Journal of
Risk and Financial Management

MDPI

Article

Illusion of Control: Psychological Characteristics as Moderators in Financial Decision Making

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Abstract: Financial decision making requires a sound handling of chance events. However, various studies have suggested that people are prone to illusion of control, i.e., the belief that prospects of a chancy event are better if they are involved in the randomisation process. This paper reports results from an experiment ($N = 420$) suggesting that psychological characteristics moderate risk-taking behaviour under such circumstances. For example, we find that subjects high in sensation seeking buy more tickets of a risky lottery if they determine the winning numbers themselves and the random event lies in the future. The findings suggest that "illusion of control" effects are at least partly driven by underlying (idiosyncratic) emotions/preferences rather than an actual belief in control. Regarding applications, the results emphasise the importance of individual characteristics for the behaviour of decision makers in a financial context.

Keywords: illusion of control; financial decision making; investment decisions; risk

Citation: Schütze, Tobias, Ulrich Schmidt, Carsten Spitzer, and Philipp C. Wichardt. 2024. Illusion of Control: Psychological Characteristics as Moderators in Financial Decision Making. *Journal of Risk and Financial Management* 17: 65. https://doi.org/10.3390/jrfm17020065

Academic Editor: Thanasis Stengos

Received: 19 December 2023
Revised: 31 January 2024
Accepted: 2 February 2024
Published: 7 February 2024

1. Introduction

Many decisions in life involve some form of assessment of an uncertain or risky prospect by the decision maker. Prominent examples from the realm of economics are financial decisions including saving, participation in pension plans and more general financial investment decisions (e.g., Froot et al. 1993; Olsen 1997; cf. Kim et al. 2017, for a discussion of financial decision making in the family). In such instances, individual decision makers have to assess the profitability of decisions, which, to a varying degree, entail an element of risk (or chance) regarding their eventual outcomes, in order to determine, for example, optimal investment strategies (e.g., Olsen and Cox 2001; Duxbury and Summers 2004; Sachse et al. 2012; Chai et al. 2021). Optimal decision making in such situations naturally requires a sound understanding of the connection between chance and the possible returns on investment—one of many aspects of financial literacy the economic importance of which has been emphasised, for example, by Lusardi and Mitchell (2011) and Lusardi and Mitchell (2014). Moreover, finances have been identified as a key determinant of overall well-being (e.g., Wilmarth 2021; Bialowolski et al. 2021; Shehzad et al. 2023).

However, as discussed by an extensive literature in psychology, people making decisions in a context where the outcome is determined by chance tend to succumb to what is referred to as illusion of control (cf. Langer 1975; see Presson and Benassi 1996, for a meta-analysis; Stefan and David 2013, for a review). In particular, people think that chances of success are higher if they are familiar with the randomisation procedure/device (e.g., Benassi et al. 1979) or are themselves more involved in the randomisation procedure (e.g., Dunn and Wilson 1990; Langer 1975). Moreover, it has been argued that the timing of the

outcome can affect perceived control, with future events being more prone to illusion of control (e.g., Strickland et al. 1966; Williams and LeBoeuf 2017; Klusowski et al. 2021). Yet, empirical results regarding timing effects are ambiguous. While Strickland et al. (1966) find larger bets in a dice-throwing game when betting is carried out before the die is thrown, Klusowski et al. (2021) find no such effect in a large online study and no evidence that choice creates illusory control. Furthermore, in contrast to the psychological literature, studies in economics are also less conclusive with respect to illusion of control in general (cf. Charness and Gneezy 2010; Li 2011; see Filippin and Crosetto 2016, for further references).[1]

Hypothesising that individual differences regarding illusion of control may be related to psychological background characteristics (and potentially average out if not controlled for), the present study investigates the relationship between involvement in the process and timing of the event on risk-taking behaviour. More specifically, we conducted a modified version of the lottery investment task introduced by Gneezy and Potters (1997). In our experimental task, subjects could buy lottery tickets with a correlated 50% chance of winning (determined by the throw of a dice); i.e., either all tickets win or none so that the number of tickets bought can be interpreted as a measure of risk taking. Treatments varied in who determined the winning numbers (subjects or experimenter) and whether the dice was thrown before or after the tickets were bought (with no information on outcome being given prior to ticket purchases).

