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Not All Income is the Same to Everyone: Cognitive Ability and the House Money Effect in Public Goods Games

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Abstract

The provision of public goods often suffers from a social dilemma generating too little contributions. Yet, it remains an open question how positive contributions materialise. Existing studies suggest that individuals' decisions on how much to contribute depend on cognitive skills. Furthermore, mental accounting research indicates that the source of income matters for economic decision making. I show experimentally that subjects' contributions in a one-shot linear public goods game depend on an interplay of the two factors. While a house money effect exists for subjects with low cognitive skills there is no such effect for those with high cognitive skills. My findings have important implications for taxation, redistribution, and voting behaviour, as well as past and future experiments.

Keywords: Public Goods; Experiment; Cognitive Skills; House Money Effect; Mental Accounting; Endowment Source.

JEL Classification Numbers: C91, D03, H41.

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1 Introduction

Due to their characteristics of non-excludability and non-rivalry, public goods are peculiar to the economic world. The free-rider problem predicted by classic economic theory causes the private provision of public goods to be too low and inefficient outcomes. Yet, anecdotal evidence and experiments in linear public goods games reveal positive contributions, albeit below the social optimum. Although vital to know it remains an open question how contributions materialise. Uncovering the main drivers of high contributions might enable us to solve the social dilemma in certain situations and can help us understand when co-operative outcomes evolve.¹

In a classroom experiment, I find that subjects' contributions to a linear public good depend on an interplay of cognitive abilities and income origin. I show that there exists a house money effect for subjects with low cognitive skills while there is no such effect for those with high cognitive skills. More precisely, when compared to individuals with high cognitive skills, those with low cognitive skills invest more into the public good when their endowment is windfall and less when it is earned.

The paper is structured as follows. Section 2 provides an overview over related literature and demonstrates my contribution by establishing respective hypotheses. Section 3 and 4 describe the experimental design and the obtained results. 5 concludes and suggests implications.

¹In 2005, the journal "Science" published a list of 125 scientific problems that are unanswered to date and are assumed to be drivers of basic scientific research over the next quarter-century. The list of top 25 questions included the question "How Did Cooperative Behavior Evolve?" (Pennisi, 2005).

2 Literature

Research on mental accounting suggests that subjects treat windfall money differently than income they have earned. This is referred to as the house money effect (Thaler, 1985). This should be taken into account by economists who *inter alia* want to explain and predict economic behaviour. For this reason, scholars have tested whether the effect exists in a number of economic games. For dictator games in which a player can decide on how much to donate to a recipient, the results provide concordant evidence. Here, subjects show less generosity with earned income when compared to windfall income (e.g. Cherry, Frykblom and Shogren (2002), Oxoby and Spraggon (2008), and Reinstein and Riener (2012) for a more recent experiment). Furthermore, Carlsson, He and Martinsson (2013) show that the effect is not merely an artefact in lab experiments but persists even in the field (though to a lower extent).

A similar pattern is observed in standard trust or investment games. In these games an investor A decides on the amount of an endowment to transfer to another subject, who receives a multiple thereof. Subsequently, B can reward the trust displayed by A and return a share of the received transfer back to the investor. Standard economic theory suggests that subject B will return zero, retaining the entire transfer. As a rational individual, investor A will take this into account and transfer zero in the first place. Along with results obtained in dictator games, Houser and Xiao (2015) find that transfers by both players are lower if they have to command over earned money. Since pairs of participants were always in the same treatment (windfall or earned

money), the effect, in particular for the returned transfer, could be a result of peer effects as well.

However, due to or in spite of numerous attempts, corresponding evidence in public goods games remains mixed (Spraggon and Oxoby, 2009). Cherry, Kroll and Shogren (2005) find that contributions in public goods games are independent of endowment origin. This is in line with results obtained by Antinyan, Corazzini and Neururer (2015), as well as Clark (2002). In contrast to these results, other scholars indicate that contributions are decreasing in effort which hints at a house money effect. In a linear public goods game in which subjects were uninformed about the heterogeneity regarding the sources of endowment, Muehlbacher and Kirchler (2009) find that individuals who have to exert more effort for a given endowment contribute less. Furthermore, Dannenberg, Riechmann, Sturm and Vogt (2012) provide results for a house money effect on inequality aversion. In public goods games with and without punishment their results indicate that windfall money reduces the aversion to disadvantageous inequality. Finally, Harrison (2007), who re-analysed the data gathered by Clark (2002) by applying panel estimation methods, shows that individuals have a higher propensity to free-ride in linear public goods games if they play with windfall money. This behaviour is at odds with the rationale that windfall money evokes perceived property rights less strongly than earned money and is therefore spent more generously (see Hoffman and Spitzer (1985) and Hoffman, McCabe and Smith (1996)).

To date however, the discussion has ignored a major factor indispensable for explaining the house money effect. Research in various fields shows that humans differ with respect to their cognitive abilities. The complexity of

most economic problems requires analytical reasoning. As a result, cognitive skills are one of the fundamental determinants of varying responses in economic issues. Analysing a sample of more than 1,000 adults living in Germany, (Dohmen, Falk, Huffman and Sunde, 2010) show that cognitive ability highly correlates with risk aversion. Since many economic decisions have uncertain outcomes, it is likely that this disparity results in varying behaviour. Ultimately, cognitive skills appear to matter in the particular case of public goods games as well. Lohse (forthcoming) shows a positive link between cognitive skills and contributions. Opposing results are obtained in a one-shot prisoner's dilemma game which is akin to the linear public goods game (Kanazawa and Fontaine, 2013). The authors hypothesise that individuals of greater intelligence have a better understanding of the game and therefore recognise defection as the optimal strategy. Also pointing towards a negative correlation, Nielsen, Tyran and Wengström (2014) find that free-riders score significantly higher results in a cognitive reflection test.

