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Gender and Cooperation in the Presence of Negative Externalities

Abstract

Social dilemmas often impose negative externalities on third parties. We experimentally analyze gender differences in cooperation in such a setting, i.e., a prisoner's dilemma game, with a passive third party that may be harmed when active players mutually cooperate. Applying a within-subjects setting, we compare cooperation under anonymity and social information, as personal characteristics are commonly known in real-life relations. Results show that the presence of a negative externality particularly affects guilt-averse women, who cooperate less often independently of the degree of information they receive. No gender difference is found absent negative externalities.

JEL-Codes: C920, D010, J160.

Keywords: cooperation, experiment, gender differences, negative externality, social information.

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1. Introduction

People often face social dilemmas where they have to trade off individual and collective interests. In these cases, individuals can increase their payoffs when making a socially defecting choice, whereas all decision makers would be better off if everybody cooperated. Individual incentives can thus lead to outcomes that are collectively suboptimal (Dawes, 1980, Balliet, 2010). Prominent economic social dilemma games are prisoner's dilemmas (Rapoport et al., 1965, Rapoport and Chammah, 1965, Andreoni and Miller, 1993) and public goods games (Ledyard, 1995, Fehr and Gächter, 2000, Keser and Van Winden, 2000), which may be applied to many real-life situations. Well-known examples are the fight against climate change, environmental conservation or work organization.

The social desirability of cooperation changes, however, if it is not something which is unambiguously positive for society (such as the provision of public goods), but if cooperation causes harm for third parties. For example, in the intra-firm setting, tax evasion, accounting fraud, and illegal activities such as the emission scandal may increase mutual payoffs of collaborating parties in a given company. At the same time, this cooperative behavior may lower payoffs of third parties such as consumers, taxpayers or other individuals such as shareholders. In a similar vein, cartels are an obvious application of social dilemmas where third parties are harmed. On the one hand, members increase their payoffs if they cooperate and charge collusive prices. On the other hand, this comes at the cost of consumers. The decision to cooperate is typically made by individuals, who may not only weigh their personal benefits and potential risks, but also the (passive) outsiders' potential losses. However, the multitude of theoretical and empirical works in industrial organization focuses on firms and their incentives as the unit of analysis (Levenstein and Suslow, 2006, Connor and Bolotova, 2006). A notable exception are oligopoly experiments (e.g., Huck et al., 1999, 2001, 2004), where subjects in the laboratory assume the role of firms. However, these papers typically simulate consumers and therefore do not consider negative externalities.[1] Furthermore, individual characteristics are usually not examined, even though they can determine economic and social preferences relevant for cooperation (e.g., Chaudhuri et al., 2002).

One of these characteristics is an individual's gender, which provides a promising avenue for research in social dilemmas with negative externalities. First, even though empirical research provides evidence that women may reduce corruption, increase public goods provision and participate in cartels less often (Swamy et al., 2001, Chattopadhyay and Duflo, 2004, Haucap and Heldman, 2022), little is known about different behavior of male and female decision makers in the situations described above, since women are still under-represented in management positions (Santacreu-Vasut and Pike, 2019). Second, experimental and empirical research has repeatedly revealed gender differences in preferences that determine behavior (Croson and Gneezy, 2009) and occur early in life

[1] Only few oligopoly experiments compare computerized buyers with human players who actively decide and are no passive third parties (Ruffle, 2000, Potters and Suetens, 2013, Kalaycı, 2015).

(Francesconi and Parey, 2018, Sutter et al., 2019, Iriberri and Rey-Biel, 2021). For example, women have been found to be less risk tolerant (Charness and Gneezy, 2012), less competitive (Niederle and Vesterlund, 2007, Heinz et al., 2016), and sometimes less trusting than men (Rau, 2012). It was also found that women are more generous (Eckel and Grossman, 1998, Grosch and Rau, 2017) and more cooperative than men (Ortmann and Tichy, 1999). These differences represent key aspects in social dilemma situations, that on the one hand reflect risky environments and on the other hand may affect social preferences of decision makers. The results are thus of particular interest in light of gender inequality and the effectiveness of (affirmative action) policies aimed at increasing diversity (Balafoutas and Sutter, 2012, Niederle et al., 2013, Grosch et al., 2020).

Motivated by these findings, we run a laboratory experiment to conduct a comprehensive analysis of gender differences in cooperation. Our setting of a social dilemma that may entail a negative externality is essential for many business contexts, where cooperative illegal actions may harm third parties (e.g., tax evasion, accounting fraud) in firms, or in markets (charging collusive prices). The experiment adopts a salami-slicing-approach to understand the complexity of gender differences in cooperative behavior and how it is affected by the choice environment, such as the potential impact on third parties and information on interaction partners. We model cooperation in a prisoner's dilemma, where it harms passive third players (Engel and Zhurakhovska, 2014). The novelty of our approach is twofold. First, we study gender differences in a setting, where cooperation comes at the expense of a passive third party. Second, we apply a within-subjects setting to compare cooperation under anonymity and in the case where players have social information, as personal characteristics of interaction partners may commonly be known in business relations. In a first step, subjects decide without having information about their interaction partner, which yields insights on the pure gender differences in cooperative behavior when third parties are harmed. In a second step, they receive information on the interaction partner before deciding again. To study the causal effect of the negative externality, we introduce a control treatment, where mutual cooperation does not harm the third party. To shed light on the underlying mechanisms, we collect an extensive set of economic preferences (risk, patience, social value orientation) and psychological measures (betrayal-, guilt-, and shame aversion), which are of relevance in this context.

Results demonstrate that women behave significantly less cooperative than men when outsiders are harmed. The gender difference is driven by guilt- and shame-averse women, who are less likely to cooperate when it causes harm for third parties. The gender difference vanishes in the control treatment, where women cooperate significantly more compared to the treatment with negative externalities. Importantly, the results are robust in the social-information condition when revealing players' personal characteristics. In this case, women again show the same low degree of cooperative behavior. Interestingly, men seem to be sensitive to the decision context, i.e., they significantly reduce cooperation when knowing that their interaction partner is female.

Our results have practical implications, suggesting an increase of women in management positions may reduce cooperation in social dilemma situations that impose harm on

third parties. The finding that men cooperate less often when knowing that they interact with women also suggests that increasing the share of women may help to lower harmful cooperation in these situations. For intra-firm decisions, this practice may be helpful to encounter cooperation in illegal activities, such as tax evasion or accounting fraud. At the market level, this suggests that policies aiming at an increase in diversity within firms may have the beneficial side effect of reducing the likelihood of antitrust infringements. However, the results have to be taken with a grain of salt, as further research regarding repeated contexts and the role of selection effects is necessary to draw clear conclusions for market settings.

2. Experimental Design

In this section, we present the experimental design. Our study consists of two main blocks, which comprise two parts each. In the first block, subjects participate in the main part of our within-subjects experiment, the cooperation games. In the second block, we focus on possible channels for subjects' behavior. Precisely, we elicit economic preferences and apply a set of psychological measures, which are relevant for cooperative behavior in this setting.

2.1. First Block: Cooperation Games

In the beginning of the experiment, subjects complete a basic sociodemographic questionnaire (gender, age, number of semesters studied). Next, they are informed that the experiment consists of four parts and that they receive new instructions before each part begins. When participating in a part, subjects do not know any details about the next part (see Appendix C). Participants are told that either part one or two will be randomly selected to determine their final payoff, while parts three and four are both paid with certainty. The resulting payoffs are not disclosed during the experiment and only communicated when the experiment is finished.

In the first block of the within-subjects experiment, subjects participate in two consecutive cooperation games (parts one and two), which are based on a symmetric two-person prisoner's dilemma extended by a third player who is a passive outsider and does not participate in the game. This design builds on Engel and Zhurakhovska (2014), but differs in three important respects. First, in our setting, we frame subjects' actions (player A and player B) as setting a high vs. a low price. This approach is inspired by Cooper and Kühn (2014) who also model cooperation in simple matrix games. In our game, the passive player (player C) can be regarded as a third party, who is harmed by mutual cooperation of active decision makers, such as passive stakeholders in a company setting, or a consumer on a market. His payoff is only lowered when both active players cooperate, which is similar to a scenario where active decision makers engage in fraud in a company or form a cartel on a market. This stands in contrast to Engel and Zhurakhovska (2014), where the payoff of the third player is already reduced whenever at least one of the two active players cooperates. Second, we extend the one-shot prisoner's dilemma to a within-subjects design, where the same participants are re-matched and decide in an additional prisoner's

dilemma (henceforth: cooperation game). Here, we disclose information on some personal characteristics of the active players (see below for details) in order to analyze the stability of subjects' behavior when social information of players is revealed. We apply this method because, on the one hand, it is realistic that personal characteristics of interaction partners may be known in business relations. On the other hand, social information of the interaction partner may serve as a signal for his or her willingness to cooperate. Furthermore, this allows for an analysis not only of gender differences in cooperation, but also of how knowledge about gender might impact behavior.

We apply two treatments in block one. The general sequence is the same in both treatments, the only difference is the payoff consequence for the passive player. In the *baseline* treatment, consumers (i.e., the passive players) are not hurt by cooperation, while in the *negative* treatment, mutual cooperation between the active players harms the third player. The first block starts with the first of the two cooperation games. Here, players are randomly matched in groups of three, which consist of two active players (P_A and P_B) and one passive player (P_C). Roles are randomly allocated and remain constant throughout both cooperation games. Each subject is informed about their role and moves to the decision stage of the first cooperation game. In this game, players do not have information about each other's characteristics. All subjects receive an initial endowment of €6 and are shown the payoff matrix on their computer screens. Moreover, the on-screen instructions explain the payoff consequences of the possible active players' choices for all players. In the experiment, we call the actions of the two players "high price" and "low price."[2] Moreover, we use neutral names (player A, player B, player C) for the players. Next, the two active players (P_A and P_B) play the cooperation game, while the passive player (P_C) does not make a choice. We apply the following payoff parameters:

Table 1: The Payoff Matrix

		P_B	
		High Price	Low Price
P_A	High Price	P_A: €14, P_B: €14 P_C: €6 − U	P_A: €8, P_B: €16 P_C: €6
	Low Price	P_A: €16 , P_B: €8 P_C: €6	P_A: €10, P_B: €10 P_C: €6

If P_A and P_B cooperate and choose a high price, they can increase their payoff by €8 and earn €14 each, including their endowment. If one player defects while the other player cooperates, the defector receives a total of €16, whereas the co-operator receives €8. If both players choose the low price and defect, each one receives €10. The payoff of P_C is determined by the active players' choices, depending on the treatment. This externality is indicated by U:

[2]We used this slightly framed version to emphasize to the decision makers that charging a high price may increase their payoffs. However, we do not call the players "firms," as we do not intend to apply a real oligopoly setting.

