Trust and Trustworthiness as a Behavioural Social Norm[1]

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Trust and Trustworthiness as a Behavioural Social Norm. We present the results of a trust investment game performed with university students in Slovakia. We discuss the social norms of the participants of our experiment, notably the notions of trust and reciprocity. By analyzing the one-shot version of the game, as well as the case of a repeated game with unspecified number of repetitions, we also show a dependence on outcome of the prior rounds (hence the learning effect) and provide a possible explanation for the choice of behaviour strategies observed in our sample.
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Introduction

The development of behavioural economics showed results indicating that trust could in general present a factor explaining some phenomena in behaviour of economic subjects that still lack a generally accepted theory. The trust game is one of the most frequently discussed experimental methods considered in this respect. In the last two decades, a large number of highly acclaimed experiments based on the trust game have been conducted.

Trust, as a social phenomenon, is used to explain the level of the economic well-being in particular countries. Fukuyama (1995) stated that the trust between people within a society represents social capital, which is the main factor of economic development. This is the so called „Fukuyama Conjecture". It was supported by some experimental results (e.g. for a comparison of Indian and Swedish experimental results, see Ahmed – Salas 2008), but was not so obvious in another (comparing Swedish and Tanzanian experiments; Holm – Danielson 2005). Csukás et al. (2008) made an intercultural trust comparison including several countries. Based on the experimental results, it is clear that the intercultural differences, as well as the differences based on the different stage of economic development are not the only particular factors affecting the trust level.

In some deductive approaches to this problem, there has been a shift from the assumption of "rational behaviour", or "self-regarding model of preferences" (which have roots in Game Theory) towards "other regarding

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model of preferences". This model considers the level of individual wellbeing to be influenced by the wellbeing of others (see Fehr – Schmidt, 1999 or Cox et al. 2008). The reason for this is given by the existence of altruistic motives and reciprocity in human individual behaviour. The difference between reciprocity and altruism is based on the reaction of the other player. In the case of altruism, a positive reaction to one's actions (e.g. those beneficial to others) is neither expected nor provided. On the other hand, reciprocity is ultimately based on the expectation of positive (negative) reaction of the partner. According to its nature, positive and negative reciprocity is distinguished.

Accepting the importance of trust in economic development, many theorists try to find significant factors influencing it. The search for such factors has become a subject of multidisciplinary research. Gender trust motives were discussed by Cox and Deck (2006), Greig and Bohnet (2005) and others. Fershtmanand Gneezy (2001) investigated ethnic discrimination in the trust games in Israeli society. The influence of prior communication on the trust building was discussed by Ben-Ner and Putterman (2009). Engelmann and Fischbacher (2009) and Coricelli et al. (2006) analyzed various aspects of information asymmetry in trust games. Takahashi et al. (2006) found a relation between personal physical attractiveness and trust. In her dissertation thesis, Stanton (2007) showed the influence of the different hormonal concentrations in a brain on the generosity of the players.

There is a relatively large space for research that deals with the pre-experiment trust attitudes and trust strategies in real experiments. Somewhat surprisingly, the analysis of attitudinal and behavioural data discovered that attitudinal measures are not related to trust, but to trustworthiness (Glaeser et al. 2000; Lazzarini et al. 2004). On the other hand, Fehr et al. (2003) showed that under certain circumstances, attitudinal trust can also be used as a predictor of trust.

There is also a general proposition claiming that the reduction of the social distance among subjects increases trust. In trust experiments, this has mostly been tested either by enlarging or reducing the anonymity in participant interactions (e.g. Homan et al., 1999). Tests conducted in slums (Binzel and Fehr, 2010) showed only limited validity of this proposition.

Trust in sociological literature

Trust is presented as a research subject in a list of cited papers. Torsello (2008) presumes that high degrees of trust promote economic progress, whereas low degrees of trust are reflected in corruption, clientelism and are harmful to society. Thus, trust seems to be crucial in the set-up of democracy. Čermák and Stachová (2010) attribute existence of trust to common social norms and values. Vašečka (2007) considers two levels of trust. The first one is a vertical

trust; toward institutions and the second one is horizontal trust, toward others individuals. Horizontal trust is in a high degree the result of psychological mechanism of self-projection, meaning that if one considers himself as unselfish, willing to help and honest, he will treat others in same manner. Beck (1999) deems that trust is one of the possible ways of risk reduction in society. Trust can clear down casualness of the world we are living. Garfinkel (1963) presume that in case when trust is offered, it is generally expected in return and that trust is an instrument used to define ones relationship to others. He also perceives trust as the virtue used to the benefit of all parties involved in action. Tokuda et al. (2008) analyze interpersonal trust influence on quality of life. They distinguish three types of trust: trust in people, trust in human fairness and trust in human nature. Upon their study, all three type of trust have impact on quality of life. Zaheer et al. (1998) indicate that trust influences the knowledge sharing effectiveness and actions coordination in management. King (2000) points out trusts effect on teamwork. Sato (2002*)* argues that trust can be affected by economic status of interacting parties. Gibbons (2001) also mentions calculative trust as a possible origin of trust. Deutsch (1960) find out that more someone trusts, more trustworthy he is and vice versa. Moreover peoples with authoritarian tendencies are more suspicious and untrustworthy. Gurtman (1992) find out that interpersonal trust is distinct from exploitability and gullibility. Gurtman also suggest that extreme distrust is related to distress.

