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Social Norm and Giving with Indivisibility of Money: An Experiment of Selfishness, Equality and Generosity[1]

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Abstract:
We study a dictator game considering selfishness, equality and generosity. The dictators first indicate their willingness to give in a decision form and then allocate 10 *yuan* cash to the receiver in an envelope. The cash consists of 10 banknotes of 1-yuan in Treatment 1 (high divisibility) and 2 banknotes of 5-yuan in Treatment 2 (low divisibility). Treatment 2 only has three choices of giving (0, 5, 10). 30% of individuals take ceilings or floors rather than the standard rounding in Treatment 2. However, the individual round-up and round-down behaviors mute each other at the aggregate level.

JEL Classification: C91, D03, E03, M59
Keywords: dictator game, social norm, divisibility of money, selfishness, equality, generosity

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1. Introduction

In *Money and the Mechanism of Exchange* (1875), William Stanley Jevons analyzed four functions of money: a medium of exchange, a measure of value, a standard of value and a store of value. Divisibility of money matters crucially to the convenience of using money to intermediate the exchange of goods and its accuracy in measuring values. In macroeconomics, Berentsen and Rocheteau (2002) show that the indivisibility of money may result in huge inefficiencies or even no trade in the exchange economy.

Although the divisibility of money is first and foremost a topic for macroeconomic studies, it matters for microeconomic, non-market behavior of individuals, as well. It is not difficult to identify situations in which people want to give to others but are faced with the indivisibility of money. For example, one can hardly expect change to be available when he/she wants to give to a street musician, donate to a charity, or chip in for a farewell gift to a departing colleague. If one's willingness to give is 2$, but he/she only has 5$ notes, what should he/she do? What about the case in which his/her willingness to give is 3$? His/her decision may be driven by a mixture of **selfishness, equality and generosity.**

In this paper, we study the role of the indivisibility of money in the dictator game, which has been widely researched in the literature (Kahneman et al. 1986, Forsythe et al. 1994, Hoffman et al. 1996, for a recent survey of the literature, see Bolton et al. 2008, Engel, 2011). The dictator game has been widely used to study social norms, such as fairness, cooperation and competition (Fehr and Schmidt 1999, Bolton and Ockenfels 2000, Bayer, 2016)[2]. However, the literature has not reached an agreement regarding the attitude toward inequality and fairness (Fershtman, Gneezy and List 2012), which demonstrates heterogeneities of social norms. Following the literature, this paper hence specially creates a situation of money indivisibility in which only three extreme cases **(selfishness, equality, and generosity)** are available to the participants.

The baseline treatment is the same as the traditional one: the dictator D sets an allocation of a stake of 10 *yuan* (unit of Chinese currency, 6.7 *yuan*=1 USD) between himself/herself and a receiver R. The variation is that after the dictator's willingness to give is elicited in a piece of paper, we inform him/her that the smallest change is a 5-*yuan* banknote. Therefore, the possible giving from D is limited to the set $\{0, 5, 10\}$.

In theory, people should simply round their willingness to give to the nearest round number of 5. Mathematically, let W be the initially indicated willingness to give and T be the transfer he/she makes facing the shortage of change; this consideration leads to:

$$T = \begin{cases} 0 & if \quad W \in [0, 2.5) \\ 5 & if \quad W \in [2.5, 7.5) \\ 10 & if \quad W \in [7.5, 10] \end{cases}$$

Or more generally, $T = round\left(\frac{W}{5}, 0\right) \times 5$.

[2] Strictly speaking, dictator games are not about cooperation, unless there is repeated interaction with role reversal (like for instance in Camera et al., 2012, 2013, Dreber et al., 2014).

If a person rounds the numbers down, amounts in [0, 5) will be rounded to 0, and [5, 10) rounded to 5 when the subject prefers to use shortage of changes as an excuse for being more selfish.

It is possible that a person chooses to round the number up instead; we will see amounts in (0, 5] rounded to 5, and (5, 10] rounded to 10. It seems that a giving of 10 may be difficult to be explained, although it occurs in the real world and in this experiment.

Fershtman, Gneezy and List (2012) point out that equality aversion may exist in some situations that are socially accepted. Our design only has three choices of giving (0, 5, 10) and entails three extreme cases **(selfishness, equality and generosity, respectively).** If a person morally neither likes being selfish (0) nor likes being equal (5), his/her choice would be giving 10. Such a design enables us to test (in)equality aversion.

$$T = \begin{cases} 0 & Selfishness \\ 5 & Equality \\ 10 & Generosity \end{cases}$$

We design two treatments. In both treatments, the dictator first fills her willingness to give in a decision form. Then, (1) in Treatment 1 (high divisibility treatment), she is provided 10 banknotes of 1 *yuan* each and is asked to put as many banknotes as she wishes in the envelope that is directed to the receiver; and (2) in Treatment 2 (low divisibility treatment), she is only provided 2 banknotes of 5 *yuan* each and is asked to put as many banknotes as she wishes in the envelope that is directed to the receiver, as well.

