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Impact of lottery promotion wins and losses: evidence from a mobile payment service

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Abstract

Purpose – Lottery promotion is a gambled price discount that provides random incentives for each consumer transaction. This study investigates how winning (i.e. being selected exactly once during the promotion) and losing (i.e. never being selected) influence consumer payment both during and after the promotion.

Design/methodology/approach – Using data from a lottery promotion conducted by a Japanese mobile payment provider, we applied a difference-in-differences with propensity score weighting approach. By comparing winners and losers, respectively, to non-participants, we estimated the causal effects of winning and losing on consumer payment during and after the promotion.

Findings – The results show that, during the promotion, even those who lost the lottery increased their payment amounts compared to non-participants and winners demonstrated a larger increase than losers. Furthermore, after the promotion, losing still led to higher payment amounts relative to non-participation, while winning produced an even greater increase than losing.

Originality/value – Few previous studies have focused on the losing effect, used non-participants as a baseline or examined the post-promotion period. This study fills an important research gap by identifying and comparing the causal effects of winning and losing on consumer payment during and after the promotion. Academically, it extends uncertainty resolution theory to scenarios involving losses and provides empirical evidence for habit formation driven by the promotion experience, independent of incentive receipt. By discussing these effects, this paper also provides comprehensive insights into the cost-effectiveness and design of lottery promotions and offers significant practical implications.

Keywords Uncertainty, Lottery promotion, Mobile payment, Field experiment, Difference-in-differences

Paper type Research article

1. Introduction

To capture consumer interest, many companies adopt lottery promotions where a random lottery occurs with each payment and offer consumers the chance to win incentives (Ho *et al.*, 2022; Mazar *et al.*, 2017; McDonald's, 2024). Specific examples of lottery promotions include the campaign by McDonald's (McDonald's, 2024) and the discounts or cashback campaigns by mobile payment services such as WeChat Pay and Alipay (Ho *et al.*, 2022). There are two types of lottery promotions: participants are guaranteed to receive incentives, and participants may not necessarily receive an incentive. In particular, the latter type of lottery promotion is more cost-effective for companies than the former one because they only need to provide incentives to winners.

In lottery promotions where not all participants win, evaluating how winning and losing influence consumer payments during and after the promotions is important to optimize the design for short- and long-term profitability. Participants are divided into winners, who receive incentives, and losers, who do not. Although both winners and losers have the opportunity to receive incentives during the promotions, no incentives are offered after the promotions.

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The effects of winning and losing during promotions are key to driving short-term profitability, as the excitement of participation can encourage higher payment levels from winners and losers. Furthermore, understanding their effects after promotions is essential to fostering long-term customer loyalty, which is closely related to the sustained profitability of companies (Zhang *et al.*, 2010). Although winners may feel satisfied and continue to engage, losers may experience frustration, which could reduce their future payments. Therefore, understanding these effects during and after the promotions is critical to designing lottery promotions that are profitable in the short and long term.

Despite the importance of understanding the effects of winning and losing in lottery promotions during and after, to the best of our knowledge, the existing literature on lottery promotions does not provide evidence examining these effects across both phases. The existing literature lacks consensus on the effectiveness of lottery promotions. Some studies have questioned their effectiveness (e.g. Gneezy *et al.*, 2006; Hardisty and Pfeffer, 2017; Newman and Mochon, 2012; Simonsohn, 2009) and have indicated that consumers perceive the uncertainty of winning as a risk and prefer certain promotions that guarantee incentives over lottery promotions. On the other hand, numerous studies highlight the effectiveness of lottery promotions compared to certain promotions (e.g. Ailawadi *et al.*, 2014; Alavi *et al.*, 2015; Dhar *et al.*, 1995; Goldsmith and Amir, 2010; Lee and Qiu, 2009; Li *et al.*, 2022; Mazar *et al.*, 2017; Shen *et al.*, 2015; Shen *et al.*, 2019; Tan and Chen, 2021). These studies suggest that lottery promotions create positive effects by generating excitement, surprise, and curiosity among consumers. While these studies offer insights into effective conditions for lottery promotions, they primarily focus on scenarios without losers, where incentives are guaranteed. Consequently, they do not directly estimate the causal effects of winning and losing in lottery promotions, where winners and losers co-exist. Furthermore, most existing research has concentrated on the effects of promotions during promotions, while their post-promotion effects have received relatively little attention.

To address this issue, this study empirically examines the effects of winning and losing in a lottery promotion, analyzing behavioral changes during and after the promotion. Using transaction data from a mobile payment provider, we compare the payments of winners and losers with a control group of non-participants. To the best of our knowledge, this study is the first to use a natural field experiment to distinguish the effects of winning from losing by comparing them against a non-participant baseline, and to track their persistence post-promotion. Specifically, this study seeks to comprehensively evaluate these effects by first quantifying the causal effects of winning and losing compared to non-participants. Building on this, we then directly compare the winning effect with the losing effect to understand their relative magnitude, and finally examine the persistence of both effects over time to assess their long-term behavioral consequences.

A key challenge in analyzing these data arises from the voluntary nature of participation in lottery promotions, which leads to a non-random selection of participants and non-participants. Intuitively, the participants can exhibit higher loyalty to the mobile payment service than the non-participants, potentially leading to overestimating the effects. To address this selection bias, we adopt a difference-in-differences (DID) approach with propensity score weighting (Abadie, 2005) as our identification strategy. This approach ensures that covariates that can cause selection bias between participants and non-participants are adequately adjusted, enabling the proper quantification of winning and losing effects (Angrist and Pischke, 2014; Rosenbaum and Rubin, 1983). Furthermore, by designing this identification strategy to account for time-varying treatment effects, we can quantitatively assess the causal effects of winning and losing separately during and after promotion, recognizing that the effects can follow different trends in these phases.

Our investigation reveals key findings during and after the promotion. First, we found that losing increased payments during the promotion while winning had an even more significant impact on payment increases than that of non-participants. These results are consistent with the theory of uncertainty resolution discussed in previous research (e.g. Lee and Qiu, 2009; Ruan

et al., 2018; Shen *et al.*, 2019). Second, we found that consumer payments after the promotion period increased for winners and losers compared to non-participants, with winners showing a more significant effect than losers. These findings suggest that repeated payments during promotion encourage habit formation among consumers, consistent with existing literature on habit formation (e.g. Neal *et al.*, 2012; Wood and Neal, 2009).

