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An Eye for an Eye – The Study of Negative Reciprocity. Evidence From a Game Show

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Abstract: The proposed research is an attempt to analyse the tendency to take a revenge revealed by the participants in the television program "Ten to One" and its relationship with gender, education, and demographic variables of a player. Choices made by participants consist of indication of a participant who will answer the next question. Since this reduces the ones probability of winning the episode, the feedback can be considered as a negative reciprocity or simply: revenge.

Keywords: gender discrimination, negative reciprocity, reciprocity

JEL codes: C91, D91, J16

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1. Introduction

Bowles et al. (1997) proposed the concept of Homo Reciprocans, which defines an individual that rewards positive behaviour of community members and sanctions those undesirables. In general, reciprocity can affect relationships in groups, by strengthening the norms accepted by the group. Sanctioning undesired behaviours allows members of the group to prevent, or at least limit, its occurrence in the future. The same applies to desired behaviours: by rewarding them the group encourages its members to repeat that behaviour in the future. Willingness to express negative reciprocity may be also perceived by members of the group as an observable characteristic which typically goes along with unobservable personal traits. If these are, for some strategic reasons, favoured in a given environment, then willingness to express negative reciprocity becomes an element of a signalling game. Some researchers (Dohmen et al. 2006) raise the question whether reciprocal behaviour can increase the probability of success or raise one's performance. That could be the case if one belief that he or she can be a target of negative reciprocity if he or she fails or express low performance. Depending on type of occupation it is possible that an employer prefers reciprocal behavioural patterns amongst workers (Akerlof 1982, Bewley 1999) as they allow the employer to easier identify individuals with often non-directly observable, personal characteristics. This can be the case in highly competitive environments or for those occupations which naturally demand willingness to seek power and authority such as high-level managers. As those individuals who are more likely to take revenge tend to be more motivated by abovementioned factors (McKee, Feather, 2008), their attitude toward negative reciprocity may serve as a proxy of desirable and typically harder to observe characteristics. It may also be the case that in some work environments reciprocity is a personal characteristic demanded per se.

However, it could be a hard task, for an outside observer, to identify the patterns of this phenomenon based on observations from, say, corporations and any other real-life environments in which it is the team, which is responsible for complex task realization, not an individual. Unfortunately, on the basis of data from the labour market, it is relatively hard to investigate whether there are characteristics (such as gender, education or origin) that increase the likelihood of desirable behaviours. To overcome this limitation, one can use methods from the field of experimental economics such as laboratory experiment. Attitudes towards positive and negative reciprocity have been verified with the usage of pure experimental methods, like games on public goods (Fehr and Gächter 2000, Carpenter and Seki 2005). Positive and negative reciprocity were also verified in games that simulated employers

and workers relationships where the employer could reward the employee for the desired level of effort or punish him if he was declaring lower effort than desired (Fehr et al. 1997, Gächter and Falk 1998). In experiment modified by Pereira et al. (2006), after observing a pay-for-effort pay, the employee could once again decide on his or her level of effort, followed by a re-decision about the pay etc. In response to high wages, employees declared a level of effort close to theoretical equilibrium of the game, showing little willingness to reciprocate the positive behaviour of employers. Employers, on the other hand, have gradually lowered wages, especially when they did not observe negative reciprocity for some time from the part of the employee. However, over time, the efforts of the employees declined, resulting in negative reciprocity, so that the payouts achieved by the participants never met theoretical predictions of the outcome of the game.

Unfortunately, laboratory experiments have their own limitations. One of the main concerns stressed in literature (Dickhaut et al., 2011) is that the task is often artificial and unfamiliar to participants. Low stakes can potentially have different impact on motivation of participants than a high stake would have. However, using high stake in the lab would be of course inefficient in terms of cost per observation. Another typically mentioned issues with experiments (Longhi et al., 2005) is homogeneity of obtained sample. This is why additional methods can be used to overcome that issue and support conclusions drawn upon the results obtained in the lab. Therefore, in proposed project a dataset based on decisions of participants of a game show will be used. It offers an environment with high stakes and highly diversified sample, especially in terms of age and education. As it bears the burden of non-balanced sample in terms of gender, laboratory experiments will be used, to compensate that.

