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Myopic risk-seeking: The impact of narrow decision bracketing on lottery play

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Abstract In two experiments conducted with low-income participants, we find that individuals are more likely to buy state lottery tickets when they make several purchase decisions one-at-a-time, i.e. myopically, than when they make one decision about how many tickets to purchase. These results extend earlier findings showing that "broad bracketing" of decisions encourages behavior consistent with expected value maximization. Additionally, the results suggest that the combination of myopic decision making and the "peanuts effect"—greater risk seeking for low stakes than high stakes gambles—can help explain the popularity of state lotteries.

Keywords Decision framing · Bracketing · State lotteries · Myopic loss aversion · Peanuts effect · Gambling

JEL Classification C91 · D81 · I30

State lotteries are a multibillion dollar industry and the most popular form of legal gambling (Kearney 2005a). In 2005, total sales from state lotteries surpassed $50 billion, with instant games accounting for the largest fraction—50%—of this amount (Hansen 2007). Playing the lottery is inconsistent with expected utility maximization, assuming diminishing marginal utility. Yet, despite its negative expected value (about −$0.47 for each dollar spent, on average; LaFleur and LaFleur 2003) and the fact that it has the lowest payout rate of any form of commercial gambling (Clotfelter and Cook 1991), clearly many people find playing the lottery appealing.

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The enormous popularity of the lottery suggests that people do get some value from playing it, perhaps entertainment or excitement. However, while the benefit of a single ticket purchase may seem to outweigh the cost, people may fail to fully account for the long-term, cumulative cost of playing. This cost can be substantial, especially for low-income families who spend a disproportionate fraction of their income on lottery tickets. Much as small increases in calorie intake can, over long periods of time, lead to substantial weight gain, the ongoing cost of playing the lottery can have adverse consequences for low-income families. One study found that the introduction of a state lottery reduced low-income households' expenditures on food, rent, mortgage, and other bills by 2.5% and by 3.1% when the lottery included instant games (Kearney 2005b).[1]

We present research that helps explain the popularity of lotteries, despite their high cost. We propose that when people decide whether to purchase a lottery ticket, they consider each ticket individually rather than adopting a long-term view that aggregates the cost of multiple ticket purchases. We test the prediction that people buy more tickets when they view the decision to purchase tickets *myopically*, making one decision at a time, rather than *broadly bracketing* the decision—i.e., considering the aggregate consequences of purchasing multiple tickets.

Our study is modeled after prior research on "myopic loss aversion" (Bernartzi and Thaler 1995), which refers to the combination of narrow bracketing and loss aversion (the disproportionate weighting of losses relative to gains). Research on myopic loss aversion examines people's propensity to reject advantageous gambles (i.e. gambles with positive expected values) when they are presented one at a time. As demonstrated in the classic example by Samuelson (1963), a single 50–50 chance of gaining $200 or losing $100 offers an equal chance of ending up with a gain or loss. Loss aversion leads to an overweighting of the latter, which discourages people from taking the gamble.[2] However, when one considers many plays of such a gamble, the odds of ending up with a loss progressively diminish, which encourages greater risk taking. Myopic loss aversion has been demonstrated in numerous laboratory studies (Bellemare et al. 2005; DeKay and Kim 2005; Gneezy et al. 2003; Gneezy and Potters 1997; Keren and Wagenaar 1987; Langer and Weber 2001, 2003; León and Lopes 1988; Redelmeier and Tversky 1992; Thaler et al. 1997; Wedell and Böckenholt 1994), and has been used to explain such diverse phenomena as the attractiveness of expensive car rental collision insurance coverage and the equity premium puzzle (Benartzi and Thaler 1995).

The current study, in contrast, focuses on a different type of prospect than those thus far examined in the myopic loss aversion literature. We examine people's propensity to accept disadvantageous bets—specifically lottery tickets—when evaluating them myopically. Our research builds on the prior work of Langer and

[1] These estimates are conservative since they do not account for the fact that a substantial fraction of the households included in the data do not play the lottery. Clotfelter et al. (1999) estimates that approximately 50% of low-income households play the lottery.

[2] See Benartzi and Thaler (1999) for a discussion of why this decision implies loss aversion, not simply risk aversion.

Weber (2001, 2005), who also challenge the generality of the myopic loss aversion results. They demonstrate that for some risky prospects "reverse myopic effects" exist in which gambling is more attractive when decisions are made myopically. The prospects identified by Langer and Weber have a positive expected value and the risk profile of holding a junk bond or issuing a loan, in which there is a large probability of a moderate return but a small chance of a large loss in case of default. An example of such a gamble, shown experimentally to be more attractive with myopic evaluation rather than with broad bracketing (corresponding to playing the gamble three times), is a 90% chance to gain $15 and a 10% chance to lose $100 (Langer and Weber 2005). The gamble is more attractive with myopic evaluation because individuals who are prone to loss aversion and diminishing sensitivity to gains do not proportionately value the likely increase in the magnitude of the gain, but greatly dislike the increased chance of ending up with a loss.