The remainder of this paper is organized as follows. Section 2 explains the theoretical background and develops the hypotheses. Section 3 explains the data used in the study and describes the econometric approach used to test the proposed hypotheses. Section 4 presents the results, and Section 5 discusses the findings and their marketing implications, concluding this paper.

2. Hypotheses development

To understand the effects of winning and losing in lottery promotions during and after, we explain their connections with uncertainty promotions, uncertainty resolution, and habit formation and develop the corresponding hypotheses.

2.1 Uncertainty promotions

Uncertainty promotions are uncertain marketing tactics, where companies intentionally remove information about promotions to stimulate consumer interest (Kovacheva and Nikolova, 2023). The main information concealed in such promotions is the incentive consumers can receive: for monetary promotions involving discounts or cashback (e.g. Alavi *et al.*, 2015; Mazar *et al.*, 2017), and for non-monetary promotions offering products (e.g. Goldsmith and Amir, 2010; Laran and Tsiros, 2013). Lottery promotions are a common form of uncertainty promotions, in which a random lottery occurs with each payment (e.g. Alavi *et al.*, 2015; Goldsmith and Amir, 2010; Mazar *et al.*, 2017).

The existing literature presents different opinions on the effectiveness of lottery promotions. Some studies have questioned their efficacy (e.g. Eskinazi *et al.*, 2024; Gneezy *et al.*, 2006; Hardisty and Pfeffer, 2017; Newman and Mochon, 2012; Rydval *et al.*, 2009; Simonsohn, 2009). These studies suggest that consumers perceive the uncertainty of obtaining incentives as risky, leading them to prefer certain promotions with guaranteed incentives. Gneezy *et al.* (2006) proposed the *uncertainty effect*, where people value uncertain options lower than their worst possible outcome. Hardisty and Pfeffer (2017) identified that participants prefer immediate gains and losses when the future is uncertain and future gains and losses when the present is uncertain.

On the other hand, many studies have suggested that lottery promotions can be more effective than certain promotions (e.g. Ailawadi *et al.*, 2014; Alavi *et al.*, 2015; Attari *et al.*, 2022; De Vries and Zhang, 2020; Dhar *et al.*, 1995; Goldsmith and Amir, 2010; Laran and Tsiros, 2013; Lee and Qiu, 2009; Li *et al.*, 2022; Mazar *et al.*, 2017; Shen *et al.*, 2015; Shen *et al.*, 2019; Tan *et al.*, 2019; Tan and Chen, 2021; Tan, 2023). These studies have indicated that lottery promotions generate positive effects by evoking feelings of enjoyment, surprise, and curiosity in consumers (e.g. Gupta *et al.*, 2020; Laran and Tsiros, 2013). Previous studies highlighting the positive aspects of lottery promotions include those of Goldsmith and Amir (2010) and Alavi *et al.* (2015). Goldsmith and Amir (2010) found that consumers respond positively to lottery-based incentives as though they expect the best possible outcome among the possible winning options. Alavi *et al.* (2015) focused on the post-promotion phase and showed that lottery promotions could mitigate the negative impact on repeat purchases of consumers after the promotion compared to certain promotions.

Table 1 summarizes the key existing studies on the effectiveness of lottery promotions and highlights the differences from our study. To provide a comprehensive comparison, Table 1 examines four critical aspects of existing studies: whether natural field experiments were conducted, whether comparisons included non-participants, whether lottery winners and losers were analyzed, and whether post-promotion effects were investigated. Natural field

Table 1. Qualitative comparison between existing studies on lottery promotions and this study

References	Natural field experiment	Control: non-treatment	Winners/losers	Post-treatment
Gneezy *et al.* (2006)				
Rydval *et al.* (2009)				
Simonsohn (2009)				
Newman and Mochon (2012)				
Hardisty and Pfeffer (2017)				
Eskinazi *et al.* (2024)				
Dhar *et al.* (1995)	✓			
Lee and Qiu (2009)				
Goldsmith and Amir (2010)	✓			
Laran and Tsiros (2013)	✓			
Ailawadi *et al.* (2014)				
Alavi *et al.* (2015)	✓	✓		✓
Shen *et al.* (2015)				
Mazar *et al.* (2017)	✓			✓
Shen *et al.* (2019)	✓			
Tan *et al.* (2019)				✓
De Vries and Zhang (2020)				
Tan and Chen (2021)				
Attari *et al.* (2022)				
Tan (2023)				
Ours	✓	✓	✓	✓

Note(s): Natural field experiment (Harrison and List, 2004) indicates whether natural field experiments were conducted. Control: non-treatment represents whether comparisons included non-participants. Winners/losers denotes whether lottery winners and losers were analyzed. Post-treatment indicates whether post-promotion effects were investigated

Source(s): Authors' own work

experiments are experiments in which subjects naturally experience treatments and do not know they are being studied (Harrison and List, 2004). As shown in Table 1, to the best of our knowledge, this study is the first to empirically conduct a natural field experiment that quantitatively evaluates the effects of winning and losing in lottery promotions to compare winners and losers with non-participants and to examine these effects during and after the promotions.

2.2 Uncertainty resolution

Consumer payments during lottery promotions could increase as participants resolve their uncertainty. Loewenstein (1994) defined the concept of the knowledge gap as the discrepancy between what one knows and wants to know and stated that curiosity arises from the desire to close this gap. This prior study assumed that actions to resolve uncertainty contribute to closing the knowledge gap, which implies that individuals are motivated to act to resolve uncertainty. Inspired by Loewenstein (1994), Hsee and Ruan (2016) considered that humans have the desire to resolve uncertainty and demonstrated that even when the expected outcome is negative, individuals are more likely to act when the outcome is uncertain than certain.

