Discussion Paper No. 10-006

Stability and Explanatory Power of Inequality Aversion – An Investigation of the House Money Effect

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Non-technical summary

Theories of fairness preferences have gained remarkable attention throughout much of recent economic literature. Formal models have been proposed which are able to explain behaviour that is yet unexplained by the classical model of the strictly egocentric economic man ("homo oeconomicus"). These models have been tested in laboratory experiments. In another, seemingly unrelated, strand of experimental literature the focus lies on the influence of the origin of money, disposed of by subjects in economic experiments on the subjects' behaviour. It has been frequently found that it makes a difference whether the money comes in form of windfall gains, granted by the experimenter ("house money"), or if it is a form of compensation for "real efforts", exerted by the subjects during the experiment itself. An important open question is how these two strands of research fit together. How does the house money effect influence fairness preferences revealed in the lab, and their explanatory power for individual behaviour in other games? If there is a significant influence to be found, the origin of the money clearly deserves to be a part of modern theories of individual preferences. This paper is dedicated to answering the above question.

For this purpose, we experimentally elicit subjects' fairness preferences controlling for the origin of the money and test the theoretical predictions for individual behaviour in a social dilemma situation. As a representative for theories of fairness preferences, we chose the model of inequity aversion by Fehr and Schmidt (1999). Our results indicate that individual inequality aversion is not generally robust to the way endowments emerge. Overall, we observe a low predictive power of the theoretical model which is significantly affected by the way the endowment in the preference elicitation games emerges. In particular, the theoretical model has only predictive power for individual behaviour in selected cases when the endowment is house money. As soon as the endowment for preference elicitation has to be earned, the predictive power disappears. Therefore, future experimental research into fairness preferences and their relevance for individual behaviour in many economic areas has to consider the origin of the monetary endowment.

Das Wichtigste in Kürze

In den letzten Jahren haben ökonomische Theorien zu Fairnesspräferenzen zunehmend an Aufmerksamkeit gewonnen. Zahlreiche formale Modelle wurden entwickelt, um individuelles Verhalten zu erklären, welches nicht mit der ökonomischen Standardtheorie vom Homo oeconomicus in Einklang steht. Für den Test dieser Modelle werden insbesondere ökonomische Laborexperimente genutzt. Ein anderer, davon zunächst unabhängiger Bereich der experimentellen Verhaltensökonomik beschäftigt sich mit der Frage, inwieweit die Entstehung der monetären Anfangsausstattung in Laborexperimenten das Verhalten der Versuchspersonen beeinflusst. Es macht oftmals einen großen Unterschied, ob das Geld den Versuchspersonen geschenkt wird oder ob diese sich das Geld zunächst durch reale Anstrengungen verdienen müssen. Die vorliegende Arbeit bringt diese zwei Bereiche zusammen und untersucht die Frage, inwieweit die Entstehung der Anfangsausstattung die im Labor gezeigten Fairnesspräferenzen und deren Exklärungskraft für individuelles Verhalten in anderen Spielen beeinflusst.

Dafür messen wir mit Hilfe einfacher experimenteller Spiele die Fairnesspräferenzen der Versuchspersonen bei gleichzeitiger Kontrolle der Entstehung der Anfangsausstattung und überprüfen dann die Bedeutung der Präferenzen für das individuelle Verhalten in einem sozialen Dilemma. Dabei verwenden wir das Modell der Ungleichheitsaversion von Fehr und Schmidt (1999). Unsere Ergebnisse zeigen, dass die individuelle Ungleichheitsaversion von der Art und Weise der Entstehung der Anfangsausstattung beeinflusst wird. Darüber hinaus ist die Erklärungskraft des Modells für das individuelle Verhalten im sozialen Dilemma gering und ebenfalls von der Entstehung der Anfangsausstattung abhängig. Nur in Einzelfällen stimmen beobachtetes und erwartetes Verhalten überein, wenn die Anfangsausstattung verschenkt wird. Sobald das Geld durch reale Anstrengungen verdient wird, verliert das Modell der Ungleichheitsaversion seine Erklärungskraft. Zukünftige experimentelle Untersuchungen von Fairnesspräferenzen und ihrer Relevanz für individuelles Verhalten in unterschiedlichen ökonomischen Situationen sollten daher die Entstehung der monetären Anfangsausstattung berücksichtigen.

Stability and Explanatory Power of Inequality Aversion –

An Investigation of the House Money Effect

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Abstract: In this paper, we analyse if individual inequality aversion measured with simple experimental games depends on whether the monetary endowment in these games is either a windfall gain ("house money") or a reward for a certain effort-related performance. Moreover, we analyse whether the way of preference elicitation affects the explanatory power of inequality aversion in social dilemma situations. Our results indicate that individual inequality aversion is not generally robust to the way endowments emerge. Furthermore, the use of money earned by real efforts instead of house money does not improve the generally low predictive power of the inequality aversion model. Hypotheses based on the inequality aversion model lose their predictive power when preferences are elicited with earned money.

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1 Introduction

Theories of other-regarding preferences have gained remarkable attention throughout much of recent economic literature. Formal models have been proposed which are able to explain behaviour that is yet unexplained by the classical model of the strictly egocentric economic man ("homo oeconomicus").[1] In another, seemingly unrelated, strand of experimental literature, the focus lies on the influence of the origin of the money, disposed of by subjects in economic experiments on the subjects' behaviour. It has been frequently found that it makes a difference whether the money comes in form of windfall gains granted by the experimenter ("house money"), or if it is a form of compensation for "real efforts", exerted by the subjects during the experiment itself.[2]

An important open question is how these two strands of research fit together. How does the house money effect influence other-regarding preferences revealed in the lab? If there is a significant influence to be found, the origin of money clearly deserves to be part of modern theories of individual preferences. This paper is dedicated to answering the above question. As a representative for theories of other-regarding preferences, we chose the model by Fehr and Schmidt (1999). Our reason for this choice is that this model presents a simple and well-established theoretical framework that allows for the explanation and prediction of human behaviour in various strategic decision situations, as demonstrated in Fehr and Schmidt (1999, 2006). Still, one question remains: Do the results of the model hold in the presence of money originating from real efforts as they do in the case of house money?

The model by Fehr and Schmidt (1999; in the following F&S) captures other-regarding preferences in form of inequality aversion by introducing two parameters into the utility function measuring the disutility from advantageous and disadvantageous inequality. Among others, the model offers an easy explanation for the persistent phenomenon of voluntary cooperation in prisoner's dilemma and public good games: Individuals who are averse to unequal payoff distributions obviously also dislike being exploited by free riders and similarly dislike exploiting others by free riding in cooperation games. Hence, the theory creates a close

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1 For prominent examples of models of other-regarding preferences, see Fehr and Schmidt (1999), Bolton and Ockenfels (2000), or Charness and Rabin (2002).

2 The house money effect has been investigated in different areas of research and with different experimental settings. Beside dictator and ultimatum games, there are at least two further strands in the literature: house money effects in Public good games, e.g. Clark (2002), Cherry et al. (2005, 2007), and Kroll et al. (2007), and house money effects in settings where subjects face risky choices, e.g. Keeler et al. (1985), Thaler and Johnson (1990), Arkes et al. (1994), Keasey and Moon (1996), and Ackert et al. (2006).

link between subjects' attitudes to inequality aversion and subjects' behaviour in other classes of games such as the prisoner's dilemma.

As the F&S model is intended to describe (individual) preferences, it must principally be open to within-subject tests, i.e. checking whether individuals identified as "fair" (inequality averse) in the sense of the theory behave consistently in other games. This is exactly the approach followed in this paper. The F&S model has so far been subject to only few empirical within-subjects tests – and the evidence is mixed. Blanco et al. (2008) find that the F&S model has some explanatory power on the aggregate, but not on the individual level. Blanco et al. (2008) use a two-step method. They first measure individual degrees of inequality aversion using a modified dictator and ultimatum game. In the second step, the subjects play (among others) a simple one shot public good game. Dannenberg et al. (2007) use a similar design to test F&S. They first elicit the subjects' inequality aversion parameters and then play a standard public good game, which is repeated ten times. Dannenberg et al. (2007) find that the F&S model has some explanatory power under certain conditions: What is needed for individuals to behave according to F&S's prediction is certain information about their co-players' inequality aversion. Teyssier (2009) investigates the F&S model in sequential public good games. She finds that first mover behaviour is driven by beliefs and risk aversion but, opposed to theory, not by disadvantageous inequality aversion. In contrast, second mover behaviour is driven by advantageous inequality aversion.

