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Generational Role of Sunk Cost Fallacy in Decision Making

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As humans, we make thousands of decisions daily, which are predisposed to becoming error-prone without any deliberate knowledge. The current study reports insights into the age-old phenomenon of sunk cost effect that is known to influence decision-makers to "throw good money after bad," but in the temporal domain. The study aimed to study the effect of sunk time on economic decision-making using a delay discounting paradigm. The study also aimed to understand the effect of generation and gender on sunk-time decision-making. The participants in the study included 105 individuals from across three generations from both genders (Female=58, Male= 47). The findings of the study revealed a significant main effect of sunk time, with longer time having greater discounting. The main effect of generation and gender were also significant, with millennials and males having greater discounting. These results provide robust evidence in favor of sunk cost for time with a new paradigm and some additional insights into the role of age and gender.

Keywords: Sunk Cost, Sunk Time, Decision Making, Generation, Delay-Discounting.

Sunk Cost Fallacy

Sunk cost fallacy is a cognitive phenomenon associated with a greater tendency to continue an endeavor once an investment in money, effort, or time has been made. A seminal definition of this "sunk cost fallacy" or "sunk cost effect" by Arkes and Blumer (1985) characterizes individuals as falling prey to the effect when they continue an endeavor as a result of previously invested resources such as time, money, or effort. As humans work through the process of decision-making, it is inherently seen that individuals tend to continue an endeavor or behavior simply because they have invested sufficient time and energy or there is a great deal of monetary investment. However, doing so has often proved counterproductive, and the sunk cost effect has explained this.

Arkes and Blumer (1985) were the first to identify sunk cost fallacy in their classic paper on decision-making. The sunk cost fallacy is relevant in the contemporary world because it may force economic decision-makers to "throw good money after bad" and follow biased decision-making (Garland & Newport, 1991). The tendency is irrational because sunk cost fallacy violates traditional normative economic decision-making models. However, this is contradictory to the normative model. The normative approach holds that because previous costs and gains cannot be recovered, they should not be considered when making decisions in the present scenario. Therefore, it is best to disregard them while making an economic decision (Staw, 1981). Nevertheless, the selected course of action remains unchanged for sunk cost effect (Mcaffe, Mialon, & Mialon, 2010).

Hence, rational decision-makers will decide based only on their options' current and future costs and benefits (Simon, 1955).

Effect of Age on Decision Making

The descriptive and normative models of decision-making study the predominant factors affecting decision-making. As with other psychological phenomena, research has previously reflected that a person's age might positively or negatively bias the decision-making process, or rather, that allows one to establish individual differences. The variable age is deemed necessary, especially from the naturalistic perspective, as it primarily focuses on the individuals' competence level and experiences acquired over a certain period of time with age (de Acedo Lizárraga et al., 2007).

However, contrary to this postulation, older adults often perform better in making certain decisions as a result of gaining a myriad of experiences over the years (Bruine de Bruin et al., 2012). Studies reveal that, compared to adults and retired people, youths experienced greater emotional and social pressure while making judgments. This is due to the fact that people, who lack expertise and experience in certain decision-making domains, as is the case for the majority of young people, tend to give little weight to the elements influencing the decision and are unaware of the complexity of the decision. Adults and retirees, however, pay greater attention to these aspects and evaluate the quality of their choices after putting the necessary measures into practice (Hershey & Wilson, 1997). According to Nakajima and Hotta (1989), this shows that adults have evolved various complex strategies for contrasting the factors that influence a decision.

