

# **Endowment asymmetry in the trust game: an ex post efficiency view**

Xiaoyuan Wang

School of Management and Economics, UESTC, Chengdu 611731, [wangxy@uestc.edu.cn](mailto:wangxy@uestc.edu.cn)

Jun Feng

Center for Behavioral Economics, National University of Singapore, Singapore 117592,  
[gaifj@nus.edu.sg](mailto:gaifj@nus.edu.sg)

**Preliminary Draft**

April 2018

## **Endowment asymmetry in the trust game: an ex post efficiency view**

### **Abstract**

This paper investigates endowment allocation in a trust game. We find that endowing only the trustor significantly improves the investment transfer as well as the ex post efficiency. In addition, initial endowment asymmetry leads to more equal ex post resource distribution. Keywords: Trust game, Efficiency, Endowment allocation  
JEL: C91, D61, D63

### **Introduction**

The trust game (Berg et al 1995) is a well-known and extensively replicated experimental game for quantifying individual level trust and trustworthiness in a context free environment. Both concepts of trust and trustworthiness not only are vital for smooth and efficient transactions in our daily life (e.g., Camerer 2003), but also have great implications on macro-economic performance (e.g., Glaeser et al 2000). Therefore, understanding and promoting trust has been viewed as important research questions in various fields including economics, psychology, and other fields of social science. From a behavioral perspective, research on trust games usually focuses on the possible mechanism behind participants' moves (Cox 2004, Brühlhart and Usunier 2012, Di Bartolomeo and Papa 2016). From economics perspective, the emphasis is more related economic efficiency and performance (Glaeser et al 2000, Kröger and Sabine 2007, Butler et al 2016). Our research focuses on resource allocation in a two-person economy involving investment and trust. We are interested in whether unequally distributed resources in such economy may lead to a higher ex post efficiency.

The initial endowment distribution of a standard trust game is usually symmetric, because such setting reduces the effects of unconditional preferences such as altruistic behavior for better identification. However, it is quite common that the investors have endowment advantage in real life. Trustees—who play the key role of amplify the investment is usually in lack of such resource.

Recent studies show that endowing trustees has little effect on trust (Brühlhart and Usunier 2012). Moreover, literature surveys over a large number of trust games even report a negative effect of trustee endowment (Johnson and Mislin 2011). To better investigate the

effect of initial endowment distribution. We test two versions of the two-person trust economy with the same maximum achievable total welfare. The unequally distributed economy witnesses higher investment rate, higher total economic return, as well as lower ex post distributional inequality. Trustees' behavior can explain some of these differences. The results observed provide new insights for us to understand economic inequality and allocation efficiency involving trust.

### **Experimental Design and Hypothesis**

We follow the conventional trust game design (Berg et al 1995), which is a two-person two-stage game between a trustor, who starts with an initial endowment ( $E_1$ ) and a trustee with an endowment ( $E_2$ ). The trustor first decides to make an investment ( $I$ ) from his endowment, knowing that in the second stage, the investment will be tripled and transferred to the trustee's account. The trustee then decides the appropriate amount to be returned.

Johnson and Mislin (2011) surveyed 162 replications of similar trust games conducted in various fields and different regions. About one-third of the papers feature a design without trustee endowment. After controlling for a wide range of experimental features and location dummies, the regressions report negative effects of endowed trustees on send fractions (trust), yet not on proportion returned (trustworthiness). Although those surveyed trust games are not directly comparable, this tendency is worth careful examination: if trustee endowment lowers the percentage invested, it implies that the more efficient resource allocation in a trust economy is an unequal one which favors the investor. This intuition is in sharp contrast with a public good economy where equal distribution is usually preferred.

