Why Consumers Buy Lottery Tickets When the Sun Goes Down on Them.

The Depleting Nature of Weather-Induced Bad Moods.

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We propose that weather conditions can influence consumers' engagement in lottery play. A longitudinal study on the extent of lottery play in Belgium shows that lottery expenditures are indeed higher after reduced exposure to sunshine, even after controlling for people's inertia, time-varying characteristics of the game, and deterministic seasonal components. The results of a first laboratory study are consistent with these findings, and establish a link between lottery play and negative mood. Subsequent experiments provide evidence that depletion due to active mood regulation attempts, rather than mood repair, is the underlying process for the link between bad weather and lottery play.

Although scholars disagree on when exactly the ancient tradition of lottery play started, there is general agreement that human beings have engaged in lottery play for a very long time. Archeologists even found evidence of lottery-style games dating back to the Egyptian Pharaohs. Lottery-raised funds have also been used to finance the construction of the Great Wall in China (100 BC), to replenish the French treasury in the mid 1500s, and to help finance the US Revolutionary War (http://www.naspl.org/history.html). Not only is lottery play a phenomenon of all times, it also occurs around the globe. State-operated lotteries are found in about half of the world's countries, and their annual worldwide ticket revenues amounted to $115 billion in 1997 (Garrett 2001).

Several studies have tried to cross-sectionally explain differences in the extent of gambling across individuals (e.g., Suzuki et al. 2003; Yechiam et al. 2005), social strata (e.g., Spiro 1974; Stranahan and Borg 1998), or countries (e.g., Garrett 2001). Another stream of research has focused on explaining over-time variations in gambling activity within the same population (e.g., Farrell et al. 2000; Farrell, Morgenroth, and Walker 1999; Forrest, Gulley, and Simmons 2000a, 2000b; Gulley and Scott 1993; Van Puyenbroeck 2004), linking the extent of lottery play to such factors as customer inertia and time-varying characteristics of the game (we review these characteristics in the introduction section to study 1). In this paper, we investigate whether the amount of sunshine may be another relevant factor. More specifically, we investigate whether and why the amount of sunshine one is exposed to may affect one's willingness to engage in lottery play.

According to Parker and Tavassoli (2000), several behaviors reflect an adaptation to variations in the duration and intensity of sunlight. For example, even though one would expect investors to behave rationally, research has repeatedly shown that stock-market returns are related to climatic indicators as the amount of sunshine (Hirshleifer and Shumway 2003; Saunders 1993). Mittal, Kamakura, and Govind (2004) showed that customer satisfaction with automobiles and dealership service depend on climatic variables, and Parker and Tavassoli (2000) established that consumers adapt to environments with little sunshine through a higher usage of stimulating substances as alcohol, coffee, and tobacco. Because of the thrill of the game, we posit that lottery play could fulfill a similar function as these stimulating substances (Pezza Leith and Baumeister 1996; Steenkamp and Baumgartner 1992; Yechiam et al. 2005). We therefore suggest that a reduced exposure to sunshine may result in increased lottery play (as graphically depicted in the upper part of figure 1). Evidence for this assertion is provided through a longitudinal study in which we analyze over eight years of semiweekly Belgian lottery-expenditure data. Even after controlling for many other relevant drivers, such as people's inertia and time-varying reward characteristics of the game, we find significant support for a link between reduced sunshine in the days preceding the lottery draw and lottery expenditures.

In subsequent laboratory studies, we investigate *why* this link between a reduction in sunlight and an increased engagement in lottery play takes place. We propose that a reduced exposure to sunshine leads to negative mood, which in turn leads to an increased engagement in lottery play (see middle panel of figure 1). The first part of this chain (i.e., the link between sunshine and mood) is well-established in the literature (Cunningham 1979; Eagles 1994; Goldstein 1972; Howerth and Hoftman 1984; Persinger 1975; Sanders and Brizzolara 1982). The neurotransmitters dopamine and serotonin have been identified as mediators between natural sunlight and mood (Molin et al. 1996; Mittal et al. 2004; Parker and Tavassoli 2000; van Praag 1982). The subsequent link between negative mood and lottery play, in contrast, has, to the best of our knowledge, not yet been established in the literature. Therefore, in our second study, we first provide correlational evidence for this second link.

In addition, we test in a sequence of studies (2, 3, and 4) two competing hypotheses as to why this link between bad mood and lottery play occurs. A first hypothesis states that negative moods trigger the goal of mood repair (Tice, Bratslavsky, and Baumeister 2001), which may be realized through engagement in lottery play (Pezza Leith and Baumeister 1996). This reasoning rests on the assumption that engagement in lottery play removes negative affect. It outlines a causal chain in which negative mood leads to an increasing engagement in lottery play through the activation of a mood repair goal (see hypothesis 1 in the lower part of figure 1). In this model, lottery play serves as a means to repair one's bad mood. Hence, lottery play is instrumental to mood repair. For the remainder of the paper, we refer to this causal chain as the *mood repair* explanation for lottery play.

The second hypothesis builds on the theory of self-control depletion. According to the self-regulatory resource model (Baumeister et al. 1998; Muraven, Tice, and Baumeister 1998), all acts of self-control draw on a common limited resource that is akin to energy or strength. Hence, exertion of self-control is followed by a period of diminished capacity to exert subsequent self-control (i.e., self-control depletion). Recently, Baumeister (2002) has outlined the applicability of self-control processes to consumer behavior. People in a state of depletion are found to be more likely to yield to temptation. One instance of yielding to temptation might be to buy lottery tickets. Hence, processes that undermine self-control should lead to more lottery play. One factor that has been argued to weaken self-control is active mood regulation (Baumeister and Heatherton 1996; Vohs and Baumeister 2000). People have been shown to engage in active attempts to regulate their mood whenever they experience negative emotions (Tice et al. 2001). Yet, active attempts to regulate emotions deplete the same common, limited resource that is needed to resist temptations such as an opportunity to buy lottery tickets (Vohs and Baumeister 2000). Thus, this line of reasoning outlines a causal chain in which negative mood leads to active mood regulation attempts that are depleting in nature. In other words, people who experience a negative mood will actively attempt to regulate their mood and in this process consume scarce self-control resources. The resulting state of depletion, in turn, leads to an increasing engagement in lottery play. Indeed, depleted people will have fewer self-control resources left and will suffer from a reduced resistance to the temptation to engage in lottery play (see hypothesis 2 in the lower part of figure 1). In what follows, we refer to this causal chain as the *depletion* explanation for lottery play.