The Berg trust game

Berg et al. (1995) introduced an experiment, which serves as a benchmark to many other trust games. All participants in Berg's experiment were matched to create pairs and were given some initial amount of money (endowment). First player played the role of trust or (also called „the 1-st mover", „sender") and the second player acted as trustee (called „the 2-nd mover", „receiver").The experiment has a form of a one shot sequential game. The first mover sends X monetary units (a part of his endowment) to the second player. The experiment organizer triples the money sent and the second mover receives $3X$ monetary units. Afterwards, the second mover sends an amount (Y monetary units) back to the first mover. This ends the game, leaving the first player with (Endowment $- X+Y$) monetary units and the second player with (Endowment $+3X-Y$) monetary units. The sum received by the second player ($3X$) is thus divided into the income of the sender (leading to a net profit or loss of $Y-X$) and income of the receiver ($3X-Y$, which is also the profit for the second player).

If the players were playing according to the rational (Nash equilibrium) strategy, the sender would choose $X=0$ on the assumption, that a profit maximizing receiver would play his dominant strategy and return $Y=0$ for any positive amount X. Despite of this rational solution to the problem at hand, the

experimental results of previous research, as well as our own results indicate that a majority of the players rejects this form of strategy, and both players regularly send positive amounts of money.

The above described experiment has a strong economic background. Amount of money sent by the sender (X) can be interpreted as sender's investment. The multiplication of the money sent ($3X$) models the situation of investment return. This return is being divided by the receiver (economic agent –a manager, government, etc.) between sender (investor) and himself. From this point of view, the existence of trust enables investment growth in a society. Fair division of the investment return plays also a role in motivation towards further investments.

In our analysis, we call the money amount sent (X) „trust", and the ratio Y/X „trustworthiness". Some previous research in the developing countries showed the players to act according to a balanced form of reciprocity, keeping the trustworthiness Y/X constant. On the other hand, in developed countries, the players respect the conditional norm of reciprocity, where trustworthiness Y/X increases with trust X (see Holm – Danielson 2005).

Focal strategies

The strategies that are most likely to be played by people without previous communication are called „focal strategies"(Schelling, 1980). These strategies are not necessarily equilibrium strategies, but do represent choices that the players may find attractive or – in the context of trust –ethical or just. Within these strategies, the players are approaching a particular standard level of trust/trustworthiness dictated by social norms in their society. In our paper, we recognize the following focal strategies, characterized by trustworthiness:

1. Rational strategies –if the sender believes that the receiver does not return anything, the sender sends a zero payment (X=0). Afterwards, the receiver reacts to the zero sender payment by zero return (Y=0). This kind of behaviour is typical for risk avoiding senders and for low confidence between players. Players taken o risk and achieve zero capital gain.
2. Cheating – the sender pays strictly positive amount to the receiver, but the receiver returns nothing or less than amount received (thus, $Y/X<1$). When playing this kind of strategy, the sender even loses a part of his initial endowment.
3. Reservation strategy –the sender sends positive amount to the receiver and the receiver returns precisely the same amount back to the sender ($Y=X$), keeping the rest ($2X$), so that the trustworthiness ratio Y/X equals 1. This way, the receiver takes the whole capital gain. This kind of receiver behaviour does not motivate the sender, and, from the long-term point of view, sender could prefer the rational zero payment strategy. This strategy is particularly of

interest, because it allows the receiver to avoid the feeling of stealing from the sender, as all of his money is returned back.
4. Surplus split strategy – the receiver splits the sum he obtained (3*X*) to two equal parts, returning one and keeping the other. The trustworthiness is in this situation equal to 1.5. As in this case the receiver splits the sum in half, its preference may correspond to the perceived fairness by the receiver.
5. Equity split strategy – the receiver splits the total equity of both players into two halves. This implies the resulting trustworthiness value of 2– the receiver sends back the amount 2*X*. By doing so, the receiver returns the amount originally offered by the sender, restoring his initial endowment. The remaining 2*X* are then divided equally between the two players. In the end, the total equity is therefore again divided among the players equally.

Design of experiment

The experiment was carried out by 34 pairs of students of Technical University of Košice and University of Economics in Bratislava. Participants had not previously participated in any economic experiment and each of them was endowed with 100 fictive Monetary Units (1MU≈$0.05). The amount of endowment was common knowledge.

In the beginning of the experiment, the participants were randomly divided into 2 anonymous groups of senders and receivers, so that no player had knowledge of the pairing and hence the opponent. All participants were asked to read the instructions for the game. The supervisor asked the participants whether they understand their instructions. Participants could in case of misunderstanding ask questions, so that every player was certain about the rules and the course of the game.

At the first stage of the experiment, senders filled in a card, indicating the amount of money sent to the receiver (*X*). At the same time, receivers filled in their own cards with their a priori expectations about the money they will be sent by the senders ($E_Y(X)$). Afterwards, the playing cards were collected and the supervisors calculated the amounts of money available for receivers (Endowment + 3*X*).

Next, the playing cards were distributed to players for the second stage of the experiment. Here the senders filled in their expectations about money returned by receivers ($E_X(Y)$). Meanwhile, the receivers filled in the real amounts they sent to the senders (*Y*). The supervisors recollected the playing cards and calculated the final profit for each participant. Every player then received information about his final amount of money in the game.

The entire process was treated as a one-shot game. The participants were informed that the game ends after the receivers made their choice. However, after finishing one round of the game, the participants were told that one more

round will be played, with the same rules as before. Thus, the initial endowment was again set to the same level as in the first round (the sum of money was the same, independent of the results of round one). The only additional information given to the players was that they were having the same opponent as in the first game. The roles within each pair remained the same. The participants were not informed whether this was the last round or not. A total of five rounds were played within our experiment.

At the end of the final round, the participants were asked to answer a questionnaire. Here, the particular questions were motivated by several studies regarding the socio-economic factors influencing trust. The surveys include the study of Dufwenberg and Muren (2002) who experimentally examined the role of social distance and gender in demonstration of generosity behaviour. Bornhorst, et al. (2010) observed the pattern where participants tend to trust those they trusted before and who trusted them. Houser et al. (2006) and Bohnet and Zeckhauser (2003) investigated the relation between trust and risk attitudes. The economic background of the participants regarding their trust and trustworthiness attributes was examined by Brülhart and Usunier (2008).