The reasons for asking the subject to fill her willingness to give in the form *first* before putting the money into the envelope are twofold. First, without it, we may not clearly elicit the dictator's willingness to give in the low divisibility treatment (Treatment 2) because "(attitude discrepant) behavior may change attitude" (Sears et al. 1985). If the subjects fill in their willingness to give after allocating the money instead, a subject with a willingness to give other than 0, 5 or 10 may indicate that his/her willingness to give is a number among 0, 5 and 10 in both cases to build the (self-)image of "being a consistent person". Second, a previous dictator game was conducted in a few ways in which the dictators indicate their willingness to give on papers or computer screens (e.g., Forsythe et al. 1994 as an example for pen and paper experiment; Bardsley, 2000 surveys many computerized experiments. We use pen and paper experiment in this study) or allocate the cash physically (e.g., Eckel and Grossman, 1996; Hoffman et al. 1996; Cason and Mui, 1997, Bolton et al. 1998; Ben-Ner et al. 2004, Luhan et al. 2009, Gong, Yan and Yang, 2015), but not both. A question would be whether the difference in the experimental design in this dimension changes the results. Shen and Takahashi (2013) provide between-subject evidence that subjects reject less when holding cash in hand than when holding tokens in an ultimatum game. The two-step design in our experiment serves as a good within subject design to test the neutrality of allocating money on paper versus by hand.

Our results are mainly two-fold: (i) there is no significant difference between the willingness to give and actual giving in both treatments, meaning the subjects on average give the amount indicated in the decision form and behave neither more generously nor more selfishly when allocating the money by hand compared to on the paper; and (ii) a sizable share (more than 25%) of individuals take ceilings or floors rather than the nearest round number in the low divisibility treatment. However, the individual round-up and round-down behaviors mute each other at the aggregate level. This result shows a high level of heterogeneity of individual giving behavior when faced with shortage of change. While some indeed apply a more pro-social rule, others take advantage of the possibility to use indivisibility of money as an excuse. The deviation from standard rounding in our experiment

is difficult to be explained by traditional models on fairness and social preference because those models make the same prediction as standard rounding in our setting. Our result finds its potential explanation in the "equity aversion model" by Fershtman et al. (2012).

We also investigated whether individual background variables such as gender, party membership and monthly expenditure are associated with more round-up (round-down) behavior; it turns out that students with higher monthly living expenditures (i.e., probably from richer families) are more likely to round their payment up.

As an experimental study about the divisibility of money or change, our paper is also related to the experimental economics literature on the loose change effect, that is, whether people tend to give or donate more when their cash endowment contains a greater amount of change (e.g., coins instead of notes). Fielding and Knowles (2015) conducted an experiment on whether dictators give more when their endowment contains more change. They find that although the treatments with more change are indeed with higher mean donation, the difference between these treatments and treatments with less change is not significant at the 5% level.

This experiment studies the difference between the experimental designs where subjects choose from a continuous or more "dense" decision space and where they choose from a "limited action space". In the experimental economics literature, researchers sometimes apply either of the two designs to address the same research question, with the implicit assumption that they can be used interchangeably. An example is the modification by Charness and Rabin (2002) on ultimatum game by Gueth et al. (1982). The assumption that people apply the standard rounding will be indispensable for drawing comparison between the results from the two designs. Our result shows that the assumption holds at least at the aggregate level. Bolton and Katok (1995) also conducted an experiment where the dictator can only choose to give 50% of the pie or nothing in one of the treatments. However, it is not possible for the dictator to give 100% of the pie in that experiment. Due to different focuses of study, they did not test whether the divisibility of pie influences the level of giving, and hence limited action space on giving. In Engel's (2011) meta-analysis, the author reviewed studies in which dictators only have binary choices (e.g., Bolton et al. 1998) and multiple choices (e.g., Brañas-Garza 2006) or can give any amount of integer dollars, concluding that limited action space does not influence average giving in the meta-regression but has a significant positive effect if one uses individual data. Engel's (2011) meta-analysis pools data from different experiments together; most of the experiments elicit only the actual giving, but not the willingness to give. Our experiment provides a better control by using data from single experiment and can provide a richer description on the individual rounding behavior by eliciting both willingness to give and actual giving.

The rest of the paper is organized as follows: Section 2 presents the experimental design, Section 3 reports the results, and finally, Section 4 concludes.

2. Experimental Design

The sessions were conducted in June of 2015 at Nanjing Agricultural University, Nanjing, China. More than 300 college students were recruited, among whom 286 showed up and formed 143 observations (pairs of dictator-receiver). The recruiting information is written on posters that are posted on the information board in the student dormitories and advertised in different student we-chat groups, as well. The subjects who are interested can register for the sessions by sending messages to the local experimental coordinator. They are asked to present their student ID when participating in the experiment, and the experimenters informed them that the experiment is strictly anonymous. Their decisions and payment information are only linked to their participation number in the experiment, but not their names or student ID.

