

Online Appendix A. The Realization Effect and Skewness

In what follows, we use a non-myopic framework to explain more precisely how the realization effect and the skewness of the investment opportunity are related. To do so, we build on previous work by Barberis (2012) and Imas (2016) [in an alternative to his main model]. Barberis (2012) shows that cumulative prospect theory can explain sequential risk-taking behavior and demonstrates how the skewness of a lottery affects people’s propensity to take risk. Therefore, his model is relevant for analyzing the relationship between realization and skewness. To explain differential risk-taking behavior after paper and realized losses in a non-myopic case, Imas (2016) uses the findings from Barberis (2012) framework. In the following, we will, therefore, also refer to Imas (2016).

A key ingredient of cumulative prospect theory is probability weighting (Tversky and Kahneman, 1992). People tend to overweight small probabilities while underweighting large probabilities. As a result of probability weighting, Barberis (2012) shows that (1) people are willing to invest in a symmetric lottery with negative expected payoff, and (2) prospect theory predicts an inconsistency in subsequent investment behavior. To understand these predictions, we briefly review his model. In the model, cumulative prospect theory generates inconsistency in sequential risk-taking environments, which is captured by the difference between people’s ex-ante plans and actual behavior. People initially optimize over a set of potential gambling plans. For a wide range of parameters, people prefer the “loss-exit” plan, where they plan to continue gambling if they win and stop gambling if they start accumulating losses. However, after they begin gambling, people actually deviate from this “loss-exit” plan: They continue gambling when they lose and stop gambling when they have a significantly large gain.

The reasoning is as follows: The “loss-exit” plan makes accepting risk initially attractive. A key characteristic of this plan is that its perceived distribution of outcomes over all rounds is positively skewed. Since small probabilities of winning in this plan are overweighted, gambling becomes highly attractive. In other words, following this plan limits the downside (they stop gambling after losing) while it retains the potential upside (they continue gambling after winning), making the overall lottery distribution much more positively skewed than the one of a single lottery. However, over the course of rounds, the probabilities of the prospective outcome distribution change, becoming less positively skewed. The difference in skewness over final outcomes before and after the individual starts gambling is what generates inconsistent behavior. Barberis (2012) shows that for a wide range of preference parameter values, the described probability weighting effect outweighs the loss aversion effect, and thus people are willing to begin gambling in the first place with the “loss-exit” plan in mind. The trade-off between probability weighting and loss aversion will be important to

our line of argument.

When do people deviate from the plan? People only show inconsistent behavior over the course of lotteries if the plan makes it attractive enough to accept risk in the first place. This means that the overall lottery distribution needs to be sufficiently positively skewed such that small probabilities within this plan are initially overweighted but over the course of rounds become less overweighted. More precisely, the probability weighting effect needs to dominate the loss aversion effect. Otherwise, the person would stick to his plan and not deviate from it. Now, what does realization do to gambling behavior? Imas (2016) has theoretically shown for losses that realization brings people closer to their initial plan if they suffer from inconsistent behavior. The argument is the following: Realization closes the respective mental account and internalizes the paper outcome. For a loss, this means that there is no option to break-even anymore and, therefore, people stop chasing losses. In addition to this, investing in the lottery after a realization becomes less attractive as the overall distribution becomes less positively skewed the more rounds have already been played. How realization influences risk taking after gains requires a little more explanation: For a gain, realization removes the possibility to offset future losses by previous gains. Therefore, losses are more painful after realized gains than after paper gains, which decreases people's willingness to take risk after a realized gain compared to a paper gain. In addition to this, the progress in rounds decreases the attractiveness of investing in the lottery because probability weighting changes over time. Once gains which were initially unlikely and, therefore, overweighted occurred, they are not perceived as unlikely anymore and consequently less overweighted. The lower attractiveness of the lottery combined with the larger sensitivity to future losses makes investing in the lottery after a realized gain less attractive than after a paper gain. Realization decreases people's propensity to gamble after a gain - they deviate from the ex-ante plan.

Realization of a loss brings people closer to their initial plan (Imas, 2016), whereas realization of a gain does not. How can this prediction be used to explain the relationship between the realization effect and the skewness of lotteries? First, we consider a symmetric lottery and assume that it is played over four rounds (as in experiment 2). We assume that people form an optimal "loss-exit" plan as described above. However, this plan has an overall lottery distribution, which is not very positively skewed compared to, for example, the one that would emerge from a positively skewed lottery. This has a key implication: People are less likely to deviate from the optimal plan for losses and more likely to deviate from it for gains. They are predicted to act inconsistently after gains while they act consistently after losses. This implication follows directly from Barberis (2012), who finds that at least 26 rounds are necessary to observe inconsistency with symmetric lotteries for the usually assumed preference parameter values of Tversky and Kahneman (1992). This can easily be

seen in our setting of either a symmetric lottery with $p=1/2$ versus a positively skewed lottery with $p=1/6$ played over four rounds. The most favorable outcome (4 successes) occurs with a probability of $1/16$ for the symmetric lottery compared to $1/1296$ for the positively skewed lottery. Therefore, the more positively skewed the lottery is, the fewer rounds are needed to observe inconsistency.

This implication is essential to understand why the realization effect is less likely to be found for symmetric lotteries. A necessary condition to find differential behavior between paper and realized outcomes is that people deviate from their optimal plan after a loss and stick to it after a gain. As explained, this occurs if probability weighting is very pronounced due to the degree of skewness of the lottery distribution. The skewness can be affected in two ways: Either it can be increased by providing a positively skewed lottery from the beginning or by extending the number of rounds people can invest in the lottery. Since the number of rounds is fixed over all our experiments, it is the skewness of the symmetric lottery that makes deviations from the ex-ante plan after a loss unlikely and after a gain likely. After a paper loss, people are actually willing to gamble but do not do so with a symmetric lottery over a few rounds because the probability weighting effect does not outweigh the loss aversion effect.

