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The Moonlighting Game

An Experimental Study on Reciprocity and Retribution

by

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Abstract
We introduce the *moonlighting game*. Player A can take money from or pass money to player B, who can either return money or punish player A. Thus our game allows to study both positively and negatively reciprocal behaviour. One-shot experiments were performed with and without the possibility of making non-binding contracts beforehand. We find that retribution is much more compelling than reciprocity. Although contracts are not binding they increase trust but we do not find evidence that they also encourage reciprocity.

Keywords
Reciprocity, retribution, fairness, non-binding contracts

JEL Classification Codes
C78, C91, D63, J41, K42

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I. Introduction

Consider the following situation: An illegal moonlighter has been engaged for some piece of work. He has access to a till containing money in order to buy materials, and is supposed to be paid for the work after he has finished. Since the whole activity is forbidden, neither the moonlighter's performance nor the principal's payments can be legally enforced. In this situation, the moonlighter has several options: he may take money out of the till and disappear. He may not work at all. Or he may work at an arbitrary activity level, where more effort causes higher costs for him, but also a higher principal's surplus. After the work has been done (or not), the principal has several options: she may pay him the amount agreed upon, but she might as well pay less or nothing. However, if she was betrayed by the moonlighter, she can do nothing against him but go to court and sue him for damages, but since both parties violated the law, both will bear negative consequences.

It is clear that according to the orthodox assumption of pure rationality no exchange of work and money will take place, the moonlighter will rather take as much as possible out of the till. He knows that the principal will neither pay him nor go to court, for both options are costly for the principal. Hence, the moonlighter can neither expect to be rewarded for his effort nor to be penalised for embezzlement.

Looking at the little example, we see that the game considered here is characterised by four features: first, the moonlighting activity improves the situation of both players, and thus, at least if the view is reduced to the two parties immediately involved, increases *efficiency*. Second, an *agreement* is settled to gather the surplus. Though it is not binding, it establishes a social relationship where the two parties declare a common interest. Third, the mutual improvement requires *trust* and *reciprocity*. The employer must feel an obligation to pay the bill after the work has been done, even if there is no legal means to force him to do so. Fourth, the moonlighter faces the employer's unspoken threat of *retribution*, the fear of being punished for betrayal, despite the knowledge that this is not rational.

We designed an experiment integrating all features mentioned above: The principal (player B) proposes a non-binding contract to the moonlighter (player A) specifying the actions to choose in the following play. Player A can accept or reject the proposal. The contract will not affect further play in any way, thus it is cheap talk in the game theoretic sense. After having accepted or rejected the contract, player A decides upon either taking money from the second mover, which represents the embezzling action, or passing money to her. The passed amount is tripled by the experimenter, standing for the surplus gained by the moonlighter's activity. The second mover now can either return money, i.e. pay the moonlighter, or specify a fine that she imposes on him, which is also costly for her. This action represents the option that the principal claims for damages in court, leading to prosecution of both parties.

A central feature of our moonlighting situation is that both kind and unkind moves are feasible for both players. It is an open question how the co-existence of both opportunities affects

human behaviour with respect to trust, reciprocation[1], and retribution. In the existing experimental studies, however, either positive or negative reciprocity is examined. FEHR, KIRCHSTEIGER, and RIEDL (1993) analyse (positive) reciprocity in a labour market context. They observe that experimental firms systematically overpay workers, compared to the competitive equilibrium wage, to induce an increased effort. In the *investment game* by BERG, DICKHAUT, and MCCABE (1995), the first moving player can also (but only) pass money to the second mover, which is tripled by the experimenter. The second mover can voluntarily return money. The results clearly refute the hypothesis of subgame perfect rationality and support the impact of reciprocal fairness[2]. In contrast, VAN HUYCK, BATTALIO, and WALTERS (1995) find support for strategic behaviour and reject fairness and trust hypotheses. In their *peasant-dictator game* the peasant decides about an investment which reduces his current credit but results in a multiple future taxable income. The dictator imposes a tax on that income. In one treatment the dictator chooses the tax rate *before*, in a second condition *after* the peasant decides on his investment. Strategic considerations imply a positive investment in the first treatment, while in the second one the peasant would not invest anything. The authors report that their experimental data are highly correlated with these strategic predictions.