The subjects play a dictator game, in which the dictator allocates 10 *yuan* between herself and the receiver using integer numbers, and the receiver does not make a decision. The dictator and receiver do not receive additional show up fees on top of the payment from the dictator game. All dictators sit in one room, while all receivers sit in the other room. As in Hoffman et al. (1996) and many other papers, the transfer of money is done via numbered envelopes to ensure anonymity. The dictator puts the transfer in the envelope with her subject number in the experiment, and the envelope is directed to the receiver in the other room with the same number. Two treatments are set up:

Treatment 1 (the baseline treatment with high divisibility of money): banknotes of 1 *yuan* are prepared so that all integer amounts proposed by the dictator are achievable. The experiment consists of two stages. In the first stage, we take record of the willingness to give indicated by the dictator on the decision form. After we collect the decision forms in the second stage, they make their actual giving (the number of 1 yuan banknotes they put in the envelope). The advantage of taking double book keeping is to check the possibility that the subjects change their mind after they see the money; in particular, they become less generous than they were when recording the decision.

Treatment 2 (the treatment with low divisibility of money): banknotes of 5 *yuan* are available, so that the dictators can only give the amount of 0, 5 or 10 yuan to the receiver by putting 0, 1 or 2 notes of 5 yuan in the envelope. Like Treatment 1, both their initial indicated willingness to give and the amount they give are recorded by the experimenter to study what kind of rounding rule the individuals apply when faced money indivisibility.

The number of observations is 48 for Treatment 1 and 95 for Treatment 2. We assign more subjects to Treatment 2 because of its higher relevance to the research question, while the baseline treatment is only to reproduce the qualitative pattern of results from previous literature. [3]

The experimental instruction was written in Chinese; there is an English translation in Appendix A.1.

3. Experimental Results

3.1. Summary Statistics

Table 1 shows the mean and standard error of the willingness to give and actual giving in Treatments 1 (high money divisibility) and 2 (low money divisibility). On average, both the dictator's willingness to give and the actual amount given are between 30% and 40% of the total stake. This result is not very different from the result from a typical dictator game (e.g., the mode of 30% of the stake in Forsythe et al. 1994). We do not reject the null hypothesis that the average willingness to give and the average actual amount given are the same in either of the two treatments at 5% level according to Student's t-test (*p-value* is 0.3173 for Treatment 1, and 0.3996 for Treatment 2).

Table 1: Mean and Variance of the Amount Given in Treatment 1 and 2.

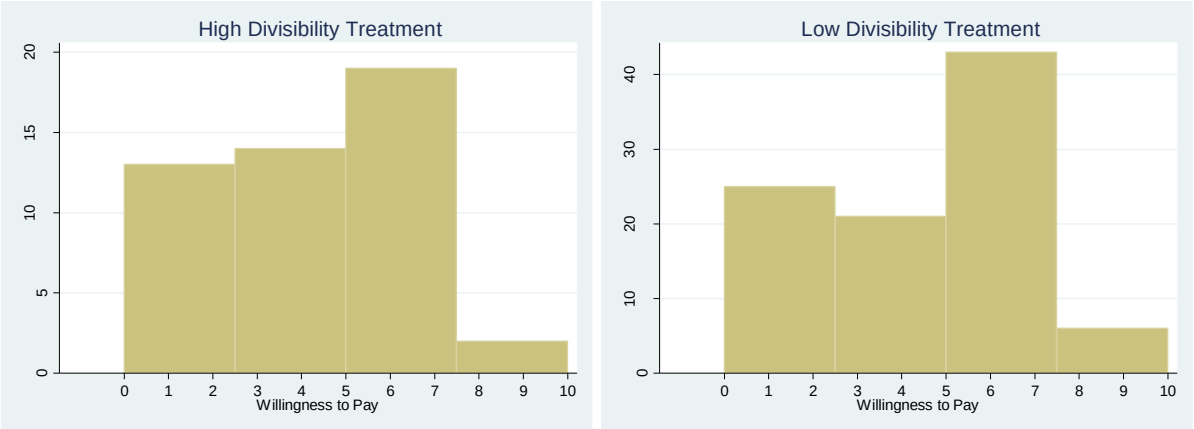
	Treatment 1	Treatment 2

[3] We are not the first to use relatively imbalanced samples for the baseline and treatment groups. List (2007) also has two treatment groups about twice the size of the baseline group.

	(Baseline Treatment)		(Treatment with Indivisibility of Money)	
	Willingness to Give	Actual Amount Given	Willingness to Give	Actual Amount Given
Mean	3.72	3.85	3.92	3.74
Standard Error	0.31	0.32	0.24	0.29

Figure 1 shows the histograms of willingness to give in both treatments. Among the 48 subjects in the high divisibility treatment, 13 (27.08%) have a willingness to give lower than 2.5, 33 (68.75%) have willingness to give between 2.5 and 7.5, and 2 (4.17%) have willingness to give equal to or higher than 7.5. Among 95 subjects in the low divisibility treatment, 25 (26.36%) have willingness to give below 2.5, 64 (67.37%) have willingness to give between 2.5 and 7.5 and 6 (6.32%) have willingness to give equal to or above 7.5. This outcome suggests that the distribution of willingness to give is very similar in both treatments. Kolmogorov-Smirnov test for equality of distribution functions can also not reject the hypothesis that the distribution functions of willingness to give and actual giving are the same for the two treatments at 5% level (*p-value* is 0.958 for willingness to give in Treatment 1 versus Treatment 2, and 0.064 for actual giving in Treatment 1 and Treatment 2). The number of observations is 48 for Treatment 1 and 95 for Treatment 2. The Mann-Whitney-Wilcoxon test can also not reject the null hypothesis that the average of the willingness to give and actual payment are the same for the two treatments (*p-value* is 0.581 for willingness to give, and 0.615 for actual payment).

