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The impact of childhood environments on the sunk-cost fallacy

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Abstract

The sunk-cost fallacy is a well-documented cognitive bias in the decision-making literature. Although the emerging literature on childhood socioeconomic status suggests that early-life environments shape individuals' decision strategies and have a long-lasting impact on their decisions, little is known about the impact of childhood socioeconomic status on the sunk-cost fallacy. Using two different scenarios and an actual choice task, we provide converging evidence that individuals who grew up in resource-scarce environments (those with lower childhood socioeconomic status) are reluctant to abandon inferior choices merely because they have already invested substantial resources in them, resulting in the sunk-cost fallacy. This fallacy occurs because individuals with lower childhood socioeconomic status tend to perceive the loss of their prior investments as more wasteful than those with higher childhood socioeconomic status.

KEYWORDS

childhood socioeconomic status, cognitive bias, consumer decision-making, perceived wastefulness, socioeconomic status, sunk-cost fallacy

1. INTRODUCTION

Consider the following two situations. John paid $10.95 to watch a movie on pay TV but gets bored in 5 min. Olivia is in the same situation except that she paid nothing. Who would be more likely to finish the movie instead of stopping midway through? One of the possible answers may be that John, who invested money, would finish the movie to get his money's worth. This is well supported by previous research on the sunk-cost fallacy. The sunk-cost fallacy refers to the tendency to continue the endeavor following an investment of significant yet irreversible resources (Arkes & Blumer, 1985; Staw, 1976). It is a cognitive bias in decision-making whose influence is observed in various domains such as professional sports (Staw & Hoang, 1995), long-term memberships (Dick & Lord, 1998), human relationships (Rego et al., 2018), or animal behavior (Pattison et al., 2012). The fallacy is fundamental in that even objective information or feedback cannot completely eliminate it (Keefer, 2015).

Importantly, previous research suggests that individual differences determine the extent to which people "throw good money after bad." For example, individuals whose age is younger (Strough et al., 2008), whose culture is low in uncertainty avoidance (Keil et al., 2000), whose personality is high in agreeableness and conscientiousness (Fujino et al., 2016), and whose coping orientation is state-oriented (i.e., ruminating about past events; Van Putten et al., 2010) are more likely to fall prey to the sunk-cost fallacy. While these findings delineate who is more susceptible than others to the fallacy,

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few of them seem to provide actionable insights into developing marketing plans; for example, it may not be easy for companies to identify highly agreeable or state-oriented consumers. Furthermore, considering the recent assertion that the sunk-cost fallacy is developed and reinforced through the adaptive learning process (Wong & Kwong, 2018), investigating the sunk-cost fallacy from an individual's developmental pathways from childhood could deepen our understanding of this important cognitive bias. Finally, to the best of our knowledge, no prior research has examined this resource-relevant bias from a social class perspective. Our research attempts to fill this gap by uncovering how an individual's experienced abundance/scarcity of resources during childhood influences the ways/he deals with a sunk cost in adulthood. When reconsidering the opening question, we contend that the answer may depend on the childhood socioeconomic status (SES) of John, which may affect his current decision-making involving a sunk cost.

Childhood SES (hereafter) reflects the availability of resources in one's early life stage (Bradley & Corwyn, 2002). A growing body of research has documented that one's childhood SES affects many aspects of later lives ranging from cognitive adaptations (Mittal et al., 2015), health (Chen, 2004), impulsivity (Mittal & Griskevicius, 2014), to decision-making such as risk-taking choices (Amir et al., 2018), preference for the scarce option (Park, Kim & Kim, 2022), or preference for sustainable luxury brands (Kim, Park & Septianto, 2022). Because childhood SES can program individuals to follow certain decision strategies over time (Ellis et al., 2009), the internalized strategies shaped early in life can determine decision-making and behavioral patterns in adulthood (Amir et al., 2018).

In the present research, we propose that childhood SES can determine susceptibility to the sunk-cost fallacy. Specifically, combining perspectives from the sunk-cost research suggesting loss aversion as the underlying mechanism (Frisch, 1993; Soman, 2004) and childhood SES research showing that growing up poor strengthens the motivation to avoid losses (Amir et al., 2018; Griskevicius, Ackerman et al., 2013; Infurna et al., 2011), we predict that individuals with lower childhood SES are more susceptible to the sunk-cost fallacy than those with higher childhood SES. We further predict that this effect occurs because the scarcity of resources during childhood has programmed individuals with lower childhood SES to perceive the loss of prior investments as more wasteful compared to those with higher childhood SES.

Our research makes several contributions. First, it extends the sunk-cost fallacy literature by demonstrating how individual differences in one's childhood experiences influence the susceptibility to the sunk-cost fallacy. Second, our research adds to the growing body of research that investigates the long-lasting influences of one's early-life SES on various aspects of later lives that often surpass the impact of current wealth (Amir et al., 2018; Griskevicius, Ackerman et al., 2013; Infurna et al., 2011). Third, our research also contributes to the decision habit literature (Betsch et al., 2002) by demonstrating how patterns and preferences formed during one's childhood extend their influence on decision-making in adulthood or later stages. In what follows, we provide a review of the relevant research to advance two hypotheses. We test these hypotheses across three experiments using hypothetical scenarios as well as an actual choice task. We conclude by discussing the implications of our findings and suggesting avenues for future research.

