

The Extent to Which Gender Difference Influences the Degree of Subjection to the Endowment Effect—An Empirical Finding

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ABSTRACT

The maximum price that someone is willing to pay for a good is usually much less than the minimum price that the person is willing to accept to give up the same good (the WTA-WTP gap). This is known as the endowment effect. Loss aversion is the main reason of endowment effect. This study investigates whether gender differences affect the degree of subjection to the endowment effect, and if they do, to what extent. The experiment measures the WTA-WTP gap for male and female respectively. The result shows that the female generally display a larger WTA-WTP gap than male, hence showing that they are more subjected to the endowment effect. Future research may gain more understanding on the factors that influence the strength of endowment effect.

Keywords: endowment effect, loss aversion, male, female

1. INTRODUCTION

The literature on decision making under certainty is extensive, which includes research in endowment effect, sunk-cost fallacy, anchoring and adjustment, the prospect theory, and so on. An important subset of this literature is the endowment effect as it is proved to exist in a substantial amount of research. The endowment effect was first addressed in 1980 by the economist Richard Thaler. Richard Thaler (1980) gave half of the students in his class a Cornell University coffee mug and allowed them to trade freely with the other half of the students. However, the striking result showed that little trading occurred. Kahneman, Knetsch and Thaler (1991) conducted an experiment, similar to the experiment done by Thaler in 1980. However, in this investigation, participants who owned the mugs were asked, for a given list of prices, whether they will sell the mug for this price. The students who weren't given the mugs were asked, for the same list of prices, whether they were willing to buy the mug for that price. The experiment asked about willingness to accept—WTA for the students owning the mugs, and willingness to pay—WTP for the other students. Again, contradicting to standard economic theory, the median WTA was \$5.75, but the median WTP was only \$2.25, showing a median WTA-WTP gap of \$3.5. The common WTA-WTP gap was called the endowment effect by Thaler. It means that people often demand a higher price to give up an object they own than they would be willing to pay to own it [1] (Thaler, R (1980)). The endowment effect is thought to arise from the concept of loss aversion, which is, the utility loss of giving up an object is greater than the utility of acquiring it [2] (Kahneman, D & Tversky, A (1984)).

The endowment effect is still a broad subject, which only illustrates that WTA should be higher than WTP. However, it is important to find that how much it is higher, which is the degree of subjection to the endowment effect. The degree of subjection can be correlated with many factors. Maddux, W, Yang, H and Falk, C in 2010 studied cultural differences in the endowment effect; Lin, C, Chuang, S and Kao, D in 2006 studied the role of emotions in the endowment effect etc. However, the literature does not contain much about the correlation between gender differences and the endowment effect, which will be investigated in this study. This study investigates whether gender differences can influence the degree of subjection to the endowment effect. If it does, the extent to which it influences the degree can be found out. In this study, some participants are given a cup of milk-tea, and they will estimate their WTA. The participants who aren't given a mug estimate the WTP. The degree of subjection to endowment effect is measured by WTA-WTP gap. The mean and median WTA and WTP will be measured for both male and female, and subtracting WTP from WTA gives the WTA-WTP gap.

Although past literature on the relationship between gender and endowment effect is rare, it is still possible to work out a hypothesis by reference to the research on relationship between gender and loss aversion, as endowment effect is a manifestation of loss aversion [3] (Kahneman, D & Knetsch, J & Thaler, R (1991)). Rau, H (2014) studied the influence of gender differences on disposition effect and loss aversion. He applied Weber and Camerer's (1998)'s framework and experiment, and concluded that women invest less, have higher disposition effects, and are more loss averse than men [4]. Wieland, A and Sarin, R (2015) studied the influence of gender differences on risk aversion under

uncertainty. Participants were asked three questions adapted from prior research in which they stated their willingness to pay for something similar to a ‘fixed probability lottery’ (Sarin, R& Wieland, A (2015)). They concluded that women exhibit a greater risk aversion than men under certainty [5]. In the second study above, only gain is involved as there is no potential loss. Therefore, we may conclude that women are more risk averse when facing gains, which implies that women are more subjected to the prospect theory. As loss aversion is also the core reason of prospect theory, the results of this study show that women are more loss averse than men.