Regarding the house money effect, cognitive ability appears to be particularly relevant. The concept of mental accounting proposes that individuals categorise income in order to simplify economic decisions. This suggests that individuals' cognitive skills are associated with the extent to which they practice mental accounting and thus with related phenomena such as the house money effect. An experiment conducted by Abeler and Marklein (forthcoming) supports this prediction. By giving out non-distortive vouchers² of equal value for either an entire dinner (meal and beverages) or beverages only, they

²A voucher is non-distortive if its value is below the price of every possible consumption good. Such a value only shifts the budget constraint towards a higher consumption level and will not turn it like changing relative prices.

find that individuals with lower cognitive skills have a higher propensity to violate the fungibility of money. Receiving a voucher for drinks only, they increase beverage consumption disproportionately.

Following this rationale, I argue that individuals differ in the degree to which they exercise mental accounting. While subjects with low cognitive skills need to simplify economic problems by applying mental accounting, the opposite is true for subjects with high cognitive skills. Since mental accounting constitutes the origin of the house money effect, one should observe corresponding behaviour for individuals with low but less so for individuals with high cognitive skills. Therefore, I hypothesise that subjects with low cognitive skills contribute less the higher the share of earned income. For contributions by individuals with high cognitive skills the origin of income has little or no effect.

3 Experimental Design

To test my hypotheses I conducted a classroom experiment³ among first year business administration students at the Technical University of Munich, Germany.⁴ The experiment consisted of four parts: first, a heterogeneous real effort task divided the subjects into three treatment groups. Subsequently, the participants played a three person linear public goods game without any

³Experiments have shown that contributions in the public goods game increase when anonymity decreases (e.g. Andreoni and Petrie (2004)). Since this paper aims to uncover an interaction of the house money effect and cognitive skills, the overall level of contributions is less relevant. In fact, I assume that neither the house money effect nor cognitive skills interact with behaviour subject to varying confidentiality. As all participants face the same environment, I question any effects on the results presented here.

⁴Instructions translated to English are provided in the appendix.

information regarding their opponents' types or choices. In part three subjects were required to complete a cognitive task that elicited their cognitive abilities. Finally, I inquired about risk preferences⁵ and demographic information (sex and age).

At the beginning of the experiment, the participants were randomly divided into three treatment groups. Each group had to colour in a different number out of a total of 150 circles. 67 subjects had to colour in 10 percent (15 circles), which I will refer to as the low effort treatment. 39 subject played in the medium effort treatment and had to colour in 50 percent (75 circles). 55 subjects had to colour in 90 percent (135 circles). This was the high effort treatment.⁶ This task was used to simulate a real effort task that is not cognitively demanding.⁷ In total, 161 students participated in the experiment. Seven participants did not finish the task and were excluded from the lottery draw which was used to pay out a fraction of participants. I consider this proof for having successfully induced dis-utility of labour. The respective subjects were also excluded from the econometric analysis. For having coloured in all circles appropriately, all subjects received an endowment of 100 tokens (10 tokens = 0.60 Euro). As the participants had to colour in different fractions of circles, this induced different proportions of

⁵I used a question taken from the German Socio-Economic Panel which asks for a subject's general attitude towards risk. It allows respondents to indicate their willingness to take risks on a scale from zero to ten, with zero indicating complete unwillingness to take risks, and ten indicating complete willingness to take risks.

⁶As the main focus of the experiment was to compare behaviour in the extreme cases of mainly windfall versus mainly earned money, I tried to collect more observations in the low and high effort treatment. Nevertheless, the medium treatment was introduced in order to achieve a better picture and was useful for robustness checks.

⁷I do not use GMAT questions or similar tasks since performance is likely to correlate with cognitive skills.

earned and endowed income (i.e. either 10, 50, or 90 percent of the total income was earned). Subsequent to their task, individuals could decide on which proportion of their endowment to invest in a one-shot three-person linear public good with a marginal per capita return of 0.5. Therefore, the pay-off function π_i of player i with $i \in \{1, 2, 3\}$ who contributes $\theta_i \in \{0; 100\}$ is given by:

$$\pi_i = (100 - \theta_i) + 0.5 \cdot \sum_{j=1}^3 \theta_j$$

with $\theta_j \in \{0; 100\}$ being the contribution of player $j \in \{1, 2, 3\}$. Subjects did not know the effort levels of the other two players. However, they knew that all combinations of effort levels were possible.

In order to control for cognitive ability, subjects had to perform the cognitive reflection test (CRT) as proposed by Frederick (2005). Although the test only contains three questions, it significantly correlates with test results from more sophisticated tests such as the *Wonderlic Personnel Test* or the *Wechsler Matrix Test* (Frederick, 2005; Toplak, West and Stanovich, 2011; Toplak, West and Stanovich, 2014). Due to the fact that the sample consists of first year students who have not yet had many opportunities to participate in experiments, I am confident that they were unfamiliar with the test and preclude concerns raised by Toplak et al. (2014).⁸ I further want to capture effects related to gender and age, for which reason information on both was asked from the students. With a share of almost 69 percent males, the

⁸After the experiment, many students expressed the wish to receive the correct answers to the test. Even though the participants asked this during class, nobody guaranteed the correctness of any of their answers. This affirmed my assumption that the participants were not familiar with the questions.

sample may seem biased. However, taking into account that only 33 percent of all business students at the Technical University of Munich are female, one can consider the sample to be random and thus representative for the population at hand. One week after the experiment, 18 participants were randomly chosen and assigned into groups of three to receive their final pay-off. The pay-off was calculated by considering the contributions made by the individuals, which had been drawn to form each group of three. Although not every participant was paid, the prospect of receiving the pay-off with an expected probability of about 10 percent provided a sufficient incentive to act according to their true preferences (Dohmen et al., 2010).⁹ On average, the selected students earned 7.68 Euro.

4 Results

As summarised in Table 1, subjects on average contributed around 51 percent of their initial endowment.

