625)	(0.570)	(1.800)
Involvement	2.918	-0.438^{*}	2.496
	(2.597)	(0.225)	(2.786)
Competition X Involvement	0.461	0.786	1.441
	(1.828)	(0.534)	(1.827)
Transfer	-0.417^{***}	0.086^{***}	-0.337^{***}
	(0.037)	(0.011)	(0.042)
Period	-0.309^{***}	-0.014	-0.338^{***}
	(0.058)	(0.017)	(0.067)
Constant	20.500^{***}	0.599^{***}	21.897^{***}
	(1.956)	(0.228)	(2.058)
Pseudo R^2	0.010	0.010	0.005
Observations	8868	8868	8868
Censored observations	930	1	1353

$^{*}p < .10$, $^{**}p < .05$, $^{***}p < .01$

Notes: Robust standard errors, clustered by 51 sessions, are in parentheses. Dependent variables are the number of punishment points assigned to the buyer (model 1), the other seller(s) (2), or in total (3). For the intense competition treatment, the dependent variable in model 2 corresponds to the sum of punishment assigned to the other two sellers. The table reports Tobit regressions right-censored at 50 corresponding to the maximum possible punishment level. The models correspond to those estimated via OLS in Table 3.

Table A2: Two-part models for effects on punishment for A and B/C/(D)

	DV: Punishment for A		DV: Punishment for B/C/(D)	
	(1)	(2)	(3)	(4)
	1st part (OLS)	2nd part (Tobit)	1st part (OLS)	2nd part (Tobit)
Competition	-0.120^{***}	-13.473^{***}	0.110^{***}	3.935^{***}
	(0.033)	(2.039)	(0.025)	(1.229)
Exogenous Mechanism	0.036	-7.983^{**}	0.021	-2.374^{**}
	(0.045)	(3.860)	(0.031)	(1.040)
Competition X Exogenous Mechanism	−0.018	7.234^{**}	−0.005	−0.011
	(0.055)	(2.868)	(0.046)	(1.257)
Transfer Level	0.035	-7.805^{*}	0.039	−0.690
	(0.045)	(4.150)	(0.046)	(1.626)
Competition X Transfer Level	0.012	6.375	0.007	0.233
	(0.045)	(3.975)	(0.036)	(2.063)
Intense Competition	−0.041	-9.854^{**}	0.005	2.748^{*}
	(0.044)	(4.296)	(0.041)	(1.441)
Competition X Intense Competition	0.019	5.708	0.103	-3.766^{**}
	(0.057)	(4.629)	(0.070)	(1.556)
Symmetric Participation	0.045	0.642	−0.003	0.517
	(0.057)	(4.063)	(0.034)	(1.076)
Competition X Symmetric Participation	0.037	2.894	0.067^{**}	−1.233
	(0.041)	(3.711)	(0.031)	(1.643)
Acceptance	0.078^{*}	−5.703	0.064^{**}	0.552
	(0.043)	(3.746)	(0.030)	(1.373)
Competition X Acceptance	0.034	4.794	0.023	−1.873
	(0.043)	(3.033)	(0.036)	(1.646)
Involvement	0.047	2.368	−0.037	−1.549
	(0.054)	(4.337)	(0.029)	(1.719)
Competition X Involvement	0.015	3.748	0.077^{**}	0.427
	(0.039)	(3.842)	(0.029)	(1.756)
Transfer	-0.007^{***}	-0.586^{***}	0.002^{***}	0.363^{***}
	(0.001)	(0.063)	(0.001)	(0.041)
Period	-0.014^{***}	0.354^{***}	-0.006^{***}	0.225^{***}
	(0.001)	(0.109)	(0.001)	(0.043)
Constant	0.550^{***}	41.795^{***}	0.148^{***}	3.857^{***}
	(0.032)	(3.108)	(0.027)	(0.974)
R^2 / Pseudo R^2	0.044	0.020	0.045	0.035
Observations	8868	3386	8868	1798
Censored observations		930		1

$^{*}p < .10$, $^{**}p < .05$, $^{***}p < .01$

Notes: Robust standard errors, clustered by 51 sessions, are in parentheses. In the 1st part regressions, the dependent variable is a dummy taking on the value of 1 if there was positive punishment, and zero otherwise. In the 2nd part, the dependent variable is the number of punishment points assigned, given that punishment was positive; cases with zero punishment are excluded. For the intense competition treatment, the dependent variable in (4) corresponds to the sum of punishment assigned to the other two sellers. The 2nd part Tobit regressions are right-censored at the maximum punishment of 50. The two-part models fit the data better than the Tobit regressions reported in Table A1: For the punishment for A, the combined log-likelihood of the two-part model is $-17,747.9$ compared to $-35,802.9$ of the Tobit model. For the punishment for the other seller it is $-10,111.6$ compared to $-26,904.2$.

Table A3: Two-part models for effects on total punishment

	DV: Total punishment (1) 1st part (OLS)	(2) 2nd part (Tobit)
Competition	-0.070^{*}	-11.808^{***}
	(0.037)	(1.789)
Exogenous Mechanism	0.032	-9.857^{**}
	(0.047)	(4.421)
Competition X Exogenous Mechanism	-0.005	6.117
	(0.059)	(3.931)
Transfer Level	0.041	-8.997^{**}
	(0.046)	(4.482)
Competition X Transfer Level	0.035	4.681
	(0.046)	(3.075)
Intense Competition	-0.031	-9.809^{**}
	(0.043)	(4.277)
Competition X Intense Competition	0.092	1.156
	(0.066)	(3.378)
Symmetric Participation	0.042	1.392
	(0.058)	(4.737)
Competition X Symmetric Participation	0.058	1.528
	(0.046)	(3.261)
Acceptance	0.080^{*}	-5.746
	(0.044)	(4.264)
Competition X Acceptance	0.047	3.566
	(0.044)	(2.451)
Involvement	0.053	0.321
	(0.055)	(5.202)
Competition X Involvement	0.040	2.652
	(0.042)	(3.805)
Transfer	-0.007^{***}	-0.257^{***}
	(0.001)	(0.083)
Period	-0.011^{***}	0.199
	(0.001)	(0.130)
Constant	0.544^{***}	45.334^{***}
	(0.033)	(3.628)
R^2 / Pseudo R^2	0.025	0.011
Observations	8868	3807
Censored observations		1353

$^{*}p < .10$, $^{**}p < .05$, $^{***}p < .01$

Notes: Robust standard errors, clustered by 51 sessions, are in parentheses. In the 1st part regressions, the dependent variable is a dummy taking on the value of 1 if there was positive punishment, and zero otherwise. In the 2nd part, the dependent variable is the number of punishment points assigned, given that punishment was positive; cases with zero punishment are excluded. The 2nd part Tobit regressions are right-censored at the maximum punishment of 50. The two-part model fits the data better than the Tobit regression reported in Table A1: the combined log-likelihood of the two-part model is $-18,659.9$ compared to $-35,641.0$ of the Tobit model.

