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Abstract

In this study, we conducted a simple self-control investment experiment to investigate the tangibility effect of paper money and coin. We found that, compared to the non-cash condition, physically holding either paper money or coin made subjects significantly less likely to participate in the investment experiment and those who did participate invested significantly less. In addition, an aversion towards coins in small investments and a gender difference in investment decision were found.

Keywords: Tangibility effect; Paper money; Coin; Experiment

JEL classification: C91, D03

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1. Introduction

Does holding cash physically in one's hand *per se* significantly change one's economic behavior? It seems that this topic has been somewhat neglected in the economics literature but has gradually begun to attract interest from behavioral economists. So far, only a very few studies have investigated this issue experimentally. Reinstein and Riener (2012) examined the tangibility effect as well as the windfall effect in a dictator game experiment. They found that the dictators gave significantly less to the respondents when their endowment was in cash than when their endowment was only displayed on a computer screen. Shen and Takahashi (2013) conducted two ultimatum game experiments and found that proposers offered more and responders rejected less frequently in the cash sessions than in the token sessions. Moreover, two quite recent studies dealt somewhat with the tangibility effect in public goods experiments. Myrseth et al. (2015) found a strong positive association between cooperation and self-control, and a negative association between cooperation and impulsivity in treatments that rendered money more tangible. Wang and Qin (2015) introduced punishment into a public goods game and found that cash penalties were significantly more effective than electronic cash-exchangeable penalties.

Most of the above studies stated that holding cash physically caused subjects to be more self-interested and/or more risk-averse. For a detailed discussion and explanation on this tangibility effect of cash, see Reinstein and Riener (2012) and Shen and Takahashi (2013). In this study, we investigate whether this effect also exists in a simple self-control experiment regarding making an investment decision. We introduce two kinds of cash – paper money and coins– into the experiment to compare subjects' behaviors in cash environments with those in a non-cash environment (see the detailed introduction in the next section). Concerning the effect of coins on subjects' behaviors, Vandoros (2013) designed two experiments to examine how money denomination and the choice between or availability of coins and banknotes influenced consumers' purchasing behavior. His results showed that, first, for small amounts of money, consumers might prefer a smaller monetary value in banknotes to a higher value in coins; and second, people carrying coins were more likely to make a purchase of small value than people not carrying coins. Both experimental results demonstrate an aversion towards coins. Therefore, we also expect to see coins play some role in our experiment.

2. Experimental design

We conducted an experiment that included two questionnaires and a simple self-control investment experiment at Hiroshima City University in July and October 2015. Before the investment experiment, we asked all subjects to answer two questionnaires[1] and offered each subject a reward of 1000 JPY for completing them.[2] The overall experiment consisted of three sessions which differed with regard to the method of paying the 1000 JPY reward for filling out the questionnaires. In the first and second sessions, which we named the *Paper Money* session and the *Coin* session, 1000 JPY in paper money and 1000 JPY in coins, respectively, were directly given to the subjects. In the third session, named the *Non-cash* session, we only told the subjects that they would receive 1000 JPY and payment was eventually conducted after the experiment.

The procedure of the *Paper Money* session is as follows. When subjects arrived at the scheduled classroom (Room 1), they were asked to answer the questionnaires. When they finished, they were asked to go to another room (Room 2) to receive their payment. At Room 2, subjects received a written experimental instruction and an envelope containing one 1000-yen bill. When subjects finished reading the instruction by themselves, one experimenter took them one by one to another room (Room 3). When a subject arrived at Room 3, one experimenter asked him/her whether he/she would participate in the investment experiment. If not, the subject would be asked to bring the 1000 JPY and leave the room. If so, the subject would be asked to decide how much to invest in units of 10 JPY, write down that amount on a record sheet, and press the button of a dice-rolling machine. The return on the investment was determined by the number shown on one die. Rolls of 4, 5, and 6 meant that the investment amount would be multiplied by 2, and rolls of 1, 2, and 3 meant that the investment amount would be multiplied by 0.[3] After the return on the investment amount was settled, the subject left Room 3 and the next subject was brought into the room to perform the investment experiment.

The procedures of the *Coin* and *Non-cash* sessions were identical to that of the *Paper Money* session except that subjects were given an envelope containing 1000 JPY in coins (one 500-yen coin, four 100-yen coins, one 50-yen coin, and five 10-yen coins) in Room 2 in the *Coin* session and subjects were just told in Room 2 that they would receive 1000 JPY in the *Non-cash* session.

