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Reference dependence and lottery participation

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Abstract

We assume that lottery participants are poor relative to their target income. Reference dependence with loss aversion can render the marginal utility of income non-monotonic in line with the Friedman–Savage hypothesis. As a result, lottery participation can be rationalized without invoking probability weighting. The theoretical implications align with recent empirical evidence on lottery spending.

KEYWORDS

Friedman–Savage hypothesis, loss aversion, lotteries, reference dependence

JEL CLASSIFICATION

D01, D81, D90

> It is not the man who has too little, but the man who craves more, that is poor.
>
> —Seneca, Epistle II

1 | INTRODUCTION

In economic analysis and decision making, active and widespread participation in lotteries remains a controversial and puzzling topic, typically relegated to the area of behavioral biases. The leading behavioral explanation of lottery participation is derived from prospect theory with subjective probability weighting (Kahneman & Tversky, 1979; Quiggin, 1982). Within this framework, we explore a complementary mechanism: that lottery spending may also depend on subjective reference points for income. Allowing such reference points can rationalize positive lottery spending even without invoking subjective probability weighting. Our argument is centered on the stoic aphorism in the epigraph, which we interpret as saying that lottery participants are poor relative to their target income or, in our model, reference point. We also show that our theoretical predictions are in accordance with empirical evidence on lottery spending, including the latest evidence reported by Lockwood et al. (2025), the consistency of which with probability weighting is not unequivocal.

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Drawing on the reference-dependent subjective expected utility of Sugden (2003) (also see Kőszegi & Rabin, 2006), we model individual utility as a weighted average of the objective (standard) utility and subjective utility of consumption. The subjective utility of consumption is subject to loss aversion in relation to a reference point, which, unlike in Kahneman and Tversky (1979), we allow to depart from the current income. If consumption drops below the reference point, the consumer experiences a loss in utility which is larger in absolute value than the gain in utility if consumption increases by the same amount above the reference point. Such utility specifications can generate non-monotonic marginal utility of consumption, which, as originally argued by Friedman and Savage (1948), can explain lottery participation as utility maximizing behavior.

Our model predicts that only individuals with income below the reference point can find it optimal to participate in lotteries, which can also be applied to explain more active lottery participation from individuals with lower income. Another practically relevant prediction is that observationally similar individuals can make different decisions about lottery participation. From two individuals with the same level of income it is the individual with a higher reference point that is more likely to participate in a lottery. In other words, it is not only the level of income that matters for lottery participation but rather its relationship to the reference point, which can be different for different people. Importantly, as discussed later and as originally noted by Markowitz (1952), reference dependence mediates the criticisms of the Friedman and Savage (1948) hypothesis.

The new evidence on lottery spending reported by Lockwood et al. (2025) provides a new test for lottery theories. The semi-elasticities of lottery demand with respect to the jackpot expected value and second prize expected value are found to be 1.7 and 0, respectively. In other words, lottery participants seem to be unmoved by changes in the second prize but very responsive to changes in the jackpot. This evidence is not straightforward to reconcile with theories based solely on probability weighting, as it would require very large relative overweighting of the jackpot probability.[1] The observed difference in semi-elasticities can, however, arise naturally in our model: the effect of a prize change on lottery spending depends on whether the prize takes consumption below or above the reference point. If below, the loss-aversion factor arising from additional spending can offset the effect of larger prize money, explaining the zero semi-elasticity. If the prize takes consumption above the reference point, the offsetting factor is absent, leading to a positive semi-elasticity. In practice, for most draws of the Powerball and Mega Millions lotteries studied in Lockwood et al. (2025), the value of the second prize is arguably below the reference point for lifetime income, whereas the jackpot exceeds it.

The remainder of the paper is organized as follows. After reviewing the related literature in Section 2, we present the model of lottery participation in Section 3. In Section 4, we perform the comparative statics analysis of lottery spending. The last section concludes the paper.