There is a second argument adding to this reasoning: when abstracting from the role of ex-ante plans, a symmetric lottery provides little opportunity to recover from a paper loss because the potential upside is relatively small compared to the downside. Consistent with the effect of probability weighting, the decreased chance to break-even makes deviations from the ex-ante plan after a paper loss less likely. As explained by Imas (2016), realization of a loss brings people closer to the initial plan and circumvents inconsistent behavior. However, if there is no inconsistent behavior, realization should have little effect: people will adhere to their ex-ante plan after a loss and behave similarly after a paper and realized loss.

Similar reasoning works for gains. After a gain, the loss aversion effect outweighs the probability weighting effect. Although, previous paper gains cushion future losses, which decreases loss aversion, the progress in rounds in a symmetric lottery is accompanied by a strong reduction in probability overweighting. Ultimately, the unattractiveness of the lottery dominates, and the person is less likely to continue gambling after a paper gain. This means that the person shows inconsistency in his investment decisions. There is another point adding to the unattractiveness of a symmetric lottery: The relatively large downside can potentially wipe out people's previous gains as well as parts of their own money if they gamble again. Consistent with our previous line of argument, the risk to be wiped off by large losses makes deviations from the ex-ante plan after a paper gain more likely. As explained above, realization presents another way to prevent people from gambling after a gain. However, if there is inconsistent behavior after paper gains as well as after realized gains, realization

has little effect in preventing people who else gamble from gambling: people will not adhere to their ex-ante plan after a gain and behave similarly after a paper and realized gain.

The same reasoning as above applies to negatively skewed lotteries. As the probability weighting works in the opposite direction (losses are overweighted and gains underweighted) and the potential upside relative to the downside becomes even less attractive compared to the symmetric lottery, realization will have little effect because people are already predicted to stick to their ex-ante plan after paper losses and deviate from it after paper gains.

Online Appendix B. Experiment Instructions

This appendix contains the instructions of experiment 1. Moreover, it presents exemplary screenshots of experiment 1.

B.1 Instructions in the paper treatment of experiment 1

Welcome to our experimental study on decision making. The experiment will take about 30 minutes. All the money you earn is yours to keep. You receive 8.00 Euro in an envelope. This is your money which you can use to participate in the experiment. Please check that the envelope contains 8.00 Euro. The experiment consists of 4 successive rounds of investment decisions. You will have 8.00 Euro in total to invest. Each round you must decide how much of 2.00 Euro you would like to invest in a lottery: With a probability of $1/6$ (16%) the lottery will “succeed” and you will make 7 times the amount you invested. With a probability of $5/6$ (84%) the lottery will “fail” and you will lose the amount you invested. The procedure in each round is the same.

First, you are assigned one success number between 1 and 6. It is displayed on the computer screen. Second, you enter the amount you would like to invest in the lottery. The amount can be up to 2.00 Euro. When everyone is ready, the experimenter will roll a six-sided die in front of the class. If the rolled number is your success number, you will win the round and you will earn 7 times the amount invested. If the rolled number is not your success number, you will lose the invested amount. The outcome of the lottery is reported each round. Afterwards, you get a new success number and make the same decision in the next round.

At the end of the four rounds, your game payment will be the 8.00 Euro you started with plus your net earnings from the investments. Note that net earnings can be positive or negative.

B.2 Instructions in the realization treatment of experiment 1

Welcome to our experimental study on decision making. The experiment will take about 30 minutes. All the money you earn is yours to keep. You receive 8.00 Euro in an envelope. This is your money which you can use to participate in the experiment. Please check that the envelope contains 8.00 Euro. The experiment consists of 3 successive rounds of investment decisions. You will have 6.00 Euro in total to invest. Each round you must decide how much of 2.00 Euro you would like to invest in a lottery: With a probability of $1/6$ (16%) the lottery will “succeed” and you will make 7 times the amount you invested. With a probability of $5/6$ (84%) the lottery will “fail” and you will lose the amount you invested. The procedure in each round is the same.

First, you are assigned one success number between 1 and 6. It is displayed on the computer screen. Second, you enter the amount you would like to invest in the lottery. The amount can be up to 2.00 Euro. When everyone is ready, the experimenter will roll a six-sided die in front of the class. If the rolled number is your success number, you will win the round and you will earn 7 times the amount invested. If the rolled number is not your success number, you will lose the invested amount. The outcome of the lottery is reported each round. Afterwards, you get a new success number and make the same decision in the next round.

At the end of the three rounds, your game payment will be the 8.00 Euro you started with plus your net earnings from the investments. Note that net earnings can be positive or negative. After the three rounds, you begin with the next part of the experiment. In the next part, you make one more decision.

Figure B.1: Experiment 1 Screen 1 Round 1.

Round 1

Your success number for this round is 6

You can invest between 0 and 2 Euro.

Your invested amount:

Let's role a die

Figure B.2: Experiment 1 Screen 2 Round 1.

