Experimental Analysis of the House-Money Effect in a Public Goods Environment

by

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EXPERIMENTAL ANALYSIS OF THE HOUSE-MONEY EFFECT IN A PUBLIC GOODS GAME

Experiments in economics usually begin with an initial endowment to subjects. Essentially, subjects are given starting capital to be used in the games conducted by the experimenter. While this practice is necessary to conduct the experiment, it could potentially affect the decisions of the subjects as there is no risk of suffering any net monetary loss. This phenomenon is known as the house-money effect. Since the original discovery, the house-money effect has been studied in different contexts and settings. The results from these experiments have varied. This study serves as a robustness check on past research conducted on the house-money effect.

The experiment was conducted with 69 student subjects in two treatment groups. Thirty-six subjects participated in the house treatment where subjects were credit money in their experimental accounts upon arrival at the public goods experiment (standard protocol in experimental economics). Thirty-three subjects participated in the advance treatment where subjects were given money prior to arriving at the public goods experiment. Additionally, subjects in each treatment participated in two sessions spread across three weeks. In conclusion, the study does not find strong statistical evidence of a house-money effect within the public goods environment.

1. Introduction

Experiments in economics usually begin with an initial endowment to subjects. Essentially, subjects are given starting capital to be used in the games conducted by the experimenter. While this practice is necessary to conduct the experiment, it could potentially affect the decisions of the subjects as there is no risk of suffering net monetary loss. This phenomenon is known as the house-money effect. People tend to be more risk-seeking with easily gotten money. This behavioral pattern was first analyzed by Thaler and Johnson (1990).

Since the original discovery, the house-money effect has been studied in different contexts and settings. Clark (2002) and Cardenas et. al. (2014) examine the house-money effect using a public goods game and an ordered lottery selection, respectively. The results from these experiments have varied. Clark (2002) found that subjects who were given house-money were no more or less cooperative than those who had been given their endowments in advance. However, when Harrison (2007) reanalyzed the same data, a significant effect was found. Similarly, when additional research was conducted by Cardenas et. al. (2014), evidence suggesting a house-money effect was identified.

The mixed results in the literature suggest that the identification of a house-money effect is sensitive to features of the experimental design, particularly to differences in how advance payments are made to subjects. Clark (2002) simply asks subjects to bring a specified amount of their own money to the experiment, while Cardenas et. al. (2014) provides subject an advance payments three weeks prior to the experiment. By combing design elements from Clark (2002) and Cardenas et. al. (2014), this study re-examines the presence of the house-money

Sixty-nine subjects participated in a public goods game. Subjects' contributions to the public good serves as a measure of their cooperation with fellow-group members. Considering

the importance and ubiquity of cooperation in social and economic interactions, it is important to understand the impact of the timing of receipt of individuals' endowments on their choices in this setting.

Thirty-six subjects participated in the house treatment and 33 subjects participated in the advance treatment. Each subject self-selected the time in which they would attend the experiment. They had no previous knowledge of the experimental treatments, nor the treatment in which they would be participating in. Per economic experimental convention, the money distributed to the advance subjects covered the potential for net losses. However, each subject had the potential to earn more or less than the endowed amount.

In contrast to economic experimental convention, each subject in the advance treatment received an endowment of $12.50 three weeks prior to the experiment. These subjects were told to each bring $12.50 when they returned to the laboratory for the actual experiment. Subjects were intentionally not told to bring the same $12.50 cash previously given. The experiment was designed in this way, so subjects felt no direct pressure to save the advance $12.50. In a post-experiment questionnaire, we asked subjects how much of the advance payment they had left, thus requiring this amount to be replaced before they returned. Ultimately, this design seeks to closely resemble the subjects using their own money in the experiment, as they were able to spend the money prior to the experiment, while still maintaining the requirements set forth by IRB.

This paper is organized as follows. Section 2 contains a review of previous research conducted on the house-money effect. Section 3 details the experimental design utilized in this study. Section 4 presents the results and analysis. Section 5 includes a brief discussion and summary of the study.

2. Literary Review

Past evidence suggests people receiving small, one time "windfall gains," often exhibit riskier behavior with this gain. This phenomenon has been labeled the house-money effect (Thaler and Johnson, 1990). Standard experimental economics protocol provides each participant an initial endowment of money to be used in the experiment. Past experimental economics studies using the voluntary contribution mechanism (VCM) found a significant proportion of subjects contribute towards a public good, even though the individual payoff-maximizing choice is to free-ride on others' contributions (Ledyard, 1995).

Clark (2002) examines whether behavior in economic experiments using the voluntary contribution mechanism (VCM) for public goods is affected by the origin of the funds participants used. Additionally, the study analyzed whether the level of provision observed in VCM experiments provide a misleading indication on the degree of free-riding organizations can expect.