Even though the existence of negative reciprocity was investigated in some laboratory experiments, it was rarely analysed in multiplayer and sequential games whether there are any factors which might attract decision- makers to pay more attention to an optimal task allocation. An example of such multiplayer and repetitive setting is the game show “Ten to One” (“Jeden z Dziesięciu”). The objective of proposed project is to contribute to understanding of negative reciprocity, in these rarely examined settings. As mentioned above, depending on the situation the negative reciprocity can also serve various purposes. The same rule applies to the case of “Ten to One” (rules of the game are further explained in “work plan” section). In early stages negative reciprocity can be treated as pure manifestation of inclination towards “revenge”. As the game progress, it may become part of player’s strategy of expected gain maximization (for example, by stopping other players from further nominations of an individual recognized

as inclined towards negative reciprocity). The second case may be treated as rational, while the first does not have to be, thus the distinction of these two motivations in theoretical model seems relevant. Using the game as a starting point makes it possible to implement the idea of strategical situation into generalized model of bilateral negative reciprocity. In this project, laboratory experiments will serve as the method complementary to observations collected on the basis of the television game show.

In this project I analyse the behaviour of participants in the game show "Ten to One". This is an innovative approach in several respects. First, to author's best knowledge, this is the first study of negative reciprocity based on game show data. Additionally, it seems that this is the first project of its kind made on Polish data. What's more, using one of the longest-running TV game shows in the world, the horizon of the sample seems to be unprecedented in experimental economics. It could potentially allow you to try to identify changes in the abovementioned behaviour over the past 25 years.

2. Hypotheses

The first stage of proposed research is an attempt to analyse the tendency to take a revenge revealed by the participants in the television program "Ten to One" and its relationship with gender, education and other demographic variables of a player. Choices made by participants consist of indication of a participant who will answer the next question. Since being nominated reduces nominated player's probability of winning the episode, nominating back can be considered as a case for negative reciprocity or simply: revenge. In addition, the results of the behavioural analysis of decisions made by game show participants will be supported by a laboratory experiment (further referred to as Experiment), which will allow for an extension of the analysis of the relationship between demographic characteristics of individuals and the group, individual beliefs and negative reciprocity. Previous research on negative reciprocity (Goodboy, 2012) found that male students were more often expressing negative reciprocity than female students. The gender effect was also confirmed by a meta-analysis of Miller et al. (2008). However, these experiments have been done in rather homogenous and balanced samples. Some work environments might not be so balanced and if males outnumber females, we can suspect that females self-selecting to these environments might differ from a typical or stereotypical female. That aspect is well reflected in game show "Ten to One". Stereotypically, women are linked with such personal traits as orientation towards social relationships, other people and their feelings, impulsiveness, kindness and modesty, while males are perceived as task oriented,

responsible for earning assets, assertive, ambitious and aggressive. Most of these stereotypes are common to many cultures and have deep influence on self-awareness of individuals and their personalities, so males and females may differ also in motivational aspects behind the negative reciprocity (Wojciszke, 2006).

The stereotypes linked with masculinity may promote more strategical usage of negative reciprocity, while those connected with femininity would rather contribute towards vengeful motives than strategical ones. Males could be in that case willing to take revenge if they are disproportionally often nominated, while females may not pay attention to equal distribution of nominations (which can be also interpreted as tasks to solve). Therefore, following hypothesis was formulated:

H1: Negative reciprocity expressed by males is predominantly driven by dissatisfaction with lack of socially optimal allocation, while their female counterparts are more often motivated by personal vengeance.

To further investigate this hypothesis in Experiment (which extrapolates the "Ten to One" game to settings which are not present in the actual game) participants will be asked about their motivations behind particular decisions.