Insert figure 1 about here

If mood repair is the underlying process for the link between bad mood and lottery play, we should find that lottery play is related to the extent to which people feel bad *at the moment* they are given the opportunity to buy lottery tickets. In contrast, if depletion due to active mood regulation attempts underlies the link between bad mood and lottery play, bad mood should increase the engagement in active mood regulation, which reduces subsequent resistance to temptations such as lottery play. It is important to point out that according to this process, we should find that lottery play is related to the extent to which people felt bad *some time before* they are given the opportunity to buy lottery tickets. The latter model implies a lag of several minutes that allows people to engage in active mood regulation attempts (e.g., Baumeister et al. 1998). This model makes no predictions as to people's mood at the moment they are given the opportunity to buy lottery tickets, however. Indeed, although attempts to actively regulate bad moods are likely to lead to decreased self-control resources, these attempts may or may not be successful, that is, they do not necessarily lead to improvements in bad moods (Vohs and Baumeister 2000).

The remainder of the paper is organized as follows. Using an extensive time series of actual lottery expenditures, we first establish the link between bad weather and an increased engagement in lottery play. In three laboratory studies, we show that bad mood is a driver for this phenomenon. We test the mood repair and the depletion accounts of the link between bad mood and lottery play against each other and find evidence for the latter and not for the former. This combination of longitudinal, secondary-data, analysis with various controlled experiments should contribute to the external and internal validity of our substantive conclusions.

STUDY 1

Several studies on gambling behavior have appeared in recent literature. A lot of these studies have focused on *anomalies* in lottery play such as the favorite-longshot bias in horse racing (e.g., Vaughan Williams and Paton 1997) and the gamblers' fallacy in lotteries (e.g., Terrell 1994). The favorite-longshot bias in horse race betting refers to 'underbetting' short-odds (favorite) horses and 'overbetting' long-odds horses relative to their objective probabilities of winning. The gambler's fallacy refers to the bettor's belief that the probability of an event is lowered when the event has occurred recently, although the probability is known to be independent across trials. Other studies have focused on *cross-sectional* differences in gambling behavior

(Suzuki et al. 2003; Spiro 1974; Yechiam et al. 2005). One particularly robust finding in this respect is the observation that poorer people spend a higher percentage of their income on lottery tickets than more wealthy people (e.g., Stranahan and Borg 1998).

At an aggregate level, Garrett (2001) provided an empirical analysis on lottery games across 82 different countries. He found significant differences in sales per capita and in sales as a percentage of GDP per capita across continents and countries. Differences in the income elasticity of demand for lottery tickets across continents and countries were observed as well. These findings provide some indirect evidence that climate might influence lottery play. However, more conclusive evidence for the link between weather conditions and lottery play would be provided by means of a longitudinal study including climate as an explanatory variable.

Several *longitudinal* studies on the underlying drivers of lottery play have already been conducted. Using UK data, Farrell et al. (1999) found that the extent of lottery play was strongly influenced by inertia in consumers' gambling behavior, as the extent of lottery play in the previous period had a significant positive effect on lottery play in the period of interest. It was also found that rollovers heightened the potential addictiveness of numbers games. In another UK study, the impact of both rollovers and super-draws was explained in terms of the changes they induce in the expected value of lottery tickets (Forrest et al. 2000b)[1]. In a related UK study, Forrest et al. (2000a) replicated the finding that sizes of rollovers and super-draws had an important positive impact on the expected value of lottery tickets. In addition, they found evidence that Wednesday lottery draws were significantly less popular than Saturday lottery draws. The latter result was consistent with the findings of Gulley and Scott

[1] Rollovers occur when no player selects the full set of winning numbers in the current draw. The jackpot prize money of the current draw is then added to the jackpot pool for the following draw. Super-draws occur when the game organizers exercise their option to add to the jackpot fund.

(1993), who, in a US setting, found a strong tendency for midweek draws to be less attractive. In another UK study, Farrell et al. (2000) affirmed that rollovers produce increases in the expected value of holding a lottery ticket. Virtually all results were replicated in the Belgian lottery market by Van Puyenbroeck (2004), who also found that the day of the week on which the draw took place (i.e., Wednesday or Saturday), rollovers, and super-draws affected lottery play through changes in the expected value of the lottery tickets.

Taken together, these studies find evidence of systematic patterns explaining variability in lottery play over time. In the present study, we assess whether weather conditions, and more specifically the number of hours of sunshine in the days preceding the lottery draw (i.e., in the period one can buy the tickets), have *additional* explanatory power, even after controlling for these aforementioned factors.

The setting used for our study was the Belgian "lotto game", which is comparable to the games considered in the previous studies. Similar in format to many US state lotteries, the Belgian lotto game is a pari-mutuel 6 / 42 numbers game. The nominal price is fixed and unchanging: € 0.50 must be paid for each combination of six numbers entered in the game. As the Belgian lotto game is very popular (i.e., sales typically amount to about 0.475% of GDP; Garrett 2001), a substantial jackpot pool is generated for each draw. Approximately 50% of this pool is awarded to ticket holders that match different numbers of the balls drawn. The jackpot is shared by those (if any) matching 6 correct numbers and smaller prizes are awarded to players with partially correct entries). The other 50% is shared by the operator, the distributors, and good causes. If no player selects the full set of winning numbers, a rollover is declared and the jackpot prize money is added to the jackpot pool for the following draw. Draws take place semiweekly, on Saturdays and Wednesdays. Rollovers are carried forward from one Wednesday to the next and from one Saturday to the next. Occasionally, the game organizers exercise their option to add to the jackpot fund. This results in a so-called super-draw.