This desire to resolve uncertainty, initially discovered in psychological contexts, has been suggested to have applications in marketing (e.g. Lee and Qiu, 2009; Ruan *et al.*, 2018; Shen *et al.*, 2019). Lee and Qiu (2009) demonstrated through laboratory experiments using hypothetical rewards that uncertain events with positive potential elicit stronger positive emotions than certain events of equivalent attractiveness. Ruan *et al.* (2018) investigated this desire to resolve uncertainty in the context of consumer information acquisition. They showed that withholding some details creates uncertainty, which, when resolved, leads to a more positive experience than providing all information at once.

As a study focusing on lottery promotions, Shen *et al.* (2019) introduced the *reinforcement-uncertainty effect* and demonstrated that even when the monetary value of lottery promotions is lower than that of certain promotions, lottery promotions encourage more repeated participation. To explain this effect, they introduced two types of utility: *outcome acquisition utility* and *uncertainty resolution utility*. The outcome acquisition utility defined how one feels about the outcome, while the uncertain resolution utility represents how one feels about knowing the unknown. They assumed that lottery promotions are more effective than certain promotions because they provide both types of utility simultaneously, whereas certain promotions only provide outcome acquisition utility.

However, while the previous study identified the existence of uncertainty resolution utility in controlled settings, it primarily focused on scenarios where participants were guaranteed to win an incentive, thus always receiving both utilities. Therefore, it did not examine situations where participants may not receive incentives because they lost in lottery promotions. Furthermore, since this study focused on comparing lottery promotions with certain promotions during the promotions, it did not quantify and directly compare the effects of winning and losing in lottery promotions during and after the promotions.

To address these gaps, we extend the two-utility framework proposed by Shen *et al.* (2019) to a more common and managerially relevant scenario: lottery promotions where participants can, and often do, lose. We propose that the two utilities can be decoupled to explain the differing effects on winners and losers. Specifically, we argue that losers, while receiving no tangible prize and thus zero outcome acquisition utility, still experience uncertainty resolution utility. This psychological reward is particularly accessible in the context of our study, as participation is seamlessly integrated into routine payment activities. Resolving uncertainty, therefore, requires no additional effort or monetary cost beyond the expenditure consumers would have made anyway. This low-cost and rewarding experience, driven by curiosity and the desire to close the knowledge gap, can function as positive reinforcement, encouraging repeated payments. Therefore, even participants who never win (losers) should increase their payment compared to non-participants. In contrast, winners experience a dual benefit. They receive the same uncertainty resolution utility as losers, plus the tangible outcome acquisition utility from the prize they win. Combining these two positive utilities should create a more powerful reinforcing effect than the single utility experienced by losers. This leads to the prediction that winners will demonstrate a significantly larger payment increase. Consequently, we propose the following hypotheses:

H1. Losers in lottery promotions exhibit more increased payment during the promotions than non-participants.

H2. Winners in lottery promotions exhibit more increased payment during the promotions than losers.

2.3 Habit formation

Consumer payments after lottery promotions could increase according to habit formation. Early research on habit formation (Hull, 1943) explained it as a mechanism of associative learning and stimulus-response processes. In this paradigm, habitual behavior has been conceptualized as an automatic response governed by minimal or virtually no cognitive attention (e.g. Posner and Snyder, 1975; Shiffrin and Schneider, 1977). Specifically, when individuals repeatedly perform a specific behavior in a given context, they consistently repeat the same behavior in similar or identical contexts (Neal *et al.*, 2012; Marchette *et al.*, 2011; Muraven and Baumeister, 2000; Wood and Neal, 2009).

Habitual behavior has been considered a significant area of study in the marketing context, and numerous studies have examined the impact of habits on consumer purchase (e.g. Bell *et al.*, 1998; Corstjens and Lal, 2000; Ehrenberg and Goodhardt, 1968; Ji and Wood, 2007; Liu-Thompkins and Tam, 2013; Odin *et al.*, 2001; Shah *et al.*, 2014). Ji and Wood (2007)

investigated the underlying mechanisms of daily consumption of consumers and demonstrated that habitual behavior could be triggered regardless of consumer intentions. Liu-Thompkins and Tam (2013) showed that consumer repeat purchases are driven by habits and highlighted the importance of incorporating behavior repetition into promotional activities. Shah *et al.* (2014) demonstrated that marketing strategies, including promotions, can temporally influence customer habit formation.

Furthermore, several studies have reported the effects of habit formation in the context of promotions for the payment service analyzed in this study (e.g. Ho *et al.*, 2022; Wang *et al.*, 2019). Wang *et al.* (2019) used the push-pull-mooring framework (Bansal *et al.*, 2005; Chen *et al.*, 2023) and demonstrated that monetary incentives from promotions in this mobile payment service positively induce switching behavior from other mobile payment services. They also showed that consumers continue to use this mobile payment service, even when other services offer monetary incentives. Ho *et al.* (2022) demonstrated that promotions for mobile payment services induce switching from cash users and that this behavior persists even after the promotions.

Although the findings of Wang *et al.* (2019) and Ho *et al.* (2022) are valuable for understanding the effects of promotions on habit formation, they were limited to cases where consumers receive incentives through promotions. Our study extends this understanding by examining how habits are formed even when participants can lose. As discussed in Subsection 2.2, the desire for uncertainty resolution can drive repeated payments even in the absence of a win. This repeated behavior during promotion can serve as the primary mechanism of habit formation (Neal *et al.*, 2012; Wood and Neal, 2009). Specifically, we argue that the repeated transactions made by losers to experience uncertainty resolution utility are sufficient to foster a new payment habit. This newly formed habit is expected to persist even after the promotion ends, leading to sustained payment levels higher than those of non-participants who did not undergo this behavioral repetition. Furthermore, the strength of a habit is known to be proportional to the frequency of the behavior that formed it (Wood and Neal, 2009). As argued in Subsection 2.2, winners are expected to increase their payments more significantly during the promotion, driven by the dual forces of outcome acquisition and uncertainty resolution utility. This higher frequency of payments should build a more robust habit compared to that formed by losers. This stronger habit is then expected to translate into a greater and more persistent increase in payment behavior after the promotion. Therefore, we propose the following hypotheses:

H3. Losers in lottery promotions exhibit more increased payment after the promotions than non-participants.