At the opening of each decision round in a VCM public goods experiment, each subject is matched with our subjects to form a group and is s endowed with experimental tokens (Isaac et al., 1984 and Andreoni, 1995). In Clark (2002), subjects were placed groups of 5 and endowed with 80 experimental tokens. Subjects then allocated tokens between an "Individual Exchange" and a "Group Exchange." Each token in the Individual Exchange yields one cent and each token in the Group Exchange two and one-half cents. Tokens allocated to a subject's Individual Exchange yield private earnings for that subject. Each token allocated the Group Exchange by a group member yields a half cent per group member. This game was repeated for 10 decision rounds. The dominant strategy for each subject is to invest zero tokens into the Group Exchange every decision round. However, if each subject contributed all 80 tokens to the Group Exchange every round, each subject would earn $20, a $12 increase from the

dominant strategy payoff of $8. Thus, group members allocating their entire endowment to the Group Exchange is socially optimal.

Clark (2002) conducted with two treatment groups, the house-money treatment (H), and the own-money treatment (O). The recruitment conditions were the same for each treatment group. Each subject was recruited with the requirement, "you must bring $8 to the experiment." Each subject was told they could avoid losing this $8 with certainty through their own decisions. All subjects signed a consent form immediately before the experiment that promised they would be paid "an average amount of $12-$16, but the actual amount will vary due to decision-making."

The manipulation between the two treatments occurred with the origin of the funds utilized in the experiment. Treatment (H) was provided the initial endowment as conventional to economic experimental convention. In contrast, treatment (O) was not provided this initial endowment. The instructions for treatment (O) and treatment (H) were identical except for two lines placed near the top of treatment (O)'s instructions. Treatment (O)'s instructions included the following sentences. "In a few moments, you will be asked to give the $8 you brought with you today to the experimenter. The $8 will be used to fund your personal investment account for use in today's experiment." Subjects in treatment (O) would accumulate $8 less than subjects in treatment (O). The earnings of subjects in treatment (O) would range from -$4 to $16. The earnings of subjects in treatment (H) would range from $4 to $24. To maintain an identical final wealth distribution, each subject in treatment (O) was automatically given a $8 participation fee on top of their VCM decision round earnings.

A total of 150 students participated, 75were given the house-money (H) treatment and 75 were given the own-money treatment (O). Within each session, three groups of five were

formed. Group pairings were reassigned each round, so no subject shared a group with the same four people for any given round.

The study found the differences in mean allocation decisions across all rounds between the two treatments was not statistically significant. Ultimately, the experiment found no evidence of a house-money effect in the voluntary public good environment.

The voluntary public good design utilized in Clark (2002) served as the basis for the experimental design utilized in this study. Two treatment groups with similar manipulations were employed. In contrast, subjects were paired with the same groupings for each of the twenty rounds. Additionally, the manipulation of the own-money treatment differed. Subjects were not asked to bring a specified amount of their own money to the experiment. Instead, subjects were given money three weeks in advance of the actual experiment. Subjects were asked to bring the same amount of money back with them three weeks later. Another difference is that subjects in our advance treatment never presented the endowment they were given prior to the experiment.

Harrison (2007) reconsiders evidence from Clark (2002). Clark (2002) claimed to show that using “house money” in standard public good experiments has no effect on behavior. However, Harrison (2007) shows an effect when one examines the data using appropriate statistical methods. Harrison (2007) examined the individual-level responses and accounted for the error structure of the panel data. Using the same data in Clark (2002), Harrison (2007) clustered each group's standard errors, as the decisions of each subject was not independent from the decisions of their group members. Harrison (2007) encouraged the use of panel econometric methods over the use of unconditional nonparametric methods. This study utilized

panel econometric methods in the analysis section of the study. He also examined the variation in the allocation decisions, rather than exclusively focusing on the mean.

Harrison (2007) addresses the unconventional participation fee applied to the own money (O) treatment. Common practice suggests experimenters avoid mentioning specific numerical target earnings. In doing so, subjects may adopt a strategy derived from their expectations. A numerical target earnings figure was not mentioned in the requirement literature utilized in this study.

Cardenas et. al. (2014) design an experiment focusing on risk preferences over lotteries. They seek to determine the extent to which the house-money effect modifies risky decision making. The experiment consisted of two sessions with 172. Control and treatment groups were utilized in the experiment. Within each session, subjects were randomly assigned to treatment groups (cash in advance treatment) or control groups (cash the day of the experiment treatment). The standard protocol cash-the-day-of-the-experiment treatment served as the control. Over the two sessions, 61 subjects were assigned to each treatment.