Table A4: OLS regression results when considering only decisions from B type sellers

	(1) Punishment for A	(2) Punishment for C/(D)	(3) Total Punishment
Competition	−5.755***	2.448***	−3.307
	(1.981)	(0.569)	(1.988)
Exogenous Mechanism	−2.261	−0.139	−2.401
	(2.910)	(0.227)	(2.950)
Competition X Exogenous Mechanism	−1.446	−0.590	−2.036
	(2.907)	(0.717)	(2.901)
Transfer Level	−2.406	−0.497**	−2.904
	(2.878)	(0.190)	(2.887)
Competition X Transfer Level	−0.346	0.426	0.080
	(2.519)	(0.714)	(2.470)
Intense Competition	−7.593**	0.277	−7.316**
	(2.956)	(0.336)	(3.016)
Competition X Intense Competition	3.751	0.514	4.265
	(2.536)	(0.742)	(2.567)
Symmetric Participation	−0.760	0.476*	−0.284
	(3.101)	(0.254)	(3.122)
Competition X Symmetric Participation	0.749	−0.133	0.615
	(2.359)	(0.670)	(2.382)
Acceptance	−1.651	0.147	−1.504
	(3.083)	(0.248)	(3.042)
Competition X Acceptance	2.604	0.314	2.918
	(2.427)	(0.687)	(2.544)
Involvement	2.805	−0.153	2.652
	(3.087)	(0.179)	(3.109)
Competition X Involvement	−0.847	0.476	−0.372
	(2.274)	(0.945)	(2.227)
Transfer	−0.479***	0.060***	−0.418***
	(0.044)	(0.011)	(0.046)
Period	−0.328***	−0.012	−0.340***
	(0.083)	(0.018)	(0.092)
Constant	22.083***	0.324*	22.407***
	(2.363)	(0.178)	(2.389)
R^2	0.086	0.085	0.052
Observations	4860	4860	4860

$^{*}p < .10$, $^{**}p < .05$, $^{***}p < .01$

Notes: Robust standard errors, clustered by 51 sessions, are in parentheses. Only decisions from B type sellers are considered, except for the symmetric access treatment, for which both seller types are included, as both types have access to the transfer under price setting power in this treatment. Post-estimation Wald tests show that the effect of competition on punishment for A when considering only decisions from B types is significant in the exogenous mechanism, involvement, and transfer level treatment ($p \leq .001$), as well as in the acceptance treatment ($p = .022$), but not in the intense competition treatment ($p = .205$). The increase in punishment for the other seller(s) is significant in all treatments ($p < .001$). For total punishment, it is significant in the exogenous mechanism ($p = .012$), symmetric access ($p = .047$), involvement ($p < .001$), and equal transfers ($p = .031$) treatments, but not in the acceptance ($p = .800$) and the intense competition treatment ($p = .551$).

Table A5: Tobit regression results when considering only decisions from B type sellers

	(1) Punishment for A	(2) Punishment for C/(D)	(3) Total Punishment
Competition	-7.461^{***}	2.448^{***}	-4.779^{**}
	(2.422)	(0.568)	(2.417)
Exogenous Mechanism	-3.181	-0.139	-3.693
	(3.475)	(0.226)	(3.609)
Competition X Exogenous Mechanism	-0.693	-0.590	-1.370
	(3.401)	(0.716)	(3.480)
Transfer Level	-3.336	-0.497^{***}	-4.331
	(3.446)	(0.190)	(3.544)
Competition X Transfer Level	0.335	0.426	0.921
	(3.035)	(0.712)	(2.966)
Intense Competition	-9.133^{**}	0.277	-9.182^{**}
	(3.555)	(0.335)	(3.747)
Competition X Intense Competition	4.979	0.514	5.369^{*}
	(3.054)	(0.740)	(3.056)
Symmetric Participation	-1.234	0.476^{*}	-0.670
	(3.711)	(0.254)	(3.874)
Competition X Symmetric Participation	1.334	-0.133	1.199
	(2.874)	(0.669)	(2.960)
Acceptance	-2.397	0.147	-2.543
	(3.701)	(0.247)	(3.811)
Competition X Acceptance	3.502	0.314	4.214
	(2.874)	(0.686)	(3.049)
Involvement	3.066	-0.153	3.045
	(3.811)	(0.179)	(4.002)
Competition X Involvement	-0.586	0.476	-0.062
	(2.890)	(0.943)	(2.767)
Transfer	-0.554^{***}	0.060^{***}	-0.512^{***}
	(0.053)	(0.011)	(0.058)
Period	-0.331^{***}	-0.012	-0.368^{***}
	(0.095)	(0.018)	(0.110)
Constant	24.820^{***}	0.324^{*}	26.205^{***}
	(2.941)	(0.177)	(3.063)
R^2 / Pseudo R^2	0.012	0.015	0.007
Observations	4860	4860	4860
Censored observations	605	0	852

$^{*}p < .10$, $^{**}p < .05$, $^{***}p < .01$

Notes: Robust standard errors, clustered by 51 sessions, are in parentheses. Only decisions from B type sellers are considered, except for the symmetric access treatment, for which both seller types are included, as both types have access to the transfer under price setting power in this treatment. The table reports Tobit regressions right-censored at 50 corresponding to the maximum possible punishment level. The models correspond to those estimated via OLS in Table A4.

Table A6: OLS regression results when considering only decisions from C/(D) type sellers

	(1) Punishment for A	(2) Punishment for B/(C)	(3) Total Punishment
Competition	-7.364^{***}	0.683	-6.682^{***}
	(1.371)	(0.567)	(1.314)
Exogenous Mechanism	−0.119	−0.375	−0.493
	(2.076)	(0.456)	(2.150)
Competition X Exogenous Mechanism	4.183^{**}	0.372	4.554^{**}
	(1.868)	(0.815)	(2.085)
Transfer Level	0.751	0.611	1.361
	(2.179)	(1.060)	(2.526)
Competition X Transfer Level	2.738	0.332	3.070
	(2.698)	(0.940)	(2.502)
Intense Competition	1.183	0.594	1.777
	(3.509)	(0.904)	(3.640)
Competition X Intense Competition	−0.604	0.325	−0.280
	(3.105)	(1.008)	(3.083)
Acceptance	3.321	0.870	4.190
	(2.360)	(0.744)	(2.540)
Competition X Acceptance	0.101	−0.086	0.015
	(1.858)	(0.748)	(1.650)
Involvement	2.436	-0.745^{*}	1.691
	(2.517)	(0.430)	(2.542)
Competition X Involvement	1.611	1.094	2.705
	(1.649)	(1.062)	(1.900)
Transfer	-0.230^{***}	0.121^{***}	-0.110^{*}
	(0.046)	(0.025)	(0.058)
Period	-0.286^{***}	−0.020	-0.306^{***}
	(0.065)	(0.032)	(0.078)
Constant	15.153^{***}	0.863^{*}	16.016^{***}
	(1.763)	(0.459)	(1.791)
R^2	0.064	0.047	0.037
Observations	3564	3564	3564

$^{*}p < .10$, $^{**}p < .05$, $^{***}p < .01$

Notes: Robust standard errors, clustered by 51 sessions, are in parentheses. Only decisions from C and D type sellers are considered. The symmetric access treatment is excluded because all seller are identical in this treatment. Post-estimation Wald tests show that the effect of competition on punishment for the other seller(s) when considering only decisions from C and D types is significant in the involvement, acceptance, and intense competition treatments ($p < .001$), as well as in the exogenous mechanism ($p = .016$) and the transfer level treatment ($p = .049$).The increase in punishment for the other seller(s) is (marginally) significant in the exogenous mechanism ($p = .082$) and the involvement treatment ($p = .047$). It is not significant in the other treatments. For total punishment, it is significant in the acceptance ($p < .001$), intense competition ($p = .015$), involvement ($p = .003$), and transfer level treatments ($p = .096$), but not in the exogenous mechanism treatment ($p = .203$).

Table A7: Tobit regression results when considering only decisions from C/(D) type sellers

	(1) Punishment for A	(2) Punishment for B/(C)	(3) Total Punishment
Competition	-8.098^{***}	0.682	-7.663^{***}
	(1.573)	(0.566)	(1.526)
Exogenous Mechanism	-0.300	-0.373	-0.909
	(2.296)	(0.456)	(2.487)
Competition X Exogenous Mechanism	4.490^{**}	0.370	5.154^{**}
	(2.065)	(0.814)	(2.335)
Transfer Level	0.492	0.610	1.202
	(2.449)	(1.058)	(2.932)
Competition X Transfer Level	3.052	0.333	3.440
	(3.011)	(0.938)	(2.859)
Intense Competition	1.137	0.594	1.739
	(3.941)	(0.903)	(4.220)
Competition X Intense Competition	-0.656	0.325	-0.364
	(3.528)	(1.006)	(3.568)
Acceptance	3.354	0.869	4.566
	(2.631)	(0.743)	(2.926)
Competition X Acceptance	0.111	-0.085	-0.188
	(2.127)	(0.747)	(1.911)
Involvement	2.695	-0.745^{*}	1.877
	(2.781)	(0.430)	(2.931)
Competition X Involvement	1.547	1.094	2.927
	(1.787)	(1.060)	(2.063)
Transfer	-0.258^{***}	0.121^{***}	-0.129^{*}
	(0.051)	(0.025)	(0.067)
Period	-0.290^{***}	-0.020	-0.314^{***}
	(0.070)	(0.032)	(0.088)
Constant	16.235^{***}	0.863^{*}	17.624^{***}
	(1.984)	(0.458)	(2.106)
R^2 / Pseudo R^2	0.008	0.008	0.005
Observations	3564	3564	3564
Censored observations	289	1	444

$^{*}p < .10$, $^{**}p < .05$, $^{***}p < .01$

Notes: Robust standard errors, clustered by 51 sessions, are in parentheses. Only decisions from C and D type sellers are considered. The symmetric participation treatment is excluded, because it did not have any C types without access to the transfer under price setting power. The table reports Tobit regressions right-censored at 50 corresponding to the maximum possible punishment level. The models correspond to those estimated via OLS in Table A6.