H4. Winners in lottery promotions exhibit more increased payment after the promotions than losers.

3. Data and methodology

3.1 Data

We analyze incentive acquisition data from a lottery promotion conducted by a mobile payment provider in Japan and the provider's mobile payment transaction histories. Users of this mobile payment service could use a smartphone app with Quick Response (QR) codes to complete transactions in daily settings such as convenience stores, supermarkets, drugstores, electronics retailers, and restaurants.

The provider conducted the lottery promotion from January 31, 2023, to February 28, 2023. Users were required to explicitly opt-in via the app for participation. After enrolling, they could enter the lottery for every payment of 500 yen or more during the promotion. Participants could enter the lottery multiple times, and each lottery resulted in a win or a loss notification. The winners received points corresponding to their prizes, while the losers were not awarded

points. The prizes consisted of three prizes: first, second, and third. The winners of each prize earned points equivalent to 100%, 10%, or 0.2% of their transaction amount, respectively. These points were redeemable as cash-equivalent value (1 point = 1 yen) and could be used for subsequent transactions. Although participants could enter the lottery multiple times, once their accumulated points exceeded 10,000, they became ineligible for further participation.

These data have two key features that are ideal for conducting our research. First, participation in the lottery promotion was voluntary, relying entirely on users' initiative to engage. This feature provides a clear baseline for comparing winners and losers and quantifying the winning and losing effects. Second, in this lottery promotion, a lottery occurred randomly with each participant's payment. This feature ensures the presence of both winners and losers among the participants. The data enables us to quantify the causal effects of winning and losing in promoting consumer payment by appropriately adjusting for confounders and comparing the participants with non-participants.

Data were collected for approximately 16 months, including three months before promotion, the one-month promotion period, and 12 months after. Note that no similar campaigns were opened to users after the promotion. To ensure the robustness and clarity of our findings, this analysis focuses on specific, representative user groups. We excluded users who won the first or second prizes because their small number (less than 1% of total participants) precluded robust statistical analysis. Furthermore, we focused on the effect of a single win for two key reasons: theoretical clarity and methodological rigor.

First, from a theoretical standpoint, isolating a single win is crucial for cleanly separating the effects of the two utilities. The initial win provides the purest measure of the marginal impact of "outcome acquisition utility." Subsequent wins, however, would introduce confounding psychological factors such as learning effects, evolving expectations of future wins, or the diminishing marginal utility of prizes. By defining our winners by a single, minimal win, we can more precisely attribute the behavioral difference between winners and losers to acquiring the outcome, free from these complexities. Given that more than 70% of participants never won or won the third prize just once, this design choice also ensures our findings are based on the most common and representative user experiences.

Second, from a methodological perspective, analyzing multiple wins presents significant challenges related to endogeneity. The number of wins is endogenous to the number of transactions; users who transact more frequently are inherently more likely to win multiple times. This makes it difficult to disentangle the causal effect of winning from the user's pre-existing high-frequency behavior. A rigorous analysis of multiple wins would require advanced econometric models to address this endogeneity, which is beyond the scope of our primary research question.

Therefore, our focused design, comparing users who won the third prize once (winners) against those who never won (losers), is not a limitation but a deliberate strategy. It allows for a direct and rigorous comparison between a pure uncertainty resolution utility experience (for losers) and an experience combining that with a marginal outcome acquisition utility (for winners). This sharp contrast provides a robust and methodologically sound framework for testing our core hypotheses. For our analysis, a random sample of 10,000 users from each of these groups, along with non-participants, was drawn.

3.2 Methodology

A key challenge in estimating these effects is the endogeneity associated with user-voluntary selection in the promotion. If the winning and losing effects are quantified simply by comparing these two groups, differences in characteristics between participants and non-participants can result in selection bias. Intuitively, users who habitually use the mobile payment service are more likely to participate in the promotion.

To address this endogeneity, we employ a DID with propensity score weighting approach, proposed by Abadie (2005) and adopted in several studies in management research

(e.g. Arslan *et al.*, 2023; David R. Bell *et al.*, 2018). This strategy allows us to estimate the causal effects of the promotion by mitigating selection bias from both observable and unobservable factors. The validity of the DID framework fundamentally relies on the parallel trends assumption (Angrist and Pischke, 2014), which is the notion that, in the absence of the promotion, the outcome trends for the participants and non-participants would have been parallel. However, since participation in the promotion is voluntary, participants and non-participants likely differ in their baseline characteristics (e.g. pre-existing loyalty or usage frequency), potentially violating this assumption.

To address this challenge, our strategy proceeds in two complementary steps. First, to make the parallel trends assumption more plausible, we account for selection bias based on observable characteristics using propensity score weighting. This initial step aims to create a synthetic control group statistically comparable to the participant group before the promotion begins. This involves calculating the propensity score for each user, which is their conditional probability of participating in the promotion given their observed pre-promotion characteristics (Rosenbaum and Rubin, 1983). By re-weighting the non-participant group using these scores, we can adjust for the initial differences between the groups. This pre-processing step is crucial because it allows us to construct a more appropriate counterfactual and subsequently test whether the parallel trends assumption holds by examining the pre-promotion data (the pre-trend).

Second, using this weighted data, we employ a DID framework to account for unobservable, time-invariant factors (e.g. inherent user motivation) that propensity scores cannot address. In essence, DID identifies the treatment effect by comparing the before-and-after change in an outcome for the treatment group to that of the newly weighted control group (Angrist and Pischke, 2014). We use an event-study DID model, which is an extension that captures the dynamics of the treatment effect over time (e.g. Miller, 2023). This is essential for our research, as we aim to assess the effects' immediate and long-term persistence. Specifically, we estimate the time-varying effects of winning and losing in the promotion for each outcome using the following two-way fixed effects regression, a common approach in DID analysis (e.g. Berman and Israeli, 2022; Bronnenberg *et al.*, 2020).

$$Y_{it} = \beta_0 LOSE_i + \beta_1 WIN_i + \gamma Z_{it} + \sum_{t \neq -1} \tau_{0t} LOSE_i \times Z_{it} + \sum_{t \neq -1} \tau_{1t} WIN_i \times Z_{it} + \epsilon_{it}, \quad (1)$$

where t is a variable representing time periods: $t < 0$ denotes the pre-promotion period, $t = 0$ is the promotion period, and $t > 0$ indicates the post-promotion period. Y_{it} is the outcome variable for the user i at time t. ϵ_{it} is the error term. Z_{it} is a dummy variable for user i at time t. $LOSE_i$ is a variable that equals one if the user i is the loser in the lottery promotion. WIN_i is a variable that equals one if the user i is the winner in the lottery promotion. The parameters of interest, τ_{0t} and τ_{1t}, represent the dynamic causal effects of losing and winning for each period t.