The research that I have mentioned above show that women are more loss averse than men. Therefore, a hypothesis can be generated such that the female displays a stronger endowment effect than male. That is, in the experiment, the female group may demonstrate a larger mean WTA-WTP gap.

2. RESEARCH METHODOLOGY

2.1. Participants

A total of 16 people ranging between 14 and 18 years old participated in the study. 8 males (mean age=16.125) and 8 female (mean age= 15.625) were sampled. Participants were drawn from all over the campus, from all the grades. Students agreed to join the investigation by joining a We-chat group by using a mobile phone to scan a QR code. Participants were all high-school students with the nationality of Chinese, and were all born in China. Participants all take courses ranging from Chinese, math, English, physics, chemistry, art, accounting, business-studies, computer science, drama, economics, geography, history, Japanese, music, psychology, physical education, sociology and Spanish.

Participants were assigned to different conditions such that half of the students in each gender group would get a cup of milk tea by a random process, such as lottery. Therefore, there are actually 4 groups:

Table 1 groups of participants

Female with milk-tea	Female without milk-tea
Male with milk-tea	Male without milk-tea

Due to this sampling method, the participants are not truly representative for the whole population because all participants were drawn from a high-school, creating potential problems for generalizing the results from this study into another population.

2.2. Materials

Half of the students were randomly assigned a cup of milk-tea (a Chinese drink with milk and black tea) by a lottery

machine [6] (method of experiment by Kahneman, D& Knetsch, J& Thaler R (1990)). The lottery machine is used as it is a fair way to assign the milk-tea randomly. A cup of milk-tea is used as the actual endowment because it is popular among students, thus it wouldn’t create significantly low WTA or WTP. Before the experiment, a question was asked in the We-chat group such that ‘Are there students who don’t like milk-tea?’ This was to again decide whether milk-tea can be a suitable endowment. No participants responded that he had a negative preference towards milk-tea, so milk-tea was used. The price tag on the cup was removed so that participants would value the endowment on their own.

During the experiment, the students filled in a questionnaire. The questionnaire is composed with 1 question asking for gender, 15 questions irrelevant to the aim of the experiment and 1 final question asking for either WTA or WTP. The irrelevant questions are included to give time for the endowment effect to function unconsciously. Examples of irrelevant questions are:

What subject(s) do you plan to study in university?
Are you satisfied with the current faculty of our school?
Why?

WTA or WTP is asked in the final question. Participants answer one of the following questions:

Q1: You now own the cup of milk-tea. If you do not wish to drink it now, you can return it for some money. What’s the minimum amount of money you would like to exchange it for?

Q2: Unfortunately, you are not assigned a cup of milk tea. There are still several cups of milk-tea left. What’s the maximum price you are willing to pay to get a cup?

Question 1 asks for WTA, whereas question 2 asks for WTP. Therefore, students who are assigned a cup of milk-tea would answer question 1, and those who are not will answer question 2.

2.3. Procedure

After participants enter the classroom, the purpose of the experiment was briefly explained. However, the definition of endowment effect was not explained, because there was the risk that the WTA-WTP gap would be affected, as participants may realize that WTA and WTP should be the same. Participants were addressed that they had the right to quit the experiment at any time.

Then, half of the participants (a total of 8 students) were assigned a cup of milk-tea by a lottery machine. Participants were assigned the award were encouraged to have a taste of the milk-tea, which was purposed to give participants a sense of ownership. After that, the participants started to fill in the questionnaire, in which irrelevant questions would take participants 7 to 10 minutes to answer. After all participants completed the questionnaire, they were all acknowledged.