In the study, we assessed whether the weather conditions in the three days preceding a lottery draw affects total lottery expenditures. As the lottery draw takes place in the evening to enable the public to still buy tickets the day of the draw, this amounts to the number of hours of sunshine on the Thursday, Friday and Saturday for Saturday draws, and on Monday, Tuesday and Wednesday for Wednesday evening draws. The sunshine data were accumulated across three days to have a comparable number of days preceding both draws, and to make the level of data aggregation comparable to that of the dependent variable. As such, abstraction was made of the number of hours of sunshine on Sunday.

Data on lottery sales and game characteristics were made available by the National Lottery of Belgium, whereas daily sunshine data were obtained from the Belgian meteorological institute Belgocontrol. Our period of analysis was from October 1993 until August 2002, resulting in 925 semiweekly lottery draws. There was considerable variability in the number of hours of sunshine, ranging from 0.00 to 15.40 (M = 4.49, SD = 4.19). To account for diminishing returns to scale, both the dependent variable (lottery expenditures) and the key explanatory variable (combined number of hours of sunshine in the days preceding the lottery draw) were log-transformed. As a few observations experienced zero sunshine hours, we followed common practice and added a small number to each observation before taking the log-transform.[2] A graph of both series is presented in figure 2. For expository purpose, we present the final year of the data in figure 2 (comparable patterns were obtained in the other years).

[2] The size of this number was varied from 0.1 to 1.0 (reported in table 1), but this did not affect our substantive conclusion on the significance of any of the effects.

The expenditure series clearly shows the influence of occasional super-draws. The jigsaw pattern in the expenditures series also shows that the Saturday draws (odd position in the series) are more popular than Wednesday draws (even position).

Insert figure 2 about here

In line with previous research, we added the following control variables to the model: a dummy variable to indicate whether it was a Saturday draw, two autoregressive terms to account for inertia in people's gambling behavior, an indicator variable to denote whether or not there was a rollover, and the size of the super-draw. The first autoregressive term allows for inertia across draws on two different days (e.g., whether the gambling behavior on Saturday is influenced by one's gambling the preceding Wednesday), whereas the second autoregressive term captures the time dependence across common days. A rollover took place in 13% of the cases, and in 3.6% of the cases, the game organizers exercised their option to announce a super-draw, the amount of which varied in size between € 600,000 and € 5,000,000.

Insert table 1 about here

Parameter estimates and white heteroscedasticity-consistent standard errors are presented in table 1. In line with previous findings (see e.g., Farrell et al. 1999, 2000; Forrest et al. 2000a, 2000b; Gulley and Scott 1993; Van Puyenbroeck 2004), we observed that the day of the week on which the draw took place, inertia in people's gambling behavior, and the presence of rollovers as well as the size of the super-draw (if any) all had a highly significant effect on lottery expenditures. In combination, these findings offer considerable face validity to our model. Most importantly, however, we found that, even though the combined control variables already resulted in an R^2_{adj} of 0.93, the sunshine-variable still had a significant negative effect (β = -0.01, $p < 0.05$) on lottery revenue. This effect stayed significant, even when we controlled for other seasonal influences through the inclusion of two harmonic (sine, cosine) deterministic components (see Hanssens, Parsons, and Schultz 2003, 46, for a review on other marketing applications of this procedure). Hence, *if people are exposed to less sunshine before the lottery draw, lottery expenditures increase,* which confirms our prior expectation.

In the subsequent laboratory studies, we assess some potential underlying mechanisms for this effect. Specifically, two competing explanations for this result are investigated. Both rely on weather-induced negative mood as a potential driver of the link between sunlight exposure and lottery play. One hypothesis states that lottery play could be instrumental for repairing one's bad mood, whereas the other hypothesis states that lottery play might be a mere consequence of depletion due to active mood regulation attempts.

STUDY 2

Study 2 is a laboratory study that is correlational in nature. As already argued, a reduced exposure to sunshine has consistently been found to lead to negative mood (Cunningham 1979; Eagles 1994; Goldstein 1972; Howerth and Hoftman 1984; Persinger 1975; Sanders and Brizzolara 1982). Although the link between sunshine and mood is well-documented in the literature, the link between mood and lottery play is not. Hence, the first aim of study 2 is to demonstrate that lottery play is indeed related to negative mood. Its second aim is to find preliminary support for one of the proposed underlying processes for the link between negative mood and lottery play.

We assessed participants' mood states upon entering the laboratory. Subsequently, participants engaged in a creativity task during which they were given the opportunity to regulate their moods. Afterwards, participants' mood states were assessed once more. Finally, participants were given the opportunity to buy lottery tickets. We expect to find a positive correlation between negative mood and lottery expenditures. In addition, if mood repair explains the link between negative mood and lottery play, negative mood as measured immediately before participants are given the opportunity to buy lottery tickets should be more predictive of lottery expenditures than negative mood as measured some minutes before that opportunity. In contrast, if depletion explains the link, negative mood as measured some minutes before participants are given the opportunity to buy lottery tickets should be more predictive than negative mood as measured immediately before the opportunity to buy lottery tickets. Indeed, according to the depletion explanation, it takes some minutes before mood regulation attempts will lead to a state of depletion (Baumeister et al. 1998), and hence before people will become susceptible to lottery play.

Method

Participants. Participants were 46 undergraduate students (20 men and 26 women). Ages ranged from 18 to 33 years (*M* = 21.78 years, SD = 2.50 years). Participants received € 6 for their cooperation.