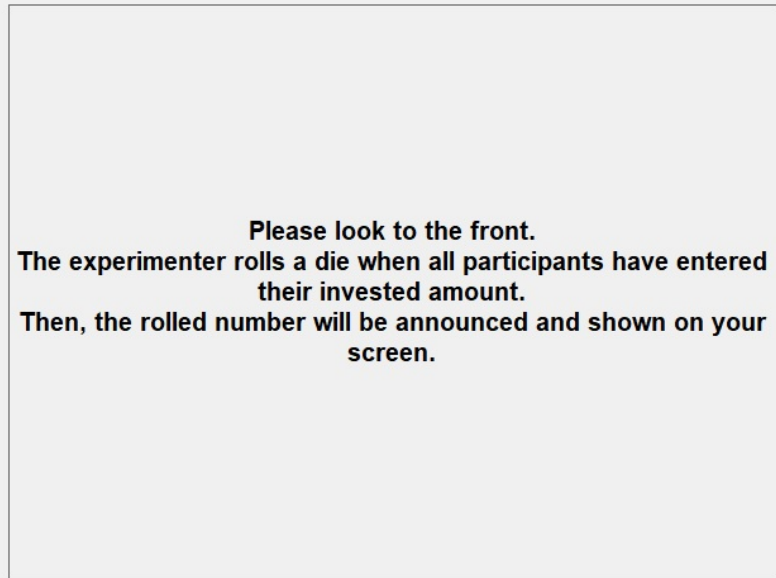


Figure B.3: Experiment 1 Screen 3 Round 1.

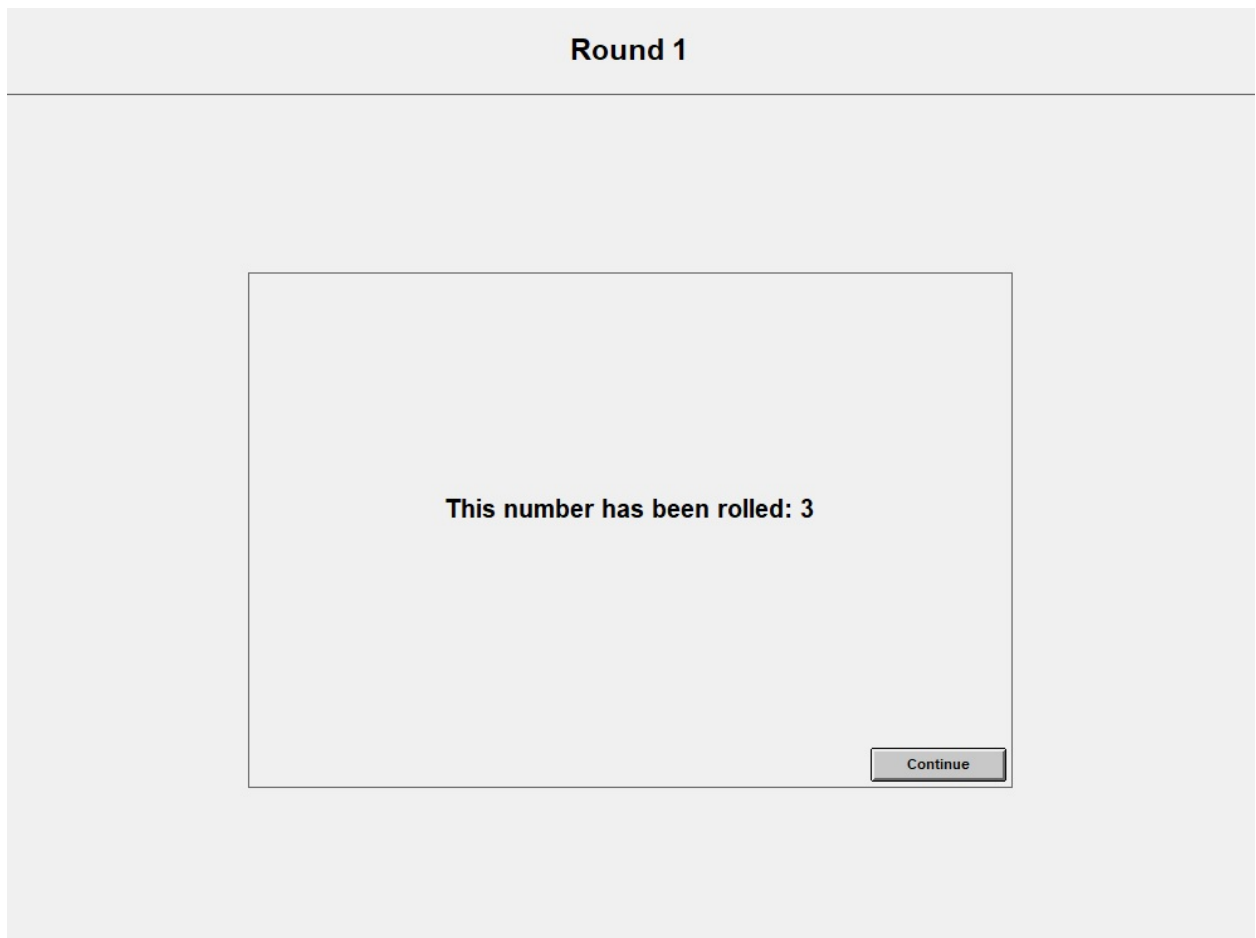


Figure B.4: Experiment 1 Screen 4 Round 1.