2. THEORETICAL BACKGROUND AND HYPOTHESIS DEVELOPMENT

2.1. Sunk-cost fallacy and loss aversion

The sunk-cost fallacy refers to the tendency to continue pursuing or increase investment in an inferior option just because significant but irreversible resources (e.g., time, money, efforts) have been invested in it. From an economics perspective, this is a violation of rational decision-making because our decision should be influenced only by incremental costs and benefits rather than previously incurred costs (R. Thaler, 1980). However, it is well established that decision-makers are often influenced by sunk costs (Arkes & Blumer, 1985). For example, when people paid full rather than discounted prices, they attended more shows with their seasonal tickets (Arkes & Blumer, 1985), used the gym facility more (Gourville & Soman, 1998), or ate more at an all-you-can-eat restaurant (Just & Wansink, 2011). The sunk-cost fallacy has been robustly demonstrated with purely scenario-based studies (Arkes & Blumer, 1985), field experiments (Ashraf et al., 2010), or large-scale observational data sets (Ho et al., 2018).

Previous research suggests loss aversion as the underlying mechanism for the sunk-cost fallacy (Soman, 2001; Soman & Cheema, 2001). The mental accounting theory argues that people practice "cognitive booking" for their transactions (R. Thaler, 1980, 1985). When a person makes an investment, a new mental account is created, and the investment is allocated to expense. An important premise of this perspective is that people are reluctant to close their mental accounts in the red—that is, with a net loss. Thus, so long as an account remains "in the red," people are driven to make further investments in the ongoing endeavor to satisfactorily close their account in the black (Prelec & Loewenstein, 1998). Along this line, waste aversion—the desire not to appear wasteful—has been proposed as one of the psychological underpinnings for the sunk-cost fallacy (Arkes & Blumer, 1985). Therefore, people commit the sunk-cost fallacy more when they are (vs. not) responsible for the initial investment (Wong & Kwong, 2018), when the magnitude of the costs is bigger (Ho et al., 2018), or when there is a chance to break-even (R. H. Thaler & Johnson, 1990). Conversely, the sunk-cost effect is attenuated when one receives a windfall income (Soman & Cheema, 2001) or when transaction costs and benefits are decoupled (Soman & Gourville, 2001).

Although one's cognitive ability does not alleviate the sunk-cost fallacy (Haita-Falah, 2017), prior research has shown that the susceptibility to the sunk-cost fallacy varies by individual differences (Fujino et al., 2016; Misuraca et al., 2021; Strough et al., 2008; Van Putten et al., 2010; Yan & Otto, 2020). For example, the sunk-cost fallacy is more evident in those younger rather than older (Strough

et al., 2008), those with high agreeableness and conscientiousness (Fujino et al., 2016), those from a low uncertainty avoidance culture (Keil et al., 2000), and those who tend to ruminate (vs. let go of) the past events (Van Putten et al., 2010). In contrast, maximizers (Misuraca et al., 2021) and those with a high need for cognition are less susceptible to the sunk cost fallacy (Yan & Otto, 2020). Adding to this literature, we examine one source of such individual differences that would affect the sunk-cost effect. We explore how an individual's SES in childhood influences one's tendency to commit the sunk-cost fallacy.

2.2. The impact of childhood SES on sunk-cost fallacy

All organisms face the fundamental challenge of allocating limited resources to vital tasks over the life course (Griskevicius et al., 2011). From evolutionary perspectives, research has explained how organisms, including humans, develop strategies that optimize the utilization of limited resources across important tasks (Griskevicius et al., 2011; Stearns, 1992). Growing research has documented that early-life environments determine many aspects of individuals' behaviors, including cognitive development (Mittal et al., 2015), health (Chen, 2004), impulsivity (Mittal & Griskevicius, 2014), risk-taking (Amir et al., 2018), and preference for the scarce option (Park, Kim & Kim, 2022).

Notably, Amir et al. (2018) proposed a theoretical framework called the uncertainty management framework suggesting that individuals who experience scarcity in early life tend to develop preferences intended to minimize the downside costs of uncertainty. Compared with those from resource-abundant environments, individuals who grew up in resource-scarce environments are more vulnerable to unexpected losses as they could more significantly affect their life. Therefore, minimizing negative costs could be critical, especially for those with lower childhood SES. Consistently, research shows that compared with individuals who grew up with affluent resources, individuals who grew up with scarce resources are more likely to avoid extreme options (Kim, Giroux et al., 2022) and complex, unfamiliar logos as an attempt to minimize uncertainty and possible losses (Kim, Park & Septianto, 2022).

The sunk-cost fallacy occurs because individuals follow the "do-not-waste" norm and focus on minimizing the risk of wasting resources rather than maximizing future utility (Arkes, 1996; Arkes & Blumer, 1985; Chira et al., 2008). As discussed earlier, individuals with lower childhood SES are more likely to minimize any potential losses than those with higher childhood SES (Amir et al., 2018). Although our prediction is particularly concerned with the impact of childhood environments, it is also consistent with prior work showing greater risk aversion for individuals with lower SES (Amir et al., 2018; Haushofer & Fehr, 2014). Research indicates that when facing limited resources, people become more focused on those scarce resources (Shah et al., 2012). Therefore, the poor tend to pay more attention to what things cost (Shah et al., 2015), such as hidden taxes (Goldin & Homonoff, 2013). Also, under the conditions of scarcity, pressing needs lead to biases in individuals' perceptions. For example, children of lower economic status tend to overestimate the size of coins than those of higher economic status (Bruner & Goodman, 1947). Similarly, food deprivation leads people to perceive food stimuli as bigger (Zitron-Emanuel & Ganel, 2020). Together, prior work suggests that individuals growing up in resource-scarce environments pay more attention to the limited resources because wasting resources could be more distressing to them, relative to those growing up in resource-abundant environments.