(i) In the *baseline* treatment, P_C is not affected and receives his endowment of €6 ($U = 0$), independently of the active players' choices.

(ii) In the *negative* treatment, cooperation of P_A and P_B imposes a negative externality on the passive third party. If both active players choose the high price, P_C's endowment is reduced by €3 ($U = 3$) and he receives a total payoff of €3. Otherwise, active players' actions do not harm the passive third party's payoff. In a stylized way, one interpretation may be that only in the case of mutual cooperation a cartel is established.

The Nash equilibrium is similar in both treatments, i.e., the active players always make a defective choice, namely choosing a low price. After having submitted their choices, P_A and P_B are asked to indicate their beliefs on the choice of the other active player. We do not incentivize the belief elicitation of the active players to avoid hedging behavior of their stated beliefs against adverse outcomes of their decision in the game (Blanco et al., 2010). At the same time, we measure the beliefs of P_C regarding the behavior of active players. That is, we ask them to assess whether both cooperate, defect or whether one cooperates while the other defects. We incentivize this measure with €1 per correct guess.

Next, subjects receive new instructions for the second part. Players know that groups are reshuffled, while the players' roles remain the same as in the first game. We then disclose information on the active players, i.e., P_A and P_B receive the following information about each other: gender, age and number of semesters studied. The characteristics of P_C are not revealed to the active players. Active players participate in the same version of the cooperation game as before. Again, we apply exactly the same belief elicitation. P_C is informed about the demographics of one of the active players and again has to predict the outcome of the game.[3]

A short questionnaire for the two active players concludes the first block of the experiment. In the questionnaire, we ask whether the active players focused more on the active players' payoffs or on the passive player's payoff.[4] We ask this question twice in a row for each of the two cooperation games. After all subjects made their choices, they proceed to the second block of the experiment.

2.2. Second Block: Elicitation of Economic Preferences and Psychological Measures

In the second block of the experiment, we elicit a set of economic preferences and psychological measures to learn more about the underlying channels of subjects' behavior in

[3]This disclosure of information is limited to only one of the two players to pin down P_C's belief on how this exact player will behave. The goal is to learn about passive players' average belief of players with such characteristics. Guessing the behavior of two players would require to anticipate interaction effects, which is more complex and biases this analysis.

[4]We asked them: "What was the payoff consequence you focused on when taking your decisions in part one?" They could choose one of the three answers: (i) The payoff consequences of the other active player and my own payoff consequences; (ii) The payoff consequences of the passive person (person C) and my own payoff consequences; (iii) Only my own payoff consequences.

the cooperation games. The elicitation of preferences is conducted in separate consecutive parts (parts 3 and 4), where subjects always receive new instructions (see Appendix A for detailed explanations). In the third part, we measure subjects' risk tolerance with the method of Eckel and Grossman (2002). Participants have to choose one of six lotteries, where higher choices correspond to lower risk aversion. In the fourth part, we measure social value orientation with the task of Murphy et al. (2011). Subjects are matched in pairs and have to decide about the monetary allocation between them and a passive player in six decision sets. Based on their replies, we compute a Social Value Orientation (SVO) angle. Higher (lower) angle values can be interpreted as more (less) prosocial.

Before we apply our verbal measures on psychological preferences, we inform subjects that they will participate in several questionnaires before the experiment concludes. First, we measure betrayal aversion with two slightly modified verbal questions initially introduced by Cubitt et al. (2017). The two questions focus on situations, where players can decide to trust and either face social or natural risk. Subjects have to state the lowest probability of their trust being reciprocated required to make them choose to trust in these situations. We measure betrayal aversion as the difference between the stated probabilities when facing social and natural risk. Betrayal aversion increases (decreases) in the difference.

In the next part, subjects complete some questions of the psychological TOSCA-3 questionnaire introduced by Tangney et al. (2000) and used in experiments by Bellemare et al. (2019).[5] Subjects are presented with nine scenarios of everyday life and have to indicate how likely it is that they would react in certain ways. Based on the replies, we compute indices on: guilt-proneness, shame-proneness, externalization of blame, and detachment/unconcern. Finally, we measure time preferences following Müller and Rau (2021) and Rau (2021) by asking two questions, where subjects have to trade off a monetary amount between two time points. First, they have to state the level of immediate compensation in Euros to forego a payment of €1000 in six months. Afterward, they are asked about the required level of compensation in six months to forego a payment of €1000 in twelve months. We compute the mean of both answers. The measure is interpreted as follows: more (less) patient subjects request a higher (lower) amount.

At the end of the experiment, the final payoffs are determined. The computer randomly picks one of the two cooperation games of block one and informs subjects about all player's choices and their individual earnings. All profits made in the preferences-elicitation stage (block two) are added. They result from the coin toss in the risky lottery and the randomly determined money allocation in the SVO elicitation task. Each subject is informed about the profits in the payoff-relevant parts and on the total profits of the experiment.

[5]The Test of Self-Conscious Affect (TOSCA-3) (Tangney et al., 2000) has long been used by psychologists as an instrument for empirically distinguishing between trait emotions of guilt and shame. There are various versions of the TOSCA-3 questionnaire, which consist of brief scenarios that respondents would be likely to encounter in day-to-day life. Each scenario is followed by a number of associated statements that include phenomenological aspects of shame and guilt. For each statement, respondents rate how likely they could react in the manner stated on a 5-point scale.

2.3. Procedure

The experiment was conducted online between January and March 2021 with the student subject pool of the Düsseldorf Institute for Competition Economics (DICE) in Germany. It was programmed in z-Tree unleashed (Fischbacher, 2007, Duch et al., 2020) and took place via participants' web browser. We recruited subjects from various study fields and age groups from the university's database for lab experiments using ORSEE (Greiner, 2015). In total, 408 subjects (*negative*: 234, *baseline*: 174) participated in the experiment. Due to technical problems during the online experiment (e.g., people dropping out or their internet connection being lost), we lost some observations and remain with the data of 382 subjects. Precisely, the data contains 223 subjects (54% female) that participated in the *negative* treatment and 159 subjects (58% female) that participated in the *baseline* treatment. We ran 25 sessions of varying size. A session lasted about one hour and subjects' mean earnings were €12.92 (*negative*: €12.61, *baseline*: €13.36) including the show-up fee of €6. The study was pre-registered on aspredicted.org under the number 56299: https://aspredicted.org/yz8uv.pdf.

3. Hypotheses

Next, we derive hypotheses based on the experimental literature on gender effects in cooperation. Our basic setting of the cooperation game is similar to Engel and Zhurakhovska (2014). The authors study a prisoner's dilemma game, where cooperation of active players may have a negative externality on a passive outsider. Results show that cooperation levels decrease in the level of harm on the outsider. Based on this finding, we expect less cooperation when negative externalities exist.

Hypothesis 1: Less cooperation is observed in the treatment with a *negative* externality than in *baseline*.

Regarding gender differences, the psychological literature finds mixed evidence for prisoner's dilemmas (Croson and Gneezy, 2009). Some studies report that men are more cooperative than women (e.g., Rapoport and Chammah, 1965, Kahn et al., 1971), whereas other studies find that women cooperate more often than men (e.g., Sibley et al., 1968). In line with the latter, most economic experiments show that women are more cooperative than men (Frank et al., 1993) and that this gender difference vanishes after repetitions (Ortmann and Tichy, 1999).[6] In *baseline*, we focus on a one-shot setting, which is most closely related to economic prisoner's dilemma experiments. Therefore, we postulate that women cooperate more than men.

Hypothesis 2a: In the *baseline* treatment, women cooperate more often than men.

[6] A meta study on gender differences in cooperation in public goods games finds that on average no gender differences can be found. Men tend to behave more extreme, whereas women are more likely to behave moderately cooperative (Thöni et al., 2021).

The main difference of our treatment manipulation is that the active player's action can influence a passive player's payoff in the *negative* treatment. Thus, the *negative* treatment additionally shares common characteristics of an experimental dictator game (Kahneman et al., 1986, Engel, 2011). In such games, it was found that female dictators send higher amounts to passive recipients than men (Eckel and Grossman, 1996). An explanation may be gender differences in guilt aversion (Plant et al., 2000, Else-Quest et al., 2012) as women may feel guiltier than men when not behaving altruistically towards passive players. Similar results are reported in the experimental literature on lying games focusing on "black lies", i.e., a person increasing their payoff at the expense of a passive other person. Results show that women engage significantly less often in unethical behavior than men (Capraro, 2018, Grosch and Rau, 2017) in such contexts.[7] Taken together, we expect that women behave less cooperatively in the *negative* treatment than men to avoid feeling guilty when the payoff of the passive player would be lowered.

Hypothesis 2b: In the treatment with the *negative* externality, women cooperate less often than men.

Our analysis of the effects of disclosing active players' information in the social-information setting is conducted on an exploratory basis, as the evidence is not conclusive. Information about interaction partners may increase cooperation by creating a group identity, but might have the opposite effect if people consider each other as the "outgroup" (Goette et al., 2012, Chen and Li, 2009). Furthermore, information can trigger different beliefs about behavior, especially regarding gender. Several studies conclude that women are generally expected to behave more cooperatively than men in social dilemmas (Cigarini et al., 2020, Orbell et al., 1994) and make more altruistic and generous choices in ultimatum and dictator games (Brañas-Garza et al., 2018, Solnick, 2001). Yet other studies report mixed effects of gender disclosure: For instance, it was found that it may increase competition and retaliation in same-gender pairings, which reduces cooperation (Sutter et al., 2009). In dictator games, some studies report that neither gender shows a behavioral change when gender is known (e.g., Dufwenberg and Muren, 2006), while Ben-Ner et al. (2004) find that only women react to receiving gender information on the interaction partner, i.e., they give significantly less to other women compared to men. Moreover, Jetter and Walker (2018) report that women compete more aggressively in the game show "Jeopardy" when knowing that, paired with men.

In light of these results, we refrain from deriving and pre-registering hypotheses for this setting.

4. Results

In this section, we present our results on cooperative behavior in the two stages of our treatments. We report two-sided p-values throughout.

[7] In a meta study Gerlach et al. (2019) argue that although most papers conclude that men behave more dishonestly than women, some studies have found no gender differences.

4.1. Cooperative Behavior: Anonymous Setting (Stage One[8])

To obtain a general understanding of the relationship between negative externalities and cooperative behavior, we first focus on treatment effects between *negative* and *baseline*. In stage one, results show that a significantly smaller share of players (38%) behave cooperatively when a third party is harmed, compared to the baseline treatment (52%) (Chi²-test, $p = 0.030$). This is in line with the findings of Engel and Zhurakhovska (2014). As less cooperation is observed in the presence of negative externalities, we find support for Hypothesis 1.

Next, we turn to our main results on gender differences with respect to cooperative behavior. Figure 1 shows the share of cooperating subjects in the two treatments, *negative* (left panel) and *baseline* (right panel).