Age Effect on Sunk Cost Fallacy

Studying sunk cost effects across generations has lent some positive evidence in favor of older adults, stating that they are less susceptible to the fallacy. Strough et al. (2014) found that older persons were likelier to make normatively sound judgments and less inclined to succumb to the sunk-cost fallacy. They favor intuitive processing more because it is associated with a lower sunk cost impact (Huai, Lui, & Peng, 2022). In light of the sunk cost effect phenomena, older persons are better equipped to decide to end such failed commitments than younger ones, especially when irrecoverable losses are significant, and to deal with the related irrecoverable losses (Bruine de Bruin et al., 2014). Similarly, Strough et al. (2008) investigated this on seventy-five college students and 73 community-dwelling older adults who participated in a study with two pairs of scenarios. Sunk cost fallacy was calculated based on their investment with each pair. As initially suspected, the results revealed that older persons had lower sunk-cost fallacy rates than younger adults. In a follow-up study, Strough, de Bruin, and Parker (2015) recruited some participants through an online survey from various age groups who responded to two sunk-cost scenarios and measured their coping strategies. Similar to previous studies, an age difference was found in persistence, where older adults were more willing to cancel failing plans, especially for high irrecoverable losses. This is explained by the socio-emotional selectivity theory that asserts cognitive processing and decision-making. Studies on social cognition and decision-making point to improved comprehension of fundamental emotional states long into adulthood and greater integration of emotion into cognitive decision-making processing (Carstensen et al., 1999). Since fluid intelligence decreases with age, older adults will likely perform poorly in decision-making.

Issues with Present Studies

Although there is ample research evidence from various domains to say that

older adults are far less susceptible to give into sunk cost fallacy than the younger population, it is essential to note that these generalizations are made based on research on sunk cost of money only. Of all the research, only one involved two scenarios of the sunk cost of time, leading us to believe that the same results might not be accurate for temporal sunk cost decision-making. An additional issue is a defining cut-off for the age group. The age group mentioned in the research is constantly changing, which might nullify the experiences of two generations. Since most of these studies were conducted by JoNell Strough, replicating these researches is another challenge. People who belonged to middle adults in the last decade might be considered older adults in the next.

Sunk Cost Time vs. Money

Decades of research, questionnaire experiments, field experiments, and correlational field studies have supported sunk cost effect literature (Navarro & Fantino, 2009). Arkes and Blumer (1985) provided evidence for the sunk money effect in a landmark series of ten experiments. In the first experiment, the participants were presented with a situation where they purchased tickets for two trips, a Michigan and Wisconsin trip that fell on the same weekend and cost $100 and $50, respectively. While they liked the Wisconsin trip more, contrary to the beliefs of traditional economic theory, 54% of the people chose the Michigan trip instead. In another experiment, two groups of participants were asked if they would continue building a radar-bank plane by spending 1 million when another firm had already built a cheaper and faster one, the only difference being that the first group had already invested 9 million, unlike the other. Their analysis revealed a significant difference between the two groups, concluding that subjects in a sunk-cost situation have an inflated estimate of the likelihood that the completed project will be a success. Following this study, several researchers have attempted to study the sunk cost effects on humans and animals (Garlan & Newport, 1991; Kacelnik & Marsh, 2002; Piedad, Field & Rachlin, 2006). Soman (2001) studied the sunk cost impact brought on by two domains, time and monetary investment, and investigated whether the two share an identical nature. Unlike in the monetary domain, the sunk cost effect observed in time investments was apparent. Navarro and Fantino (2009) revealed the first convincing evidence for a sunk time effect in humans, particularly in their behavioral studies (Experiments 5-7), where participants spent a short or lengthy time solving a jigsaw puzzle. They also discovered sunk cost effects in a scenario where participants envisioned investing time and effort in tasks requiring time and effort commitments. In another series of experiments, Navarro (2007) discovered that the sunk time effect is significant and that certain aspects of the lost time, such as how fascinating or tedious it is, may impact the effect.

Contrary to their suggestion, no significant differences were found for sunk cost or the enjoyment of the task in a different series of experiments (Billings, 2021). Park et al. (2013) conducted a study to understand better the impacts of temporal sunk costs on prospective passengers' cancellation intentions and monetary sunk costs. The results showed that passengers' intent to cancel a travel product decreased as the temporal and financial sunk costs increased. All these studies reveal that sunk cost does not have enough evidence to give a conclusive inference. The study, thus, explores the sunk cost phenomenon, considering the effects of both time and money.