2 | RELATED LITERATURE

Stylized facts on lottery participation give rise to two main questions that a lottery theory needs to address. Firstly, why do only some people participate in lotteries? Secondly, why do people with lower income participate more actively in lotteries? The neoclassical (expected utility) paradigm fails on both questions (Vickrey, 1945) unless it permits non-monotonic marginal utility of money (Friedman & Savage, 1948; Markowitz, 1952). Friedman and Savage (1948) showed that the coexistence of insurance and gambling can be reconciled within expected utility theory if the utility of wealth contains a locally convex segment. In their formulation, utility is concave at low and high wealth levels but convex over an intermediate range, implying risk aversion for moderate risks and risk seeking for sufficiently large gains. Markowitz (1952) argued that locating this convexity at fixed wealth levels generates implausible implications and instead proposed that utility be evaluated relative to a reference level of "customary wealth."

In contrast, leading explanations attribute lottery participation to behavioral biases such as probability weighting, self-control problems, or bounded rationality. See, for example, Kahneman and Tversky (1979), Quiggin (1991), Tversky and Kahneman (1992), Clotfelter and Cook (1993), and Guryan and Kearney (2010); for reviews, see Grote and Matheson (2013) and Benjamin (2019). Other explanations emphasize the utility of entertainment derived from playing a lottery (e.g., Conlisk, 1993; Diecidue et al., 2004) or the anticipatory utility from contemplating a potential win (e.g., Loewenstein, 1987). Using a natural experiment embedded in popular U.S. lotteries and complemented with a nationally representative survey, Lockwood et al. (2025) estimate the cumulative role of behavioral biases for lottery spending at 43%, implying that additional motives may be quantitatively important. The contribution of the present

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paper is to show that subjective reference points provide such an additional explanation of lottery participation, thereby reviving the insights of Friedman and Savage (1948) and Markowitz (1952).

A key modeling assumption in this paper is that individuals evaluate income relative to subjective reference points, which may reflect financial goals, past experiences, or social comparisons. This assumption is grounded in a large empirical literature showing that well-being depends not only on absolute income, but also on how income compares to salient benchmarks. The Easterlin paradox exemplifies this idea: although richer individuals report higher happiness within a given population, long-run increases in average income do not translate into lasting gains in average life satisfaction (Easterlin, 1974). Numerous studies have since confirmed that changes in subjective well-being are better explained by changes in relative rather than absolute income (for examples see Clark & Oswald, 1996; Stutzer, 2004; Ferrer-i-Carbonell, 2005; for a review see Clark et al., 2008). In line with this evidence, many modern household surveys now include questions on financial satisfaction, which provide a behavioral proxy for whether individuals perceive their income as adequate. For example, the General Social Survey in the U.S. asks respondents how satisfied they are with their financial situation. As shown in Table 1, there is substantial heterogeneity in financial satisfaction even within the same income group: some high-income individuals report dissatisfaction, while some low-income individuals report being satisfied. This dispersion suggests that reference points differ across individuals, and that perceived shortfalls from these targets occur across the income distribution.

3 | MODEL

Consider a lottery with a very large fixed number N of tickets issued. There are one first prize of x_1 and several second prizes of x_2, where the probability of winning the first prize from a single lottery ticket is equal to f_1 and winning a second prize equal to f_2. The expected value of a lottery ticket, $f_1x_1 + f_2x_2$, is strictly smaller than its price p. For ease of exposition and without any implications for our results, we shall ignore the possibility of winning multiple prizes when a not too large number of lottery tickets is bought.[2] Furthermore, when multiple tickets are bought, the probability of winning a second prize can be very closely approximated by nf_2, which we use in our analysis for convenience. Altogether, we consider three lottery outcomes from a purchase of n tickets: (i) the first prize is won, (ii) a second prize is won, (iii) no prize is won, with their respective probabilities given by nf_1, nf_2, and $1 - nf_1 - nf_2$.