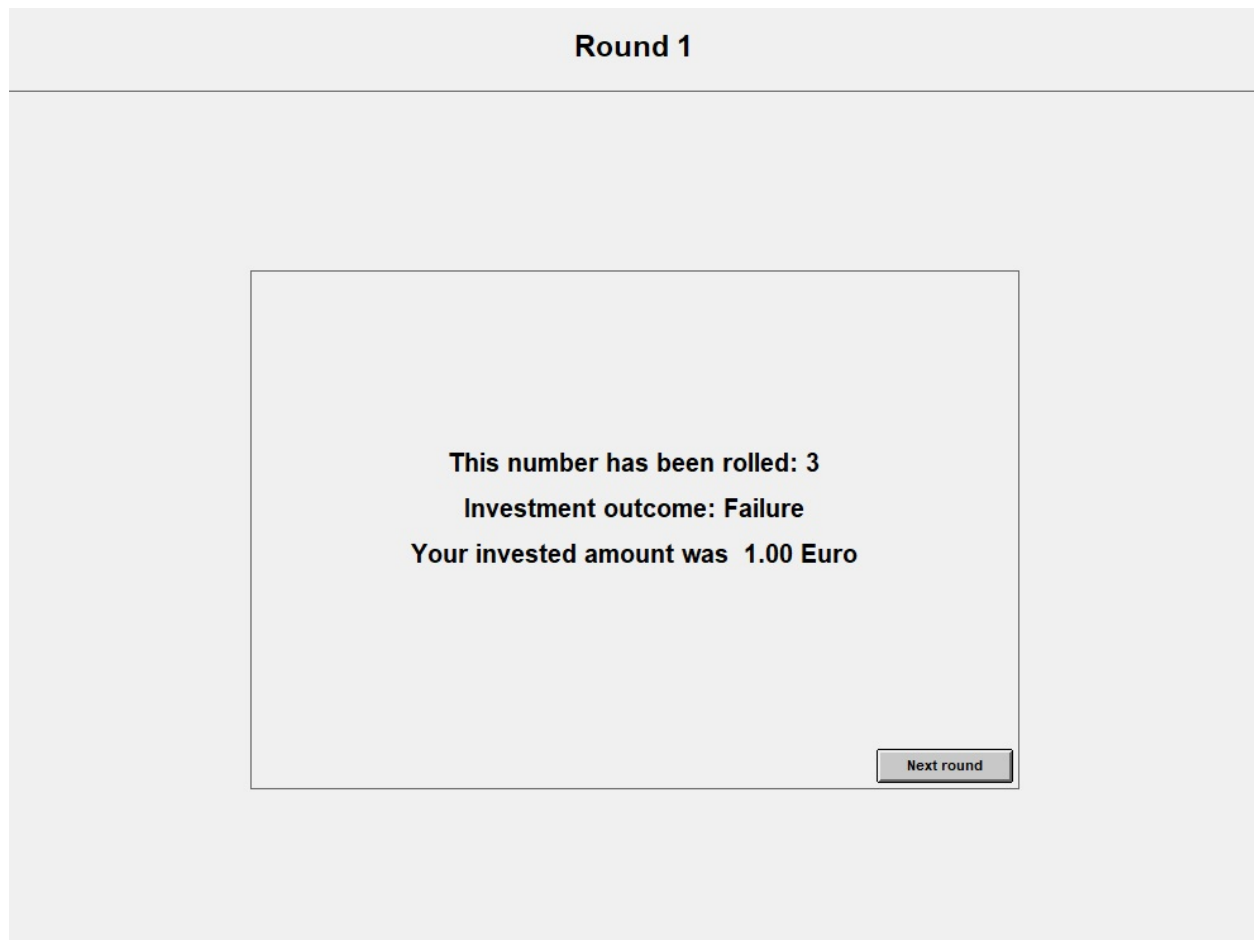


Figure B.5: Experiment 1 Earnings Update After Round 3 - Paper Treatment.

Update

Your total earnings for the three rounds are 4.50 Euro.

Continue

Figure B.6: Experiment 1 Earnings Update After Round 3 - Realization Treatment.

Update

Your total earnings for the three rounds are 4.50 Euro.

If you made a loss, please take the difference out of the envelope and hand it back to the experimenter.

If you made a gain, you receive in addition to the amount in the envelope the difference between the total gain and the amount in the envelope.

Remain on this page until the experimenter collected or gave you the amount of money.

Continue

Online Appendix C. Measures used in the Experiments

This appendix details how different concepts were measured in the experiments including risk aversion, loss aversion, time preferences, illusion of control, financial literacy, and cognitive reflection.

C.1 Risk aversion (Dohmen et al., 2011; Falk et al., 2016)

How do you see yourself: Are you generally a person who is fully prepared to take risks or do you try to avoid taking risks? Please use a scale from 0 to 10 for your assessment. 0 means not at all willing to take risks and 10 means very willing to take risks.

C.2 Loss aversion (Gächter et al., 2007)

Loss aversion is measured by the number of accepted gambles from Table C.1.

Table C.1: Choices to accept or reject a coin toss for different outcomes

	Accept	Reject
If the coin shows heads, you lose 20 Euro. If the coin shows tails, you win 60 Euro.		
If the coin shows heads, you lose 30 Euro. If the coin shows tails, you win 60 Euro.		
If the coin shows heads, you lose 40 Euro. If the coin shows tails, you win 60 Euro.		
If the coin shows heads, you lose 50 Euro. If the coin shows tails, you win 60 Euro.		
If the coin shows heads, you lose 60 Euro. If the coin shows tails, you win 60 Euro.		
If the coin shows heads, you lose 70 Euro. If the coin shows tails, you win 60 Euro.		

C.3 Time preferences (Falk et al., 2016)

In comparison to others, are you a person who is generally willing to give up something today in order to benefit from that in the future or are you not willing to do so? Please use a scale from 0 to 10, where 0 means you are “completely unwilling to give up something today” and 10 means “you are very willing to give up something today.” You can also use the values in-between to indicate where you are on the scale.

C.4 Illusion of control (Wood and Clapham, 2005)

Read each of the following statements carefully. Rate to what extent you agree or disagree with each statement. 1 means that you strongly disagree and 5 means that you strongly agree.