Literature also suggests that gender of revenge matters. Goodboy (2012) states that students of both genders also directed vengeful dissent more towards male instructors than female ones. Also, motivations behind such action might be different between the two genders. Differences in personal traits between genders, such as aggression typically linked with the male gender, depends on the context and situation. According to meta-analysis (Hyde et al., 1990), aggression of males is typically moderately higher than that of females, however it raises rapidly when the intensity of harm was significant and highly painful to the victim. It may result from differences in the process of socialization of boys and girls but can have also evolutionary and social background (Wojciszke, 2006). Due to the "chivalry effect" we can expect males to be less vengeful towards females than other male counterparts, while that effect of gender of the counterpart may not be significant for females. Thus, may cause negative reciprocity also to vary, depending on a context. Therefore, following hypothesis was stated:

H2: Negative reciprocity of males towards males is driven more with vengeful motives than the negative reciprocity of males towards females is.

In order to test these hypotheses, the dataset originating from game show "Ten to One" and Experiment will be used for conducting the empirical analysis.

3. Methodology and data analysis

The Polish version of "Fifteen to One", locally known as "Jeden z Dziesięciu" is a highly successful game show, on air continuously since 1994. The rules are essentially analogous to the UK original, except that only ten contestants are involved. Standing behind randomly allocated, consecutively numbered lecterns forming a semicircle, they are asked a number of trivia quiz questions. Each incorrect answer (or no answer at all within three seconds) means losing one of the "lives"; a contestant with no lives left is eliminated from the show. The game proceeds in three rounds. The first one involves no strategic decisions – contestants are asked two questions each and have to answer at least one of them correctly to proceed to Round 2, where they retain two or three of their initially assigned lives. Round 2 starts with Contestants 1, 2, 3 etc. each being asked one question. However, as soon the first correct answer is given, often by Contestant 1 (or C1 for short) already, the players start nominating one another to answer the next question. The contestant who gave the last correct answer is always the one to nominate. For example, if C2 nominates C4 and she fails to answer, C2 nominates again (possibly C4 again if she is still in the game). Round 2 ends when only three players are left standing. These three start Round 3 with three lives each, no matter how many they had left after Round 2. The first questions in this round are answered by whoever is the first one to push their buzzer upon hearing the question. Players start nominating only once one of them has answered three questions correctly. In this round, unlike in Round 2, contestants sometimes nominate themselves, because a correct answer yields 20 points after self-nomination (provided at least one other contestant is still alive) and only 10 points otherwise. Players also receive a small tie-breaking bonus equal to the number of chances they had after Round 2 plus the number of chances they have after Round 3. The round ends after 40 questions or (more often) as soon as all contestants lose all their lives. In the former case the high scorer among the survivors (not necessarily having the largest number of lives left) is the winner. If all contestants have been eliminated, the last survivor is the winner (even if his or her final score is lower than that of somebody eliminated previously). The winner typically earns 3,000 PLN (ca. 700 euro), which is just shy of mean gross salary, and a weekly stay in a luxurious hotel. The number of points the winner ends up with is also relevant, because only 10 top scorers in a series of 25 consecutive shows qualify to the Grand Finale, which follows the same rules, except that the value of the prizes is as high as 50,000 PLN.

Because players reveal, among others, information about their education, interests, profession or city of origin, these features can be used to broaden the analysis of a relationship with the likelihood that negative reciprocity will occur. The database consists of 177 episodes were aired between 1994 and 2024 which translates into more than 9000 decisions taken by players (within maximum 10 alternatives to choose from. Precise number of alternatives depends on the number of players still participating in the game).