Given that childhood SES adjusts the patterns of reactions to environments and internalizes the strategies that individuals follow over time, it is often more predictive of adult behavior than current SES (Park et al., 2022; Griskevicius & Kenrick, 2013; Griskevicius et al., 2011; Stearns, 1992). Consistent with this, Amir et al. (2018) posit that preferences intended to manage uncertainties are especially determined by the environments early in life because successful strategies can be internalized early in life and practiced through preferences helping to guide efficient decision-making in adulthood.

In sum, previous research on childhood SES suggests that early-life environments are particularly informative because individuals develop their behavioral patterns and preferences in response to their early-life environments over time (Amir et al., 2018; Griskevicius & Kenrick, 2013; Griskevicius et al., 2011; Wong & Kwong, 2018). As noted earlier, individuals with lower (vs. higher) childhood SES tend to focus on scarce resources and attempt to minimize costs. Thus, it is likely that those with lower childhood SES would perceive the loss of prior investments as more wasteful, and as a result, be more susceptible to the sunk-cost fallacy.

H1: The sunk-cost fallacy would be stronger for individuals with lower childhood SES than those with higher childhood SES.

H2: The greater perceived wastefulness of prior investments underlies the stronger sunk-cost fallacy for individuals with lower childhood SES.

3. PILOT STUDY

We first conducted a (small-scale) pilot study to see whether there exist any meaningful patterns in the relationship between childhood SES and the sunk-cost fallacy. One-hundred and fifty-five US residents (M_{age} = 41.90, SD = 15.01; 51.0% female) from Amazon Mechanical Turk (MTurk) participated in the study in exchange for monetary compensation. Participants first read the following scenario adapted from previous research (Dijkstra & Hong, 2019; Frisch, 1993; Strough et al., 2014).

> Imagine that you are staying in a hotel room on vacation. You paid $10.95 to see a movie on pay TV. You turn on the TV, and there is a movie on. After 5 minutes, you are bored, and the movie seems pretty bad. How much longer would you continue to watch the movie? Think

about this situation as you normally would. Which of the following courses of action would you select?

Participants then indicated how long they would continue watching the movie on a 5-point scale (1 = *stop watching entirely*, 5 = *watch until the end*). The higher willingness to continue watching the movie represents the greater susceptibility to the sunk-cost fallacy.

After filler tasks (e.g., choosing food and beverage options), participants completed childhood SES measures. As in Griskevicius et al. (2011), childhood SES was measured with the following three items: (a) "My family usually had enough money for things when I was growing up"; (b) "I grew up in a relatively wealthy neighborhood"; (c) "I felt relatively wealthy compared to the other kids in my school" (1 = *strongly disagree*, 7 = *strongly agree*, Cronbach's $\alpha = 0.855$). We also measured current SES to control for the simple current wealth effect on the sunk-cost fallacy (e.g., Haita-Falah, 2017). Current SES was measured with the following three items: (a) "I have enough money to buy things I want"; (b) "I don't need to worry too much about paying my bills"; (c) "I don't think I'll have to worry about money too much in the future" (1 = *strongly disagree*, 7 = *strongly agree*, Cronbach's $\alpha = 0.930$). Finally, participants provided demographic information.

Results are largely supportive of our hypothesis. First, a simple correlation showed that childhood SES negatively correlates with the sunk-cost fallacy scores ($r = -0.162$, $p = 0.044$). Second, when we regressed the sunk-cost fallacy scores on both childhood and current SES, the test of overall significance yielded a marginally significant result (Adjusted $R^2 = 0.03$, $F(2, 152) = 2.97$, $p = 0.054$). More importantly, the sunk-cost fallacy scores were more strongly associated with childhood SES ($\beta = -0.14$, $t = -1.67$, $p = 0.097$) than current SES ($\beta = -0.110$, $t = -1.34$, $p = 0.183$), suggesting that individuals' early-life environments predict the sunk-cost fallacy better than their current environments. These results are consistent with our hypothesis that individuals with lower childhood SES would be more susceptible to the sunk-cost fallacy than those with higher childhood SES. Further, the weaker effect of the current SES suggests that our results cannot be explained by the mere wealth effect. Having confirmed the relationship, we proceed to conduct a full-scale experimental investigation.

4. STUDY 1

Study 1 aims to test our hypothesis 1. In this study, participants read a scenario about two upcoming ski trips for which they had already paid. One skip trip was more expensive (i.e., higher sunk costs) but expected to be less enjoyable (i.e., lower expected benefits) than the other ski trip. As two ski trips are for the same weekend, participants must choose which ski trip they would go on. Since the incurred costs for the two skip trips are irreversible, the rational decision should only be based on incremental benefits (i.e., choice of a less expensive but more enjoyable ski trip). We predicted that individuals with lower childhood SES would be more likely to choose the more expensive but less enjoyable ski trip than those with higher childhood SES. This study was preregistered on AsPredicted.org (https://aspredicted.org/blind.php?x=MYD_TXP).