Generational Cohorts and Age

In this context, studying sunk cost fallacy across generations has led researchers to

believe that individuals might have some age differences in sunk-cost decision-making. The study focuses on the generational trajectory rather than just the variable of age since while younger and older individuals might have distinct perspectives and follow distinct patterns of decision-making at a given time, age cohorts or generations allow us to go deeper and look at how older persons felt about a particular issue when they were younger and discuss how decision-making may vary across generations. Thus, it is essential to consider the broader societal changes within a generation's life cycle. These changes have a more significant impact on the value systems, life orientations, outlook towards life, life goals, and decision-making of the new generation compared to earlier ones. Older people are more likely to reflect the values prevalent when they were growing up. The greater acceptance of homosexuality and inter-religion, caste dating/marriage among young people than among older ones today are examples of this. It is pertinent to study the intergenerational changes in decision-making and sunk cost effect.

Nevertheless, regardless of life cycle stages, the impact of experiences of a single generation that individuals experienced throughout their formative years is generally steady throughout their lifetimes (Inglehart, 1997; Strauss & Howe, 1991). Hence, we propose generation as a variable that is better defined and more stable over time. We propose the usage of US Generation Cohorts: Baby Boomers (Born between the years 1946–1964), Gen X (Born between 1965–1979), Gen Y or millennials (Born between 1980–1994), and Gen Z (Born between 1995–2015).

Current Study

The research on sunk time effect has yielded some contradicting evidence in the literature. Some experiments (Soman, 2001) claim that individuals do not incur sunk cost effect of time, while others (Navarro, 2007; Castillo et al., 2020) claim that sunk cost decision-making is present in individuals. The primary aim of this study is to understand the effect of sunk time on decision-making. For this, the current study employs a delay discounting paradigm with an adjusting-amount method. Additionally, the research evidence already shows that there is an impact on the generation of sunk-cost decision-making. However, this generalization is made based on sunk cost of money only. Since we have established that sunk cost of time does not necessarily follow the patterns of the sunk cost of time, this also aims to understand the effect of generation on temporal sunk-cost decision-making. Lastly, the effect of gender on decision-making is yet unclear as well. Some researchers state that females are more susceptible, while others claim that males are more. The study aims to understand gender differences in sunk-time decision-making.

Method

The study aims to understand generational differences in sunk cost decision-making of individuals. The experimental situation is adapted from previous research (Castillo et al., 2020), developed by field pioneers, and is adapted in the Indian context. Psychopy software (Version PsychoPy 2022.2.3) was used to design the experiment, where participants were randomly assigned to different groups of the time: one month, three months, six months, or one year.

Participants

The current study includes 105 participants from three generations, Gen Z, millennials, and Gen X. In the Gen Z group, 35 people born between 1995 and 2015 were included (M = 20.85 Years, SD = 1.61 Years). In the millennials group, 35 people

born between 1980 and 1994 were included (M = 31.8 Years, SD = 4.23 Years). In the Gen X group, 35 people born between 1965 and 1979 were included (M = 49.0 Years, SD = 4.11 Years). It was ensured that all the participants understood English, as the statements were presented in English. The quota sampling technique was initially used, where equal members from each generation were taken. After the intended participants were decided, convenience sampling was used to find participants within each group.