The role of retribution is focused mainly by the experimental literature on the ultimatum game[3]. In these experiments, low offers are typically punished by rejections. Our moonlighting game involves a more incremental punishment: more punishment is more costly, and, contrary to the ultimatum game, it gets the more expensive to punish player A down to a given payoff level the more aggressive the first mover's demand has been. FEHR, GÄCHTER, and KIRCHSTEIGER (1997) use a related punishment facility in a third stage which they add to their gift exchange game. They find that the threat of (non-rational) punishment increases workers' reciprocity, and by that high levels of co-operation can be achieved.

In many real life situations legally binding agreements are either impossible or their transaction costs are prohibitive, but there is at least a facility to agree upon a non-binding arrangement. Does the opportunity to conclude contracts effect reciprocal behaviour even if the contracts are not binding? There are only few studies which analyse the impact of non-binding contracts. IRLENBUSCH (1999) studies a five stage goods exchange game and finds that with non-binding contracts a considerably high goods exchange activity takes place, even more than in a control treatment in which some players have to adhere to the contract. However, in absence of a control group without contracts an isolated effect of non-binding agreements cannot be inferred

[1] If not explicitly mentioned, the simple term *reciprocity* indicates positively reciprocal behaviour. Following ELSTER (1989), we will use the term *retribution* for negatively reciprocal behaviour.

[2] Other experimental studies have followed these seminal papers, e.g. DUFWENBERG and GNEEZY (1996) and JACOBSEN and SADRIEH (1996).

[3] In the ultimatum game which was introduced by GÜTH, SCHMITTBERGER, and SCHWARZE (1982), the proposer offers to the responder a division of a cake. If the responder accepts, the division is implemented, if he rejects, both receive nothing. The subgame perfect prediction states that since the responder will not reject any positive offer, the proposer will offer

from these results. To gain insight into this question, we conducted our experiment in two treatments: in one condition we left out the pre-stage in which the contract is made.

II. The Model and the Experimental Design

In our two stage extensive form game, the first and the second mover decide subsequently on actions changing both players' balances of account. Before the game starts, both players are endowed with 12 *talers*, the fictitious currency of the experiment. The first mover (player A) can either take an amount of money from the second mover (player B), or, alternatively, he can pass an amount to player B. In the latter case, the experimenter adds two talers to each taler that was passed, analogously to the investment game by BERG, DICKHAUT, and MCCABE (1995). We restricted the amount x player A could give or take to 6 talers at maximum, to ensure that in every case player B would have the option to pass money to player A as well as to harm her. At the second stage player B can pass up to 18 talers to player A or, alternatively, spend up to six talers to reduce player A's final payoff by three times the amount she spends. Player B is always restricted to choices that do not result in negative final payoffs for either of the players. This means that player B is not allowed to pass more than is left to her after the first stage, and she cannot spend an amount that would harm player A by more than his current balance. The option neither to take nor to pass, and thereby leave both credits unchanged, is independently available at both stages.

The subgame perfect equilibrium prediction is simple, applying backward induction. At the second stage, player B will neither punish nor return any money, since both actions would reduce her payoff. Thus, player A will take the maximum possible amount from player B. A pareto efficient solution, on the other hand, is obtained if and only if player A passes the maximum amount allowed. An incentive to choose this option out of player A's self-interest is given if he expects that player B will punish other actions or reciprocate on passing.

In the first condition, we allowed player B to propose a non-binding contract on the strategy choices of both players. Player A could accept or reject, but neither the proposal nor the response by player A would in any way change the strategic options of any player. Hence, the contract is mere cheap talk in the game theoretic sense. In the second condition, we omitted the contract stage.

Like in BERG, DICKHAUT, and MCCABE (1995) we performed one-shot experiments. Our experiment was conducted as a *mensa experiment*. This type of experiments is adequate for simple one-shot decision tasks, for which subjects have to be recruited for a short time only (SELTEN and OCKENFELS, 1998). Four cubicles were placed in each of the foyers of the law and economics lecture hall and the cafeteria building (Mensa) of the University of Bonn. Students passing by were encouraged to participate in the experiment through posters. Each

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virtually nothing, and the responder will accept. GÜTH (1995), ROTH (1995), and CAMERER and THALER (1995) provide surveys over ultimatum experiments.

place corresponded to one of the roles of the game. A subject participating in one building playing the role of player A was always matched to a subject located in the other building acting as player B. The two buildings are distant from each other, which guaranteed complete anonymity between subjects. The decisions were transmitted by helpers via telephone, so that no direct communication between subjects took place. In addition we applied a double blind procedure[4] by using pseudonyms and anonymous payment, to induce anonymity also between the subjects and the experimenters.