In addition, we collected data on attachment style (e.g., Bowlby 1982), a psychological construct categorising people's relationship style (the main styles being avoidant, anxious and secure, with the latter referring to people scoring low in both the avoidant and the anxious dimension)—where avoidance is associated with a pessimistic view of others (e.g., Shaver and Mikulincer 2012) and a high need for self-reliance (e.g., Wei et al. 2007). Moreover, we collected data on sensation seeking (Zuckerman 1994)—where higher scores indicate a higher willingness to take risks (Zuckerman 1994)—and general risk preferences (cf. Dohmen et al. 2011; Lönnqvist et al. 2015). The aim of this study was to assess how these characteristics (attachment, sensation seeking, risk attitudes) impact on illusion of control in the lottery task, assuming that positive correlations would hint at a general relevance in risk assessment in financial decision making.

Regarding the results, we find that—on an aggregate level—significantly more tickets are bought, i.e., more risks are taken, if winning numbers are chosen by the subjects rather than the experimenter (4.29 vs. 3.22, two-sided Mann–Whitney U test $p < 0.01$). Moreover, contrary to previous studies (Strickland et al. 1966; Klusowski et al. 2021), we find that, overall, more tickets are bought if the chance event (dice throw) lies in the past and only information about the outcome is missing (3.93 vs. 3.26, two-sided Mann–Whitney U test $p < 0.05$); the effect is driven by the *No Choice* treatment (3.71 vs. 2.63, two-sided Mann–Whitney U test $p < 0.05$).

With respect to psychological characteristics, if subjects can choose the winning numbers, sensation seeking moderates the timing effect. In particular, risk taking is greater for subjects with high levels of sensation seeking before the realisation of the random event. Moreover, we find that attachment avoidance and attachment anxiety moderate the timing dimension in the *No Choice* treatment in that subjects with low and medium levels of attachment avoidance/anxiety show increased risk-taking behaviour after the random event has been realised (but no information is given).

Taken together, when the subjects' own contribution in the random procedure is limited (winning numbers are predefined), attachment secure subjects show increased illusion of control over an event that is already determined. If the random event lies in the future, we find indications of illusion of control for subjects high in sensation seeking who can determine winning numbers themselves. Given the link to psychological background characteristics, however, we are hesitant to attribute behaviour to subjects really having an illusion of control. Instead, we see our results in line with the arguments presented by Li (2011) suggesting that such behaviour is driven by preferences or, in our case, emotional states rather than by an actual illusion of control.

In view of their applications, we see our results as informative regarding financial literacy and potential biases in the behaviour of, in particular, financial decision makers (see also, for example, Olsen and Cox 2001; Duxbury and Summers 2004; Sachse et al. 2012). While the experimental context, of course, is a stylised one, many financial decisions that entail a form of risk (or chance) can, for example, be framed with either more or less personal involvement (e.g., investing in bonds vs. picking stocks, being offered a fixed pension saving scheme vs. a more flexible one); similarly, the profitability of decisions may occasionally depend on chance factors that have been realised in the past but have not been revealed (e.g., risk factors in insurance decisions).[2] If personal characteristics matter in the way observed here, assessments of risk and corresponding behaviour may vary depending on an interaction of contextual and personal characteristics.

Whether more risk-taking behaviour eventually is preferable (or politically desirable), of course, will depend on the context as well as on the question whether only monetary outcomes are considered relevant or more general views on subjective well-being are taken (e.g., Chai 2023). Additionally, it should be noted that in the present setting, more risk taking is actually preferable in terms of expected monetary outcomes. Finally, we want to emphasise that the chance events considered in the present research do not allow for negative final outcomes. Thus, how behaviour is affected by the described characteristics in the case of chancy events where expected monetary rewards may become negative would be an important open question for future research.

In the following sections, we describe the experiment in more detail (Section 2), present the results (Section 3) and briefly discuss potential implications (Section 4).

2. Experimental Design and Procedure

For our study, we conducted a modified pen and paper version of the lottery investment task developed by Gneezy and Potters (1997). In particular, participating subjects were endowed with a hypothetical amount of EUR 40 and offered the opportunity to buy up to 10 lottery tickets at a price of EUR 4 each. Lottery tickets gain either EUR 9 or EUR 0 for each ticket bought (correlated success), with a 50% probability of winning. Hence, more tickets bought imply a higher variance in outcomes, i.e., higher risk. The outcome of the lottery was determined by a 6-sided dice with 3 numbers corresponding to a gain and the remaining 3 numbers corresponding to a loss.