Like Langer and Weber, we present a "reverse myopic effect" using state instant lottery tickets, which have an outlay of $1 for a very small probability of a large gain ($5,000, putting aside intermediate prizes), with an overall negative expected value. However, our explanation for this effect differs from that described by Langer and Weber (2001, 2005). As we discuss in detail below, the attractiveness of a single lottery ticket can be explained by a combination of overweighting the small probability of winning and underweighting the small cost of the ticket. Both of these effects are diminished with broad bracketing, leading to the prediction that people will be less prone to purchase lottery tickets under broad than narrow (myopic) bracketing. This prediction is opposite to the positive relationship between broad bracketing and risk taking observed for the positive expected value prospects commonly examined in the myopic loss aversion literature, but is consistent with the general assertion that broad decision bracketing induces people to assess the aggregate consequences of decisions, leading to better outcomes (Kahneman and Lovallo 1993; Read, Loewenstein and Rabin 1999). However, as explored by Langer and Weber (2001, 2005), there exist exceptions to this general rule whereby broad bracketing will lead to the rejection of advantageous prospects.

1 Why broad bracketing discourages lottery ticket purchases

That broad bracketing will decrease lottery ticket purchases is predicted by theories that can account for why people play the lottery in the first place: Markowitz's theory of the utility of wealth (1952) and the probability weighting function from Kahneman and Tversky's (1979) prospect theory.

One possible reason why people play the lottery is that spending small amounts on the tickets yields smaller disutility than one would expect if one assumed diminishing marginal utility. To explain the occurrence of simultaneous gambling and insurance purchases, Markowitz (1952) proposed a utility function defined over gains and losses (rather than absolute levels of wealth) that had three inflection points, one at the status quo, one on the gain side, and another on the loss side (Fig. 1). Markowitz's utility function is convex for small gains and concave for small losses. In the domain of gains, this implies that when the stakes are small, people prefer fair gambles to small certain gains (e.g., a gamble with a 10% chance to win

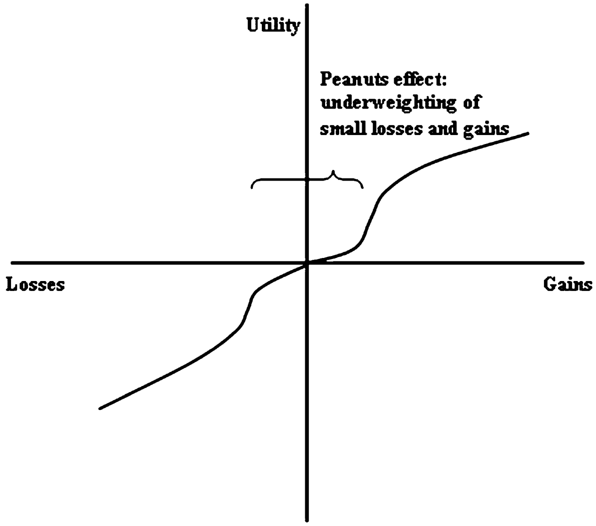

Fig. 1 Markowitz's proposed utility function

$1 is preferred to $0.10 for sure). When stakes are high, then people prefer large certain gains to a fair gamble (e.g., $100 for sure is preferred to a 10% chance to win $1,000). In the domain of losses, it is the reverse. People are more risk averse for small stakes losses (e.g., losing $0.10 for sure is preferred to a 10% chance to lose $1), and risk seeking for large stake losses (e.g., a 10% chance to lose $1,000 is preferred to losing $100 for sure). This underweighting of small gains and small losses was later dubbed the "peanuts effect" (Prelec and Loewenstein 1991), and has been demonstrated empirically in numerous laboratory studies (see Greene and Myerson 2004 for a review and see Weber and Chapman 2005 for an in-depth investigation of the effect).

The peanuts effect in Markowitz's utility function can help to explain why people buy lottery tickets. When people decide whether or not to purchase a $1 lottery ticket, they are choosing whether to incur the loss of $1 to obtain a small chance to win a large sum of money and they underweight this small cost. However, as costs rise, as would be the case if one bought multiple tickets, the marginal disutility of paying for tickets increases as the utility function becomes steeper. Thus, Markowitz's utility function predicts that people will purchase fewer tickets as the decision is bracketed more broadly because thinking in terms of large money amounts (e.g., spending $5 for five lottery tickets) shifts them to a point on the utility function where the marginal disutility of making the payments is larger.

Another possible reason for why people play the lottery is that they place disproportionate weight on small probabilities, as specified by many generalized expected utility theories (e.g., Edwards 1962; Kahneman and Tversky 1979; Quiggin 1982; Tversky and Kahneman 1992). Overweighting small probability outcomes increases the appeal of lottery tickets, which offer a small probability of winning a large prize. Moreover, most of the theories that posit overweighting of small probabilities also assume insensitivity to variations in probability at low levels—that is, the probability weighting function is elevated but relatively flat for low levels of probability (Kahneman and Tversky 1979; Prelec 1998; Tversky and Kahneman 1992). The implication of this general property of the weighting function, termed discriminability, is that people become less sensitive to changes in probability as they move away from the “certainly will not happen” and “certainly will happen” endpoints (Wu and Gonzalez 1998; Gonzalez and Wu 1999). Again, this property leads to the prediction that broad bracketing will decrease lottery ticket purchases because people are insensitive to the difference between, for example, a 0.001 chance of winning relative to a 0.002 chance of winning, but are sensitive to the increased cost required to produce such a doubling of probability.