Figure 1: The histogram of willingness to give in the high and low divisibility treatments.



The finding in this section (in particular about Treatment 1) can be summarized by Result 1.

Result 1*: the experimental design on whether to allow subjects allocating money on paper or by hand does not lead to changes the experimental result. On average, there is no difference between the willingness to give indicated in the decision form and the cash allocated by hand in both the high and low divisibility treatments.*

3.2. Detailed Comparison of Willingness to Give and Actual Giving

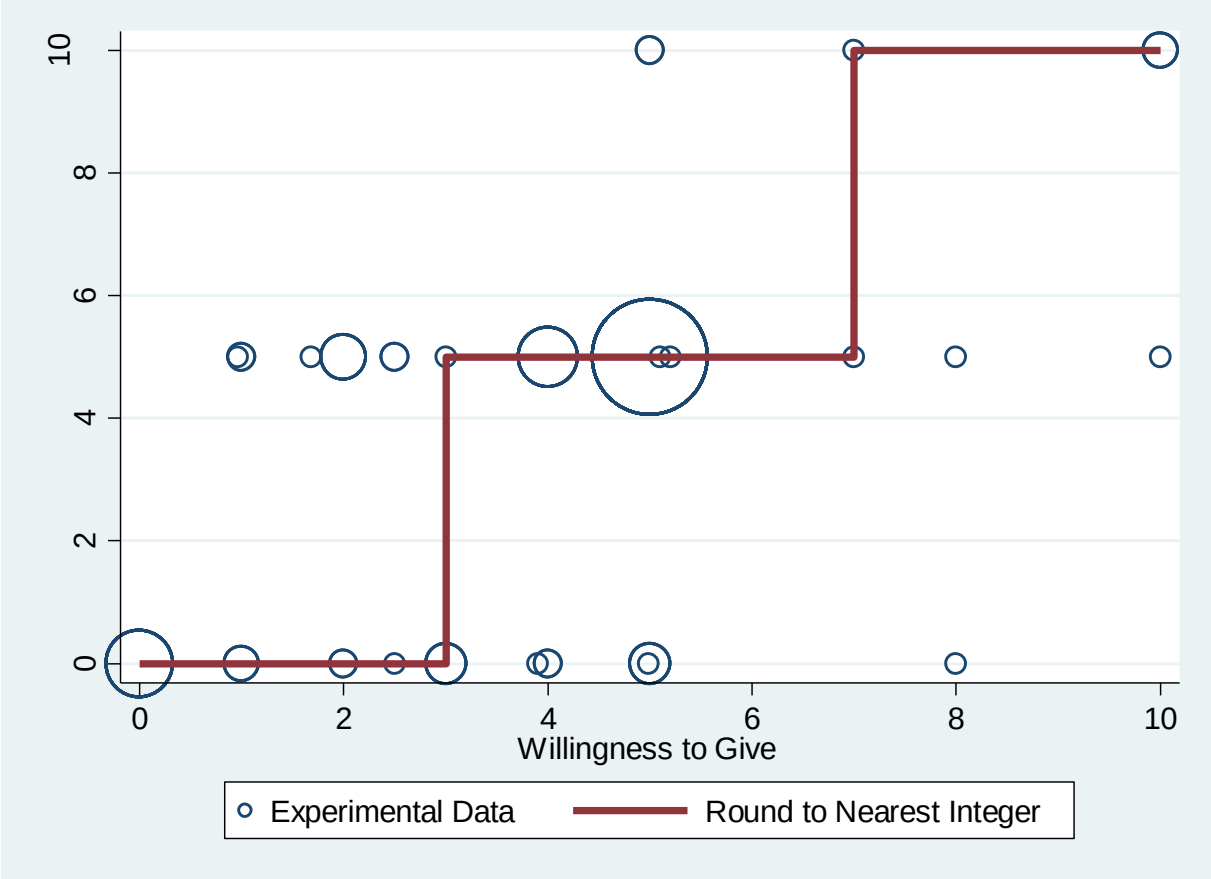
Figure 2 illustrates the relationship between the indicated willingness to give and the actual giving in Treatment 2. As is seen from the figure, when the willingness to give increases in Treatment 2, the relationship between indicated willingness to give and actual giving is not fully captured by the step-wise linear relationship indicated by the "rounding to the nearest round number of 5" rule. (1) When the willingness to give is very small, many subjects with willingness to give of 1 or 2 give 5 to avert giving nothing and feeling of guiltiness. (2) When the willingness to give is larger, most subjects with willingness to give of 8 or higher give 5 instead of 10 to avoid leaving himself/herself with nothing. (3) When the willingness to give is at a moderate level, the deviation may happen in either direction.