The detailed distribution of contributions is illustrated in Figure 1. Note that the plotted normal distribution function is calculated on the basis of positive contributions only. This accounts for the intensive and extensive margin of the decision problem at hand.

⁹Participants were told that about every tenth participant would be paid out. The nature of the three-player public goods game required that only multiples of three could be drawn. As a result, three participants were drawn in a session with 13, respectively 24 subjects and six participants were drawn in sessions consisting of 66, respectively 85 subjects.

Table 1: Summary statistics

Variable	Obs	Mean	Std. Dev.	Median
Correct	154	2.013	1.016	2
Cognitive	154	.403	.492	0
Contribution	154	50.903	29.278	50
Risk	153*	5.418	2.002	6
Sex	154	.688	.465	1
Age	154	19.773	2.159	19

*One participant did not specify her risk preferences.

In the CRT, 40 percent had all three answers correct, followed by 32 percent with two, 16 percent with one and 12 percent with zero correct answers (Table 2).

Table 2: Correct answers in the cognitive reflection test

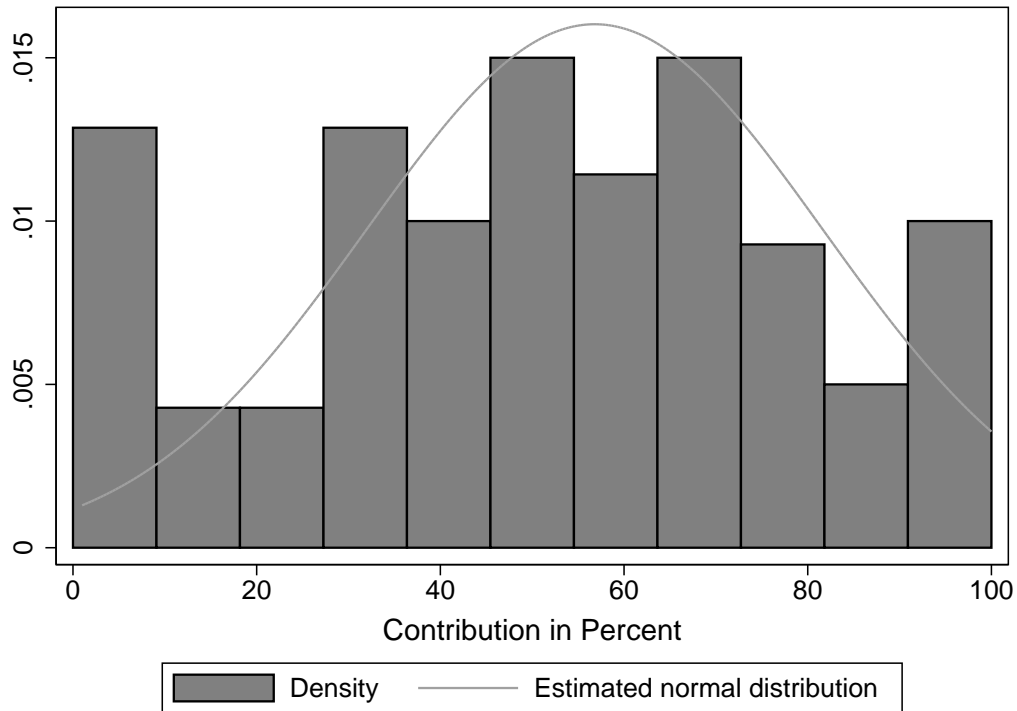
Correct Answers	Frequency	Percent
0	18	11.69
1	24	15.58
2	50	32.47
3	62	40.26
Total	154	100.00

In line with Cherry et al. (2005), contributions do not differ significantly across effort levels (55 percent in the low versus 48 percent in the high effort treatment, $p = 0.2302$, Mann-Whitney-U test).¹⁰ Figure 2 illustrates that the differences is not economically significant either.

More importantly, however, distinguishing between cognitive skills yields another picture. For doing so I generate a dummy variable that divides the sample into two subgroups: individuals with high and those with low

¹⁰The subjects in the medium treatment are excluded in the non-parametric tests. This treatment was included in order to preclude a quadratic relationship. However, the contributions of subjects in the medium treatment remain between those of subjects in the high and low effort treatment, regardless of cognitive ability.

