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Examining the Relationship Between Objective and Subjective Dimensions of Socioeconomic Status and the Temporal Discounting of Reward and Effort

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ABSTRACT

Objective: Temporal discounting may vary with socioeconomic resources and macroeconomic conditions. This study examined associations between objective and subjective socioeconomic status (SES) and the temporal discounting of rewards and effort costs among Iranian university students.

Method: Using a descriptive–correlational design, 61 students (53 women, 8 men) from public universities in Tehran were recruited through convenience sampling during the 2024–2025 academic year. Research instruments included a Rating Task to assess the subjective value of rewards and subjective cost of efforts, and an Intertemporal Choice Task to measure reward and effort discounting via hypothetical "smaller–sooner" versus "larger–later" choices. Subjective and objective SES were assessed using the MacArthur Scale of Subjective Social Status (Adler et al., 2000) and the Ghodratnama Socioeconomic Status Questionnaire (Ghodratnama et al., 2013), respectively. Individual reward- and effort-cost discounting parameters (k) were estimated using a hyperbolic model. Analyses were conducted in R 4.5.0.

Results: Objective SES showed a significant positive correlation with reward discounting ($r = 0.271$, $p = 0.047$) but not with effort discounting ($r = -0.096$, $p = 0.460$). Subjective SES was not significantly associated with reward discounting ($r = -0.021$, $p = 0.878$) or effort discounting ($r = -0.015$, $p = 0.909$). Effort discounting was not related to either SES dimensions.

Conclusions: The positive association between objective SES and reward discounting diverges from the pattern commonly reported in stable economies, suggesting that macroeconomic context—particularly chronic high inflation—may moderate SES-discounting relationships. The absence of SES-effort associations reinforces the conceptual distinction between delay and effort costs.

Keywords: Delay Discounting, Effort Discounting, Intertemporal Choice, Reward Discounting, Socioeconomic Status.

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Introduction

Many consequential everyday decisions involve trade-offs between the magnitude of an outcome and the delay to its receipt (Wan et al., 2026). In intertemporal choice, people commonly prefer a smaller reward available sooner to a larger reward available after a delay because the subjective value of a reward decreases as the delay to its receipt increases (Frederick et al., 2002; Reimers et al., 2009). This decline in subjective value is referred to as delay or reward discounting and is frequently described using a hyperbolic discounting function (Frederick et al., 2002).

Temporal discounting is not necessarily expressed uniformly across all outcomes and decision contexts. Previous research has shown that discounting rates can vary according to characteristics of the outcomes being evaluated, with nonmonetary outcomes often being discounted differently from monetary rewards. A systematic review of delay-discounting research found that nonmonetary outcomes are often discounted more steeply than monetary outcomes, while individual differences in discounting also show some degree of consistency across outcome domains (Odum et al., 2020). This pattern suggests that temporal discounting reflects both characteristics of the outcome being valued and individual differences in the valuation of delayed consequences. Consequently, associations observed for delayed monetary or tangible rewards should not automatically be generalized to other forms of value or cost.

Effort constitutes another cost that can influence subjective valuation and choice (Peck & Madden, 2023). In conventional effort discounting, the subjective value of a reward decreases as the effort required to obtain it increases (Ostaszewski et al., 2013).Temporal effort discounting refers to the attenuation of anticipated effort costs as the time until task performance increases (Le Bouc & Pessiglione, 2022). When effort costs are discounted steeply, an effortful task may appear less costly when scheduled for the future than when it must be performed immediately, potentially increasing the tendency to postpone task completion (Le Bouc & Pessiglione, 2022). Although delay and effort costs can both be represented by discounting functions, neuroimaging evidence indicates that they are processed partly through distinct valuation systems (Prévost et al., 2010). Thus, behavioral similarities between delay and effort discounting do not imply that they reflect an identical underlying process.