The advance treatment group received the initial endowment for the experiment 21 days in advance of the experiment. The control treatment group received the initial endowment on the day of the experiment. The 21-day time period between the endowment of the advance treatment and the experiment was estimated to be sufficient time for subjects to incorporate the cash as part of their pocket money. Subjects were recruited from classrooms. On the day of recruitment, an announcement was made about the experiment. The two treatments were detailed to all potential subjects and they were told if they participated they would be randomly assigned to one of the two treatments. Thus, all subjects had perfect information regarding the treatment they were assigned to, as well as the treatment they were not assigned to. Informing

all subjects of all the treatments in the experiment is not standard protocol in experimental economics

On the day of the classroom recruitment, subjects were told the actual experiment would be conducted three weeks from that date. All subjects then signed a contract stating they would participate in the experiment three weeks from then. Subjects assigned to the advance treatment were given 40,000 COP (Columbian currency) after signing the contract. The contracts for the advance treatment also included a clause that subjects would bring 40,000 COP (Columbian currency) back with them on the day of the actual experiment. The experiment followed the Binswanger (1980) and Attanasio et al. (2012) Ordered Lottery Selection (OLS) design. Each subject was given a piece of paper with six different uniform-probability lotteries involving possible losses depending on a coin toss. Each subject selected one lottery to play. At that time, the subjects were unaware they would make further choices.

Once each choice had been collected, the subjects were handed a second set of six lotteries. However, this set of lotteries did not involve losses. The subjects were told the outcome would depend on another coin toss and their payments would be computed using the sum of results from both lotteries. After the new choices had been collected, subjects were then asked to complete a socioeconomic survey. At this point each coin toss took place.

Prior to the start of the experiment, each subject was asked how much money they had in their pockets. The study found subjects in the advance treatment group had significantly more cash in their pockets than the control. However, the difference was smaller than the initial endowment. This amount was calculated by taking the amount subjects self-reported and subtracting the initial endowment. It was estimated that the advance treatment spent on average

thirty-five percent of their advance payment cash. The demographic and questionnaire data from Cardenas et. al. (2014) can be seen in Table 1.

Table 1: Demographic Characteristics of Treatment and Control Groups, Cardenas et al. (2014)

Variable	Mean Value or Percentage		P-value	
	Control	Treatment	Rank-Sum test	T-test
Gender (% female)	36.1 %	57.4 %	0.019	0.018
Age	19.6	18.8	0.170	0.034
Single[(1)]	96.7 %	100 %	0.156	0.156
Siblings	1.4	1.5	0.405	0.291
Semester	3.3	3.0	0.261	0.371
Monthly expenses[(2)] (COP)	445 080	443 440	0.840	0.968
Housing stratum[(3)]	4.72	4.8	0.898	0.671
Money in pocket (COP)	41 132	67 098	0.000	0.001
Adjusted Money in pocket[(4)] (COP)	81 132	67 098	0.014	0.057

Notes:
[(1)] Only two participants (both in the control group) reported "other" as marital status
[(2)] Using midpoint of reported range
[(3)] Housing strata in Colombia range from 1 (lowest) to 6 (highest).
[(4)] Amount of money at time of making decisions (pocket + 40 000 for participants in control group)

On average, the study found no major statistical difference in the distributions of the observed coefficient of risk behavior across the two groups. In contrast, after controlling for the available cash the subjects had in their pockets at the time of the experiment, the study found that those in the treatment group who had more money with them on the day of the experiment tended to be more risk tolerant while those who had less where more risk averse. If the spending of the endowed money is interpreted as the spending of one's own money, the findings suggest a small house-money effect.

The design of the advance payment process was relied upon in designing the procedures for this study. Similar to Cardenas et. al. (2014), subjects in the advance treatment were given

an initial endowment three weeks prior to the experiment. Additionally, the questions pertaining to money in pocket and what they did with the advance money in the 21 days prior to the experiment were expanded. As detailed in the next section, subjects were recruited using an existing subject database so that subjects were not told about the treatment they were not assigned to.

3. Experimental design

Subjects were volunteers from the student body of Appalachian State University. The subjects were recruited using ORSEE (Greiner, 2004) via emails sent to the Appalachian Experimental Economics Laboratory subject database (AppEEL). Each subject in the database received an email to participate in the experiment. A total of 69 subjects participated in the experiment. Two treatments were examined, the house treatment (the control) and the advance treatment. As a variation of the experimental protocol used by Cardenas et al. (2014), all subjects came to the AppEEL laboratory twice. During the initial visit, subjects were told that the actual experiment would take place three weeks from that day and time. Subjects were then offered contracts stating they would return 21 days later to participate in the experiment. Subjects in both treatments were paid $5 for showing up to the first session, regardless of whether they signed the contract or not. The contract in the advance treatment also mentioned that subjects would be paid an additional $12.50 if they signed the contract to return in three weeks. The contract stated they were guaranteed to make at least $5 during the second session. If subjects lost a portion of the $12.50 during the second session, they agreed to reimburse the money that was lost at that time. An advance payment of $12.50 was chosen as this is the self-interested, monetary maximizing Nash equilibrium of the public goods game subjects played during the second session. The first session took approximately 10 minutes.