An individual's utility of consumption c consists of two components. The first component captures the objective utility of consumption given by strictly concave function $h(c)$. The second component captures the subjective utility of consumption measured against reference point r. The subjective utility is given by universal gain-loss function $m(c - r)$ that satisfies assumptions A0–A4 from Kőszegi and Rabin (2006). In particular, the function m is concave for $c \geq r$ and convex for $c < r$, which captures diminishing sensitivity around the reference point (assumption A3). Loss aversion is

TABLE 1 Financial satisfaction across U.S. income groups, 1972–2024.

Income decile	A	B	C
D1	26.5	44.6	28.9
D2	46.9	35.8	17.2
D3	43.9	38.9	17.2
D4	39.0	42.4	18.5
D5	32.4	45.8	21.8
D6	27.0	48.7	24.3
D7	22.7	50.6	26.7
D8	18.2	49.7	32.0
D9	12.7	47.5	39.8
D10	7.6	34.9	57.6

Abbreviations: A, not satisfied at all; B, more or less satisfied; C, pretty well satisfied.

Source: U.S. General Social Survey. Based on average levels of financial satisfaction across income deciles of surveyed individuals from 1972 to 2024. Respondents were asked: "So far as you and your family are concerned, would you say that you are pretty well satisfied with your present financial situation, more or less satisfied, or not satisfied at all?".

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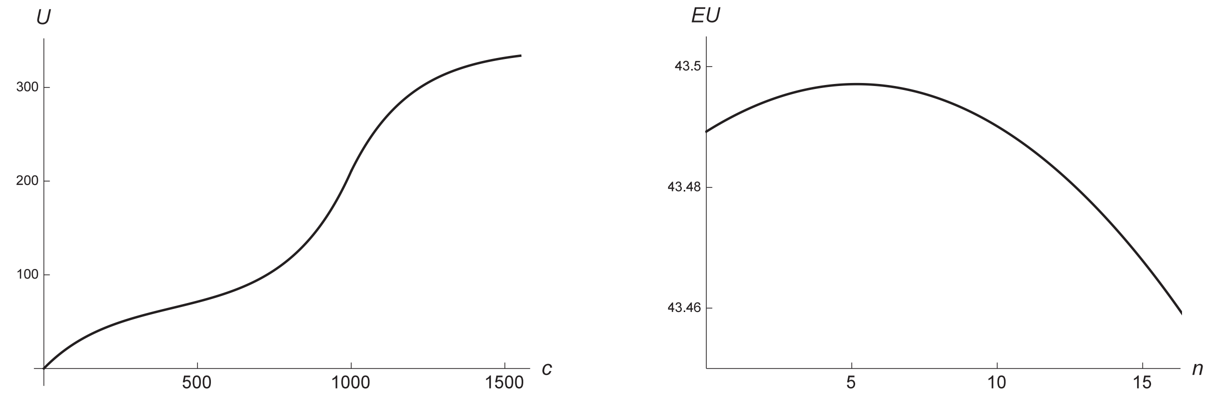

FIGURE 1 The utility and expected utility functions. The left diagram shows the graph of utility function $U(c)$ and the right diagram shows the graph of expected utility function $EU(n)$, where the underlying functional forms are given by Equations (2) and (3). The utility function is normalized so that $U(0) = 0$. Parameter values are $\lambda = 1.1$, $\eta = 1/3$, $\mu = \alpha = 0.0051$, $\nu = 0.005$, $r = 1000$, $y = 200$, $x_1 = 1000$, $x_2 = 100$, $f_1 = 0.0005$, and $f_2 = 0.001$.

captured by the condition $m(y) + m(-y) < m(x) + m(-x)$ for $y > x > 0$ (assumption A2), together with the parameter that scales losses relative to gains (assumption A4). Altogether, we express an individual's utility function of consumption $U(c)$ as a weighted average of the two components:

$$U(c) = \eta h(c) + (1-\eta)m(c-r), \tag{1}$$

where $\eta \in (0,1]$ is a weight on the objective utility of consumption. For the theoretical underpinnings of utility in Equation (1) and of expected utility given below, see Sugden (2003), Köbberling and Wakker (2005), and Kőszegi and Rabin (2006) and for practical applications see, for example, Crawford and Meng (2011), Card et al. (2012), Thakral and Tô (2021), and Zubrickas (2023).