Experiment Details and Procedure

An experimental situation was developed utilizing a 4 x 3 x 2 randomized block design. Four versions of the scenario were developed to represent four different levels of sunk cost. In the experiment, there were three independent variables: Sunk time (one month, three months, six months, and one year); generation (Gen Z, Millennials, and Gen X); and gender (Male and Female). All variables were administered between subjects, where the computer program randomized the first variable. The participant was randomly assigned to one of four groups in the experiment. The participants were given a scenario that read, "*We are conducting a study to determine how people make choices. There is no right or wrong answer, just your preference. Imagine you are part of a group of sellers collecting unique antique items. Recently, you have acquired a guitar. However, you had to wait (a month/ 3 months/6 months/1 year) to receive it. After waiting for that period, you received the guitar and paid the value of Rs. 10,000. Imagine that, at this time, someone offers to buy it from you. Please choose the minimal amount of money for which you would sell the guitar.*" After the situation presentation, the participant had to respond by using the keyboard. The amount of money (selling price) entered as the response was later analyzed using Jamovi (Version - 2.3.6) Software.

Results

In this experiment, participants were randomized into one of four groups. 26 participants were assigned to Group 1 (1 month), 25 participants were assigned to Group 2 (3 months), and 27 participants each were assigned to Group 3 (6 months) and Group 4 (1 year). The average amount of money people were willing to sell the guitar (selling price) was Rs. 16.9k.

Table 1: Experiment: Descriptive: Mean and SD of Selling Price

	Number of participants	Mean (in thousand rupees)	SD (in thousand rupees)
Gender			
Male	47	17.2	14
Female	58	16.7	13.3
Generation			
Gen Z	35	16.5	9.31
Millennials	35	20.6	20.9
Gen X	35	13.7	3.77
Sunk Time			
1 month	26	14.2	5.01
3 months	27	14.7	5.07
6 months	25	13.3	5.41
1 year	27	25.1	23.7
Total	105	16.9	13.5

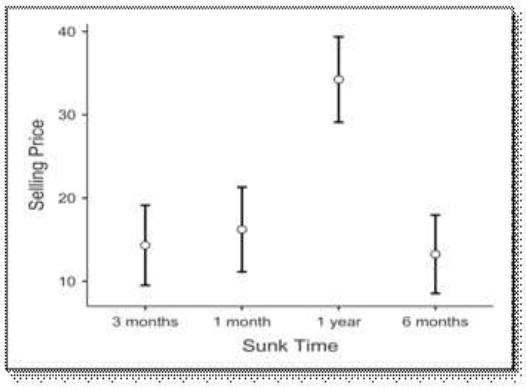
The selling price differed according to the sunk time, generation, and gender. A factorial ANOVA revealed a significant overall model with $F(23, 81) = 3.59^{***}$, $p < 0.001$. The results can be seen in Table 1.2.

Table 2: Experiment: ANOVA Amount (in thousand rupees)

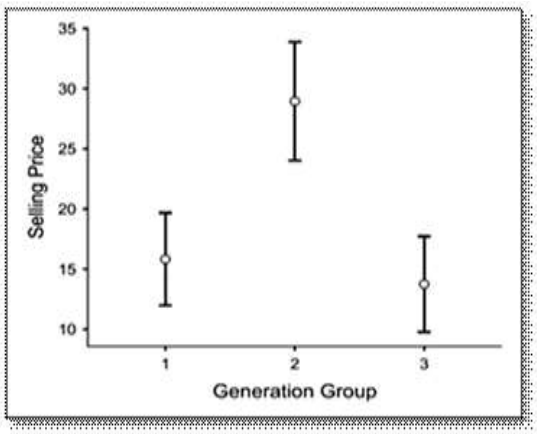
	Sum of Squares	df	Mean Square	F	p
Overall model	20359	23	885	3.59***	<.001
Generation	2955	2	1478	12.67***	<.001
Sunk Time	5324	3	1775	15.21***	<.001
Gender	936	1	936	8.02**	0.006
Generation * Sunk Time	4217	6	703	6.02***	<.001
Generation * Gender	2094	2	1047	8.97***	<.001
Sunk Time * Gender	1335	3	445	3.81*	0.013
Generation * Sunk Time * Gender	3498	6	583	5***	<.001
Residuals	9449	81	117		