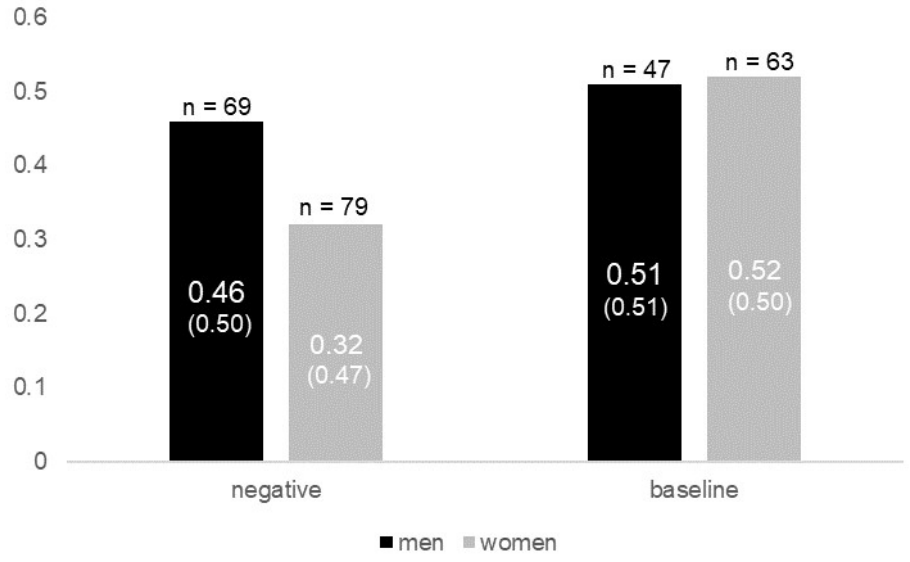

Figure 1: Share of cooperating subjects in *negative* (left panel) and *baseline* (right panel), conditional on gender (men: black bars; women: gray bars). Standard deviations in parentheses.

Figure 1 highlights that the lower rate of cooperation in *negative* is driven by female subjects, who cooperate significantly less often (32%) when they exert a negative externality compared to the *baseline* treatment (52%) (Chi²-test, $p = 0.013$). By contrast, no treatment differences exist for men, who cooperate in 51% of all times in *baseline* and at a similarly high level (46%) in *negative* (Chi²-test, $p = 0.620$). Focusing on gender differences in the treatment with the negative externality, we find that women cooperate significantly less often than men (Chi²-test, $p = 0.066$), which provides first support for our directed Hypothesis 2b.[9] Indeed, this gender difference does not occur in *baseline*.

[8]Parts one and two are henceforth referred to as "stage one" and "stage two". Since the cooperation games are two substages of one part, which analyzes cooperative behavior, we refer to the two cooperation games as "stages" in our analysis.

[9]Since we pre-registered a directed hypothesis, we can also focus on a one-sided test: Chi²-test, $p = 0.033$.

Since women in *baseline* do not cooperate more than men (Chi²-test, $p = 0.891$), we find no support for Hypothesis 2a.

The findings are confirmed by Probit regressions on cooperation rates. To study for the channels of cooperative behavior, we include our data on preferences and psychological measures. For these measures, we conduct a Principal Component Analysis (PCA) to reduce the number of correlated variables. Factors were extracted based on the Kaiser criterion, i.e., components were dropped, for which the eigenvalues are less than one. We identified four components with eigenvalues exceeding one.[10] A loading of 0.50 or greater was used to identify items. In component one, two items of the TOSCA-3 scales load positively and very strongly, namely detachment (0.65) and externalization of blame (0.67). This component presents an unemphatic person who is not aware of his mistakes. We call this component *PC1: unconcerned others*. In component two, two further items of the TOSCA-3 scales load positively and very strongly: proneness to shame (0.67) and proneness to guilt (0.63). Therefore, we call this component *PC2: shame & guilt*. Patience loads very strongly in component three (0.80) and svo (-0.53) loads negatively. We call this component *PC3: patient & individualistic*. In component four, betrayal aversion (0.74) and risk tolerance (0.67) load strongly. This component is labelled *PC4: betrayal & risk tolerant*.

Table 2: Probit regressions on cooperation rates. Average marginal effects reported.

	all data			negative				
				both genders			women	men
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
negative	-0.135**	0.013	0.010					
	(0.057)	(0.070)	(0.075)					
female	-0.080	-0.028	-0.010	-0.145**	-0.182***	-0.110		
	(0.052)	(0.067)	(0.076)	(0.064)	(0.061)	(0.079)		
female × negative		-0.159*	-0.146					
		(0.091)	(0.103)					
belief cooperation		0.470***	0.462***		0.439***	0.422***	0.361***	0.494***
		(0.020)	(0.022)		(0.027)	(0.033)	(0.054)	(0.025)
PC1: unconcerned others			0.008			-0.000	0.040	-0.050
			(0.021)			(0.028)	(0.032)	(0.042)
PC2: shame & guilt			-0.031			-0.076**	-0.113**	0.004
			(0.025)			(0.036)	(0.048)	(0.046)
PC3: patient & individualistic			0.019			0.046**	0.006	0.109***
			(0.024)			(0.020)	(0.034)	(0.026)
PC4: betrayal & risk tolerant			0.020			0.021	0.028	0.008
			(0.025)			(0.042)	(0.056)	(0.049)
Controls	no	no	yes	no	no	yes	yes	yes
Obs.	258	258	258	148	148	148	79	69

Standard errors in parentheses

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

[10] A varimax rotation was applied.

Table 2 presents Probit regressions on cooperation rates. Models (1) – (3) focus on the aggregate data to analyze treatment effects. Models (4) – (8) provide a closer look at the drivers of the treatment effect, i.e., gender differences in the *negative* treatment. All models include a gender dummy (*female*), which is 1 for women. In models (1) – (3), we include a treatment dummy (*negative*), which is 1 for the treatment with a negative externality. In models (2) – (3) we control for the interaction effect (*female x negative*) of the treatment and gender. We include a dummy (*belief cooperation*), which is positive when players believe that the other active player is cooperative. Furthermore, the principal components of subjects' preferences ($PC1$ – $PC4$) are included in models (3), (6), (7), and (8). We focus on the sub samples of women (model (7)) and men (model (8)) to control whether gender-specific effects exist regarding the impact of economic preferences and psychological measures. In models (3), (6), (7), and (8) we apply sociodemographic variables as controls (*age* and whether subjects are *econ* students). All regressions present average marginal effects and standard errors, clustered at the session level.[11]

Model (1) shows that the coefficient of the treatment dummy is significant with a negative sign, i.e., the likelihood of cooperative behavior is about 14 percentage points smaller when negative externalities exist. Thus, we find support for Hypothesis 1. The treatment effect is also reflected by our questionnaire, where we asked active players whose payoffs they focused on. We find that in the *negative* treatment, a significantly smaller fraction of active players (48%) state that they focused on the payoffs of the active players compared to the *baseline* treatment (70%) (Chi²-test, $p < 0.001$). Focusing on models (2) – (3), it can be seen that the coefficient of *negative x female* adds support to Hypothesis 2b. That is, women are 16 percentage points less likely to cooperate in *negative* than in *baseline*.[12]

Moreover, models (4) – (5) add further support to this finding. That is, the coefficients of *female* are significantly negative, which demonstrates that particularly women behave less cooperatively when negative externalities exist. Model (5) shows that the gender effect is also robust and even becomes stronger in effect size when controlling for subjects' beliefs that the other active player cooperates. We also find that *belief cooperation* is highly significant and positive, highlighting that subjects in *negative* cooperate more when they hold the belief that the other player is cooperative. Overall, our results again emphasize that cooperative behavior is lower in *negative*, since particularly women are less likely to cooperate. We summarize our findings as follows:

[11] We cluster the standard errors at the session level to control for session heterogeneity, i.e., the online sessions are relatively heterogeneous regarding the number of participants, which reflects in the duration of the sessions.

[12] The gender difference in cooperative behavior is also reflected by our questionnaire on active players' payoff focus. We find that a significantly smaller share of women (48%) focuses on active players' payoffs in *negative* as compared to the *baseline* treatment (75%) (Chi²-test, $p = 0.001$). By contrast, no significant treatment difference can be found for men (*negative*: 49%; *baseline*: 64%; Chi²-test, $p = 0.122$).

Result 1:

(a) Subjects cooperate less often when negative externalities on third parties exist.

(b) The treatment effect is induced by women who are less likely to cooperate in the *negative* treatment.

Turning to the effects of economic preferences and psychological measures, models (3) and (6) highlight that the inclusion of the PCs turns *female x negative* (model (3)) and the *female* dummy in model (6) insignificant. At the same time, model (6) highlights that the coefficient of *PC2: shame & guilt* is negative and significant in the *negative* treatment. Moreover, the coefficient of *PC3: patient & individualistic* is positive and significant. Thus, more shame and guilt averse subjects are less likely to cooperate, whereas more patient and individualistic subjects are more likely to cooperate in the negative treatment. Thus, the gender effect is apparently driven by economic preferences and psychological measures.

Next, we focus on gender-specific effects in the *negative* treatment. In model (7) it can be seen that the effect of shame and guilt aversion particularly matters for women. Precisely, the coefficient of *PC2: shame & guilt* is significantly negative, and it is the highest coefficient (-0.117) of all PCs. Whereas, all other coefficients of the PCs are insignificant. By contrast, model (8) reveals that shame and guilt aversion do not matter for men, i.e., the coefficient of $PC2$ is insignificant and of small effect size (0.004). Applying a median split, we also find that less guilt and shame averse women with a score below/equal the median of $PC2$ cooperate 52% of the time. By contrast, for an above median score of $PC2$ the share of cooperative women (22%) is significantly smaller (Chi²-test, $p = 0.008$). The effect is less pronounced and insignificant for men (Chi²-test, $p = 0.113$). For men, we find that the coefficient of $PC3$ is positive and significant, i.e., individualistic men who are patient are significantly more likely to cooperate in the *negative* treatment. In summary, we find that the gender effect of lower cooperative behavior is mainly driven by guilt and shame averse women.

Result 2: Cooperation negatively correlates with guilt and shame aversion, which is particularly pronounced for women, who are less likely to cooperate when negative externalities on third parties exist.

Finally, we find that *belief cooperation* is positive and highly significant in all regression models, i.e., subjects are more likely to cooperate when they believe that the other player cooperates. We also find no gender difference in *belief cooperation*, i.e., how often subjects believed that the other active subject cooperates (men: 49% vs. women: 57%; Chi²-test, $p = 0.350$) and in the beliefs of passive players that both active players cooperate (men: 53%; women: 49%; Chi²-test, $p = 0.713$). Although, the coefficient of *belief cooperation* is highly significant and positive for both genders in models (7) and (8), it turns out that the effect size is higher (0.494) for men than for women (0.361).