Due to concerns that subjects would not sign the contract or subjects would sign the contract but not show up for the second session, more subjects were recruited for the first session than we expected to have complete the study. In the control treatment, 45 subjects showed up for the first session, 44 signed the contract, and 36 returned for the second session. In the advance treatment, 47 subjects showed up for the first session, 41 signed the contract and received the advance payment, and 33 returned for the second session with at least the advance payment amount in cash. One subject who signed the contract and received the advance payment but did not return for the second session emailed Dr. Stoddard the next day. He returned $6 of the $12.50 to Dr. Stoddard in his office the next day.

The purpose of the advance payment three weeks prior to the experiment was to give subjects time to feel as if the $12.50 was their own money. Cardenas et al. (2014) estimated that subjects spent approximately 30% of the advance payment in their study. However, as described in more detail in the next section, their measurement for how much of the advance payment subjects spent before returning to the lab is faulty. The Cardenas et al. (2014) measure applied to the data from experiment would imply subjects did not spend any of the advance payment and brought more cash to the experiment as backup. Fortunately, in this study, additional measures were used to measure how much they spent. These measure report that some subjects did spend some of the advance payment prior to returning to the lab for the second session.

At the second session, subjects participated in a repeated VCM public goods game, similar to Clark (2002). The public goods game consisted of 20 rounds. For each treatment, subjects were randomly and anonymously matched into groups of 3. Each subject remained in the same group for all 20 rounds of the experiment. Each subject had a private account, and

the three group members together shared a group account. Each subject started each round with 50 tokens in his/her private account. In each round, each group member allocated tokens to the group account from his/her own private account. Each token a group member allocated to the group account; 1 token came out of their own private account. However, each token allocated to the group account was multiplied by 1.5. At the conclusion of each round, subjects received the remaining tokens in their private accounts, as well as ⅓ of the ending value of the tokens in the group account.

The dominant strategy for subjects wishing to maximize their own earnings, assuming all subjects in the group wish to maximize their own earnings, is to move zero tokens into the group account. The group's total earnings are maximized when all subjects allocate all of their endowment of tokens to the group account. Subjects made all decisions without knowledge of the decisions of their other group members. However, at the conclusion of each round, subjects were shown the number of tokens moved to the group account by each individual member of the group. Additionally, subjects were shown their own earnings in tokens for each round. The computerized experiment was programmed with zTree (Fischbacher, 2007).

The contracts and instructions are included in the Appendix. The instructions for the public goods game were identical between the two treatments, with one exception. Instructions for the advance treatment (A) included this additional statement.

> If your earnings from the experiment are greater than $12.50, then you will receive the difference at the conclusion of the session. If your earnings from the experiment are less than $12.50, you will need to pay the experimenter the difference between $12.50 and your earnings. For instance, if you earn $14, at the conclusion of the session you will be paid $1.50. In contrast, if you earn $11, at the conclusion of the session you will

need to pay the experimenter $1.50. You will always be able to avoid losing money with certainty through your own decisions.

At the conclusion of the experiment, subjects from the house treatment were given an envelope with their individual earnings. This procedure differed from the process utilized in the payment of the advance treatment subjects. For subjects in the advance treatment, envelopes contained only the amount above the initial $12.50 given to subjects two weeks prior to the experiment. Additionally, subjects with earnings below the advance payment of $12.50 paid the experimenter the difference between the advance payment and their actual earnings. Only one subject earned less than the $12.50 advance payment. This subject paid the experimenter $0.25.

Finally, subjects completed a post-experiment questionnaire, included below. The questions were developed after reviving past research conducted by Cardenas et. al. (2014) asked all subjects how much cash they currently had in their possession (first question). The aim of this question is to get a measure of how much of the advance payment subjects had spent. However, to get at this measure more directly, we expand the questionnaire to include questions 2 & 3.[1]

[1] Cardenas et al. (2014) also had subjects answer socio-economics questions, which we did not include.

House Treatment (H) Post-Experiment Questionnaire

1. How much cash do you currently have in your possession?

Advance Treatment (A) Post-Experiment Questionnaire

1. How much cash do you currently have in your possession (including the $12.50 you received from the experimenters prior to today)?

2. Of the original $12.50 cash you received from the experimenters prior to today, how much of that specific cash do you have left? For instance, if you spent $5.25 on a sandwich, then you would have $7.25 left ($12.50 - $5.25) and would have needed to replace the $5.25 before you came to the session today.

3. If you have all of the original $12.50 cash left, why did you not spend it before today? (Possible multiple choice options: Felt obligated to bring all of the original cash to the session; Do not typically make purchases with cash; Other-please describe below.)

4. Results and Analysis

Table 2 displays the demographic characteristics of the two treatment groups, house (control) and advance. Each treatment consisted of students from Appalachian State University. The age of the subjects ranged from 18 to 29. The number of semesters studied ranged from 1 to 5. Additionally, the subjects belonged to 38 different areas of study (majors). The number of economics courses completed by each subject ranged from 0 to six courses. The maximum number of economics experiments the subjects participated in did not exceed 10 experiments.