The questionnaire contained questions regarding participants gender (bivalent variable *Gender,* 0 – male, 1 – female), number of siblings (integer variable *Num_Siblings*), risk aversion (3 degree ordinal variable *Risk_Av*), participant´s attitudes toward hazard (5 degree ordinal variable *Hazard*), sympathies toward classmates (5 degree ordinal variable *Sym_Class*), their sentiments about collective (5 degree ordinal variable *Sen_Coll*), trust toward society (5 degree ordinal variable *Tru_Soc*), total trust in someone (bivalent variable *Tru_Som, 0 – yes, 1 - no*), total mistrust in someone (bivalent variable *Mist_Som, 0 – yes, 1 - no*), point of origin (3 degree ordinal variable *Poi_Ori* measuring the size of the town where the participant is living), monthly revenue (cardinal variable *Mon_Rev*).

After finishing both the experiment and the questionnaire, the participants were paid proportionally to their final equity obtained in all rounds ($ 6,95 per student on average).

Analysis of the first round – the one shot game

We compare our experimental results with the best known and cited experiments (Berg – Dickhaut – McCabe 1995, hereafter abbreviated as BDM; Holm – Danielson 2005, abbreviated as HD; Cox 2004) that were performed with the university students as well. Despite the small observation samples, some similar patterns of the experiments participants' behaviour were observed. This discussion is of importance for identification and explanation of different receiver behavioural norms. As the participants in our experiment

were not informed about the plan to play multiple rounds, the results from our first round are fully compatible to the results of the previous studies.

The first movers in our experiment have sent on average 39 monetary units (MU), that is, 39 % of the initial endowment. The second movers paid back 59 MU on average (151 % of the amount received). Four senders (13 %) sent nothing, and four sent the full amount of their endowment (100 MU). The modal payment was 30MU sent by 11 senders (32 %) – see Fig.1.

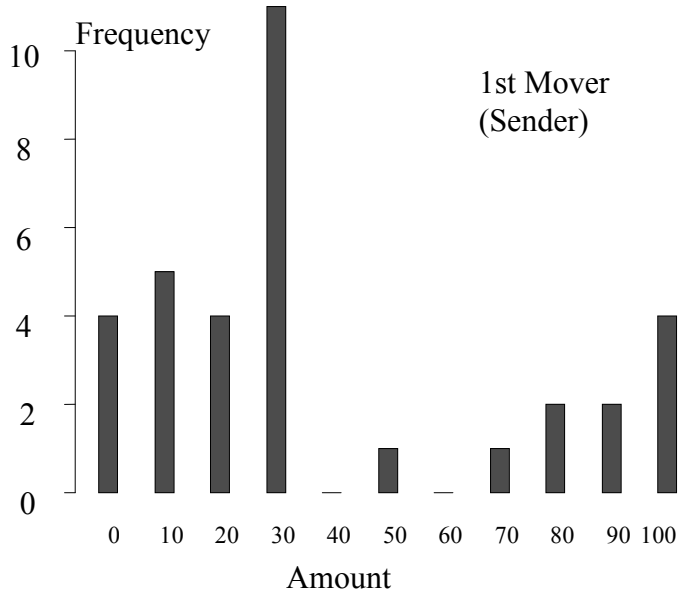

Fig. 1: **Distribution of money sent**

If we analyze the results in the context of the experiments given in Table 1, the following is facts are of interest:

Tanzanian 1-st movers sent 53 percent of their endowment, which was the second highest ratio of all experiments analyzed. This fact contradicts the Fukuyama conjecture. Surprisingly, only 2 percent of the Tanzania players played the most secure strategy – sent nothing, which was by far the smallest ratio of all analyzed experiments. On the other hand, this experiment recorded also the smallest share of the full trust of senders (9 %), who were sending their whole endowment. Therefore, the players from a developing country avoided extreme behaviour.

Table 1: **Comparison of the Slovak experimental results with other experiments**

	BDM (US)	Cox (US)	HD (Sweden)[4]	HD (Tanzania)[4]	Our experiment
Number of pairs	32	32	55	100	34
Endowment	$10	$10	About $22	About$3	About $5
Average payment from the sender	52%	60 % [3]	51%	53%	39%
Trustworthiness (Y/X)	90 [1]	84 [3]	105	111	155
Full trust (1-st mover sent the whole endowment, in %)	16	41	18	9	12
Rational strategy X=0, Y=0 (in %)	6	19	3	2	12
Cheating Y/X < 1 (in %)	44	44	30	33	15
Reservation strategy Y/X = 1 (in %)	9	6	24	21	12
Surplus split strategy Y/X = 1.5 (in %)	13	3	18	7	6
Equity split strategy Y/X = 2 (in %)	16	13	10	13	30
Correlation (Y/X,X)	0.01[2]	-0.06[3]	0.394***	-0.036	-0.048

[1] Berg et al. (1995) did not introduce the mean return. We estimated it after analyzing Fig. 2 (p. 130), which represents the payments of all sender-receiver pairs.

[2] Berg et al. (1995) calculated a Spearman rank correlation coefficient without reporting its significance level. Holm and Danielson (2005) did not specify the type of the correlation coefficient used. In the Slovak experiment, we applied Pearson correlation coefficient because of the absence of the data outliers and higher correlation test power.

[3] Characteristics were estimated from Fig. 1, p. 271 of the original paper. Our estimated Pearson correlation coefficient was statistically insignificant.