We note that the graph of utility function U can take the shape hypothesized by Friedman and Savage (1948). Depending on the values of utility weight η and reference point r and on the functional forms of the utility components, the graph of utility function U can have concave and convex parts. Specifically, at low levels of consumption utility function U can be concave because of the dominance of the objective utility of consumption, for example, if Inada condition $\lim_{c\to 0} h'(c) = \infty$ is imposed. With levels of consumption increasing and approaching the reference point, the loss aversion of subjective utility can start playing the dominant role, thus, leading to a convex part of utility function U. For levels of consumption above the reference point, utility function U turns concave again. See the left diagram of Figure 1 for an example with subjective utility $m(c-r)$ given by

$$m(c-r) = \begin{cases} \dfrac{1-e^{-\mu(c-r)}}{\mu} & \text{for all } c \geq r, \\ \lambda \dfrac{e^{\nu(c-r)}-1}{\nu} & \text{for all } c < r \end{cases} \tag{2}$$

and objective utility $h(c)$ by

$$h(c) = \frac{1-e^{-\alpha c}}{\alpha}. \tag{3}$$

Köbberling and Wakker (2005) discuss the advantages of the linear-exponential functional form in modeling loss aversion.

Next, we consider an individual with income y and assume that this income is not high enough to permit buying a very large number of lottery tickets, so our lottery assumptions apply to any feasible level of spending. The expected utility of consumption from buying n lottery tickets is then given by

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$$EU(n) = \sum_{i=1}^{2} nf_i\, U(c_i) + (1 - nf_1 - nf_2)\, U(c_0), \tag{4}$$

where $c_i = y - np + x_i$ denotes the level of consumption in the event of winning prize x_i, $i = 1, 2$, and $c_0 = y - np$ denotes the level of consumption in the event of not winning a prize. If the individual is "rich" in the sense that his income is equal to or greater than the reference point, $y \geq r$, then he does not find it rational to purchase any lottery tickets due to his risk aversion at the levels of consumption above the reference point. In contrast, if the individual is "poor" in the sense of $y < r$, then we can have that $EU(1) > EU(0)$ as assumed henceforth. The right diagram of Figure 1 illustrates the latter possibility by showing the graph of expected utility EU for a lottery with $x_1 = 1000$, $x_2 = 100$, $f_1 = 0.0005$, and $f_2 = 0.001$ and the underlying utility function used in the left diagram.

The utility theory of Friedman and Savage (1948) and its applications to lottery participation are subject to various criticisms. The most common criticism is that if the utility of all individuals were characterized by the utility function used in Figure 1, then we would find only individuals with middle income (i.e., with consumption in the convex region of the utility function) participating in lotteries (Markowitz, 1952). At the same time and in contrast to empirical evidence, individuals with low and high income (i.e., with consumption in the concave regions of the utility function) would not participate in lotteries. For an extensive discussion of this criticism, see Machina (1982) and for a textbook treatment, see Hirshleifer and Riley (1992). We note that this criticism does not apply to our theory. In our model, the reference point is individual-specific and, thus, so is the shape of utility, which implies that it is the level of income in relationship to the reference point that determines lottery participation. For instance, high-income individuals can be "poor" and participate in lotteries if they entertain a reference point above their current income. In contrast, low- or middle-income individuals can be "rich" and, thus, abstain from lotteries if they have only a modest reference point. For empirical motivation and practical evidence supporting this idea, see Table 1 and the discussion accompanying it in the introduction.