To obtain unbiased estimates of these parameters, we implement the regression using a weighted least squares approach based on the estimator from Abadie (2005). The average treatment effect on the treated (ATT) at time t, which τ_{0t} and τ_{1t} are intended to estimate, is given by

$$\begin{aligned} ATT_t &= \mathbb{E}\left[Y_t^1 - Y_t^0 \middle| W = 1\right] \\ &= \mathbb{E}\left[\frac{Y_t - Y_{-1}}{P(W=1)} \cdot \frac{W - P(W=1|X)}{1 - P(W=1|X)}\right], \end{aligned} \quad (2)$$

where Y_t^1 represents the potential outcome if exposed to the treatment, Y_t^0 represents the potential outcome in the absence of the treatment, W denotes whether the user participated in the promotion, Y_t is the realized outcome at t, Y_{-1} is the realized outcome at $t = -1$, which is

the reference point for the pre-trend, X represents the user's covariates (characteristics). The estimates of ATT_t is given by

$$\widehat{ATT}_t = \frac{1}{N}\sum_{i=1}^{N} \frac{Y_{it} - Y_{i,-1}}{P(W_i = 1)} \cdot \frac{W_i - \widehat{e}(X_i)}{1 - \widehat{e}(X_i)}, \tag{3}$$

where $\widehat{e}(X_i)$ is the propensity score estimated using X_i. If losers are selected as the treatment group, $\widehat{ATT}_t = \tau_{0t}$, and if winners are selected as the treatment group, $\widehat{ATT}_t = \tau_{1t}$ we calculate the weights defined in equation (2) for each user. Specifically, the weight of the treatment group (winners and losers) is 1, and the weight of the control group is $\widehat{e}(X_i)/(1-\widehat{e}(X_i))$. Then, we use them as weights to estimate the weighted least squares to estimate the parameters in equation (1).

Furthermore, our identification strategy requires that the covariate distributions of the treatment and control groups overlap. Even if the two covariate distributions overlap, large biases or variances may occur in regions of the covariate space with limited observations. To address these issues, as shown in Crump *et al.* (2009), we include only users with propensity scores between 0.1 and 0.9 as a subsample that can accurately estimate the ATT_t. This approach improves the reliability of the estimates under our identification strategy using the propensity score weighting.

In our analysis, we calculate the propensity score $\widehat{e}(X_i)$ with logistic regression. The covariates X_i are the total transaction amounts and the number of transactions made by the users 3 months, 2 months, and 1 month before promotion, and the dependent variable is W_i.

4. Results

We first report the results of several robustness checks performed on this identification strategy. Next, we present the main analysis results, which quantify the effects of winning and losing in the lottery promotion during and after the promotion, to test our hypotheses from H1 to H4. To evaluate these hypotheses, we used the total transaction amounts and the number of transactions at each time point t as outcomes of interest.

First, we evaluated whether our identification strategy validly estimates the effects of winning and losing in the promotion. To verify the validity of the identification strategy, we examined pre-trend patterns that support the parallel trends assumption (Angrist and Pischke, 2014), which posits that the trends in the outcomes of the treatment and control groups would have been the same in the absence of treatment. We used the total transaction amounts and the number of transactions during the pre-treatment period to visually examine whether the trends in the outcomes of the winners and losers were parallel to those of the non-participants. This visual examination is standard in the DID literature (e.g. Arslan *et al.*, 2023; Bell *et al.*, 2018).

Figure 1 displays the average trends for the winners (Win) and losers (Lose) as the treatment groups, and the non-participants (Non participation) as the control group using equation (1) with the propensity score weighting.

As shown in Figure 1, the trends in the total transaction amounts and the number of transactions for the winners and losers are parallel to those of the non-participants. Therefore, Figure 1 provides visual evidence supporting the parallel trend assumption.

Furthermore, to verify the parallel trends assumption, we conducted a pre-trend test using equation (1) (e.g. Arslan *et al.*, 2023). Specifically, we focus on the estimates of τ_{0t} and τ_{1t} for $t < 0$ in equation (1). When estimating equation (1) over multiple periods, testing the causal effect for each period involves multiple testing (Callaway and Sant'Anna, 2021). In this multiple testing setting, to appropriately compute the standard errors of the estimated causal effects for each period, we used the bootstrap method (Efron and Tibshirani, 1994). The specific procedure was as follows: First, we performed resampling with replacement from the data to construct bootstrap samples. Next, we estimated equation (1) using these bootstrap

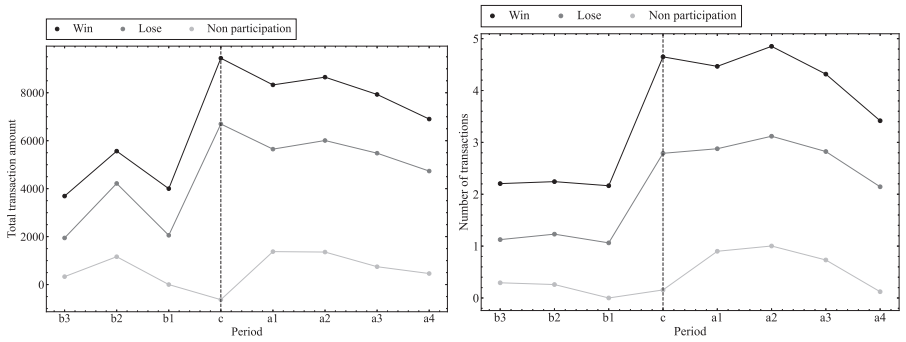

Figure 1. Impact of lottery results on transaction amounts (Left) and number of transactions (Right): A graphical analysis. We calculate the values based on the values one month before the lottery promotion. Variables *b1*, *b2* and *b3* represent one, two and three months before the promotion, respectively; *c* denotes the period of the lottery promotion; and *a1* through *a4* indicate the average values for each period after the promotion, grouping the 12 months following the promotion into intervals of three months. Source: Authors' own work

samples and calculated the estimated causal effects for each period. By independently repeating the above steps B times, we could obtain the empirical distributions of the causal effects of winning and losing in each period. Using the empirical distributions obtained through the above procedure as approximations of the population distribution functions allowed us to calculate the standard errors of the estimated causal effects for each period.