The prediction that people will purchase fewer tickets when the decision is broadly bracketed holds even if we consider that people derive utility not just from the value of the gamble itself, but also from the associated entertainment of playing. As predicted by the peanuts effect, broad bracketing will shift people to a point on the utility function where the marginal disutility of the cost of the tickets becomes steeper, making it less likely that the monetary and entertainment value of the gamble will compensate. Similarly, insensitivity to small increases in the probability of winning, relative to a change from *no* chance to *a* chance, would make five chances to win less than five times as exciting as a single chance.

1.1 The current study

We test the prediction that broad decision bracketing reduces lottery ticket purchases. Experiment 1 confirms this central prediction and Experiment 2 ensures that this effect persists in the face of decision feedback about the outcomes of previous lottery ticket purchases. Since most lottery tickets don’t pay off, people tend to get negative feedback from playing the lottery repeatedly, and this feedback might counteract the two effects just discussed. Both studies were conducted at the Greyhound bus station in Pittsburgh because it provides a constantly replenishing population of low-income individuals. Low-income individuals spend a higher percentage of their income on lottery tickets than do those with higher incomes (Brinner and Clotfelter 1975; Clotfelter and Cook 1989; Kearney 2005a; Livernois 1987; Spiro 1974; Suits 1977),[3] despite the fact that the negative expected value exerts a disproportionate adverse impact on their financial position. We discuss the implications of our results for deterring low-income populations from playing state lotteries.

2 Experiment 1

To test the hypothesis that broad decision bracketing will decrease ticket purchases, we gave participants the opportunity to earn $5 and then offered them the opportunity to purchase lottery tickets. This decision was framed in three different

[3] Some studies even find higher absolute demand for lottery tickets among low-income populations (Clotfelter et al. 1999; Hansen 1995) and Hansen et al. (2000) report that, across five states, income is a more consistent predictor of lottery ticket sales than education, race, or age.

ways using a between-subjects design. In the *myopic* condition, participants made five decisions about whether to purchase a ticket, one decision at a time. In the *broad bracketing* condition, participants decided how many tickets to buy in one single decision (between zero and five tickets). We also included a third, *all-or-nothing* condition, similar to the *broad bracketing* condition, in which participants were given a single choice between buying five lottery tickets or none. Based on the theories described above, we predicted that participants would purchase more lottery tickets in the *myopic* condition than in the *broad bracketing* condition or the *all-or-nothing* condition.

2.1 Methods

The sample consists of 122 participants who were approached while they waited to board buses at the Greyhound station in Pittsburgh, Pennsylvania. Everyone in the station was approached unless they were sleeping, talking on the phone, about to board, unable to speak English, or exhibiting signs of psychosis.

We asked potential participants to complete a survey in exchange for $5. This survey, unrelated to the experiment, asked about their opinions on Pittsburgh. After completing the survey, all participants were given the opportunity to either keep the $5 they had earned from completing the survey or to use this money to purchase instant scratch-off lottery tickets. Since many participants were traveling out of state, they were told that we would cash in a winning ticket for any amount other than the jackpot. We chose instant lottery tickets because they are the most popular of all lotteries, are disproportionately played by low-income individuals (Kearney 2005b), and because the instant payment feature makes them attractive to travelers who are in transit to a different state.

Participants were informed that they would be making decisions about instant scratch-off tickets, each of which cost $1. They were randomly assigned to one of the three conditions. In the *myopic* condition, participants were told they would be receiving their payment in stages. In each stage, the participant was told, “Here is $1 as part of the payment for your time filling out the survey,” and were handed $1. When they flipped to the next page, they were shown an instant scratch-off ticket and read the following:

Would you like to buy a lottery ticket?
____*Yes* ____*No*

This procedure was repeated five times. To hold information constant across conditions, participants were not allowed to scratch off any ticket(s) they purchased until the conclusion of the experiment.

In the *broad bracketing* condition, participants were told, “Here is $5 as the payment for your time filling out the survey,” and were handed $5. When they flipped to the next page, they were shown five instant scratch-off tickets and read:

How many tickets do you want to purchase?
____*5 lottery tickets*
____*4 lottery tickets*
____*3 lottery tickets*

____*2 lottery tickets*
____*1 lottery tickets*
____*No lottery tickets*

In the *all-or-nothing* condition, the procedure was identical to the broad bracketing condition, except participants could only buy five lottery tickets or none:

Do you want to buy 5 lottery tickets?
____*Yes* ____*No*

Next participants reported demographic information and their usual frequency of playing the lottery. We anticipated that people who frequently play the lottery would tend to buy lottery tickets in our experiment.

2.2 Results

Table 1 presents the demographic breakdown of the sample, which is by intention not representative of the U.S. population. The median income, at $19,000, is less than half that of the general population ($48,201 in 2006) and over half of the sample (54%) is African American.