3. RESULTS

The lottery procedure was such that exactly four male and four female received the milk-tea, and exactly eight male and eight female participated in the experiment. Although

the allocation of the stimulus—milk-tea, seems like to be deliberately considered, it is actually a random allocation. The descriptive statistics of this experiment are shown as the following:

All participants:

Table 2 results of all participants

	Mean/RMB	Median/RMB	Variance	Standard deviation
WTA	20.125	17.500	188.859	13.743
WTP	7.125	5.000	30.875	5.557
WTA-WTP gap	14.625	12.500	--	--

Male:

Table 3 results of male participants

	Mean/RMB	Median/RMB	Variance	Standard deviation
WTA	16.500	10.000	284.250	16.860
WTP	9.500	6.500	38.250	6.185
WTA-WTP gap	7.000	3.500	--	--

Female:

Table 4 results of female participants

	Mean/RMB	Median/RMB	Variance	Standard deviation
WTA	23.750	27.500	67.188	8.197
WTP	4.750	5.000	13.000	3.601
WTA-WTP gap	19.000	22.500	--	--

Recall the hypothesis: the female group may demonstrate a larger mean WTA-WTP gap. To decide whether the hypothesis is correct, the mean WTA-WTP gaps are calculated for the male group and the female group respectively. Median, variance and standard deviation of WTA and WTP are calculated to help evaluate the reliability of the experiment and the result, which will be discussed in the ‘discussion’ section (a WTA does not have a corresponding WTP, so the WTA-WTP gap does not have a variance or standard deviation). Variance and standard deviation are calculated also to decide which type of t-test to use and to calculate the ‘t’.

From the above tables, we can easily see that both the mean and median WTA-WTP gap for women are significantly higher than those of men. In terms of mean WTA-WTP gap, that of female is 19.000, whereas that of male is only 7.000.

The female group has a mean WTA-WTP gap of $\frac{19}{7} = 2.714$ times of that of the male group. In terms of median WTA-WTP gap, a difference between 22.5 of female and 3.5 of male is even more persuasive as the figure for female is $\frac{22.5}{3.5} = 6.429$ times of that of male.

Although the difference between WTA-WTP gap of male and female is quite significant, both mean and median can be affected by extreme samples, and actually they are—one questionnaire has a WTA of 45, which is two times higher than the actual price of the milk-tea. Therefore, statistical devices need to be used, and in this study, t-tests (difference of means) are used. A problem is that WTA-WTP gap does not have variance or standard deviation as mentioned above, so it is not available to use WTA-WTP gap directly. However, WTA and WTP both have variance and standard deviation. Therefore, the solution to this is to break up the hypothesis into two parts. The hypothesis that females have a higher mean WTA-WTP gap can be broken into:

- (1) The female has a higher mean WTA.
- (2) The female has a lower mean WTP.

Since from the above tables it is obvious that the variance of both WTA and WTP are very different between the two gender groups, non-pooled t-tests is used. The t-tests are carried out as follows. In each case, let $\alpha = 0.05$. Degree of freedom is $(N_1 + N_2) - 2 = 16 - 2 = 14$, so critical value for ‘t’ is 1.7613.

t-test for WTA:

In this case, the null hypothesis (H_0) is that $X_1 - X_2 \geq 0$, and the alternative hypothesis (H_a) is that $X_1 - X_2 < 0$.

The information necessary for the t-test is shown in table 5.

Table 5 data used for t-test for WTA

Group	Mean	Sample size N	Standard deviation S
Male	$X_1 = 16.500$	8	$S_1 = 16.860$
Female	$X_2 = 23.750$	8	$S_2 = 8.197$

$$t = \frac{X_1 - X_2}{\sqrt{\left(\frac{S_1^2}{N_1}\right) + \left(\frac{S_2^2}{N_2}\right)}} = 1.093 < 1.7613 \quad (1)$$

Therefore, the alternative hypothesis that female has a higher mean WTA is rejected.

t-test for WTP:

In this case, the null hypothesis (H_0) is that $X_1 - X_2 \leq 0$, and the alternative hypothesis (H_a) is that $X_1 - X_2 > 0$ (see table 6).

Table 6 data used for t-test for WTP

Group	Mean	Sample size N	Standard deviation S
Male	$X_1 = 9.500$	8	$S_1 = 6.185$
Female	$X_2 = 4.750$	8	$S_2 = 3.601$

$$t = 1.8772 > 1.7613$$

Therefore, the alternative hypothesis that female has a lower mean WTP is accepted.

Overall: after the hypothesis is broken up into two hypothesis, the one that female has a lower mean WTP is accepted, but the one that female has a higher mean WTA is not proved to be valid. The result of the experiment will be evaluated in ‘discussion’ section.