In this paper, we reconsider eliciting preference parameters and report on new experiments testing whether the F&S model has predictive power on an individual level for cases with and without house money. To measure the individual degrees of inequality aversion we use the two-step method proposed by Blanco et al. (2007), i.e. we measure inequality aversion using modified dictator and ultimatum games. Different from former studies, all games are constructed in order make decisions for our subjects as easy as possible. Consequently, we used dichotomous games as a means of measuring subjects' attitudes towards inequality aversion. In order to check for cooperative behaviour we employ one shot prisoner's dilemma games. Given the subjects' inequality aversion elicited before we are able to compare individual behaviour with the predictions by the F&S model.

What makes our experiments different from all studies undertaken before is the fact that we explicitly focus on the role of the origin of money spent in our experiments. Cherry (2001) and Cherry et al. (2002) observe that in a dictator game – similar to the one applied in order to elicit the F&S-parameter indicating the extent of inequality aversion – selfish behaviour significantly increased when the money had to be earned in a task previous to the genuine experiment. The insight that dictators may be less benevolent when feeling entitled to their endowment can be traced back to the work of Hoffman et al. (1994) who also analyse this effect in the ultimatum game. They find that offers are clearly smaller if the proposer earns the right to his role instead of having it assigned randomly. Ruffle (1998) lets recipients compete in a skill-testing contest where the outcome determines the size of the monetary stake: Successful recipients are given a higher amount than losing recipients. The pie is then divided by the dictator in the dictator game and the proposer in the ultimatum game. Results indicate, that compared to a control treatment the dictators reward skilful recipients with higher offers but punish unskilful ones only moderately with slightly lower offers.

Endowing subjects in an experiment according to their performance in a real effort task means endowing different people with different amounts of money, so any behavioural difference observed could also be caused by a stake effect. Meaning an accurate experimental design should also check for a stake effect. Consequently, we have two treatment variables in our experiment. Firstly, we vary the way the initial endowment has emerged. Thereby, we distinguish between the “Effort” case, where the endowment has to be earned, and the “No effort” or house money case, where the money is granted by the experimenter. Secondly, in order to avoid stake effects when analysing a potential house money effect, we vary the endowments disposed of by the subjects. In the “Rich” case, the subjects dispose a larger amount of money than in the “Poor” case.

In our experiment, the weight of advantageous inequality aversion remains constant across all treatments. However, we observe a house money effect for the extent of the aversion against disadvantageous inequality: when subjects have to exert effort before the decision task, they show a stronger aversion against disadvantageous inequality. Thus, the distribution of types with specific F&S preferences is affected by the treatment variables. Overall, we observe a low predictive power of the F&S model which is significantly affected by the way the endowment in the preference elicitation games emerges. In particular, the F&S model has only predictive power for individual behaviour in selected cases when the endowment is house money. As soon as the endowment for preference elicitation has to be earned by having to employ real effort, the predictive power of the F&S model disappears.

The remaining paper is organised as follows: section 2 introduces the games and very briefly outlines the theory of Fehr and Schmidt (1999). Section 3 describes our experimental setting. Section 4 presents the results, and section 5 discusses the results and concludes.

2 Theoretical background: The model of Fehr and Schmidt (1999)

2.1 Inequality aversion

According to Fehr and Schmidt (1999) individuals are not exclusively motivated by the absolute payoff they can earn, but also value allocations due to their distributional consequences. Particularly, F&S assume that individuals suffer from differences between others' payoffs and their own. In the two-subjects case which is particularly relevant for our experimental setting the F&S utility function for subject i has the following form:

$$U_i(\pi_i, \pi_j) = \pi_i - \alpha_i \max\{\pi_j - \pi_i, 0\} - \beta_i \max\{\pi_i - \pi_j, 0\} \qquad (1)$$

where π_i and π_j denote the absolute payoffs of subjects i and j, respectively, $\alpha_i \geq 0$ measures the impact of disadvantageous inequality on i's utility, while $\beta_i \geq 0$ measures the corresponding impact of advantageous inequality.[3] F&S assume $\beta_i < 1$, i.e. players are not willing to "burn" their money to eliminate advantageous inequality. In addition, they assume that players put a weakly stronger weight on disadvantageous inequality, i.e. $\alpha_i \geq \beta_i$.[4]

2.2 The prisoner's dilemma game

The assumption of inequality aversion has a strong impact on the theoretical predictions of the outcomes in several classes of games. In a prisoner's dilemma game (PD) for example, preferences of the F&S type may lead to the cooperative outcome in contrast to the prediction derived by standard economic theory. To see this, look at the following symmetric PD: Both players $i = 1, 2$ are given some initial endowment y which can either be contributed to a public project or not. Player i's contribution to the project is denoted by g_i. The production function for the project is simply given by the sum over the contributions of both subjects. Let

[3] In the following, all conditions are stated for the case of two players. The generalisation to the n-player case is straightforward and can be found in Fehr and Schmidt (1999).

[4] This condition is employed by Fehr and Schmidt (1999) in order to facilitate the critical condition for cooperation in a voluntary contribution game (VCG). Proposition 4 of their proof (part C, p. 862) states that a player with $\beta_i > 1 - m$, where m denotes the marginal per capita return of the public investment, chooses to cooperate in a VCG if the following condition is met: $k/(n-1) \leq (m + \beta_i - 1)/(\alpha_i + \beta_i)$ where k are players with $\beta_i < 1 - m$. If $\alpha_i \geq \beta_i$ then this is the sole condition that has to be fulfilled. If one abandons $\alpha_i \geq \beta_i$, then a second condition might become binding, namely $k/(n-1) \leq m/2$. As we will see in section 3, for treatments with cooperation hypothesis this condition always holds in our experiment.

us assume that the per capita return of an investment in the project is given as some constant m with $1/2 < m < 1$. Then the monetary payoff for player i is given by $\pi_i(g_1, g_2) = y - g_i + m(g_1 + g_2)$. Thus, for player i it is a dominant strategy to choose $g_i = 0$ and the unique equilibrium of this game is not to contribute to the project. However, mutual cooperation, i.e. $g_i = y$, would be beneficial since the collective return is $2m > 1$. Hence, the social optimum is achieved, if both players contribute their initial endowment to the project leading to payoff $\pi_i^{SO} = 2my$, which is more than the payoff players would receive in the Nash equilibrium ($\pi_i^{NE} = y$).

F&S show that this result is fundamentally altered if players are endowed with inequality aversion according to (1). They prove the following results:

i. If $m + \beta_i < 1$, then it is a dominant strategy for player i to choose $g_i = 0$.

ii. Let $m + \beta_1 < 1$, but $m + \beta_2 \geq 1$. Although player 2 is relatively strongly averse to inequality, in the unique equilibrium both players choose not to contribute, i.e. $g_i = 0, i = 1,2$.

iii. If, however, $m + \beta_i > 1$ holds for both players, an equilibrium with positive contributions to the project exist, i.e. both players choose contribution levels $g_i = g \in [0, y]$.

The intuition behind these results is the following. First, if a player with $m + \beta_i < 1$ invests in the project his monetary return is m while he gains a maximum non-monetary utility of β_i. Now, if the sum of both returns is less than one, it is obviously the best strategy not to invest into the project, irrespectively of what the other player does. Second, if the other player obeys to $m + \beta_j < 1$, player i will not be willing to contribute even if he shows stronger aversion to advantageous inequality, i.e. for him $m + \beta_i > 1$ holds. In this case player i cannot reduce advantageous inequality, but only increase disadvantageous inequality. Only if both players are sufficiently strong averse to advantageous inequality they are able to sustain the cooperative outcome in the PD.

2.3 The prisoner's dilemma game with punishment

The idea, that punishment of defecting players may increase cooperation in the PD, is straightforward. In a setting with standard preferences, however, punishment is a non credible threat. Imagine a two-stage game: Stage one is the PD as described in the section above. Stage two of the game incorporates the possibility for a player to enact some punishment on the opponent. A player i can punish his opponent j by lowering the opponent's payoff by $p_{ij} > (1-m)y$. In order to reduce an opponent's payoff, the punisher must incur costs of $c > 0$. Since punishment is costly, it will not be carried out by rational players interested only in their absolute material payoff on the second stage. Since players anticipate the outcome on the second stage they will not contribute in the first stage of the game.