The dependent variable for each participant was the total number of lottery tickets purchased. Figure 2 shows the distribution of ticket purchases for each of the experimental conditions. Since the distributions of ticket purchases are positively skewed, we used a non-parametric Mann–Whitney Test to analyze differences in lottery ticket purchases across conditions. As can be seen in Table 2, our prediction that broad bracketing would lead to fewer purchases was supported. Participants in the *myopic* conditions purchased more than twice the number of tickets than those in the broad bracketing condition, a significant difference. Similarly, ticket purchases in the *all-or-nothing* condition were less than half those in the *myopic* condition, also a significant difference.

Figure 2 shows that in the *all-or-nothing* condition, in which participants could choose to purchase either zero or five tickets, 87% of the participants purchased zero tickets. The distribution of ticket purchases is positively skewed in the *myopic* and *broad bracketing* conditions, and more so in the *broad bracketing* condition. It seems that participants in the *broad bracketing* condition are reluctant to purchase more than two tickets. In fact, no participant purchased three or four tickets and only one purchased all five tickets.

We used regression analysis to ensure that the effect of decision bracketing on ticket purchases holds when we control for demographic variables, which might have varied between conditions despite random assignment. We used Poisson regression since the data is a count of the number of tickets purchased (Table 3). We restricted the analysis to the *myopic* and *broad bracketing* conditions because the *all-or-nothing* condition has a binary dependent variable (0 tickets purchased or five tickets purchased), whereas the dependent variable in the *myopic* and *broad bracketing* conditions ranges from zero to five tickets. Decision bracketing was a dummy variable, coded 0 for *myopic bracketing* and 1 for *broad bracketing*. Due to the difficulty of interpreting Poisson coefficients, Table 3 displays the exponentiated

Table 1 Demographic information

	Experiment 1	Experiment 2
N	122	117
Age		
Mean	31.6	32.2
Median	26	33
Range	18–78	18–82
Income		
Mean	$28,575[a]	$29,630[b]
Median	$19,000	$25,000
Range	$8,400–$85,000	$0–$150,000
Education (%)		
At least college degree	21	28
No college degree	79	72
Gender (%)		
Males	52	65
Female	48	35
Race (%)		
African American	54	56
Caucasian	36	33
Hispanic	3.5	4
Asian	3	4
Reported "other"	3.5	3
Occupation (%)[c]		
Managerial professional	7	
Technical professional	5	
Sales and marketing	10.5	
Administrative/clerical	16	
Skilled blue collar	17	
Unskilled blue collar	21.5	
Students	18	
Retired	2	
Homemaker	3	

[a] Only 67 participants reported income data in Section 3.
[b] One hundred one participants reported income data in Section 4.
[c] Occupation data was collected for Section 3 only.

coefficients which are equivalent to incidence rate ratios. A one unit increase in the independent variable is associated with a multiplicative change in the mean number of tickets purchased by a factor of the incidence rate ratio.

Specification 1 shows that participants in the *broad bracketing* condition purchased significantly fewer tickets than those in the *myopic* condition when there are no control variables in the model (also shown in Table 2). In specification 2, we include the dummy variable chronic, which reflects the tendency to play the lottery in daily life (coded 1 if the participant reported playing the lottery at least a few times a month, 0 otherwise). As expected, the coefficient on chronic is significant and positive, indicating that across conditions, chronic players purchased more lottery tickets. Table 4 displays mean ticket purchases for chronic and non-chronic players and includes the *all-or-nothing* condition, which was excluded from the regression analysis. Specification 3 includes both chronic and decision bracketing and shows that the effect of decision bracketing remains significant after controlling for chronic.

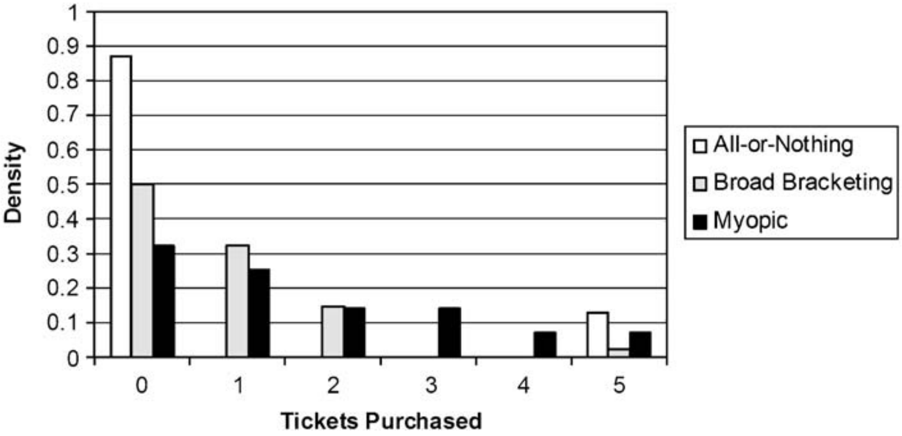

Fig. 2 Histogram of lottery tickets purchased in the myopic, broad bracketing and all-or-nothing conditions for Experiment 1

Previous research found that ticket purchases are inversely related to age and education, males play more than females, and African Americans play more than other ethnic groups (Clotfelter et al. 1999; Light 1977). Specification 4 shows the effects of these demographic control variables. Age is only significant when included with age squared. There is a tendency for African Americans (coded as 1 if African American, 0 otherwise) to have a higher propensity to play the lottery, but this does not reach significance (z=1.49, p=0.14). The coefficients for the variables college (coded 1 for a college graduate, 0 otherwise) and female (coded 1 if female, 0 otherwise) were not significant.

