

Sunk Cost Fallacy in Blind Box Consumption Among High School Students

Ziyan Qiao

Shenzhen College of International Education, Shenzhen, Guangdong, 518043, China

S21177.qiao@stu.scie.com.cn

Abstract. Blind box consumption attracts young consumers with its novelty and mystery, and high school students are essential consumers in the blind box economy. With the increasing popularity of blind boxes among senior high school students, a rising number of high school students consume irrationally, and the sunk cost fallacy influences consumers' decisions. The research entails a laboratory experiment, exploring the existence and extent of sunk cost fallacy in blind box purchase behavior of senior high school students in China, and uses SPSS to analyze data. Research results have shown that the majority of high school students are affected by sunk cost fallacy in blind box consumption. They are more heavily influenced by this heuristic bias when the sunk costs are high. Also, females are more likely to be affected by this bias than male students, as they consider more about the money and time they already spent.

Keywords: Sunk cost fallacy, Blind box, Behavioral economics, Laboratory experiment.

1. Introduction

Blind box consumption has become a significant trend in recent years, particularly among high school students. Blind boxes, or mystery boxes, are identical boxes containing random, unpredictable items of varying styles and shapes. The "blind" characteristics of the box make it stand out from the crowd of fashionable toys and become increasingly popular. In every series of blind boxes, there is a hidden variant, which typically refers to a variant of the blind box that is more desirable and rarer than the regular set of blind boxes. As consumers purchase blind boxes, they do not know the boxes' content and what they will get, with the possibility of discovering hidden variants that excite blind box collectors or enthusiasts.

The consumer group of blind boxes is relatively young. The Animation Comic Game (ACG) teenagers who are fascinated with brand culture and in first- and second-tier cities, female white-collar workers who are interested in fashion and seek cuteness are essential in driving the popularity of blind boxes. However, the trend of blind box consumption raises concerns about the decision-making process involved. Prior research has posited that consumers who purchase blind boxes may be swayed by psychological phenomena such as loss aversion, the anchoring effect [1], and the gambler's fallacy [2], causing consumers to make irrational decisions. However, there are currently no research papers regarding the effect of sunk cost fallacy on the consumption of blind boxes. It has been proven through numerous research that individuals frequently make irrational decisions by allowing sunk costs, which are investments that cannot be recuperated, to influence their decision-making process [3-9]. The sunk cost effect represents a prevalent cognitive bias among individuals, wherein they continue to allocate their time and financial resources towards a particular purchase or investment, despite it no longer being a logical decision, simply due to the amount of resources already invested. It is essential to be mindful of the sunk cost fallacy when engaging in blind box purchases. High school students may feel compelled to purchase blind boxes due to their previous investment, despite diminishing returns or unsatisfactory outcomes.

The sunk cost fallacy, especially in relation to blind box consumption among high school students, holds both theoretical and practical significance. The study aims to add to the existing literature on decision-making biases and consumer behavior by shedding light on the psychological mechanisms that drive the popularity of blind boxes. It also offers insights into the factors that influence the purchasing decisions of young consumers.

The identification of the sunk-cost fallacy through field data can present a challenging task due to the inherent existence of selection bias [10]. As a result, evidence of this fallacy has only been found in hypothetical situations and field experiments. There have been limited efforts to document it in laboratory settings, and the evidence provided needs to be more balanced [11]. This research entails a laboratory experiment examining the impact of the sunk cost bias on blind box consumption among high school students while also considering the potential influence of gender on decision-making. The focus of this study is on students in high school who are between the ages of 15 and 18.

The research investigates whether students' prior investments in collecting blind box items affect their future purchasing decisions, and if so, to what extent. Quantitative and qualitative data will be collected through questionnaires distributed among a diverse sample of high school students from various socio-economic backgrounds. The questionnaire after the experiment will assess participants' blind box consumption habits, thought processes, and intentions to continue purchasing blind boxes. Furthermore, it will incorporate specific scenarios to evaluate participants' willingness to invest further despite unfavorable outcomes. SPSS will be used to analyze the relationship between each data set.

2. Experiment Design

Participants were recruited using the school-based method and were randomly selected from the school. They were all informed of the experiment and provided their consent to participate. Participants have the right to withdraw at any time. One hundred and sixty same socio-economic background students (80 males, 80 females, mean age is 16 years, standard deviation is 0.95, age range fifteen to eighteen) from Guangzhou and Shenzhen participated in this study.

