When Choices Do Not Reveal Preferences: Deliberative Precision in Intertemporal and Risky Financial Decisions

Roberta Martino[1], Viviana Ventre[2], Salvador Cruz Rambaud[3], Fabrizio Maturo[1]

[1]Faculty of Economics and Law, Department of Economics, Statistics, and Business, Universitas Mercatorum, Rome, Italy

[2]Department of Mathematics and Physics, University of Campania Luigi Vanvitelli, Caserta, Italy

[3]Departamento de Economía y Empresa, Universidad de Almería, Spain

Abstract

Observed financial choices are often interpreted as direct expressions of latent preferences. In intertemporal decision-making, the choice of a smaller-sooner payoff is commonly read as evidence of impatience or impulsivity. The present paper argues that this interpretations may be incomplete, because observed choices can confound valuation and implementation. A formal framework is proposed in which impatience affects intertemporal valuation through the discount function, whereas impulsivity is modeled as decision immediacy, captured by limited deliberation and reduced implementation precision. It follows that: shorter deliberation lowers implementation precision, making choices less sensitive to consequences and closer to random behavior; longer deliberation improves preference implementation, so observed choices better reflect the discounted-utility ranking; greater impatience may reduce optimal deliberation, making impatience and impulsivity structurally distinct but behaviorally associated. Finally, even if the model is developed for smaller-sooner versus larger-later choices, a separate section will discusses how the same valuation–implementation logic can be extended to risk-taking by using intertemporal risky prospects, where probability weights may depend on the temporal position of outcomes. From an empirical perspective, in both cases, process-level observables such as response times, consistency across repeated choices, and sensitivity to payoff or probability perturbations are needed to distinguish genuine preferences from imprecise implementation.

Keywords: intertemporal choice; risk-taking; behavioral finance; impatience; impulsivity; rational inattention; subjective probability; deliberative precision.

1 Introduction

Financial decision-making often combines time, uncertainty, and limited cognitive resources. Individuals decide whether to consume today or save for the future, whether to accept immediate liquidity or wait for a larger payoff, and whether to choose a safer or a riskier financial prospect. In these contexts, final choices are frequently interpreted as direct evidence of latent preferences. In the context of intertemporal choices [4], a smaller-sooner (SS) choice is usually associated with impatience, present bias, or impulsivity [6][11]. The present contribution argues that such interpretations may be underidentified [7]. The same observed choice can be generated by different mechanisms: an immediate choice may reflect stronger impatience in valuation, but it may also reflect low deliberation and low precision in the implementation of a valuation that is not necessarily impatient.

The research question is therefore: *when a SS choice is observed, does it reveal a true preference, or does it reveal an imprecise implementation process?*

2 Baseline framework: intertemporal choices

The baseline model considers intertemporal choices. Let the decision maker choose between a smaller-sooner payoff $x_0 > 0$ received at time 0 and a larger-later payoff $x_t > 0$ received at time $t > 0$. Let u be an increasing and concave utility function, and let $f(s;\theta)$ be a discount function, where θ denotes the degree of impatience [10]. After a deliberation time τ, the discounted utilities are

$$U_{SS}(\tau,\theta) = u(x_0)f(\tau;\theta), \qquad U_{LL}(\tau,\theta) = u(x_t)f(t+\tau;\theta).$$

The deterministic valuation gap is

$$D(\tau,\theta) = U_{SS}(\tau,\theta) - U_{LL}(\tau,\theta).$$

This component captures the valuation channel: impatience changes the discounted comparison between the immediate and delayed outcomes.

The implementation channel is introduced through a rational-inattention-inspired stochastic choice rule [1][3][5]. Deliberation affects the effective noise level $\lambda(\tau)$, assumed to be decreasing in τ. Therefore, longer deliberation increases the precision with which discounted valuations are translated into choices. The probability of choosing the smaller-sooner option is

$$\pi_{SS}(\tau,\theta) = \sigma\left(\frac{D(\tau,\theta)}{\lambda(\tau)}\right), \qquad \sigma(z) = \frac{1}{1+e^{-z}}.$$

Thus, observed choices depend on the composite index $D(\tau,\theta)/\lambda(\tau)$, not on impatience alone.