Recent evidence supports treating temporal and effort-based costs as distinct behavioral constructs. Neuroimaging research indicates that although immediate and delayed choices engage some common valuation-related systems, the neural networks involved in temporal and effort discounting differ substantially, with relatively limited overlap between the networks associated with the two forms of cost (Varma et al., 2023). Similarly, a recent systematic review of human effort discounting research identified substantial heterogeneity in how effort is defined, manipulated, and modeled across studies and concluded that effort discounting should not simply be treated as another form of delay discounting (Escobar & Mitchell, 2025). The authors noted that

differences in experimental definitions and methodologies currently limit strong conclusions about the relationship between effort and delay discounting. Taken together, these findings support examining reward and effort discounting as distinct behavioral outcomes rather than assuming that findings from one form necessarily generalize to the other.

Both forms of discounting have been associated with immediately reinforcing but maladaptive behaviors. Steeper delay discounting has been associated with substance use and addictive behavior (Bickel & Marsch, 2001), cigarette smoking and other behavioral indicators of impulsivity (Reimers et al., 2009), and greater susceptibility to unhealthy eating and obesity-related behavior (Epstein et al., 2010). Similarly, studies employing alternative measures of effort expenditure have found that individuals who demonstrate low effort or low persistence toward task completion are at elevated risk for obesity (Mathar et al., 2016) .Excessive effort discounting has also been linked to apathy and anhedonia in major depression (Bonnelle et al., 2015) and schizophrenia (Fervaha et al., 2013).

Among the contextual factors that may shape students' educational expectations and performance, family socioeconomic status appears to play an important role (Majidi & Abolmali alhusseini, 2019). Evidence indicates that temporal preferences are also associated with individuals' socioeconomic circumstances and broader financial conditions (Ishii, 2015; Ruggeri et al., 2022). Scarcity-based accounts propose that limited resources capture attention and direct cognitive capacity toward pressing needs, thereby increasing the relative importance of immediate outcomes (Mullainathan & Shafir, 2013). Poverty-related stress and negative affect may further influence economic decision-making by increasing attention to immediate concerns (Haushofer & Fehr, 2014). Environmental unpredictability accounts similarly propose that individuals may prioritize immediate outcomes when the availability or value of future resources is perceived as uncertain (Pepper & Nettle, 2017). From these perspectives, steeper temporal discounting may represent a context-sensitive response to resource scarcity and environmental uncertainty rather than solely a deficit in self-control (Haushofer & Fehr, 2014; Pepper & Nettle, 2017).

Socioeconomic status (SES) comprises both access to material resources and perceptions of one's relative social rank (Kraus et al., 2012). Objective SES is commonly operationalized using indicators such as income, educational attainment, and occupational status (Adler et al., 2000). Subjective SES refers to individuals' perceived position relative to others within the social hierarchy (Adler et al., 2000). Although objective and subjective SES are related, they represent distinct and non-interchangeable dimensions of socioeconomic experience (Kraus et al., 2012). Examining both dimensions may therefore provide a more comprehensive account of how material resources and perceived social standing relate to intertemporal choice (Ishii, 2015). Supporting the broader relevance of socioeconomic conditions to cognitive and educational outcomes, a large Iranian study of 11,790 ninth-grade students found that family income was significantly associated

with scholastic aptitude, with economic factors showing a stronger role than family and educational factors overall (Zivari Rahman et al., 2024). Whether such socioeconomic differences extend to temporal valuation processes, however, remains unclear

Previous research has generally associated greater socioeconomic resources with shallower delay discounting and a stronger preference for larger, later rewards (de Wit et al., 2007; Green et al., 1996; Reimers et al., 2009). In a large sample of 42,863 participants, for example, higher income and educational attainment were associated with a lower probability of selecting a smaller, sooner monetary reward (Reimers et al., 2009). However, these associations do not appear to be uniform across populations. Wan et al. (2026) found that self-reported household income was unrelated to discounting among participants younger than 35 but moderated age-related differences in discounting among older adults. Income may therefore operate as a conditional indicator of temporal preferences rather than as a consistent predictor across age groups, particularly in samples composed predominantly of younger adults (Wan et al., 2026). This limitation highlights the need to examine socioeconomic status using broader measures rather than relying exclusively on income.