In total, 208 subjects participated in the experiment: three groups of 65, 68, and 75 for the *Paper Money*, *Coin*, and *Non-cash* sessions, respectively. Including answering the questionnaires and being paid, each subject spent about 25 minutes. Subjects earned, on average, 1044 JPY (about 8.7 USD, using 1 USD = 120 JPY).

3. Results

[1] The contents of questionnaires are about food-purchasing decisions and choices of payment schemes. None of questions were relevant to the purpose of this study.

[2] The purpose of letting subjects answer questionnaires and receive payment is to avoid the so-called windfall gain effect. For details on this effect, see Cherry et al. (2002), Oxoby and Spraggon (2008), and Reinstein and Riener (2012).

[3] The expected return on any investment amount is zero.

Table 1. Summary of the investment experiment

Investment range (endowment = 1000 JPY)	*Paper Money*	*Coin*	*Non-cash*
= 1000 JPY	9.23%	10.29%	13.33%
510 – 990 JPY	0.00%	1.47%	2.67%
= 500 JPY	12.31%	7.35%	14.67%
10 – 490 JPY	18.46%	33.82%	25.33%
= 0 (did not attend)	60.00%	47.06%	44.00%
Number of subjects	65	68	75
Average investment amount (JPY)	196.92	222.06	273.69

Table 2. Results of Heckman selection model by using maximum likelihood estimates

	Investment equation		Selection equation	
	Coefficient	Robust S.E.	Coefficient	Robust S.E.
Paper Money	–222.327***	76.092	–0.473***	0.168
Coin	–108.014*	63.200	–0.230*	0.137
Male	397.343***	65.519	0.845***	0.148
Constant	50.000***	0.000		
Log pseudolikelihood	–855.327			
Observations	208			

Notes. S.E. denotes standard error. *Paper Money*, *Coin*, and *Male* are dummy variables. * $p < 0.10$. ** $p < 0.05$. *** $p < 0.01$.

Table 1 describes the subjects’ investment behaviors in the three sessions and Table 2 reports the regression results obtained from the Heckman selection model (Heckman, 1979) by using maximum likelihood estimates.

As shown in the rightmost two columns of Table 2, results of the selection equation which applies the Probit model to estimate the probability of attending the experiment suggest that subjects in the *Paper Money* and *Coin* sessions were significantly less likely to participate in the investment experiment, compared to their counterparts in the *Non-cash* session. This result is consistent with the observations provided in Table 1 showing that the percentage of subjects who invested zero was the highest in the *Paper Money* session (60.00%), followed by the *Coin* session (47.06%) and the *Non-cash* session (44.00%). Meanwhile, the significantly positive parameter of the *Male* dummy indicates that men were more likely to participate in the investment experiment.

Results of the investment equation presented in the second and third columns of Table 2 indicate that subjects who selected to participate in the investment experiment invested significantly less in the *Paper Money* and *Coin* sessions than in the *Non-cash* session. The result that male subjects invested significantly more than females supports previous evidence that women are more risk-averse than men (Charness and Gneezy, 2012; Harris et al., 2006).

Although Chi-squared tests after the Heckman selection model estimation suggest that there are no differences between the *Paper Money* session and *Coin* session, either in the probability of participating in the investment experiment or in the investment amount (both p values > 0.20), we found that the percentage of less-than-half investments was significantly higher in the *Coin* session than in the *Paper Money* session (p = 0.08, one-tailed proportion test), [4] which may serve as evidence supportive of an aversion to coins in small amounts as found in Vandoros (2013).[5]

4. Conclusion

This study has three main findings. First, holding cash physically does significantly change subjects' behaviors by way of decreasing their likelihood of participating in an investment experiment and their investment amount when they do participate. Second, aversion towards coins in small amounts does exist for small investments. Third, although the expected return on any amount of investment was designed to be zero, men were more likely to participate in the experiment and invested more than women when participating. All the results are interesting, but their robustness needs to be verified by additional future studies.

One limitation of the present study is that our subjects were all students. It would be more interesting and important to study non-student subjects with different socioeconomic backgrounds. Research with non-student pools suggests that students might not be very representative of the larger society (Carpenter et al., 2004). Therefore, future studies could be conducted that recruit members from other sections of society.

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[4] The percentage of less-than-half investments in the *Coin* session was also higher than in the *Non-cash* session (p = 0.05, one-tailed proportion test).

[5] It would be interesting to replace the 500-yen coin with five 100-yen coins and investigate whether the aversion to coins in small amounts still exists. We leave this as a future task.

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