Table A8: OLS and Tobit regression results for punishment under competition

	Punishment for A		Punishment for B/C/(D)	
	(1)	(2)	(3)	(4)
	OLS	Tobit	OLS	Tobit
Winner	−0.819	−0.747	−4.739***	−4.739***
	(1.108)	(1.123)	(0.848)	(0.846)
Exogenous Mechanism	0.515	0.555	−0.852	−0.852
	(1.842)	(1.873)	(1.064)	(1.063)
Winner X Exogenous Mechanism	−1.150	−1.282	0.936	0.936
	(1.985)	(2.039)	(1.052)	(1.050)
Transfer Level	1.439	1.515	0.772	0.772
	(1.673)	(1.710)	(1.111)	(1.109)
Winner X Transfer Level	−0.530	−0.582	−0.517	−0.517
	(1.688)	(1.742)	(1.179)	(1.177)
Intense Competition	−1.554	−1.514	−0.493	−0.493
	(1.304)	(1.334)	(1.017)	(1.015)
Winner X Intense Competition	1.810	1.811	2.093**	2.093**
	(2.210)	(2.285)	(0.891)	(0.889)
Symmetric Participation	2.387	2.465	0.805	0.805
	(1.920)	(1.982)	(0.984)	(0.982)
Winner X Symmetric Participation	0.880	0.965	−0.257	−0.257
	(1.729)	(1.777)	(1.070)	(1.068)
Acceptance	3.110***	3.253***	0.665	0.665
	(1.123)	(1.163)	(0.991)	(0.989)
Winner X Acceptance	−1.193	−1.270	−0.014	−0.014
	(1.854)	(1.887)	(0.978)	(0.976)
Involvement	2.228	2.306	0.496	0.496
	(1.644)	(1.685)	(1.036)	(1.034)
Winner X Involvement	0.203	0.332	−0.447	−0.447
	(1.723)	(1.757)	(1.122)	(1.120)
Transfer	−0.066	−0.064	0.118***	0.118***
	(0.056)	(0.057)	(0.028)	(0.028)
Period	−0.307***	−0.306***	0.000	0.000
	(0.066)	(0.068)	(0.025)	(0.025)
Constant	9.678***	9.716***	4.152***	4.152***
	(1.272)	(1.304)	(0.842)	(0.840)
R^2 / Pseudo R^2	0.016	0.002	0.145	0.024
Observations	4176	4176	4176	4176
Censored observations		149		0

$^{*}p < .10$, $^{**}p < .05$, $^{***}p < .01$

Notes: Robust standard errors, clustered by 51 sessions, are in parentheses. "Winner" is a dummy variable taking on a value of 1 for buyers who won the auction, and a value of 0 for those who lost. For the intense competition treatment, the dependent variable in (3) and (4) corresponds to the sum of punishment assigned to the other two sellers. Only observations from the competitive mechanism are considered. Tobit regressions are right-censored at 50 corresponding to the maximum possible punishment level. Coefficients in (3) and (4) are identical because there was no right-censoring for the punishment for the other seller(s). Post-estimation Wald tests after OLS regressions show that the punishment for A is the same for winners and losers in all treatments ($p > .10$ for all treatments). However, losers punish the other seller(s) significantly more than winners do in all treamtents ($p < .001$ for all treatments).

B Predictive Power of Different Punishment Motives

In this appendix we explore the extent to which different punishment motives that have previously been discussed in the literature can explain the punishment pattern we observe in our baseline condition:

1. For a given transfer, the punishment for A is lower under competition than under price setting power.

    1.a Both B and C punish A less under competition than under price setting power (holding the transfer constant).

    1.b The punishment for A decreases in the transfer level.

2. For a given transfer, the punishment for the other seller is higher under competition than under price setting power.

    2.a The increase in the punishment for the other seller under competition is driven by the fact that the losers in the competitive auction punish the winners.

    2.b The punishment for the other seller increases in the transfer level.

3. For a given transfer, total punishment is lower under competition than under price setting power.

Since we study costly punishment in one-shot interactions, models assuming pure self-interest cannot explain positive punishments in our setup. We therefore derive predictions using four alternative motives: outcome-based fairness, intention-based reciprocity, attribution of responsibility, and the perception of competition as a fair mechanism. We aim at capturing the "essence" of each motive and formalize them in the most simple and stylized way we could think of. For each motive we define a measure of a player's punishment inclination in each situation that can occur in the experiment. To facilitate the comparison of the predictive power of the different motives, we formalize them as fully nested models, i.e., we determine the underlying punishment inclination based on the outcome-based fairness approach and implement the other three motives as simple weighting functions.

Tables B1 and B2, and Figure B1 provide detailed illustrations of the punishment pattern predicted by each of the four motives. The top part of Table B1 displays the punishment inclinations predicted by the outcome-based fairness approach. The bottom part of Table B1 displays the punishment inclinations generated by the other three motives. The punishment inclinations predicted by intention-based reciprocity, responsibility attribution, and the perception of competition as a fair mechanism are obtained by simply multiplying the punishment inclinations predicted by the outcome-based approach with the corresponding weighting function. The weights are summarized in Table B2. In what follows, we explain each model briefly and discuss the extent to which predicted behavior corresponds to actually observed behavior in the baseline treatment.

B.1 Outcome-Based Fairness

Theories of outcome-based fairness (e.g., Fehr & Schmidt, 1999; Bolton & Ockenfels, 2000) assume that decision makers experience a disutility if their own payoff differs from the payoffs of other players in their reference group. In our experiment these models have predictive power, because punishing a player who is better off allows reducing disadvantageous payoff inequality. We implement the punishment inclination triggered by outcome-based fairness as a linear function of disadvantageous payoff inequality. Disadvantageous payoff inequality is maximized if a player receives no transfer (or a transfer of 0). In this case the sum of differences between the punisher's own payoff and the other two players' payoffs is equal to 80 (punishment prediction = 1). Smaller payoff inequalities reduce the punishment prediction proportionally.[26] Formally, the outcome-based punishment inclination ρ_i^j of player i targeted at player j, $i \neq j$, is thus defined by:

$$\rho_i^j = \frac{\max(x_j - x_i, 0)}{80},$$

where x_i and x_j represent the payoffs of the corresponding player. The inequality is divided by the largest possible inequality (80) to normalize the measure to the range from 0 and 1.

The top part of Table B1 provides details on the punishment intensities predicted by a model of purely outcome-based fairness. The table reveals that outcome-based fairness fails to predict our three main results (Results 1-3). As punishment is solely determined by outcomes, outcome-based fairness cannot explain why the same transfer triggers different punishment inclinations depending on the mechanism chosen to determine the transfer (see also Panel A of Figure B1). However, the outcome-based measure captures correctly that the punishment for A decreases in the transfer (Result 1.b), while the punishment for the other seller increases in the transfer (Result 2.b). Moreover, the outcome-based measure is also in line with the fact that sellers' mutual punishments are driven by the seller who lost the competitive auction (Result 2.a).