To rectify the perceived shortcomings of the Friedman and Savage (1948) hypothesis, Markowitz (1952) offers a refinement of this hypothesis by introducing a reference point, which is the individual's current (or customary) level of wealth. The individual is assumed to be initially risk-loving then risk-averse over gains above the reference point while initially risk-averse then risk-seeking over losses. For the application of the Markowitz (1952) model, see, for example, Peel (2013) who explains the use of multiple prizes in lotteries, or Post and Levy (2005) who analyze market portfolio efficiency, or Georgalos et al. (2021, 2023) who explain risky choice in experimental research. Comparing the shape of utility, we note that one difference of our model from Markowitz (1952) lies in the reference point, which we model as idiosyncratic target income rather than as fixed at the current or customary level of income.[3] In our model, therefore, two individuals with the same level of income can derive different utility of consumption if their reference points differ and, accordingly, they can make different decisions about lottery participation. Furthermore, the property that the individual is initially risk-loving then risk-averse over gains above the reference point is not assumed in our model, unlike in Markowitz (1952), but rather derived from the interplay of objective and subjective utility.

In what follows, we shall ignore the integer problem and treat n as a continuous variable. We find the optimal amount n^* of tickets bought from the first-order condition $EU'(n^*) = 0$, which is given by

$$\sum_{i=1}^{2} \left(f_i\, U(c_i) - n^* f_i p\, U'(c_i) \right) - (f_1 + f_2)\, U(c_0) - (1 - n^* f_1 - n^* f_2) p\, U'(c_0) = 0. \tag{5}$$

The second-order condition requires $EU''(n^*) < 0$. For ease of exposition, we rule out the possibility of the corner solution $n^* = y/p$. It is useful for subsequent analysis to provide an intuitive account of the first term of the first-order condition. Purchasing an additional lottery ticket has two effects on expected utility. The first effect is an increase of f_i in the probability of winning prize x_i and gaining utility $U(c_i)$, $i = 1, 2$. We will refer to this effect as the *prize effect*. The second effect is the higher cost of lottery spending as the additional ticket reduces consumption c_i by p, resulting in the utility loss of $pU'(c_i)$ occurring with probability $n^* f_i$. We will refer to the second effect as the *cost effect*. As for the remaining terms of the first-order condition in Equation (5), term $(f_1 + f_2)U(c_0)$ captures the opportunity cost of winning a prize. The last term captures the disutility of additional lottery spending for the outcome when no prize is won.

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4 | LOTTERY SPENDING PROPERTIES

In this section, we analyze the comparative statics of lottery spending with respect to income y, price p, and, most importantly, prizes x_1 and x_2. We assume a prize structure such that only winning the first prize brings consumption at or above the reference point, namely, $x_1 \geq r$, whereas $x_2 + y < r$. This assumption is arguably consistent with the Mega Millions and Powerball lotteries, where for most draws the value of the second prize lies below the average U.S. household lifetime income, unlike the value of the first prize.[4] The implication of this assumption is that we have $U''(c_1) < 0$ whereas it can be that $U''(c_2) > 0$. In what follows, we consider only the case when utility U is convex at c_2.

Applying the Implicit Function Theorem to the first-order condition in Equation (5), we obtain after transformations the derivative of the optimal lottery spending with respect to income y equal to

$$\frac{dn^*}{dy} = \frac{1}{p} + \frac{f_1\left(U'(c_0) - U'(c_1)\right) + f_2\left(U'(c_0) - U'(c_2)\right)}{-EU''(n^*)}. \tag{6}$$

The sign of this derivative is ambiguous as the second term on the right-hand side can be negative because of the convexity of utility U at c_2. This observation is consistent with the inconclusive findings of Lockwood et al. (2025) on the sign of the income elasticity of lottery spending based on within-consumer income variation. At the same time, they report a negative between-consumer (cross-sectional) income elasticity, which can be related to the share of people with non-zero spending declining with income. The declining extensive margin of lottery spending is an implicit feature of our model as the necessary condition $y < r$ for non-zero lottery spending is less likely to hold at larger levels of income. Thus, the model can be consistent with both negative between-consumer and positive within-consumer income elasticities.