Table A1 in Appendix A.3 further shows the distribution of individuals with respect to willingness to give and actual giving. Among 48 subjects in Treatment 1 (baseline, high money divisibility treatment), 40 (83.3%) give the amount exactly as indicated in the decision form. Eight subjects (16.7%) give a different amount from that indicated. Specifically, 4 subjects give less and 4 give more than the willingness to give indicated on the paper. However, note that 6 out of the 8 subjects give a different amount from indicated because their initial willingness to give was a non-integer and they must give an integer actual amount. Thus, only 2 subjects deviate from their indicated willingness to give when they do not have to.

Among 95 subjects in Treatment 2 (low money divisibility treatment), 67 of them (70.5%) give the amount that can be explained by the standard rounding rule referring to the number written on paper. In contrast, the remaining 28 (29.5%) deviate from the standard rounding rule. Note that among the 67 subjects who give their indicated exact willingness to give, 47 of them give 0/5/10 because their indicated willingness to give is exactly 0/5/10. This means that among the 48 (95-47=48) subjects who are obliged to give a different amount from their indicated willingness to give, more than half (28/48=58.3%) do deviate from rounding. In terms of the number of individuals who deviate, the non-standard rounding behavior in Treatment 2 is substantial. Among those who deviate, 16 subjects take the floor of the willingness to give and 12 take the ceiling. This suggests that there is no systematical bias of subjects' rounding behavior. Consequently, the deviation from standard rounding is not pronounced, at least at the aggregate level. It also explains why the difference between willingness to give and the actual giving is not statistically significant in the case of low divisibility case of money.

We note that the difference in the share of agents who apply the standard rounding rule between the two treatments is NOT caused by the difference in the willingness to give or in actual giving between the two treatments, since the difference between the two treatments neither for the willingness to give nor for the actual giving is significant at 5% level according to the t-tests (*p-value* is 0.6297 for the test on willingness to give, and 0.7673 for the test on actual giving).

Figure **2**: The Scatter of the Indicated Willingness to Give and Actual Payment in Treatment 2.



Note: The red thick line is the prediction by standard rounding, and hollow circles are experimental data. We use weighted markers in Stata. The size of each point is proportional to the number of observations for this pair of willingness to give and actual giving. The smallest circle is associated with 1 observation and the largest circle is associated with 33 observations.

These findings are summarized in Result 2.

Result 2*: When subjects are faced with low divisibility of money, most of them round their initial willingness to give to the nearest multiples of 5. For those who deviate from this rule, (1) when the willingness to give is very small/ large, there is a tendency for the dictators to apply the round-up/-down rule; and (2) when the willingness to give is at moderate level, the deviation may happen in either direction. Our findings suggest that the subjects tend to avoid extreme values (giving all or zero). However, the round-up and round-down behavior of the agents seems to cancel out at the aggregate level. The average deviation from standard rounding is not significantly different from zero.*

3.3.Rounding Behavior and Social Demographic Information

Why do some subjects round their amount up while others round down? Given the high fraction of subjects deviating from the standard rounding, it is unlikely to be caused by calculation error or failure in memorizing previous choices. To explore the answer to this question, we define subjects' deviation from the standard rounding behavior as

$$Deviation = Actual\ Amount\ Given - Round\left(\frac{Willingness\ to\ Give}{5}, 0\right) \times 5,$$

and regress this variable on the variables of gender, monthly living expenditure and whether the subject is a party member, a student cadre or coming from urban area. The "$Round(x, 0)$" operator rounds the result inside to the nearest integer (0 means no numbers after the decimal point). The expression $Round(Willingness\ to\ Give/5,0) \times 5$ is equal to 0 if willingness to give is smaller than 2.5, 5 if it is between 2.5 and 7.5, and 10 if it is between 7.5 and 10. Positive (negative) deviation means the dictator gives too much (little) than the amount implied by the standard rounding, and hence has a tendency to round numbers up (down). We try to see if the rounding up (down) behavior is associated (and therefore can be potentially explained) with any social background information. For example, if women tend to round up the amount they give due to stronger social preference as found in the previous literature (Croson and Gneezy, 2006), the gender coefficient for female should be positive. The results are reported in Table 2. We do not find significant effect of the indicator variable for gender. One the other hand, the result shows that the coefficient for monthly living expenditure is positive and significantly different from 0 at 1% level. 1% higher living expenditure is associated with 0.032 *yuan* more actual giving compared to the level suggested by applying the standard rounding rule. This suggests students who spend more or from wealthier family are more likely to apply pro-social rounding rule (rounding-up).

Table 2: Regressing the deviation from standard rounding rule in Treatment 2 on social demographic variables using OLS model: $deviation_i = c_0 + c_1 \times male + c_2 \times party + c_3 \times cadre + c_4 \times urban + c_5 \times lnexp + e_i$.