[26] If there are disadvantageous payoff inequalities relative to both other players and the payoff inequalities cannot be completely eliminated, linear inequality aversion does not predict how the punisher will allocate his punishment points to the other two players. Our measure assumes that the punisher allocates punishment points proportionally to the relative size of the corresponding inequality.

Table B1: Players' punishment inclinations according to different motives

		Power			Competition					
					B wins			C wins		
Model	**Punisher**	**A**	**B/C**	**Total**	**A**	**B/C**	**Total**	**A**	**B/C**	**Total**
Outcome-	B	$\frac{80-2t}{80}$	0	$\frac{80-2t}{80}$	$\frac{80-2t}{80}$	0	$\frac{80-2t}{80}$	$\frac{80-t}{80}$	$\frac{t}{80}$	1
Based	C	$\frac{80-t}{80}$	$\frac{t}{80}$	1	$\frac{80-t}{80}$	$\frac{t}{80}$	1	$\frac{80-2t}{80}$	0	$\frac{80-2t}{80}$
Intention-Based	B	$\frac{80-2t}{80}$	0	$\frac{80-2t}{80}$	$\frac{80-2t}{80}$	0	$\frac{80-2t}{80}$	$\frac{80-t}{80}$	$\frac{0.5t}{80}$	$\frac{80-0.5t}{80}$
Reciprocity	C	$\frac{80-t}{80}$	0	$\frac{80-t}{80}$	0	$\frac{0.5t}{80}$	$\frac{0.5t}{80}$	0	0	0
Responsibility-	B	$\frac{80-2t}{80}$	0	$\frac{80-2t}{80}$	$\frac{40-t}{80}$	0	$\frac{40-t}{80}$	$\frac{40-0.5t}{80}$	$\frac{0.5t}{80}$	0.5
Attribution	C	$\frac{80-t}{80}$	0	$\frac{80-t}{80}$	$\frac{40-0.5t}{80}$	$\frac{0.5t}{80}$	0.5	$\frac{40-t}{80}$	0	$\frac{40-t}{80}$
Fair	B	$\frac{80-2t}{80}$	0	$\frac{80-2t}{80}$	$\frac{40-t}{80}$	0	$\frac{40-t}{80}$	$\frac{40-0.5t}{80}$	$\frac{0.5t}{80}$	0.5
Competition	C	$\frac{80-t}{80}$	$\frac{t}{80}$	1	$\frac{40-0.5t}{80}$	$\frac{0.5t}{80}$	0.5	$\frac{40-t}{80}$	0	$\frac{40-t}{80}$

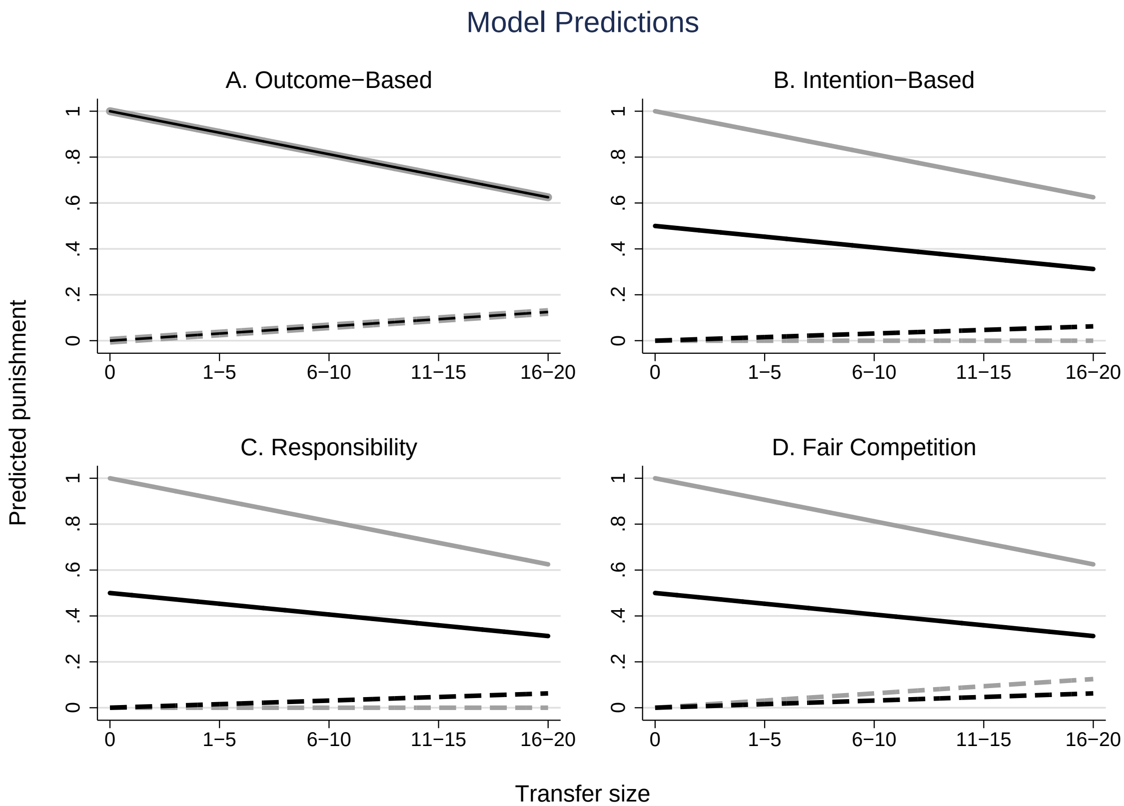
Notes: t stands for the transfer from A to the receiving seller (B or C). The columns indicate the player at which punishment is targeted, the rows indicate the player at the origin of the punishment. The top of the table displays the punishment inclinations of B and C towards A and the other seller (B/C) in the baseline treatment according to an outcome-based fairness model. For the outcome-based model, we assume that a player's punishment inclination towards another player is a linear function of the disadvantageous inequality that the punisher experiences relative to the other player. We normalize the measure by dividing the experienced inequality by the maximally possible disadvantageous inequality of 80. The bottom of the table shows the punishment inclinations in the alternative models that result from multiplying the punishment inclinations defined in the outcome-based model with the weighting factors summarized in Table B2.

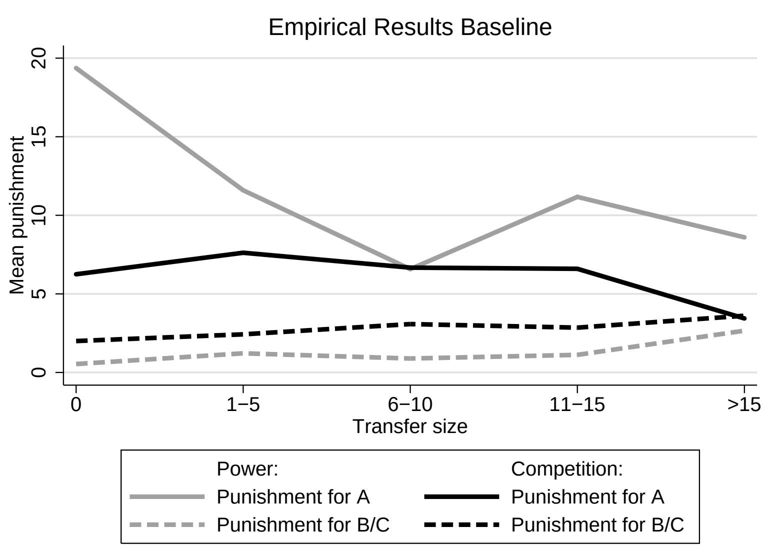
We now turn to the other three punishment motives. We model each one of them as a weighting function η which transforms the punishment intensities predicted by the outcome-based approach. For every alternative model we consider, the punishment inclination of player i towards player j, $i \neq j$, is therefore defined by:

$$\rho_i^j = \eta \times \frac{\max(x_j - x_i, 0)}{80}$$

Table B2 summarizes the weighting functions η for all alternative models. We discuss the derivation of these weights and the resulting punishment predictions for each alternative model below.