Furthermore, the literature has focused more extensively on objective socioeconomic indicators than on individuals' perceived social position. Although research on subjective SES and temporal discounting remains comparatively limited, available findings indicate that perceived social rank may contribute to intertemporal choice (Ishii, 2015; Ishii et al., 2017). Ishii (2015) found that lower subjective SES was associated with steeper delay discounting among Japanese adults, whereas objective SES showed no significant independent association. This relationship was subsequently replicated in Japanese and European American samples, despite cultural differences in the overall level of discounting (Ishii et al., 2017). These findings suggest that subjective SES may capture aspects of socioeconomic experience that are not fully represented by income, education, or other objective indicators. Nevertheless, objective and subjective SES have rarely been examined together in predominantly young university samples, leaving their relative associations with temporal preferences insufficiently understood.

The meaning of these associations may also depend on the broader economic context. In a cross-national study of 13,629 participants from 61 countries, temporal-discounting patterns were associated with individual and national financial conditions, including wealth, inequality, debt, and inflation (Ruggeri et al., 2022). Notably, the association between inflation and temporal discounting became more pronounced at very high inflation levels (Ruggeri et al., 2022). One plausible interpretation is that immediate rewards become relatively more attractive when the future purchasing power of delayed outcomes is uncertain, although this mechanism was not directly tested by Ruggeri et al. (2022). Iran therefore constitutes a theoretically informative context in which to examine socioeconomic variation in temporal preferences. Previous Iranian

research examined delay discounting within a high-inflation macroeconomic context and found that educational attainment, but not income alone, was significantly associated with discounting (Eivazi et al., 2022). However, that study did not assess subjective SES, leaving unclear whether perceived social position is associated with intertemporal choice beyond objective socioeconomic indicators in this context.

More fundamentally, the literature discussed above has examined SES primarily in relation to the discounting of delayed rewards (de Wit et al., 2007; Ishii, 2015; Ishii et al., 2017; Reimers et al., 2009). Far less is known about whether socioeconomic circumstances are associated with the temporal valuation of effort costs. Conventional effort-discounting research has examined how increasing effort requirements reduce the subjective value of associated rewards, whereas temporal effort discounting concerns the attenuation of anticipated effort costs as the delay until task performance increases (Peck & Madden, 2023; Prévost et al., 2010; Le Bouc & Pessiglione, 2022). Because delay and effort costs are supported by partly distinct valuation systems, associations between SES and reward discounting cannot be assumed to extend to the temporal discounting of effort costs (Prévost et al., 2010). Moreover, objective and subjective SES have rarely been examined simultaneously in predominantly young university samples. It therefore remains unclear whether socioeconomic circumstances are differentially associated with reward and effort discounting, particularly among young adults experiencing substantial economic uncertainty. Addressing this gap requires the simultaneous examination of objective and subjective SES in relation to both delayed rewards and delayed effort costs within the same population.

The present cross-sectional study examined whether objective and subjective socioeconomic status (SES) were associated with the temporal discounting of delayed rewards and effort costs among students attending public universities in Tehran. By assessing both dimensions of SES within the same sample, the study aimed to determine whether material socioeconomic conditions and perceived social standing showed similar or distinct patterns of association with intertemporal valuation.

Materials and Methods

Design

This study employed a cross-sectional correlational design to examine the associations between socioeconomic status and temporal discounting variables at a single point in time. The design was selected because the primary objective was to assess the direction and strength of relationships among objective SES, subjective SES, reward discounting, and effort discounting without manipulating the study variables. Accordingly, the findings were interpreted as associations rather than evidence of causal relationships.

Participants

The target population comprised undergraduate, master's, and doctoral students enrolled at public universities in Tehran during the 2024–2025 academic year. Recruitment was conducted through student groups, university notice boards, and institutional online platforms in order to reach students from different academic levels. Interested students were provided with general information about the study and were invited to indicate their willingness to participate. Those who volunteered were screened according to the predefined eligibility criteria, and individuals who met the inclusion requirements were subsequently enrolled in the study. This recruitment procedure resulted in a convenience sample of students who were willing and available to attend the laboratory-based assessment sessions.

A total of 61 participants were selected using convenience sampling. This approach was adopted owing to the laboratory-based nature of the study, which required individual participation under standardized experimental conditions and entailed substantial scheduling constraints. Consequently, only students with both physical and temporal availability during the data-collection period were able to participate. Although this sampling strategy limits the generalizability of the findings, it ensured rigorous control over the experimental environment and standardized administration of the computerized tasks.The required sample size was estimated using G*Power. Assuming a medium-sized correlation, a significance level of .05, and statistical power of .80, the minimum required sample size was approximately 59 participants. The final sample (N = 61) therefore exceeded the a priori sample-size requirement.