In addition, we run the same sub sample regression models for the *baseline* treatment, where we do not find gender differences in cooperation (see Table B.5 in the Appendix).

All regressors are insignificant, except the highly significant positive coefficient of *belief cooperation* and the weakly significant positive coefficient of *PC4: betrayal & risk tolerant* in the male sample. Importantly, in the regressions of the *baseline* treatment, we do not find a correlation between shame and guilt aversion and cooperation.

4.2. Cooperative Behavior: The Role of Social Information about Players' Characteristics (Stage One vs. Stage Two)

In this section, we compare subjects' cooperative behavior in the anonymous first stage to the second stage, where we inform subjects about some characteristics (age, gender, semesters studied) of the matched active player. This approach sheds light on whether social information affects cooperative behavior in our setting.

In line with the previous findings, we confirm our treatment effect in stage two, i.e., cooperation is significantly lower with the negative externality (30%) than in *baseline* (47%) (Chi²-Test, $p = 0.005$). Focusing on the dynamics, it turns out that subjects in *negative* cooperate insignificantly less often when receiving information on their interaction partners (stage two) as compared to the anonymous setting (stage one) (38%) (Wilcoxon matched-pairs test, $p = 0.111$). No difference can be found in *baseline* (Wilcoxon matched-pairs test, $p = 0.487$). Thus, for our further analyses on the stability of cooperative behavior under social information, we focus on the *negative* treatment. Turning to gender effects, Figure 2 presents an overview of the dynamics of cooperative behavior of men (left panel) and women (right panel) in the two stages of *negative* (see Figure B.5 in Appendix B for a diagram focusing on *baseline*). Black bars represent cooperation under anonymity, whereas gray bars represent cooperation when some characteristics of the matched partner are known (info social).

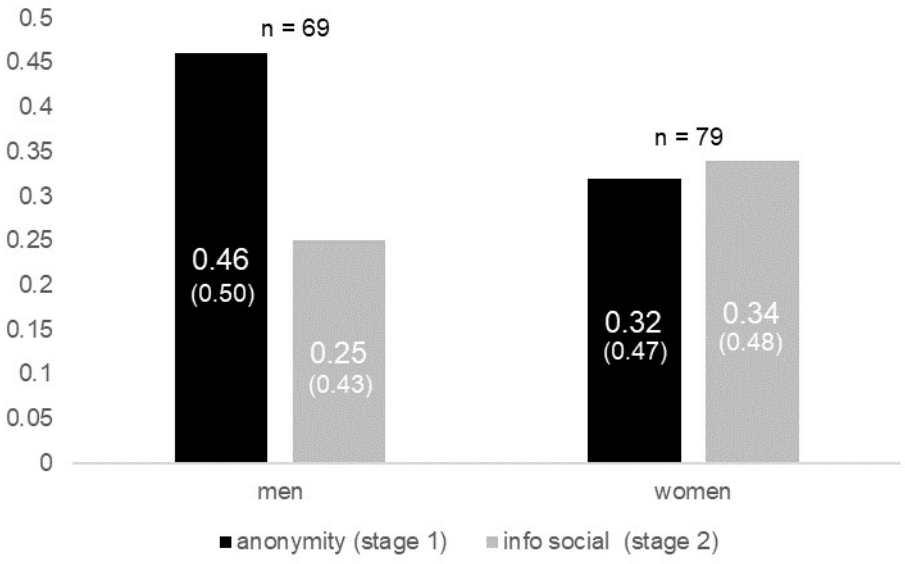

Figure 2: Impact of knowledge about personal characteristics (social information) in the *negative* treatment. The diagram displays the share of cooperating men and women in stage 1 (black bars) and stage 2 (gray bars) conditional on gender. Standard deviations in parentheses.

Figure 2 highlights that women's behavior is not context dependent, as we find that their low rate of cooperation in *negative* still holds when they receive social information on their interaction partners. Thus, we find no significant difference between their cooperation levels of stages one and two (Wilcoxon matched-pairs test, $p = 0.839$). By contrast, introducing social information on the interaction partner significantly reduces cooperative behavior of men (Wilcoxon matched-pairs test, $p = 0.003$). In stage two, results show that cooperative behavior of women and men is not significantly different anymore (Chi²-test, $p = 0.205$). In *baseline*, we do not observe these gender effects, i.e., the cooperation rates across stages are not significantly different for both men and women.[13]

A closer look shows that in the *negative* treatment, mainly subjects who cooperated in stage 1 change their behavior in stage 2. More precisely, the majority of formerly cooperating men (59%) defects in stage 2, whereas a lower fraction of formerly cooperating women (44%) defects in stage 2. By contrast, we find less evidence of changed behavior in stage 2 for subjects who did not cooperate in stage 1 (men: 11%, women: 24%). To learn more about gender-specific effects of social information, we concentrate on the changed behavior of subjects who cooperated at stage 1. Figure 3 overviews the share of subjects who cooperated at stage 1 and changed their behavior to defection conditional on subjects' gender (left panel: men, right panel: women) and the social information on the matched gender of the interaction partner (black: men, gray: women).

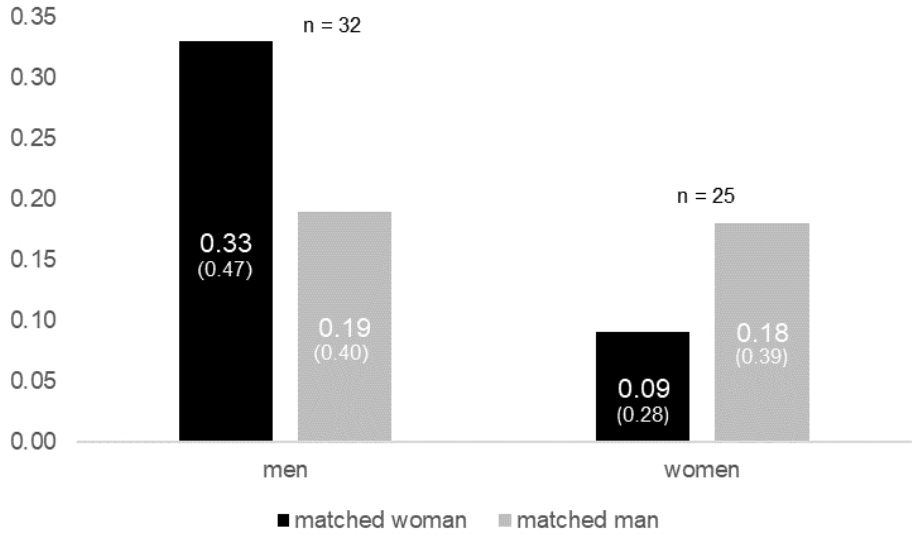

Figure 3: The diagram presents the share of subjects who formerly cooperated and changed to defection after being informed that they were matched with a woman (black bars) or with a man (gray bars) in the *negative* treatment. In the left (right) panel, the diagram presents male (female) subjects' behavior. Standard deviations in parentheses.

It can be seen that the decrease of cooperating men is mainly driven by individuals who were informed that they would interact with a woman in stage 2. These men significantly more often (33%) decrease cooperation compared to women (9%) who received the same

[13]Wilcoxon matched-pairs tests find for men: $p = 0.508$ and for women: $p = 0.152$.

information (Chi²-test, $p = 0.011$). By contrast, this gender difference does not occur when subjects know that they are matched with a man. Here, a similar share of men (19%) and women (18%) decreases cooperative behavior (Chi²-test, $p = 0.913$).

Our effects are confirmed by Probit random effects panel regressions using the sample of the *negative* treatment (Table 3) (see Table B.6 in Appendix B for the corresponding regressions using the *baseline* sample).

Models (1) – (3) are random effects panel Probit regressions to analyze cooperative behavior in stages 1 and 2 using the aggregate data of the *negative* treatment. In the models, we use a dummy representing cooperative behavior at stages 1 and 2 as a dependent variable. To obtain deeper insights on the channels of subjects' reasons for stopping cooperation at stage 2, models (4) – (6) are Probit regressions that consider only the stage-2-behavior of subjects. Precisely, we focus on the sub sample of subjects who cooperated at stage 1. In this respect, the models focus on a dummy as a dependent variable, which is 1 if subjects cooperated at stage 1 and defected at the second stage. Models (1) – (3) include *social information*, a dummy that is positive when subjects make their decision in stage two and a gender dummy (*female*). Moreover, models (2) – (3) include the interaction of *female* and *social information* and dummies of subjects' beliefs that the other active player would cooperate (1 = yes; 0 = no) at stages 1 and 2. In model (3) we additionally control for the effects of our principal components (see regression models in Table 2) and we include subjects' age and a dummy that controls whether they study economics, as control variables. Models (4) – (6) take into account subjects' stage-2-behavior, focusing on the sub sample of subjects who cooperated at stage 1. All models include a gender dummy. Models (5) – (6) also include subjects' belief that the other active player would cooperate at stage 2. To learn more about the role of social information for subjects' decrease in cooperation, model (6) includes the information presented to the subject in the social information stage. More precisely, *social information: woman* is a dummy, which is 1 (0) when subjects were informed in stage two that the matched person is female (male). *social information: age* is the age of the matched partner in years, which was communicated to subjects in stage two. *social information: semester* is the matched partner's number of semesters studied, which was disclosed as well. All regressions focus on average marginal effects and standard errors clustered at the session level.

Models (1) – (3) confirm the findings displayed in Figure 2. The significantly negative coefficients of *social information* show that subjects are less likely to cooperate in *negative* when presented with social information on the matched subject.[14] The negative *female* dummy shows in models (2) – (3) that women generally cooperate less often in the *negative* treatment, which however, changes when subjects are presented with social information, as men also decrease cooperation. The latter effect is documented by the significantly negative coefficient of the interaction of *female* and *social information* (models (2) – (3)).

[14]The questionnaire data on subjects' payoff focus do not reflect the difference in cooperation between stage one and two. In both stages, a similar fraction of players focuses on active players' payoffs (stage one: 48%, stage two: 52%; Wilcoxon matched-pairs test, $p = 0.522$).