Figure B1: Predicted and observed punishment patterns by mechanism and transfer size





Notes: In the figure, the punishment inclination is averaged across the two seller types in the experiment. This is why the predictions of the intention-based (Panel B) and the responsibility model (Panel C) are identical. The different predictions of the two models for the different types can be seen in Table B1.

Table B2: Weighting factors for punishment inclinations in alternative fairness models

		Power		Competition			
				B wins		C wins	
Model	**Punisher**	**A**	**B/C**	**A**	**B/C**	**A**	**B/C**
Intention-Based	B	1	0	1	0	1	0.5
Reciprocity	C	1	0	0	0.5	0	0
Responsibility	B	1	0	0.5	0.5	0.5	0.5
Attribution	C	1	0	0.5	0.5	0.5	0.5
Fair	B	1	1	0.5	0.5	0.5	0.5
Competition	C	1	1	0.5	0.5	0.5	0.5

Notes: The table displays the weighting factors η for punishment inclinations of B and C towards A and the other seller (B/C) in the baseline treatment. The weights are relative to the punishment inclinations of the outcome-based fairness model defined in the top part of Table B1. The columns indicate the player at which punishment is targeted, the rows indicate the player at the origin of the punishment.

B.2 Intention-Based Reciprocity

A critical difference between the purely outcome-based approach and theories of intention-based reciprocity is that the perceived unfairness of an outcome does not only depend on the realized payoffs, but also on available, but not chosen alternatives (Rabin, 1993; Falk & Fischbacher, 2006; Dufwenberg & Kirchsteiger, 2004). As in the model of Falk & Fischbacher (2006), we assume that the degree to which players suffer from inequality depends on whether the inequality has been caused by an unkind act of another player or not. Suppose that a decision is perceived as "fully" unkind if another player has created the unequal allocation although he could have avoided or at least reduced the inequality without creating disadvantageous inequality for himself. If the other player could only have avoided or reduced the inequality by accepting a disadvantageous situation for himself, the decision is perceived as "partially" unkind. In cases in which the other player had no possibility to avoid the inequality, the decision is not perceived as unkind at all. The degree of unkindness therefore determines whether and how strongly disadvantageous inequality creates an inclination to punish.

We operationalize these ideas as follows: Fully unkind decisions trigger the full punishment inclination justified by the inequality (i.e., $\eta = 1$). In our baseline treatment, A always has the possibility to use his power and transfer the maximum possible amount to B, which would equalize payoffs between A and B. Hence, if A chooses not to do so, the resulting inequality between A and B is always perceived as fully unkind by B. The same is true for the inequality between A and C if A uses his price setting power. Since A could have chosen competition, which would have opened up the possibility for C to obtain a positive transfer, using price setting power is perceived as fully unkind by C. Choosing competition in contrast is the kindest action of A towards C (in expectation this is true independently of the realized transfer and of whether C eventually gets the transfer or not), and should therefore not trigger any punishment for A by C ($\eta = 0$). Finally, we assume that partially unkind decisions trigger half the punishment inclination of fully unkind decisions (i.e., $\eta = 0.5$, this corresponds to ϵ in the notation used by Falk & Fischbacher 2006). In our case, the inequality that exists between the two sellers after the competitive mechanism is perceived as partially unkind by the seller who lost the auction. The auction winner could only have avoided this inequality by clicking later (or not clicking at all), and thus accepting a disadvantageous outcome for himself.

At the aggregate level, intention-based reciprocity predicts our three main results (see Panel B of Figure B1): The punishment for A is lower under competition than under price setting power (Result 1), while the punishment for the respective other seller is higher (Result 2). The measure also correctly predicts lower total punishment under competition (Result 3), because the decrease in the punishment for A is clearly smaller than the increase in the punishment for the respective other seller. However, a closer inspection of Table B1 reveals that the underlying forces behind the aggregate effects are only partially in line with the data. While the intention-based measure captures that the increase in the punishment of the respective other seller stems from the fact that the auction loser punishes the winner (Result 2a), it also predicts that the decrease in the punishment for A exclusively stems from the fact that C never punishes A if he chooses competition. This clearly contradicts our observation that both B and C punish less under the competitive mechanism (Result 1.a).

B.3 Attribution of Responsibility

Bartling & Fischbacher (2012) introduce a model in which a player's inclination to punish a specific other player depends on the extent to which this other player is held responsible for the unequal outcome. We implement this notion in a very simple way. We assume that a punisher assigns equal responsibility to all other players who have been actively involved in the decision making process that led to an unequal outcome. This implies the following responsibility attributions in our setup: Only A makes a choice if he uses his price setting power. Accordingly, A carries the full responsibility for the inequality that exists relative to the sellers ($\eta = 1$). B, on the other hand, does not carry any responsibility for the inequality that exists relative to C ($\eta = 0$). Under competition A (who chooses the mechanism) and the two sellers participating in the auction are all involved in the decision making process.

From the perspective of the punishing player (B or C) both A and the respective other seller are therefore to be blamed if a disadvantageous inequality results. Hence each one of them is held responsible for one half of the realized disadvantageous inequalities (i.e., $\eta = 0.5$ for each of them).[27]

The responsibility measure is in line with our three main results listed above (Results 1-3, see Table B1 and Panel C of Figure B1). Furthermore, it also predicts that both B and C punish A less under competition than under price setting power (Result 1.a). The measure also captures the observation that the increase in the sellers' mutual punishments under competition is caused by auction losers who punish winners (Result 2.a). Thus, at least qualitatively, the responsibility model delivers a good description of the punishment pattern observed in our experiment.

B.4 Competition as a Fair Mechanism

Finally, we also consider the possibility that people simply consider competitively determined outcomes as fair (see e.g., Hart & Moore, 2008, for arguments along these lines). We implement the idea that competition is perceived as a fair mechanism by assuming that people suffer less from disadvantageous inequality if the payoffs have been determined competitively. Specifically, we suppose that the punishment inclination is divided by two under competition (i.e., $\eta = 0.5$ if a transfer has been determined under competition).

While the concept of competition as a fair mechanism can explain why A receives less punishment for the same transfer if he chooses to let the transfer be determined competitively (Result 1), the approach fails to explain the increase in mutual punishment of the sellers under the competitive mechanism (Result 2).

B.5 Econometric Comparison of Different Motives

The discussion above seems to suggest that, qualitatively, the responsibility attribution measure best explains the punishment pattern that we observe in the experiment. However,

[27] This implementation of the responsibility model as a nested version of the outcome-based model means that part of the punishment inclination triggered by inequality disappears if the respective player is not held fully responsible for the outcome. We think it is natural to interpret this effect as "diffusion of responsibility." Alternatively, however, responsibility attribution could also be implemented such that the full punishment inclination is distributed across different players. For example, under competition not only A is punished for the inequality between A and C, but also B (because each one of them carries half of the responsibility for this outcome). In this alternative model responsibility would not be diffused, but reassigned. While we think that such a model is interesting, we decided to use the simpler, nested model to facilitate the model comparisons. However, we also derived predictions for the alternative model (not reported in the paper). The alternative model does not have superior predictive power.

Table B3 reveals that a quantitative analysis does not provide further support for this conclusion. The table reports a set of OLS estimations in which we regress the sellers' punishment decisions (targeting both A and the respective other seller) on our four measures. Not surprisingly, the R^2s of these regressions show that the explanatory power of outcome-based fairness is clearly lower than that of the other three measures. However, the predictive power of intention-based reciprocity, responsibility attribution, and a preference for competition is very similar. It is also noteworthy that all R^2s are relatively low (i.e., no measure explains more than about 17 percent of the variance). This is not surprising given the large amount of individual heterogeneity present in the data (see the discussion in Section 7).