Figure 1: Histogram of contributions

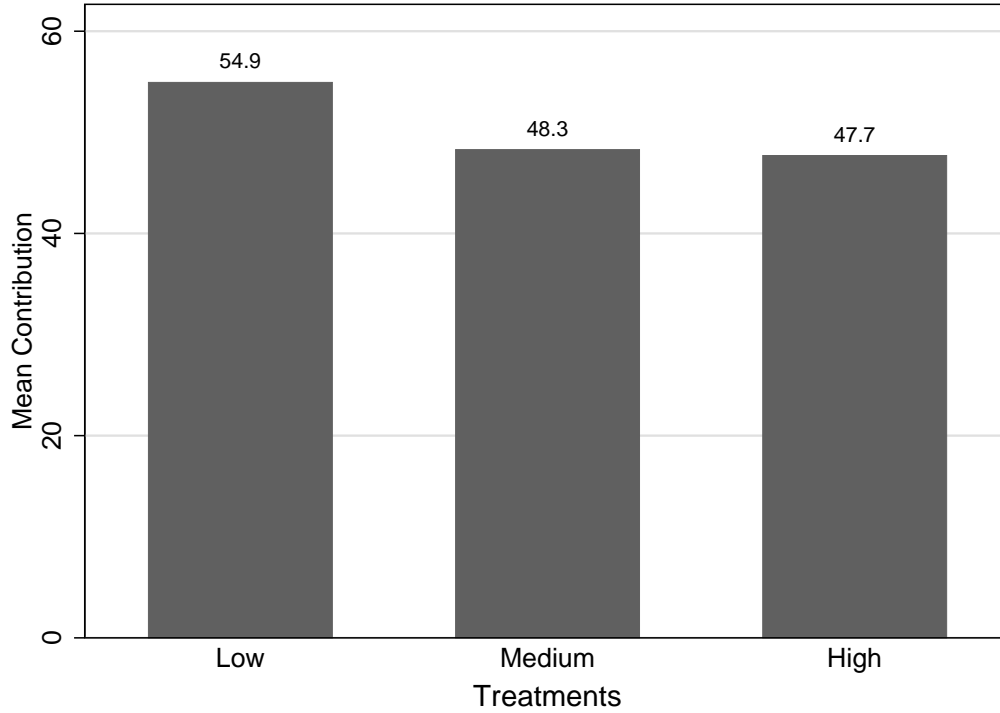


cognitive skills. The CRT includes three questions; the dummy variable turns 1 if all questions are answered correctly and 0 otherwise. This separates the sample into 40 percent high and 60 percent low cognitive types.¹¹ Choosing a lower cut-off would have generated subgroups that are too distinct in size. Table 3 displays the number of observations per subgroup.

As depicted by Figure 3 I find that subjects' contributions in a public goods game depend on an interplay of cognitive abilities and endowment source. When compared to individuals with high cognitive skills, those with

¹¹Figure 5 in the Appendix demonstrates that individuals labelled as “high cognitive” (all CRT questions correct) do not contribute significantly less than their counterparts ($p = 0.8259$, Mann-Whitney-U test).

Figure 2: Contributions by treatment group



low cognitive skills invest significantly more into the public good when their endowment is windfall and less when it is earned. To be more precise, contributions by individuals with high cognitive skills do not differ significantly by endowment source (48 percent in the low versus 55 percent in the high effort treatment, $p = 0.5775$, Mann-Whitney-U test). These subjects do not exhibit a house money effect whilst contributing 50 percent on average. Contrarily, contributions by individuals with low cognitive skills are significantly higher in the low effort treatment (63 percent) than in the high effort treat-

Table 3: Number of observations per treatment group and cognitive skills

Cognitive	Treatment Group			Total
	Low	Medium	High	
Low	30	29	33	92
High	35	9	18	62
Total	65	38	51	154

Table 4: OLS 1: Contributions to Public Good: Dummies for Treatment Group (Low Effort as Reference), and cognitive skills

	Contribution	
Medium Effort	-20.26***	(-2.90)
High Effort	-19.77***	(-2.64)
Cognitive	-9.813	(-1.47)
Medium Effort & Cognitive	16.80	(1.36)
High Effort & Cognitive	19.87*	(1.91)
Age	0.782	(0.77)
Sex	-4.387	(-0.91)
Risk	5.999***	(5.36)
Constant	18.12	(0.81)
Session FE	Yes	
Observations	153	
R^2	0.235	
Adjusted R^2	0.175	

t statistics in parentheses

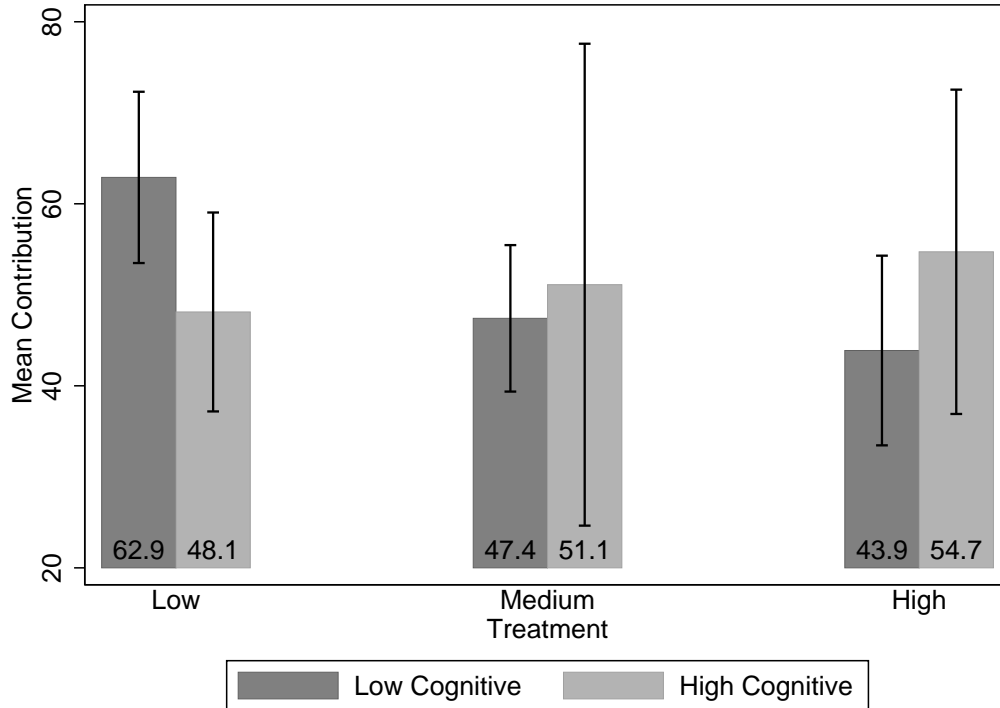
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

ment (44 percent, $p = 0.0157$, Mann-Whitney-U test). Thus, these subjects exhibit the house money effect.¹²

The results are robust to controlling for session fixed effects, sex, age, and risk preferences in OLS regressions with cognitive ability as a dummy (Table 4) and as a continuous variable (Correct) that indicates the number of correctly answered CRT questions (Table 5 in the Appendix).