4.1. Participants and design

We recruited 250 US participants ($M_{age} = 41.84$, SD = 12.13; 50.4% female) from MTurk by offering monetary compensation. Participants read the following scenario titled "Vacation Decision." The scenario was adapted from Arkes and Blumer (1985).

> Assume that you have spent $100 on a ticket for a weekend ski trip to Michigan. Several weeks later you buy a $50 ticket for a weekend ski trip to Wisconsin. You think you will enjoy the Wisconsin ski trip more than the Michigan ski trip. As you are putting your just-purchased Wisconsin ski trip ticket in your wallet, you notice that the Michigan ski trip and the Wisconsin ski trip are for the same weekend! It's too late to sell either ticket, and you cannot return either one. You must use one ticket and not the other. Which ski trip will you go on?

Participants then indicated their preferences on a 7-point scale (1 = *Definitely $100 ski trip to Michigan*, 7 = *Definitely $50 ski trip to Wisconsin*). This item was reverse-coded so that higher scores indicated higher susceptibility to the sunk-cost fallacy. Participants completed the same childhood SES (Cronbach's $\alpha = 0.811$) and current SES (Cronbach's $\alpha = 0.881$) measures as in Pilot study. Finally, they provided their age, gender, and current income level.

4.2. Results and implications

First, a simple correlation revealed that childhood SES was negatively correlated with the sunk-cost fallacy ($r = -0.166$, $p = 0.009$). Next, when we regressed the sunk-cost fallacy scores on both childhood and current SES, controlling for age, gender, and current income, the overall model was significant (Adjusted $R^2 = 0.03$, $F(5, 244) = 2.26$, $p = 0.049$). Consistent with the prediction, childhood SES was negatively associated with the sunk-cost fallacy scores ($\beta = -0.21$, $t = -2.13$, $p = 0.034$). None of current SES, age, gender, and current income were significantly associated with the sunk-cost fallacy scores (all p's > 0.155). These results were consistent with our prediction and provided support for our hypothesis that those with lower childhood SES would be more susceptible to the sunk-cost fallacy.

5. STUDY 2

In Study 1, we have established the relationship between childhood SES and the sunk-cost fallacy. In Study 2, we aim to replicate the findings of Study 1 and investigate the underlying mechanism.

Specifically, we examine whether perceived wastefulness (Bornstein & Chapman, 1995) mediates the relationship between childhood SES and the sunk-cost fallacy. In doing so, we used the same scenario as in Pilot study (Dijkstra & Hong, 2019; Frisch, 1993; Strough et al., 2014) but varied the magnitudes of two types of prior investment (i.e., money and time) for the following reason. The original movie scenario alludes to time investments (e.g., 5 min) in addition to monetary investments (e.g., $10.95). Although 5 min may not be perceived as a significant investment of a resource, it is not clear whether participants make decisions based on money, time, or both. We test this for exploratory purposes.

5.1. Participants and design

Three hundred and twenty-two US residents (M_{age} = 40.80, SD = 13.54; 49.7% female) from MTurk participated in the study in exchange for monetary compensation. This study used a 2 (monetary investment: high vs. no) × 2 (time investment: high vs. low) between-subjects design. As in Pilot study, participants imagined watching a boring movie in a hotel room, but we slightly modified the scenario such that the amounts of money and time investments varied across conditions. In the *high monetary investment* condition, we told participants that they had paid for the movie ("You paid $10.95 to see a movie on pay TV."). In the *no monetary investment* condition, we told them that the movie was for free ("You turn on the TV and there is a movie on."). In the *high time investment* condition, we told participants that they had already watched the movie for 45 min. In the *low time investment* condition, the duration was just 5 min. All participants then indicated how long they would remain committed to watching the movie on a 5-point scale as in Study 1 (1 = *stop watching entirely*, 5 = *watch until the end*).

Next, perceived wastefulness was assessed with a single-item measure ("If I stop watching the movie, my previous effort regarding watching the movie would be") on a 7-point scale (1 = *not at all wasteful*, 7 = *very wasteful*) adapted from Kim (2019). After some filler tasks (e.g., choosing popcorn and soda), participants completed the same childhood SES (Cronbach's α = 0.854) and current SES (Cronbach's α = 0.895) measures as in previous studies. Finally, participants provided demographic information.

5.2. Results and implications

First, we ran a multiple moderation model using Hayes (2017) Model 3 with 5000 bootstrapped samples (i.e., IV: childhood SES, moderator #1: monetary investment [1: high vs. 2: no], moderator #2: time investment [1: high vs. 2: low], & DV: sunk-cost fallacy tendency). For the time investment condition, the results did not reveal any significant main effect (β = −0.02, p = 0.901, 95% confidence interval [CI] = [−0.349 to 0.307]) or higher-order interaction effects (all p's > 0.210), though the overall model was significant (95% CI = [0.001−0.488]). Thus, we collapsed on the data across two levels of time investment in further analysis.