The experiment was completed by all participants who arrived in the laboratory. The participants were assigned randomly to either the present or absent condition of sunk cost, which is group A (experiment group), and group B (control group). Participants have been demonstrated the process of drawing blind boxes. They used printout money to make transactions when they decided to keep purchasing blind boxes. Every participant in the experiment group (group A) did two scenarios. In the experiment group when a sunk cost is present, the first scenario (S1) reads as follows:

“You have the opportunity to purchase one of 10 blind boxes, but you won’t know which one contains the hidden variant (which is your favorite) until you open it. Each box costs \$5, and you have enough money to buy 10 boxes. However, after opening the second box, the seller tells you they run out of the material that makes the hidden variant and offers to replace it with another of the same quality (no commercial fraud exists), but the style may not be the type you like. Remember that once you purchase the item, you cannot return or exchange the item. Consider if you want to continue it and record your answers to the questions.”

The second scenario (S2) for the group with a sunk cost is when the participants purchased and opened the seventh blind box. In a situation without sunk costs, the scenarios can be described as:

“You have the opportunity to purchase one of 10 blind boxes, but you won’t know which one contains the hidden variant (which is your favorite) until you open it. Each box costs \$5, and you have enough money to buy 10 boxes. However, when you are about to purchase your first blind box, the seller tells you they run out of the material that makes the hidden variant and offers to replace it with another of the same quality (no commercial fraud exists), but the style may not be the type you like. Remember that once you purchase the item, you cannot return or exchange the item. Consider if you want to continue it and record your answers to the questions.”

Participants had to fill out a questionnaire after the experiment, with questions about their willingness to continue purchasing and their reasons for it. The material used for this investigation were ten blind boxes, printouts of money for transactions, and surveys for participants to fill out.

There are two hypotheses for this experiment. First, high school students tend to be affected by sunk cost fallacy during blind box consumption, thus engaging in risky and irrational behavior.

Second, female high school students will rate higher than male students in terms of blind box purchases.

3. Data analysis

3.1. Quantitative analysis

Table 1 below suggests that, when comparing Group A and Group B for their initial purchasing intention (less or no sunk cost), there is little difference between their initial score (mean score of group A is 28.15, mean score of group B is 25.54, standard deviation of A is 26.07, standard deviation of B is 27.26); thus, the participants are randomly allocated to the experiment group and control group.

Table 1. Comparison between Group A (scenario 1) and Group B.

	Obs.	Mean	Std. Dev.	Std. Error	Diff. in mean
Experiment1-S1	80	28.150	26.067	2.914	2.641
Control	80	25.536	27.261	3.643	

The effects on willingness (percentages from 0 to 100%) to continue purchasing blind boxes due to a sunk cost (money already spent to buy two or seven boxes) were analyzed using a correlation analysis. The findings in Table 2 indicate that the presence of sunk cost has a significant impact. There is a significant difference in group A when comparing the results in scenarios one and two (mean of scenario one is 28.51, Mean of scenario two is 57.84, Standard Deviation of scenario one is 26.07, standard deviation of scenario two is equals 30.52).

As shown in Table 2, their percentage of willingness to purchase further blind boxes in scenario two is higher than in scenario one when the sunk cost is low. The variance in the means of the two scenarios was substantial and unlikely to be a random outcome. After conducting a t-test, the resulting t-statistic was 4.870, at 55 degrees of freedom ($t(55)$ is 4.870, p-value less than 0.001).

Table 2. Comparison between scenario 1 and two of the experiment groups.

	Obs.	Mean	Std. Dev.	Std. Error	Diff. in Mean	p-value	t	df
Experiment-S1	80	28.150	26.067	2.914		<0.001	4.870	55
Experiment-S2	80	57.836	30.521	3.412				

As for the scenario when sunk costs are high, the high school students will rate their willingness to pay significantly higher than when the sunk cost is low. In conclusion, the sunk cost fallacy exists in blind box consumption among high school students only when the sunk cost is high enough. Therefore, hypothesis one is proven right that high school students tend to be affected by sunk cost fallacy during blind box consumption.