Inclusion criteria comprised voluntary and informed participation, current university enrollment, age above 18 years, no current use of psychotropic medication, and no history of brain surgery; the latter two criteria were assessed via self-report. Exclusion criteria included inattentive performance on the computerized tasks and failure to comply with task instructions.

Participants were individually invited to the Psychology Laboratory of Allameh Tabataba'i University. After receiving a general explanation of the study procedures and providing informed consent, they completed a demographic questionnaire assessing age, sex, educational level, and marital status. The computerized tasks were administered individually in a quiet, well-lit environment with minimal distractions, using a laptop computer equipped with a 15.6-inch display. Prior to task administration, participants received standardized verbal instructions. The tasks were programmed in MATLAB using the Psychophysics Toolbox, and each experimental session lasted approximately 40 minutes. To minimize fatigue and attentional decline, participants were provided a brief rest period and light refreshments during the session. As compensation for participation, each participant received a gift card and 5 GB of mobile internet data.

Instruments

Reward and Effort Rating Task. The Reward and Effort Rating Task was used to assess the subjective value of rewards and the subjective cost of effortful activities. Participants indicated the quantity of a given reward or effort item that they considered equivalent in value or cost to receiving or giving up €1 or €5. Items and their corresponding units (e.g., number, grams, meters) were presented at the center of the screen, and responses were entered via keyboard.

The primary purpose of this task was to obtain individualized subjective valuations for reward and effort items that would subsequently inform the intertemporal choice task. To ensure consistency in participants' monetary reference points and reduce ambiguity in value estimation, the instructions specified that 100,000 and 500,000 Iranian tomans corresponded to €1 and €5, respectively, based on the approximate exchange rate at the time of data collection.

The task comprised two sections: reward valuation and effort valuation. The reward section included 60 reward items, equally divided between food rewards (e.g., grilled chicken kebab) and non-food rewards (e.g., flowers), for which participants indicated the quantity considered equivalent to €1 or €5. The effort section consisted of 60 effort items, equally divided between cognitive effort (e.g., memorizing n digits) and physical effort (e.g., performing n sit-ups), for which participants indicated the amount of effort considered equivalent to €1 or €5.

The task was originally developed by Le Bouc and Pessiglione (2022). For the present study, it was culturally adapted for use in Iran by replacing culturally unfamiliar items with locally relevant equivalents and updating normative item values.

In the original study, content validity was supported through the inclusion of a balanced set of reward and effort items spanning multiple behavioral domains. Construct validity was established through computational modeling, which demonstrated systematic reductions in subjective value as a function of delay and systematic changes in subjective effort costs consistent with theoretical predictions of hyperbolic discounting. Furthermore, differential discounting patterns across reward, effort, and punishment domains provided evidence of discriminant validity.

For the present study, a Persian version of the task was developed through a rigorous cultural adaptation process. First, all items were translated into Persian and independently back-translated to ensure conceptual equivalence with the original version; several items were culturally adapted (e.g., sushi was replaced with grilled chicken kebab). Content validity was then formally evaluated by a panel of ten experts in cognitive psychology. Item-level Content Validity Index (CVI) values averaged 0.80 for reward items and 0.83 for effort items, and items failing to meet acceptable thresholds were revised or removed. Finally, the adapted version was pilot-tested with eight university students to evaluate face validity, clarity of instructions, response distributions, and task feasibility. The pilot data yielded behavioral patterns consistent with hyperbolic discounting, providing preliminary support for the construct validity of the Persian adaptation.

Intertemporal Choice Task (ICT). The Intertemporal Choice Task (ICT) was used to assess temporal discounting of rewards and effort. The task comprised separate reward and effort blocks designed to estimate individual rates of reward discounting and effort discounting, respectively. Block order was counterbalanced across participants.

Each block consisted of 60 trials, and no item was repeated within a block. Choice alternatives were presented simultaneously on the left and right sides of the screen, and the spatial position of the sooner option was counterbalanced across trials. Responses were self-paced, and the selected option was highlighted in red for 200 ms following each choice.