We select two set of initial endowments. In the symmetric endowment treatment, each trustor and trustee start with  $E_1 = E_2 = 15$  experimental tokens; in the asymmetric endowment treatment, only the trustor has  $E_1 = 20$  experimental tokens in the beginning ( $E_2 = 0$ ). With a multiplier of three, the total maximum achievable economic returns are both 60 tokens. The symmetric treatment is equivalent to the case of first transferring 5 tokens in the asymmetric treatment. Therefore, they can both achieve similar outcomes

under the same conventional distributional concerns. If the effect of expected reciprocity (e.g., Cox 2004) is linear, it is expected that the difference in investment transfers cross treatment should be less or equal to 5 tokens (i.e.,  $I_{20-0} - I_{15-15} \leq 5$ ).

We collect two treatments and four sessions of data<sup>1</sup> on May 2016. In each session, there are 20 subjects with their roles randomly determined and fixed throughout the session. The subjects randomly match with their partners (a trustor or trustee) and play the trust game for 10 rounds. All 80 participants are undergraduate or graduate students of the University of Electronic Science and Technology of China. With a conversion rate of 1:1, the average payment of the trust game is 23.6 Yuan in addition to a show-up fee of 15 Yuan. The experiment was programmed and conducted with the software z-Tree (Fischbacher 2007).

## Results

Table 1 lists summary statistics for each experimental session. The first two sessions correspond to the asymmetric endowment treatment. The investment rate is significantly higher compared with that in the symmetric endowment treatment (Wilcoxon rank-sum test,  $P$ -value $\approx 0.001^2$ ), creating a larger return for trustees to split<sup>3</sup>. Accounting for the additional 5 tokens of the trustors, the absolute investment amount is still higher (i.e.,  $I_{20-0} - I_{15-15} > 5$ , Wilcoxon rank-sum test,  $P$ -value $\approx 0.011$ ). Consequently, the asymmetric condition witnesses a significantly higher ex post total welfare (Wilcoxon rank-sum test,  $P$ -value $\approx 0.011$ ). Trustees' percentage return rate are about the same across treatments (Wilcoxon rank-sum test,  $P$ -value $\approx 0.978$ ). The additional investment returns created are mostly taken by trustees. The absolute return is not statistically higher (Wilcoxon rank-sum test,  $P$ -value $\approx 0.245$ ) in the asymmetric endowment treatment. However, in the asymmetric endowment treatment, trustees' advantage reduces the

---

<sup>1</sup> The subjects also participate another experiment after the trust game. The two experiments are independent and the instructions of the second part are not given until the beginning of that part.

<sup>2</sup> Without further notice, statistical tests are clustered at the individual level.

<sup>3</sup> Experimental data reports an average difference of 32% across treatment, closer to Johnson and Mislin 2011's meta-analysis result (28%).

originally existed inequality and results in a more break even scenario. The average gap between each trustor and trustee in the asymmetric treatment is 6.29, compared with 11.98 in the symmetric treatment (Wilcoxon rank-sum test, P-value $\approx$ 0.016).

Utilizing only the first round data before any cross-group interactions, the investment rate is still highly significant (Wilcoxon rank-sum test, P-value $\approx$ 0.003). The ex post total welfare in the asymmetric endowment treatment is higher and marginally significant (Wilcoxon rank-sum test, P-value $\approx$ 0.059). The average gap is smaller but not significant (Wilcoxon rank-sum test, P-value $\approx$ 0.733). Utilizing only the last round data, the investment rate and the ex post total welfare are not significantly higher in the asymmetric endowment condition, while the gap of the ex post distribution is marginally lower (Wilcoxon rank-sum test, P-value $\approx$ 0.058).

Figure 1 and Figure 2 visualize all transfers and returns conditional on all rounds or the first round. Both figures are sorted according to the amount transferred first, and then the amount returned. It is clear that trustors are more willing to fully invest in an environment with advantageous inequality, compared with the one with equal endowment. Altruism or other fairness concept is not likely to be the only explanation for such a large transfer.