1. There are secrets to successful casino gambling that can be learned.

2. It is a good advice to stay with the same pair of dice on a winning streak.
3. One should pay attention to lottery numbers that often win.
4. If a coin is tossed and comes up heads ten times in a row, the next toss is more likely to be tails.
5. The longer I have been losing, the more likely I am to win.

C.5 Financial literacy (Van Rooij et al., 2011)

1. Which of the following statements describes the main function of the stock market?
 - (a) The stock market helps to predict stock earnings.
 - (b) The stock market results in an increase in the prices of stocks.
 - (c) The stock market brings people who want to buy stocks together with people who want to sell stocks.
 - (d) None of the above.
 - (e) Do not know.
2. Which of the following statements is correct? If somebody buys the stock of firm B in the stock market:
 - (a) He owns a part of firm B.
 - (b) He has lent money to firm B.
 - (c) He is liable for firm B's debt.
 - (d) None of the above.
 - (e) Do not know.
3. Which of the following statements is correct?
 - (a) Once one invests in a mutual fund, one cannot withdraw the money in the first year.
 - (b) Mutual funds can invest in several assets, for example invest in both stocks and bonds.
 - (c) Mutual funds pay a guaranteed rate of return which depends on their past performance.
 - (d) None of the above.
 - (e) Do not know.

4. Which of the following statements is correct? If somebody buys a bond of firm B:
- (a) He owns a part of firm B.
 - (b) He has lent money to firm B.
 - (c) He is liable for firm B's debt.
 - (d) None of the above.
 - (e) Do not know.
5. Considering a long time period (for example 10 or 20 years), which asset normally gives the highest return?
- (a) Savings accounts
 - (b) Bonds
 - (c) Stocks
 - (d) Do not know.
6. Normally, which assets displays the highest fluctuations over time?
- (a) Savings accounts
 - (b) Bonds
 - (c) Stocks
 - (d) Do not know
7. When an investor spreads his money over different assets, does the risk of losing money:
- (a) Increase
 - (b) Decrease
 - (c) Stay the same
 - (d) Do not know.
8. If the interest rate falls, what should happen to bond prices?
- (a) Rise
 - (b) Fall
 - (c) Stay the same
 - (d) Do not know.

C.6 Cognitive Reflection Test (Toplak et al., 2014)

1. If John can drink one barrel of water in 6 days and Mary can drink one barrel of water in 12 days, how long would it take them to drink one barrel of water together?
2. Jerry receives both the 15th highest and the 15th lowest mark in the class. How many students are in the class?
3. A man buys a pig for 60 Euro, sells it for 70 Euro, buys it back for 80 Euro and sells it finally for 90 Euro. How much has he made?
4. Simon decided to invest 8,000 Euro in the stock market one day early in 2017. Six months after he invested, on July 17, the stocks he had purchased were down 50%. Fortunately for Simon, from July 17 to October 17, the stocks he had purchased went up 75%. At this point, Simon
 - (a) has broken even in the stock market
 - (b) is ahead of where he began
 - (c) has lost money
5. A bat and a ball cost 1.10 Euro in total. The bat costs 1.00 Euro more than the ball. How much does the ball cost?
6. If it takes 5 machines 5 minutes to make 5 widgets, how long would it take 100 machines to make 100 widgets?
7. In a lake, there is a patch of lily pads. Every day, the patch doubles in size. If it takes 48 days for the patch to cover the entire lake, how long would it take for the patch to cover half of the lake?

Online Appendix D. Additional Results from the Experiment

This appendix presents additional results from the experiments. In Tables D.1, D.2, and D.3, we examine dynamic risk-taking more generally and report the changes in risk taking over all rounds prior to the final round for the positively skewed, symmetric, and negatively skewed lottery, respectively. In Table D.4, we provide an overview of the outcomes after round 3 for the participants in the positively skewed lottery. Table D.5 shows how risk taking after gains in the positively skewed lottery depends on the round of success. The regression analysis in Table D.6 presents whether, and to what extent the realization effect depends on individual characteristics such as, for example, gender, risk aversion and time preferences.

Table D.1: Dynamic risk-taking in the positively skewed lottery (round 1 to 3). The table shows the average invested amounts in the lottery and the respective changes in the average invested amounts between rounds for the first three rounds of experiment 1 (in Euro). Panel A is restricted to participants who lost in the first three rounds of the experiment, Panel B shows averages for all participants with at least one gain in the first three rounds. Both panels show results by treatment (paper and realization). Change is the difference between the investment of two subsequent rounds. N provides the number of participants for each treatment-outcome combination. T-values of a two-sided t-test are shown in parentheses.

<i>Panel A: Risk-taking after losses</i>						
Treatment	Invested amount			Change		N
	Round 1	Round 2	Round 3	R2–R1	R3–R2	
Paper	0.98	0.91	0.78	–0.07 (1.11)	–0.13 (1.77)	57
Realization	0.90	0.73	0.80	–0.17 (3.07)	0.07 (1.15)	58
<i>Panel B: Risk-taking after gains</i>						
Treatment	Invested amount			Change		N
	Round 1	Round 2	Round 3	R2–R1	R3–R2	
Paper	0.94	0.73	0.71	–0.21 (2.86)	–0.02 (0.28)	35
Realization	0.71	0.77	0.73	0.06 (0.65)	–0.04 (0.42)	36

Table D.2: Dynamic risk-taking in the symmetric lottery (round 1 to 3). The table shows the average invested amounts in the lottery and the respective changes in the average invested amounts between rounds for the first three rounds of experiment 2 (in Euro). Panel A is restricted to participants who lost in the first three rounds of the experiment, Panel B shows averages for all participants with at least one gain in the first three rounds. Both panels show results by treatment (paper and realization). Change is the difference between the investment of two subsequent rounds. N provides the number of participants for each treatment-outcome combination. T-values of a two-sided t-test are shown in parentheses.