To assess reward discounting, participants made a series of hypothetical choices between a smaller reward available sooner and a larger reward available after a delay (e.g., "Would you prefer five skewers of grilled chicken kebab today or ten skewers in seven days?"). Reward quantities were derived from participants' individualized valuations obtained in the Rating Task, and delays were randomly selected from ten intervals (0, 1, 2, 3, 5, 7, 10, 14, 21, and 30 days).

To assess effort discounting, participants made analogous choices between a smaller amount of effort required sooner and a larger amount of the same effort required after a delay (e.g., "Would you prefer performing 50 sit-ups today or 100 sit-ups in seven days?"), using the same delay intervals. In this context, however, delays represented the period during which participants could freely choose when to perform the required effort (Le Bouc & Pessiglione, 2022).

The ICT was adapted from the paradigm developed by Le Bouc and Pessiglione (2022), who demonstrated that the task reliably captures individual differences in the temporal discounting of rewards and effort using computational modeling approaches. Their findings indicated that participants' choices were well described by hyperbolic discounting functions and that the estimated discounting parameters exhibited meaningful variation across motivational domains. Comparable paradigms have been widely employed in research on intertemporal choice, subjective valuation, and effort-based decision-making, further supporting the validity of the present approach.

To quantify individual discounting rates and estimate subjective values from participants' choices, a hyperbolic discounting model (Mazur, 1987) was fitted to the behavioral data:

$$V = \frac{A}{1 + KD}$$

where *V* denotes subjective value, *A* represents the objective value of the item (derived from the Rating Task), *k* is the individual discounting parameter, and *D* denotes delay in days. For reward discounting, *A* corresponded to the participant-specific monetary value assigned to each reward item; for effort discounting, *A* corresponded to the subjective cost assigned to each effort item. Separate *k* parameters were estimated for reward and effort discounting.

Because discounting parameters typically exhibit substantial positive skewness, all *k* values were log-transformed prior to statistical analysis. Accordingly, all subsequent analyses were conducted using log-transformed discounting parameters (ln *k*) for both reward and effort discounting.

The k parameter represents the rate at which subjective value changes as a function of delay; larger k values indicate a steeper decline in subjective value across increasing delays. In the present study, reward and effort discounting parameters were estimated separately so that the temporal valuation of rewards could be examined independently from the temporal valuation of effort costs.

MacArthur Scale of Subjective Social Status. Subjective SES was assessed using the national version of the MacArthur Scale of Subjective Social Status developed by Adler et al. (2000). The instrument presents a 10-rung ladder representing the socioeconomic hierarchy in society. Participants were asked to select the rung that best represented their socioeconomic position relative to other people in Iran, with the upper and lower rungs representing the highest and lowest socioeconomic positions, respectively. Scores range from 1 to 10, with higher scores indicating higher perceived socioeconomic status. Previous research has supported the construct validity of the scale through its associations with objective socioeconomic indicators and psychological and health-related outcomes (Adler et al., 2000). Because the scale consists of a single item, internal-consistency reliability was not applicable.

Ghodratnama Socioeconomic Status Questionnaire. Objective SES was operationalized using the Socioeconomic Status Questionnaire developed by Ghodratnama et al. (2013). The questionnaire assesses four socioeconomic domains: income, economic class, educational attainment, and housing status. It contains six demographic questions and five primary items assessing household income, current housing value, purchasing power for housing, parental educational attainment, and perceived economic class. The five primary items are rated on a 5-point scale ranging from 1 (*very low*) to 5 (*very high*) and are summed to produce a total score ranging from 5 to 25, with higher scores indicating higher socioeconomic status.

The instrument was selected because it provides a multidimensional assessment of socioeconomic conditions rather than relying on a single indicator such as income or education. By incorporating information related to financial resources, housing, educational background, and perceived economic position, the questionnaire captures several aspects of participants' socioeconomic circumstances that may be relevant to decision-making and temporal preferences. Eslami et al. (2014) reported a Cronbach's alpha coefficient of .83. In the present sample, Cronbach's alpha was .60, indicating modest internal consistency. This relatively lower coefficient should be interpreted cautiously because the questionnaire combines heterogeneous socioeconomic indicators that may not necessarily be expected to show strong inter-item homogeneity.