Materials and Procedure. A miniature lottery bowl containing 42 lottery balls (i.e., the number of lottery balls used in the Belgian lottery) was placed in the laboratory. Participants came to the laboratory in groups of seven to nine persons. Each participant was assigned a seat in a partially enclosed cubicle and worked individually for the main part of the study. Upon arrival, participants received their participation fee and filled out an informed consent form.

As a first task, the 10 negative affect items taken from the Positive Affect Negative Affect Scale (Watson, Clark, and Tellegen 1988) were administered (i.e., NA1). The 10 negative affect items assessed participants' current mood state. For each item, answers were given on a five-point Likert scale ranging from *Right now, I feel this way very slightly or not at all* (1) to *Right now, I feel this way extremely* (5).

After the set of affect items was administered, participants left their individual cubicles and were asked to collectively engage in a creativity task that allowed them to regulate their mood. As bad mood is a strong incentive to engage in upward mood regulation (Tice et al. 2001), those participants who entered the lab in a bad mood are assumed to engage in active upward mood regulation. Further, as creativity tasks have been shown to induce people to regulate their mood upward (Cohen and Andrade 2004), participants had to engage in a creativity task that lasted for approximately 25 minutes. On turn, they had to pronounce a word of which the first letter had to match the last letter of the previous word.

After the creativity task, participants again took place in the partially enclosed cubicles. Once more, the 10 negative affect items were administered (i.e., NA2). We administered the negative affect items twice (NA1 and NA2) to find out at which moment mood was more predictive of lottery play.

In the next phase of the study, participants were given the opportunity to engage in a pari-mutuel 6 / 42 numbers game. This format was chosen because it corresponded to the real-life format, thereby increasing consistency with the aforementioned longitudinal study on secondary data and providing participants with a sense of familiarity towards the game. Participants were free to determine if and how many lottery tickets they bought. Each ticket cost € .50, and had to be bought with their participation fee. Our dependent measure was each participant's amount of lottery expenditures.

Results and Discussion

We conducted a regression analysis with both indicators of mood as predictor variables and lottery expenditures (overall *M* = € 0.54, SD = € 0.55) as the dependent variable. As gender and age effects did not affect our conclusions, these factors are further ignored. Negative mood as measured at the beginning of the session (i.e., NA1; $\alpha_{NA1} = .85$; *M* = 1.40, SD = 0.41) turned out to be significantly positively correlated with lottery expenditures ($\beta = .07$, $t = 2.05$, $p < .05$). In other words, the worse participants felt when they entered the lab, the higher their lottery expenditures 25 minutes later. This finding supports the hypothesis that lottery play is related to negative mood. In addition, as lottery expenditures were related to the extent to which people felt bad some time *before* they were given the opportunity to buy tickets, this finding is consistent with the depletion explanation. Negative mood as measured immediately before participants were given the opportunity to buy lottery tickets (i.e., NA2; $\alpha_{NA2} = .79$; *M* = 1.31, SD = 0.37), in contrast, did not significantly predict lottery expenditures ($\beta = -.03$, $t = -0.87$, NS). This finding is inconsistent with the mood repair explanation.

The depletion explanation would be supported further if mood *changes* would predict lottery expenditures. We therefore conducted a regression analysis with the following two explanatory variables: (i) the negative mood as measured immediately before participants had the opportunity to buy lottery tickets (i.e., NA2), and (ii) the difference between negative mood as measured at the beginning of the session and as measured immediately before participants had the opportunity to buy lottery tickets (i.e., NA1-NA2). Lottery expenditures was the dependent variable. The negative mood difference score was positive (i.e., negative mood at time 2 was significantly smaller than negative mood at time 1, t (45) = 2.50, $p < .05$), indicating that mood had indeed, as predicted by Cohen and Andrade (2004) and Tice et al. (2001), recovered during the creative word game. The change in negative mood turned out to be significantly positively correlated with lottery expenditures ($\beta = .06$, $t = 2.09$, $p < .05$), while NA2 was not ($t = 0.80$, NS). Hence, the bigger the reduction in negative mood, the higher lottery expenditures were. This finding provides further support for the depletion explanation.

In conclusion, the outcome of our analyses showed that negative mood predicts lottery expenditures. In addition, this study provides preliminary support for the assertion that depletion due to active mood regulation attempts rather than mood repair is the underlying process for the link between bad mood and lottery play. In two follow-up studies, we try to find further evidence for the depletion explanation of lottery play. In a third study, we manipulate mood and depletion orthogonally. In a fourth study, we induce bad moods and manipulate whether subsequent mood regulation attempts are depleting or not. In both studies, we assess the impact of our manipulations on lottery play. To provide additional evidence for a causal link between reduced exposure to sunshine and an increased engagement in lottery play driven by negative mood, we manipulate mood through exposure to sunshine. This is implemented through a script-reading procedure in which participants are confronted with different amounts of exposure to sunshine.

STUDY 3

The aim of study 3 is to experimentally manipulate weather-related mood and to find further evidence for the hypothesis that the link between bad mood and lottery play rests on the depleting nature of active mood regulation attempts rather than on the mood repairing nature of lottery play. We induce either a bad or a good mood state in participants, and ask them to subsequently engage in a task that was either depleting or not. Afterwards, all participants are given the opportunity to buy lottery tickets. If mood repair explains the link between bad mood and lottery expenditures, the latter should be higher for participants in a bad mood than for those in a good mood, regardless of their level of self-control depletion. In contrast, if depletion explains the link between bad mood and lottery expenditures, lottery expenditures should be higher for depleted than for non-depleted participants, regardless of their mood state.

Method

Participants. Participants were 71 undergraduate students (32 men and 39 women). Data from 3 participants were discarded because they did not comply with the instructions. Ages ranged from 17 to 28 years (M = 21.04 years, SD = 2.29 years). Participants received € 6 for their cooperation.

Materials and Procedure. The procedure of study 3 was identical to the one of study 2, apart from the following. To increase the sensitivity of the set of negative affect items used in study 2, we administered visual analogue versions of this set of items (Franik and Pathak 2003). For each item, participants were asked to indicate on a 100 mm line to what extent they felt the particular emotion.