Next, we conducted a moderation model using Hayes (2017) Model 1 with 5000 bootstrapped samples (i.e., IV: childhood SES, moderator: monetary investment [1: high vs. 2: no], DVs: sunk-cost fallacy tendency or perceived wastefulness). For the sunk-cost fallacy, the predicted significant interaction effect emerged (β = 0.32, SE = 0.10, p = 0.002, 95% CI = [0.115−0.502]). Specifically, when the monetary investment was high, the sunk-cost fallacy was stronger for participants with lower childhood SES (estimated $M_{-1SD\ childhood\ SES}$ = 3.48) than for those with higher childhood SES ($M_{+1SD\ childhood\ SES}$ = 2.84, effect = −0.17, p = 0.024, 95% CI = [−0.324 to −0.023]). When there was no monetary investment, the pattern was unexpectedly reversed[1] ($M_{-1SD\ childhood\ SES}$ = 1.57 vs. $M_{+1SD\ childhood\ SES}$ = 2.09, effect = 0.14, p = 0.038, 95% CI = [0.008−0.027]), as shown in Figure 1.

A similar pattern of results was obtained for perceived wastefulness. There was a significant interaction (β = 0.28, SE = 0.12, p = 0.023, 95% CI = [0.038−0.515]). Specifically, when the monetary investment was high, the perceived wastefulness for withdrawing from the movie was higher for participants with lower childhood SES (estimated $M_{-1SD\ childhood\ SES}$ = 5.80) than for those with higher childhood SES ($M_{+1SD\ childhood\ SES}$ = 5.12, effect = −0.18, p = 0.042, 95% CI = [−0.362 to −0.007]). When there was no monetary investment, however, the perceived wastefulness did not differ for participants with lower and higher childhood SES ($M_{-1SD\ childhood\ SES}$ = 3.79 vs. $M_{+1SD\ childhood\ SES}$ = 4.13, effect = 0.09, p = 0.256, 95% CI = [−0.067 to 0.252]), as shown in Figure 1.

When we conducted the same analyses with current SES, the interaction effects were not significant for the sunk-cost fallacy (β = 0.01, SE = 0.11, p = 0.916, 95% CI = [−0.202 to 0.225]) nor for perceived wastefulness (β = 0.06, SE = 0.13, p = 0.627, 95% CI = [−0.188 to 0.311]).

We further conducted a mediated moderation model using Hayes (2017) Model 8 with 5000 bootstrapped samples. The overall model of the mediated moderation was significant (β = 0.04, SE = 0.02, 95% CI = [0.001−0.090]). Specifically, when the monetary investment was high, perceived wastefulness mediated the relationship between childhood SES and the sunk-cost fallacy (effect = −0.03, SE = 0.02, 95% CI = [−0.061 to −0.001]), whereas the direct effect was marginally significant (β = −0.15, SE = 0.08, p = 0.054, 95% CI = [−0.297 to 0.002]). When there was no monetary investment, however, perceived wastefulness did not mediate the relationship (effect = 0.01, SE = 0.02, 95% CI = [−0.014 to 0.046]).

To summarize, Study 2 replicated the findings of our previous study that lower childhood SES individuals were more susceptible to the sunk-cost fallacy than those with higher childhood SES. We also found that childhood SES predicted perceived wastefulness. Specifically, when there was a prior monetary investment, lower childhood SES individuals perceived the investment to be more wasteful than did higher childhood SES individuals, if they were to withdraw. However, the effect of childhood SES disappeared when there was no prior monetary

[1]This effect can be simply explained by the greater need for closure in the rich (vs. the poor; Dhont et al., 2013). Since this effect is not our main focus in this paper, we will not discuss this issue later.

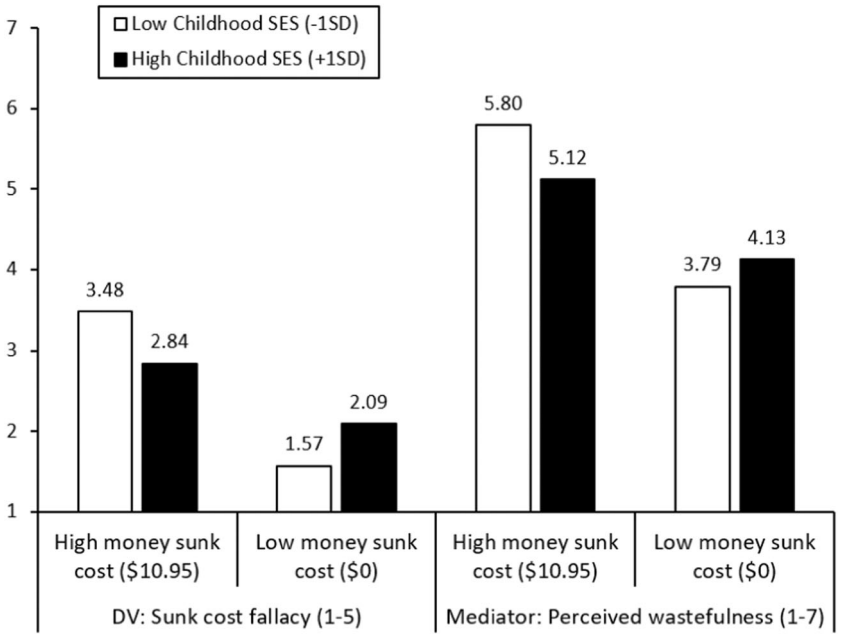

FIGURE 1 The results of study 2. SES, socioeconomic status.

investment. More importantly, perceived wastefulness mediated the effect of childhood SES on the sunk-cost fallacy. Finally, the current SES did not predict the sunk-cost fallacy or perceived wastefulness. Thus, our findings cannot be attributed to the mere wealth effect. In all, the results of Study 2 lend support to our hypotheses 1 and 2.