Data analysis

Analyses were conducted in R 4.5.0. Distributions, normality, and influential observations were examined before inferential analysis. Descriptive statistics were reported as means and standard deviations or medians and interquartile ranges, as appropriate. Spearman's rank correlations assessed associations among objective SES, subjective SES, log reward-*k*, and log effort-*k*. All tests done with significance set at $p < 0.05$.

Spearman's rank correlation was selected because the primary analyses concerned monotonic associations between socioeconomic indicators and discounting parameters and because the relatively small sample size and distributional characteristics of the variables did not warrant assuming bivariate normality. Correlation coefficients were interpreted as measures of the direction and strength of association rather than as evidence of causal relationships. The correlation matrix included the association between objective and subjective SES as well as the associations of each SES measure with reward and effort discounting. The association between reward and effort discounting was also examined to assess whether the two behavioral measures were related within the same participants.

Results

Demographic Characteristics

A total of 61 participants (53 women and 8 men) were included in the study. The median age was 26.00 years ($Q_1 = 24.00$, $Q_3 = 36.00$). Regarding educational attainment, 6 participants (9.8%) were undergraduate students, 38 (62.3%) were master's students, and 17 (27.9%) were doctoral students. With respect to marital status, 40 participants (65.6%) were single and 21 (34.4%) were married (Table 1).

Table 1. Demographic Characteristics of the Participants (N = 61)

Category	Variable	Frequency (n)	Percentage (%)
Sex	Male	8	13.1
	Female	53	86.9
Educational level	Bachelor's degree	6	9.8
	Master's degree	38	62.3
	Doctoral degree	17	27.9
Marital status	Single	40	65.6
	Married	21	34.4

Descriptive statistics for the study variables are presented in Table 2. The mean objective SES score was 17.57 (SD = 3.37), whereas the median subjective SES score was 6.00 (IQR: 5.00–7.00).

For the log-transformed discounting parameters, the mean reward discounting rate was −0.06 (SD = 0.95), while the median effort-cost discounting rate was −1.07 (IQR: −2.22–0.92).

Table 2. Descriptive Statistics for Demographic, Socioeconomic Status, and Temporal Discounting Variables

Characteristic	N = 61
Objective SES	17.57 (3.37)
Subjective SES	6.00 (5.00, 7.00)
Effort discounting	-1.07 (-2.22, 0.92)
Reward discounting	-0.06 (0.95)

Median (Q1, Q3); Mean (SD)

Correlation Analysis

Spearman's correlations were conducted to examine associations among objective SES, subjective SES, effort discounting, and reward discounting (Table 3). Objective SES was not significantly correlated with subjective SES, (r = 0.166, p = 0.202), or effort discounting, (r = -0.096, p = 0.460). In contrast, objective SES was significantly and positively associated with reward discounting, (r = 0.271, p = 0.047), indicating that higher objective SES was associated with greater discounting of delayed rewards.

Subjective SES was not significantly associated with either effort discounting, (r = -0.015, p = 0.909), or reward discounting, (r = -0.021, p = 0.878). Similarly, effort discounting was not significantly related to reward discounting, (r = -0.077, p = 0.578).

Table 3. Spearman Rank Correlations Among Socioeconomic Status and Discounting Variables

Variables	Objective SES	Subjective SES	Effort Discounting	Reward Discounting
Objective SES	-	r=0.166 p=0.202	r = -0.096 p = 0.460	r = 0.271 **p** = 0.047
Subjective SES	r=0.166 p=0.202	-	r = -0/015 p = 0.909	r = -0.021 p = 0.878
Effort Discounting	r = -0.096 p = 0.460	r = -0.015 p = 0.909	-	r = -0.077 p = 0.578
Reward Discounting	r = 0.271 **p** = 0.047	r = -0.021 p = 0.878	r = -0.077 p = 0.578	-

Discussion

The present study examined the associations of objective and subjective socioeconomic status (SES) with reward and effort discounting in a sample of students enrolled at public universities in Tehran. Three principal findings emerged. First, objective SES was positively associated with reward discounting ($r = 0.271$, $p = 0.047$), indicating that participants of higher objective SES exhibited greater discounting of delayed rewards. Second, subjective SES was not significantly associated with either reward discounting ($r = -0.021$, $p = 0.878$) or effort discounting ($r = -0.015$, $p = 0.909$). Third, effort discounting demonstrated no significant association with either objective or subjective SES. Collectively, these findings suggest that the relationship between socioeconomic circumstances and intertemporal valuation may be more intricate than a simple linear model in which greater socioeconomic resources are uniformly associated with lower discounting.