After filling out an initial set of negative affect items (i.e., NA1), participants were assigned to one of the four conditions resulting from crossing the mood manipulation (negative versus positive) with depletion (high versus low). The mood manipulation was induced by asking participants to read a one-page description of a character that was walking around in a solitary landscape (see, for example, Tice et al. 2001 for the use of script reading as mood induction procedure). Participants were asked to imagine that they themselves were this character. For half of the participants, the character walked around in sunny weather conditions. Therefore, these participants were hypothesized to develop a positive mood. For the other half of the participants, the character walked around in cloudy weather conditions. Hence, these participants were hypothesized to develop a negative mood (e.g., van Praag 1982).

Next, participants were asked to again fill out the set of negative affect items (i.e., NA2). This was done to validate that the mood manipulation influenced participants' mood states as expected. Afterwards, the depletion manipulation was induced by means of a variation of a Stroop color-naming task. Participants were asked to indicate the ink color of 50 words. The words of which the color had to be indicated were always color names (e.g., blue). In the non-depleting conditions, words and ink colors were matched (e.g., RED in red ink). In the depleting conditions however, words and ink colors were mismatched (e.g., RED in yellow ink). In addition, participants in the depleting condition faced an exception to this rule. In case a word in blue ink appeared on the screen, they were instructed to indicate the word rather than the ink color. These deviating trials occurred in 25% of the trials. Because of the need to override impulses and dominant responses, this task was hypothesized to be depleting. A similar task proved to be a successful depletion manipulation in earlier research (Wallace and Baumeister 2002).

Subsequently, participants filled out the set of negative affect items one last time (i.e., NA3). This was needed to validate that mood states did not change during the Stroop color-naming task. In fact, in both depleting and non-depleting conditions, participants in bad mood states should be unable to engage in attempts to actively regulate their moods, since Stroop color-naming tasks consume the attentional processes that are required in active mood regulation (Baumeister et al. 1998).

Finally, participants were given the opportunity to engage in a pari-mutuel 6 / 42 numbers game. As in study 2, our dependent measure was lottery expenditures.

Results and Discussion

Preliminary analyses revealed that our weather-induced mood manipulation was successful. After the mood induction (α_{NA2} = .93), negative mood was significantly larger in the bad mood condition (*M* = 18.84, SD = 17.25) than in the good mood condition (*M* = 11.42, SD = 10.56), t (69) = 2.16, $p < .05$. Before the mood induction, the mood conditions did not differ in negative mood (α_{NA1} = .89, bad mood condition: *M* = 14.94, SD = 14.83; good mood condition: *M* = 12.73, SD = 11.15), t (69) = 0.70, NS.

Additional analyses also revealed that mood states did not change during the Stroop color-naming task. Negative mood as measured before the Stroop color-naming task (i.e., NA2; *M* = 15.29, SD = 14.81) was not significantly different from negative mood as measured after the Stroop color-naming task (i.e., NA3; $\alpha_{NA3} = .92$; *M* = 13.66, SD = 11.45), *t* (69) = 1.43, NS.

To test our hypothesis that depletion predicts engagement in lottery play, we conducted a two by two ANOVA using mood (manipulated bad mood versus good mood) and depletion (depletion versus no depletion) as the independent variables. We found a significant main effect of depletion, indicating that lottery expenditures were higher for depleted (*M* = € 0.57, SD = € 0.63) than for non-depleted participants (*M* = € 0.32, SD = € 0.32), $F(1, 67) = 5.01$, $p < .05$, irrespective of their mood state. Neither the main effect of mood, $F(1, 67) = 0.64$, NS, nor the mood by depletion interaction effect, $F(1, 67) = 2.27$, NS, were significant.

Our failure to find a main effect of mood rules out the mood repair explanation for the link between weather induced bad mood and lottery play. However, one could still argue that the mood repair explanation was not tested fairly, because of the lag between the mood induction and lottery play in our design. To rule out this concern, we conducted a follow-up experiment (*n* = 39) in which we manipulated mood in the same way as in the original design, but removed the lag (and hence also the depletion manipulation) between the mood induction and lottery play. We conducted a one-way ANOVA using mood (manipulated bad versus good mood) as the independent variable. The dependent variable was lottery expenditures. Although negative mood was again significantly larger in the bad mood condition (*M* = 24.17, SD = 19.36) than in the good mood condition (*M* = 7.09, *SD* = 7.00), *t* (37) = 3.63, $p < .01$, we found no effect of mood, indicating that lottery expenditures were as high for participants in a bad mood state (*M* = € 0.53, SD = € 0.50) as for participants in a good mood state (*M* = € 0.42, SD = € 0.45), *t* (37) = 0.68, NS. This failure to find an effect of mood as measured immediately before lottery play is consistent with our failure to find a main effect of mood in the main experiment, and with the lack of correlation between lottery expenditures and bad mood as measured immediately before the opportunity to buy lottery tickets in study 2.

Overall, the results of study 3 provide considerable support for the depletion explanation, and fail to provide support for the mood repair explanation of lottery play. Both findings are consistent with the findings of study 2. So far, we find evidence that depletion plays a role. However, we have not yet presented evidence that depletion due to attempts to *actively* regulate one's bad mood is a precursor of lottery play. Hence, we conduct a fourth study that is complimentary to study 3 and in which we manipulate whether or not mood regulation attempts are active or passive in nature. We judge that we can fully abandon mood repair as a viable explanation for lottery play, as both studies 2 and 3 failed to support the mood repair hypothesis.