Next, we consider the price semi-elasticity of lottery spending. It is determined by $\xi_p = \frac{d \ln n^*}{dp}$ and is equal to

$$\xi_p = -\frac{1}{p} + \frac{U'(c_0)}{n^* EU''(n^*)}. \tag{7}$$

As expected, the sign of the price semi-elasticity is negative and the size appears to be inversely dependent on price p. While the latter observation is at odds with the assumption of constant price semi-elasticity made by Lockwood et al. (2025), coincidentally their reported semi-elasticity of -0.5 may not be distant from our theoretical prediction calculated for $p = 2$, which is the present ticket price of the Powerball and Mega Millions lotteries.

The most contentious and interesting finding reported by Lockwood et al. (2025) about lottery spending behavior is that consumers respond only to an expected value change in the first prize but not in the second prize.[5] We demonstrate that this difference in behavior arises naturally in our model. Consider the derivatives of the optimal lottery spending with respect to prizes x_1 and x_2, which are respectively given by

$$\frac{dn^*}{dx_1} = \frac{f_1\, U'(c_1) - n^* f_1 p\, U''(c_1)}{-EU''(n^*)}, \tag{8}$$

$$\frac{dn^*}{dx_2} = \frac{f_2\, U'(c_2) - n^* f_2 p\, U''(c_2)}{-EU''(n^*)}. \tag{9}$$

As winning the first prize brings consumption c_1 above the reference point, we can immediately establish that derivative dn^*/dx_1 is positive because of $U''(c_1) < 0$. The sign of the derivative dn^*/dx_2 is, however, ambiguous because $U''(c_2)$ may be positive for $c_2 < r$. In that case, an increase in the second prize raises the prize effect of additional spending $\left(f_2 U'(c_2) > 0\right)$ but simultaneously raises the cost effect $\left(n^* f_2 p\, U''(c_2) > 0\right)$. The two forces may offset each other, so a larger second prize need not induce higher optimal spending. In contrast, a larger first prize increases the prize effect of additional spending and also lowers its cost effect because consumption c_1 is outside the loss aversion region, $c_1 > r$.

Lockwood et al. (2025) estimate the semi-elasticities of lottery spending with respect to the first and second prize expected values at approximately 1.7 and 0, respectively. We calibrate our model to reproduce these values in the lottery environment analyzed by Lockwood et al. (2025). The first and second prizes are set to 25,857,104 and 471,255,

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TABLE 2 Calibrated reference-dependent preference parameters.

Parameter	Value
η	0.445
λ	1.762
α	1.21×10^{-5}
μ	7.67×10^{-9}
ν	1.31×10^{-6}
r	$2.394W$

respectively, reflecting expected splitting among winners, taxation, and the conversion of the advertised annuity into a present value. The expected value of the two large prizes is fixed at 0.35, allocated in a 3.3 : 1 ratio between the jackpot and the second prize, which yields probabilities $f_1 = 3.904 \times 10^{-9}$ and $f_2 = 8.583 \times 10^{-8}$. The expected value of all remaining prizes is also 0.35 per ticket and is deducted from the face value of a $2 ticket, resulting in an effective ticket price of 1.65. Lottery prizes are evaluated relative to continuation wealth, calculated as annual income multiplied by the remaining working horizon and adjusted for taxes. Using annual income of approximately $72,000 (tab. 5 of Lockwood et al., 2025), a 20-year horizon, and a 0.7 after-tax factor, continuation wealth is $W = 72,000 \times 20 \times 0.7 = 1,008,000$. The reference point r in our model is specified as a multiple of this value. Preferences follow the CARA specification used earlier in the paper, with reference dependence around r governed by separate curvature parameters for gains and losses and a loss aversion coefficient.