df = degrees of freedom, *p<0.05, ***p<0.001

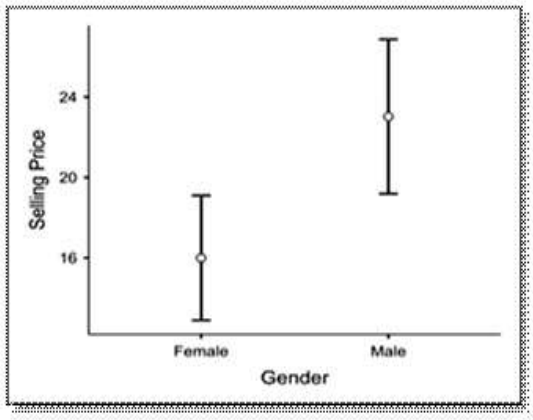
As can be seen from the table, the main effect of the sunk time was significant, F (3, 81) = 15.21***, p < 0.001. A post hoc test on sunk time revealed that the sunk cost incurred in one year time (M = 25.1, SD = 23.7) was significantly different with one month (M = 14.2, SD = 5.01), three months (M = 13.3, SD = 5.41) and six months (M = 14.7, SD = 5.07).



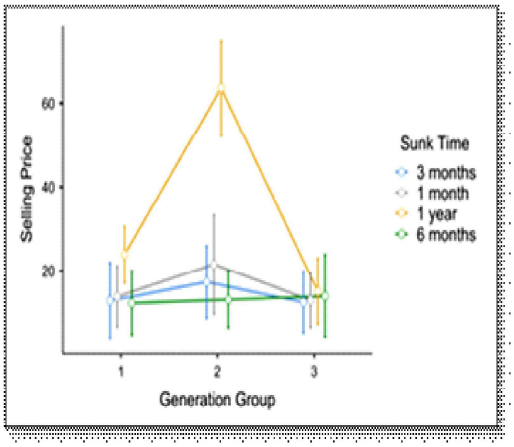
A: Main Effect of Sunk Time



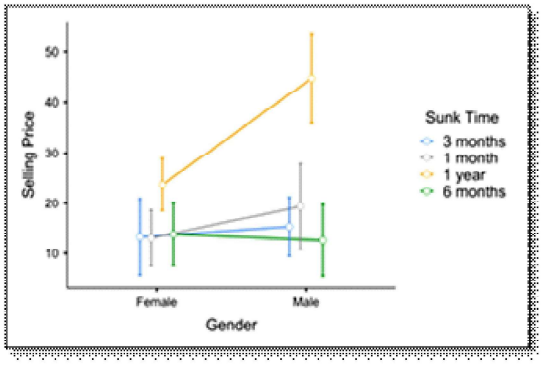
B: Main Effect of Generation



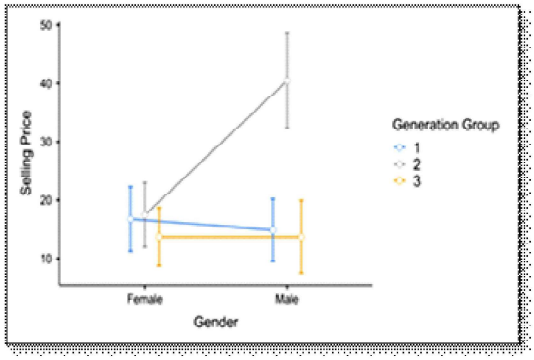
C: Main Effect of Gender



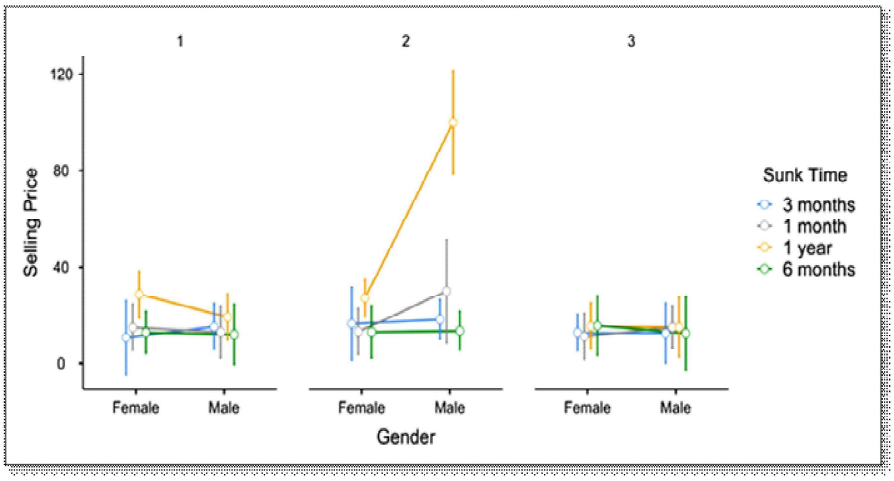
D: Interaction effect of Generation * Sunk Time



E: Interaction effect of Sunk Time * Gender



F: Interaction effect of Generation * Gender



G: Interaction effect of Sunk Time*Generation * Gender

Figure 1: The figure below shows the main effects of sunk time (A), Generation (B), and Gender (C), along with interaction effects of Generation * Sunk Time (D), Sunk Time * Gender (E), Generation * Gender (F), and Generation * Sunk Time * Gender(G).

Table 3: *Experiment: Post-Hoc Comparisons- Sunk Time*

Comparison		Mean Difference	SE	df	t	p_{tukey}	Cohen's d
1 month	3 months	1.89	3.52	81	0.536	0.95	0.175
1 month	6 months	2.97	3.48	81	0.852	0.829	0.275
1 month	1 year	-18.02	3.63	81	-4.959***	<.001	-1.668
3 months	6 months	-1.08	3.38	81	-0.32	0.989	-0.1
3 months	1 year	-19.91	3.54	81	-5.629***	<.001	-1.843
6 months	1 year	-20.99	3.5	81	-5.993***	<.001	-1.943

SE = Standard error of mean; df = degrees of freedom, ***p<0.001