According to Krawczyk and Starzykowska (2017), if a player is in a relatively bad strategic situation (having a poor record so far), she or he should rather focus on survival, i.e. nominate rather weak players. The better one's relative situation, the more one can afford to nominate strong players to eliminate them and qualify to Round 3 with the weak ones. Therefore, if in abovementioned situations player decides to play tit-for-tat against their strategic interest (i.e. weak player nominates back a strong one, or a strong one nominates back a weak one), that form of negative reciprocity can be treated as personal vengeance. The question which may arise is whether the participants perceive nominating back as a vengeance. Judging from players' comments such as "if you're looking for a war, you'll find it" occasionally uttered in such situations, the answer is yes. Belief that participants perceive nominating back seems therefore justified.

The game show allows to control whether the composition of the group (i.e. the percentage of men and women in the group) is affecting the scope of negative reciprocity only to some extent. However, since there are no episodes where women were a majority of the group, it would be necessary to use a laboratory experiment to correctly analyse the influence of the composition of the group on the behaviour of the players. Likewise, as the age of the participants is not public information at the game show, its impact can be only tested in laboratory conditions. An answer to that issue is therefore Experiment 1. In Experiment 1 subjects will face open-ended questions in a game of similar design that is present in the game show. In order to correctly establish a level of similarity of decisions made in the laboratory to those observed in "Ten to One" some sessions will repeat the gender-composition of the group observed in episodes included to the database. Further sessions will be performed within gender-balanced or female-dominated groups. In each session participants will differ in terms of age, education and profession. In treatment sessions investigating the effect of age, the age of participants will be revealed before the game, while in the rest it could only be deducted from physical traits of participants.

4. Data analysis

The mixed logit model corresponds to the repetitive character of the game and allows the heterogeneity of the participants' preferences. Contrary to the linear models, it is possible to consider the fact that each of the decision makers is actually making a series of decisions. These decisions may in fact be linked to a logical sequence of some sort, and an attempt to analyse them as separate and independent decisions may lead to distortions of the observed phenomenon (Jaeger, 2008).

The results obtained with the mixed logit model in STATA enabled to see that there are differences between men and women in their tendency to take revenge. The table below presents the marginal effects of initial models.

Table 1: Impact of decision maker's gender on negative reciprocity revealed in choices of contestants of "Ten to One" game show[1]

Variable \ Specification	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**
ROUND 2					
Instant revenge	0.008***	0.004***	0.002**	0.003**	0.003**
Instant revenge * female nominates		0.001***	0.002**	0.002**	0.002*
Revenge taken later			0.002	0.001	0.001
Revenge taken later * female nominates			0.005*	0.003*	0.003*
Opponent is the only female					-0.007*
N	**64 580**	**64 580**	**64 580**	**64 580**	**64 580**
ROUND 3					
Instant revenge	0.027***	0.024***	0.014***	0.015***	0.017***
Instant revenge * female nominates		0.011	0.000	0.001	0.000
Revenge taken later			0.036***	0.023***	0.029***
Revenge taken later * female nominates			0.003**	0.008**	0.017**
Opponent is the only female					-0.002
N	**35 914**	**35 914**	**35 914**	**35 914**	**35 914**
ENTIRE GAME					
Instant revenge	0.051***	0.049***	0.033***	0.034***	0.037***
Instant revenge * female nominates		0.047***	0.022*	0.022*	0.023*
Revenge taken later			0.009*	0.008*	0.008*
Revenge taken later * female nominates			0.012***	0.012*	0.009*
Opponent is the only female					-0.008*
N	**100 494**	**100 494**	**100 494**	**100 494**	**100 494**

Legend: * p < .1; ** p < .05; *** p < .01

[1] In specification 4, the influence of education on the probability of nominating a player was also controlled. In specification 5, the influence of the size of the city from which the potential player comes was controlled for. All additional variables turned out to be insignificant. These variables, however, were not considered in the context of the hypothesis of negative reciprocity and were therefore omitted.