VARIABLES	(1) Deviation	(1) Deviation
Male	-1.136	
	(0.695)	
Party	0.984	
	(1.416)	
Cadre	-1.280*	
	(0.706)	
Urban	-0.668	
	(0.629)	
Lnexp	3.160***	2.426**
	(1.103)	(1.097)
Constant	-21.97***	-17.58**
	(7.875)	(7.878)
Observations	94	94
R-squared	0.117	0.051

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Note: Male, party, cadre, and urban are dummy variables indicating whether the student is male, a party member, a student cadre or coming from urban area. lnexp is the natural logarithm of monthly living expenses. We have 94 observations because one student did not fill in the monthly expenditure information. The large negative intercepts result from a relative large lnexp, and the mean value is 7.13.

3.4. Models on Fairness and Social Preferences

Starting from late 1990s, several models have been introduced to explain humans' deviation from pure selfish behavior in games. Among these models, the Equity, Reciprocity and Competition (ERC) model by Bolton and Ockenfels (2000) and the Fairness, Cooperation and Competition model by Fehr and Schmidt (1999) are two most influential ones to describe the results of ultimatum bargaining game and dictator game. The horse-race test of the two models can be found in Engelmann and Strobel (2004) and Blanco et al. (2011). Charness and Haruvy (2012) test several models on social preferences in a gift exchange experiment. Recently, Fershtman et al. (2012) proposed a new explanation to giving in games on social preferences. They argue that maybe people give non-zero or fair amount to others in these games not because they dislike inequity, but because giving a fair share of the stake is the only applicable social norm in that setting[4]. When the game is combined with other elements and other social norms can be applied, dictators may implement unfair allocations if other social norms give room for that. While we find it difficult to explain different rounding behavior in our data using models assuming inequity aversion, the approach based on "switching between social norms" in Fershtman et al. (2012) has greater potential in explaining our data.

We attempted to apply both the ERC and Fehr and Schmidt models to our data and report the results of the derivation in Appendix A2. It turns out that the theoretical prediction of the ERC model is exactly the same as standard rounding behavior, and we cannot apply Fehr-Schmidt model to our data due to the restriction by the data structure. We must conclude that the deviation from the standard rounding behavior found in the low divisibility treatment hardly finds any explanation in traditional models assuming inequity aversion. Recently, Fershtman et al. (2012) argue that giving by dictators in dictator games may not be caused by inequity aversion, but simply social norms under specific situations. They use tipping in restaurants as an example:

"……most individuals leave a tip in restaurants that they do not intend to visit again……They may not care about the welfare of the waitress, they may even think that the service was bad and does not merit a tip, but nevertheless they leave a tip because not doing so is against important social norms and therefore costly……"

In our low divisibility treatment, aside from the standard mathematical rounding rule, there are indeed two potential social norms that are both applicable to the dictator:

Social Norm 1: since giving is a gesture of good will, it is always better to give more than less. One should thus round their giving, similar to the social norm for tipping in restaurants in some European countries.

Social Norm 2: when one does not have the right change on himself/herself, it is socially acceptable for him/her not to give to street musicians or donate to charity boxes. While it is good to give, giving should cause no pain or inconvenience to the giver in the first place.

[4] Schram and Charness (2015) conduct another study on the role of social norm in dictator games.

Our low divisibility treatment gives room for both social norms. Thus, subjects can choose according to their own preferences. That is, if they have "warm glow" utility (Andreoni, 1990), they can use Social Norm 1 as an additional motivation to give more, while if they are selfish, Social Norm 2 gives them good excuse to cease giving.

Particularly, our design of low divisibility treatment only gives the subjects three choices of giving (0, 5, 10), and respectively entails three extreme cases: selfishness, equality and generosity. When a person does not like being selfish, nor likes being "equal", his/her choice must be generosity (giving 10). Hence, those who give 10 can also be explained as well.

Furthermore, our finding that students with higher monthly expenditures have a larger tendency to round up is in accord with the explanation based on social norms. It is worthwhile to note that in China, there is sometimes a social norm that goes in the opposite direction of tipping in restaurants and famers' markets, known as the "forgo the change" (*mo ling* in Chinese) norm. That is, after the total price of the purchase is calculated, it is socially acceptable for the customer to ask the seller/shop owner to forgo the change. For example, the customer may ask if he can pay 100 *yuan* for a meal that costs 102.5 *yuan* on the bill in a non-luxury restaurant, and it is highly likely for the manager/owner to grant this *ad hoc* "discount" to attract or keep frequent customers. We postulate that students from higher (lower) income families observe more situations where people apply tipping (forgo the change) in their daily life. This leads to the heterogeneity of round-up and round down behavior in the population.

Conclusion

This experiment studies how people's giving differs when they allocate the money on paper versus by hand, and with low versus high level of money divisibility. The treatment of low money divisibility specially creates a situation entailing three extreme cases: selfishness, equality and generosity.