This outcome is substantially altered if preferences of the F&S type are involved. Two possibilities have to be distinguished. First, if only one player – who is called a "conditionally cooperative enforcer" – obeys $\beta_i \geq 1-m$ and if, in addition, this player is also sufficiently averse of disadvantageous inequality, i.e. if $\alpha_i > c/(1-c)$, then a subgame perfect equilibrium exists where both players choose to contribute $g_i = g \in [0, y]$. The reason is simple: If the other player does not contribute, the enforcer will carry out the punishment $p_{ij} > (1-m)y$ in the second stage of the game. This threat is credible, because the punishment eliminates the disutility the enforcer derives from disadvantageous inequality. In addition, the condition $\beta_i \geq 1-m$ guarantees that the enforcer will prefer to cooperate on the first stage of this game due to his relatively high degree of aversion to advantageous inequality. Second, the same outcome, however, can be achieved, if both players obey $\alpha_i > c/(1-c)$, irrespectively of their degree of aversion against advantageous inequality. In this case, both players relatively strongly dislike disadvantageous inequality and both players simply police each other.

3 Experimental design and hypotheses

We used four different games (games A, B, C, and D) in our experimental design. The purpose of games A and B was to elicit each subject's type, according to the F&S model. After the elicitation games, subjects are matched into pairs depending on their behaviour in games A and B and interact with each other in two PD games (games C and D). All games were played one-shot between two players.[5] The co-player changes between all games so that each pair of players meets only once. Thereby a player could meet in game D another type of co-player than in game C. This section presents the treatments, the design of all games and the corresponding hypotheses.

3.1 Treatments

Our design comprises two treatment variables (see table 1). The first treatment variable is called "Emergence of endowment" and has the specifications "Effort", where subjects had to earn their endowment, and "No effort", where subjects are given house money. In the Effort specification subjects earned their endowment by typing the data[6] of journal articles in an excel file. We chose this kind of work because it is a tedious real-effort task which demands subjects' effort in a real sense. The best 50 % who typed most of the journal articles gained a high endowment (€10.00), and the others gained a low endowment (€5.00). In the No effort specification one half of subjects randomly obtained the high endowment and the other half the low endowment. While the subjects in the Effort specification knew of the existence of two different endowments[7] and how they were allocated the subjects in the No Effort specification did not. Accordingly, the second treatment variable, called "Stakes", has the specifications "Rich", where subjects disposed of a high endowment (€10.00), and "Poor", where the subjects disposed of a low endowment (€5.00). Applying a 2 x 2 factorial design generates four treatments which are depicted in table 1.

Table 1: Treatments

Treatment variable		Stakes	
	Specification	Rich	Poor
Emergence of endowment	Effort	*Effort rich*	*Effort poor*
	No effort	*No effort rich*	*No effort poor*

Notes: Subjects were evenly distributed across the four treatments.

This design enables us to study the behavioural changes caused by different stakes (Rich vs. Poor) in an effort and no-effort situation (called "stake effect") as well as the effects triggered

[5] We used z-tree for programming. See Fischbacher (2007).
[6] Title and authors of the article, name, volume, and page number of the journal.
[7] They were informed about their relative performance, so subjects could infer to which group (rich or poor) they belong.

by differences in the emergence of endowment (Effort vs. No effort) in a high and low-stakes situation (called “house money effect”).

3.2 Elicitation games – typecasting individuals

Game A is a modified dictator game designed to measure the subjects’ aversion against advantageous inequality. There are two players, the dictator and the recipient. The dictator decides how to divide his endowment between himself and the recipient. In case of the high endowment, he can choose between either €9.00 for himself and €1.00 for the recipient or €5.80 for both players.[8] In case of the low endowment all amounts are exactly half. The recipient has no choice but to accept the dictator’s decision. All subjects made the dictator’s decision. The dictator and the recipient were always in the same treatment and subjects were aware of this fact. For example, if in the *Effort rich* treatment the dictator was to divide his earnings of €10.00 he knew that the recipient had also earned €10.00 but in the role of the recipient she had no chance to revert to the money. Since the subjects had only two alternatives to distribute the money, we can only determine whether the subjects’ aversion against advantageous inequality is above or below the critical value of $\beta_i = 0.4$.

Game B is a modified ultimatum game designed to analyse the subjects’ aversion against disadvantageous inequality. The game involves two players, a proposer and a responder. The proposer offers how to divide his endowment: In case of the high endowment, he can choose between either €8.30 for himself and €1.70 for his co-player or €5.00 for both players. In case of the low endowment all amounts are exactly half. In the second stage of the game the responder decides whether she would accept the unequal distribution. If she accepts the unequal distribution the money will be distributed as proposed. If she does not accept the proposal both players receive €1.00. If the proposer suggests the equal distribution this proposal will be realised presuming the responder’s acceptance. Game B was played with the strategy method, i.e. all subjects made both decisions in the role of the proposer and the responder. Thus, in game B we follow Fehr and Schmidt (2006) who recommend using “strategic games” in order to elicit preference parameters, capturing not only traits of inequality aversion, but also strategic considerations like intentions and reciprocity. Again, the proposer and the responder were in the same treatment. The responder’s decision is relevant for the individual aversion against disadvantageous inequality. Since the subjects’

[8] Payoffs in games A and B were determined in pretests to ensure that we obtained a sufficient number of observations for each decision.

decision was dichotomous, i.e. they could accept or reject one pre-defined proposal of an unequal distribution we can only determine whether the subjects' aversion against disadvantageous inequality is above or below the critical value of $\alpha_i = 0.1$.

Due to the four possible combinations of values of the parameters α_i and β_i we find four possible "types" of individuals. People with low α_i and low β_i are mainly concerned with their own absolute payoffs. This egocentric type of individuals is consequently called EGO. The opposite case are individuals who suffer from having a lower payoff than others (high α_i) and a higher payoff than others (high β_i). These individuals are called FAIR types. There are two mixed types. Individuals not significantly caring for having less payoff than others (low α_i) but suffering from others having lower payoffs than they have themselves (high β_i) are CARING. The reverse type is ENVIOUS, individuals who suffer from being worse off than others (high α_i) but do not care too much for being ahead of others (low β_i).

The typification of subjects results in four different types which are presented in table 2.

Table 2: Types

Parameter		α_i	
		$\alpha_i > 0.1$	$\alpha_i < 0.1$
β_i	$\beta_i > 0.4$	FAIR	CARING
	$\beta_i < 0.4$	ENVIOUS	EGO

Notes: In experimental pre-tests we tried different critical values by varying the payoffs in games A and B. The implemented critical values guarantee that each type has a sufficient number of observations. We assume that the individuals whose α_i or β_i equals the critical value, decided randomly and therefore did not bias the distribution of types.

3.3 Prisoner's dilemma games

After subjects had completed the typification they played two PD games (C and D) in deliberately composed pairs. Each player was informed how his co-players in games C and D had behaved in games A and B. During the typification games, the subjects did not know that further games would follow and that their co-players in the following games would be informed about their decisions in these games. We believe that this is a sound way to avoid strategic behaviour on the one hand and deception of subjects on the other hand in order to test theories which make type-specific predictions.[9] Both PD games contained a try-out round

[9] Several authors, see e.g. Ockenfels and Weimann (2002), Ben-Ner et al. (2004), and Fischbacher and Gächter (2009), choose a similar way when they match subjects according to the behaviour in previous games without informing subjects in advance about this procedure.

that was not relevant for the payoff. Game C is a PD where the two players can decide whether or not they want to cooperate. The corresponding payoffs are presented in table 3.

Table 3: Payoffs in the PD (game C)

Payoffs in €		Player 2	
		Cooperation	Defection
Player 1	Cooperation	8.40; 8.40	4.20; 11.20
	Defection	11.20; 4.20	7.00; 7.00

Note: The instructions for the PD did not use the expression “to cooperate” and “to defect”, but “to contribute to a joint project” and “not to contribute to the project”.

Game D consists of two stages. The first stage is equivalent to game C. After the players are informed about their co-player’s decision in the first stage, a second stage follows where subjects have the possibility to reduce the co-player’s payoff, i.e. a punishment mechanism is introduced (Fehr and Gächter 2000). If a player chooses the punishment possibility the own payoff is reduced by €0.40 and the co-player’s payoff is reduced by €4.00.