The experiments were conducted on two consecutive days during lunch time, when the cafeteria building was most crowded. Subjects could participate only once in only one of the treatments. All in all 120 subjects were involved, 28 independent subject pairs in the condition with, and 32 in the treatment without non-binding contracts. The voluntary statements of the subjects on their major and their age suggest that most of them were students of different disciplines, where law and economics students constitute the largest fractions[5].

The instructions were formulated in neutral words. Expressions like "give", "take", "return" or "punish" were avoided, instead it was phrased that an action "increases a credit" or "decreases a credit". All feasible actions and their consequences for both players at both stages were listed in a table. The decisions were made by checking corresponding boxes on the decision form. If an action would lead to a negative credit (what was not allowed), the experimenter crossed it off the table before the sheet was handed out to the subject. The instruction sheets and the decision forms for player B in the treatment with contracts (original texts in German) are reproduced in the appendix. The sheets for player A and those of the treatment without contracts are analogous.

III. Results

Figure 1 and figure 2 show the decisions of the subjects in the two conditions with and without contracts. The black bars indicate the amounts x given or taken by the players A, the grey bars show the responses of the players B in terms of their effect on player A's credit. The bars are ordered from the highest taken to the highest given amount of player A. In figure 3 the realised final payoff allocations are depicted. The horizontal axis shows player A's, the vertical axis player B's payoff[6]. The triangles show the final allocations in the treatment with contracts, the

[4] HOFFMAN, MCCABE, SHACHAT, and SMITH (1994) and HOFFMAN, MCCABE, and SMITH (1996) raise the question whether smaller social distance between subject and experimenter increases the influence of norms like reciprocity and equity, and find some support for it. BOLTON and ZWICK (1995), LAURRY, WALKER, and WILLIAMS (1995), BOLTON, KATOK, and ZWICK (1998), and BOHNET and FREY (1999), however, look for, but fail to find, substantial effects on behaviour induced by a double-blind procedure.

[5] Compulsory statements were not requested because of anonymity considerations.

[6] The organisation of the diagram is analogous to BERG, DICKHAUT, and MCCABE (1995, p. 136).

circles those in the no contract condition. Coinciding points have slightly been offset[7]. We have inserted several points, lines, and areas representing prominent payoff schemes. Along the line TUZ, both players receive equal payoffs. RUX is the line which represents the allocations in which player B neither returns money nor harms player A. The line SUY represents all allocations in which player A's final payoff equals his initial endowment.