The direction of the observed correlation between objective SES and reward discounting contrasts with the pattern generally reported in previous research. Higher income, educational attainment, and access to socioeconomic resources have typically been associated with shallower delay discounting and a greater preference for larger, later rewards (Green et al., 1996; de Wit et al., 2007; Reimers et al., 2009). Longitudinal evidence from adolescent samples has similarly linked lower family SES with steeper delay discounting (Peviani et al., 2024). Nevertheless, the present finding should not be interpreted as evidence that higher SES reliably predicts greater preference for immediate rewards. The effect was small, its statistical significance was marginal.

Differences in sample composition may partly explain why the inverse association commonly reported in previous studies was not observed. The present sample consisted primarily of postgraduate students, for whom conventional indicators such as household income, housing conditions, and parental education may not correspond closely to personal financial independence or current access to economic resources. Age may also contribute to heterogeneity in the relationship between income and temporal preferences. Wan et al. (2026) found that household income was unrelated to delay discounting among adults younger than 35 years, although it moderated age-related differences among older adults. This evidence suggests that the association between economic resources and discounting may be weaker or less consistent in younger populations. However, it does not directly explain the positive direction observed in the present study. Given the age variation within the current sample, future studies should examine age as a potential moderator and distinguish family SES from participants' independently controlled financial resources.

The broader economic context may also be relevant, although it was not directly assessed in this study. Cross-national evidence indicates that temporal preferences vary with individual and national financial conditions, including wealth, inequality, debt, and inflation (Ruggeri et al., 2022). Under sustained economic uncertainty, the expected purchasing power or accessibility of

delayed monetary outcomes may influence their present subjective value. Iran may therefore represent an informative context for examining socioeconomic differences in intertemporal choice. Nevertheless, the present study did not assess perceived inflation, financial insecurity, expectations regarding future purchasing power, or trust in the delivery of delayed rewards. Macroeconomic conditions consequently cannot be considered an explanation for the observed association. Their possible moderating role should instead be treated as a hypothesis for future research.

Subjective SES was not significantly correlated with reward discounting. This result differs from findings reported by Ishii (2015) and Ishii et al. (2017), in which lower perceived social rank was associated with steeper delay discounting. One possibility is that subjective social position is not uniformly associated with intertemporal choice across populations and socioeconomic contexts. Among university students, perceived social rank may be influenced by academic standing, family background, anticipated occupational status, and social comparison, which may not correspond directly to currently available financial resources.

Neither objective nor subjective SES was significantly correlated with the temporal discounting of effort costs. The lack of correlation between reward and temporal effort-cost discounting is consistent with the possibility that the temporal valuation of benefits and costs involves at least partly distinct processes. Neuroimaging research has similarly indicated that delay and effort costs can recruit partly distinguishable valuation systems (Prévost et al., 2010).

Several limitations should be considered. First, the sample was small, recruited through convenience sampling, predominantly female, and composed mainly of postgraduate students. These characteristics restrict generalizability and limit the precision with which small correlations can be estimated. Second, the cross-sectional correlational design precludes conclusions regarding causality or directionality. Third, the internal consistency of the composite SES questionnaire was modest in the present sample ($\alpha = 0.60$). Measurement error may therefore have reduced the stability and interpretability of associations involving this score. The heterogeneous content of the measure, including both material indicators and perceived economic class, further complicates its interpretation as a purely objective SES measure. Also, the analyses did not adjust for potentially relevant characteristics such as age, educational level, financial independence, employment, or personal versus household income.