Subjects were paid separately for games A and B, and games C and D. The payments from games A and B were computed as follows: Subjects in the same treatment were randomly matched into pairs. One of the two games was randomly chosen and the corresponding roles in that game were randomly allocated to each player in a pair. Payments were then determined by the players’ decisions. The payments from games C and D were determined in a similar way: Subjects in the same treatment were randomly matched into pairs. A random draw determined which game would be relevant and the payments were realised according to the players’ decisions in that game. The payoff rules were common knowledge to all participants.

3.4 Hypotheses for the PD games

The analysis of F&S in this paper is based upon the assumption that players know their opponents’ type. For this reason, in our experimental treatments, we informed the participants prior to the PD games (games C and D) on how their opponent had behaved in games A and B played before. Thus, these subjects were principally able to derive the corresponding type of their co-player.

Based on the experimental design and the theoretical explanations in section 2, we are able to derive cooperation hypotheses for all pairs depending on their composition. Thereby we assume that, whenever F&S predict the existence of multiple equilibria, subjects will prefer the Pareto dominant equilibrium, i.e. the one with the higher monetary payoff. The cooperation hypotheses for all possible combinations of types are presented in table 4. The hypotheses are independent of the treatment, i.e. the fact that someone has earned the endowment or that someone has a relatively low endowment does not affect the theoretical prognosis.

Table 4: Cooperation hypotheses

Type combination	PD (game C)	P-PD (game D)
FAIR-FAIR, FAIR-CARING, CARING-CARING	Cooperation	Cooperation
FAIR-ENVIOUS, FAIR-EGO, ENVIOUS-ENVIOUS	Defection	Cooperation
CARING-ENVIOUS, CARING-EGO, ENVIOUS-EGO, EGO-EGO	Defection	Defection

Notes: All equilibria are symmetric, i.e. either both players cooperate or both players defect.
Abbreviations: PD = prisoner's dilemma, P-PD = PD with punishment opportunity.

The punishment hypothesis can be derived in a similar way. According to F&S the following conditions have to be fulfilled in order to rationalise punishment behaviour by a subject *i* at the second stage of game D: (i) for *i*'s aversion to disadvantageous inequality $\alpha_i > 0.1$ holds, (ii) subject *i* cooperates in game D, and (iii) the co-player *j* in game D defects.

4. Results

Six hundred students participated in the experiment which took place in April and October 2008 at the experimental laboratory MaxLab of the University of Magdeburg, Germany. Our design was arranged a way that 150 subjects participated in each treatment. The subjects' socio-economic characteristics are presented in table 11 in the appendix.

The result section is divided into two parts. The first part is about the subjects' behaviour in the modified dictator and ultimatum games, and individual inequality aversion. The second part is about the questions (i) whether there is a house money effect and (ii) whether the subjects' inequality aversion can account for different individual behaviour in the PD games.

4.1 Elicitation of inequality aversion

Table 5 shows the subjects' decisions in both games broken down by treatment. In game A overall 50 % of the subjects choose the equal distribution, i.e. for those subjects $\beta_i > 0.4$ holds. Regarding the treatments, about 55 % choose the equal distribution in *No effort rich* while in all other treatments 47 % to 49 % do so. Using the binomial test there are no significant ceteris-paribus differences between treatments (see table 12 in the appendix).

Table 5: Subjects' decision in game A and game B

Subjects' decisions		Frequency in %
Game A (modified dictator game)	Dictator choosing equal split ($\beta_i > 0.4$)	50.17
	Effort rich	48.67
	No effort rich	55.33
	Effort poor	47.33
	No effort poor	49.33
Game B (modified ultimatum game)	Proposer proposing unequal split	31.33
	Effort rich	26.00
	No effort rich	33.00
	Effort poor	34.67
	No effort poor	31.33
	Responder rejecting unequal split ($\alpha_i > 0.1$)	34.17
	Effort rich	37.33
	No effort rich	28.67
	Effort poor	34.00
	No effort poor	36.67

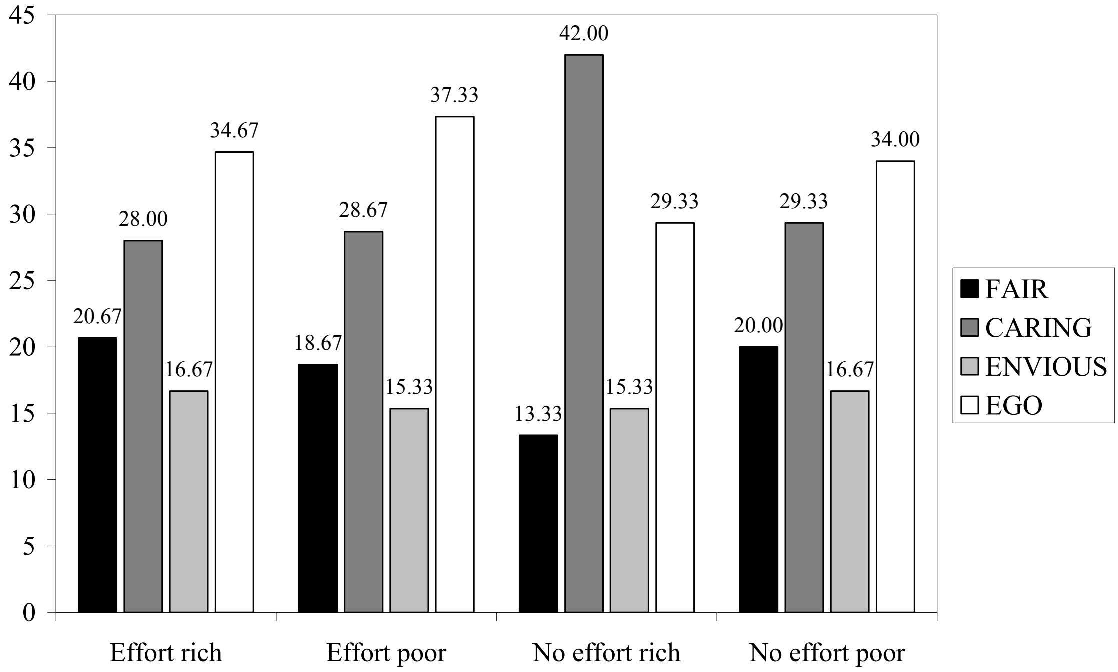
In game B overall 31 % propose the unequal distribution. In *Effort rich*, only 26 % decide this way while in all other treatments 31 % to 35 % do so. The differences (see table 12 in the appendix) are at least weakly significant between *Effort rich* and *No effort rich* (p = 0.056) as well as between *Effort rich* and *Effort poor* (p = 0.020). Considering the responder's choice, which determines parameter α_i, we observe that overall 34 % of the subjects reject the unequal distribution. For those subjects $\alpha_i > 0.1$ holds. In *No effort rich* we observe an exceptionally low rejection rate of about 29 % while the rejection rate is highest with over 37 % in *Effort rich*. The differences are significant between *No Effort rich* and *Effort rich* (p = 0.028) as well as *No effort rich* and *No effort poor* (p = 0.037). Thus, we can state the following results:

Result 1: Parameter β_i is not affected by the treatment variables.

Result 2: Proposers give more money in Effort rich than in the corresponding treatments. Parameter α_i is higher in Effort rich compared to No effort rich. Thus, with respect to α_i there is a house money effect for the high-endowment case. Since α_i is higher in No effort poor than in No effort rich, there is also a stake effect for the no-effort case.

The fact that dictator behaviour does not vary over treatments does not necessarily mean that the treatment variables do not affect the distribution of types according to the F&S model. If, for example, at the aggregate level, 50% of subjects choose the equal split, this can be caused by different mixtures of FAIR and CARING types which both dispose of $\beta_i > 0.4$. The next step, therefore, is to analyse the distribution of types and how these distributions are affected by our treatment variables. Figure 1 shows the distribution of types in each treatment. While the distribution of types looks very similar across the treatments *Effort rich*, *Effort poor*, and *No effort poor,* the distribution in *No effort rich* clearly differs from all other treatments. A chi-square goodness-of-fit test confirms this impression. While the differences between *No effort rich* and each of the other treatments are significant ($p < 0.01$), there are no significant differences between the other three treatments.