Figure 2 presents the point estimates and 95% confidence intervals of τ_{0t} and τ_{1t} when the results are the total transaction amounts and the number of transactions, respectively, using the bootstrap method with $B = 1,000$. In Figure 2, estimates were calculated relative to one month before the promotion, with *b3* and *b2* representing three and two months earlier, *c* denoting the promotion period, and *a1* to *a4* indicating three-month intervals post-promotion over 12 months. As shown in Figure 2, the estimated values of τ_{0t} and τ_{1t} for total transaction amounts and the number of transactions at *b3* and *b2*, where $t < 0$, are not statistically significant ($p > 0.05$). These results provide quantitative evidence supporting the validity of the parallel trends assumption between the promotion participants (winners and losers) and non-participants. These findings suggest that the assumption of parallel trends is likely to hold, which indicates the validity of our identification strategy. Therefore, the effects τ_{0t} and τ_{1t} estimated using equation (1) can be considered the causal effects of winning and losing in the lottery promotion at time t.

With our identification strategy, we tested our main hypotheses by comparing the promotion's winners and losers with those of its non-participants. Table 2 presents the estimated causal effects of winning and losing in the lottery promotion on the outcomes of interest at each time point t ($t \geq 0$). $t = 0$ represents the promotion period, while $t > 0$ denotes the post-promotion period.

As shown in Table 2, the losing effect led to significant increases in both total transaction amounts ($\tau_{00} = 5,254$, $p < 0.05$) and the number of transactions ($\tau_{00} = 1.58$, $p < 0.05$) during the promotion, supporting H1. The winning effect resulted in even more significant increases in total transaction amounts ($\tau_{10} = 6,061$, $p < 0.05$) and the number of transactions ($\tau_{10} = 2.33$, $p < 0.05$), surpassing the losing effect and supporting H2.

Furthermore, the losing effect significantly increased both total transaction amounts ($\tau_{01} = 2,229$, $\tau_{02} = 2,598$, $\tau_{03} = 2,671$, $\tau_{04} = 2,221$, $p < 0.05$) and the number of transactions ($\tau_{01} = 0.92$, $\tau_{02} = 1.06$, $\tau_{03} = 1.02$, $\tau_{04} = 0.96$, $p < 0.05$) after promotion ($t > 0$). Similarly, the winning effect led to significant increases in total transaction amounts ($\tau_{11} = 2,958$, $\tau_{12} = 3$,

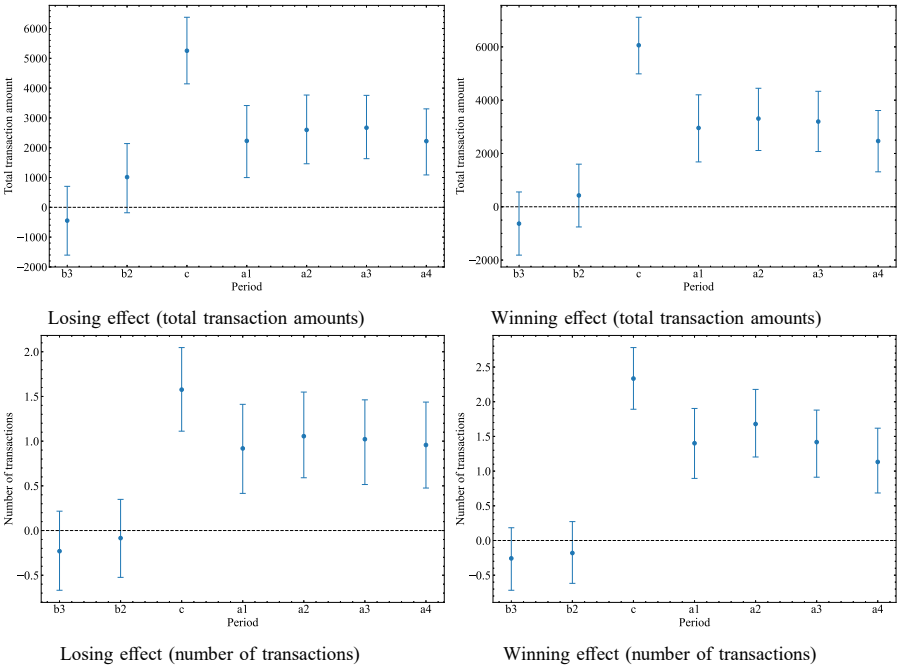

Figure 2. The point estimates and 95% confidence intervals of the losing effect τ_{0t} and the winning effect τ_{1t} when the outcomes were the total transaction amounts and the number of transactions, respectively, using the bootstrap method with $B = 1,000$. The estimates are calculated relative to one month before the promotion, with *b3* and *b2* representing three and two months prior, *c* denoting the promotion period, and *a1* to *a4* indicating three-month intervals post-promotion over 12 months. Source: Authors' own work

310, $\tau_{13} = 3,198$, $\tau_{14} = 2,468$, $p < 0.05$) and the number of transactions ($\tau_{11} = 1.40$, $\tau_{12} = 1.68$, $\tau_{13} = 1.42$, $\tau_{14} = 1.13$, $p < 0.05$). These results demonstrate that, regardless of the lottery's outcome, the total transaction amounts and transaction numbers increase significantly after the promotion, with the winners increasing more than the losers. Therefore, these findings support H3 and H4.