As shown in table 3 below, there are no significant difference between gender when comparing participants in control group. It appears that the difference in means between the two conditions was the result of random chance, as p is larger than 0.05. At 39 degrees of freedom, the t-test resulted in a t-statistic of -1.933 ($t(39)$ is -1.933, p-value equals 0.061).

Table 3. Comparison between males and females in the control group.

	Obs.	Mean	Std. Dev.	Std. Error	Diff. in mean	P-value	t	df
Male	40	22.179	28.717	5.427	6.95	0.061	-1.933	39
Female	40	36.036	34.956	6.606				

However, gender difference is shown when the sunk cost presents. As shown in Table 4 below, it exists in the experiment group. Following a statistical analysis using a t-test with 39 degrees of freedom, the resulting t-value obtained was -4.269. ($t(39)$ is -4.269, p-value less than 0.001).

Table 4. Comparison between females and males in the experiment group.

	Obs.	Mean	Std. Dev.	Std. Error	Diff. in mean	p-value	t	df
Male	40	50.675	30.420	4.810	14.325	<0.001	-4.269	39
Female	40	65.000	29.264	4.627				

Therefore, the gender difference is shown when sunk costs are present in blind box consumption, and female participants are more heavily affected by this heuristic bias than male participants. Thus, hypothesis two is correct.

3.2. Qualitative analysis

In scenario one, when the sunk cost is low, 19 out of eighty students chose yes (keep purchasing) when asked, “Will you keep purchasing blind boxes if you faced this scenario?” While in scenario two, when the sunk cost is relatively high, 49 out of 80 students chose to keep purchasing. Many participants have a much higher percentage of willingness to purchase when facing relatively high sunk costs.

When asked about their thought processes, many participants answered, “I have already spent so much money buying blind boxes, I cannot stop now” and “I already invested so much, maybe I will see my outcome if I keep purchasing.” When the participants who chose to keep purchasing further boxes were asked whether they agreed with the opinion that “Although the new hidden variant may not necessarily be the type I like, I have already invested \$35, I might as well continue to invest \$15 to buy all boxes, and there may be unexpected surprise or gains.”, majority of the participants wrote agree.

4. Discussion

It is clear from the findings of this study that high school students are influenced by the sunk cost fallacy when it comes to blind box consumption. This can lead to risky and irrational decision-making behavior, which supports the first hypothesis.

The results showed that high school students became emotionally attached to the sunk costs incurred in their blind box purchases. Participants might experience feelings of regret and hesitation when considering giving up their past investments, even if they have faced multiple disappointments. Participants tend to have stronger emotions toward losses than gains due to loss aversion, and the fear of losing past investments, which is the blind boxes already bought to achieve the hidden variant, may override rational decision-making, leading to continue purchasing rather than cutting losses. This is an example of sunk cost fallacy, where past investments are prioritized over future utility. It's important to consider future needs rather than past investments.

The optimism theory suggests that people maintain a positive outlook even in uncertain situations and may unconsciously believe they are lucky. It is possible to overestimate the probability of expected events while also underestimating the chances of unexpected events occurring [12]. Numerous individuals who derive pleasure from purchasing blind boxes frequently employ optimistic reasoning to justify their continued acquisition of them, despite experiencing disappointment with their contents. They believe that future purchases will yield superior results, and this positive outlook influences their decision-making regarding further investment in blind boxes. Rather than assessing the probabilities objectively, they concentrate on positive expectations, which can result in irrational behavior and the sunk cost fallacy.

This study sheds light on gender differences in relation to cognitive bias in blind box consumption among high school students, specifically hypothesis two. The study's results confirm the hypothesis that female students are more prone to sunk cost bias than their male counterparts. The qualitative and quantitative data reveal that female participants tend to have a stronger emotional attachment to their sunk costs in blind box consumption. They would feel a greater sense of regret and loss if they were to stop buying blind boxes after investing significant resources. During the interviews,

participants used phrases like “I can't give up now” or “I've already invested so much, I can't stop”, highlighting their emotional attachment.

In addition, the study found that women were more inclined to justify their ongoing involvement in blind box consumption with optimistic reasoning. They maintained a positive attitude, thinking that their future purchases would yield better results and thus rationalizing their continued investment in blind boxes, despite repeated disappointments. The qualitative data also indicated that social factors impacted women more than men. Peer pressure and the desire to stay connected with their peers influenced their choices, prompting them to buy blind boxes to avoid feeling excluded or falling behind in their collections.