It should be noted that we found null results for time investment. Our reasoning for this is as follows. Prior research has demonstrated that the sunk-cost effect is robust in monetary investments but not in behavioral investments (e.g., time or effort) unless such investments are associated with monetary values (Cunha & Caldieraro, 2009; Soman, 2001). Therefore, for the half of our participants who were told that the movie was free (i.e., in the no monetary investment condition), it was practically the same as we just manipulated behavioral investments without association with monetary values. From this perspective, we retrospectively conjecture that time investment should not show any difference in the sunk-cost fallacy. We address this issue further in the next study Table 1.

6. STUDY 3

The purpose of Study 3 is twofold. First, we aim to replicate the findings of our previous studies by measuring actual behavior. Second, we further explore the aforementioned issue in Study 2. One of the reasons that purely behavioral sunk-cost effects are unlikely is because of the difficulty in booking and tracking the behavioral costs in a mental account (Cunha & Caldieraro, 2009). Thus, in Study 3, we combined participants' behavioral investments with monetary values.

We utilize the structure of an online crowdsourcing platform (e.g., Amazon MTurk) to design our study where online workers' time investments are linked to monetary compensation, and we measure their actual behaviors. Specifically, online workers in such a platform choose to participate in a survey for a fixed amount of compensation. Workers are expected to receive the money only when they complete the survey. Thus, their time investments in a survey are "sunk" unless they complete the survey. In our study, participants are required to perform tedious tasks (i.e., solving math problems). Then, in the middle of the survey, participants are informed that they have an opportunity to switch to another survey (c. f., Jhang & Lynch, 2015). Participants are informed that they will receive the promised amount of compensation if they finish either the current or the other survey. Importantly, the other survey, if participants were to switch, would take a slightly shorter time to finish than the remaining time of the current survey. Then, participants are asked to choose whether they want to remain committed to the tedious current survey or to switch to the other survey. Given that irreversible time costs have already been incurred, rational participants would make decisions based on what to expect in the next few minutes. Thus, by observing participants' actual choices, we can determine whether the sunk-cost fallacy is higher for those with lower childhood SES. It is noteworthy that this study design is the mirror image of Study 1 where the fixed irreversible monetary costs (e.g., $100 or $50) were already incurred, and participants had to choose between more and less enjoyable experiences (e.g., Ski trips to Wisconsin vs. Michigan). The only exception is that, in Study 3, the invested and will-be-invested resources are of the same kind (i.e., time). We predicted that those with lower childhood SES would be more likely to stay in the current survey than those with higher childhood SES.

6.1. Participants and design

Two hundred and fifty-three US residents (M_{age} = 41.62, SD = 12.27; 54.9% female) recruited from MTurk participated in the study in

TABLE 1 Summary of results

Pilot study (N = 155 mTurkers; M_{age} = 41.90)

Scenario: Watching a boring movie in a hotel room ($10.95 paid, has watched for 5 min)

Sunk-cost fallacy measure: how long one would watch the movie

	DV	IVs–socioeconomic status (SES)		Overall model fit
		Childhood SES	Current SES	
Regression	SCF	β = −0.14, t = −1.67, p = 0.097	β = −0.11, t = −1.34, p = 0.183	Adjusted R^2 = 0.03, F (2, 152) = 2.97, p = 0.054
Findings	• The sunk-cost fallacy is negatively associated with childhood SES but not current SES.			

Study 1: Initial evidence (N = 250 mTurkers; M_{age} = 41.84)

Scenario: Weekend ski trip to Wisconsin ($50 paid, more enjoyable) versus Michigan ($100 paid, less enjoyable)

Sunk-cost fallacy measure: preference for Michigan ski trip to Wisconsin ski trip

	DV	IVs–socioeconomic status (SES)		Overall model fit
		Childhood SES	Current SES	
Regression	SCF	β = −0.21, t = −2.13, p = 0.034	β = −0.12, t = −1.22, p = 0.222	Adjusted R^2 = 0.03, F (5, 244) = 2.26, p = 0.049
Findings	• Established the relationship between childhood SES and the sunk-cost fallacy.			

Study 2: Mediating role of perceived wastefulness & moderating role of investment size (N = 322 mTurkers; M_{age} = 40.80)

Scenario: Watching a boring movie in a hotel room ($10.95 paid vs. no cost)

Sunk-cost fallacy measure: how long one would watch the movie

	DV	Moderator	Mediator	IV–childhood SES		Test statistics	Overall model fit or higher-order interaction
				Low (−1SD)	High (+1SD)		
Hayes Model #1	PW	MI-High		5.80	5.12	β = −0.18, p = 0.042	β = 0.28, SE = 0.12, p = 0.023
		MI-Low		3.79	4.13	β = 0.09, p = 0.256	
Hayes Model #1	SCF	MI-High		3.48	2.84	β = −0.17, p = 0.024	β = 0.32, SE= 0.10, p = 0.002
		MI-Low		1.57	2.09	β = 0.14, p = 0.038	
Hayes Model #8	SCF	MI-High	PW	Indirect effect = −0.03, 95% CI = [−0.061 to −0.001]			Moderated mediation index = 0.04, BootSE = 0.02, 95% CI: [0.001–0.090]
		MI-Low		Indirect effect = 0.01, 95% CI = [−0.014 to 0.046]			
Findings	• The negative relationship between childhood SES and the sunk-cost fallacy disappears when investment is low.						
	• The above moderation effect is mediated by perceived wastefulness.						