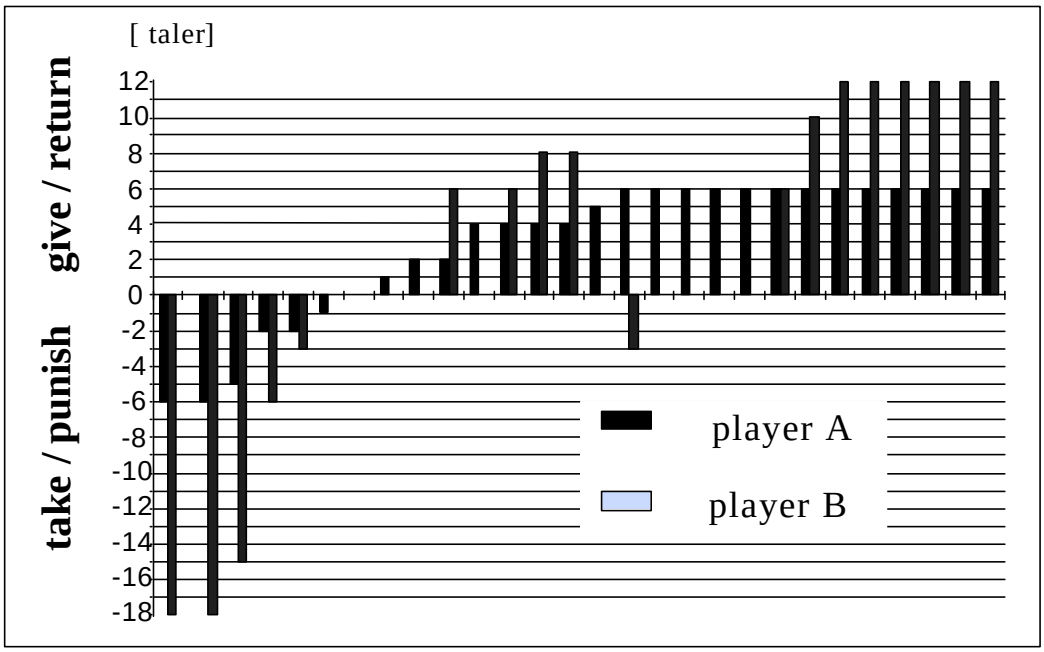

Figure 2 Decision of players in the treatment with contracts

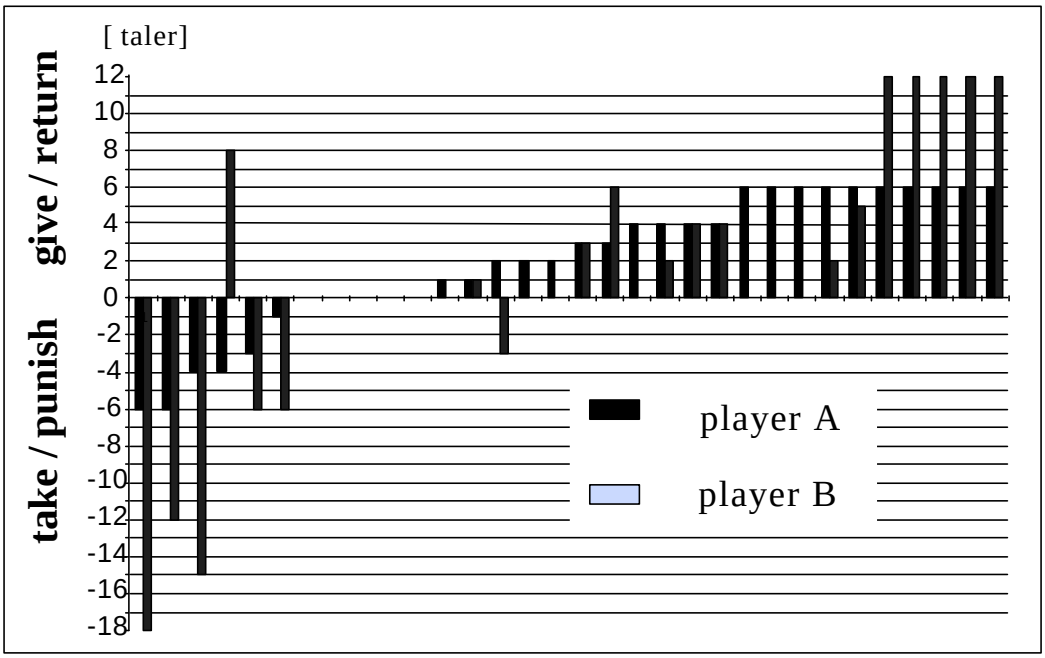

Figure 3 Decision of players in the treatment without contracts

[7] The structure of the game implies that most points correspond to a unique combination of actions. Only the points on the line UX are ambiguous, since they could be reached by a taking action only, or by a combination of a taking and a payback

III.1 Player A's Strategies and Their Success

Table 1 shows the average final payoffs (avg.), the standard deviations of the payoffs (st.dev.), and the number (#) of players A who take money, pass money, or refrain from both (which we refer to as player A's *neutral action*) for both treatments[8].

Table 1 Player A's average payoff (in talers) conditioned on his strategy choice

Treatment	Take			Neutral			Give		
	avg.	st. dev.	#	avg.	st. dev.	#	avg.	st. dev.	#
with contracts	5.6	4.3	6	12	0	1	12.4	4.3	21
without contracts	4.6	3.9	5	12	0	5	11.7	5.3	21

Two thirds of the players A decide to pass money to player B, more than half of them even pass the maximum feasible amount of six talers. But they take a considerable risk to be exploited, while the neutral action turns out to be quite successful. All players A who neither give nor take finish with their initial endowment of 12 talers. Almost all players A who take money make a loss because they are punished. Only two players A in each of the treatments take the maximum amount from player B and thereby behave according to the game theoretic prediction. Since all of them are punished, the subgame perfect outcome does not occur once.

III.2 Player B's Behaviour

Most players B who face a taking action punish player A to an extent that both players finish with about equally low payoffs. The more money is taken by player A, the more money is spent on punishment. The Spearman rank correlation between the amount taken and the amount spent on punishment yields a positive correlation of 0.87, significant at the 1% level (one-tailed, we pooled the data from both treatments since the number of observations is low).