Specification 5 includes the experimental and control variables. The full model shows that the effect of broad bracketing is negative and significant, indicating that broad bracketing reduces purchase of lottery tickets, controlling for all demographic variables. The incidence rate ratio indicates that the number of tickets purchased in the *broad bracketing* condition is 0.44 times the number of tickets purchased in the *myopic* condition, holding all other variables constant. In absolute terms, this corresponds to a decrease in expected purchases by 0.79 tickets. The coefficient of chronic also remains significant. Chronic players purchase 2.74 times the number of tickets as non-chronic players, as predicted by the incidence rate ratio of the Poisson regression in the *myopic* and *broad bracketing* conditions. This corresponds to an increase in expected purchases of 1.39 tickets. According to the actual means of the data displayed in Table 4, which also includes the *all-or-nothing* condition, chronic

Table 2 Mean lottery tickets purchased in each condition in Experiment 1

Condition	Mean tickets (standard deviation)	Mann–Whitney test
Myopic (n=43)	1.58 (1.58)	
Broad bracketing (n=40)	0.75 (1.00)	Myopic vs. broad bracketing z=2.46, p=0.01
All-or-nothing (n=39)	0.64 (1.69)	Myopic vs. all-or-nothing z=4.09, p<0.01

Table 3 Poisson regression analysis of the effect of broad decision bracketing on lottery ticket purchases Experiment 1

	Incidence rate ratios				
	(1)	(2)	(3)	(4)	(5)
Broad bracketing	0.474*		0.467*		0.443*
	(0.104)		(0.102)		(0.109)
Chronic		2.502*	2.542*		2.741*
		(0.535)	(0.543)		(0.629)
Age				0.899*	0.886*
				(0.029)	(0.031)
Age^2				1.001*	1.001*
				(0.001)	(0.001)
African American				1.410	1.551***
				(0.326)	(0.371)
College				1.518	1.928**
				(0.394)	(0.521)
Female				1.249	1.122
				(0.280)	(0.247)
McFadden's pseudo R^2	0.048	0.063	0.113	0.070	0.188
Observations	83	83	83	72	72

Analysis restricted to the myopic and broad bracketing conditions. Incidence rate ratios are reported instead of regression coefficients due to their ease of interpretation. Standard errors are in parentheses.
*p<0.01, **p<0.05, ***p<0.10

players purchase exactly twice the number of tickets as non-chronic players. The quadratic relationship between age and tickets purchased indicates that there is a negative effect of age on percentage of lottery ticket purchases before age 31 and a positive effect thereafter. African Americans purchase more tickets at a marginal level of significance, with African Americans purchasing 1.55 times that of other ethnic groups, corresponding to an absolute difference of about a half of a ticket. Now the coefficient on college is significant, but in the "wrong" direction, indicating that people with a college degree purchase 1.93 times more tickets than those without a college degree, an absolute difference of 0.80 tickets. There remains no effect of gender on ticket purchases.

Noting that our sample has a lower level of education than the general population helps to explain the unexpected positive relationship between a college degree and

Table 4 Comparison of mean ticket purchases between chronic and non-chronic players

	Experiment 1	Experiment 2
Non-chronic players	0.87	1.26
	(1.41)	(1.79)
	n=103	n=95
Chronic players	1.74	1.70
	(1.85)	(1.87)
	n=19	n=20

Standard deviations are in parentheses.

ticket purchases. A college education may have different significance for a population of people traveling by Greyhound than it would have in a broader sample. Perhaps the college graduates in our sample have unmet income aspirations that motivate them to play the lottery.

Income was reported by only approximately 57% of the participants in the *broad bracketing* and *myopic* conditions, and thus was excluded from the analysis. When income is included in the full model, the effect of broad bracketing remains significant (IRR=0.467, $z=-2.18$, $p=0.03$), even though the sample is practically cut in half, and the effect of income (expressed in thousands) on ticket purchases is not significant (IRR=0.990, $z=-0.83$, $p=0.41$).

2.3 Discussion

We find that myopic decision making results in more lottery ticket purchases relative to the *broad bracketing* and *all-or-nothing* conditions. Studies on myopic loss aversion thus far have only examined prospects with positive expected values and demonstrated that broader decision bracketing leads to increased risk taking. In contrast, the current study offers evidence that for attractive prospects with negative expected values, broad bracketing can reduce risk taking. Combining these findings points to the more general hypothesis that broader bracketing produces behavior closer to expected value maximization.

It should be noted that our experimental paradigm departs from the reality of how people typically decide to purchase lottery tickets (although it offers a higher degree of realism than a typical laboratory experiment); it is unusual to receive an unexpected proposition to purchase lottery tickets while waiting for a bus. To increase the realism of the situation we used actual lottery tickets and we had participants “earn” money to purchase tickets, instead of merely endowing them with it. This was done to reduce the house money effect, which is the tendency to consume (Henderson and Peterson 1992) or risk (Ackert et al. 2006; Thaler and Johnson 1990) money that was received as a result of a windfall.