Study 3: Actual behavior (N = 253 mTurkers; M_{age} = 41.62)

Task: Working on a survey that consists of tedious math problems

Sunk-cost fallacy measure: remain committed to the current survey

	DV	IVs–socioeconomic status (SES)		Overall model fit
		Childhood SES	Current SES	
Binary logistics regression	SCF	β = −0.21, Wald = 4.16, p = 0.041	β = 0.07, Wald = 0.63, p = 0.426	−2 log likelihood = 321.40
Findings	• Those with lower childhood SES chose to stay committed to the tedious survey.			
	• The sunk-cost fallacy was higher for low childhood SES participants in actual behavior.			

Abbreviations: MI, money investment; PW, perceived wastefulness; SCF, sunk-cost fallacy.

exchange for monetary compensation. Participants first reported their childhood and current SES on the same scales as in Studies 1 and 2 (Cronbach's $\alpha = 0.852$ & 0.890, respectively). After a filter task, participants were then informed that they would be asked a series of questions that they were expected to answer quickly and correctly. To motivate participants, they were informed that they would find their percentile for their performance at the end of the survey. Once the participants started the task, they were presented with two simple math questions (e.g., addition or subtraction of two-digit numbers) along with a progress bar at the top (e.g., 1/8). Participants were able to move to the next set of questions only when the two questions were correctly answered. Each page contained exactly the two math questions with no exception. After the participants finished the fourth set of math questions (4/8), on the next page, they saw the following question.

> You've completed about half of the survey. If you want to continue, you can keep going. However, if you do not like this task for some reason, you may switch to the other survey. If you switch to the other survey, it will take a slightly shorter time than the remaining time of this survey.[2] You will receive the same amount of money if you complete the new survey, although your responses to this survey will be lost. Would you like to switch to the other survey or stay in the course?

Afterward, participants chose between the following two options; (a) I would like to switch to a new survey, and I understand that I'm going to lose all I have done so far in this survey; (b) I would like to keep doing and finish this survey. After the choice task, participants continued to participate in other studies for the remaining portion of the survey. Finally, participants' numeracy was measured using the following three items (a) "Which of the following numbers represents the biggest risk of getting a disease" 1 in 100, 1 in 1000, and 1 in 10; (b) "If the chance of getting a disease is 15%, how many people would be expected to get the disease out of 100"; (c) "If Person's A's chance of getting a disease is 1 in 100 in 10 years, and Person's B's risk is double that of A, what is B's risk?" (Weller et al., 2013). Numeracy ability scores were calculated by adding the number of correct answers and thus ranged between zero and three.

6.2. Results and implications

First, a simple correlation revealed that childhood SES was correlated positively with current SES ($r = 0.395$, $p < 0.001$). Next, when we conducted binary logistic regression with the sunk-cost fallacy scores on childhood and current SES (−2 log-likelihood = 321.40, Cox & Snell $R^2 = 0.02$), we found that the childhood SES had a negative impact on the sunk-cost fallacy choice ($\beta = -0.21$, SE = 0.10, Wald = 4.16, $p = 0.041$), whereas the current SES had no impact ($\beta = 0.07$, SE = 0.09, Wald = 0.63, $p = 0.426$). Finally, we conducted the same analysis with additional variables of participants' numeracy ability and the decision time for the fourth set of math questions. The numeracy ability was not significant ($\beta = 0.14$, SE = 0.20, Wald = 0.49, $p = 0.484$) and the decision time for the fourth set of math questions was expectedly significant ($\beta = -0.01$, SE = 0.01, Wald = 9.20, $p = 0.003$). Importantly, the pattern of the results of the childhood SES (−2 log-likelihood = 310.07, Cox & Snell $R^2 = 0.06$; $\beta = -0.23$, SE = 0.10, Wald = 4.93, $p = 0.026$) and the current SES ($\beta = 0.03$, SE = 0.10, Wald = 0.08, $p = 0.782$) remained consistent. Therefore, the results indicated that our main effect exists regardless of participants' numeracy ability. Taken together, Study 3 replicated our previous studies with a purely behavioral investment scenario.

7. GENERAL DISCUSSION

The present research investigated the impact of childhood SES on the sunk-cost fallacy. Three studies, along with a pilot study, demonstrated that people with lower (vs. higher) childhood SES were more susceptible to the sunk-cost fallacy. Further, this effect was driven by the differences in the degree to which lower and higher childhood SES individuals felt perceived wastefulness for withdrawing from the events. The first two studies provided initial evidence for the proposed effect. In a pilot study, we first found a pattern between childhood SES and the sunk-cost fallacy. Then, Study 1 showed that, compared to higher childhood SES individuals, those with lower childhood SES were more susceptible to the sunk-cost fallacy. Study 2 replicated this negative relationship between childhood SES and the sunk-cost fallacy using a different scenario but also tested for the proposed underlying mechanism. Study 2 revealed that the effect of childhood SES on the sunk-cost fallacy was mediated by perceived wastefulness. In particular, this effect occurred only when a prior monetary investment was involved. The effect disappeared when there was no monetary investment. Study 3 further demonstrated that the proposed effect was evident in actual behavior (please see Supporting Information: Web Appendix for the design structure of each study). Unlike childhood SES, current SES did not influence the sunk-cost fallacy (Pilot study, Studies 1, 2, and 3). Taken together, our research provides novel insight into the impact of childhood resources on the sunk-cost fallacy. This is the first to demonstrate how and why childhood SES affects the sunk-cost fallacy.