Table 3: Random effects panel Probit regressions on cooperation rates (models (1) – (3)) and Probit regressions on the likelihood to stop cooperation (models (4) – (5)) in the negative treatment. Average marginal effects reported.

	negative (stages 1 & 2) cooperation			negative (stage 2) stop cooperation		
	(1)	(2)	(3)	(4)	(5)	(6)
social information	-0.087*	-0.213***	-0.213***			
	(0.045)	(0.058)	(0.060)			
female	-0.025	-0.195***	-0.157**	-0.172	-0.141	-0.039
	(0.062)	(0.067)	(0.079)	(0.138)	(0.157)	(0.924)
female × social information		0.238***	0.239***			
		(0.081)	(0.082)			
belief cooperation stage 1		0.238***	0.223***			
		(0.046)	(0.044)			
belief cooperation stage 2		0.192***	0.202***		-0.147	-0.082
		(0.064)	(0.062)		(0.167)	(0.172)
social information: woman				-0.062	-0.077	0.207
				(0.198)	(0.183)	(0.170)
social information: age				0.003	0.003	0.005
				(0.013)	(0.013)	(0.029)
social information: semester				-0.021	-0.023	-0.029
				(0.024)	(0.026)	(0.041)
female × social information: woman						-0.500**
						(0.232)
female × social information: age						-0.006
						(0.035)
female × social information: semester						0.058
						(0.064)
PC1: unconcerned others			0.004			
			(0.025)			
PC2: shame & guilt			-0.052*			
			(0.028)			
PC3: patient & individualistic			0.037			
			(0.028)			
PC4: betrayal & risk tolerance			-0.006			
			(0.032)			
Controls	no	no	yes	no	no	yes
Groups	148	148	148	-	-	-
Obs.	296	296	296	57	57	57

Standard errors in parentheses

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Finally, models (2) – (3) show that subjects' who believe that the other active player would cooperate in stages 1 and 2, are more likely to cooperate. In model (3), we also find that the coefficient of $PC2$ is negative and weakly significant, which again confirms our finding in Table 2 that shame and guilt averse subjects are less likely to cooperate when negative externalities exist. We summarize our findings as follows:

Result 3: Womens' cooperative behavior is robust to an environment, where they have social information of their interaction partner. By contrast, men cooperate less often when they have social information on personal characteristics of the matched subject.

Next, we focus on the reasons for subjects' decrease in cooperative behavior in stage 2. Models (4) – (5) show that *female* is insignificantly negative, which indicates that women are less likely than men to stop cooperation when presented with social information. In line with Figure 2, model (6) highlights that it is particularly the male subjects who decrease cooperative behavior when presented with the social information that the other player is female. This is documented by the significantly negative coefficient of *female x social information: woman*. The effect size is clearly higher (-0.500) than the effect size of the positive coefficient of *social information: woman* (0.207). Thus, the general relation of subjects who are informed that they interact with women being more likely to decrease cooperation, is driven by male subjects. A closer look reveals that men who are matched with a woman hold a lower belief (35%) that their interaction partner cooperates, as compared to men who were informed that they are matched with another man (56%). Thus, in the *negative* treatment, the behavioral change of men is reflected by their belief, which indicates that the information about being matched with a female player serves as a signal to anticipate uncooperative behavior. This suggests that men correctly anticipate women to react more guilt averse when they exert a negative externality and therefore behave less cooperatively.

By contrast, Table B.6 in Appendix B shows that we do not find such a behavior for men in the *baseline* treatment, i.e., the interaction of *female x social information: woman* is not significant. In *baseline*, for stage two, we find that men who cooperated in stage 1 hold a significantly higher belief (86%) that the female interaction partner cooperates compared to the *negative* treatment (Chi^2-test, $p = 0.003$).

Result 4:

(a) In the social information condition, men are less likely to cooperate when matched with a woman.

(b) Men who stop cooperating when playing with women hold a lower belief that their interaction partner would cooperate than men who play with men.

(c) Information on social characteristics has no effect on cooperative behavior of women.

5. Discussion

Our paper started with the observation that many economic social dilemma situations exist, where mutual cooperation harms passive third parties. Surprisingly enough, there has been little research on gender differences in cooperation games with negative externalities, even though gender differences are known to exist with respect to socially harmful behavior such as corruption. Gaining insights into this topic is of importance for

many intra-firm business relations and may help to increase the understanding of collusive behavior within markets when consumers are harmed.

The current paper sheds new light on these aspects. Starting with an in-depth analysis of gender differences in cooperation, we focus on a simple stylized environment that abstracts from a market setting or a concrete business setting, such as reporting taxes. On the one hand, this may come at the cost of losing external validity. On the other hand, our analysis provides a very high degree of internal validity, as we exploit the advantages of laboratory experiments to achieve a high degree of control regarding subjects' heterogeneity and their impact on behavior. In a comprehensive experiment, we control one by one for several important personality factors when individuals decide to cooperate. First, we study the role of gender for cooperative behavior that comes at a cost for a third party. Second, we compare subjects' behavior in an anonymous setting to a situation, where decision makers receive social information on their interaction partners, which is common in many business relations. Finally, we collect economic preferences and elicit psychological measures to identify what personal characteristics drive these gender differences.

Our results show that women are, in general, less inclined to engage in cooperative behavior at the cost of somebody else than men. Importantly, this effect does not depend on knowing anything about the interaction partner. Instead, for female decision makers, we find that providing social information on their matching partner leads to the same low cooperation rates. In contrast, male participants are less sensitive to the negative externality and cooperate more often in its presence. They do react to the provision of social information, though, and engage in less cooperation when matched with a woman. However, it remains to be explored how stable these effects are once the game is played repeatedly and players can develop more trust in each other, such as through communication (Fonseca and Normann, 2012, Cooper and Kühn, 2014, Andres et al., 2021).

Our current findings suggest that an increased female representation in management positions can have the benefit of lower cooperative (or collusive) activities which harm third parties. Importantly, we show that this effect is not attenuated in situations where decision makers have social information on their interaction partners, which is common in daily business life. For management boards and competition authorities, the results can imply that diversity may be an additional factor they could promote, as this potentially fosters compliance within companies and with antitrust laws. This may have interesting implications for the impact of affirmative action policies (Balafoutas and Sutter, 2012, Niederle et al., 2013), which may foster increased ethical behavior. Moreover, competition agencies may also use these insights as part of their forensic cartel analysis, as traditional male-dominated industries may be more prone to collusion than industries with a more diverse set of managers. However, more evidence is needed in terms of selection effects and potential changed behavior after women were promoted. Grosch et al. (2020) show that when women actively assume leadership responsibilities, they may adjust their behavior to more unethical behavior in line with their expected norms of the business environment.

With respect to further research on the role of gender for cooperation, we have only analyzed a simple game with binary decisions so far. The setting serves as a starting point

to cleanly disentangle the basic effects of gender, social information, economic preferences, and psychological measures in a salami-slicing approach. A strength of this approach is that we provide results of basic research with respect to gender differences in cooperation and its determinants that are highly internally valid and can be universally applied to different settings: in business contexts within companies or at the market level when analyzing collusive behavior of firms. To further study the role of gender differences in collusive behavior of firms, more experimental research is needed on repeated settings in market games, where subjects can choose among continuous market prices. Motivated by experimental evidence that gender differences may change over time (Mason et al., 1991, Ortmann and Tichy, 1999), it will also be interesting to understand how men and women manage to overcome distrust when meeting repeatedly. Further extensions may also include communication, which is common in business relations. In the context of oligopoly-market settings, it will also be interesting to focus on women's and men's reactions to antitrust policies such as leniency programs. Since women are often found to be more risk averse (Charness and Gneezy, 2012) and loss averse (Rau, 2014), the inclusion of fines and penalties in an experimental setting may further strengthen our main finding that women are less likely to engage in cooperative behavior.

Finally, future research should focus on the role of minorities or people characterized by cultural or educational differences for cooperative behavior. In this respect, global evidence of preference heterogeneity in risk, trust, and altruism suggests country dependent variations (Falk et al., 2018), which may influence cooperation and the design of compliance and antitrust policies.

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Appendix A. Detailed Explanations of the Preference Elicitation

Elicitation of Risk Aversion

To measure risk aversion, we apply the lottery-choice task introduced by Eckel and Grossman (2002), where subjects choose one of six lotteries. These lotteries have a 50% chance of yielding either a high payoff (Event A) or a low payoff (Event B). Table A.4 overviews the choice set, i.e., the six lotteries, the corresponding expected payoffs, and the implied CRRA range. Higher lottery choices can be interpreted as lower risk aversion. After subjects selected their lottery, a random draw decides whether Event A or Event B materializes. At the end of the experiment, subjects are informed on the outcome.

Table A.4: Lottery choices of the risk elicitation

Choice	Event A	Event B	Expected Payoff	Impl. CRRA Range
1	€5.60	€5.60	€5.60	$3.46 < r$
2	€7.20	€4.80	€6.00	$1.16 < r < 3.45$
3	€8.80	€4.00	€6.40	$0.71 < r < 1.16$
4	€10.40	€3.20	€6.80	$0.50 < r < 0.71$
5	€12.00	€2.40	€7.20	$0 < r < 0.50$
6	€14.00	€0.40	€7.20	$r < 0$

Elicitation of Social Value Orientation (SVO)

We elicit Social Value Orientation (SVO) with the task of Murphy et al. (2011). In this setting, participants are matched in pairs. There are two roles, one active and one passive person. Each subject initially takes on the role of an active player, who is confronted with six different decisions on how to allocate points that are later converted to money between her and another individual. Subjects have to choose the preferred point allocation for themselves and their matched partner in each of the six decision sets. In the task, we make use of the original trade-offs used in Murphy et al. (2011). We present the six choice sets below. The following exchange rate is applied: 1 point = €0.03. Subjects know that at the end of the experiment, one player of the pair is randomly selected by the computer and becomes the active player, whereas the other player is passive. An SVO angle can be computed for each person by evaluating the participant's decisions during the six sets in the active role.[15] Higher (lower) angles represent more (less) pro-social subjects. In figure A.4 we present two representative choice scenarios.

Elicitation of Betrayal Aversion

We verbally measure betrayal aversion in a modified variant of two questions introduced by Cubitt et al. (2017). We present subjects with two scenarios of hypothetical taxi rides. In each of them, they have to choose between two taxi companies. Company A charges a fixed fee, whereas company B charges a variable fee, which could either be low or high. In the first scenario, the variable fee is characterized by social risk, since the taxi driver may betray the subject by driving an expensive detour instead of a cheap direct route. In the second scenario, the variable fee is characterized by natural risk, since it depends on traffic conditions, i.e., bad (high fee) or good

[15]The SVO angles are computed with the following formula: $SVO = arctan(\frac{(\bar{A}_O - 50)}{(\bar{A}_S - 50)})$, whereas $\bar{A}_O(\bar{A}_S)$ is the mean allocation, which a passive player allocated to himself (to the other passive player).