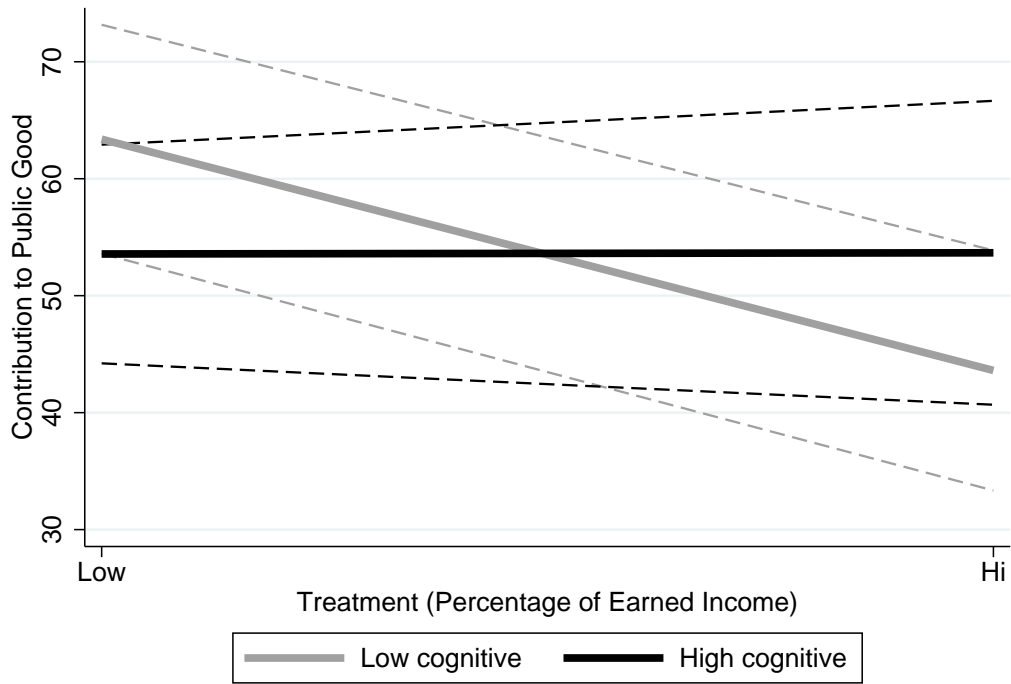
¹²Analogous t-tests deliver the same results.

Figure 3: Contributions by cognitive type and treatment group (Figure 6 in the Appendix displays corresponding boxplots)



Calculating the contributions by individuals with high and low cognitive abilities in the high and low effort treatment while keeping the control variables from OLS 1 at their means gives a similar pattern as the non-parametric analysis. This is captured by Figure 4, which serves as a graphical illustration for the underlying effect. For individuals with high cognitive skills the slope is not significantly different from zero ($p = 0.851$, t-test). This indicates that the propensity to co-operate for those individuals is independent of whether they exert effort for the money they decide upon or not. The opposite is true for individuals with low cognitive skills. They give less the more they have to

Figure 4: OLS 1: Contributions by cognitive type and treatment group (low and high)



Note: Dashed lines represent 95% confidence intervals.

work for their endowment. This is depicted by a significantly negative slope ($p = 0.006$, t-test).

Interestingly, the two graphs intersect roughly in the middle of both extremes. This means that in a situation in which income consists of half wind-fall and half earned money, individuals with high and low cognitive skills are comparably co-operative.

In addition to these results, I observe a negative but non-significant effect of cognitive skills on co-operative behaviour.¹³ Hence, in contrast to Lohse (forthcoming) I argue that individuals with lower cognitive skills are not less

¹³See Figure 5 for the respective mean contributions.

generous or co-operative *per se*. It depends on the origin of their endowment. Furthermore, risk seeking preferences foster high contributions to the public good.

One can argue that a subject's choice on whether and how much to contribute are two distinct decision problems (Harrison, 2007). However, separating zero contributions and positive contributions does not affect the results (see Table 6 and Figure 7 in the Appendix). Regarding the extensive margin, I only find significant effects for gender and risk preferences. Male subjects are less likely to contribute, while risk seeking subjects do so with a higher probability. However, neither cognitive ability nor the source of income have a significant effect on contribution behaviour.

5 Conclusion

Public goods games have always received high levels of attention in social science. Especially during the last decades, experimental studies have frequently tried to shed light on the dynamics behind co-operative behaviour. For instance, researchers want to understand *when* co-operation arises and *how* it evolves when the game is played repeatedly. Nevertheless, existing research primarily reveals *which* games induce high contributions and which do not (see Zelmer (2003) for an overview on public goods games). However, many real life settings do not allow for adjustments of the "game" that is played. Instead, it would be helpful to know *who* will co-operate and who will not. If we knew who to rely on, we could concentrate on convincing individuals that are more reluctant to co-operate and thereby increase efficiency.

Furthermore, if we know that behaviour is more sensitive to endowment origin for some than for others, governments can target policies more precisely. Both tasks, however, require information on individual preferences and behaviour in various settings.

This is the first paper to show that contributions to a linear public good depend on an interplay of income origin and cognitive skills. Contributions to a public goods game can be regarded as subjects' revealed preferences in favour of the public good in question or her cooperativeness. If the composition and the source of income have an influence on preferences, policy makers should consider the impact of a changing composition of income in decisions on taxation and redistribution. Policies that increase the share of earned money could shift preferences towards less demand and support for public goods for a certain subgroup of the population. In addition, my findings can help to explain voting behaviour as a means to express preferences (e.g. the approval of publicly financed large-scale projects). The described dynamics could in turn be exploited in order to implement policies that need the population's support.

Finally, the results have far-reaching implications for past and future experiments. In economics the participant pool often consists solely of university students. There is no doubt that these subjects have above average cognitive skills. Nevertheless, I am able to identify an interaction effect within this group. For a population that includes individuals with lower cognitive skills the interaction effect will be even more pronounced. Hence, this severely limits the external validity of experimental findings which could be affected by the house money effect.

The results are particularly relevant for public goods games due to the inefficiencies we observe in this regard. However, it may also be of interest whether an interaction of the house money effect and cognitive skills occurs in other economic games.