7.1. Theoretical and practical contributions

The present research has several theoretical contributions. First, our findings contribute to the sunk-cost fallacy literature that has studied how individual differences influence the sunk-cost fallacy to different degrees. Prior research showed that the susceptibility to the sunk-cost fallacy was determined by one's age (Strough et al., 2008), personality (Fujino et al., 2016), culture (Keil et al., 2000), temporal

[2]This instruction is critical for making this task associated with the sunk cost fallacy in that the expected cost for switching to a new task is smaller than that of the status quo task.

horizons (Strough et al., 2014), needs for cognition (Yan & Otto, 2020), and coping orientations (Van Putten et al., 2010). Our research adds another important determinant to extant literature—childhood SES. Building on the recent perspective that the sunk-cost fallacy reflects an individual's decision patterns developed and reinforced through the adaptive learning process over time (Wong & Kwong, 2018), the present research showed that individuals from less affluent childhood environments are more likely to fall into the sunk-cost fallacy compared with those from wealthy childhood.

Second, unlike prior work that examined how childhood environments influence decision-making among children and adolescents (Burdick et al., 2013; Lundberg et al., 2009), our research shows that one's early-life environments can have long-lasting influences on decision-making. Specifically, we identified the impact of childhood SES on the susceptibility to the sunk-cost fallacy in adulthood. Importantly, our findings indicate that an individual's childhood resource level is a stronger predictor of the sunk-cost fallacy than the Person's current wealth level. These findings contribute to the childhood SES literature (Amir et al., 2018; Griskevicius. Ackerman et al., 2013; Infurna et al., 2011) by uncovering another important decision domain (i.e., the sunk-cost fallacy) that is influenced by abundance/scarcity of resources in one's early life.

Our research offers several practical implications. First, our findings suggest an important implication for lower childhood SES consumers' financial decision-making. While experts often advise people to buy and hold stocks for longer terms than to buy and sell frequently, too much patience can backfire. One of the common mistakes by nonprofessional investors is holding a loser for too long, expecting to get even (Artzberger, 2022). Relatedly, investors often attempt to average down stocks by purchasing an additional share of the losing stock in the hope that it eventually rebounds. It is a high-risk strategy because the fall may not be temporary but is only the beginning of a greater decline. Our findings suggest that such a bias can do more damage to lower childhood SES investors because they would perceive greater wastefulness from cutting losses in a losing stock. Thus, it is crucial for policymakers to require stock firms and trading platforms to equip their customers with adequate education and information and to design web/application user interfaces to protect customers.

Additionally, it should be noted that not every situation involving a sunk cost would be disadvantageous to those with lower (vs. higher) childhood SES. On the bright side, those with lower childhood SES may persist longer in important domains. For instance, our findings suggest that college students who grew up in relatively poorer environments may be less likely to drop out during the semester because of their “sunk” tuition. Thus, federal agencies or social services that provide financial education may encourage those with lower childhood SES to stick to this somewhat difficult and boring subject by reminding them of how much time and effort they have already invested in the program. Practitioners can apply our findings to any services that promote the well-being of individuals such as debt-repayment programs or employee wellness programs.

7.2. Limitations and future research

The present research has some limitations. Even though we did not find a significant effect of the current SES on the sunk-cost fallacy, some may argue that an individual's current (vs. past) abundance in resources should affect the perceived wastefulness of sunk costs (i.e., wealth effect). Indeed, Gächter et al. (2022) showed that (current) income and wealth levels are positively associated with loss aversion which should lead to the sunk-cost fallacy (R. Thaler, 1985). Bruine de Bruin et al. (2007) also found that those with low (current) SES are more vulnerable to the sunk cost fallacy. Although none of these studies measured childhood SES, their results seem to conflict with our findings. However, the sunk cost fallacy can be seen as not a simple decision but rather an individual's decision patterns developed and reinforced through the adaptive learning process over time (Wong & Kwong, 2018). This suggests that the sunk cost fallacy should be more strongly influenced by one's life strategy than momentary judgment, which is more consistent with our findings. Nevertheless, future studies can investigate the relationship between the two constructs. It will be also especially interesting to examine the behaviors of individuals who made a transition between two life stages (e.g., from lower childhood SES to higher current SES or vice versa).

Next, although the present research successfully demonstrated the impact of childhood SES on the sunk-cost fallacy, we have only limited knowledge about its boundary condition. When will individuals with lower childhood SES exhibit a lower susceptibility and those with higher childhood SES exhibit a higher susceptibility to the sunk-cost fallacy? As the sunk-cost fallacy prevents optimal decision-making, understanding what kind of intervention strategies might help low childhood SES individuals reduce the fallacy is important for their welfare. Such knowledge will improve the applicability of the current findings.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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