STUDY 4

The aim of the fourth study is to experimentally manipulate depletion due to engagement in active mood regulation attempts, and to find further evidence that depletion due to this engagement in active mood regulation attempts underlies the link between bad mood and lottery play. We induce a bad mood state in all participants. Subsequently, we ask participants to engage in a mood regulation task that was either depleting in nature or not. More specifically, one half of the participants is asked to attempt to actively regulate their bad moods through engagement in a thought-listing task (i.e., mood regulation of a depleting nature), whereas the other half's mood is repaired through a mood induction procedure (i.e., mood regulation of a non-depleting nature). Afterwards, all participants are given the opportunity to buy lottery tickets. We expect that lottery expenditures will be higher for participants who engage in mood regulation attempts of a depleting nature than for participants who engage in mood regulation attempts of a non-depleting nature.

Method

Participants. Participants were 27 undergraduate students (5 men and 22 women). Ages ranged from 18 to 28 years (*M* = 21.74 years, SD = 2.35 years). Participants received € 6 for their cooperation.

Materials and Procedure. The procedure of study 4 was identical to the one of study 3, apart from the following. After filling out the visual analogue format of the 10 negative affect items (i.e., NA1), receiving the weather-induction of a bad mood (i.e., reading a one-page description of a character walking around in cloudy weather conditions), and filling out the visual analogue format of the 10 negative affect items for a second time to validate that the mood manipulation influenced their mood states as expected (i.e., NA2), participants were assigned to one of two experimental conditions.

In both conditions, participants were asked to engage in a task that enabled them to change their bad mood state. Participants in the depleting condition were asked to engage in a thought-listing task. They were guaranteed confidentiality and urged to write down their stream of consciousness. This task gave participants the opportunity to engage in active mood regulation attempts, something people spontaneously do whenever they feel bad (Tice et al. 2001). However, as active attempts to regulate mood result in depletion (Vohs and Baumeister 2000), this task was hypothesized to be depleting. Participants in the non-depleting condition were subjected to a mood induction procedure. They were asked to hand-copy a text to yoke them to participants in the other condition (see, for example, Zuckerman et al. 1978 for the use of a yoked experimental design) with respect to the physical effort they had to exert. The text resulted from a thought-listing task in an independent pilot study in which we induced a bad mood state in the same way as we did in study 3, and in which we subsequently asked participants to attempt to actively regulate their bad mood. This text was used as a mood induction procedure (e.g., Tice et al. 2001). As participants in this condition did not have to attempt to regulate their mood actively, the mere hand-copying of this pre-generated text was hypothesized to be considerably less depleting.

In the next phase of the study, participants filled out the visual analogue format of the 10 negative affect items one last time (i.e., NA3). This was done to assess how participants' mood states were influenced by their active or passive mood regulation attempts. Finally, participants were given the opportunity to engage in a pari-mutuel 6 / 42 numbers game. As before, our dependent variable was lottery expenditures.

Results and Discussion

Preliminary analyses revealed that our mood manipulation was successful: the bad mood induction increased negative mood. Negative mood as measured after the bad mood induction (i.e., NA2; $\alpha_{NA2} = .90$; $M = 19.00$, SD = 13.78) was significantly higher than negative mood as measured before the bad mood induction (i.e., NA1; $\alpha_{NA1} = .81$; $M = 14.60$, SD = 12.09), $t(25) = 2.09$, $p < .05$).

Preliminary analyses also revealed that mood regulation in the non-depleting condition was successful: the good mood induction decreased negative mood. Negative mood as measured before the mood regulation task (i.e., NA2; *M* = 21.73, SD = 14.60) was significantly higher than negative mood as measured after the mood regulation task (i.e., NA3; $\alpha_{NA3} = .85$; *M* = 13.66, SD = 12.58), *t* (13) = 3.23, *p* < .01. In contrast, preliminary analyses revealed that mood regulation in the depleting condition was unsuccessful: thought-listing did not decrease negative mood. Negative mood as measured before the mood regulation task (i.e., NA2; *M* = 16.05, *SD* = 12.75) was not significantly different from negative mood as measured after the mood regulation task (i.e., NA3; *M* = 17.63, SD = 9.90), *t* (12) = -0.46, NS. This finding is in line with previous literature stating that attempts to actively regulate bad moods are likely to lead to decreased self-control resources, but will generally not lead to improvements in bad moods (Vohs and Baumeister 2000). Despite the different impact of the mood regulation task on negative mood in both conditions, negative mood as measured after the mood regulation task (i.e., NA3) was far from significantly different in the depleting (*M* = 17.63, SD = 9.90) and the non-depleting condition (*M* = 13.66, SD = 12.58), *t* (25) = 0.91, NS. This lack of difference in negative affect rules out negative mood as an explanation for the effect of mood regulation type on lottery expenditures reported next.

We conducted a one-way ANOVA using mood regulation type (depleting versus not depleting) as an independent variable. The dependent variable was lottery expenditures. We found a significant effect of mood regulation type, indicating that lottery expenditures were significantly higher for participants who engaged in attempts to actively regulate their bad moods (i.e., mood regulation attempts of a depleting nature; *M* = € 0.81, SD = € 0.75) than for participants whose mood was regulated by means of the mood induction procedure (i.e., mood regulation attempts of a non-depleting nature; *M* = € 0.25, SD = € 0.33), $F(1, 25) = 6.44$, $p < .05$. Negative mood as measured after the mood regulation task (i.e., NA3) was not significantly correlated with lottery expenditures (r = .16, NS). The effect of mood regulation type on lottery expenditures remained unchanged ($F(1, 24) = 5.65$, $p < .05$), when negative mood as measured after the mood regulation was included as a covariate (i.e., NA3, $F(1, 24) = 0.20$, NS). Hence, study 4 provided further evidence that depletion due to active mood regulation attempts is the underlying process for the link between weather-induced negative mood and an increasing engagement in lottery play.