Figure 1 and Figure 2 also provide trustees' behavior. In the symmetric condition, the smaller transfers are treated similarly compared with larger transfers by the trustees. In the asymmetric condition, however, the costs of the smaller transfers are mostly not covered, leading to a disadvantageous position of the trustor. This result can be also illustrated using the regression Table 2. The send fraction does not significantly correlate with the percentage returned in the symmetric endowment treatment; while in the asymmetric endowment treatment, it positively associates with the percentage returned. In other words, lower transfers imply higher risks of free ride.<sup>4</sup> Therefore, trustors in this treatment have clearer incentives to improve investment. Conventional fairness and reciprocity may not be

---

<sup>4</sup> Trustees negatively reciprocate larger transfers close to 10--this may not be explained by distributional preferences.

sufficient to motivate this tendency to reward higher transfers; it seems that the reference for kindness and (positive) reciprocity is changing across the two economies.

### **Conclusion**

Our experimental result confirms a negative effect of trustee endowment and shows that an asymmetric allocation of initial endowment in a trust economy can amplify trust behavior significantly. The unequal allocation of initial endowment changes trustors' behavior, as well as trustees' conditional transfers. The asymmetric trust economy leads to a higher ex post total welfare and achieves even more equal ex post outcome, compared with an initially equally distributed trust economy.

Although trust games are well replicated, few studies have focused on the effect of endowment allocation on total efficiency improvement in a trust economy. Trust games in real life usually does not prohibit different motivations entering in to play. Therefore, our result can be useful in better understanding economic inequality and growth at the aggregate level.

## References

- Bellemare, Charles, and Sabine Kröger. “On Representative Social Capital.” *European Economic Review* 51, no. 1 (2007): 183–202.
- Berg, Joyce, John Dickhaut, and Kevin McCabe. “Trust, Reciprocity, and Social History.” *Games and Economic Behavior* 10, no. 1 (July 1, 1995): 122–42.  
<https://doi.org/10.1006/game.1995.1027>.
- Brühlhart, Marius, and Jean-Claude Usunier. “Does the Trust Game Measure Trust?” *Economics Letters* 115, no. 1 (2012): 20–23.
- Camerer, Colin F. *Behavioral game theory: Experiments in strategic interaction*. Princeton University Press, 2011.
- Cox, James C. “How to Identify Trust and Reciprocity.” *Games and Economic Behavior* 46, no. 2 (2004): 260–81. [https://doi.org/10.1016/S0899-8256\(03\)00119-2](https://doi.org/10.1016/S0899-8256(03)00119-2).
- Di Bartolomeo, Giovanni, and Stefano Papa. “Trust and Reciprocity: Extensions and Robustness of Triadic Design.” *Experimental Economics* 19, no. 1 (2016): 100–115.
- Fischbacher, Urs. “Z-Tree: Zurich Toolbox for Ready-Made Economic Experiments.” *Experimental Economics* 10, no. 2 (2007): 171–178.
- Glaeser, Edward L., David I. Laibson, Jose A. Scheinkman, and Christine L. Soutter. “Measuring Trust.” *The Quarterly Journal of Economics* 115, no. 3 (2000): 811–846.
- Johnson, Noel D., and Alexandra A. Mislin. “Trust Games: A Meta-Analysis.” *Journal of Economic Psychology* 32, no. 5 (2011): 865–889.

Table 1 Summary Statistics: All Rounds

	Session 1	Session 2	Session 3	Session 4
Endowment ( $E_1 - E_2$ )	20-0	20-0	15-15	15-15
Send Amount	14.16 (7.06)	16.8 (5.80)	7.28 (4.68)	6.26 (5.14)
Send Percentage	70.80%	84.00%	48.53%	41.73%
Occurrence of 0 sent	10%	7%	8%	2%
Return Amount	14.54 (12.52)	21.09 (13.38)	7.93 (6.91)	7.17 (9.28)
Return Percentage	34.23%	41.85%	36.31%	38.18%
Occurrence of 0 return	21%	17%	15%	33%
Ex ante total welfare	20	20	30	30
Ex post total welfare	48.32	53.6	29.56	27.52
Ex post distribution	20.38-27.94	24.29-29.31	15.65-28.91	15.91-26.61
Number of Obs	100	100	100	100