From the results of the dictator game, we find that the first dimension of design is neutral to experimental results while the second one is not. On average, people give the same amount of money when they allocate physical cash as when giving money on the paper, and a substantial share of individuals do not apply the standard rounding rule when faced with indivisibility of money.

Our result has several implications to related studies and policy making:

First, in the previous literature, both decisions on the paper and allocating cash physically are used for the dictator game. Our result suggests that the design in this dimension does not influence the result and the data from experiments using the two approaches are comparable.

Second, given that there is no systematical way for agents to round up or down, their willingness to give when the decision space is changed from a continuous one to a discrete one, and the experimental results in similar experiments should be robust to changes of experimental design in this dimension, which can potentially allow for comparison of a broader range of experiments.

One possible variation of the current experiment takes the form that the dictator and receiver may start from a different combination of endowments from (100%, 0%), e.g., (50%, 50%) (like in List, 2007, Kpruka and Weber, 2013). In this situation, the dictator may also

choose to "take" from instead of giving to the wealth of the receiver. This will be helpful to examine if our results hold in the opposite direction[5]. We leave this to further research.

[5] The findings in Zhang and Ortmann (2014) suggests there should be no effect of the taking framing if we interpret taking by giving by changing the reference point.

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Appendix (Not for Publication)

A.1 Experimental Instructions

To Dictators

Part 1

Welcome to the experiment on decision making. Your earnings in this experiment will depend on your decisions. The number on the paper card that you received is your participant number in this experiment. You will need this number to fill in the decision form and receive payment. Please keep this card carefully. This experiment will not collect information about your personal identity.

There are two roles in the experiment, A and B. We use two rooms and the participants playing the same role are seated in the same room. This classroom is room A.

Students sitting in room A play role A. Each student playing role A receives an initial wealth of 10 yuan. A can choose to allocate the 10 yuan between a student playing role B in the way he/she likes. B does not need to make a decision.

As a student playing role A, please write down your card number in the first row and the amount you want to give to B in the second row. Please place the completed form in to the envelope and return to the organizer after you fill in the form.

Please include:

Your number in the experiment is _____.
As a student playing A, you want to give B _____ (a number between 0 and 10) yuan.

If this is Treatment 1, the experimenter now collects the instructions and decision forms for Part 1 and distributes Part 2 of the instructions and the envelopes containing ten banknotes of 1 yuan each.

If this is Treatment 2, the experimenter now collects the instructions and decision forms for Part 1 and distributes Part 2 of the instructions and the envelopes containing two banknotes of 5 yuan each.

Part 2

In today's experiment, the smallest unit of change that we can provide is 1 yuan (Treatment 1)/5 yuan (Treatment 2). Therefore, only round numbers of 1 yuan/5 yuan can be allocated.

As a student playing role A, please write down your card number in the first row and the amount you decide to give to B (must be a round number of 1 yuan/5 yuan) in the second row. Please place the completed form and the number of banknotes in to the envelope and return to the organizer after you fill in the form. We will pass the banknotes in the envelope to the student playing role B who is matched to you in the other room.

Please complete:

Your number in the experiment is _____.
As a student playing A, you decide to give B _____ (a round number of 1 / 5) yuan.

To Receivers

Welcome to the experiment on decision making! Your earnings in this experiment will depend on your decision and decision by others. The number on the paper card that you received is your participant number in this experiment. You will need this number to fill in the decision form and receive payment. Please keep this card carefully. This experiment will not collect information about your personal identity.

There are two roles in the experiment, A and B. We use two rooms and the participants playing the same role are seated in the same room. This classroom is room B.

Students sitting in room B play role B. Each student playing role A receives an initial wealth of 10 yuan. A can choose to allocate the 10 yuan between you and himself/herself in the way he/she likes. You do not need to make a decision.

To keep records, please fill in the following form. Please place the completed form in to the envelope and return to the organizer after you fill in the form.

Please fill in:

Your number in the experiment is _____.
As a student playing B, you received _____ yuan.

A.2 Derivation of the Simple ERC and Fehr-Schmidt Model for This Paper

The original ERC model is written in the following manner:

$$U_i = a_i c\sigma_i - b_i(\sigma_i - \frac{1}{2})^2,$$

where a and b are two parameters, c is the stake to be divided, and σ_i is the share of money the dictator reserves for herself. In our experiment, $c = 10$, $c\sigma_i = 10 - x_i$, $x_i - 5 = 10\left(1 - \sigma_i - \frac{1}{2}\right) = 10(\frac{1}{2} - \sigma_i)$. Substituting these back to the equation,

$$U_i = a_i c\sigma_i - b_i\left(\sigma_i - \frac{1}{2}\right)^2 = a_i(10 - x_i - \frac{b}{100a_i}(x_i - 5)^2)$$