Figure 1: Relative frequencies of types [in %]



A closer look at the data reveals which types are responsible for this observation (see table 13 in the appendix). On the one hand, in *Effort rich* the fraction of FAIR types is significantly higher than in *No effort rich*. On the other hand, in *Effort rich* the fraction of CARING types is significantly lower than in *No Effort rich* (chi-square test, $p < 0.01$). This effect is reversed when we compare *No effort rich* with *No effort poor*. The fraction of FAIR types is significantly lower in *No effort rich* compared to *No effort poor* ($p < 0.05$), but the fraction of CARING types is significantly higher in *No effort rich* than in *No effort poor* ($p < 0.01$). There are no other significant differences of types between treatments. To sum up, we can state the following results:

Result 3: There is a house money effect in the high-endowment case. In Effort rich, FAIR types are more frequent and CARING types less frequent than in No effort rich.

Result 4: There is a stake effect in the no-effort case. In No effort rich, FAIR types are less frequent and CARING types are more frequent than in No effort poor.

4.2 Prisoner's dilemma games

To analyse the subjects' behaviour in the PD games we look at the mean per-pair cooperation rates. For each pair the mean cooperation rate can only amount to 0 (neither of the two players cooperates), 0.5 (one of the two players cooperates) or 1 (both players cooperate). Table 6 shows the mean per-pair cooperation rates sorted by treatments. Moreover, it is distinguished between the subjects who are in a pair with the cooperation hypothesis and the subjects who are in a pair with the defection hypothesis (see table 4).

Table 6: Mean per-pair cooperation rates in the PD games

			Treatments			
Game		Total	*Effort rich*	*Effort poor*	*No effort rich*	*No effort poor*
PD (game C)	Obs.	300	75	75	75	75
	Mean	0.125	0.127	0.093	0.153	0.127
	Standard error	0.014	0.027	0.025	0.029	0.029
	Mutual cooperation	6	1	1	2	2
Pairs with cooperation hypothesis	Obs.	111	18	33	31	29
	Mean	0.176	0.167	0.136	0.161	0.241
	Standard error	0.017	0.039	0.024	0.029	0.045
	Mutual cooperation	4	1	1	1	1
Pairs with defection hypothesis	Obs.	189	57	42	44	46
	Mean	0.095	0.114	0.060	0.148	0.054
	Standard error	0.007	0.015	0.009	0.022	0.008
	Mutual cooperation	2	0	0	1	1
PD with punishment (game D)	Obs.	300	75	75	75	75
	Mean	0.138	0.160	0.133	0.140	0.120
	Standard error	0.014	0.029	0.027	0.031	0.028
	Mutual cooperation	7	1	1	3	2
Pairs with cooperation hypothesis	Obs.	130	33	29	30	38
	Mean	0.133	0.151	0.121	0.183	0.092
	Standard error	0.012	0.026	0.022	0.033	0.015
	Mutual cooperation	3	0	0	2	1
Pairs with defection hypothesis	Obs.	170	42	46	45	37
	Mean	0.143	0.200	0.141	0.111	0.149
	Standard error	0.011	0.026	0.021	0.017	0.024
	Mutual cooperation	4	1	1	1	1

Let us first consider the PD. The first column of the table shows that overall 12.5 % of the subjects cooperate. The mean cooperation rate of the subjects with cooperation hypothesis is 17.6 % and with defection hypothesis 9.5 % only. This difference is highly significant (exact MW U test, $p < 0.01$). The finding that subjects with cooperation hypothesis cooperate more often applies to all treatments. The difference in cooperation rates, however, strongly differs between the treatments. While the difference is large in *No effort poor* and to lesser extend in *Effort poor*, it is rather small in *Effort rich* and *No effort rich*. The comparison of cooperation rates by means of the MW U test indicates that the differences in *Effort rich*, *No effort rich,* and *Effort poor* are insignificant ($p > 0.10$). In contrast, the difference is highly significant in *No effort poor* ($p = 0.000$). It seems that inequality aversion elicited via the distribution of a small amount of house money are able to explain individual behaviour in the PD better, than using a relatively large endowment of house money or any amount of earned money.

We do not observe such an effect in the PD with punishment opportunity. Overall, 13.8 % of the subjects cooperate in this game. The mean per-pair cooperation rate of all subjects with cooperation hypothesis is in fact lower than the one of all subjects with defection hypothesis. The difference in the mean cooperation rate between subjects with and without cooperation hypothesis is not significant (exact MW U test, $p > 0.10$), neither for single treatments nor for all treatments taken together.

Higher mean cooperation rates for pairs with cooperation hypothesis, however, do not mean that these pairs are able to successfully coordinate at the Pareto superior equilibrium more often, compared to pairs with defection hypothesis. As the numbers in table 6 show, there are only a few cases were subjects mutually cooperate – independently from the treatment.

By means of a regression analysis of the whole sample we are able to analyse whether the subjects with the cooperation hypothesis, have a higher willingness to cooperate in the PD controlling for other factors which may influence the subjects' behaviour. Since the decisions in the games C and D are dichotomous we use the logit regression model, one of the most frequently used models for binary outcomes. Table 7 shows the logit regression estimates for the PD. The dependent variable is a dummy variable for the individual cooperation in the PD. The independent variables include dummy variables for the treatment variables (*effort*, *rich*), socio-economic variables (*experience*, *economics*), and a dummy variable for the respective cooperation hypothesis (*C-hypothesis*). The first column shows the regression results estimated on the whole sample. They indicate that the probability to cooperate is significantly higher for subjects being in a pair with the cooperation hypothesis. Furthermore, the probability to cooperate is significantly lower for students with an economic subject. The treatment variables and other socio-economic variables do not have significant effects. The regression results estimated on treatment subsamples indicate that the impact of the theoretical hypothesis is mainly driven by the treatment *No effort poor*. In this treatment, a change from defection to cooperation hypothesis increases the probability to cooperate by about 17 percentage points.

Table 7: Logit regression for cooperation in the PD

		Subsamples			
Variable	Total	*Effort rich*	*Effort poor*	*No effort rich*	*No effort poor*
Effort	-0.020				
	(0.027)				
Rich	0.037				
	(0.026)				
Experience	-0.002	-0.011	0.010	0.003	-0.010
	(0.004)	(0.008)	(0.006)	(0.009)	(0.009)
Economics	-0.095***	-0.110*	-0.109**	-0.075	-0.095*
	(0.027)	(0.058)	(0.051)	(0.059)	(0.051)
C-hypothesis	0.067**	0.043	0.076	-0.004	0.166***
	(0.028)	0.063	(0.048)	(0.061)	(0.058)
No. of obs.	598	150	149	149	150
Wald chi^2	23.40	9.16	5.89	1.66	13.28
$P > chi^2$	0.000	0.027	0.117	0.647	0.004
Pseudo R^2	0.053	0.067	0.085	0.013	0.142

Notes: Numbers are average marginal effects. Numbers in parentheses are robust standard errors. Asterisks (*, **, ***) denote statistical significance at the 0.1, 0.05 and 0.01 levels, respectively. A dummy (1 if cooperation, 0 if defection) is the dependent variable. Definition of independent variables: *effort*: 1 (0) if endowment was (not) earned, *rich*: 1 (0) if endowment was € 10.00 (€ 5.00), *experience*: number of participations in experiments, *economics*: 1 (0) if subject has (not) an economic major, *C-hypothesis*: 1 (0) if subject is (not) in a pair with the cooperation hypothesis.

In the following we describe the results of similar regressions for the PD with punishment possibility (see table 8). The results indicate that the subjects behave consistently across the two PD games since subjects who cooperate in the PD are also more likely to cooperate in the punishment PD. The behaviour of the co-player *j* in the PD does not significantly change the probability to cooperate in the punishment PD, which makes sense because the co-players in the two games were different. The cooperation hypothesis does not have a significant effect which could be expected from the non-parametric tests. Thus, from the non-parametric tests and regression analysis we can state the following results:

Result 5: With respect to the cooperation rates, the F&S model has predictive power in the PD only for No effort poor.

Result 6: For the cooperative behaviour in the PD with punishment possibility, F&S has no explanatory power at all. Subjects who cooperate in the PD show a higher probability to cooperate in the PD with punishment possibility.