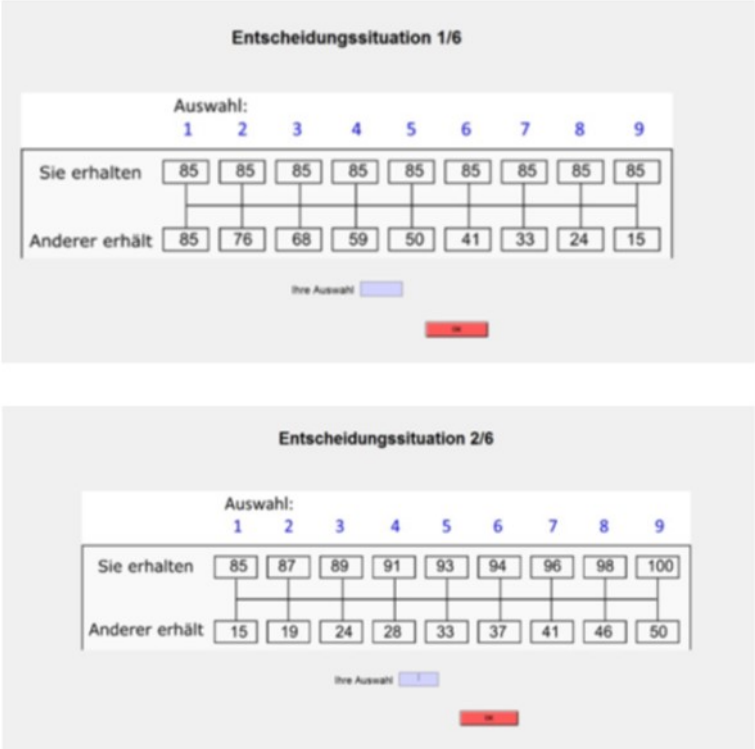

Figure A.4: Choice sets of the task. "Entscheidungssituation" = Decision situation; "Auswahl" = Choice; "Sie erhalten" = You receive; "Anderer erhält" = Other subject receives; "Ihre Auswahl"= Your choice

(low fee). For the first scenario, subjects have to state the minimum probability of honest drivers for them to choose the company with the variable fee. For the second scenario, they are asked about the minimum probability of good traffic conditions to pick said company. Participants' betrayal aversion is computed as the difference of the stated probabilities of scenario one and two. Subjects, who require a higher probability in the social risk scenario than in the neutral risk scenario, are classified as betrayal-averse subjects. The higher the probability premium they demand in the social risk case, the more betrayal averse are subjects.

Elicitation of Guilt- and Shame Aversion (TOSCA-3 Questionnaire)

We measure subjects' guilt- and shame aversion with a questionnaire common in psychology, i.e., TOSCA-3 (Tangney et al., 2000). Our questions are chosen from Bellemare et al. (2019) and relate to 16 scenarios. Out of these we picked nine TOSCA-3 questions [16], which are most relevant to guilt- and shame aversion. In these questions, subjects are presented with daily life situations and common reactions of people in these situations. Subjects have to imagine themselves in these situations and indicate how likely they would react in each of the ways (a-d or a-e) described. They reply on a 5-point Likert scale (1 = not likely; 5 = very likely). Using the replies, four indices can be computed ((i) guilt-proneness; (ii) shame-proneness; (iii) externalization; (iv) detachment/unconcern). The scale scores are the sum of responses to relevant items (for the response, we count the number (1-5), which is selected in the Likert scale). The coding is the following:

Question 1: a) shame; b) detached; c) guilt; d) externalization
Question 2: a) guilt; d) externalization; e) shame

[16] We picked questions: 1, 3, 5, 7, 9, 12, 13, 15, 16. For an overview of the questions, see the instructions.

Question 3: a) externalization; b) detached; c) shame; d) guilt
Question 4: a) shame; b) externalization; c) detached; d) guilt
Question 5: a) externalization; b) shame; c) detached; d) guilt
Question 6: a) detached; b) shame; c) externalization; d) guilt
Question 7: a) externalization; b) shame; c) guilt; d) detached
Question 8: a) shame; b) externalization; c) guilt; d) detached
Question 9: a) detached; b) guilt; c) shame; d) externalization

Appendix B. Tables and Figures

Table B.5: Probit regressions on cooperation rates in the *baseline* treatment. Average marginal effects reported.

	baseline				
	(1)	(2)	(3)	(4)	(5)
		both genders		women	men
female	0.013	-0.033	-0.064		
	(0.084)	(0.071)	(0.071)		
belief cooperation		0.508***	0.457***	0.506***	0.448***
		(0.028)	(0.037)	(0.050)	(0.064)
PC1: unconcerned others			0.023	0.052	0.004
			(0.033)	(0.041)	(0.042)
PC2: shame & guilt			0.021	0.024	0.037
			(0.022)	(0.035)	(0.040)
PC3: patient & individualistic			-0.021	-0.059	0.027
			(0.049)	(0.048)	(0.066)
PC4: betrayal & risk tolerant			0.016	-0.008	0.078*
			(0.035)	(0.044)	(0.042)
Controls	no	no	yes	yes	yes
Obs.	110	110	110	63	47

Standard errors in parentheses

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

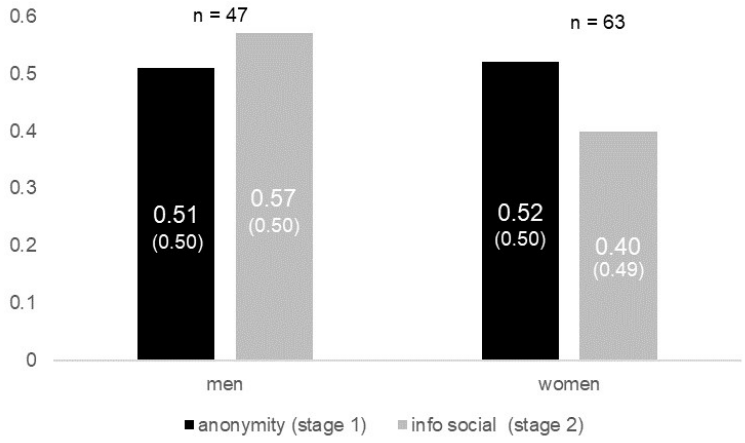

Figure B.5: Impact of information of social characteristics in the baseline treatment. The diagram presents the share of cooperating men and women in stage 1 (black bars) and stage 2 (gray bars) conditional on gender. Standard deviations in parentheses.

Table B.6: Probit regressions on the likelihood to defect in the baseline treatment. Average marginal effects reported.

	baseline (stage 2) stop cooperation		
	(1)	(2)	(3)
female	0.366***	0.331***	1.022***
	(0.096)	(0.111)	(0.218)
social information: woman	0.232**	0.230*	0.091
	(0.118)	(0.122)	(0.147)
social information: age	0.007	0.007	0.023
	(0.008)	(0.008)	(0.005)
social information: semester	-0.016	-0.023	-0.007
	(0.032)	(0.035)	(0.023)
belief cooperation stage 2		-0.119	-0.138
		(0.186)	(0.141)
female × *social information: woman*			0.158
			(0.140)
female × *social information: age*			-0.032***
			(0.009)
female × *social information: semester*			-0.003
			(0.027)
Controls	no	no	yes
Obs.	57	57	57

Standard errors in parentheses

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Appendix C. Experimental Instructions (translated from German)

The instructions were shown on participants' screens. Comments that did not appear on the screens are written in cursive parentheses.

Appendix C.1. ***The Prisoner's Dilemma***

C.1.1. Questionnaire

Welcome to the Experiment!
Before we start, we'd like you to answer the following questions. Your information might be shown anonymously to other participants. At no point will your data be connected to your name.

1. What is your gender? [female/male/divers]
2. What is your age? [free input]
3. How many semesters have you been studying (total of Bachelor and Masters)? [0, 1, ..., 6 or higher]

C.1.2. General Instructions

The experiment consists of 4 parts, in which you can earn money. The computer will randomly decide whether part 1 or part 2 are paid out. Parts 3 and 4 will both be paid and are added to your earnings from the selected part (1 or 2). At the beginning of each part, you will receive new instructions on the screen.Your participation in the experiment is compensated with at least €6. Possible additional earnings from parts 1-4 are added at the end of the experiment.After finishing the experiment, you will need to fill in your ORSEE-ID. If you have any questions or trouble, please write a private message to the experimenter in Webex.

C.1.3. Instructions for Stage 1

In part 1, the computer will assign one of three possible roles to you (person A, person B, person C). The computer randomly matches groups that consist of three players (person A, person B, person C). In these groups, person A and B play an active part, while person C is passive and does not make choices. Players A and B take on the roles of firms on a market. In part 1 they simultaneously decide whether to set a high or a low price. While players decide, they do not know what the other person chose. Both players' payoffs depend on their own and the other person's decision.
If person A and B both set a high price, person C's payoff is reduced by half *(only in negative treatment, not shown in baseline).*

There are 4 possible cases:

1. Person A and person B both set a low price: Person A and B each receive €10; Person C receives €6.
2. Person A and person B both set a high price: Person A and B each receive €14; Person C receives €3 *(negative treatment, in baseline: Person C receives €6).*
3. Person A sets a low price, person B sets a high price: A receives €16, B receives €8, C receives €6.
4. Person A sets a high price, person B sets a low price: A receives €8, B receives €16, C receives €6.

All payoffs include a starting capital of €6. If part 1 is picked at the end to determine the final payoff, you will be informed about the other player's decision and the resulting payoff. If you click "okay", you will be informed about your role and which group you were allocated into. Afterwards, you will see an overview of all 4 cases. Part 1 begins, and you can make a choice if you a person A or B.

C.1.4. Information about Role and Group Allocation

The result of the random draw is: You are [person A/ person B/ person C]. You are in group [group number].

C.1.5. Decision 1

The following 4 payoff combinations are possible:

	Person A/B chooses: low price	Person A/B chooses: high price
You choose: low price	You: 10; Person A/B: 10; Person C: 6	You: 16; Person A/B: 8; Person C: 6
You choose: high price	You: 8; Person A/B: 16; Person C:6	You: 14; Person A/B: 14; Person C: 3 (in baseline: Person C:6)

- Please decide, what price you want to set: (*only shown to players A and B*) [high/low]
- How do you think players A and B will decide? If you are correct, you earn €1 extra. (*only shown to player C*) [both choose a high/low price; A/B chooses high/low]

C.1.6. Belief 1 (only shown to players A and B)

What price do you think did person A/B (the other player) choose? [high/ low]

C.1.7. Instructions for Stage 2

In part 2, you are in the same role as in part 1. The computer randomly assigns new groups that consist of three players (person A, person B, person C). In these groups, person A and B play an active part, while person C is passive and does not make choices. You will receive information about the active player that was assigned to you on the next screen. Persons A and B again take on the roles of firms on a market who simultaneously decide whether to set a high or a low price. While players decide, they do not know what the other person chose. Both players' payoffs depend on their own and the other player's decision. If person A and B both set a high price, person C's payoff is reduced by half. *(only in negative treatment, not shown in baseline)*

There are 4 possible cases:

1. Person A and person B both set a low price: Person A and B each receive €10; Person C receives €6.
2. Person A and person B both set a high price: Person A and B each receive €14; Person C receives €3 *(negative treatment, in baseline: Person C receives €6).*
3. Person A sets a low price, person B sets a high price: A receives €16, B receives €8, C receives €6.