Therefore, the model in our paper is a monotonic transformation of the original ERC model:

$$u_i = \frac{1}{a_i}U_i = 10 - x_i - \alpha_i(x_i - 5)^2$$

where $\alpha_i = \frac{b_i}{100a_i}$ and x_i is the amount given to the receiver. The detailed derivation of this model from the original ERC model is shown in Appendix A.2. This utility function therefore consists of two parts: (1) the utility generated by the money she reserves for herself $10 - x_i$, and a "punishment" term for deviation from the situation where the money is divided equally, namely, $x_i = 5$.[6] The further away x_i is from 5, the lower is the utility. α_i is the parameter for inequality aversion in this model. This utility function is maximized when

$$x_i^* = 5 - \frac{1}{2\alpha_i}$$

If we assume that the subjects maximize their utility, so that x_i^* is the willingness to give they indicated in the decision form, the equation can be inversed to solve the individual parameter for inequality aversion.

$$\alpha_i = \frac{1}{2\times(5 - willingness\ to\ give)}$$

Note that the ERC model does not allow α_i being negative, because the giving in a dictator game almost never exceeds half of the total stake in previous experiments. However, since there are several subjects in this experiment giving more than 5 *yuan*, the model is silent about the case where $x_i^* > 5$.

Knowing this parameter makes it possible to calculate the utility level for each individual when they give 0 and 5 respectively. The model can then compare and predict which of the three cases maximizes the utility when the subjects face indivisibility of money. The results are shown in Table 3:

Table 3: Predicted Results for the Bolton-Ockenfels Model

Willingness to Give	Implied α	Utility x=0	Utility x=5	Optimal Choice among 0, 5 and 10
0	0.10	7.50	5.00	0
1	0.13	6.88	5.00	0

[6] Goeree et al. (2010) extend the model to the cases with more than 2 players and can choose to form networks when playing dictator game.

2	0.17	5.83	5.00	0
3	0.25	3.75	5.00	5
4	0.50	-2.50	5.00	5
5	$+\infty$	$-\infty$	5.00	5

Note: The implied parameter for inequality aversion, utility levels and predicted choice facing the indivisibility of money predicted by the Bolton-Ockenfels model.

The calculation shows that the optimal choice over 0 and 5 predicted by the Bolton-Ockenfels model coincides with the result of standard rounding when $x_i^* \leq 5$.
Ideally, one would like to also conduct simulation using the Fehr-Schmidt model. This is not feasible due to the structure of the model and our data. Consider the model specification:
$u_i = y_i - \alpha_i \max(y_j - y_i, 0) - \beta_i \max(y_i - y_j, 0)$,
where $y_i = 10 - x_i$ is the dictator's own payoff and $y_i = x_i$ is the amount given to the receiver. Due to the linear functional form of the model, it is not possible to find the exact solution of the implied α_i, β_i by solving $x_i = argmax_{x_i}(1 - x_i - \alpha_i \max(2x_i - 10,0) - \beta_i \max(10 - 2x_i, 0))$. It is therefore not possible to use the willingness to give to simulate the predicted choice between 0, 5 and 10 using this model. An experimental design that is more suitable to measure Fehr-Schmidt model can be found in Yang et al. (2012).

A.3 Distribution of Willingness to Give and the Actual Giving in the Treatment 1 and 2

Table A1: Distribution of Willingness to Give and the Actual Giving in Treatment 1 (baseline treatment, top panel) and 2 (treatment with indivisibility of money, bottom panel).

Willingness to Give in Treatment 1

Actual Giving	0	0.1	0.11	0.5	1	2	3	3.8	4	4.05	5	5.2	6	10	Total
0	3	1	0	0	0	0	0	0	0	0	0	0	0	0	4
1	0	0	1	1	1	1	0	0	0	0	0	0	0	0	4
2	0	0	0	0	0	4	0	0	0	0	0	0	0	0	4
3	0	0	0	0	0	0	7	0	0	0	0	0	0	0	7
4	0	0	0	0	0	0	0	1	5	1	0	0	0	0	7
5	0	0	0	0	0	0	0	0	0	0	17	1	0	0	18
6	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
8	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1
10	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2
Total	3	1	1	1	1	6	7	1	5	1	17	1	1	2	48
Actual<WTG		1				1				1		1			4
Actual=WTG	3				1	4	7		5		17		1	2	40
Actual>WTG			1	1		1		1							4

Willingness to Give in Treatment 2

Actual Giving	0	0.96	1	1.68	2	2.5	3	3.9	4	4.99	5	5.1	5.2	7	8	10	Total
0	11	0	3	0	2	1	4	1	2	1	4	0	0	0	1	0	30
5	0	1	2	1	5	2	1	0	9	0	33	1	1	1	1	1	59
10	0	0	0	0	0	0	0	0	0	0	2	0	0	1	0	3	6
Total	11	1	5	1	7	3	5	1	11	1	39	1	1	2	2	4	95
Round Up		1	2	1	5						2			1			12
Round to Nearest	11		3		2	2	1		9		33	1	1	1		3	67
Round Down						1	4	1	2	1	4				2	1	16

Note: The numbers in the cells are the number of subjects choosing the respective amount. “Round to Nearest” means the dictator just takes the nearest round number of 5 to her willingness to give. “Round up (down)” means that the dictator takes the nearest round number of 5 that is larger (smaller) than her willingness to give.