Table B3: Predictive power of punishment motives

	DV: Punishment for A and B/C			
	(1)	(2)	(3)	(4)
	OLS	OLS	OLS	OLS
Outcome-Based	12.013***			
	(1.284)			
Intention-Based		13.367***		
		(1.456)		
Responsibility			15.108***	
			(1.623)	
Fair Competition				15.268***
				(1.638)
Constant	0.919***	1.852***	1.250***	1.091***
	(0.233)	(0.329)	(0.328)	(0.331)
R^2	0.134	0.170	0.169	0.168
Observations	3264	3264	3264	3264
Clusters	136	136	136	136

$^{*}p < .10$, $^{**}p < .05$, $^{***}p < .01$

Notes: Robust standard errors, clustered by individual, are in parentheses. The models include both punishment for the buyer and punishment for the other seller as the dependent variable. Only data from the baseline treatment are considered.

C Experimental Instructions (Baseline)

General instructions for participants

We are pleased to welcome you to this economic study.

If you read the following instructions carefully you can – depending on your decisions and those of the other participants – earn money in addition to the **10 Euros** you receive as an initial endowment. It is thus very important, that you read these instructions carefully. If you have questions, please address them to us.

Communication with other participants of this study is strictly forbidden during the study. Violation of this rule leads to exclusion from the study and from all payments.

During the study, we will not speak of Euros, but of points. Your entire earnings will thus be first calculated in points. The points you earn during the study will be converted to Euros at the end of the study, where the following exchange rate applies:

5 Points = 1 Euro.

At the end of the study, we will pay you the point amount you earn during the study plus 10 Euros for showing up in **cash**.

We will explain the exact procedure of the study on the following pages.

The study

The study lasts for **12 periods**. At the beginning of each period, two other participants will be randomly assigned to you. This assignment takes place **anew** each period. This means that the same participants are **not** assigned to you in the individual periods. You will neither learn of the identity of the persons assigned to you before nor after the study. The persons assigned to you will also not learn of your identity.

There are three types of participants in this study: participants A, B, and C. In each period, a participant A, a participant B and a participant C are assigned to each other. **You are a <u>participant A / B / C</u> for the entire duration of the study.**

All participants with whom you interact during this study are sitting in this room.

Participant A's decision on the distribution procedure

In each period, participant A can decide which procedure will be used to distribute 110 points between the three participants.

To do this, participant A can choose one of the following distribution procedures:

- The **direct decision mechanism** or
- The **competitive mechanism.**

Both procedures will be explained in more detail on the following pages.

The direct decision mechanism

In the direct decision mechanism, participant A decides him/herself how the 110 points will be divided between him/herself and the other two participants. The starting point is determined by the following distribution:

Points for participant A	Points for participant B	Points for participant C
90	**10**	**10**

Participant A can only change the distribution by transferring points to participant B. He or she can transfer between 0 and 40 points to participant B. Every point that participant A transfers to participant B increases participant B's payment by one point and at the same time reduces participant A's payment by one point.

Participant A cannot transfer points to participant C, meaning that participant C always receives 10 points.

The following table indicates how participant A's transfer decision changes the final distribution of points:

	Points for participant A	Points for participant B	Points for participant C
Transfer to B = 0	**90**	**10**	**10**
Transfer to B = 1	**89**	**11**	**10**
Transfer to B = 2	**88**	**12**	**10**
Transfer to B = 3	**87**	**13**	**10**
….	**…**	**…**	**…**
Transfer to B = 40	**50**	**50**	**10**

If, for example, participant A transfers two points to participant B, participant A will receive 88 points, participant B 12 points, and participant C 10 points.

The competitive mechanism

In the competitive mechanism, participants B and C compete with one another. The competition involves accepting a certain distribution of the 110 points. The starting point is determined by the following distribution:

Points for participant A	Points for participant B	Points for participant C
90	**10**	**10**

The number of points that participant B **or** participant C can earn during the competition phase begins at 10 points and **increases by one point every second**.

The first participant (B or C) to accept the distribution receives the corresponding number of points. The other participant receives 10 points.

If participant A chooses the competitive mechanism, his or her number of points depends on which distribution participant B or C accepts. Participant A's number of points begins at 90 and **decreases by one point every second**.

The following table gives a survey of the distributions that can result from the competitive mechanism:

	Points for participant A	Points for the first participant (B or C) to accept the distribution	Points for the other participant (B or C)
At the beginning	**90**	**10**	**10**
after 1 second	**89**	**11**	**10**
after 2 seconds	**88**	**12**	**10**
after 3 seconds	**87**	**13**	**10**
….	**…**	**…**	**…**
after 40 seconds	**50**	**50**	**10**

The resulting distribution thus depends on how much time elapses until either participant B or participant C accepts the distribution.

If, for example, participant C accepts after 2 seconds, then participant A receives 88 points, participant C 12 points, and participant B 10 points.

After 40 seconds, the distribution is at 50-50-10, and will no longer change. The participant B or C who first accepts then receives 50 points; the other participant receives 10 points.

Point deductions by participants B or C

Once the distribution of the points has been determined – either by means of the direct decision or the competitive mechanism – the computer will randomly select either participant B **or** C. This random selection is independent of the previous course of events. If, for example, the competitive mechanism was chosen, the random selection is independent of who first accepted the distribution. Participants B and C always have a 50% probability of being selected by the computer.

The participant B or C whom the computer randomly chooses receives five additional points. The selected participant can use the additional points to deduct points from the other participants. He or she relinquishes 0.1 additional points for every point he deducts from the other participants. The randomly selected participant B or C thus has the possibility of using the five additional points to deduct up to 50 points from the other participants. He or she can also deduct less than 50 points from the other participants, thus retaining a part, or all, of the additional points.

The point deductions can be divided among the other participants in any way. However, a participant cannot lose more points than he or she earned in the direct decision or the competitive mechanisms.

Examples

In order to illustrate how the final payments are determined, please look at the following examples, which were chosen entirely randomly:

Example 1: Participant A selects the direct decision mechanism. He or she transfers 35 points to participant B. After the transfer decision, A thus has 90-35 = 55 points, participant B has 10+35 = 45 points, and participant C has 10 points. The computer randomly selects participant B to deduct points, granting him or her 5 additional points. Participant B decides to deduct 31 points from participant A and 9 points from participant C. He or she thus deducts a total of 40 points, thus giving up 40 x 0.1 = 4 of the additional points. The following payments thus result:

Points for participant A	Points for participant B	Points for participant C
55-31 = 24	45+5-4 = 46	10-9 = 1

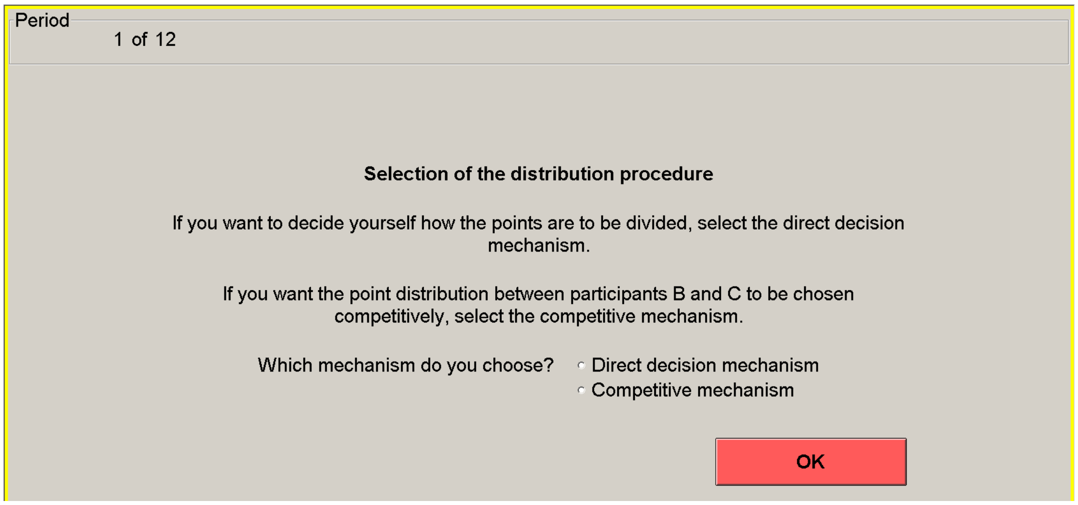
Example 2: Participant A selects the competitive mechanism for making the distribution. Participant B accepts the division after 6 seconds. After the competitive mechanism, participant A thus has 84 points, participant B has 16 points, and participant C has 10 points. The computer randomly selects participant C to deduct points, granting him or her 5 additional points. He or she decides to deduct 10 points from participant A and 5 points from participant B. He or she thus deducts 15 points and therefore gives up 15 x 0.1 = 1.5 of the additional points. The following payments thus result:

Points for participant A	Points for participant B	Points for participant C
84-10 = 74	16-5 = 11	10+5-1,5 = 13,5

Example 3: The participant randomly chosen for deducting points (B or C) does not deduct any points from the other participants. In this case, all participants receive the points determined in the direct decision or the competitive mechanism, and furthermore, the participant B or C chosen for deducting points receives the additional five points.