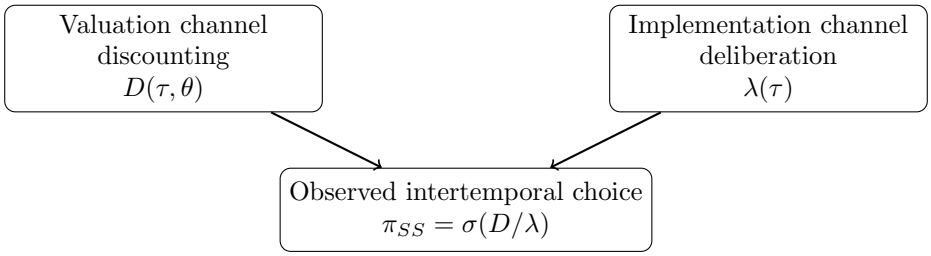

Figure 1: The baseline separation between valuation and implementation in intertemporal choice.

3 Main theoretical implications

The first implication concerns consequence sensitivity. Define

$$CS(\tau,\theta) = \frac{\partial \pi_{SS}(\tau,\theta)}{\partial D(\tau,\theta)} = \frac{\pi_{SS}(\tau,\theta)(1-\pi_{SS}(\tau,\theta))}{\lambda(\tau)}.$$

If $\lambda(\tau) \to +\infty$ as $\tau \to 0^+$, then

$$\pi_{SS}(\tau,\theta) \to \frac{1}{2}, \qquad CS(\tau,\theta) \to 0.$$

Therefore, when deliberation is very short, the choice becomes weakly sensitive to payoff differences. In this framework, impulsivity is not identified with impatience. It is interpreted as low-precision implementation of an underlying valuation.

The second implication concerns optimal deliberation. The decision maker chooses τ by maximizing

$$W(\tau, \theta) = EU(\tau, \theta) - c(\tau),$$

where

$$EU(\tau, \theta) = \pi_{SS}(\tau, \theta)U_{SS}(\tau, \theta) + (1 - \pi_{SS}(\tau, \theta))U_{LL}(\tau, \theta),$$

and $c(\tau)$ is an increasing and convex deliberation cost. Under sufficient decreasing-differences conditions, optimal deliberation is weakly decreasing in impatience [8]:

$$\tau^*(\theta) \text{ is weakly decreasing in } \theta.$$

If impulsivity is defined as decision immediacy, $I(\theta) = 1/\tau^*(\theta)$, then impulsivity is weakly increasing in impatience. This result does not collapse the two constructs. It shows that impatience and impulsivity may become behaviorally associated through the optimal deliberation problem.

The third implication is identificational. If p_{SS} is the observed frequency of smaller-sooner choices, then

$$\log\left(\frac{p_{SS}}{1 - p_{SS}}\right) = \frac{D(\tau, \theta)}{\lambda(\tau)}.$$

Thus, smaller-sooner frequencies identify only a composite index. They do not separately identify discounted valuation and implementation precision.

4 Application to risk-taking: from intertemporal choice to intertemporal risky prospects

The baseline SS–LL model is not, in itself, a model of risk-taking: it just states that observed choices may fail to reveal latent preferences when implementation is noisy.

This logic can be extended to risky financial decisions by considering intertemporal risky prospects. Let a prospect be represented as (x, t, p), where x is the monetary outcome, t is the time of receipt, and p is the probability of occurrence. In a present-value representation, the subjective value of the prospect can be written as

$$V(x, t, p, \theta) = u(x)f(t; \theta)w(p, t)$$

where $f(t; \theta)$ captures temporal discounting and $w(p, t)$ captures the subjective probability weight [9] and represents the way probability is transformed and possibly affected by time [2].

This extension is motivated by previous evidence on intertemporal risky prospects [12], where equivalent intertemporal pairs were first elicited and then equal random probabilities were added to them. From a normative perspective, adding the same probability to two equivalent intertemporal prospects should preserve indifference. Empirically, however, choices shifted away from indifference, suggesting that subjective probability may depend on the temporal structure of the prospect.