<i>Panel A: Risk-taking after losses</i>						
Treatment	Invested amount			Change		N
	Round 1	Round 2	Round 3	R2–R1	R3–R2	
Paper	1.40	1.37	1.45	–0.03 (0.41)	0.08 (1.45)	22
Realization	1.57	1.50	1.53	–0.07 (0.49)	0.03 (0.29)	15
<i>Panel B: Risk-taking after gains</i>						
Treatment	Invested amount			Change		N
	Round 1	Round 2	Round 3	R2–R1	R3–R2	
Paper	1.35	1.15	1.19	–0.20 (1.80)	0.04 (0.52)	27
Realization	1.43	1.56	1.38	0.13 (1.81)	–0.18 (1.57)	30

Table D.3: Dynamic risk-taking in the negatively skewed lottery (round 1 to 3).

The table shows the average invested amounts in the lottery and the respective changes in the average invested amounts between rounds for the first three rounds of experiment 3 (in Euro). Panel A is restricted to participants who lost in the first three rounds of the experiment, Panel B shows averages for all participants with at least one gain in the first three rounds. Both panels show results by treatment (paper and realization). Change is the difference between the investment of two subsequent rounds. N provides the number of participants for each treatment-outcome combination. T-values of a two-sided t-test are shown in parentheses.

<i>Panel A: Risk-taking after losses</i>						
Treatment	Invested amount			Change		N
	Round 1	Round 2	Round 3	R2–R1	R3–R2	
Paper	1.53	1.66	1.67	0.13 (2.12)	0.01 (0.04)	32
Realization	1.70	1.79	1.78	0.09 (1.64)	–0.01 (0.26)	38
<i>Panel B: Risk-taking after gains</i>						
Treatment	Invested amount			Change		N
	Round 1	Round 2	Round 3	R2–R1	R3–R2	
Paper	1.45	1.60	1.60	0.15 (2.52)	0.00 (0.00)	70
Realization	1.58	1.71	1.67	0.13 (1.86)	–0.04 (0.67)	64

Table D.4: Overview of outcomes after round three in the positively skewed lottery The table shows how many participants have negative, positive or zero net earnings after round three, as well as the average earnings and the standard deviation of the earnings after round three. For those participants who have a gain after round three, we report in which round they won the lottery (those with a loss never won the lottery). We provide the number of observations for each outcome by treatment.

Outcome by the end of round 3	N Total	Average Earnings	Std. Deviation of Earnings	N Paper	N Realization
Loss (Earnings < EUR 8.00)	115	5.45	1.62	57	58
Gain (Earnings > EUR 8.00)	71	12.04	1.92	35	36
Success only in round 1	21	11.83	2.24	11	10
Success only in round 2	17	12.50	3.46	12	5
Success only in round 3	27	11.39	2.86	10	17
Success in two rounds	6	14.38	2.95	2	4
No Gain/Loss (Earnings = EUR 8.00)	17	8.00	0	13	4

Table D.5: Risk taking after gains in the positively skewed lottery. The table shows the average invested amounts in the lottery for all rounds of experiment 1 (in Euro) conditional on the round of success. Panel A is restricted to participants who win in round one and have a gain by the end of round three, Panel B displays averages for participants who win in round two and have a gain by the end of round three, and Panel C shows averages for all participants who win in round three and have a gain by the end of round three. All three panels show results by treatment (paper and realization) and differences between treatments. Change is the difference between the investment in the final round and round three. N provides the number of participants for each treatment-outcome combination. T-values of a two-sided t-test are shown in parentheses.

<i>Panel A: Success in round 1</i>						
Treatment	Round 1	Invested amount		Round 4	Change	N
		Round 2	Round 3		R4–R3	
Paper	0.96	0.72	0.74	1.00	0.26 (2.00)	13
Realization	0.78	0.68	0.53	0.48	–0.05 (0.73)	14
Difference	0.19 (0.95)	0.04 (0.20)	0.21 (0.91)	0.52 (2.32)	0.31 (2.17)	
<i>Panel B: Success in round 2</i>						
Treatment	Round 1	Invested amount		Round 4	Change	N
		Round 2	Round 3		R4–R3	
Paper	1.00	0.87	0.68	0.77	0.08 (0.64)	13
Realization	0.81	1.01	0.67	0.83	0.16 (1.04)	7
Difference	0.18 (0.84)	–0.14 (0.42)	0.01 (0.03)	–0.06 (0.21)	–0.07 (0.34)	
<i>Panel C: Success in round 3</i>						
Treatment	Round 1	Invested amount		Round 4	Change	N
		Round 2	Round 3		R4–R3	
Paper	0.86	0.50	0.64	0.86	0.22 (1.30)	11
Realization	0.61	0.65	0.82	0.62	–0.20 (1.91)	19
Difference	0.25 (1.08)	–0.15 (0.60)	–0.18 (0.78)	0.24 (0.92)	0.42 (2.24)	

Table D.6: The realization effect for gains and losses with controls (univariate).

The table shows the results of OLS regressions with the change in the invested amount between rounds three and four in experiment 1 as the dependent variable. Realization is an indicator variable taking a value of one for the realization treatment. Control variables are a male indicator, risk aversion (RA; reversed scale of the original question, 0=not risk averse, 10=very risk averse), loss aversion (LA), time preferences (TP; 0=very impatient, 10=very patient), illusion of control (IOC; 1=low, 5=high), financial literacy (FL; 0=low, 8=high), and cognitive reflection (CR; 0=low, 7=high). Robust standard errors are shown in parentheses. ***, **, and * indicate significance on the 1%, 5%, and 10% levels, respectively.