Table 8: Logit regression for cooperation in the punishment PD (game D)

		Subsamples			
Variable	Total	*Effort rich*	*Effort poor*	*No effort rich*	*No effort poor*
Effort	0.026				
	(0.027)				
Rich	0.013				
	(0.027)				
Experience	0.009**	0.013*	0.009	-0.000	0.011
	(0.004)	(0.008)	(0.007)	(0.008)	(0.006)
Economics	-0.003	-0.008	-0.005	0.011	0.014
	(0.028)	(0.063)	(0.059)	(0.058)	(0.052)
C-hypothesis	-0.005	0.013	-0.041	0.074	-0.085*
	(0.027)	(0.063)	(0.049)	(0.063)	(0.046)
PD-C	0.340***	0.275**	0.473***	0.248**	0.489***
	(0.061)	(0.127)	(0.152)	(0.106)	(0.110)
PDother-C	0.037	0.074	0.091	0.035	-0.022
	(0.043)	(0.105)	(0.090)	(0.081)	(0.057)
No. of obs.	598	150	149	149	150
Wald chi^2	53.64	10.35	18.02	10.54	26.1
P > chi^2	0.000	0.066	0.003	0.061	0.000
Pseudo R^2	0.108	0.069	0.174	0.080	0.223

Notes: Numbers are average marginal effects. Numbers in parentheses are robust standard errors. Asterisks (*, **, ***) denote statistical significance at the 0.1, 0.05 and 0.01 levels, respectively. A dummy (1 if cooperation, 0 if defection) is the dependent variable. Definition of independent variables: *effort*: 1 (0) if endowment was (not) earned, *rich*: 1 (0) if endowment was € 10.00 (€ 5.00), *experience*: number of participations in experiments, *economics*: 1 (0) if subject has (not) an economic major, *C-hypothesis*: 1 (0) if subject is (not) in a pair with the cooperation hypothesis, *PD-C:* 1 (0) if subject (did not cooperate) cooperated in the PD, *PDother-C:* 1 (0) if subject's co-player (did not cooperate) cooperated in the PD.

The observed punishment behaviour at the second stage of game D can be compared with the punishment hypothesis. Overall subjects punish in 116 of 600 cases (19 %). This is much more than one would have expected according to F&S – the model predicts punishment in only 19 cases (3 %). Furthermore, the percentage of cases correctly predicted by the punishment hypothesis is only about 13 %. The descriptive statistics are shown in table 9 below. The differences between observed and expected punishment are highly significant (binomial test, $p < 0.01$). Table 14 in the appendix shows who punishes. Over all treatments EGO types have the highest probability to punish (41 of 116 cases are EGO types).

Table 9: Punishment behaviour in the punishment PD (game D)

Treatment	observed punishment	expected punishment according to F&S	punishment correctly predicted by F&S
Effort rich	38 (25.33)	6 (4.00)	5 (13.16)
Effort poor	24 (16.00)	6 (4.00)	4 (16.67)
No effort rich	28 (18.67)	6 (4.00)	5 (17.86)
No effort poor	26 (17.33)	1 (0.67)	1 (3.85)
total	116 (19.33)	19 (3.17)	15 (12.93)

Notes: Numbers are the absolute frequency, relative frequency in % are in brackets.

Analogously to the cooperation behaviour in game D, a logit regression is run for the subjects' use of the punishment opportunity (table 10). The dependent variable is a dummy indicating whether or not the subject punishes his co-player. The results estimated on the total sample show that subjects who cooperate in the first stage of the punishment PD are significantly more likely to punish their co-players. Furthermore, the dummy variable for the respective punishment hypothesis (*P-hypothesis*) is weakly significant. The regression results, estimated on treatment subsamples, indicate that the impact of the punishment hypothesis is driven by the treatment *No effort rich*. In this treatment, a change from non-punishment to punishment hypothesis increases the probability to punish by about 53 %. Remarkably, in none of the effort treatments the punishment hypothesis has a significant effect.

The following result, with respect to the punishment behaviour, can be stated:

Result 7: Overall, subjects punish more often then one would have expected according to F&S. Subjects who cooperate in game D are significantly more likely to punish their co-players. The punishment hypothesis has predictive power in No effort rich only.

Table 10: Logit regression for punishment (game D)

		Subsamples			
Variable	Total	*Effort rich*	*Effort poor*	*No effort rich*	*No effort poor*
Effort	0.017				
	(0.030)				
Rich	0.043				
	(0.030)				
Experience	-0.001	0.011	-0.008	-0.016	-0.000
	(0.004)	(0.008)	(0.008)	(0.009)	(0.009)
Economics	-0.018	0.056	-0.005	-0.047	-0.081
	(0.031)	(0.066)	(0.057)	(0.058)	(0.063)
P-hypothesis	0.240*	0.208	0.015	0.537**	—[1]
	(0.144)	(0.254)	(0.123)	(0.258)	
P-PD-C	0.342***	0.381***	0.509***	0.152	0.289**
	(0.066)	(0.114)	(0.127)	(0.150)	(0.136)
P-PDother-C	-0.048	-0.099	-0.094	0.074	-0.095
	(0.045)	(0.083)	(0.084)	(0.103)	(0.077)
No. of obs.	598	150	149	149	149
Wald chi^2	63.44	21.41	23.76	18.92	10.49
P > chi^2	0.000	0.001	0.000	0.002	0.033
Pseudo R^2	0.121	0.141	0.211	0.140	0.072

Notes: Numbers are average marginal effects. Numbers in parentheses are robust standard errors. Asterisks (*, **, ***) denote statistical significance at the 0.1, 0.05 and 0.01 levels, respectively. A dummy (1 if punishment, 0 if not) is the dependent variable. Definition of independent variables: *effort*: 1 (0) if endowment was (not) earned, *rich*: 1 (0) if endowment was € 10.00 (€ 5.00), *experience*: number of participations in experiments, *economics*: 1 (0) if subject has (not) an economic major, *P-hypothesis*: if subject should punish according to the punishment hypothesis, *P-PD-C:* 1 (0) if subject cooperated (did not cooperate) in the first stage of the punishment PD, *PDother-C:* 1 if subject's co-player cooperated (did not cooperate) in the first stage of the punishment PD.

[1] Observation dropped since there is only one case with *P-hypotheses* = 1.

5 Discussion and conclusion

The first objective of our study was to run a "robustness check" for inequality aversion with respect to the house money effect. In this regard the robustness of the dictator's generosity across treatments is a remarkable result of our study. Particularly, their willingness to choose the equal split is not affected by the way how the subjects obtained their money. At first sight, this seems surprising since it contrasts the results in Cherry (2001) who observes a sharp decline in positive offers as soon as dictators had to earn their endowment by employing some effort. A closer inspection, however, may quickly solve this puzzle. Contrary to the design chosen by Cherry, in our experiment both parties – dictators and recipients – had to work. Previous work has shown that the "deservingness" has a measurable impact on dictators' givings. Ruffle (1998), for example, observes an increase in dictators' offers after he increased the deservingness of the recipients. This effect has also been observed by Eckel and Grossman (1996) in a different context: When an anonymous subject in the role of the recipient is replaced by an established charity, in this case the American Red Cross, donations will triple. However, not only the deservingness of the recipient, but also the dictator's deservingness may influence offers: If dictators think that they deserve a higher share than the equal, as they have spent some effort to receive their money, their giving surely will decline. This is the observation in Cherry (2001). Hence, increasing only the deservingness of recipients will only get the dictators to choose positive offers more often, but increasing only the deservingness of the dictator will make donations decrease. However, in our setting there is no asymmetry between the players, i.e. the relative deservingness is constant across all treatments. This helps to explain why the dictator's behaviour is so stable across treatments.

Interestingly, a different effect seems to be the case for α_i, the weight of disadvantageous inequality. With respect to α_i we observe a house money effect, i.e. responders more often reject unequal proposals when they had successfully worked for their endowment. Thus, despite the fact that relative deservingness has not changed in this situation, responders have a different view on what is the "fair share". As the perception of this acceptable share is moving towards their own favour, subjects reject low offers with higher frequency – their α_i increases. In other words, we observe a self-serving change in the judgment on what displays an acceptable offer. Babcock and Loewenstein (1997) summarise an impressive body of empirical evidence indicating that under circumstances of "morally ambiguous settings in which there are competing 'focal points'" people tend to rely on the fairness notion which favours what is in their self-interest. Already in the standard ultimatum game with house money, the rejection of "unfair" offers can be explained by this behavioural pattern. Obviously, in the effort case, the self-serving change in the judgment on an acceptable offer is strengthened and can therefore explain the change of the responders' behaviour.