Furthermore, we examine the effects of winning and losing in lottery promotion during and after promotion from a profitability perspective. Assuming that the mobile payment provider earns a transaction fee of 2% from the merchants, the total transaction amount results in Table 2 showed that the increase in transaction fees per user due to the effect of winning the lottery during and after the promotion was 359.90 yen. The increase per user due to the effect of losing was 299.46 yen. Considering these results and the fact that users received an average incentive of 5.3 points when participants were the winners, the profits from the effects of winning and losing were 354.60 and 299.46 yen, respectively. These findings suggest that allowing the participants to be the winners can generate higher profits than allowing the participants to be the losers.

5. Discussion

This study addresses a significant gap in the marketing literature by empirically analyzing the effects of winning and losing in a lottery promotion, both during and after the promotion. Using a DID with propensity score weighting approach, our analysis revealed two key findings. First, winners and losers in the promotion significantly increased their payment

Table 2. Impact of lottery wins and losses

Outcome	Status	*t*	Mean	S.E.	C.I.	Effect size
Total transaction amount	Lose	0	5,254	562	(4,143, 6,377)	0.23
		1	2,229	613	(998, 3,415)	0.09
		2	2,598	591	(1,461, 3,768)	0.11
		3	2,671	561	(1,632, 3,757)	0.12
		4	2,221	564	(1,087, 3,304)	0.10
	Win	0	6,061	555	(4.988, 7,111)	0.27
		1	2,958	633	(1,683, 4,201)	0.12
		2	3,310	601	(2,112, 4,447)	0.14
		3	3,198	568	(2,073, 4,333)	0.14
		4	2,468	582	(1,311, 3,613)	0.11
Number of transactions	Lose	0	1.58	0.24	(1.11, 2.05)	0.18
		1	0.92	0.26	(0.42, 1.41)	0.10
		2	1.06	0.25	(0.59, 1.55)	0.10
		3	1.02	0.24	(0.51, 1.46)	0.10
		4	0.96	0.24	(0.48, 1.44)	0.10
	Win	0	2.33	0.24	(1.89, 2.78)	0.27
		1	1.40	0.26	(0.89, 1.90)	0.14
		2	1.68	0.25	(1.20, 2.18)	0.16
		3	1.42	0.25	(0.91, 1.88)	0.14
		4	1.13	0.24	(0.68, 1.62)	0.12

Note(s): S.E.: Standard error. C.I.: 95% Confidence interval. Effect size indicates Hedges' *g* (Hedges, 1981)
Source(s): Authors' own work

compared to non-participants during the promotion. Second, and perhaps more importantly, these positive effects persisted up to a year after the promotion ended, demonstrating a lasting impact on consumer payment.

The results of this study reveal a significant finding on consumer payment in lottery promotions. Our analysis demonstrates that consumers who participated but never won a prize still significantly increased their payments compared to non-participants. This losing effect adds a new dimension to the conventional understanding of promotional value, which often focuses primarily on the incentive awarded. This phenomenon can be evaluated through the theory of uncertainty resolution. Participating and resolving an outcome's uncertainty is a psychological reward, powerful enough to stimulate repeated transactions. While winners certainly experience a more substantial effect due to the added outcome acquisition utility, the losing effects suggest that the engagement mechanism of a lottery is more complex than a simple cost-benefit calculation.

Furthermore, our findings illustrate a dynamic two-stage process that promotes long-term behavioral change. First, the desire to resolve the uncertainty drives repeated payments during the promotion. Second, this repetition promotes habit formation, resulting in a sustained increase in spending long after the promotion has finished. Consistent with the reinforcement-uncertainty effect and habit formation, the effect is more substantial for winners, whose higher initial transaction frequency appears to build a more robust habit.

This study provides a complete understanding of the costs and benefits of lottery promotions by quantifying these distinct effects for winners and losers over time. The following sections discuss the specific theoretical and managerial implications of these findings.

5.1 Theoretical implications

Our research empirically demonstrated the effects of winning and losing in lottery promotions during and after the promotions, which has not been extensively studied. We offer three main

theoretical contributions. Our first contribution is to present and quantify the effects of winning and losing in lottery promotions through a natural field experiment. We examined these effects both during the promotion when incentives are available and after the promotion when they are not. As summarized in Table 1, our study differs from previous studies in three key aspects. First, since previous studies focused mainly on the effects of winning in lottery promotions without losses, they have not quantified the effects of losing and compared winning and losing. We quantify and compare these effects by targeting lottery promotions that include losses. Second, previous studies typically compared lottery promotions with certain promotions without considering non-participants as a baseline. Conversely, we use non-participants as a baseline to quantify the causal effects of winning and losing. Finally, previous studies focused mainly on winning effects during promotions and did not adequately examine the effects after promotions. In contrast, we examine the effects of winning and losing on consumer payments during and after the promotion and reveal that these effects persisted after the promotion.

Our second contribution focuses on clarifying the effects of winning and losing from the perspective of uncertainty resolution literature. Shen *et al.* (2019), the most relevant prior research on uncertainty resolution, proposed the reinforcement-uncertainty effect, suggesting that lottery promotions encourage more repeat actions than certain promotions. To explain this effect, they introduced two types of utility: outcome acquisition utility and uncertainty resolution utility. They showed that lottery promotions are more effective than certain promotions with only the outcome acquisition utility because lottery promotions offer both utilities simultaneously. However, they assumed that incentives always occurred and did not examine scenarios where incentives could not be obtained. Our study extends their theory in two ways. First, we quantify the losing effect when incentives are not obtained. We show that the losing effect can encourage consumers to make repeat payments even when only the uncertainty resolution utility is present. This study clarifies the effects of lottery promotions on winning and losing, which the previous study had not addressed. Second, using non-participants as a baseline, we quantitatively compare the winning and losing effects as causal effects. We empirically demonstrate that the winning effect, including outcome acquisition and uncertainty resolution utilities, is more significant than the losing effect, including only uncertainty resolution utility. Through a natural field experiment in mobile payments, we support the existence of the two utilities as mechanisms of the reinforcement-uncertainty effect, which offers additional evidence for the theory.