[4] Holm and Danielson (2005) did not introduce the exact numbers regarding particular strategies. Therefore, we decided to estimate them by analyzing Fig. 1 (p.517) and Fig. 4 (p. 523).

The experiment of Cox was characterized by extreme behaviour in his group of American students. 19 % of them played the rational strategy and 41 % of the senders sent the whole endowment. From this point of view, this behaviour followed an opposite pattern to the behaviour of the Tanzanian students.

Slovak senders behaved conservatively. They have sent only 39 percent of their endowment on average (this share exceeded 50 % in all other experiments). On the other hand, the receivers getting small amount of money demonstrated the highest level of average trustworthiness (155 %).

The statistically significant positive correlation of trust (X) and trustworthiness (Y/X) characterizing the possible conditional form of reciprocity was recorded only in the Holm and Danielson (2005) experiment.

When comparing the prevailing strategies, receivers preferred cheating (BDM, Cox – 44 %, HD Sweden – 30 %, HD Tanzania – 33 %). Nevertheless, the Slovak case (15 percent) is the only exception. Slightly lower share of cheating receivers in the case of HD experiments (if comparing to the BDM and Cox results) was fully compensated by reservation strategies achieving 24 and 21 percent share. In most cases, this fact eliminated the capital gain income for the senders (BDM in 59 %, Cox in 69 %, HD Sweden in 57 %, HD Tanzania in 56 % of cases). The Slovak experiment was not the only one, where the zero capital gain of the senders (in 39 % of cases) did not overcome the 50 % share.

The above showed contradictions to the generally accepted Fukuyama Conjecture. Cox (2004), Berg et al. (1995), Holmes and Danielson (2005) did not analyze the strategies, which fully eliminate the capital gains for the senders. According to the experimental results, the cheating strategies share was higher in the US (44 %) than in Tanzania (33 %) and in Slovakia (15%), respectively. The share of cheating strategies in Sweden experiment was roughly the same level as in Tanzania (30 %). That is why considering the trustworthiness as a continuous variable describing smooth change in the agent behaviour could be misleading. On the contrary, attention should be focused on the standard strategies and particular social norms/groups characterizing these strategies.

Rational strategy players

The focal point of the rational strategy is fully determined by the sender. If the sender expects the receivers to behave rationally (returning nothing), than the similarly rational choice is to send a zero amount to the receiver. If the sender chooses to send zero monetary units, it is still possible for the receiver to return a nonzero amount, depleting the initial endowment, but such behaviour is

irrational in a sense that it defies the primal objective of the game. We do not pursue the analysis of such behaviour.

This rational strategy was expected to be played by the players with no trust in their anonymous partners. To identify the characteristics of the rational players group, we quantified a log it model identifying the factors significantly contributing to the probability of choosing this strategy.

According to the results given in Table 2, the *Gender* and *Sen_Coll* (sentiments about the study group) are significant in explaining the rational strategy behaviour. Being a woman decreases the odds of playing the Nash equilibrium strategy vs. playing another strategy by factor 0.15 [=exp(-1.8911)]. On the other hand, each grade on the *Sen_Coll* scale decreases the odds of playing the rational strategy by factor 0.17 [=exp(-1.7230)]. These facts confirmed women being more trusting and the fact that trust increases within the social group with the good relations.

Table 2: **The logit model of rational strategies**

Dependent variable – indicator function of sender choosing a zero amount	
Gender	-1.8911 **
	(0.7878)
Sen_Coll	-1.7230 *
	(1.0166)
Mist_Som	-2.0323
	(1.3475)
MF R^2 =0.23	

Note: Standard errors of the coefficients are in parentheses. We started with parsimonious model containing all independent variables. According to the statistical significance of the Wald test, we excluded non-significant variables. (*, **, *** denotes 10%, 5% and 1% level of significance)

Trustworthiness in the Slovak experiment

In the analysis of our experiment, we excluded the rational behaviour pairs to avoid indefinite trustworthiness (in this case the denominator of *Y/X* would be zero).

In our experiment, the average trustworthiness was 1.55, which approximates the „surplus split strategy“. On the other hand, the modal trustworthiness of 2 was recorded by 10 pairs, which corresponds to „equity split” strategy. This result can be interpreted as the predominance of the so called *other regarding preferences* (seen in deductive reasoning made by Cox et al., 2008, p. 35-36). One player returned the total amount received, which resulted in the trustworthiness of 3. Five receivers cheated and did not return even the amount the first mover sent. The trustworthiness descriptive statistics

showed that the majority (70 percent) of the second movers have had the ratio larger than 1, which lead to positive returns for the senders. The frequency distribution of the trustworthiness is given in Fig. 2. Eyeballing Fig. 3 and Fig. 4, we come to the conclusion that the conditional reciprocity behaviour was not recognized by the participants in general. The Slovak participants have made their choices consistently with the balanced norm of reciprocity. If comparing the payment behaviours of the senders and receivers, we should conclude that the receivers have positively reacted to the money received by senders (see Fig 4).