A much less homogeneous player B behaviour is observed after player A has passed money. A large fraction of players B who receive money behave selfishly and keep the whole amount. Whereas only one of eleven players B who face a taking action of player A chose not to change both credits, 7 of 23 players B who receive the maximum possible amount do so. Reciprocation is thus much less homogeneous than retribution. Players B seem to tolerate an unequal distribution much better if it prevails to their own than to player A's advantage.[9]

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action. However, we observe only one allocation on UX in the data.

[8] We exclude one player B who passes his entire credit to player A, after observing player A taking 4 talers, from the analysis.

[9] This result is in line with FEHR and SCHMIDT'S (1999) formal fairness utility model, which states that inequality of final payoffs causes a disutility to a subject, which is more pronounced if the inequality is disadvantageous. BOLTON and OCKENFELS (1999) introduce a similar model which is consistent with both symmetric and asymmetric inequality preferences.

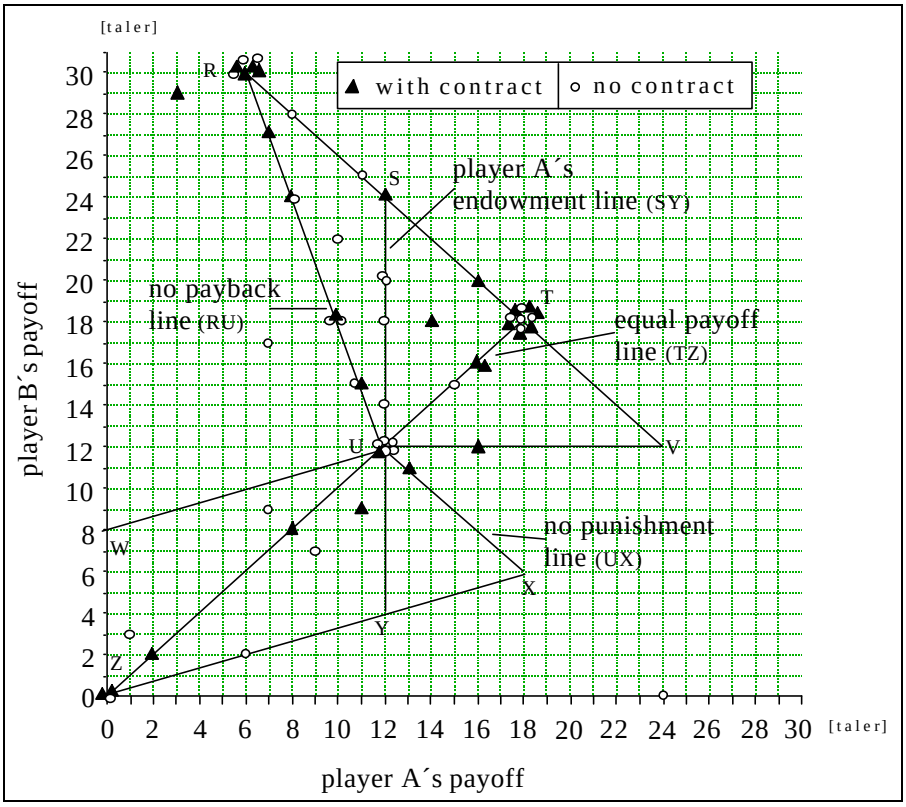

Figure 3 The final payoff allocations

III.3 The Effect of Non-Binding Contracts

Figure 4 shows the outcomes that would result if the matches were played according to player B's contract proposals. The contracts that were accepted are marked with a dot, the rejected ones with a rectangle. The "9" at the black dot at point T indicates that 9 accepted contracts propose this allocation. The contract proposals and the corresponding actual plays are depicted in figure 5. Rejected contracts are marked with an "N". We can see that the clear majority of proposals (17 out of 28 contracts) involves a positive amount to be passed and a payoff equalising amount to be returned. Three contracts propose a taking action of player A and a punishment by player B. These proposals seem to be meant as a threat rather than a desired allocation.

Although the figures 1 and 2 suggest that the differences between the two treatments are relatively small, a closer look at the data provides some evidence that contracts – although they are non-binding – can work as a means of encouraging trust. On average the players A pass an amount of 2.93 talers at the first stage in the contract treatment compared to 2.06 under the no contract condition. Even 3.64 talers were passed from those players A who were offered a positively reciprocal contract. Compared to the no contract treatment the difference is

significant at the 5% level (one-tailed, according to the Mann-Whitney U-test applied to the passed amounts in the no contract treatment compared to those by players A having observed a positively reciprocal contract in the contract treatment). This is a clear hint that especially positively reciprocal contracts can encourage trust.