4. Person A sets a high price, person B sets a low price: A receives €8, B receives €16, C receives €6.

All payoffs include a starting capital of €6. If part 2 is picked at the end to determine the final payoff, you will be informed about the other player's decision and the resulting payoff. If you click "okay", you will again be informed about your role and which group you were allocated into. Afterwards, you will see an overview of all 4 cases. Part 2 begins, and you can make a choice if you are person A or B.

C.1.8. Information about Role and Group

You are still [Person A/B]. You are now in group [group number].

C.1.9. Decision 2

The following information about person [A/B] is available *(person C always receives information on player B)*: gender [male, female, divers], age [number], current semester [1, 2, ..., 6 or higher].

	Person A/B chooses: low price	Person A/B chooses: high price
You choose: low price	You: 10; Person A/B: 10; Person C: 6	You: 16; Person A/B: 8; Person C: 6
You choose: high price	You: 8; Person A/B: 16; Person C:6	You: 14; Person A/B: 14; Person C: 3 (in baseline: Person C:6)

- Please decide, what price you want to set:
  (*only shown to players A and B*) [high/low]
- How do you think players A and B will decide? [both choose a high/low price;
  If you are correct, you earn €1 extra. A/B chooses high/low]
  (*only shown to player C*)

C.1.10. Belief 2 (only shown to players A and B)

What price do you think did person A/B (the other player) choose? [high/ low]

C.1.11. Comparison (only shown to players A and B)

In part 1, what payoff did you consider?

[my payoff and the other active player's payoff/
my payoff and the passive player's (person C) payoff/
only my payoff]

In part 2, what payoff did you consider?

[my payoff and the other active player's payoff/
my payoff and the passive player's (person C) payoff/
only my payoff]

Appendix C.2. ***Elicitation of Preferences***

C.2.1. Risk Preferences

Instructions

In part 3 you have to pick out of six lotteries. Your payoff is determined by state A or B. After you have submitted your choice, the computer tosses a coin. If the outcome is head, state A is realized. If the outcome is tails, state B is realized. If you click "okay", you see an overview of the six lotteries. You can then choose one of the lotteries. At the end of the experiment, you are informed about the coin toss and your corresponding payoff from part 3.

Decision

States A and B are both realized with a 50% change. Please choose one of the lotteries:

Lottery	Payoff State A	Payoff State B
1	€1.40	€1.40
2	€1.80	€1.20
3	€2.20.	€1.00
4	€2.6	€0.80
5	€3.00	€0.60
6	€3.50	€0.10

C.2.2. Social Value Orientation

Instructions

In part 4, the computer randomly matches you with one other person. You and this person simultaneously make several choices. At no point in the experiment will the identities be revealed. Your decisions are made in Thalers will the following exchange rate: 1 Thaler = €0.02. You will face 6 different decision situations. These situations represent your payoff and the matched player's payoff. At the bottom of the page, you find an exemplary situation. In the upper row you see your payoff, in the lower row you see the other person's payoff. You can choose between 9 different allocation of Thalers between you and the other person. In each of the 6 situations, you have to pick one out of 9 allocations.

Choice No.	1	2	3	4	5	6	7	8	9
You receive	50	54	59	63	68	72	76	81	85
Other player receives	100	89	79	68	58	47	36	26	15

Example 1: If you pick "Choice No. 2", you receive 54 Thalers. The matched person receives 89 Thalers.
Example 2: If you pick "Choice No. 6", you receive 72 Thalers. The matched person receives 47 Thalers.

Roles A and B: The person who is player A has to choose an allocation between herself and the person who is player B. Player A is active and makes a choice, while player B is passive and has to accept player A's decision. Each person decides as player A. At the end of the experiment, the computer randomly allocates the two roles between you and your matched player. If you are player

A, your choice is relevant and the other person is passive. If you are player B, the other person is active while you are passive. In this case, the matched player's decision is relevant for your payoff.

Payment: At the end of the experiment, the computer will randomly pick one of the 6 decisions, which will then determine your payoff. Additionally, the roles A and B are randomly assigned, and it will be decided if yours or the other player's choice determines the allocation of Thalers, which are then converted to Euro according to the exchange rate. We will inform you which of the 6 situations was randomly chosen and whose decision determined the payoff at the end of the experiment. You will also be informed about your resulting earnings from part 4.

Decisions

Players are presented 6 situations similar to the example with varying allocations and are asked to choose one of the allocations.

C.2.3. Betrayal Aversion

Decision 1

Please read the following text thoroughly and answer the question.

You have to travel to a larger city for personal reasons. Upon arrival at the airport, you can choose between two cab companies to reach your final destination. Cab company A sets a fixed price of €12. Cab Company B uses a taximeter. X% of the cab drivers are honest and take the direct route. The trip then costs €8. It is also possible that you get a driver who takes a detour to get more money out of you. The trip then costs €16.

How many percent of the drivers X have to be honest for you to pick company B? Please use the slider to make a choice. [Input between 0% and 100%]
Your choice indicates that you would pick company B if at least [input] % of the drivers are honest.

Decision 2

Please read the following text thoroughly and answer the question.

You have to travel to a larger city for personal reasons. Upon arrival at the airport, you can choose between two cab companies to reach your final destination. Cab company A sets a fixed price of €12. Cab Company B uses a taximeter. In X% of the time, the traffic conditions are good. The trip then costs €8. It is also possible that the conditions are bad. The trip then costs €16.

How many percent of the conditions X have to be good for you to pick company B? Please use the slider to make a choice. [Input between 0% and 100%]
Your choice indicates that you would pick company B if at least [input] percent of the traffic conditions are good.

C.2.4. Guilt and Shame Aversion (TOSCA-3)

Below are situations that people are likely to encounter in day-to-day life, followed by several common reactions to those situations.

As you read each scenario, try to imagine yourself in that situation. Then indicate how likely you would be to react in each of the ways described. We ask you to rate all responses because people may feel or react more than one way to the same situation, or they may react different ways at different times

Questionnaire

Subjects were asked to indicate their answer on the following scale (the scale was printed beside each item): not likely 1 – 2 – 3 – 4 – 5 very likely

1. You make plans to meet a friend for lunch. At 5 o'clock, you realize you stood your friend up.

a) You would think: "I'm inconsiderate"

b) You would think: "Well, my friend will understand"

c) You'd think you should make it up to your friend as soon as possible

d) You would think: "My boss distracted me just before lunch."

2. You are out with friends one evening, and you're feeling especially witty and attractive. Your best friend's spouse seems to particularly enjoy your company.

a) You would think: "I should have been aware of what my best friend was feeling."

b) You would feel happy with your appearance and personality.

c) You would feel pleased to have made such a good impression.

d) You would think your best friend should pay attention to his/her spouse

e) You would probably avoid eye contact for a long time

3. You make a mistake at your student job and find out a co-worker is blamed for the error.

a) You would think the company did not like the co-worker.

b) You would think: "Life is not fair."

c) You would keep quiet and avoid the co-worker.

d) You would feel unhappy and eager to correct the situation.

4. While playing around, you throw a ball, and it hits your friend in the face

a) You would feel inadequate that you can't even throw a ball

b) You would think maybe your friends needs more practice at catching.

c) You would think: "It was just an accident."

d) You would apologize and make sure your friend feels better.

5. You are driving down the road, and you hit a small animal

a) You would think the animal shouldn't have been on the road.

b) You would think: "I'm terrible."

c) You would feel: "Well, it was an accident."

d) You'd feel bad you hadn't been more alert driving down the road

6. While out with a group of friends, you make fun of a friend who's not there.

a) You would think: "It was all in fun; it's harmless."

b) You would feel small...like a rat.

c) You would think that perhaps that friend should have been there to defend him/herself.

d) You would apologize and talk about that person's good traits

7. You make a big mistake on an important project at work. People were depending on you, and your boss criticizes you.

a) You would think your boss should have been more clear about what was expected of you.

b) You would feel like you wanted to hide.

c) You would think: "I should have recognized the problem and done a better job."
d) You would think: "Well, nobody's perfect."

8. You are taking care of your friend's dog while your friend is on vacation, and the dog runs away.
a) You would think, "I am irresponsible and incompetent."
b) You would think your friend must not take very good care of the dog or it wouldn't not likely very likely have run away.
c) You would vow to be more careful next time.
d) You would think your friend could just get a new dog.

9. You attend a student's housewarming party, and you spill red wine on a new cream-colored carpet, but you think no one notices.
a) You think the student should have expected some accidents at such a not likely very likely big party.
b) You would stay late to help clean up the stain after the party.
c) You would wish you were anywhere but at the party.
d) You would wonder why the student chose to serve red wine with the new light carpet.

C.2.5. Patience

Decision 1

How much money would you need to receive today in order to forgo a safe payment of €1000 in 6 months? (Please enter an amount between 0 and 1000) [free input]

Decision 2

How much money would you need to receive today in order to forgo a save payment of €1000 in 12 months? (Please enter an amount between 0 and 1000) [free input]

Appendix C.3. Final Questions

What subject do you study? [business administration/economics/industrial chemistry /philosophy/politics and ethics/other]

Please enter your ORSEE-ID [free input]

Appendix C.4. Payoff Information

The following part was picked as relevant for your payoff: [part1/ part 2]
You chose: [high price/ low price]
The other player chose: [high price/ low price]
Your earnings in this part are: [payoff part 1/ 2]
In part 3 the coin toss resulted in: [state A/ state B]
Your earnings in part 3 are: [payoff part 3]
In part 4 you were: [the active player/ the passive player]
Your earnings in part 4 are: [payoff part 4]
Your total payoff in this experiment is: [total payoff]

Thank you for your participation!