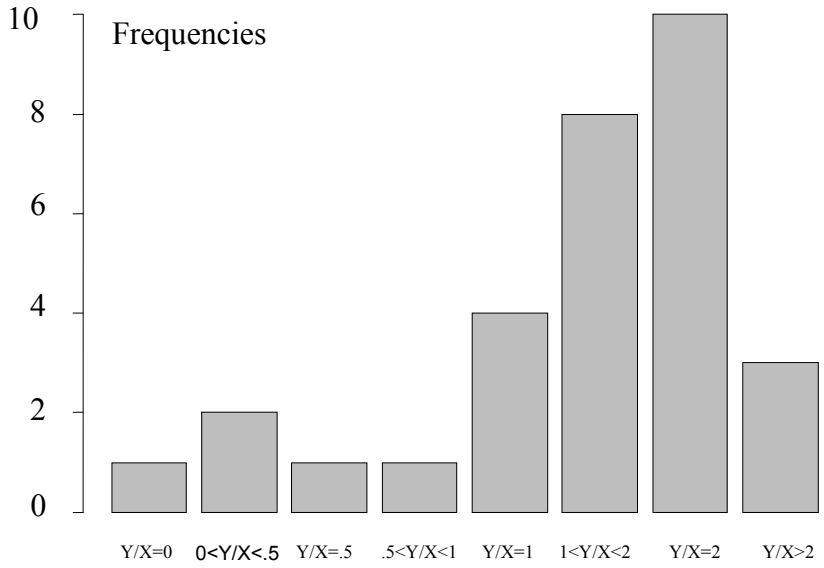

Fig. 2: **Trustworthiness distribution**

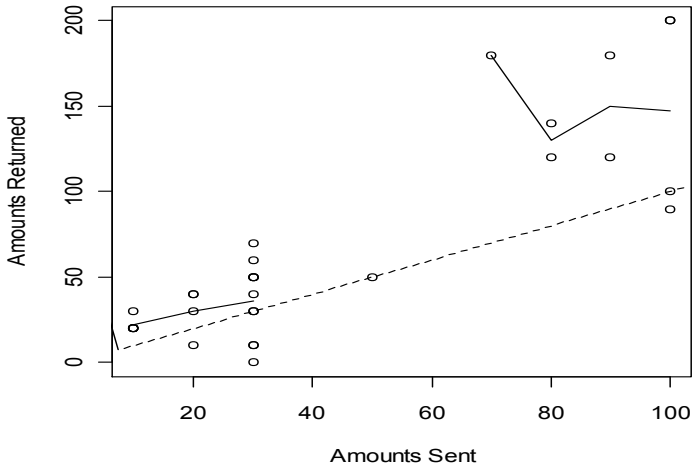

Fig. 3: **Amounts sent and amounts returned by „non-rational“ players of the Slovak experiment**

Note: Dotted line denotes the minimum acceptable receiver‘s repayment level to accept the balanced reciprocity norm of behaviour (*Y=X*); solid one line average amounts returned respecting the amounts sent.

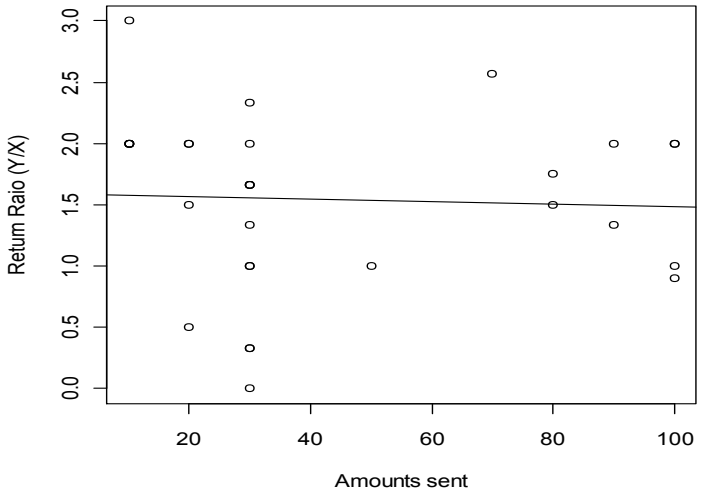

Fig. 4: **Trustworthiness ratio and amounts sent. Regression line fitting both variables has statistically insignificant negative slope (p-value 0,803)**

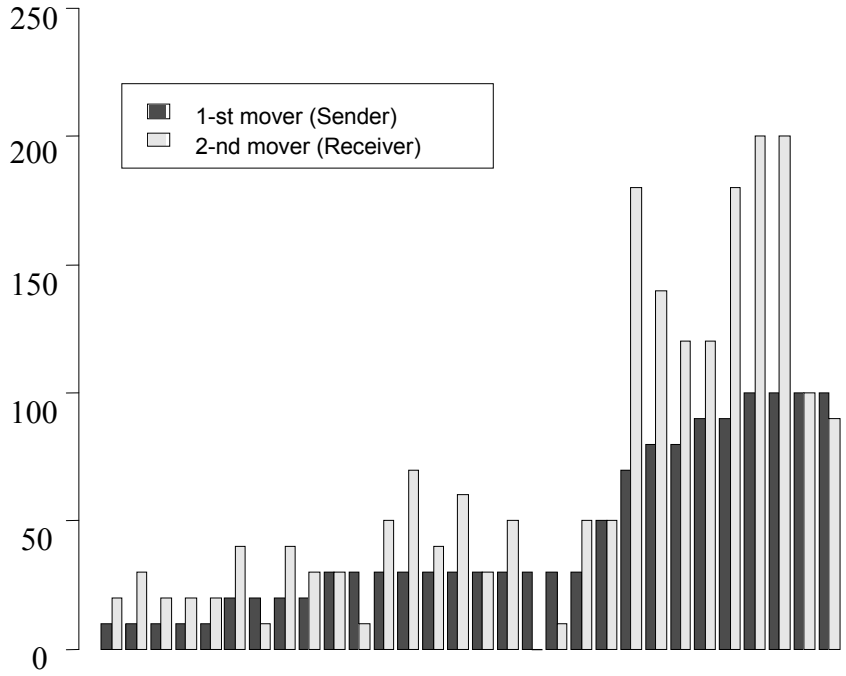

Fig. 5: **Sender-Receiver payments**

Trust/trustworthiness determinants

All participants filled in a questionnaire after taking part in the experiment. The questionnaire contained some socio-economic entries defining the participant‘s attitude to risk and socio-economic background. All the items were explored as potential predictors for the players’ decisions as well as predictors for the particular social norm of behaviour. The simple correlation analysis of the sender/receiver behaviour factors is given in Table 3 and Table 4. While inspecting Table 3, a weak explanatory power of all explored personal characteristics for sender’s decision is obvious. The only exception is the sender’s expectation about the receiver repayment $E_X(Y)$, which significantly correlates with the sender payment. On the other hand, no socioeconomic characteristic significantly correlates with this expectation. Something similar can be stated in the case of receiver. However, some socioeconomic characteristic correlate with the receiver’s money sent (Y). The analysis of both types of players showed that the real or expected actions of the respective partner are decisive in the choice of proper strategy.