One could argue that the number of tickets purchased in the myopic condition is artificially inflated because participants did not have a chance to learn from their mistakes. In the real world, when people make decisions one at a time they get feedback about outcomes. With lotteries, this feedback is generally negative because people win only rarely. We conducted Experiment 2, which gave participants feedback about the outcome of each decision before they made their next, to ensure that the results of Experiment 1 did not overstate the impact of narrow bracketing. We find that this is not the case; if anything, feedback increases the effect of narrow bracketing.

3 Experiment 2

Experiment 2 replicated the *myopic* and the *broad bracketing* conditions from Experiment 1 and also included a third condition: *myopic with feedback*. In this condition, participants were asked to scratch off each lottery ticket that they purchased immediately after purchasing it. We hypothesized that participants would purchase fewer lottery tickets in the *broad bracketing* condition than in the *myopic* condition or the *myopic with feedback* condition.

We had no strong expectations concerning the difference between the two myopic conditions. Losing feedback might give participants the opportunity to learn about the consequences of playing the lottery, and thus decrease ticket purchases. Alternatively, losing feedback might increase ticket purchases due to the desire to recover losses from previous rounds (Thaler and Johnson 1990) or due to the gambler's fallacy (Jarvik 1951), the perception that one is "due for" a win after a string of losses. The gambler's fallacy has previously been demonstrated in state lottery games where players pick numbers to bet on, evidenced by a reluctance to bet on a number after it has hit (Clotfelter and Cook 1991; Terrell 1994).

3.1 Methods

Participants were recruited from the Greyhound bus stations in the same manner described in Experiment 1. One hundred and seventeen participants participated in the experiment.

As in Experiment 1, participants completed an unrelated survey on Pittsburgh as a pretense for providing them with $5 to spend on lottery tickets. Participants were randomly assigned to a condition in a between-subjects design. The *myopic* and *broad bracketing* conditions were exactly as they were in Experiment 1. The *myopic with feedback* condition was identical to the *myopic* condition except that participants were asked to scratch off each ticket that they purchased. They were given $1 of their payment and then asked if they wanted to purchase a lottery ticket. Next they turned the page and were asked:

If you bought a lottery in the previous round, please report what was the outcome of the lottery:
_____*I won the lottery. The amount I won is:* ___________
_____*I did not win the lottery.*

Finally, participants reported demographic information and their usual frequency of playing the lottery. Since only about half of the sample reported income in Experiment 1, experimenters checked to see if the income question was answered. If not, then the experimenter approached the participant and explained that this information was completely confidential and important for the research. Then the participant was given the opportunity to privately fill in their income.

3.2 Results

Table 5 presents the average number of tickets purchased in each condition and a Mann–Whitney significance test for each of the *myopic* conditions compared to the *broad bracketing* condition. The mean number of tickets purchased in the *broad bracketing* condition was lower than that in the *myopic* condition at a marginal level of significance, replicating the finding of Experiment 1. The mean number of tickets purchased in the *broad bracketing* condition was significantly lower than in the *myopic with feedback* condition. Although mean ticket purchases were higher in the

Table 5 Mean lottery tickets purchased in each condition in Experiment 2

Condition	Mean tickets (standard deviation)	Mann–Whitney test
Broad bracketing (*n*=38)	0.71 (1.23)	
Myopic (*n*=40)	1.45 (1.91)	Myopic vs. broad bracketing z=1.55, p=0.12
Myopic with feedback (*n*=39)	1.79 (2.00)	Myopic with feedback vs. broad bracketing z=2.22, p=0.03

myopic with feedback condition than in the *myopic without feedback* condition, this does not reach statistical significance with a Mann–Whitney test (z=0.76, p=0.44).

Figure 3 compares the distribution of ticket purchases for each of the experimental conditions. Note that the distributions for *broad bracketing* and *myopic* conditions are very similar to their distributions in Experiment 1, as are their means (see Tables 2 and 5). Again we see that in the *broad bracketing* condition, no one purchases three or four tickets and only two participants purchase five tickets. The distributions for the *myopic* and the *myopic with feedback* conditions are more skewed to the right than the *broad bracketing* condition. The *myopic with feedback* condition is even more skewed to the right than the *myopic* condition, although this difference is not significant.

In Experiment 2, we rejected the use of a Poisson model in favor of the negative binomial model because the LR-test statistic was significant ($x^2(1)$=40.99, p<0.01), indicating substantial overdispersion in the data. We collapsed the two myopic conditions using the decision bracketing variable, which was coded as 0 for the *myopic* and *myopic with feedback* conditions and 1 for the *broad bracketing* condition. The dummy variable, feedback, indicates whether or not decision feedback was given, coded 0 for both the *myopic* condition and the *broad bracketing* condition and 1 for the *myopic with feedback* condition.

Specification 1 of Table 6 shows that participants in the *broad bracketing* conditions purchased significantly fewer tickets than those in the myopic conditions.