Appendix C.5. Screenshots of the Decision Screens in the Cooperation Games

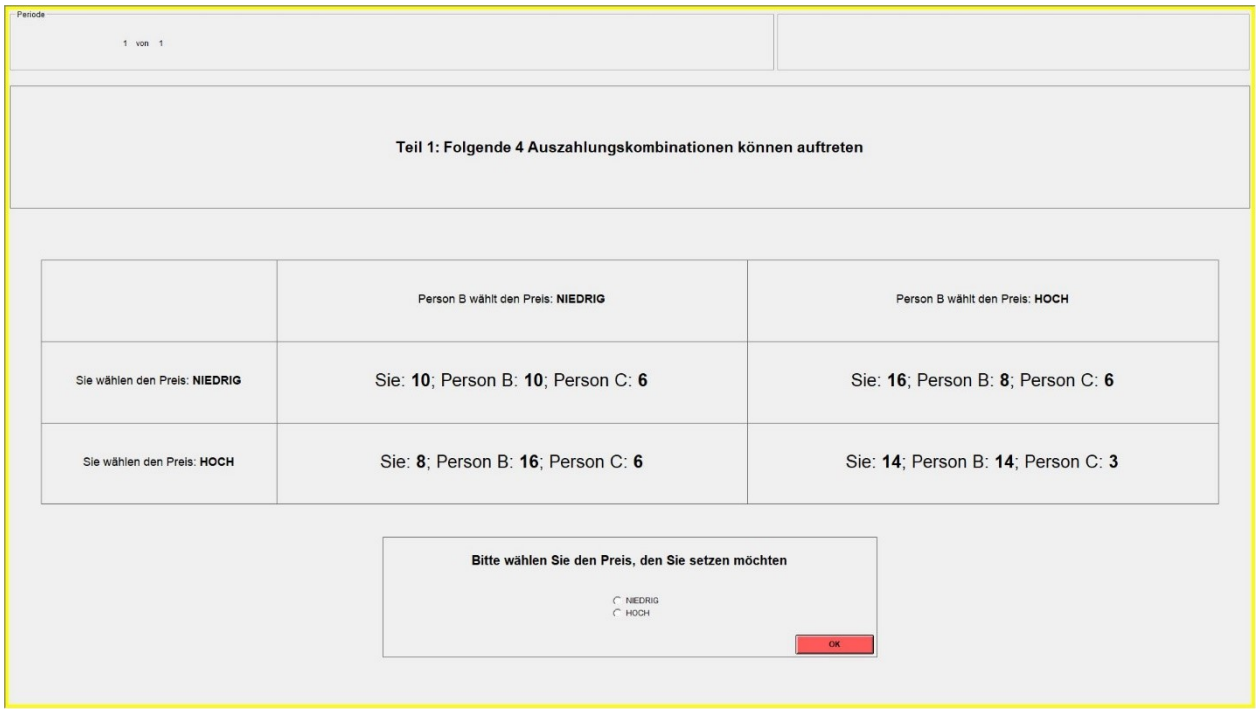

Figure C.6: Stage 1 (Negative)

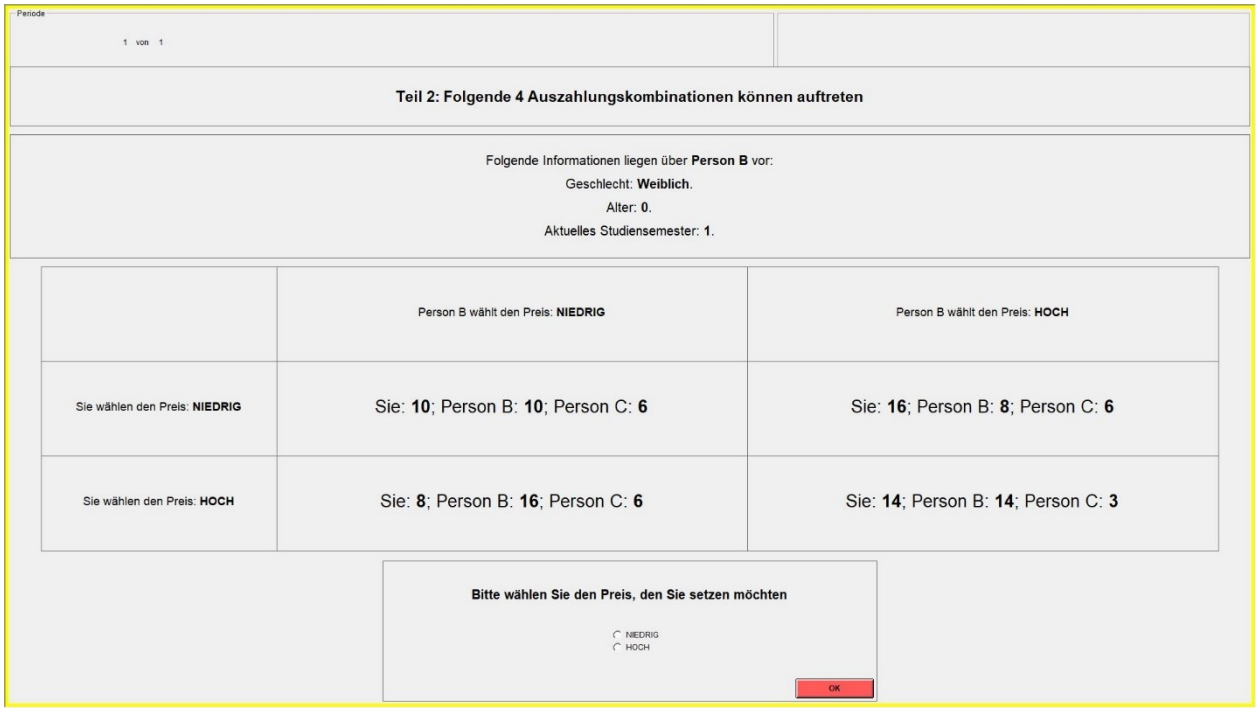

Figure C.7: Stage 2 (Negative)

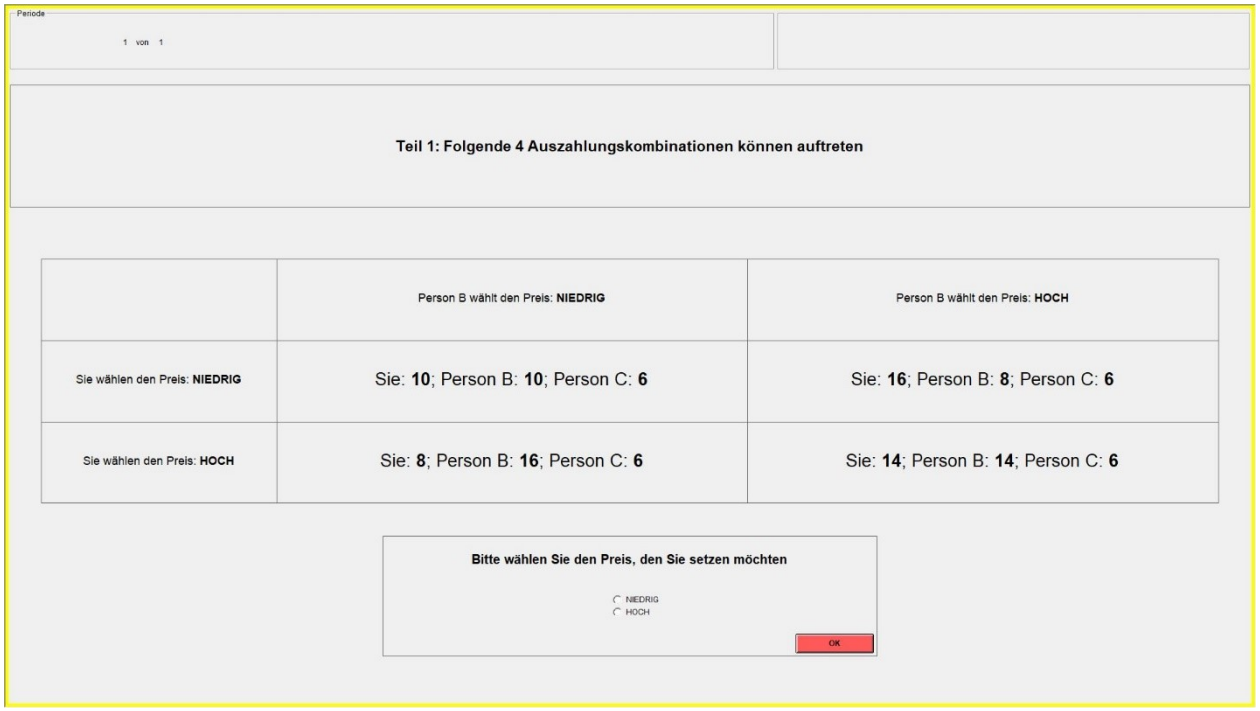

Figure C.8: Stage 1 (Baseline)

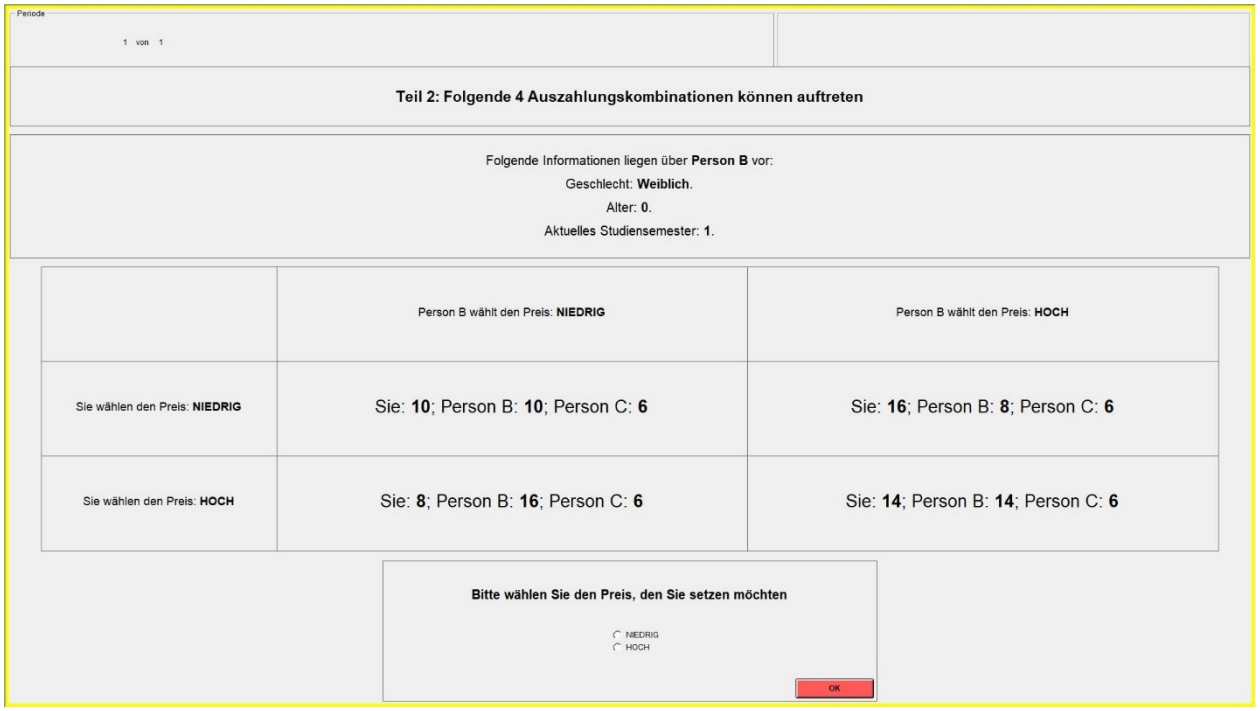

Figure C.9: Stage 2 (Baseline)