Figure 1 First-mover transfers and second-mover returns: all rounds

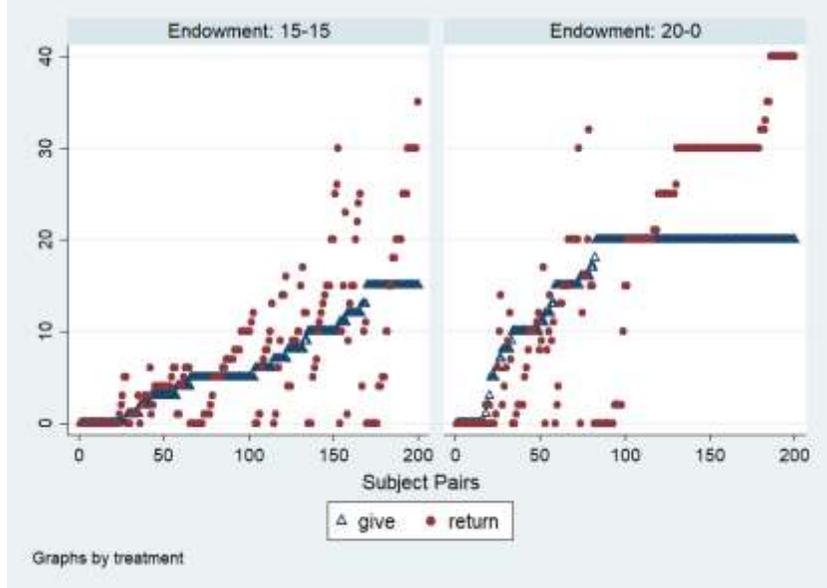


Figure 2 First-mover transfers and second-mover returns: the first round

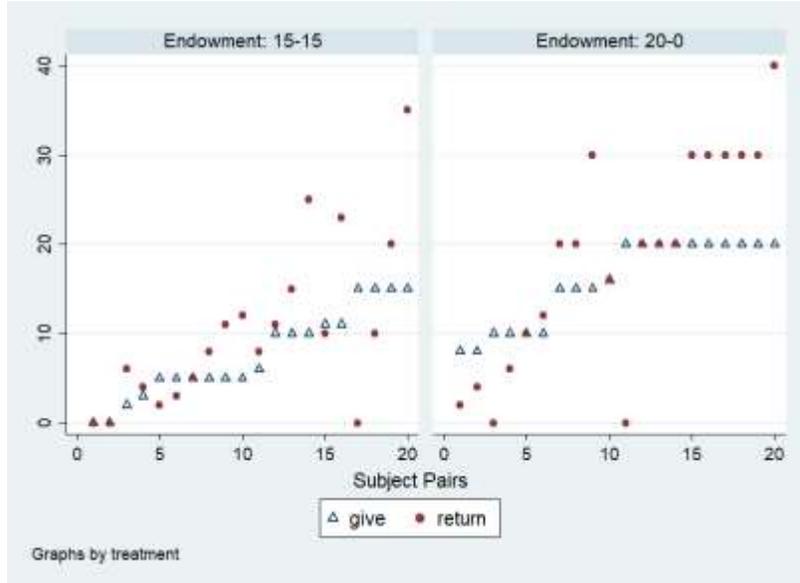


Table 2 Estimation Results on Trustees' Return Decisions

	return fraction	
	OLS	RE
send fraction	-0.0337 (0.0752)	-0.0510 (0.0733)
asymmetric endowment		
main	-0.296*** (0.0618)	-0.306*** (0.0640)
*send fraction	0.318** (0.0955)	0.337*** (0.0961)
constant	0.447*** (0.0547)	0.456*** (0.0548)
round dummies	Yes	Yes
session dummies	Yes	Yes
No. of cluster	39	39
No. of obs	355	355