GENERAL DISCUSSION

The aim of the present investigation was to show that bad weather or weather-induced bad mood lead to an increased engagement in lottery play. In addition, we wanted to find out if depletion due to active mood regulation attempts or mood repair is the underlying process. The results of our research indicate that a shortage of sunshine induces people to engage in active mood regulation attempts of a depleting nature, resulting in insufficient resources to resist lottery play. In a longitudinal study on over eight years of semiweekly lottery expenditure data, we find that a reduced exposure to sunshine in the days preceding the lottery draw resulted in higher lottery revenues. This result is obtained even after controlling for various other factors that have been identified in the literature, including the well-documented inertia in lottery play, time-varying reward characteristics of the game such as the presence of a rollover and/or super-draw, and seasonal influences. The results of a follow-up laboratory study are consistent with these findings, and establish that lottery play is related to negative mood, but only when there is a time interval that gives people the opportunity to actively regulate their mood. This data pattern is consistent with an explanation of the link between sunshine and lottery play in terms of depletion due to depleting mood regulation attempts but not in terms of mood repair (see hypothesis 2 in the lower part of figure 1). Two subsequent experiments provide further evidence that depletion due to active mood regulation attempts rather than mood repair is the process underlying the link between bad mood due to weather and lottery play. Hence, the combined use of a modelling and experimental approach enabled us to establish causal relations between the variables of interest, while enhancing the external validity of our results.

Our results raise three main questions for future research. One issue concerns the underlying reason as to why lottery expenditures are higher for depleted consumers. Another issue is the generalizability of the depletion effect to other consumer behaviors besides lottery play. Finally, other antecedents of self-control depletion besides a shortage of sunlight might be relevant in a consumer behavior context.

First, the issue as to why depletion leads to an increased engagement in lottery play remains open to future research. We know that potential players are attracted by the size of the jackpot prize but repelled by their low chances of winning this jackpot prize (e.g., Farrell et al. 1999; Forrest et al. 2000a,b). It might be that depleted consumers are more inclined to play because they perceive the jackpot prize as more attractive or because they become less repelled by the small chance of winning the jackpot prize. Depleted consumers might also be less bothered by the price (Vohs and Faber 2004).

Second, even though we only established a link between a reduced exposure to sunshine and lottery play, the underlying model strongly suggests that the effects of sunshine may be generalizable to problem gambling and addictive behaviors in general. The underlying model even suggests that the effects may also be applicable to a wide range of "more regular" consumer behaviors as well. In fact, recent research already provided some evidence that depleted consumers display impulsive spending behavior more often (Vohs and Faber 2004). We call for future research that investigates the link between sunshine or other antecedents of self-control depletion and a broad range of consumer behaviors, such as promotional sensitivity and variety seeking.

This brings us to a third area of future research, which could be to broaden our knowledge on other sorts of antecedents of self-control depletion. The antecedents of depletion we focused on in the present research were reduced exposure to sunshine, and the resulting negative mood states. However, one could also consider the influence of other climatic conditions, such as extreme cold or heat, or the extent of rainfall (see Agnew and Palutikof 1999; Keller et al. in press). In addition to (collective) mood regulation due to climatic conditions, also response inhibition has been identified as a potential resource depleting factor (Wallace and Baumeister 2002). Response inhibition may occur when consumers postpone purchases, for example, because of expected changes in one's economic conditions (Deleersnyder et al. 2004). Postponement of desired purchases is likely to be depleting for some consumers, and hence could lead to an overall reduction in their ability to resist temptations of various kinds.

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TABLE 1

UNDERLYING DRIVERS OF LOTTERY EXPENDITURES

	Dependent Variable Semiweekly Lottery Revenue (Rev_t)	
	Parameter Estimates	Standard Errors
Intercept	10.363**	0.524
Saturday Dummy	0.852**	0.047
Rev_{t-1}	0.117**	0.031
Rev_{t-2}	0.183**	0.028
Rollover (0/1)	0.119**	0.008
Super-draw (millions of €)	0.239**	0.016
$Sunshine_t$	-0.010*	0.005
n = 925 R^2_{adj} = 0.932		