Prize semi-elasticities are computed as

$$\xi_i = \left(\frac{\Delta n^*}{\Delta ev_i}\right)\frac{1}{n^*},$$

where Δev_i is a perturbation of the expected value associated with prize x_i and Δn^* is the induced change in optimal spending. A wide grid of parameter values is explored, and the best grid point is refined through a local search. The resulting calibrated parameters, rounded for presentation, are reported in Table 2. With these parameters, the model produces semi-elasticities of $\xi_1 = 1.7$ and $\xi_2 = 0.0$ for perturbations $\Delta ev_1 = \Delta ev_2 = 0.01$. The calibrated parameters display the expected asymmetry between the curvature of utility in gains and losses. In particular, the loss-side curvature parameter ν is substantially larger than the gain-side parameter μ, and the loss-aversion parameter $\lambda = 1.762$ lies within the range of values typically found in experimental and empirical studies. This asymmetry is important for generating a sufficiently strong cost effect of additional spending, which in turn allows the model to reproduce the pronounced difference between the jackpot and second-prize semi-elasticities.[6]

5 | CONCLUSION

In this paper, we propose a new explanation for lottery participation, which can be viewed as a variant of prospect theory with subjective reference points. It is based on the idea, echoing the stoic aphorism in the epigraph, that lottery participants see themselves as falling short of a target income. We show that the utility form hypothesized by Friedman and Savage (1948) can emerge under this interpretation and can generate positive lottery spending with properties consistent with the puzzling elasticities documented in Lockwood et al. (2025).

It should be emphasized, however, that subjective reference points are offered as one factor alongside other well-documented forces such as subjective probability weighting, perceptual biases, and mental accounting. Future work could examine the contribution of this mechanism within a broader framework as, for example, in Lockwood et al. (2025) that allows multiple channels to operate jointly. Before undertaking such an exercise, a prospect theory with subjective reference points should first be tested in controlled experiments. In such environments, one could contrast the predictions of models based on subjective probability weights with those based on subjective reference points, analyze their interaction, and assess their relative importance. For instance, a model with subjective probability weights would not predict differences between lottery participants and non-participants in settings without small-probability events, whereas a model with subjective reference points would.

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DATA AVAILABILITY STATEMENT

Data sharing not applicable to this article as no datasets were generated or analyzed during the current study.

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ENDNOTES

[1] Lockwood et al. (2025) show that the neo-additive weighting function of Chateauneuf et al. (2007) can be fitted to match the observed semi-elasticities, but this requires decision weights that place disproportionately high weight on the jackpot relative to the second prize. As they emphasize, these weights need not reflect beliefs about probabilities and may instead depend on factors such as advertising or game salience.

[2] Formally, one may write $f_1 = 1/N$ and $f_2 = m_2/N$, where m_2 denotes the number of second prizes. In the case of the Mega Millions or Powerball lotteries, winning probabilities f_1 and f_2 are of the order of 10^{-8} and 10^{-7}, respectively. The outcome of winning both the first prize and a second prize or winning two second prizes is highly unlikely given the amounts of lottery tickets bought by individuals in practice; see Lockwood et al. (2025) for descriptive statistics.

[3] The prospect theory of Kahneman and Tversky (1979) also uses current income as the reference point, which, as Markowitz (1952, p. 157) highlights, may be a limitation. In general, social sciences lack a unified theory that specifies how reference points are selected, though some empirical attempts in this direction do exist, see Baillon et al. (2020). Also see Reck and Seibold (2026) for a recent approach and debate about how to treat reference points in economic analysis.

[4] See Lockwood et al. (2025) for the prize structures of these lotteries.

[5] This empirical finding can be related to preference for positive skewness, see Machina (1982).

[6] We note that while the model based on subjective reference points can match the prize semi-elasticities reported in Lockwood et al. (2025), it does not by itself provide a close fit for all elasticities and related moments presented there. This is not surprising, since the model abstracts from several well-documented behavioral factors known to affect lottery demand, including probability weighting, perceptual biases, and mental accounting. Reference dependence should therefore be viewed as one such factor rather than a complete account.

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