Our third contribution is to demonstrate that lottery promotions encourage habit formation among consumers, regardless of whether they win or lose. Previous studies have extensively investigated how marketing activities, such as promotions, impact the habit formation of consumers (e.g. Ji and Wood, 2007; Liu-Thompkins and Tam, 2013; Shah *et al.*, 2014), and some have explored how promotions affect the habit formation in mobile payment services (Ho *et al.*, 2022; Wang *et al.*, 2019). However, these studies focused on habit formation through incentives obtained during promotions and did not consider that habit formation could also occur when consumers lose in lottery promotions. Our study shows that even when consumers are losers in the lottery promotion, their payments increase during the promotion, and these repeated payments help maintain habitual payments after the promotion. In addition, the more substantial winning effect after the promotion suggests that its significant impact during the promotion encourages more repeated payments, leading to stronger habit formation. These findings align with the mechanisms of habit formation reported in previous studies (Neal *et al.*, 2012; Wood and Neal, 2009). Therefore, we contribute to understanding habit formation in promotions by demonstrating that it can occur even when consumers do not receive monetary incentives.

5.2 Managerial implications

These analysis results provide clear guidelines for marketers considering implementing lottery promotions. Decisions about executing price promotions are often based on intuition or

untested assumptions, which can sometimes contradict academic evidence (Bogomolova *et al.*, 2017). Therefore, this study is also important because it provides evidence to achieve more appropriate promotional methods.

We offer two guidelines based on our analysis. First, when marketers implement lottery promotions that include winning and losing outcomes, they should increase the number of users participating. Our analysis demonstrated that participation in lottery promotions positively affected payment during and after the promotion, regardless of whether consumers win or lose. Therefore, increasing the number of consumers participating in lottery promotions is likely effective. To boost participation, companies could focus on raising awareness through increased publicity or making it easier to join by removing registration requirements. Second, based on our finding that winning yielded higher profits than losing, marketers should increase the number of winners within their limited budgets. Our study found that the effect of winning was greater than that of losing and that even a minimal incentive of 0.2% of the transaction amount on winning is effective. These findings suggest the importance of increasing the number of prizes, even if the incentives are small.

5.3 Limitations and directions for future research

This study has several limitations that leave room for future research. First, we analyzed a lottery promotion with a specific prize structure (first prize: 100% of the transaction amount; second prize: 10%; third prize: 0.2%). It remains unclear how different combinations of prizes in lottery promotions affect subsequent payments when consumers win or lose. Kalra and Shi (2010) showed that consumers' preferences for specific incentive structures in lottery promotions depend on their brand preferences and levels of risk aversion. Furthermore, a study aiming to increase physical activity through lottery promotions (Patel *et al.*, 2018) showed that incentive structures combining a grand prize with small prizes are more effective than those offering only big or small prizes. These findings indicate that responses to lottery promotions, such as winning and losing, can vary depending on the structure and characteristics of the participants' incentives. Future research can explore effective incentive structures for target consumers.

Next, while our analysis focused on the periods during and after the promotion, we have yet to discuss the overall effectiveness of lottery promotions, including the pre-promotion phase. Lottery promotions involve stages before, during, and after promotion (Tang *et al.*, 2022), and some studies have examined the pre-promotion phase (Dhar *et al.*, 1995; Yan and Muthukrishnan, 2014). For example, Yan and Muthukrishnan (2014) demonstrated that the presence of small prizes in lottery promotions could reduce the expectation of winning the grand prize and decrease the intention to participate before the promotion begins. Therefore, future research can integrate the effects observed after participating in lottery promotions, as identified in this study, with the effects before participation to provide guidelines for an effective promotion design.

Moreover, we focused on total transaction amount and number of transactions as they are the two most critical top-line indicators of a promotion's success from a managerial perspective. The total transaction amount directly corresponds to the gross payment volume that drives revenue for payment providers. The number of transactions, in turn, serves as a crucial indicator of user engagement and habit formation, signaling the service's integration into consumers' daily lives. Therefore, a significant increase in these two metrics is a primary objective for any such promotion. However, we acknowledge that these metrics, while paramount, do not capture the full spectrum of behavioral change. For example, they do not distinguish whether an increase in transactions is driven by more frequent small purchases or by an increase in the value per transaction (that is, basket size). They also do not capture the diversification of use, such as whether the promotion encouraged consumers to use the payment service across a broader range of merchant categories. Exploring these more nuanced dimensions of payment behavior, such as its "quality and diversity," represents a valuable

avenue for future research. A multifaceted investigation building on our foundational findings would be a critical step toward a deeper and more comprehensive understanding of the promotion's impact.

Furthermore, although we examined a specific lottery promotion, we have yet to investigate how consumers respond after experiencing multiple promotions. Bass *et al*. (2007) showed that excessive exposure to promotions can decrease consumer responsiveness and reduce the effectiveness of promotions. The prior study suggests that consumers who have experienced multiple lottery promotions may react differently than those who have encountered such promotions for the first time. Future studies could explore the changing effects of promotions over time to guide scheduling and repeating multiple promotions.

Finally, this study has limitations inherent to its natural field experiment methodology. Our primary contribution lies in observing real-world consumer behavior at scale, which provides high external validity. However, this approach does not directly measure the underlying psychological states through subjective indicators such as user surveys, satisfaction ratings, and attitudinal measures. Consequently, the psychological mechanisms we discuss, uncertainty resolution and habit formation, are inferred from observed behavioral patterns. This limitation applies to our two core theoretical constructs in slightly different ways. For uncertainty resolution, we have built a robust theoretical case based on established frameworks (Shen *et al*., 2019) and reinforced by the specific nature of the lottery promotion under study, which allowed for low-cost participation embedded within routine payments. This makes our inference strong, although it remains an inference. For habit formation, while the sustained post-promotion behavior is highly consistent with this theory, it serves as a plausible interpretation rather than a definitive causal proof. Other mechanisms, such as enhanced brand loyalty from the positive promotion experience, could also contribute to this long-term effect. Future research could provide a more complete picture by combining our field experiment approach with post-promotion surveys designed to measure these mediating variables (e.g. perceived excitement, habit strength, brand attitude). Such a mixed-methods approach would be ideal for bridging the gap between observable behavior and the psychological drivers.

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