Table 3: **First mover correlations (Point – biserial correlation, biserial correlation, Spearman correlation, Pearson correlation)**

	$E_X(Y/X)$	X	$E_X(Y)$
Y	0.13	0.88***	0.71***
X	0.24		0.85***
$E_X(Y)$	0.58***	0.85***	
Gender	0.22*	-0.02	-0.02
Num_Siblings	-0.17	0.09	0.1
Risk_Av	0.15	0.25	0.31*
Hazard	-0.12	-0.1	-0.25
Sym_Class	-0.15	0.19	0.08
Sen_Coll	0.06	0.06	0.05
Tru_Soc	-0.42**	-0.05	-0.01
Tru_Som	-0.03	-0.02	-0.07
Mist_Som	-0.57***	0.01	0.04
Mon_Rev	0.0	-0.12	-0.23
Poi_Ori	0.26**	0.31*	0.27*

Note: 34 observations – zero payment senders were considered in *X*, $E_X(Y)$ columns. 29 observations –zero payment senders + 1 outlier were excluded from the $E_X(Y/X)$ column. (*, **, *** denotes 10%, 5% and 1% level of significance)

Taking into account the statistically significant correlations given in Table 3 and Table 4, we formulate a recursive equation system

$$Y_i = \alpha_{1,0} + \alpha_{1,1}X_i + \beta_{1,1}Gender_i + \beta_{1,2}Hazard_i + \beta_{1,3}Tru_{Som_i} + \beta_{1,4}\left(X_i - E_{Y_i}(X_i)\right) + u_i$$

$$X_j = \alpha_{2,0} + \beta_{2,1}E_{X_j}(Y_j) + u_j$$

where *i* and *j* are index variables identifying the players. By comparing it with Table 4, we see that the first equation includes an additional term of (X_i-$E_{Yi}(X_i)$). Unlike the other regressors, we include this term for deductive rather than empirical reasons. Depending on whether the expectations about the sum received are met, it allows for modelling of reward or punishment of the sender.

As Garaj and Šujan (1980: 202) state, each equation in the recursive equation system can be estimated separately applying the ordinary least squares method (OLS). Be examining the residuals, we also conclude that our models do not suffer from endogeneity bias. By eliminating the statistically insignificant regressors, we came to the results given in Table 5.

In the Sender's equation, the positive intercept can be interpreted as a positive amount which is to be sent independently of all other socio-economic

variables. It could be then presented as an altruistic motive. On the other hand, the regression coefficient estimated by the $E_{Xj}(Y_j)$ variable can be interpreted as a multiplier of sender's expectation on the receiver repayment. In our case, this corresponds to the belief that for each additional receiver's payment the sender's payment increases by 0.453 MU.

Table 4: **Second mover correlations (Point – biserial correlation, biserial correlation, Spearman correlation, Pearson correlation)**

	Y/X	***Y***	$E_Y(X)$
Y	0.36**		0.13
X	-0.05	0.87***	-0.03
$E_Y(X)$	0.22	0.13	
Gender	-0.01	0.26**	-0.11
Num_Siblings	0.14	-0.09	0.01
Risk_Av	-0.18	0.14	0.04
Hazard	-0.18	-0.44**	-0.16
Sym_Class	-0.07	0.08	-0.19
Sen_Coll	0.19	0.12	0.17
Tru_Soc	-0.16	-0.17	-0.08
Tru_Som	0.1	-0.24*	-0.16
Mist_Som	0.17	-0.01	-0.38**
Mon_Rev	0.03	0.31*	0.06
Poi_Ori	-0.31**	-0.32**	-0.11

Note: Receivers responding to the zero sender strategy were excluded to avoid the rational strategy bias. (*, **, *** denotes 10%, 5% and 1% level of significance)

Table 5: **Regression results**

Sender – dependent variable *X*		**Receiver – dependent variable *Y***	
Intercept	10.23**	Intercept	51.537***
$E_{Xj}(Y_j)$	0.453***	$(X_i\text{-}E_{Yi}(X_i))$	1.077***
R^2	0.842	R^2	0.52
F statistics	165.7***	F statistics	33.56***
Jarque-Bera	7.67**	Jarque-Bera	2.776
Breusch-Pagan	3.757*	Breusch-Pagan	4.139**

Note: To ensure the normality of residuals, we eliminated 1 misleading outlier in both equations. The heteroscedasticity could not be eliminated by simple modifications of the functional forms, inclusion of new variables or removal of some observations. This problem influences primarily the significance of the coefficients, but the estimates remain unbiased.

Analysis of all rounds – reciprocity and trustworthiness

The results obtained from the one-shot game are fair at best. First, there are only several relationships that are strong enough to be statistically significant, which can be seen in Table 2 and 3. Moreover, the sample size prevents us from using more sophisticated modelling options, such as nonlinear models relying on asymptotic properties, which may not be valid in small samples.