The fact that the nominating player was nominated in the previous question by a given potentially nominated player (the instant revenge variable equals 1 if so, 0 otherwise) leads, in the estimations done for Round 2, 3 and the entire game, to an increase of probability of nominating back as soon as opportunity arises. Moreover, in the estimations for entire game, the interaction of the variable encoding described situation with the gender of the nominating player was also statistically significant (the female nominates is equal 1 if nominating player is women, 0 otherwise). Positive estimates for interactions in estimations for Round 2 suggest that women participating in "Ten to One" game show were slightly more likely to take immediate vengeance (negative reciprocity) towards a player who nominated them than men. That effect is not visible for estimations run solely on choices made in Round 3. However, running estimations on entire sample of choices made of contestants (i.e. for entire game) we see increase in probability of expressing negative reciprocity at very first opportunity for females. That may stem from the fact that mixed logit model allows to take into account entire choice history with respect to participant effect. Number of females in Round 3 may have been too low in the game show to see the effect of gender of decision maker in estimations on that subsample, but choices expressed in Round 3 of participating females were enough to reinforce the argument that females in the show were more likely to express negative reciprocity in immediate reaction to being nominated. In the initial model (specification 5), the probability that a woman will express negative reciprocity was higher by 6 p.p., while for men the probability of this event was only raised by 3.7 p.p. Interestingly, negative reciprocity expressed in later choices (i.e. not only immediately after being nominated) was significant only for females.

The game show also allows to control whether the composition of the group (i.e. the percentage of men and women in the group) is also affected by the negative reciprocity. Since there are no episodes where women accounted for the majority of the group, it would be necessary to use a laboratory experiment to complement the effect of the composition of the group on the behaviour of the players.

As for the participants of laboratory experiment which was mimicking the conditions of "Ten to One" game show The fact that the nominating player was nominated in the previous question by a given potentially nominated player, in the estimations done for Round 2, 3 and the entire game, leads again to an increase of probability of nominating back as soon as opportunity arises. Positive estimates for interactions in estimations for Round 2 suggest like in case of the game show, that females were slightly more likely to take immediate vengeance

(negative reciprocity) towards a player who nominated them than men. Choices expressed of participating females were enough to reinforce also in laboratory conditions the argument that females were more likely to express negative reciprocity in immediate reaction to being nominated. In the initial model (specification 5), the probability that a woman will express negative reciprocity was higher by 6.2 p.p., while for men the probability of this event was only raised by 3.9 p.p. Interestingly, negative reciprocity expressed in later choices (i.e. not only immediately after being nominated) was significant only for females. One has to note, that results obtained in laboratory experiment show lower level of significance, then in case of estimations run on database of choices made in a "Ten to One" game show, which may be the result of smaller sample.

Table 2: Impact of decision maker's gender on negative reciprocity revealed in choices of participants of laboratory experiment based on TV game show "Ten to One"

Variable \ Specification	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**
ROUND 2					
Instant revenge	0.006***	0.003***	0.002**	0.003**	0.003**
Instant revenge * female nominates		0.001*	0.001*	0.001*	0.001*
Revenge taken later			0.002	0.001	0.001
Revenge taken later * female nominates			0.003*	0.002*	0.002*
Opponent is the only female					-0.010*
N	**10 980**	**10 980**	**10 980**	**10 980**	**10 980**
ROUND 3					
Instant revenge	0.010***	0.018***	0.012***	0.012***	0.012***
Instant revenge * female nominates		0.011	0.000	0.001	0.000
Revenge taken later			0.029**	0.018**	0.018**
Revenge taken later * female nominates			0.002**	0.006**	0.009**
Opponent is the only female					-0.008
N	**6 118**	**6 118**	**6 118**	**6 118**	**6 118**
ENTIRE GAME					
Instant revenge	0.049**	0.044***	0.039***	0.039***	0.039***
Instant revenge * female nominates		0.047***	0.022*	0.022*	0.023*
Revenge taken later			0.008*	0.006*	0.006*
Revenge taken later * female nominates			0.011**	0.011*	0.008*
Opponent is the only female					-0.011*
N	**17 098**	**17 098**	**17 098**	**17 098**	**17 098**