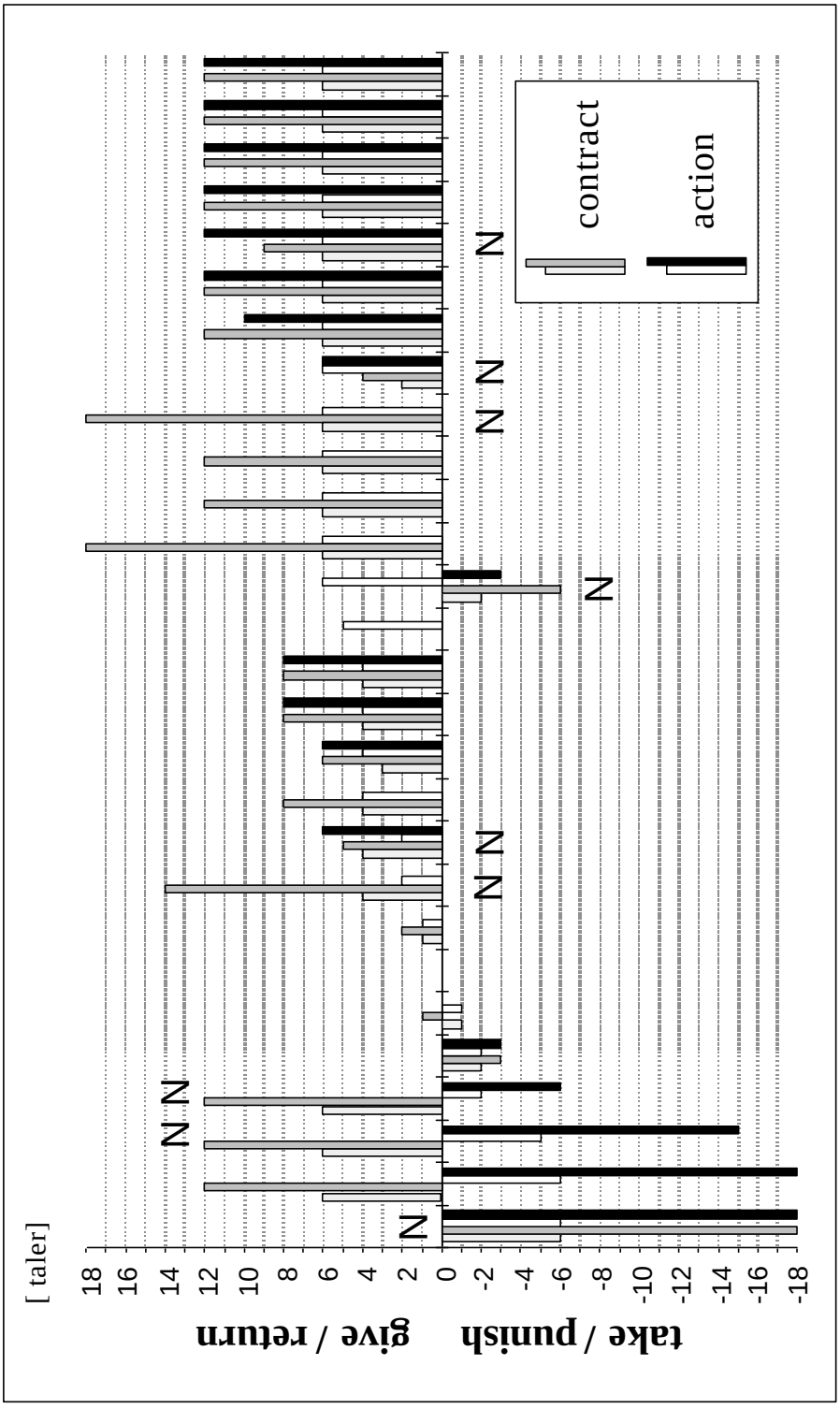

Figure 6 Contract propsals and corresponding actions of players

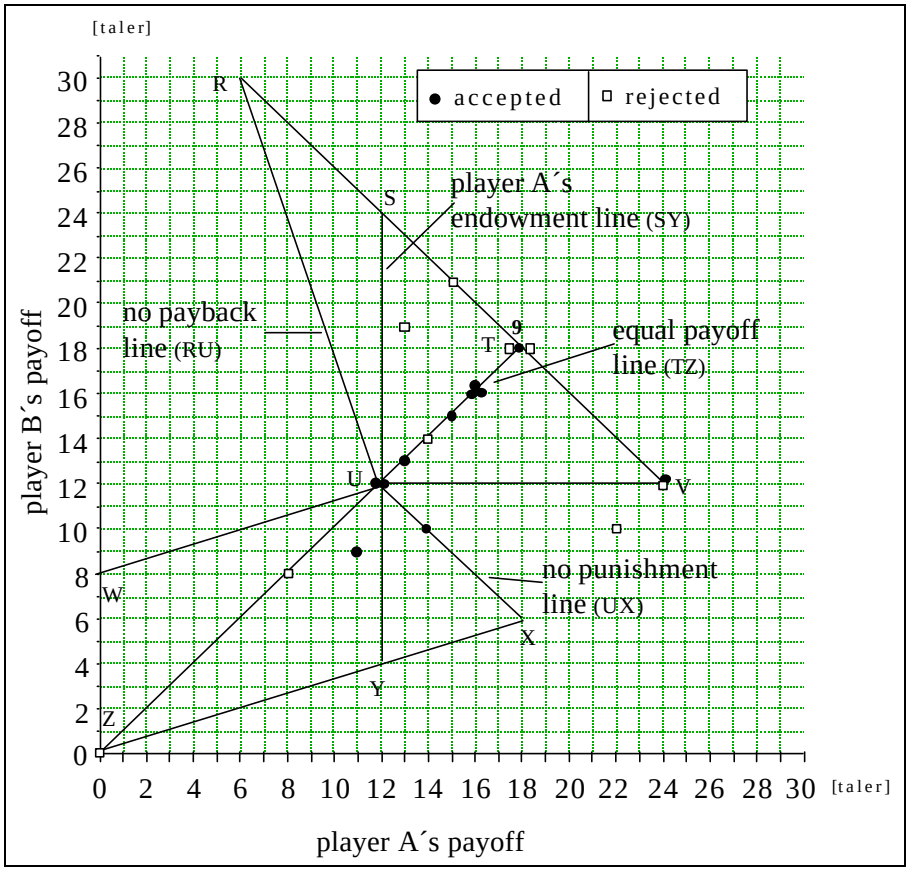

Figure 4 The contract proposals

On the other hand, we do not find evidence that non-binding contracts also encourage reciprocity. One might conjecture that the contract proposals help to avoid misunderstanding about the players' aspirations and thereby improve the occurrence of reciprocal behaviour. However, in both treatments the quota of players B who keep everything after having received the maximum of six talers is about 30% (3/10 without, 4/13 with contracts). It is interesting that all four exploiters in the treatment with contracts have made positively reciprocal proposals which intended at least payoff equalisation. Thus, these players' behaviour cannot be interpreted as misperception of player A's motives (e.g. misunderstanding giving as an act of altruism).

III.4. The Full-Trust Hypothesis

Several reciprocity studies find support for the *full trust hypothesis* which states that players B might link their willingness to equalise payoffs to the choice of player A to pass the maximum possible amount[10]. Our data provides mixed support for this hypothesis. In the treatment without contracts, weakly significantly less payoff equalising choices are made by players B if less than the maximum was passed (p=0.052, one-tailed, Fisher's exact test). 50% of the players B, who have received the maximum, equalise payoffs, but only 10% of those who

[10] See e.g. BERG, DICKHAUT, and MCCABE (1995) and the video-taped group experiments of JACOBSEN and SADRIEH (1996).

received a smaller, but positive amount, do so. This result is in line with the full trust hypothesis. However, no such difference can be found in the non-binding contract treatment. Here, the corresponding fractions are 46% payoff equalising choices after full trust, and 38% after passing less. The difference is not significant. It is striking that eight of the 28 contract proposals (28.6%) even suggest to player A to pass an amount less than the maximum, which indicates that many players B seem to understand that a player A might not show full trust to an unknown person.

We hypothesise that a player B might use the full trust argument to avoid *cognitive dissonance*[11] arising from selfish behaviour. In the no contract treatment the full trust argument provides a good device to mitigate the inconsistency of returning less than the payoff equalising amount *and* being a fair person: player B can devaluate player A's not passing everything as a signal of distrust, and thereby justify her behaviour to herself. In the treatment with contracts, this opportunity of keeping a fair self-image in spite of acting unfairly is not present for those players B who have themselves suggested a "distrusting" player A action.