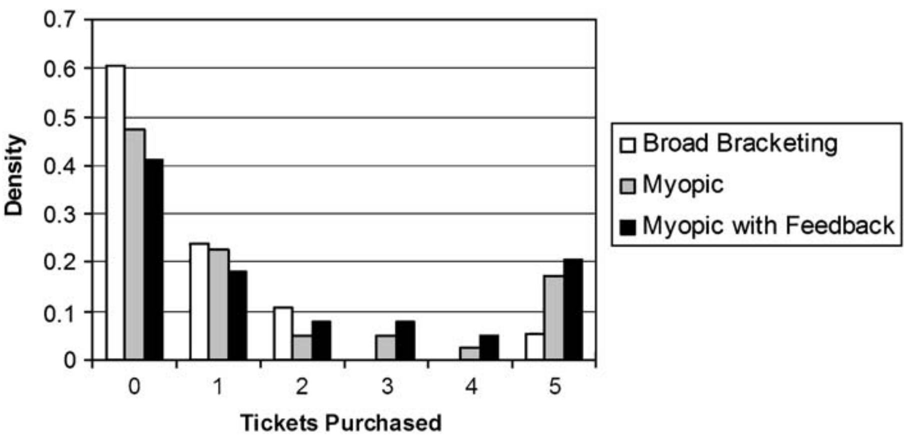

Fig. 3 Histogram of lottery tickets purchased in the broad bracketing, myopic, and myopic with feedback conditions for Experiment 2

Table 6 Negative binomial regression analysis on the effect of broad decision bracketing on number of lottery tickets purchased

	Incidence rate ratios				
	(1)	(2)	(3)	(4)	(5)
Broad bracketing	0.490*		0.489*		0.330**
	(0.171)		(0.173)		(0.141)
Feedback	1.238		1.248		0.983
	(0.389)		(0.396)		(0.348)
Chronic		1.346	1.168		1.222
		(0.486)	(0.411)		(0.517)
Age				0.985	0.972
				(0.061)	(0.059)
Age^2				1.000	1.000
				(0.001)	(0.001)
African American				1.012	0.846
				(0.328)	(0.272)
College				0.612	0.608
				(0.238)	(0.229)
Female				0.976	1.273
				(0.349)	(0.462)
Income				1.005	1.007
				(0.007)	(0.007)
McFadden's Pseudo R^2	0.019	0.002	0.021	0.009	0.037
Observations	117	115	115	97	96

Analysis includes all conditions in Experiment 2: the myopic condition, the myopic with feedback condition, and the broad bracketing condition. Incidence rate ratios are reported instead of regression coefficients due to their ease of interpretation. Income is expressed in thousands. Standard errors are in parentheses.
**p<0.01, *p<0.05

The coefficient on feedback is positive, but not significant. Specification 2 includes the dummy variable chronic only, which reflects the tendency to play the lottery in daily life (coded 1 if the participant reported playing the lottery at least a few times a month, 0 otherwise). The coefficient on chronic is positive, but is not significant. Table 4 breaks down ticket purchases by chronic and non-chronic players and shows that the mean difference is small, less than half a ticket. We are not sure why the significant effect of lottery play in daily life, found in Experiment 1, does not replicate here. Specification 3 includes chronic with broad bracketing and feedback and shows that the effect of decision bracketing remains significant.

Specification 4 includes all demographic control variables, coded as described in Experiment 1. The modified procedure to collect better income data (discussed above) was effective. Eighty-six percent of the sample reported their income, so we include this variable in our analysis as a demographic control variable (expressed in thousands).[4] However, none of the demographics, including income, are significant. A possible explanation is that our sample is more homogenous than those used in prior investigations on the impact of demographic variables on lottery ticket purchases. Our sample has a lower income, is less professional and has a higher

[4] Results are unchanged if income is excluded from the analysis.

percentage of African Americans than the US population (see Table 1). Also, in Experiment 2, there were fewer observations for both young and old participants. This restriction of range on age might help explain why the quadratic relationship between age and ticket purchases found in Experiment 1 did not replicate in Experiment 2. It is also important to note that previous studies often find inconsistent effects of demographic variables (e.g., Hansen et al. 2000).

Although including demographic variables in the sample does not change the results of our manipulation, their inclusion highlights that the results of the experimental manipulation were not due to demographic factors that varied between conditions, despite random assignment. Specification 5 includes decision bracketing, feedback, and all demographic variables. The coefficient on decision bracketing remains significant, after controlling for all other variables. The number of lottery tickets purchased when the decision is broadly bracketed is 0.33 times the number of tickets purchased when the decision viewed myopically. In absolute terms, this corresponds to an expected decrease of 1.10 tickets.

The results of the regression analysis suggest that receiving feedback about decision outcomes does not reduce the myopic risk seeking effect. We examined the effect of feedback more closely, specifically looking at the effect of receiving positive (winning) versus negative (losing) feedback in the previous round. This analysis is limited to the second, third, fourth, and fifth decisions and only those when there had been a ticket purchased in the previous round (57 observations). As could be expected, the majority of the tickets purchased were losing tickets (77.2%), with seven wins that simply recouped the cost of the ticket with either a free ticket or \$1, five wins of \$2, and one win of \$4.[5] Using logistic regression analysis with standard errors clustered by participant, we find that when a losing ticket is purchased in the previous round, participants are more likely to purchase another lottery ticket in the subsequent round (odds ratio=2.98, z=2.17, p=0.03) and this effect persists when all control variables are included in the model (odds ratio=4.84, z=2.34, p=0.02).