Future research should recruit larger and more socioeconomically diverse samples with more balanced sex and age distributions. Objective SES indicators should be examined separately to distinguish the contributions of personal income, family income, education, employment, housing, and financial independence. Direct measures of perceived inflation, economic uncertainty, expected purchasing power, financial literacy, and trust in delayed outcomes would allow macroeconomic explanations to be tested rather than inferred. Longitudinal and experimental designs would also help determine whether socioeconomic circumstances influence temporal

preferences, whether temporal preferences contribute to subsequent socioeconomic outcomes, or whether both are shaped by common contextual factors.

Conclusion

The present study examined whether objective and subjective socioeconomic status were associated with reward discounting and the temporal discounting of effort costs among Iranian university students. A small positive association was observed between the composite measure of objective SES and reward discounting, whereas subjective SES was not associated with reward discounting. Neither SES measure showed a statistically detectable association with temporal effort-cost discounting. Reward and effort discounting were also not significantly correlated with one another in this sample. These findings suggest that socioeconomic indicators and different forms of temporal valuation should not be assumed to reflect a single underlying relationship.

The positive association between objective SES and reward discounting should be interpreted cautiously. Its magnitude was modest, and the study used a relatively small convenience sample and multiple correlational tests. The finding therefore requires replication before conclusions can be drawn about the direction of the association between socioeconomic resources and reward discounting in Iranian students. Although Iran's economic conditions provide a relevant context for studying intertemporal choice, the present study did not directly assess inflation expectations, financial insecurity, anticipated purchasing power, or trust in delayed outcomes. Macroeconomic explanations for the observed pattern should therefore be regarded as hypotheses for future investigation rather than explanations established by the current data.

The absence of statistically detectable associations with effort discounting likewise does not demonstrate that socioeconomic circumstances are unrelated to the temporal valuation of effort. Rather, within the limits of the present sample and measures, SES was not associated with individual differences in this form of discounting. Larger and more socioeconomically diverse studies are needed to estimate these relationships with greater precision and to distinguish the effects of family background, personal income, employment, financial independence, and perceived economic security. Future research that directly measures economic uncertainty and follows participants over time would also help determine whether temporal preferences are stable individual characteristics, context-sensitive responses to socioeconomic conditions, or a combination of both.

Ethical considerations

Adherence to Research Ethics Principles

The study protocol was reviewed and approved by the Ethics Committee of Allameh Tabataba'i University (Ethics Code: IR.ATU.REC.1402.131). All participants received clear information about the purpose, procedures, and approximate duration of the study before participation. Written informed consent was obtained from all participants prior to data collection. Participation was entirely voluntary, and participants were informed of their right to withdraw from the study at any time without penalty. The confidentiality and privacy of participants' information were maintained throughout the research process, and no personally identifying information was reported in the analyses or publications. The study was conducted in accordance with established ethical principles for research involving human participants.

Author Contributions

First Author (Razie Vazifedoostkhalaj): Preparation of study materials, participant recruitment, conducting the experiments and data collection, implementation of the computerized tasks, data preparation, statistical analysis, analysis and interpretation of the findings, and drafting the original manuscript.

Second Author (Supervisor) (Fariborz Dortaj): Dissertation supervision, participation in study design, supervision of the research process, methodological guidance, verification and validation of the findings, interpretation of the results, and revision, review, and finalization of the manuscript.

Third Author (Supervisor) (Esmaeil Sadipour): Dissertation advisory, participation in study design, methodological consultation, research supervision, interpretation of the findings, and manuscript review and revision.

Fourth Author (Advisor) (Abdol-Hossein Vahabie): Dissertation advisory, participation in the theoretical and methodological development of the study, research supervision, interpretation of the findings, and manuscript review and revision.

All authors have read and agreed to the final version of the manuscript and have contributed substantially to the work reported.

Data Availability Statement

The data supporting the findings of this study are available from the corresponding author upon reasonable request. The data are not publicly available due to ethical and confidentiality considerations.

Declaration of Generative AI and AI-assisted technologies in the writing process

During the preparation of this manuscript, the authors used ChatGPT (OpenAI) to assist with language refinement, academic editing, and improving the clarity, organization, and readability of selected sections of the manuscript. The tool was not used to generate or alter the study data or statistical results. Following the use of this tool, the authors carefully reviewed, revised, and verified the content and take full responsibility for the accuracy, integrity, and final content of the manuscript.

Conflict of Interest

The authors declare no conflict of interest.

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