Procedure on the computer

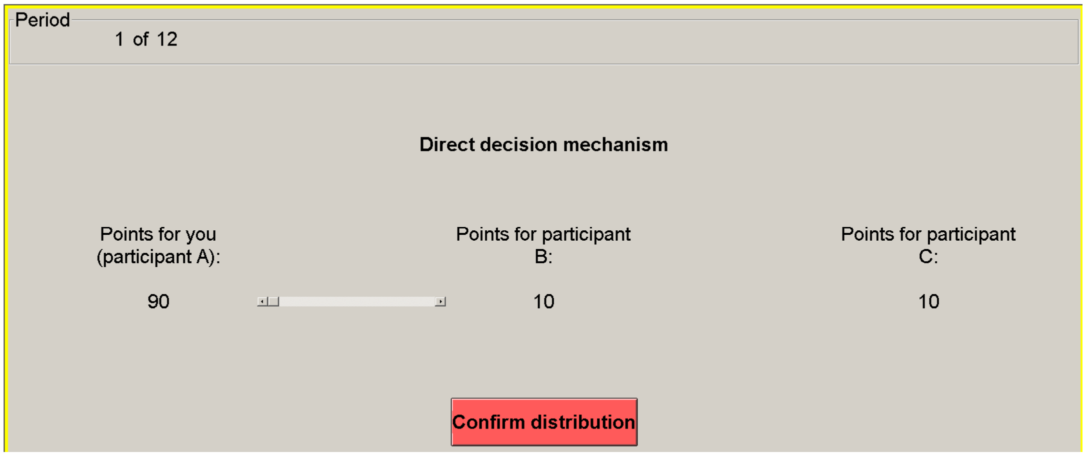
Participant A makes his or decision about the procedure to be used for determining the distribution of points on the screen below:



On each screen, you can see the present period in the upper line. In this example, it is the first of twelve periods (1 of 12).

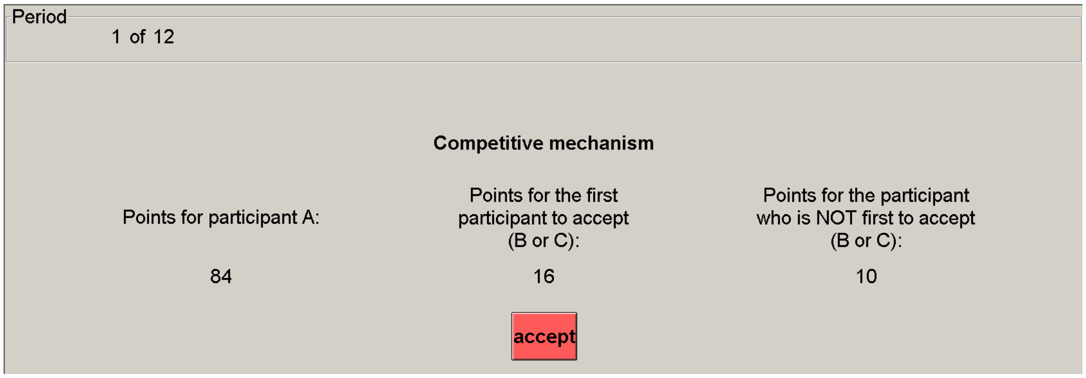
Participant A chooses the procedure that he or she would like to use and then clicks on “OK”.

If participant A decided to distribute the costs him/herself using the **direct decision mechanism**, he or she determines the exact distribution of costs on the screen below:



Participant A can move the scroll bar between the left and the middle columns and thus determine the distribution of points between him/herself and participant B. If the scroll bar is all the way to the left (as in the example above), participant A transfers no points to participant B. If the scroll bar is all the way to the right, participant A transfers 40 points to participant B. If the scroll bar is in a position in between, the corresponding number of points is transferred to participant B. The exact number of points that any position yields is indicated directly on the screen. After reaching the desired point distribution, participant A clicks on "Confirm distribution" to confirm his or her decision.

If participant A decided to determine the distribution through the **competitive mechanism**, participant B and C are informed accordingly and the competition phase begins. Participants B and C make their decisions on the following screen:



The screen shows the distributions that result in each second. The points for participant A are on the left side; the middle shows the points for the participant (B or C) who is first to accept the distribution (by clicking on the "accept" button), and the right shows the number of points for the participant (B or C) who is not the first to accept. This participant always receives 10 points.

The points for participant A and for the participant who accepts first (B or C) change from second to second. In the example shown above, you see the distribution that results after 6 seconds.

In the next second, participant A's number of points will reduce to 83 and the number of points for the participant who is first to accept will increase to 17.

In the second after that, participant A's number of points will reduce to 82 and the number of points for the participant who is first to accept will increase to 18, etc.

The competition phase concludes as soon as either participant B or participant C clicks on the "accept" button.

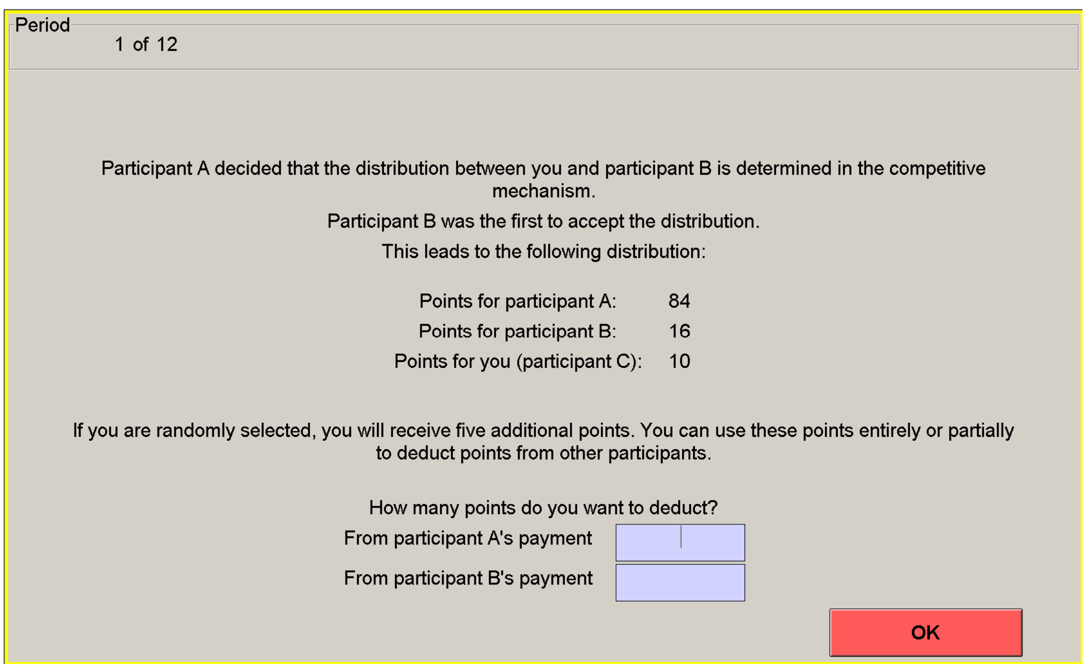
In a next step, all participants are informed of the resulting distribution. If participant A chose the direct decision mechanism, participant B and C will be informed of the distribution that participant A chose; if participant A chose the competitive mechanism, participant A will be informed of the result of the competition.