	Change in invested amount							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Realization	-0.175*** (-0.0657)	-0.182*** (-0.0656)	-0.193*** (-0.066)	-0.173*** (-0.0662)	-0.179*** (-0.0661)	-0.174*** (-0.0663)	-0.176*** (-0.0664)	-0.213*** (-0.0667)
Male	0.115* (-0.0659)							0.159** (-0.0784)
RA		-0.0275** (-0.0136)						-0.0127 (-0.0161)
LA			0.0037 (-0.0292)					0.0244 (-0.0328)
TP				0.00288 (-0.0156)				0.00594 (-0.0168)
IOC					0.0501 (-0.0445)			0.0417 (-0.0487)
FL						-0.0013 (-0.0165)		-0.0162 (-0.0198)
CRT							-0.00585 (-0.0181)	-0.0201 (-0.0209)
Constant	0.0324 (-0.0547)	0.232*** (-0.0859)	0.0984 (-0.0776)	0.0623 (-0.13)	-0.0208 (-0.104)	0.0915 (-0.0986)	0.116 (-0.108)	0.112 (-0.247)
Observations	200	200	189	200	200	200	200	189
R^2	0.048	0.054	0.044	0.034	0.04	0.034	0.034	0.081

Online Appendix E. Online Experiment

This appendix presents the results of an experiment, which was conducted online. The main difference to experiments 1-3 is that we used another realization mechanism and a different framing of the final investment round in the online experiment.

In his study, Imas (2016) tests the boundary conditions of the realization effect with respect to the realization mechanism. While in the original experiment money is physically transferred to participants by the experimenter, a robustness experiment considers an electronic transfer of money between different accounts. The process of sending money is initiated by participants. They have to type “closed” to transfer and realize outcomes from the first three lottery rounds. Based on the results, this realization mechanism is sufficient to produce a similarly strong realization effect. Imas (2016) concludes that a physical transfer of money is not necessary to show the realization effect.

We challenge this conclusion for two reasons. First, it is instrumental for the realization effect that the investor recognizes the difference between paper and realized outcomes and the point in time of realization. Not only is this distinction presumably less salient for a virtual transfer of money, but it remains open whether the two separate electronic accounts also constitute separate mental accounts. Secondly, literature in psychology shows that people perceive a physical transfer of money differently than an electronic transfer of money. For example, paying with a credit card is perceived as less painful than paying with cash explained by the transparency of the payment outflow (Raghubir and Srivastava, 2008). Likewise, realization utility might be felt less intensely when relying on this realization mechanism. We, therefore, replicate the two different mechanisms in our experiment.

Furthermore, we examine how framing affects the realization effect. We initially did not intend to investigate this question as part of the online experiment. However, after we ran the online experiment, we noticed that we deviated from the original design in how we labeled the final round in the realization treatment. This change in framing turns out to make a difference. We will, therefore, also report the results of an additional treatment in which we replicate the framing of the final round exactly as in Imas (2016).

E.1 Design and participants

We discuss that the realization mechanism might be a major determinant for differential risk taking after realized and unrealized outcomes. The less strong realization effect identified in the prior experiments casts some doubt on whether a weaker realization mechanism is sufficient to generate the effect. We thus replicate study 2 by Imas (2016) in experiment 4, which uses an online experiment

without physical transfer of money.

The structure of the online experiment was similar to the laboratory experiments with the main differences that the stakes were smaller, and the realization mechanism was modified. Participants were paid a fixed amount of \$0.30, plus their earnings at the end of the experiment. They received an endowment of \$1.00 at the beginning of the experiment to be used in four subsequent investment decisions. In each round, participants were randomly assigned a success number and decided how much of \$0.25 to invest in the same lottery as in experiment 1. Afterward, they rolled a virtual six-sided die, and the rolled number (randomly generated) was presented on the computer screen. If the success number matched the rolled number, the invested amount was multiplied by seven; if not, the invested amount was lost. Participants learned the outcome and continued with the next round with a new success number.

Participants were randomly assigned to either the paper or the realization treatment. In the realization treatment, earnings were reported at the end of the third round, and participants were asked to type “closed” in a dedicated window to realize their position. It was explained that any money they lost up to this round would be withdrawn from their account and transferred to the experimenter and any money they won would be credited to their account. Afterward, the same lottery was offered for an additional investment decision. Participants in the paper treatment viewed their earnings after round three. However, they did not initialize any transfer of money before continuing with the final investment decision. The design matches the original design by Imas (2016) as close as possible using the same stakes and, most importantly, the same realization mechanism.

As mentioned in the previous section, we unintentionally deviated from the original design with respect to the framing of the final round in the realization treatment. Instead of “Round 1” we labeled the final round “Additional Round”.¹⁵ We initially did not expect this change in framing to affect the outcome of the experiment since we assume a proper realization mechanism to be robust against relatively minor framing effects. Nevertheless, we run a second realization treatment (Realization Round 1) on Amazon mechanical Turk in which we revert the framing in the final round from “Additional Round” to “Round 1”.

Experiment 4, including all three treatments, was programmed in SoSciSurvey, a platform to create academic survey studies and conducted online using the labor market of Amazon mechanical Turk, which allowed us to get access to a more representative sample of the population.¹⁶ We recruited 471 individuals for the experiment, again guided by a power analysis. Participants were on average 36 years old, 42% of participants were male, 39% stated that they attended a statistics class, and the level of cognitive reflection was lower than in the student sample (1.84 correct answers

¹⁵ We noticed this deviation from the original design after we ran the online experiment.