Similarly, the main effect of generation was also significant, F (2, 81) = 12.67***, p < 0.001. Post-hoc test on generation revealed that the sunk cost incurred by millennials (M = 20.6, SD = 20.9) was significantly more than both Gen X (M = 13.7, SD = 3.77) and Gen Z (M = 16.5, SD = 9.31).

Table 4: Experiment: Post-Hoc Comparisons- Generation

Comparison		Mean Difference	SE	df	t	p_{tukey}	Cohen's d
Gen Z	Millenials	-13.13	3.14	81	-4.18***	<.001	-1.216
Gen Z	Gen X	2.07	2.78	81	0.745	0.738	0.192
Millenials	Gen X	15.2	3.18	81	4.778***	<.001	1.407

SE = Standard error of mean; df = degrees of freedom, ***p<0.001

Discussion

The goal of the study was to understand the valuation sunk cost of invested time using an adjusting-amount approach, as the amount for which a person will sell the guitar after waiting for a specific period of time. The sunk cost effect and delay discounting consider the role of temporally distant scenarios but have not been evaluated simultaneously (Sofis, 2018). The subjective worth of the outcome (guitar) grew as the time invested increased from lesser time periods (one month, three months, and six months) to a year. These results support our first hypothesis, which was that the amount of sunk cost of time would have a significant effect on the decision-making of individuals. The results are consistent with the assertions of Garland and Newport (1991) and other researchers like Bornstein and Chapman (1995). LeClerc et al. (1995) however, found that individuals are more averse to uncertainty when making decisions regarding the allocation of time because time is less flexible than money.