Regarding the proposers' behaviour in the ultimatum game we find that proposers are more generous in the *Effort rich* treatment. This is much in line with a rational expectations approach: In the high-endowment case, proposers correctly anticipate that responders will reject unequal offers more often when they have successfully worked for their endowment. Thus, subjects are quite rational in the way they incorporate equity into their decisions. Again, the results of our design, where both subjects have to show effort in order to get the high endowment, fit well to the ultimatum game results in section 1. Hoffman et al. (1994) observe no differences in the rejection rates of inactive responders between the effort and no-effort case, but a (again quite rational) decrease in offers by the proposers after they have successfully shown effort. If the deservingness of the responders is higher (Ruffle 1998) they are rewarded with higher offers by the proposers. Thus, similar to the dictator game above not only the proposer's legitimation, but also the perceived legitimation of the other side (the responder) matters.[10] Another major goal of this study was to examine the predictive power of the theory of inequality aversion proposed by Fehr and Schmidt (1999). F&S propose inequality aversion as a unifying principle for major classes of decision tasks. However, while inequality aversion works excellent in theory by providing a "grand unified approach" for human behaviour in bargaining and cooperation games, experimental evidence for the power of this principle is weak.

We used within-subject tests in order to check whether the measured degree of inequality aversion is responsible for cooperation or non-cooperation in a prisoner's dilemma game. Although the decision tasks were highly simplified, it turns out that the F&S theory has only very limited explanatory power. This is not to say that inequality aversion is of no importance at all, but it seems that inequality aversion is not the main driving force behind observed behaviour in dilemma situations. This paper has shown, that F&S predict individual behaviour only correctly in the context of low stakes in combination with house money. Taking on the suggestion of Teyssier (2009), that the implications of inequality aversion may be overruled by other forces such as risk aversion, the low predictive power of F&S in our experiment may be due to strategic uncertainty about others' behaviour. Even though the subjects were informed about their co-player's type, there possibly remained some uncertainty about the co-player's behaviour in the prisoner's dilemma, which might have reduced the influence of inequality aversion. Seeing the uncertainties in real world social dilemmas, the applicability of the F&S model beyond the laboratory is at least questionable.

When thinking about the applicability of inequality aversion to real world problems, another aspect has to be taken into account. In our experiment, consistency of preferences is only needed for a very short time period, namely the duration of the experiment. In other words, even under "best case" conditions, the explanatory power of inequality aversion is very limited. Brosig et al. (2007) analyse the consistency of individual behaviour within and across different classes of games and the stability of individual behaviour over time by running the same experiments on the same subjects at several points in time. Their results demonstrate that other-regarding preferences seem to wash out over time. In the final wave of experiments, it is the classical theory of selfish behaviour that delivers the best explanation of the observed

[10] It remains puzzling, that in the No-effort case subjects with a high endowment reject unequal offers with higher probability than subjects with low endowment. It seems that with a "disappointingly low" endowment subjects simply have a different notion of what is "fair".

behaviour. Stable behaviour over time is observed only for subjects who behave strictly selfish. These results strengthen our doubts about the explanatory power of the F&S model.

Concluding, we think that more research is needed in order to refine the concept of inequality aversion and related concepts of other-regarding preferences. A remaining question is, whether the house money effect observed in this paper can be reproduced for a more differentiated structure of behavioural types and for higher stakes. As our results indicate, it may well be possible that there is an interaction between the house money and the stake effect. Furthermore, a more general remaining question is which kind of preferences drives individual behaviour in social dilemma situations. These issues remain to be answered by future research.

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Appendix

Table 11: Socio-economic characteristics

Socio-economic characteristics	Frequency	Frequency in %
Total	600	100.00
Field of study		
Economic major	318	53.00
Non-economic major	282	47.00
Sex		
Male	315	52.50
Female	285	47.50
Experience in experiments		
First experiment	136	22.74
Second experiment	104	17.39
Two or more experiments before	358	59.87

Table 12: Fraction of decisions in game A and B

House money effect Decision	*Effort rich*	*No effort rich*	p-value	*Effort poor*	*No effort poor*	p-value
Game A: choosing equal split ($\beta_i > 0.4$)	48.67	55.33	0.101	47.33	49.33	0.683
Game B: Proposer choosing unequal split	26.00	33.33	0.056	34.67	31.33	0.380
Game B: Responder rejecting unequal split ($\alpha_i > 0.1$)	37.33	28.67	0.024	34.00	36.67	0.553
Stake effect Decision	*Effort rich*	*Effort poor*	p-value	*No effort rich*	*No effort poor*	p-value
Game A: choosing equal split ($\beta_i > 0.4$)	48.67	47.33	0.745	55.33	49.33	0.143
Game B: Proposer choosing unequal split	26.00	34.67	0.026	33.33	31.33	0.598
Game B: Responder rejecting unequal split ($\alpha_i > 0.1$)	37.33	34.00	0.390	28.67	36.67	0.042

Exact binomial test. N = 150 for each treatment.

Table 13: Fraction of types

House money effect Type	*Effort rich*	*No effort rich*	p-value	*Effort poor*	*No effort poor*	p-value
FAIR	20.67	13.33	0.011	18.67	20.00	0.760
CARING	28.00	42.00	0.000	28.67	29.33	0.929
ENVIOUS	16.67	15.33	0.650	15.33	16.67	0.743
EGO	34.67	29.33	0.152	37.33	34.00	0.340
Stake effect Type	*Effort rich*	*Effort poor*	p-value	*No effort rich*	*No effort poor*	p-value
FAIR	20.67	18.67	0.530	13.33	20.00	0.041
CARING	28.00	28.67	0.928	42.00	29.33	0.001
ENVIOUS	16.67	15.33	0.650	15.33	16.67	0.743
EGO	34.67	37.33	0.555	29.33	34.00	0.262

Exact binomial test. N = 150 observations for each treatment.

Table 14: Punishment behaviour

				Type			
	Pair		%	EGO	CARING	ENVIOUS	FAIR
Effort rich	cd	14	36.8	6	3	3	2
	cc	1	2.6	0	0	0	1
	dd	20	52.6	8	3	7	2
	dc	3	7.9	1	1	0	1
		38	100.0	15	7	10	6
Effort poor	cd	12	50.0	7	1	3	1
	cc	0	0.0	0	0	0	0
	dd	11	45.8	3	1	3	4
	dc	1	4.2	0	0	0	1
		24	100.0	10	2	6	6
No effort rich	cd	9	32.1	2	2	2	3
	cc	0	0.0	0	0	0	0
	dd	12	42.9	2	4	3	3
	dc	7	25.0	2	2	0	3
		28	100.0	6	8	5	9
No effort poor	cd	8	30.8	4	3	1	0
	cc	0	0.0	0	0	0	0
	dd	16	61.5	5	3	4	4
	dc	2	7.7	1	0	1	0
		26	100.0	10	6	6	4
total	cd	43	37.1	19	9	9	6
	cc	1	0.9	0	0	0	1
	dd	59	50.9	18	11	17	13
	dc	13	11.2	4	3	1	5
		116	100.0	41	23	27	25

Pair = cd (cc; dd; dc) indicates that subject *i* cooperates and subject *j* defects (both subjects cooperate; both defect; subject *i* defects and subject *j* cooperates). Type indicates the punisher's type.

Experimental instructions (“Effort rich” treatment)

Welcome to the laboratory MaXLaB!

Please read these instructions carefully and should you have any questions please give us a show of hands or open the door. In the laboratory experiment you are taking part in, you can win **cash** in € depending on your decisions and the decisions of your fellow players. All your decisions within the experiment will be **anonymous**. Only the experimenter will know your identity, but your data will be treated confidentially. Within the experiment you will be asked to make decisions in several games. You will receive detailed instructions during the experiment. Please do not communicate with one another during the experiment, and please touch the equipment in the booth only when you are asked to. Good luck for the experiment!