One way to work around this problem is the use of all rounds played in our experiment to estimate the effect of the socio-economic, as well as other variables related to the development of the game between the senders and receivers. On one hand this gives us a larger sample to work with, as the number of cases exceeds one hundred, allowing for maximum likelihood and quasi maximum likelihood estimation. Secondly, and maybe even more importantly, this process allows us to model the development of trust between the players, as the player pairs have been kept fixed in all rounds. Players, being aware that their opponents remain the same can thus build on the knowledge of previous encounters, allowing us to study the learning effects in process.

The decision to use all data raises the question of proper treatment of the information coming from different rounds. For the purposes of our analysis, we pool all the data into a single model, treating the rounds by fixed-effect dummy variables in each equation. The logic behind this approach is as follows. It is reasonable to assume that the socio-economic indicators, as reported in the questionnaire of each participant describe the player in his common decision-making process, which should clearly not depend on the round of the game. For example, a player with several siblings may have a larger propensity to share than players with none, based on the childhood experience of having to share with others. Such behavioural traits are universal, and therefore enter our model at all stages.

Of course, the particular decision in a given round cannot be expected to rely only on these personal traits. It is logical to assume that except these factors, the immediate experience from previous rounds should influence the outcome of the next. Therefore, the models have to contain the relevant variables relating the decision to prior results.

Our interest in the all-round framework is threefold. First, it is interesting to see how the model of players using rational strategies changes by introducing more rounds. Second, by having more observations at our disposal, it is possible to quantify logit/probit models for the choice of strategy by the receiver. Third, an OLS model for the trustworthiness (the *Y/X* ratio) can be quantified on the larger sample.

Before we present our results, we add three more methodological notes. As the sample size in all our models approaches or exceeds one hundred observations, we report all models with robust standard errors, which account for deviations from model assumptions. This translates to the use of quasi-maximum likelihood for logit/probit models instead of maximum likelihood, and the use of heteroscedasticity consistent covariance matrices in case of OLS. As we have seen in the model described in Table 5, the deviations from classical model assumptions are common. The use of robust estimates of coefficient covariance matrices gives the corresponding coefficient tests lower power, but is on the other hand consistent even in case of heteroscedasticity. As for other assumptions, we do not explicitly deal with autocorrelation, as this concept is not particularly meaningful in cross-sectional data (as a simple reordering of observations doesn't change the nature of studied relationship, but cancels autocorrelation).

Second, we conduct our analysis in all cases by entering all relevant variables into our estimated equation and then successively eliminate non-significant variables on the basis of a Wald test of linear restrictions (see general-to-specific approach due to Hendry et al. 2005). The variables to be eliminated are chosen with respect to their p-values. This procedure is valid as long as the p-values can be trusted. Two common sources of errors in judgment were covered above (namely, autocorrelation and heteroscedasticity). The p-values could however be also distorted by colinearity of the regressors. To test for this problem, we calculated the variance-inflation factors for each equation. Their values were less than 10 in all cases, usually less than 4, leading us to the conclusion of no colinearity problems.

Third, the use of Wald linear restriction tests implies the necessity to compare nested models. However, after a proper model has been identified, it is usually the case that by discarding some of the regressors in the process the maximum sample size for the estimation could be increased. This is a consequence of the fact that there are numerous occasions when there are missing values for certain variables which are omitted, or the variables themselves are not defined in some cases. For example, a model requiring information about the previous round cannot use the observations from the first round. When all variables referring to the previous round are eliminated by the Wald procedure, the sample size can be increased to include the first round. After finding the appropriate nested model, we always re-estimate it by using the maximum sample size available.

The results of the estimation are in Tables 6 through 8. First, we estimated a binary logit model for all focal strategies. As before, the model of playing the rational strategy includes socio-economic variables for the sender only. This is reasonable, as the choice of pursuing this strategy rests solely on the sender.

Table 6: **Logit models for all focal strategies**

Rational *(X = 0)*			
	Coeff	***Std. err.***	***Sig.***
const	-2.79223	1.38482	**
Sym_Class	0.783277	0.344161	**
Last_Ratio	-1.89044	0.526301	***
MF R^2 =0.288799; n = 112			
Cheating *(Y/X < 1)*			
	Coeff	***Std. err.***	***Sig.***
Num_Siblings	0.488342	0.283655	*
Hazard	0.803204	0.343181	**
Total_Ratio	-4.80839	1.19855	***
Last_Ratio	1.39671	0.57678	**
MF R^2 =0.517957; n = 94			
Reservation *(Y/X = 1)*			
	Coeff	***Std. err.***	***Sig.***
Hazard	-0.35916	0.151305	**
Last_Ratio	-0.73274	0.283533	***
MF R^2 =0.036913; n = 94			
Surplus split *(Y/X = 1.5)*			
	Coeff	***Std. err.***	***Sig.***
A	-0.03128	0.008387	***
Disappointed	-2.40715	0.793086	***
Sen_Coll	1.09129	0.435074	**
Sym_Class	-0.82832	0.432046	*
Mon_Rev	-0.132809	0.0619401	**
MF R^2 =0.291403; n = 131			
Equity split *(Y/X = 2)*			
	Coeff	***Std. err.***	***Sig.***
Sym_Class	-0.797826	0.177034	***
Total_Ratio	1.66761	0.491274	***
MF R^2 =0.207457; n = 106			

Note: For each strategy, *n* designates the number of valid observations in each model. *MF* R^2 is the McFadden pseudo-coefficient of determination. (*, **, *** denotes 10%, 5% and 1% level of significance)

Also, the characteristics of the receiver are not relevant, as the opponent is not known to the sender. All other focal strategies only take into the account the information on receiver alone, for similar reasons. Also, care must be taken when interpreting the results of the individual logit models in Table 6. As each equation is estimated independently of the others, we always compare a specific focal strategy with the alternative of "any other strategy". Thus, the results of the equations are not directly comparable.