Although the results generally confirm the hypothesis, it is essential to recognize variations within each gender group. Some male participants showed a tendency to fall for the sunk cost fallacy, especially those who had strong emotional connections to their blind box collections. Conversely, some female participants demonstrated resilience against the sunk cost fallacy, opting for a rational approach when deciding whether to continue purchasing blind boxes.

The results of this research have significant implications for educating purchasers and implementing measures to encourage thoughtful decision-making among high school students. Acknowledging the illogical tendencies related to sunk costs can provide insights for educational programs and interventions to promote responsible consumer behavior. By educating students about cognitive biases and decision-making heuristics, they can gain the necessary tools to make more rational decisions when faced with sunk costs. Recognizing how gender-specific factors contribute to the sunk cost fallacy can lead to creating specific solutions to minimize its effect on purchasing blind boxes. Teachers and officials may establish educational initiatives that equip male and female students with analytical abilities, enabling them to make logical decisions based on future returns instead of prior investments. Teaching critical thinking skills and fostering an understanding of probability and risk assessment can be done to help and encourage students to consider future utility over past investments.

Further research is required to study the efficacy of specific interventions and strategies in mitigating the impact of the sunk cost fallacy on the purchasing habits of high school students. Furthermore, it would be beneficial for future studies to investigate the reasons behind the gender differences in the sunk cost fallacy among high school students. Longitudinal studies may provide insight into how gender-related cognitive biases develop and their connection to other consumer behaviors. Furthermore, analyzing the impact of cultural norms and societal expectations on consumer choices could result in a more thorough comprehension of the gender disparities observed.

This experiment has a few limitations. Initially, the study was conducted with limited participants from a particular region's high schools in China. The findings may not be suitable for a broader population of high school students, as the sample size is limited, restricting the generalizability. The sampling may have bias, as the students recruited are from the same socio-economic background, which may not correspond to those from rural or other backgrounds. Additionally, this study explored the sunk cost fallacy in blind box consumption among high school students but did not thoroughly investigate the impact of other factors, such as advertising and parental influence, on their consumption behavior. Finally, this study has some ethical concerns. The study involved deception since the participants were not given full information about the actual purpose behind the research. However, the participants were debriefed afterward to ensure the deception did not harm the participants.

5. Conclusion

Ultimately, this study explored the sunk cost fallacy in blind box consumption among high school students. This research proves and confirms the existence of sunk cost fallacy in blind box consumption through laboratory experiments and SPSS analysis. To a greater or lesser extent, the students are affected by sunk cost fallacy when purchasing blind boxes, thus engaging in irrational

behavior and decision. The students are more affected by sunk cost fallacy when the sunk costs are high compared to relatively lower sunk costs. Furthermore, this research has found the gender difference when facing sunk cost fallacy. Female students are more likely to be affected by sunk cost fallacy and choose to keep purchasing blind boxes due to the consideration of past investments. They are more willing to pay for these boxes than male students and make irrational decisions. It is important to note that while many female students may be affected by heuristic bias, some are not. Conversely, some male students may be heavily impacted by this fallacy.

The majority of the participants are affected by this fallacy mainly due to loss aversion, emotional attachment to past investments, and optimistic reasoning. These results have significant implications for consumers and students. Students can be taught how to spend money wisely and on future utilities instead of past investments. This can help students develop critical thinking skills and make rational decisions.

The research addressed an area previously lacking and underexplored in the field of behavioral economics, adolescent irrational consumption behavior and blind box economy. This research provides insights into sunk cost fallacy and its relationship with blind box consumption. It benefits educators and policymakers by informing the cognitive biases that influence student's consumption behavior, aiding consumers by raising their awareness of the sunk cost fallacy that may affect their decisions, and valuable for marketing and business as it provides insights into consumer behavior, assisting them in tailoring their strategies and optimizing sales for customer satisfaction.

This study, however, did not analyze specific factors leading to gender differences in blind box consumption. The participants were from the same backgrounds and similar ages, which means the result may not be suitable for consumers from other backgrounds and ages. For future research, longitudinal studies may be adopted to analyze further factors influencing consumers' behaviors and the effective strategies and interventions. With further research, behavioral economics may bring valuable outcomes.

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