IV. Summary

We introduce the moonlighting game in which we integrate opportunities for positively as well as negatively reciprocal behaviour. It turns out that hostile actions are much more consistently punished than friendly actions are rewarded. Punishment is typically performed in a way that both players' payoffs are equal. In the case of positive reciprocity, the picture is ambiguous: many responders return money to equalise payoffs, but a substantial fraction exploits player A's trust and does not return anything. Non-binding contracts encourage player A's trust, but not necessarily player B's reciprocity: the amounts passed rise significantly when a positively reciprocal agreement was settled, but the fraction of players B who exploit player A's trust does not decrease substantially.

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Appendix: The Written Instructions (original text in German)

Information on the Experiment

Procedure

You are participating in a decision making experiment.
By using pseudonyms, it is guaranteed that neither the experimenter nor other participants can discover your identity.
Two participants will be randomly matched. It is also randomly determined, which person of a pair is player A, and decides first, and who is player B, who decides second. To ensure anonymity, player A and player B are in different buildings (canteen building and Juridicum).

At the beginning, both players are endowed with an account with a credit of 12 talers.

First, player B proposes a contract on the actions both players choose at the following decision stages. Player A can either accept or reject the contract. Independently of acceptance or rejection of the contract, two stages of decision are following. Note that both players are not bound by the contract.

At the first stage, player A chooses an action which effects his credit and the credit of player B. His decision will be transmitted to player B.
At the second stage, player B chooses an action which also effects both credits.

The resulting final credits are exchanged by a rate of 0.50 DM/taler and paid off to the participants.

How it is done:

You are **player B!**

Contract Proposal
You will draw an envelope with a pseudonym containing a contract sheet. First, you ought to propose a contract on player A's action and your action at the following decision stages.
At the first stage player A can choose either an action that increases his credit and decreases your payoff by the same amount, or he can choose an action that decreases his credit and increases your credit by the tripled amount.
At the second stage you can either decrease your credit and increase player A's credit by the same amount. Or you can choose an action that decreases your credit and decreases player A's credit by the tripled amount.
Actions that lead to negative credits for one of the players are not allowed.
Check off the actions in the corresponding decision table and put your contract proposal into the envelope. Please remember your pseudonym!

Decision
You will get back your envelope that contains the decision sheet. You will come to know whether player B has accepted or rejected the contract, and what action he has chosen. Now settle your decision by checking off the action in the decision table. Pocket the decision sheet in the envelope. The envelopes will again be collected and your decision will be passed to player A.

On the reverse you find a specimen of the decision table.
If you have any questions, please address them to the experimenter.
Please take care that your pseudonym remains hidden.

Decision Form

Player A's decision on the contract
☐ accepted ☐ rejected

Stage 1: Player A has decided!

Player A has chosen the action checked in the opposite table!

Decision Table for Player A

Contract proposal	**Player A has chosen:**	Account **Player A** Endowment: **12 talers**	Account **Player B** Endowment: **12 talers**
		+ 6	- 6
		+ 5	- 5
		+ 4	- 4
		+ 3	- 3
		+ 2	- 2
		+ 1	- 1
		0	- 0
		- 1	+ 3
		- 2	+ 6
		- 3	+ 9
		- 4	+ 12
		- 5	+ 15
		- 6	+ 18
	Credits after stage 1:		

Stage 2: You decide!

Check the action you choose in the opposite table with a cross and fill in the new credits for both players in the bottom line.

Actions leading to a negative credit for one of the players are not feasible!

Neither you nor player A are bound to the contract.

Decision Table for Player B

Contract proposal	**please check here**	Account **Player A**	Account **Player B**
	☐	+ 18	- 18
	☐	+ 17	- 17
	☐	+ 16	- 16
	☐	+ 15	- 15
	☐	+ 14	- 14
	☐	+ 13	- 13
	☐	+ 12	- 12
	☐	+ 11	- 11
	☐	+ 10	- 10
	☐	+ 9	- 9
	☐	+ 8	- 8
	☐	+ 7	- 7
	☐	+ 6	- 6
	☐	+ 5	- 5
	☐	+ 4	- 4
	☐	+ 3	- 3
	☐	+ 2	- 2
	☐	+ 1	- 1
	☐	0	0
	☐	- 3	- 1
	☐	- 6	- 2
	☐	- 9	- 3
	☐	- 12	- 4
	☐	- 15	- 5
	☐	- 18	- 6
	Credits after Stage 2:		

Voluntary information:

Gender: ☐ female ☐ male

Major: _____

Please fill in the new credits