The models introduce a number of new variables, which follow from the possibility to include results of previous round into the analysis. These variables include the amount sent by the sender (*A*), the trustworthiness ratio of *Y/X* from the previous round (*Last_Ratio*), a binary variable encoding the disappointment of the receiver, taking the value of 1 whenever the amount received from the sender is below the expectations of the receiver (*Disappointed*), the overall trustworthiness ratio for all prior rounds, calculated as the sum of payments received divided by the sum of payments sent by the sender up to, but not including the current round (*Total_Ratio*), as well as dummy variables accounting for fixed effects on each round (*Round3* to *Round5*).

Several interesting results can be seen in Table 6. For the rational strategy, we see that high trustworthiness in previous rounds indeed lowers the probability of sender playing the rational strategy. This suggests that during the rounds, trust can be earned – by sending more money back to the sender, the senders become influenced to avoid the rational strategy, supporting positive reciprocity.

Table 7: **Ordered probit model for strategy chosen by the receiver**

Strategy (n = 71)			
	Coeff	*Std. err.*	*Sig.*
Hazard	-0.516	0.164323	***
Sen_Coll	-0.23476	0.0948518	**
Total_Ratio	2.33435	0.486825	***

The logit model is most successful in explaining the behaviour of the receiver by the cheating strategy, as measured by the McFadden R^2. Higher number of siblings, as well as a tendency to be a "player/gamble" tends to increase the odds for cheating. On the first look we are also presented with a seemingly contradictory statement about the opposite signs of *Total_Ratio* and *Last_Ratio*. As these concepts are related, it might seem contradictory that they have opposing signs. However, the classic interpretation of regression coefficients rests on a *ceteris paribus* base – we interpret the regression

coefficients under the assumption that all remaining coefficient remain the same, which clearly doesn't hold in this case (changing *Last_Ratio* also necessarily changes *Total_Ratio*).

Table 8: **OLS model for trustworthiness**

Trustworthiness			
Y/X	*Coeff*	*Std. err.*	*Sig.*
const	0.59362	0.278869	**
Round3	-0.3022	0.124858	**
Round4	-0.3323	0.190477	*
Total_Ratio	1.08074	0.0681503	***
Num_Siblings	-0.1888	0.0772977	**
Last_Ratio	-0.2865	0.133955	**
$R^2 = 0.587289$			

(*, **, *** denotes 10 %, 5 % and 1 % level of significance)

In case of the surplus split, we see that the odds of playing this strategy, which is among the most egalitarian ones, are negatively influenced by the amount of monthly expenditures (and by extension, monthly income). The odds are also lower when the player has lower sympathies towards classmates and when the sender is giving a less than expected amount.

Finally, the equity split strategy is more likely played in case of high previous trustworthiness. That is, the higher the existing trustworthiness, the higher is also the probability the receiver will share the total equity of both players equally.

This conclusion is also supported in Table 7, which presents the results of estimation of a patrimonial ordered probit model for the choice of strategies by the receiver. We formulate this model by acknowledging the fact that the focal strategies of the receiver can exhibit a natural ordering by the value of the trustworthiness ratio that defines each strategy. As we go from cheating towards equity split, we steadily increase the share the receiver is willing to return to the sender. Under the assumption that the willingness to share is driven by common factors, it is reasonable to formulate the above mentioned ordered probit. The results indicate two major things: as in equity split, the likelihood of playing a specific strategy depends on the *Total_Ratio*. It also negatively depends on the way the receiver views himself as a "player", or willing to make a gamble.

Finally, Table 8 shows the patrimonial results of an OLS regression of the receiver-influencing variables on the *Y/X* trustworthiness ratio. The motivation behind this model stems from the fact that many of the games fell between the categories defined by the focal strategies – the *Y/X* ratio was different than the one required by the focal strategies. To include these observations into our analysis, we explored the factors behind the level of trustworthiness. The results are similar to those of the logit/probit models. We again see the complex *Last_Ratio* to *Total_Ratio* relationship. Number of siblings affects the trustworthiness negatively. Finally, we see that there were some significant fixed-effects related to the round that was played – the trustworthiness in rounds 3 and 4 was lower than in round 2[3], and trustworthiness in round 5 doesn´t differ significantly from the second round.

Conclusion

Our paper summarizes the result of the trust game played at two universities in Eastern Slovakia. We contribute to the discussion of the investment trust game in several ways. First, by the design of our experiment, we are able to report results under similar conditions as authors of similar research papers, thus allowing for their comparison. We show that the participants in the Slovak experiment send relatively small amounts compared to other studies, but also exhibit quite large trustworthiness.

Next, we show that by analyzing the one-shot version of the game, the choice of rational strategy for the sender can be explained by gender and some socio-economic factors, mainly related to the general level of trust within the study group. The modelling of other focal strategies is less successful, showing primarily the dependences on the expectations of the players rather the individual factors describing players. As the sample size of the one-shot game is smaller, which might restrict our analysis we utilize also the information on four additional rounds of the game. All rounds were played without prior knowledge about the termination of the experiment; the number of round was therefore indeterminate from the player's point of view.

After utilizing the information from all five rounds, we estimate an individual logit model for every focal strategy, as well as an overall ordinal probit model for its choice. This analysis focuses on rounds two to five, as under our modelling framework, information about the previous encounters with the player's partner are accounted for. These models allows us to show that there is evidence for reciprocity in the behaviour of the players – higher trustworthiness, viewed as the property of the receiver leads to higher chances

[3] As the model contains lagged variables (e.g. Last_Ratio), it does not include the first round, which would cause missing values. The base for comparison is therefore round two.

of abandoning the rational strategy and sending of positive sums by the sender. Both the individual logit, ordinal probit and a general OLS model explaining trustworthiness support a statistically significant effect of prior experiences between players, thus supporting reciprocity and learning in the trust game.

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