Table 2 also includes survey data collected at the conclusion of the experiment. Cash in wallet is the average amount of cash each subject in each treatment had in their pocket at the time of the experiment. The difference between the house treatment and the advance treatment is $14.70, slightly higher than the advance payment of $12.50. The Adjusted money in pocket in the house treatment is the subjects' answer to the Cash in wallet question plus an amount equivalent to the advance payment of $12.50. An average subject in the advance treatment had $2.20 more than subjects in the house treatment. That subjects on average had more in the advance treatment is important when compared to analysis conducted in Cardenas et al. (2014). They found subjects in the house treatment had more cash and ascribe the difference as proof that the subjects in the advance treatment viewed the money as their own. They interpret the difference in cash in wallet at the session between treatment conditions as evidence that subjects assigned to the advance treatment spent some of the advance payment. If Cardenas et al. (2014) had found a difference across treatments as we do, they would have had no evidence to suggest their protocol worked.

Fortunately, Cardenas et al. (2014) suggest a better measure for determining if subjects spent any of the advance payment would be to ask subjects directly how much of the advance payment they spent. We did this. On average, subjects in the advance treatment reported spending $2.68 ($12.50 - $9.82) of the original advance cash payment. Thus, despite not finding evidence that subjects in the house treatment had more cash in their wallets at the time of the experiment than subjects in the advance treatment, the Cash remaining question provides evidence that at least some subjects viewed the advance money as their own. Cardenas et al. (2014) estimated subjects spent 35% of the advance payment. Our estimate is 21% including all 33 subjects in the advance treatment. However, 10 of the 33 (30%) reported spending at

least some of the advance $12.50. Subjects who spent at least some of the advance cash reported spending $8.85 ($12.50 – $3.65). Of course, subjects could have made additional purchases due to a wealth effect from the advance payment without spending the actual cash they received at the first session after signing the contract. Thus, our estimate of that subjects spent on average 21% of the advance payment and that 30% of the subjects spent some of the advance payment should be interpreted as lower bounds for the effectiveness of the advance payment protocol in establishing that subjects internalized the advance payment as their own money.

Table 2: Demographic & Survey Summary Statistics

Variable	***House (Control)***	***Advance***
Gender (% female)	53%	58%
Age	20.53	20.48
Semester	2.72	2.37
# of Economic classes taken	1.39	1.42
# of Economics Experiments participated in	3.5	3.45
Cash in wallet	$14.00	$28.70
Adjusted money in pocket	$26.50	$28.70
Cash remaining	---	$9.82

**Cash in wallet adjusted to exclude response of $3,000*

4.1. Allocation Decisions in the Public Goods Game

We now move to an analysis of the allocation decisions in the public goods game. Figure 1 displays the average total group contribution of the house (control) and advance treatment groups over all 20 rounds of the experiment. It's important to note, with the design of the experiment, only the subject's first decision round was independent of the two other subjects in their group. Therefore, the existence of a house-money effect was most likely to be seen in round one of the experiment. As can be observed by the averages reported in Table 3, a Wilcoxon ranksum test reports no statistical difference can be seen between the house and

advance treatments in round one (p = 0.7790) and when analyzing average decisions across all 20 rounds of the experiment (p = 0.6506).

Figure 1: Average Group Allocation

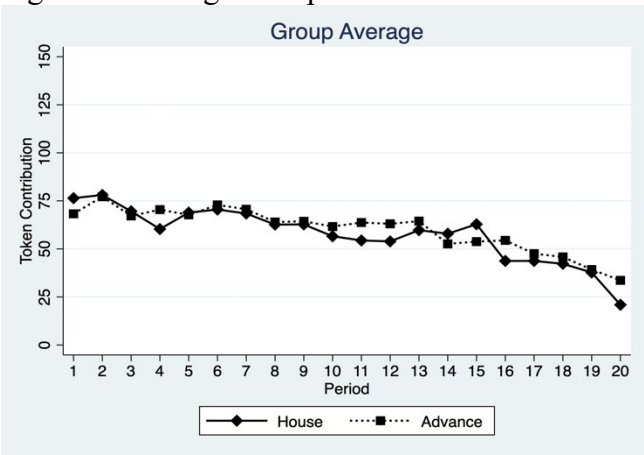

Table 3: Summary Statistics of Individual Allocation Decisions

Treatment	Number of Subjects/Group	Mean Allocation (St Dev) Round 1	Mean Allocation (St Dev) All Rounds
Control (House)	36/12	25.47 (16.54), N=36	19.19 (9.81), N=12
Advance	33/11	22.76 (13.40), N=33	20.05 (7.05), N=11

An independent observation in round 1 is a subject. An independent observation across all rounds is a group.