* $p < .05$
** $p < .01$

FIGURE 1

LINK BETWEEN SUNSHINE, MOOD, AND LOTTERY PLAY

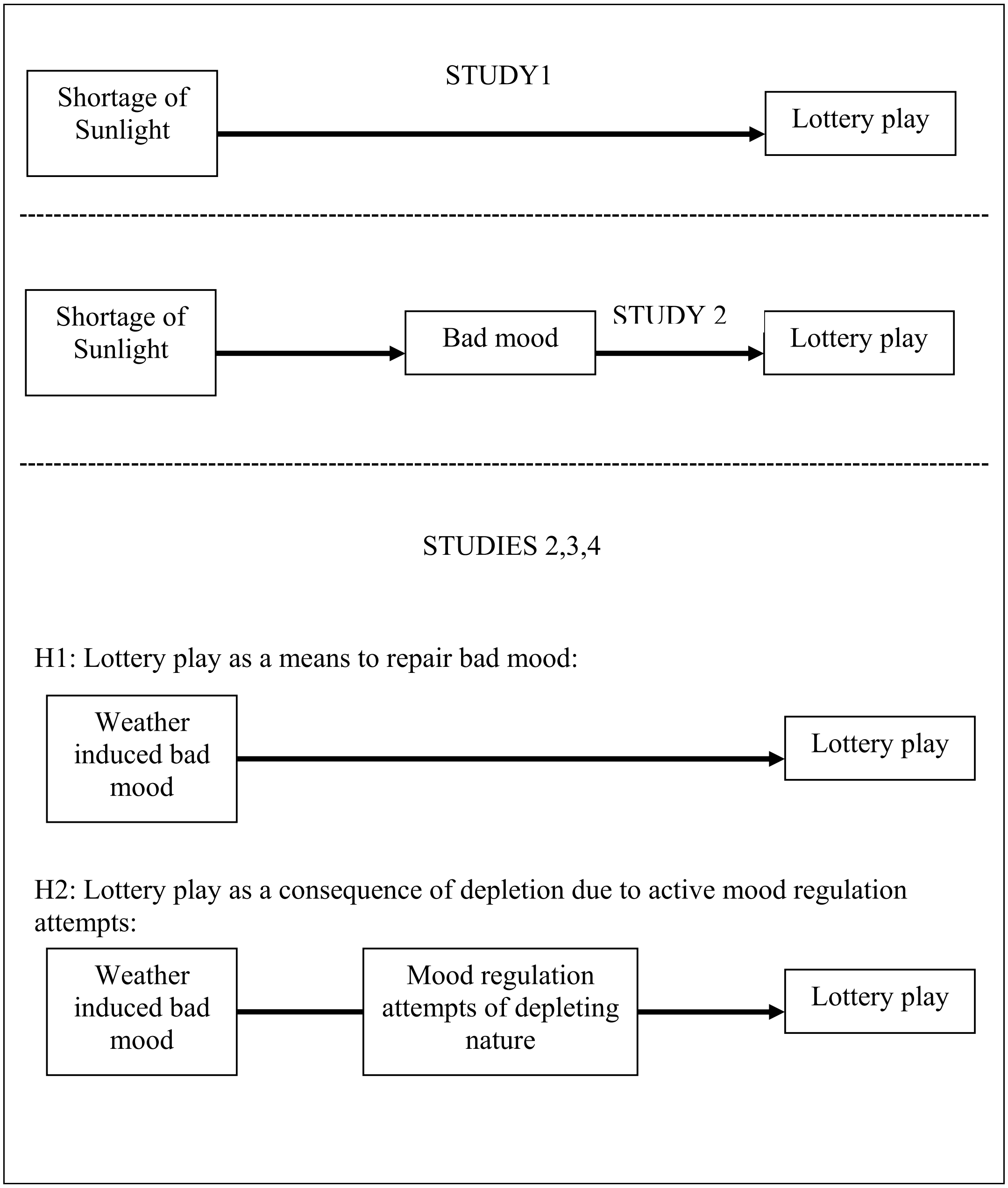
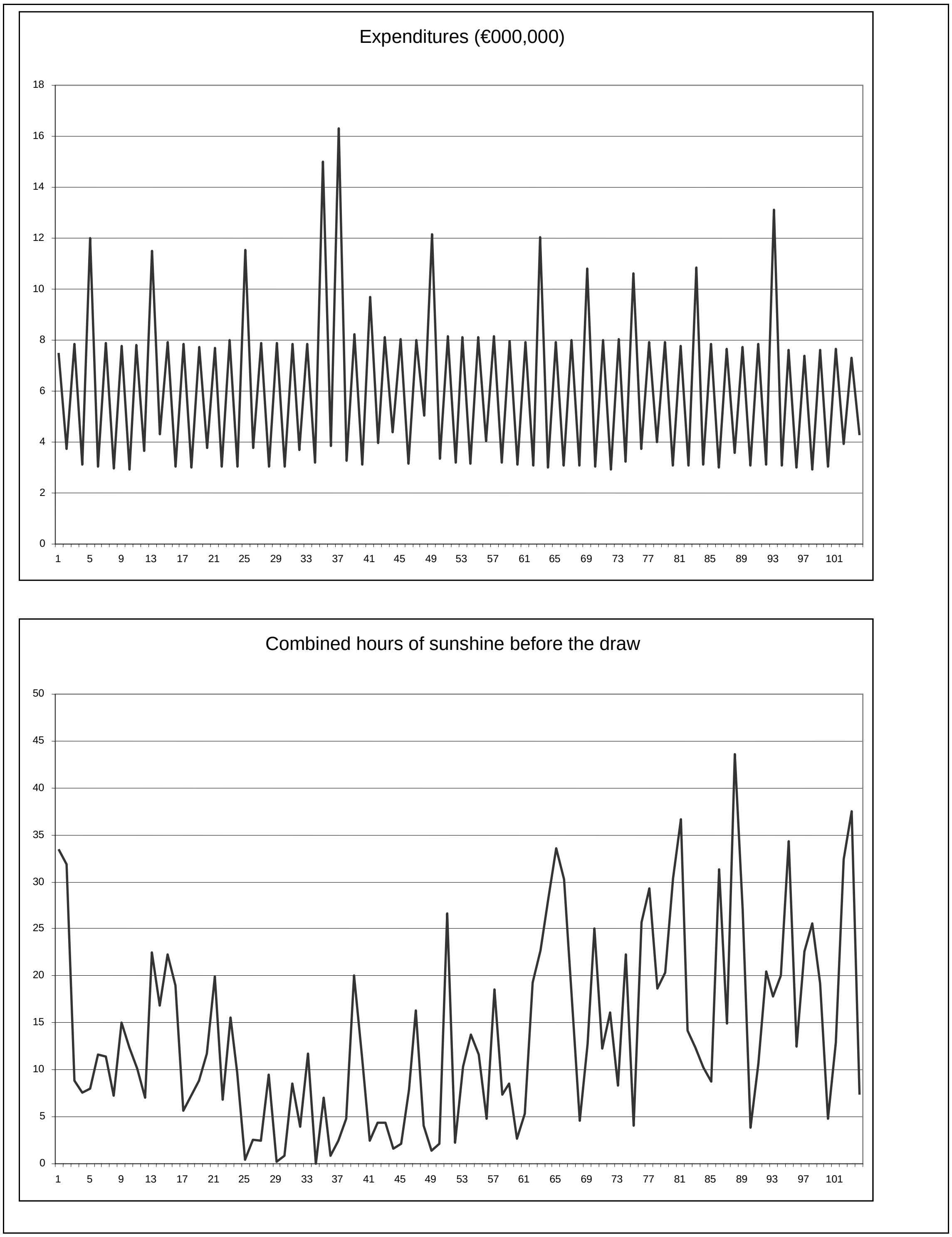


FIGURE 2

HOURS OF SUNSHINE AND LOTTERY EXPENDITURES

(AUGUST 23, 2001 – AUGUST 21, 2002)



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