¹⁶ <https://www.sosicisurvey.de/index.php?id=index&lang=en>.

out of 4).

E.2 Results

We first examine the investment decisions of participants who lost in each round prior to round four. Panel A of Table E.1 shows investments in all rounds by treatment for this group. Investments are not statistically different in round one to three across treatments. Focusing on the changes in investment between rounds three and four across treatments, we cannot find evidence for a realization effect. The difference of the changes in investment between treatments is insignificant and points in the wrong direction ($DiD = -1.48$, $t(197) = 1.37$, $p = 0.17$). To understand this result better, we consider the investment by treatment group. In line with a realization effect, participants in the paper treatment take more risk after a paper loss, but only marginally and not statistically significant (0.44 , $t(103) = 0.64$, $p = 0.52$). Unlike in experiment 1, participants in the realization treatment take significantly more risk after losses (1.92 , $t(94) = 2.29$, $p = 0.02$). This result is contradictory to the realization effect, which predicts the opposite.

As an explanation for these findings, it appears natural to question the modified realization mechanism. In this experiment, an electronic transfer of money between accounts instead of a physical transfer of money is supposed to induce a mental realization of earnings. We argue that by merely typing “closed,” participants do not perceive the difference between realized and unrealized outcomes and do not derive disutility from the realization of a loss (Barberis and Xiong, 2012). Since the realization is unrecognized, the mental account remains open, and the opportunity to break even by taking more risk persists. The investment pattern of participants in the realization treatment is consistent with this reasoning. The mechanism might rather emphasize the existence of a loss and stimulate more risk taking.

Further evidence for the assumption that participants did not perceive the electronic transfer of money between accounts as a realization might come from the gain domain. Panel B of Table E.1 summarizes the investments for participants who have a gain by the end of round three. Indeed, we neither find a realization effect for gains. Participants do not take less risk after a realized gain compared to a paper gain, but rather the opposite ($DiD = -1.67$, $t(152) = 1.38$, $p = 0.17$). As for losses, participants tend to take more risk after a realized gain than before a realized gain (1.50 , $t(64) = 1.81$, $p = 0.07$). Again this is inconsistent with a realization effect but consistent with the assumption that participants in the realization treatment did not part with the money they gained.

In the remaining part, we show the results of the “Realization (Round 1 framing)” treatment. To remind the reader, we only change the label of the final round in the realization treatment from “Additional Round” to “Round 1”. The change in framing is implemented to exactly align this

version with the original design of the online study by Imas (2016). Consistent with the realization effect, participants now tend to take less risk after a gain and a loss in the realization treatment when using the proposed change in framing (see Table E.1). In the slightly altered version, we thus successfully replicate the online study by Imas (2016). One possible reason is that the altered framing of the final round strengthens the triggered process of closing the respective mental account. The “Round 1” frame makes the beginning of a new investment episode clearer to participants, while the “Additional Round” frame might rather give participants the impression that they still have the chance to recover from the previous loss as they are offered an additional lottery. This would imply a continuation of the investment episode rather than an end.

We conclude that the realization effect is sensitive to the realization mechanism if money is not physically transferred. Presumably, participants in the realization treatment of the online experiment do not part with the money in the same way as those participants in the experiments with physical transfer do. Therefore, the realization effect becomes vulnerable to circumstantial effects such as framing. Future research could follow up on potential other effects that may be interrelated with the realization effect.

Table E.1: Risk taking in the online experiment. The table shows the average invested amounts in the lottery for all rounds of experiment 4 (in Cent). Panel A is restricted to participants who have a loss by the end of round three, Panel B shows averages for all participants who have a gain by the end of round three. Both panels show results by treatment (paper, realization and realization round 1 framing) and differences between treatments. In this experiment the realization is a non-physical transfer of money. Participants in the realization treatment had to type the word "closed" in a respective window after round 3 to realize their earnings. In the realization round 1 framing treatment, the final round was named "Round 1" instead of "Additional Round". Change is the difference between the investment in the final round and round three. N provides the number of participants for each treatment-outcome combination. T-values of a two-sided t-test are shown in parentheses.

<i>Panel A: Risk taking after losses</i>						
Treatment	Invested amount				Change	N
	Round 1	Round 2	Round 3	Round 4	R4–R3	
Paper	12.03	9.30	10.07	10.51	0.44 (0.64)	104
Realization	13.06	10.78	11.32	13.24	1.92 (2.29)	95
Realization (Round 1 framing)	12.54	9.89	14.97	12.51	–2.46 (2.51)	37
Difference	–1.03 (0.84)	–1.48 (1.20)	–1.25 (1.00)	–2.73 (2.00)	–1.48 (1.37)	
Difference (Round 1 framing)	–0.51 (0.32)	–0.59 (0.37)	–4.91 (3.04)	–2.00 (1.14)	2.90 (2.23)	
<i>Panel B: Risk taking after gains</i>						
Treatment	Invested amount				Change	N
	Round 1	Round 2	Round 3	Round 4	R4–R3	
Paper	17.64	14.79	13.41	13.24	–0.17 (0.19)	70
Realization	15.87	13.38	13.39	14.89	1.50 (1.81)	84
Realization (Round 1 framing)	11.74	10.94	11.61	10.45	–1.16 (0.81)	31
Difference	1.77 (1.28)	1.40 (0.93)	0.02 (0.01)	–1.65 (1.05)	–1.67 (1.38)	
Difference (Round 1 framing)	5.90 (3.17)	3.85 (1.96)	1.80 (0.91)	2.79 (1.35)	0.99 (0.60)	