3.3 Discussion

Experiment 2 replicates the finding that broad bracketing decreases lottery ticket purchases. The inclusion of the *myopic with feedback* condition shows that the relationship between lottery tickets purchased and myopic decision making is unaffected by the opportunity for ticket purchasers in the myopic condition to learn from feedback. Feedback about the outcomes of previous decisions does not facilitate learning about the poor odds of winning the lottery. The opportunity to learn from previous decisions, if anything, strengthens the relationship between myopic perception and lottery ticket purchases. This is surprising because few people ever won any money from playing the lottery. Of the 70 tickets purchased in the *myopic with feedback* condition, only eight tickets returned more than \$1, with \$4 being the highest win.

[5] Since the outcome of the 5th ticket purchase is irrelevant for future decisions, this count excludes the 5th round.

It may be that the high level of ticket purchases in the *myopic with feedback* condition is due to the desire to recover losses from previous rounds or due to the gambler's fallacy. Our results are consistent with both of these explanations. We find that participants are significantly more likely to purchase a lottery ticket in a given round if they purchased a losing ticket in the previous round.

4 Conclusion

Taken together, the results of Experiments 1 and 2 offer consistent evidence that myopic decision making is a significant factor that promotes lottery ticket purchases. Experiment 1 manipulated decision bracketing in two ways: by giving participants the choice of purchasing five tickets or nothing and by allowing participants to choose in a single decision how many tickets to purchase. In both cases, participants purchased fewer tickets when they viewed the decision to purchase tickets broadly rather than myopically. The results of Experiment 2 indicate that this effect is not attenuated, but if anything strengthened, by giving participants the opportunity to receive feedback about the results of previous decisions.

With the exception of the work by Langer and Weber (2001, 2005), one may be left with the impression from the myopic loss aversion literature that broader decision bracketing necessarily leads to greater risk seeking, since this literature has only examined prospects with positive expected values. The results of the current study extend the literature on myopic loss aversion by demonstrating a "myopic risk seeking effect"—that myopic evaluation of attractive prospects with negative expected values induces risk seeking behavior while broader decision bracketing reduces risk seeking behavior. These findings are reconciled by the more general theory that broad decision bracketing yields decisions more in line with expected value maximization.

From a policy perspective, these results can be interpreted to suggest that lottery ticket purchases may be a mistake, or at least to indicate that lottery ticket purchases are not a consistent preference. However, it would be futile to argue that lotteries should be abolished. Lotteries aren't going away. Even with a payoff of only $0.53 on the dollar, they are extraordinarily popular and especially among low-income individuals. Approximately 50% of households with an income less than $25,000 play the lottery, and among the households that play, the annual per capital expenditure is upwards of $550 (Clotfelter et al. 1999). The disproportionate consumption of lottery tickets by low-income individuals, combined with the fact that proceeds from lottery tickets generate revenue for the state, has led some to view state lotteries as a kind of regressive, albeit voluntary, tax. If leveling a very high tax on low-income families is not considered desirable, there is a simple solution: raise the payout on lotteries and reduce the variability of prizes. Given the importance of lottery revenues for many state treasuries, this seems unlikely to occur.

However, our results do point to a potential policy application that could selectively reduce ticket purchases by low-income players and promote responsible gambling. Lottery tickets could be sold in packages of multiple tickets, e.g., packs of five undiversified $1 tickets. In line with our research findings, this should decrease the sale of lottery tickets overall by reducing people's propensity to discount the low cost of a ticket as a “peanut” without realizing how costs add up over time. Such a policy could selectively reduce sales for low-income players rather than high-income players because the dollar value of a “peanut” can be expected to increase as income increases (Markowitz 1952). This intervention would be attractive to a state that would like to decrease its share of gambling revenue generated by low-income consumers. Of course, this must be carefully pilot tested first to avoid unintended consequences. One could imagine a scenario in which problem gamblers are hooked on a “daily dose” of lottery gambling and might step up their daily consumption to the purchase minimum.

It could be argued that this strategy would detract from the utility that a low-income individual derives from ticket purchases in the form of entertainment and excitement. However, it is also possible that the long-run consequences of fewer ticket purchases may increase overall utility. The money that would have been spent on lottery purchases may be used instead for other forms of entertainment or consumption that may more than compensate for the reduced utility from lottery playing. As suggested by Kearney’s (2005b) analysis, lottery ticket expenditures could be used instead to pay bills and build assets (in the form of mortgage payments), which may reduce the financial stress of low-income individuals. Nevertheless, it is impossible to assert with certainty that selling lottery tickets in packets of multiple tickets would either increase or decrease overall utility.

Another application of our findings is to the treatment of pathological lottery gambling. Effective clinical treatments involve education about erroneous beliefs that promote gambling—such as the gambler’s fallacy and the illusion of control (Sylvain et al. 1997). Education about the peanuts effect should be part of this education, possibly including demonstrations of how quickly gambling expenses add up and comparisons to alternative purchases that could be made if the money was invested instead.

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