## Appendices—Not intended for publication

Table 3 Summary Statistics: the first round

	Session 1&2	Session 3&4
Endowment	20-0	15-15
Sent Amount	15.85 (4.78)	7.65(4.98)
Sent Percent	79.25%	51.00%
Occurrence of 0 sent	0%	10%
Return Amount	18.50 (11.95)	10.40 (9.30)
Return Percent	38.91%	45.32%
Occurrence of 0 return	10%	15%
Ex ante total welfare	20	30
Ex post total welfare	51.7	30.3
Ex post distribution	22.65-29.05	17.75-27.55
Number of Obs	20	20

Figure 3 Investment and Return (Percentage) by Round

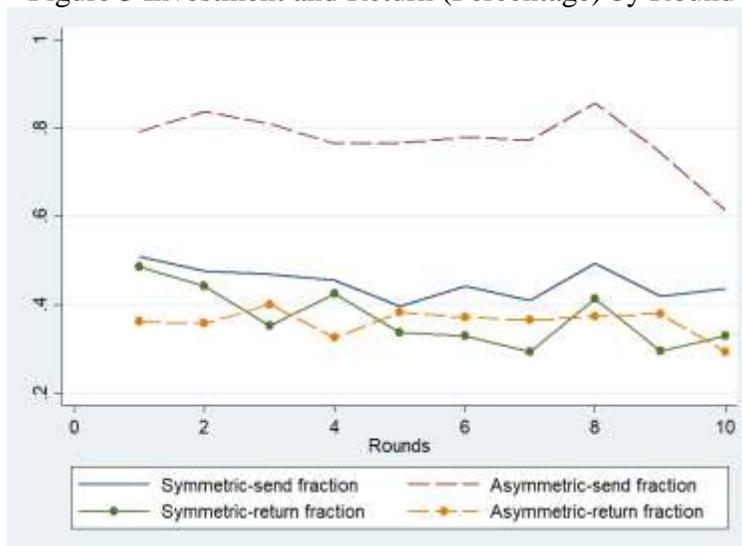


Figure 4 Investment and Return (Absolute Value) by Round

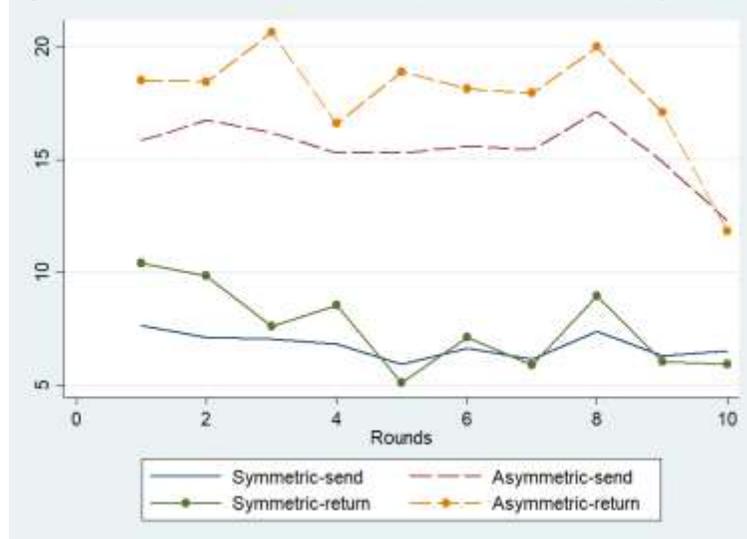


Figure 5 A copy of Brülhart and Usunier 2012’s Figure 1 (supplementary, not intended for reprint or other forms of publications). Trustors start with 10 tokens and trustees’ initial endowments from left to right are  $y_j=0$ , 10, and 20. “ $s_i$ ” is the send amount, and “ $r_j$ ” is the return amount. The red circles show that lower investments receive better (worse) repayment when trustees are (not) endowed. Their setting is one-short. In a repeated setting, this may push trustors to invest differently. Our game has similar feature, but trustees tend to negatively reciprocate low transfers in the asymmetric endowment condition.