References

- Abeler, J. and Marklein, F. (forthcoming), ‘Fungibility, labels, and consumption’, *Journal of the European Economic Association* .
- Andreoni, J. and Petrie, R. (2004), ‘Public goods experiments without confidentiality: a glimpse into fund-raising’, *Journal of Public Economics* **88**(7-8), 1605–1623.
- Antinyan, A., Corazzini, L. and Neururer, D. (2015), ‘Public good provision, punishment, and the endowment origin: Experimental evidence’, *Journal of Behavioral and Experimental Economics* **56**, 72–77.
- Carlsson, F., He, H. and Martinsson, P. (2013), ‘Easy come, easy go’, *Experimental Economics* **16**(2), 190–207.
- Cherry, T. L., Frykblom, P. and Shogren, J. F. (2002), ‘Hardnose the dictator’, *American Economic Review* **92**(4), 1218–1221.
- Cherry, T. L., Kroll, S. and Shogren, J. F. (2005), ‘The impact of endowment heterogeneity and origin on public good contributions: evidence from the lab’, *Journal of Economic Behavior & Organization* **57**(3), 357–365.
- Clark, J. (2002), ‘House money effects in public good experiments’, *Experimental Economics* **5**(3), 223–231.
- Dannenberg, A., Riechmann, T., Sturm, B. and Vogt, C. (2012), ‘Inequality aversion and the house of money effect’, *Experimental Economics* **15**(3), 460–484.
- Dohmen, T., Falk, A., Huffman, D. and Sunde, U. (2010), ‘Are risk aversion and impatience related to cognitive ability?’, *American Economic Review* **100**(3), 1238–1260.
- Frederick, S. (2005), ‘Cognitive reflection and decision making’, *Journal of Economic Perspectives* **19**(4), 25–42.
- Harrison, G. W. (2007), ‘House money effects in public good experiments: Comment’, *Experimental Economics* **10**(4), 429–437.
- Hoffman, E., McCabe, K. A. and Smith, V. L. (1996), ‘Social distance and other-regarding behavior in dictator games’, *American Economic Review* **86**(3), 653–660.

- Hoffman, E. and Spitzer, M. L. (1985), ‘Entitlements, rights, and fairness: An experimental examination of subjects’ concepts of distributive justice’, *Journal of Legal Studies* **14**(2), 259–297.
- Houser, D. and Xiao, E. (2015), ‘House money effects on trust and reciprocity’, *Public Choice* **163**(1-2), 187–199.
- Kanazawa, S. and Fontaine, L. (2013), ‘Intelligent people defect more in a one-shot prisoner’s dilemma game’, *Journal of Neuroscience, Psychology, and Economics* **6**(3), 201–213.
- Lohse, J. (forthcoming), ‘Smart or selfish - when smart guys finish nice’, *Journal of Behavioral and Experimental Economics* .
- Muehlbacher, S. and Kirchler, E. (2009), ‘Origin of endowments in public good games: The impact of effort on contributions’, *Journal of Neuroscience, Psychology, and Economics* **2**(1), 59–67.
- Nielsen, U. H., Tyran, J.-R. and Wengström, E. (2014), ‘Second thoughts on free riding’, *Economics Letters* **122**(2), 136–139.
- Oxoby, R. J. and Spraggon, J. (2008), ‘Mine and yours: Property rights in dictator games’, *Journal of Economic Behavior & Organization* **65**(3-4), 703–713.
- Pennisi, E. (2005), ‘How did cooperative behavior evolve?’, *Science* **309**(5731), 93.
- Reinstein, D. and Riener, G. (2012), ‘Decomposing desert and tangibility effects in a charitable giving experiment’, *Experimental Economics* **15**(1), 229–240.
- Spraggon, J. and Oxoby, R. J. (2009), ‘An experimental investigation of endowment source heterogeneity in two-person public good games’, *Economics Letters* **104**(2), 102–105.
- Thaler, R. (1985), ‘Mental accounting and consumer choice’, *Marketing Science* **4**(3), 199–214.
- Toplak, M. E., West, R. F. and Stanovich, K. E. (2011), ‘The cognitive reflection test as a predictor of performance on heuristics-and-biases tasks’, *Memory & Cognition* **39**(7), 1275–1289.

- Toplak, M. E., West, R. F. and Stanovich, K. E. (2014), ‘Assessing miserly information processing: An expansion of the cognitive reflection test’, *Thinking & Reasoning* **20**(2), 147–168.
- Zelmer, J. (2003), ‘Linear public goods experiments: A meta-analysis’, *Experimental Economics* **6**(3), 299–310.

Appendix

Experiment – Instructions

Dear participant,

to begin with, I would like to thank you for partaking in this experiment.

For this experiment, we do not use Euro as our currency, but **ECU (Experimental Currency Units)** instead. Upon completion of the experiment, the **ECUs** you have earned will be converted to **Euro**. The exchange rate equals **10 ECU = 0.60€**. After the experiment ends, randomly selected students will receive the payoff they have obtained.

This experiment consists of two parts: the first requires you to fulfil a task, in the second you will be asked to invest ECUs.

Part 1: Task

To complete part one of the experiment, 10 rows of circles must be filled in while either 1, 5 or 9 rows have already been filled in. For completing this task you receive an initial endowment of **100 ECU**. To participate in the draw, determining which students receive monetary payoffs, all rows must be filled in.

Part 2: Investment

In part two you anonymously play an economic game with two other participants. The amount of rows these participants had to fill in was randomly determined.

This game provides you with the option to invest a share of your initial endowment. The investment of all three group members is added up, then **multiplied by 1.5** and subsequently **split evenly among all three group members**.