4. DISCUSSION AND CONCLUSION

The failure to prove the separate hypothesis that female has a higher mean WTA clearly an unexpected result. The main reason for this is that the variance and standard deviation of WTA for both male and female are very high, causing a smaller ‘t’ calculated. When the questionnaires are examined, it is found that there are many extreme numbers affecting the data. As mentioned previously, one participant wrote ‘45’ for WTA, which is two times more expensive than the actual price of the milk-tea, which is 13 RMB for one cup. A few other participants wrote very low WTA (a lot lower than the actual price), and one reason for this, suggested by a participant who wrote the reason for his chosen WTA on the questionnaire, is that he doesn’t like drinking milk tea. Therefore, one flaw of this study is that the stimulus may not be desirable for all participants. For further research, a pre-experiment survey can be conducted, which can let participants to select one or several preferable items on a list, and the item liked by most participants can be used to minimize number of extreme anomalies.

Another limitation of this experiment is that the sample lacks age variation—all participants are aged between 14 and 18. Therefore, this is only a small portion of the population, so the experiment, to some extent, is not truly representative for the whole population. However, the

current situation that boarding students are not allowed to exit the campus does not allow the selection of participants from outside. If available, further research should consider people with a large range of age. One good control of variable is that the number of male and female participants is same. More coincidentally, exactly four male students and four female students are assigned a cup of milk tea.

Last but not least, one reason for the failure of proving one separate hypothesis is that the sample size is not large enough, which causes a low degree of freedom and thus a higher critical value of ‘t’, and a larger chance that extreme samples will affect the result to a large extent.

If the issue of variance and standard deviation is ignored, the hypothesis can be considered correct. A t-test already proves that the separate hypothesis that female has a lower mean WTP is correct. Although the other separate hypothesis isn’t valid undergoing a t-test, the raw data suggests a mean WTA difference such that the mean WTA for female is 7.25 RMB higher than that of male.

While past literature investigates difference in degree of loss aversion between male and female, this study supplements empirical findings about the influence of gender on degree of endowment effect, which is a phenomenon caused by loss aversion. To integrate findings by Sarin, R., Wieland, A., and Rau, H., we can have a preliminary conclusion that women are more loss averse and risk averse (for gains and under uncertainty), have higher dispositions effects, have lower mean WTP, and probably have higher mean WTA.

While this study only gives the result of whether gender difference can cause a different WTA-WTP gap, the reason behind this is not investigated as it is more in the field of psychology or biology. Further psychological or biological research may try to investigate the reason for this difference by referring to difference in body structures and functioning.

Moreover, as in this study the variable of gender is used, whether there is a correlation between other variables like age and the degree of subjection to the endowment effect, and probably the reasons, can be studied. A suggestion for further research is that the sample size should be as large as possible, so that extreme samples can be covered by size of sample, and there is a larger degree of freedom. With more and more research, the road of behavioral economics becomes brighter.

REFERENCES

- [1] Thaler, R. (1980). Toward a positive theory of consumer choice. *Journal of Economic Behavior & Organization*, DOI: 10.1016/0167-2681(80)90051-7
- [2] Kahneman, Daniel, Tversky, & Amos. (1984). Choices, values, and frames. *American Psychologist* 39, (4) (04): 341-350, DOI:10.1037/0003-066X.39.4.341
- [3] Kahneman, D. & Thaler, K. R. H. (1991). Anomalies: the endowment effect, loss aversion, and status quo bias. *Journal of Economic Perspectives*, 5(1), 193-206.
- [4] Rau, & Holger, A. (2014). The disposition effect and loss aversion: do gender differences matter?. *Economics Letters*, 123(1), 33-36.
- [5] Sarin, R., & Wieland, A. (2016). Risk aversion for decisions under uncertainty: are there gender differences? *Journal of Behavioral & Experimental Economics*, 60(feb.), 1-8.
- [6] Kahneman, D., & Thaler, K. R. H. (1990). Experimental tests of the endowment effect and the coase theorem. *Journal of Political Economy*, 98(6), 1325-1348.