Figure 2 displays a time trend of the proportion of complete free riders over all 20 rounds of the experiment. Two sessions of each treatment were combined and averaged over the course of the experiment to compile the graph. The proportion of free-riders was higher in the house treatment for all but round one of the experiments. If the origin of the subjects starting capital was an influencing factor on their decisions to contribute to the group account, subjects would be expected to show a preference for risk aversion. Ultimately, the results displayed in Figure 2 are the opposite of what is expected if a house-money effect exists.

Figure 2: Time Trend Proportion of Complete Free-Riders

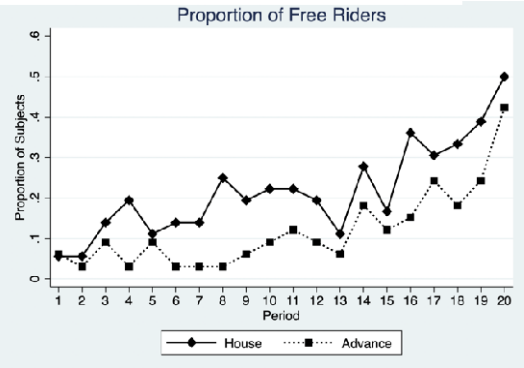

Figure 3: Time Trend Proportion of Full Contributors

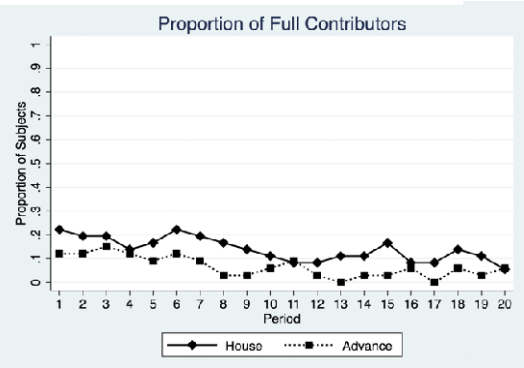

Figure 3 displays a time trend of the proportion of full contributors over all 20 rounds of the experiment. Two sessions of each treatment were combined and averaged over the course of the experiment to compile the graph. The proportion of full contributors was higher in the house treatment for all but rounds four, eleven, sixteen, and twenty. When analyzing the house-money effect and the origin of starting capital, a lower proportion of full contributors is expected in the advance treatment. However, the variation between the house treatment and advance treatment was not statistically significant, suggesting an absence of a house-money effect.

Figure 4 displays a time trend of the average proportion of positive contributors over all 20 rounds of the experiment. Two sessions of each treatment were combined and averaged over the course of the experiment to compile the graph. The average proportion of positive contributors was higher in the house treatment for all but rounds eleven, twelve, and thirteen. In rounds eleven, twelve, and thirteen, the average proportion of positive contributors was slightly higher in the advance treatment. When analyzing the house-money effect and the origin of starting capital, a lower average proportion of positive contributors is expected in the advance treatment. However, the variation between the house treatment and advance treatment was not statistically significant, suggesting an absence of a house-money effect.

Figure 4: Time Trend of the Average Contribution of Positive Contributors

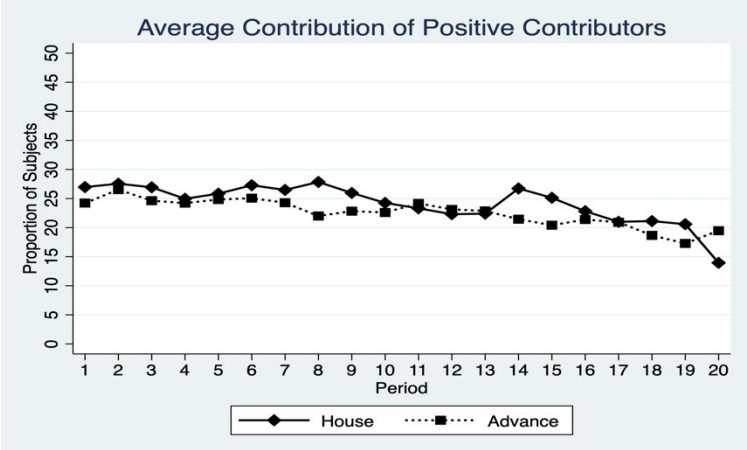

Table 4displays a two-sample T-Test with equal variances. This test analyzed the average contribution amounts of the house and advance treatment groups. The alternative hypothesis suggests the average contribution of treatment group one (house), should be statistically different than the average contribution of treatment group two (advance). With a p-value of 0.4071, the null hypothesis cannot be rejected. Therefore, the average contribution of group one is equal to the average contribution of group 2.