The share of your initial endowment you chose not to invest, goes directly towards your balance at the end of a round.

$$\text{Payoff} = (\text{Initial endowment} - \text{Investment}) + 1/3 * (1.5 * \text{Sum of investments})$$

Example:

Of her **100 ECU** initial endowment, a participant (group member 1) decides to keep **20 ECU** and invest **80 ECU**. The two other group members decide to invest **40 ECU** (group member 2) and **60 ECU** (group member 3), respectively. In total, **80 ECU + 40 ECU + 60 ECU = 180 ECU** were invested. **Multiplied by 1.5**, this amounts to **270 ECU**, which is then **divided evenly among all group members (90 ECU per person)**. As a result, the individual group members receive the following payoffs:

- Group member 1 keeps the **20 ECU** she did not invest and receives an additional **90 ECU** from the investment, a total of **110 ECU**.
- Group member 2: **60 ECU** (= 100 ECU – 40 ECU) + **90 ECU** (Investment) = **150 ECU**.
- Group member 3: **40 ECU** (= 100 ECU – 60 ECU) + **90 ECU** (Investment) = **130 ECU**.

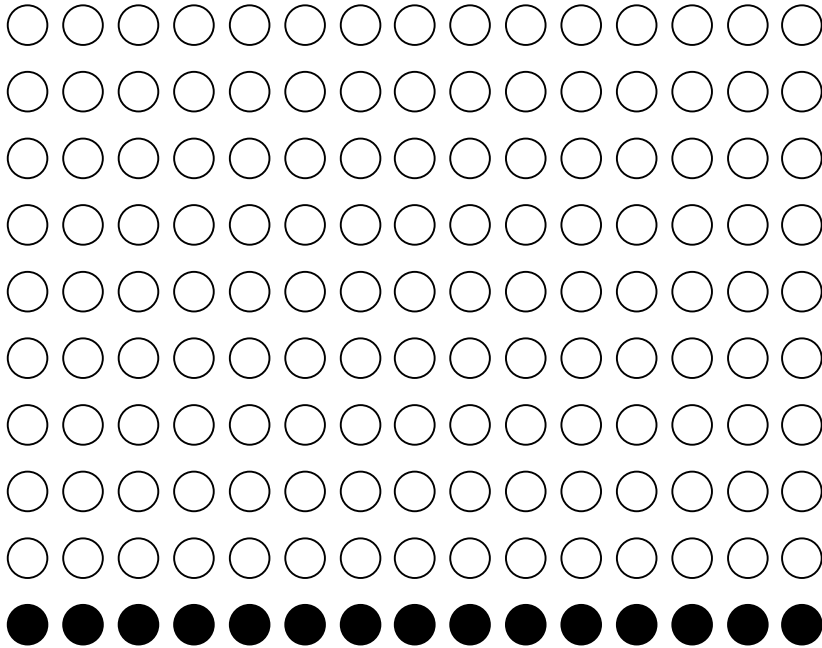
Payoff

Following this experiment, all task and decision sheets will be collected. For this reason, please detach this sheet from the second one. After the collection of the sheets, the winners will immediately and anonymously be determined. These individuals' responses will be used to calculate their respective payoffs. In the case of an incomplete response sheet, the draw will be repeated. The winners will be able to receive their payoffs at my office (2423) after presenting their title sheet and subject id/participant number, which can be found at the end of all sheets.

Subject ID: 300

Task sheet

Please fill in all empty circles with a ballpoint pen.



Subject ID: 300

Decision sheet

Investment decision

What amount would you like to **invest**?

Please choose a number **between 0 and 100**. Note that any amount of this endowment, which you choose not to invest is counted directly towards your payoff.

Additional Questions

1. A bat and a ball together cost 110 cents. The bat costs 100 cents more than the ball. How much does the ball cost? (in Euro)
2. If it takes 5 machines 5 minutes to make 5 widgets, how long would it take 100 machines to make 100 widgets? (in minutes)
3. In a lake, there is a patch of lily pads. Every day, the patch doubles in size. If it takes 48 days for the patch to cover the entire lake, how long would it take for the patch to cover half of the lake? (in days)

Risk preferences:

Assess yourself: Are you more of a risk-taking person or do you think of yourself as a risk-avoider? Please tick a box on the scale below, 0 indicating "no tolerance for risk" and 10 indicating "very risk-seeking". The values in between can help you more finely represent your image of yourself.

0 1 2 3 4 5 6 7 8 9 10

Demographic Information

In closing, I would like to ask you to give some information on yourself. It is important for analysing the data created in this experiment and will be treated strictly confidentially.

Your gender: Female
 Male

Your age:

Your final math grade:

Subject ID: 300

Figure 5: Contributions by cognitive skills

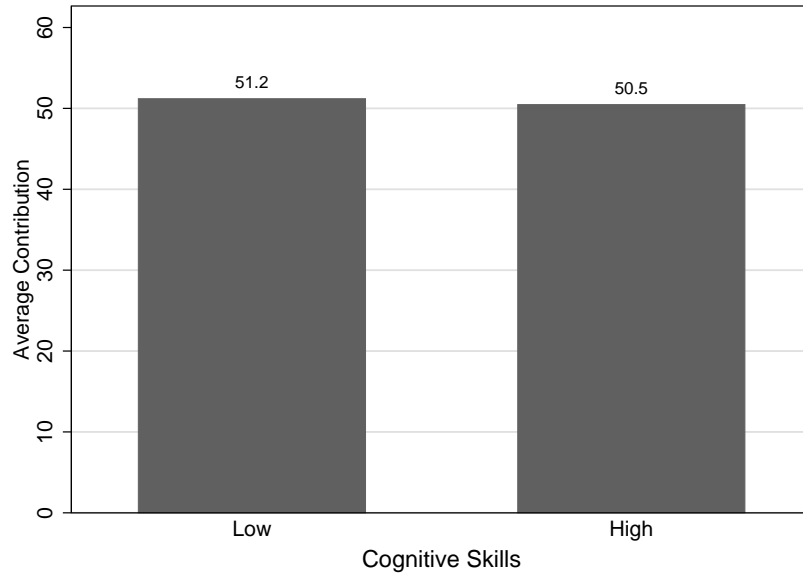


Figure 6: Boxplots: Contributions by cognitive type and treatment group (low, medium, and high)