Legend: * p < .1; ** p < .05; *** p < .01

As for the participants of laboratory experiment which was mimicking the conditions of "Ten to One" game show. The fact that the nominating player was nominated in the previous question by a given potentially nominated player, in the estimations done for Round 2, 3 and

the entire game, leads again to an increase of probability of nominating back as soon as opportunity arises. Positive estimates for interactions in estimations for Round 2 suggest like in case of the game show, that females were slightly more likely to take immediate vengeance (negative reciprocity) towards a player who nominated them than men. Choices expressed of participating females were enough to reinforce also in laboratory conditions the argument that females were more likely to express negative reciprocity in immediate reaction to being nominated. In the initial model (specification 5), the probability that a woman will express negative reciprocity was higher by 6.2 p.p., while for men the probability of this event was only raised by 3.9 p.p. Interestingly, negative reciprocity expressed in later choices (i.e. not only immediately after being nominated) was significant only for females. One has to note, that results obtained in laboratory experiment show lower level of significance, then in case of estimations run on database of choices made in a “Ten to One” game show, which may be the result of smaller sample.

5. Conclusions

The Hypothesis 1 was tested based on the decisions of participants in the game show "Ten to One" and participants in Experiment. For male participants in the game show "Ten to One" the probability of nominating a participant increased by 3.7 percentage points if the participant nominated the decision maker immediately before they had the opportunity to give feedback. For female decision makers, this probability increased by 6 percentage points if they received direct feedback. The parameter increasing the probability of negative reciprocity in subsequent decisions than direct retaliation was significant only for female decision makers, indicating that being nominated earlier by another participant is also important for them in subsequent decisions, whereas for men, its influence is observed only in direct feedback. However, the parameter indicating the connection between the frequency of being indicated by another participant above the random one was significant in the game show "Ten to One" at the significance level of $p<0.1$ only in the case of men, but its influence on increasing the probability of indication was only 0.5 p.p.

This Hypothesis 2 was verified based on an examination of participants' decisions in the game show "Ten to One" and Experiment, which supplemented the game show data sample with features not observed in the game show environment, specifically a greater proportion of women in the group in which the interaction took place. In the case of the game show "Ten to One" the probability of negative reciprocity in direct feedback decreased by 0.8 percentage

points if the participant toward whom negative reciprocity could be expressed was the only woman who started the game in each group and was insignificant if there were more than one woman among the ten players starting the game. In Experiment, which imitated the game show "Ten to One" the probability of negative reciprocity expressed toward a woman was 1.1 percentage points lower than toward a man, regardless of the number of women who started the competition in the group.

6. Possibilities for further validation of results

Because in the case of using a data source of such type, the researcher has no influence on the design of the game itself, laboratory economic experiments may be complementary tool, allowing for broadening the analysis of conditions that could potentially modify the behaviour of individuals, which were not observable during the game show. In addition, laboratory confirmation of the results obtained from empirical analysis provides additional validation of the conclusions.

As in laboratory Experiment, the rules were mimicking those of the original game show, the database allows for further investigation on the impact of group composition on reciprocity and performance under pressure. Questions used in the Experiment were randomly drawn from episodes of “Ten to One” covered into original database for this study. That allows to compare how the performance and negative reciprocity differed in similar game conditions between participants of laboratory experiment and game show, as there is a risk, that participants of game show might be more risk-seeking and competition oriented than participants of laboratory Experiment.

The database from the Experiment unlike the observations from the game show accounts also, among others, aversion to inequality and social justice. As Eisenberger et al. (2004) pointed out that the tendency for negative reciprocity can be linked to individual beliefs about other people's attitudes and character traits, database from the Experiment leaves a space to further investigate that topic in relation with choices made by laboratory experiment participants within the scope of negative reciprocity. From the job market point of view such knowledge may improve working environment, by selecting candidates with highest potential probability of representing preferred behaviour patterns.

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