Table 4: Two-sample t test with equal variances

Group	Observations	Mean	Standard Error	Standard Deviation	95% Confidence Interval	
1	12	57.575	8.495927	29.43075	38.87559	76.27441
2	11	60.14091	6.377574	21.15202	45.93079	74.35103
combined	23	58.80217	5.267494	25.26202	47.87806	69.72629
diff		-2.565909	10.77858		-24.98119	19.84937

diff = mean (1) - mean (2) t = -0.2381

df = 21

Ha: diff < 0 Ha: diff ! = 0 Ha: diff > 0

Pr(T < t) = 0.4071 Pr(|T| > |t|) = 0.8141 Pr(T > t) = 0.5929

Table 4.1: Two-sample Wilcoxon Rank-sum (Mann-Whitney) test

Group	Observations	Rank-sum	Expected
1	12	136	144
2	11	140	132
combined	23	276	276

unadjusted variance	264
adjustedment for ties	0
adjusted variance	264

Ho: sumgive(treatm ~ t==1) = sumgive(treatm ~ t==2)

z = -0.492

Prob > |z| = 0.6225

Exact Prob = 0.6505

Table 5 displays a two-sample T-Test with equal variances. This test analyzed the proportion of free-riders in the house and advance treatment groups. The alternative hypothesis suggests the proportion of free-riders in treatment group one (house), should be statistically different than the proportion of free-riders in treatment group two (advance). Prior evidence supporting the house-money effect suggests the proportion of free-riders in treatment group two (advance) should be significantly higher than the proportion of free-riders in treatment group one (house). However, with a p-value of 0.9309, the null hypothesis cannot be rejected at the 0.05 significance level. Therefore, the proportion of free-riders in treatment group two (advance), is not statistically different from the proportion of free-riders in treatment group one (house).

Table 5: Two-sample t test with equal variances

Group	Observations	Mean	Standard Error	Standard Deviation	95% Confidence Interval	
1	12	0.2180556	0.0531602	0.1841522	0.1010508	0.3350603
2	11	0.1181818	0.0347759	0.115338	0.0406962	0.1956675
combined	23	0.1702899	0.0333655	0.1600155	0.101094	0.2394858
diff		0.0998737	0.0647992		-0.0348835	0.234631

diff = mean (1) - mean (2) t = 1.5413

df = 21

Ha: diff < 0 Ha: diff ! = 0 Ha: diff > 0

Pr(T < t) = 0.9309 Pr(|T| > |t|) = 0.1382 Pr(T > t) = 0.0691

Table 5.1: Two-sample Wilcoxon Rank-sum (Mann-Whitney) test

Group	Observations	Rank-sum	Expected
1	12	167	144
2	11	109	132
combined	23	276	276

unadjusted variance	264
adjustedment for ties	-1.43
adjusted variance	262.57

Ho: sumgive(treatm ~ t==1) = sumgive(treatm ~ t==2)

z = 1.419

Prob > |z| = 0.1558

Exact Prob = 0.1634

Table 6 displays a two-sample T-Test with equal variances. This test analyzed the proportion of full contributors in the house and advance treatment groups. The alternative hypothesis suggests the proportion of full contributors in treatment group one (house), should be statistically different than the proportion full contributors in treatment group two (advance).

Prior evidence supporting the house-money effect suggests the proportion of full contributors in treatment group two (advance) should be significantly lower than the proportion of full contributors in treatment group one (house). The results of the experiment show the proportion of full contributors in treatment group two (advance), is lower than the proportion of full contributors in treatment group one (house). However, with a p-value of 0.8766, the null hypothesis cannot be rejected at the 0.05 significance level. Therefore, the proportion of full contributors in treatment group two (advance), is not statistically different from the proportion of full contributors in treatment group one (house).

Table 6: Two-sample t test with equal variances

Group	Observations	Mean	Standard Error	Standard Deviation	95% Confidence Interval	
1	12	0.1388889	0.0538631	0.1865873	0.020337	0.2574408
2	11	0.0666667	0.023355	0.0774597	0.0146286	0.1187048
combined	23	0.1043478	0.0305709	0.1466131	0.0409476	0.1677481
diff		0.0722222	0.0647992		-0.0538542	0.1982986

diff = mean (1) - mean (2) t = 1.1913
df = 21

Ha: diff < 0 | Ha: diff ! = 0 | Ha: diff > 0
Pr(T < t) = 0.8766 | Pr(|T| > |t|) = 0.2468 | Pr(T > t) = 0.1234

Table 6.1: Two-sample Wilcoxon Rank-sum (Mann-Whitney) test

Group	Observations	Rank-sum	Expected
1	12	157.5	144
2	11	118.5	132
combined	23	276	276

unadjusted variance	264
adjustedment for ties	-5.87
adjusted variance	258.13

Ho: sumgive(treatm ~ t==1) = sumgive(treatm ~ t==2)
z = 0.84
Prob > |z| = 0.4008
Exact Prob = 0.4161

Table 7 displays a group level panel regression. This regression includes three dependent variables and their relation to the independent variable. The first dependent variable is the advance treatment and is denoted by advance. The second dependent variable is the period and is denoted by period. The third dependent variable is con and is denoted by con.??