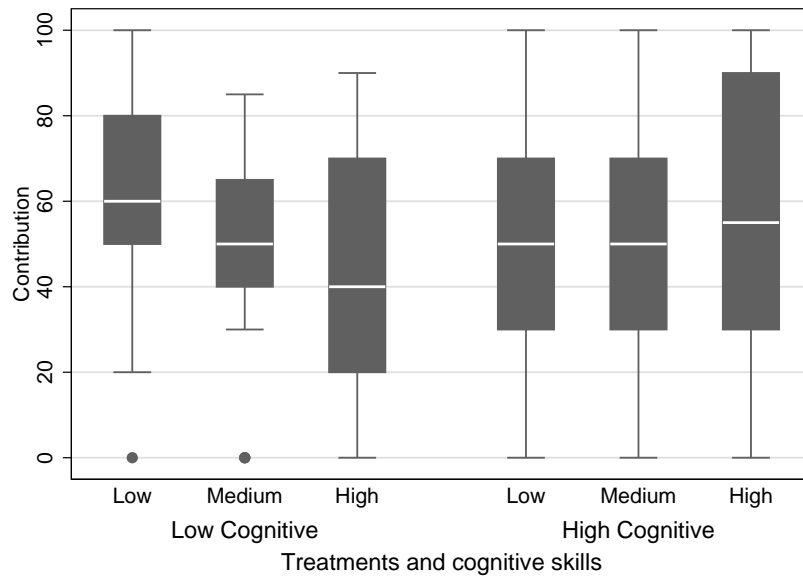


Table 5: OLS 2: Contributions to Public Good: Dummies for Treatment Group (Low Effort as Reference), number of correct answers in the CRT as continuous variable

	Contribution	
Medium Effort	-25.55**	(-2.06)
High Effort	-31.73***	(-2.64)
Correct	-5.706	(-1.60)
Medium Effort \times Correct	5.317	(0.94)
High Effort \times Correct	9.771*	(1.94)
Age	0.774	(0.76)
Sex	-3.181	(-0.66)
Risk	6.052***	(5.45)
Constant	24.51	(1.03)
Session FE	Yes	
Observations	153	
R^2	0.234	
Adjusted R^2	0.174	

t statistics in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

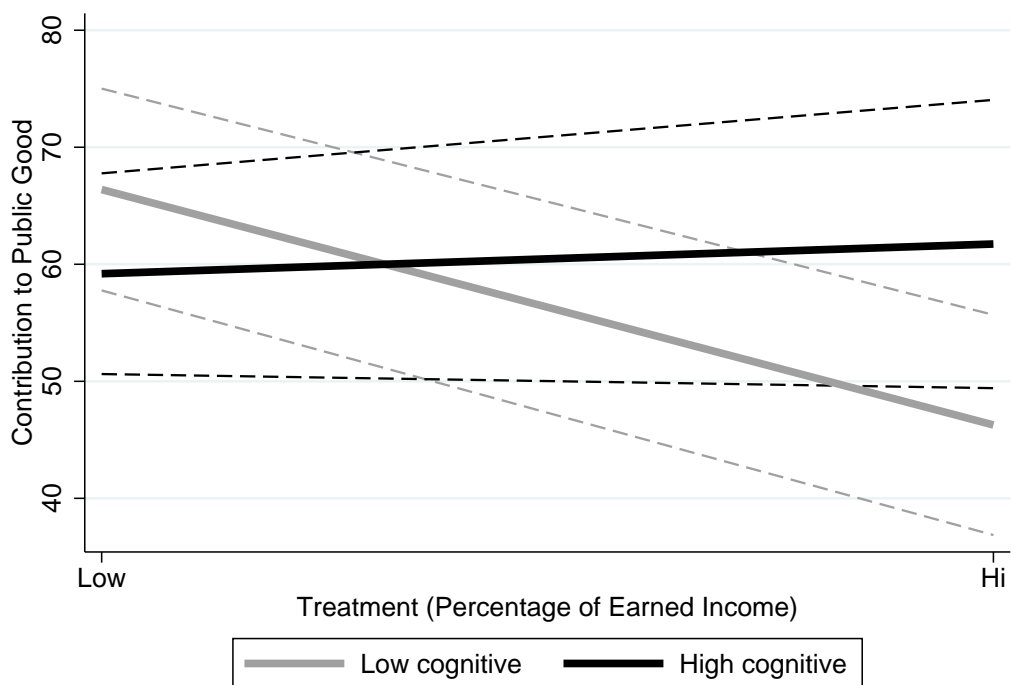
Table 6: Results for only positive contributions versus all contributions

	Positive contributions		All contributions	
Medium Effort	-14.13**	(-2.27)	-20.26***	(-2.90)
High Effort	-20.12***	(-2.98)	-19.77***	(-2.64)
Cognitive	-7.194	(-1.20)	-9.813	(-1.47)
Medium Effort & Cognitive	11.46	(1.02)	16.80	(1.36)
High Effort & Cognitive	22.66**	(2.37)	19.87*	(1.91)
Age	0.787	(0.85)	0.782	(0.77)
Sex	2.108	(0.49)	-4.387	(-0.91)
Risk	4.554***	(4.34)	5.999***	(5.36)
Constant	23.15	(1.16)	18.12	(0.81)
Session FE	Yes		Yes	
Observations	138		153	
R^2	0.228		0.235	
Adjusted R^2	0.160		0.175	

t statistics in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Figure 7: Two part model: Positive contributions by cognitive type and treatment group (low and high)



Note: Dashed lines represent 95% confidence intervals.