The present framework adds a further layer. In risky intertemporal choice, the observed selection of a risky or uncertain alternative may depend on both valuation and implementation: risk-taking should not be interpreted only as risk preference. It may also reflect time-dependent probability weighting or low deliberative precision.

Table 1: Interpretation of observed choices across domains

Observed choice	**Possible valuation mechanism**	**Possible implementation mechanism**
Smaller-sooner choice	Stronger impatience or higher discounting of future outcomes	Low deliberation and low consequence sensitivity
Larger-later choice under probability	Time-dependent subjective probability or preference for uncertainty	Imprecise implementation of the valuation gap
Risky alternative choice	Risk preference or subjective overweighting of probability	Noisy implementation under limited attention
Choice instability	Preference reversal due to time/probability interaction	Low precision across repeated decisions

5 Discussion and Conclusion

The main contribution of this work is to introduce a formal distinction between intertemporal valuation and choice implementation. Standard interpretations of smaller-sooner choices often treat observed behavior as a direct manifestation of impatience, present bias, or impulsivity. The proposed framework challenges this interpretation by showing that the same observed choice may arise from two different sources: a valuation channel, governed by the discount function, and an implementation channel, governed by the precision with which discounted values are translated into choice.

The innovation of the paper is therefore not simply to combine discounted utility with a stochastic choice rule, but to assign distinct behavioral meanings to the two components of the model. Impatience affects the deterministic comparison between the smaller-sooner and larger-later alternatives through the discounted-utility gap. Impulsivity, instead, is not modeled as a stronger preference for immediacy, but as decision immediacy under limited deliberation. In this sense, impulsivity is relocated from the valuation block to the implementation block. This allows the model to separate two mechanisms that are often observationally confounded in intertemporal choice data.

A central implication is that smaller-sooner frequencies alone do not identify the underlying psychological or economic mechanism. Observed choices identify only a composite index, given by the ratio between the valuation gap and the implementation noise. Therefore, a high frequency of immediate choices cannot be interpreted unambiguously as evidence of impatience. It may also reflect low deliberative precision, weak consequence sensitivity, or a noisy implementation of preferences. This provides a clear identification argument: final choices are informative, but they are not sufficient to recover the latent structure of the decision process.

The second contribution concerns the role of deliberation. By introducing deliberation time as an endogenous variable, the framework provides a tractable way to connect economic valuation with cognitive effort and attention. Shorter deliberation increases implementation noise and reduces sensitivity to payoff differences; longer deliberation makes observed choices more consistent with the discounted-utility ranking. Under sufficient decreasing-differences conditions, greater impatience weakly reduces optimal deliberation time. Thus, impatience and impulsivity remain structurally distinct, but they may become behaviorally associated through the optimal deliberation problem. This result is conditional and model-based, but it clarifies why impatience and impulsivity are often empirically correlated without being conceptually equivalent.

The methodological implication is that intertemporal choice experiments should move beyond final choices alone. Process-level observables such as response times, within-subject consistency, and sensitivity to payoff or delay perturbations become essential for distinguishing valuation-based impatience from implementation-based imprecision. In this perspective, response times are not merely auxiliary data, but a natural empirical counterpart of the theoretical

distinction between valuation and implementation.

It is finally discussed how the framework can be connected to risk-taking through the identification of a general problem, applicable to risky financial decisions: observed choices may confound latent preferences with noisy implementation. In intertemporal risky prospects, this issue becomes even richer because time, probability weighting, and uncertainty interact. A risky choice may reflect genuine risk preference, but it may also depend on time-dependent subjective probability or on low deliberative precision. Therefore, the framework suggests that risk-taking should not always be interpreted as risk appetite. In some cases, what appears as impatience, impulsivity, or risk-seeking may partly be imprecision.

Overall, the paper contributes to behavioral finance and decision theory by proposing a valuation–implementation framework in which observed choices do not necessarily reveal preferences. Its main novelty lies in showing that impatience and impulsivity can be formally separated, empirically confounded, and behaviorally linked through the choice of deliberation time. This perspective opens applications to investor profiling, financial education, risk assessment, and experimental designs that integrate choices with process-level measures.

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