The independent variable is the average group contribution to the group account. The house-money effect would suggest a statistical impact on the average contribution from the advance dependent variable. As shown, the advance treatment had no significant impact on the average group contribution with a p-value of 0.812. In contrast, both the period and cons did significantly impact the average group contribution.

Table 7: Group Level Panel Regression

Random-effects GLS regression — Number of Observations = 460
Group variable: groupID — Number of Groups = 23

R-sq: — Observation per group:
within = 0.1942 — minimum = 20
between = 0.0027 — average = 20
overall = 0.102 — maximum = 20

Wald chi2 (2) = 105.14
corr(u_i, X) = 0 (assumed) — Prob > chi2 = 0

sumgive	Coeffecient	Standard Error	z	P > |z|	95% Confidence Interval	
Advance	2.565909	10.77858	0.24	0.812	-18.55971	23.69153
Period	-1.959627	0.1911646	-10.25	0	2.334303	-1.584952
Cons	78.15109	7.7196	10.12	0	63.02095	93.28123
Sigma_u	25.274734					
Sigma_e	23.641896					
rho	0.53334285	(fraction of variance due to u_i)				

5. Discussion and Summary

Past research conducted on the house-money effect found statistical evidence when testing for the effect in lottery games. Additionally, multiple studies have found statistical evidence of the effect within public goods games. Our study, combined, and expanded on, experimental procedures utilized in prior experiments, thus serving as a robustness check on these past studies. We did not find evidence of a house-money effect within a public goods environment.

The experiment was run with 69 subjects in two treatment groups. Of the 69 subjects who participated in the experiment, 36 subjects participated in the house treatment and 33 subjects participated in the advance treatment. For each treatment, subjects were randomly and anonymously matched into groups of three. Each subject remained in the same group for all

20 rounds of the experiment. Each subject had a private account, and the three group members together shared a group account. In each round, subjects selected between allocating tokens to the group account and their own private account. Each member of the group was faced with this choice. Each subject started the round with 50 tokens in their private account. The house treatment served as the control group, with advance treatment as the test group. Subjects from both treatments participated in a multi-round experiment taking place over a three week-time span. The house and advance groups were spread over two days (with the corresponding date and time three weeks later). Each treatment was conducted once per day. The manipulation of the advance treatment involved an endowment of $12.50 that subjects received three weeks prior to the experiment. These subjects were told to bring $12.50 to the actual experiment. The experiment consisted of 20 rounds.

In conclusion, this study served as a robustness check on past research conducted on the house-money effect. The study utilized an alternative experimental design to induce own-money effects. However, the study did not find statistical evidence of a house-money effect within the public goods environment; observed cooperation rates and rates of free-riding were not significantly different between the two treatments. We believe that while a house-money effect may be prevalent within other risk environments, the effect is not prevalent within a public goods environment.

6. References

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7. Appendix

House Treatment Instructions & Contract

INSTRUCTIONS

1. You have the opportunity to participate in an economics experiment.
2. If you decide to participate, you should sign the contract below committing to show up on Monday, April 29th, at 3:30pm.
3. If you decide to participate, the decisions you make in the experiment and the results associated with them will remain confidential and anonymous.

Below is the contract to be signed if you decide to participate. Please read the contract carefully and sign it.

CONTRACT

I, _____ (printed full name), identified with the ID card of Appalachian State University, agree to attend an economics experiment on _____(day of week), _____(month and date), at _____(time) in Peacock Hall room #3021. I understand that I am guaranteed at least $5 for participating in both today's session and the second session of the experiment.

Signature_____

Advance Treatment Instructions & Contact

INSTRUCTIONS

1. You have the opportunity to participate in an economics experiment. For the experiment, you will receive $12.50 today. You will need to bring $12.50 with you to the second session of the experiment. You can earn more or less than this amount depending on the decisions you make during the second session of the experiment. At no point can you lose more than $12.50 that we provide.
2. If you decide to participate, you should sign the contract below committing to show up on _____(day of week), _____(month and date), at _____(time).
3. If you decide to participate, the decisions you make in the experiment and the results associated with them will remain confidential and anonymous.

Below is the contract to be signed if you decide to participate. Please read the contract carefully and sign it.

CONTRACT

I, _____ (printed full name), identified with the ID card of Appalachian State University, agree to voluntarily participate in the experiment and certify that I received the $12.50 on _____(current day of week), _____(month and date) _____(year).

Further, I agree to attend an economics experiment on _____(day of week), _____(month and date), at _____(time) in Peacock Hall room #3021. I understand that in the second session of this experiment I can earn more than $12.50 or lose some amount of the $12.50 that I have received today. However, I am guaranteed to make at least $5 for participating in both today's session and the second session of the experiment. In case I lose some of the $12.50 during the second session of the experiment, I agree to reimburse the money I lose at the conclusion of that session.

Signature: _____