Best regards, the MaXLaB-Team

1) Entry of literature

We first would like to ask you to earn money for the games in the experiment. To do so, you will have to enter details of a few literature sources (provided to you in your booth) into the computer. The more correct entries you achieve in the given 10 minutes, the more **starting money** will be granted to you for the following games. You can start entering the data only if you receive an according message on your screen. You will find an Excel file named “LITERATURE” on your screen in which the necessary details (Authors’ names, Title, Journal, Page Reference, Year) have to be entered (please do not open the file yet!). The screenshot below shows a sample entry form.

Please enter the names of the authors into column “Name(s)” (see screenshot). Abbreviate the first name of the author(s) by entering the initial only. Please separate the names of several authors with a forward slash “/”. Please enter the title into column “Title” and the name of the magazine in column “Magazine”. When providing the page(s) in column “Page Reference” please do not use a minus “-”, but please write out “to”. Please enter the year of publication in column “Year” as a number.

Only the data “Name(s)”, “Title”, “Magazine”, “Page Reference”, and “Year” need to be entered. Please provide the literature in the order at hand. We will check your data for completeness and correctness. Important: Please save the document “LITERATURE” after every complete entry, i.e. after each completed row (you can either press [Ctrl] + [S] or you can use the menu bar “File” – “Save”). The amount of valid entries will be displayed in the upper right corner. We will inform you when you can start with your entries and about the remaining time. Please do not continue entering after the time has elapsed.

2) Introduction Games A and B

Please read the following instructions carefully. In the following you will participate in two games (game A and B). The rules of both games will be given to you on your screen in the next steps. After the experiment we will determine randomly which game (game A or B) will be paid out. Please note: You should play every game as if it were the one relevant for payout. In both games, you will encounter a fellow player who has been randomly determined out of other participants in the experiment. All decisions in the experiment will be made anonymously. Your fellow player will not know about your identity and neither will you about your fellow player's. Should you have any questions please raise your hand or open the door and we will come to you.

You have just earned your starting money for the following games A and B. You have entered relatively much literature, i.e. at least 50 % of the participants in this experiment have entered less literature than you. Therefore, you receive a relatively high amount of starting money of € 10 for games A and B.

3) Game A

In game A there are two players: the "Distributor" and the "Receiver". The distributor has to select a division of his gained starting money of €10. He can choose from two possible pairs of divisions (LEFT and RIGHT) for himself and the receiver. When selecting LEFT the distributor gets € 9.00 and the receiver € 1.00. When selecting RIGHT the total amount of money increases and each player receives € 5.80. The division pair chosen by the distributor will be paid out. Payout: We will determine randomly which player will be distributor and which will be receiver in game A. Please note: Due to the application of this method, the distributor should behave as if the chosen amount of money will be paid out. Note: Your fellow player has also gained € 10.

Decision as distributor

Please choose from the following pairs of the division of your starting money by ticking the according box.

LEFT:

For me (distributor): € 9.00

For the other player (receiver): € 1.00

My Choice [box]

RIGHT:

For me (distributor): € 5.80

For the other player (receiver): € 5.80

My Choice [box]

4) Game B

In game B there are two players: the “First-Drawer” and the “Second-Drawer”. The first-drawer proposes a possible division of his starting money of € 10 by selecting either LEFT or RIGHT (see below for the amounts). The second-drawer can agree to the choice of LEFT or neglect it. If he neglects LEFT, both players receive € 1.00. If the second-drawer agrees to LEFT, then it will be divided according to the LEFT detail. If the first-drawer selects RIGHT, this choice will always be applied. We ask you to play this game both as first-drawer on this page, and as second-drawer on the following page. Payout: We will determine randomly who your fellow player will be. Then it will be determined randomly if your decision as first-drawer or as second-drawer will be relevant for the payout. Please note: Due to the application of this method the first-drawer should behave as if the chosen amount of money will be paid out. Note: Your fellow player has also gained € 10.

Decision as first-drawer

Please choose from the following pairs about the division of your starting money by ticking the according box.

LEFT

For me (first-drawer): € 8.30

For the other player (second-drawer): € 1.70

My Choice [box]

Information: If neglected by second-drawer both players receive € 1.00

RIGHT

For me (first-drawer): € 5.00

For the other player (second-drawer): € 5.00

My Choice [box]

Information: This choice cannot be neglected.

Please note: your fellow player has the opportunity to neglect your proposal if you select LEFT. In this case you and your fellow player will receive € 1.00. If your fellow player accepts your proposal of LEFT, the choice will be paid out. The proposal RIGHT cannot be neglected.

Decision as Second-drawer

Please decide as the second-drawer if you want to accept the proposal of LEFT by the first-drawer. Payout: We determine randomly if you are first-drawer or second-drawer in game B. Please note: Due to the application of this method, as a second-drawer you should behave as if your fellow player actually had proposed LEFT and you accepted or neglected the proposal. Note: Your fellow player has also gained € 10.

If my fellow player has chosen LEFT as a division of his money and I accept this proposal, then:

My payout is: € 1.70

My fellow player's payout is: € 8.30

I accept the proposal of "€ 1.70 for me and € 8.30 for my fellow player" instead of choosing € 1.00 for both of us. [box]

If my fellow player has chosen LEFT as a division of his money and I neglect it, then:

My payout is: € 1.00

My fellow player's payout is: € 1.00

I neglect the proposal of "€ 1.70 for me and € 8.30 for my fellow player" and choose € 1.00 for both of us. [box]

5) Game C

In this game you will be put into the following decision making situation. There is a project to which you can "contribute" together with another player. If *one* player contributes *both* players profit from it, and so the following amounts can be gained:

- If both players "contribute" to the project, each player receives € 8.40
- If no player "contributes", each player receives € 7.00
- If one of the players "contributes" and the other does not, the "contributing" player receives € 4.20 and the player who does not "contribute" receives € 11.20

We ask you to indicate on the screen whether you want to "contribute" in this situation or if you do not want to "contribute". Further below on your screen, you will be given information about how your current fellow player has behaved in game A and game B. Your current fellow player is in the same decision making situation as you and is given the according information about your behaviour in game A and B on his screen.

After game C you will be playing another game – game D, in which you will encounter a fellow player with whom you have not yet interacted. We will determine randomly which of both games, game C or D, will be paid out. Therefore, in game C you should behave as if exactly this game will be paid out.

Please note: Before game C starts, you will be taking a trial round which is not relevant for the payout. Your fellow player in the trial round will be the computer. The computer's decisions will be determined randomly. After the trial round, you will be playing the actual game C, which is relevant for the payout. There you will encounter your fellow player. You will be making **only one decision** in game C.

6) Game D

In this game you will be put into the following decision making situation with the stages I and II. **Stage I** is the same decision making situation as in game C. Again, there is a project to which you can "contribute" together with another player. If *one* player contributes *both* players profit from it, and so the following amounts can be gained:

- If both players "contribute" to the project, each player receives € 8.40
- If no player "contributes", each player receives € 7.00

- If one of the players “contributes” and the other does not, the “contributing” player receives € 4.20 and the player who does not “contribute” receives € 11.20

We ask you to indicate on the screen whether you want to “contribute” in this situation or if you do not want to “contribute”. Further below on your screen, you will be given information about how your current fellow player has behaved in game A and B. Please note that your current fellow player is **not the same** player as in game C. Your current fellow player is in the same decision making situation as you and is given the according information about your behaviour in game A and B on his screen.

Stage I of game D is followed by **stage II**. On the screen you will be shown your decisions of stage I, the decisions of your fellow player of stage I, and the resulting incomes. Additionally you will again be informed about the behaviour of your fellow player of game A and B. In stage II you will now have the opportunity to reduce your fellow player’s income. If you select “Reduce fellow player’s income”, the income of your fellow player of stage I will be reduced by € 4.00. However, reducing your fellow player’s income is *not free of charge* for you. You have to pay € 0.40 for that, i.e. your own income will decrease by € 0.40 if you choose to reduce your fellow player’s income. Please indicate on the screen if you want to reduce your fellow player’s income (“Yes, I want to reduce my fellow player’s income by € 4.00…”) or if you do not want to proceed like that (“No, I do not want to reduce my fellow player’s income.”). Again your fellow player is in the same situation as you and is given the according information on your behaviour.

Please note: Prior to game D you will be taking a trial round, which is not relevant for the payout. Your “fellow player” in this trial round will be the computer. The computer’s decisions will be determined randomly. After the trial round, you will be playing the actual game D, which is relevant for the payout. There you will encounter your fellow player. You will be making **only one decision** in every stage of game D.