Further, this is also because the uncertainty that comes with time makes planning difficult, invariably influencing decision-making. An interesting fact to note from the results is that although the amount of sunk cost of time has an effect on decision-making, this is only true for significant time periods. This is in opposition to the results of Castillo et al. (2020), where the value of the guitar increased with an increase in time invested at all points. But, in their case, the time varied from 1 month to 5 years, and the increase was only noticed in later years. Also, the variable in that study was measured within the group, which might have provided some cues or expectations of other situations. This bias was removed with the use of between-group scenarios. Hence, the magnitude effect Castillo et al. (2000) referred to is only working for significant time gaps. This idea is supported by Mukherjee et al. (2021), where demonstrated the magnitude-dependent loss aversion of time.

The second hypothesis was based on the generation of the individuals, where the literature suggested that older participants will incur less sunk cost than younger participants. This hypothesis was also retained, but the assumption was only partially true. Prior research has also demonstrated that the effect of expertise, the rationale behind older participants being less prone to sunk cost effect, may be limited to domain-specific situations rather than generalizing to other situations (Bornstein et al., 1999; Tan & Yates, 1995). In the experiment, millennials incurred the highest sunk cost than both Gen X and Gen Z. Although these results do not support some theoretical explanation for generational

differences, they may provide some insights into the fallacy of the new generation. The previous theories and research have limited themselves to the millennials, where the assumptions work, even in the current experiment. However, the newer Gen Z has some differences in evaluating situations, which minimizes the fallacy. There can be various reasons for this. Generation Z is the first generation to have grown up amid an era of advanced information technology (Cruz, 2016). ASA.org (2022) states that the primary reason might be that Gen Z, due to the internet, is exposed to more information, making more informed and rational decisions (Kardes et al., 2010). Another explanation for this effect might be the greater importance of money for millennials due to their age, where career and life events play a significant role in decision-making.

The third hypothesis was that the gender of the individual would also have an impact on decision-making. This hypothesis was also retained, and it was found that males incurred higher sunk costs than females. This differed from two previous researches that found women are more sensitive to sunk cost fallacy than men (Bavolar, 2013; Liang & Zou, 2018). However, the results were not derived from the experimental study but with the use of a questionnaire of A-DMC (Adult Decision-Making Competence) in both cases. So, this evidence provides more applied scenarios where males incur more sunk costs, unlike studies conducted by Weller et al. (2018) that have suggested that men perform better on metrics of rational responding. The reason provided for this is that women tend to charge lower pricing to individual clients (Cron et al., 2009). Men, on the other hand, represent a tendency toward greater impulsiveness in terms of their decision-making competence (Delaney et al., 2015). Hence, these factors are needed to be considered to understand the reason for gender differences in sunk-cost decision-making.

Limitations and Future Implications

This study is not without its limitations. Primarily, the study was conducted during covid in an online setting, which might have played a role in the control of variables. Future researches on offline settings will have better control conditions. Since the study shows a magnitude-dependent effect of the sunk cost of time, future researchers may also investigate the sunk time effect at higher time periods. Future studies can also take various different scenarios of economic, social, and non-social domains to understand the role of the contextual effect. More research is needed to understand the reasons for generation and gender differences.

Conclusion

In the current research, the primary aim was to understand the effect of sunk time on decision-making. The sunk cost time was studied with the help of an adjusting-amount approach, varying the time for the participants accordingly. As the amount of time spent increased from relatively shorter time periods (one month, three months, and six months) to a year, the subjective value of the guitar scaled up. These findings are consistent with our initial prediction that the amount of time invested in a task will significantly influence people's decision-making. However, this result was found to be magnitude dependent, with effect only present for high magnitude. Another integral aim was to study sunk cost fallacy across the dynamic generational trajectory where the older generation presumably incurred lesser sunk cost than the younger generation. The experiment conducted in the study showed that millennials incurred the highest sunk cost than both Gen X and Gen Z. Also, males were more valued time at a higher price showing more sunk cost effect.

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