Participant B **or** C will then be chosen randomly. The randomly chosen participant will receive five additional points which he or she can use entirely or partially to deduct points from the other participants.

Before participants B and C learn who has the possibility of deducting points, both enter how many points they would like to deduct from the other two participants in case the computer randomly chooses them.

If random chance determines that participant B may deduct the points, participant B will receive five additional points and his or her decision will be implemented. If random chance determines that participant C may deduct the points, participant C will receive five additional points and his or her decision will be implemented. As neither participant B nor participant C knows if the computer will select him or her randomly, each should make the decision carefully. The probability that the decision will be implemented amounts to 50%.

In this example, you see participant C's screen; that of participant B is analogous.



In this example, participant B accepted the point amount of 16 points, which results in the competition phase after 6 seconds.

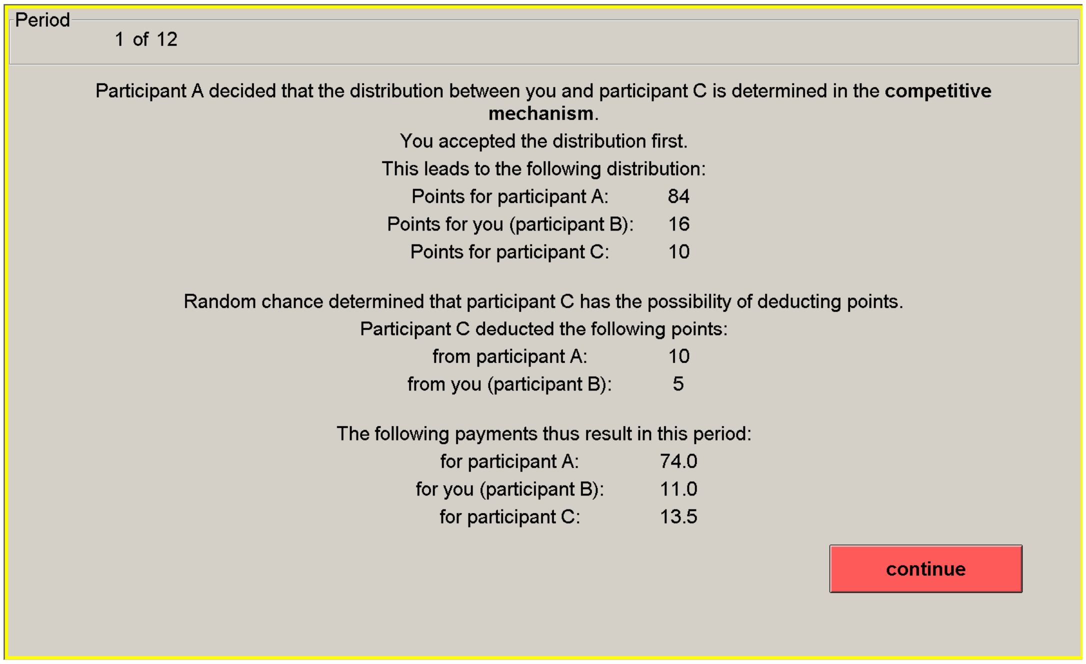
Participant C enters the number of points that he or she would like to deduct from the other participants in the corresponding fields. For each point that participant C deducts from another participant, he or she loses 0.1 additional point. If participant C does not want to deduct any points, he or she enters “0” in both fields. In this case, he or she retains all five additional points.

The decisions can be changed until the OK button is clicked on.

After participants B and C have decided on the point deductions, **the computer will randomly choose one of these participants, and the chosen participant’s point deductions will be implemented.**

The other participant’s point deductions will neither be implemented nor will this participant receive any additional points.

At the end of a period, all participants will be informed about the payments that resulted. In the example here you see participant B's screen. The screens of participants A and C are analogous.



Once all participants have pressed the "continue" button, **the next period begins, during which a new participant A, a new participant B and a new participant C are randomly matched together.**

At the end of the study, one of the 12 periods will be randomly selected. The payments from this randomly chosen period will determine your income in this study. The points you earned in this period will be converted to Euros and paid out to you, together with the initial endowment in cash. **As you do not know which period will be randomly selected, you should consider your decisions in every period very carefully.**

Do you have any questions? If yes, please raise your hand. We will come to you at your carrel.

If you do not have questions, please complete the control questions on the next page.

Control questions

Please answer the following control questions. They only serve the purpose of making you familiar with the study. The decisions and numerical amounts in the control questions are chosen completely randomly; they should not be considered an indication of or a suggestion how you could decide. Your answers to the control questions have no effect on your payment at the end of the study.

Please enter your answers directly into the computer. You can check this way whether your answers are correct. If you have a question, please raise your hand. The study cannot begin until all participants have answered the questions correctly.

1. Participant A decides for the direct decision mechanism and transfers 5 points to participant B. After the transfer decision, participant A thus has 85 points, participant B 15 points, and participant C 10 points. Partcipant C is randomly chosen to deduct points; he or she can deduct points from other participants and thus receives five additional points. Participant C then decides to make the following deductions, which appear in bold print below.

	Participant A	Participant B	Participant C
Distribution	85	15	10
- Deducted points	**15**	**5**	-
+ remaining additional points	-	-	______
= Payment?	______	______	______

Please determine the payment (in points) that results for each participant.

2. What is the maximum number of points that participant C could deduct from participant A in the example above?

____

3. What is the maximum number of points that participant C could deduct from participant B in the example above?

____

4. Participant A decides for the direct decision mechanism and transfers 36 points to participant B. After the transfer decision, participant A thus has 54 points, participant B 46 points, and participant C 10 points. Partcipant B is randomly chosen to deduct points; he or she can deduct points from other participants and thus receives five additional points. Participant B then decides to make the following deductions, which appear in bold print below.

	Participant A	Participant B	Participant C
Distribution	54	46	10
- Deducted points	**40**	**-**	**6**
+ remaining additional points	**-**	___________	**-**
= Payment?	___________	___________	___________

Please determine the payment (in points) that results for each participant.

5. Participant A decides to determine the distribution in the competitive mechanism. Participant C first decides to accept a distribution; this is after 25 seconds. Partcipant C is randomly chosen to deduct points; he or she can deduct points from other participants and thus receives five additional points. Participant C then decides to make the following deductions, which appear in bold print below.

	Participant A	Participant B	Participant C
Distribution	___________	___________	___________
- Deducted points	**27**	**3**	**-**
+ remaining additional points	**-**	**-**	___________
= Payment?	___________	___________	___________

Please determine the distribution that participant C has in the competitive mechanism after 25 seconds and the payment (in points) that results for each participant.

6. Before the computer determines which participant has the possibility to deduct points, participant B decides to deduct a total of 23 points from the other two participants, in case he or she is randomly chosen. The computer decides randomly that participant C has the possibility of deducting points. How many additional points does participant B – who is not randomly chosen – receive?

   ____

   Will the 23 points that participant B – the participant who was not chosen – wanted to deduct from participants A and C be deducted?

   YES / NO *(Please select the appropriate answer)*

7. Participant A decides to determine the distribution in the competitive mechanism. Participant B first decides to accept a distribution; this is after 2 seconds. Partcipant C is randomly chosen to deduct points; he or she can deduct points from other participants and thus receives five additional points. Participant C then decides to make the following deductions, which appear in bold print below.

	Participant A	Participant B	Participant C
Distribution	____	____	____
- Deducted points	**0**	**0**	-
+ remaining additional points	-	-	____
= Payment?	____	____	____

   Please determine the distribution that participant B has in the competitive mechanism after 2 seconds and the payment (in points) that results for each participant.

If you have a question, please raise your hand. The study will begin as soon as all participants have correctly solved the control questions and entered the answers into the computer.