The experiment was run in a 2×2 between-subject design. Treatments differed in whether winning numbers were chosen by the experimenter, referred to as Treatment: *No Choice*, or by the subject, referred to as Treatment: *Choice* (c.f. Charness and Gneezy 2010), and whether betting was carried out before or after the dice was thrown. In either case, no information about the dice throw was revealed before decisions to buy lottery tickets were made. In addition, we conducted a treatment with no choice and betting before the dice throw with low stakes, i.e., EUR 4 endowment, EUR 0.4 ticket prices and EUR 0.9 winnings in the lottery. All decisions were incentivised in that every 10th response was paid as stated, which was known to the subjects. Charness et al. (2016), reviewing a significant amount of papers, find that paying for only a subset of periods or individuals is at least as effective as the pay all approach. After choices about lottery tickets were made, subjects responded to a questionnaire including a general risk question (cf. Dohmen et al. 2011; Lönnqvist et al. 2015), questions about attachment style (Wei et al. 2007; Flemming et al. 2021) and sensation seeking (cf. Zuckerman 1994; Müller et al. 2023).

The experiment was conducted at the end of lectures at the University of Rostock in October and November 2021, with lectures being from various fields (16 lectures). After the respective lecture, students were informed about the possibility to participate in a research study and otherwise offered to leave. Subjects were shortly introduced to the experiment.[3] In treatments where decisions were to be made after the random procedure, the dice was visibly thrown in a dice cup so subjects could not see the result; in the other treatments, this happened after decisions were made. Subjects received one page of instructions with running IDs including questions about socio-demographics attached in a closed

envelope. Subjects privately read the task description, made their decisions and filled out the questionnaire.

Once all material was collected, the subjects to be paid were determined by a 10-sided dice with numbers matching the last digits of the ID. Sessions were for a one-time condition (before or after) only, and each session entailed both the *No Choice* and the *Choice* treatments.

3. Results

In total, 438 subjects participated in the experiment. Of these, 420 (60.28% female, mean age: 20.86, std. age: 2.88) were included in the analysis. We excluded 3 subjects who did not answer the lottery task and another 15 due to a printing error in the questionnaires. Table 1 summarises the experimental conditions and provides descriptive results; descriptive statistics regarding further variables are provided in Table A1 in Appendix A. The distribution of treatments is uneven due to the uncommonly strong fluctuation of lecture participation during the corona pandemic.

Table 1. Average number of tickets bought and percentage of subjects buying 0 tickets, intermediate (1–9 tickets) or maximal (10 tickets) by condition and treatment.

Choice	Betting	*N*	Avg. Tickets	0 Tickets	1–9 Tickets	10 Tickets
No Choice						
	After	115	3.71 (0.31)	29.57%	58.26%	12.17%
	Before	98	2.63 (0.30)	41.84%	53.06%	5.10%
	Before (low)	61	3.13 (0.44)	39.34%	49.18%	11.48%
Choice						
	After	94	4.20 (0.33)	17.02%	68.09%	14.89%
	Before	52	4.46 (0.50)	21.15%	55.77%	23.08%

In the following section, we first report the results comparing the No Choice and the Choice treatment. Afterwards, we provide and briefly discuss the moderating effects of risk preferences, sensation seeking and attachment style. The main findings are highlighted as *Result 1*, etc.

3.1. No Choice vs. Choice

Overall, subjects on average buy around 3.65 tickets for the lottery. Comparing treatments, subjects in the *Choice* treatment on average buy significantly more tickets than in the *No Choice* treatments (4.29 vs. 3.22, two-sided Mann–Whitney U test $p < 0.01$).

Moreover, we find that subjects buy significantly more tickets if the bet is placed after the dice is thrown (3.93 vs. 3.27, two-sided Mann–Whitney U test $p < 0.05$). However, the timing effect is entirely due the *No Choice* treatment (3.71 vs. 2.63, two-sided Mann–Whitney U test $p < 0.05$; Choice: 4.20 vs. 4.46, two-sided Mann–Whitney U test $p = 0.81$. In addition, a 2 × 2—(bet before throw vs. bet after throw) × (*No Choice* vs. *Choice*)—between-subject ANOVA with the number of tickets bought as dependent variable reveals a significant effect of the *No Choice* treatment $F(1, 356) = 0.0037$ and a (slightly) insignificant effect of timing, i.e., betting before the throw $F(1, 356) = 0.1077$.

Finally, comparing the high stakes condition with the low stakes condition in the *No Choice* condition, we find no significant difference in the number of tickets bought when stakes are higher (2.63 vs. 3.13, $p = 0.49$). For the subsequent analysis, we therefore neglect the low stakes condition to keep stakes comparable.

Result 1. *In treatments where winning numbers are chosen by the subjects, the number of overall tickets bought is higher. In the No Choice treatment, after the dice throw, more tickets are bought than before the dice throw.*

In terms of illusion of control, greater risk taking is observed in treatments where subjects choose the winning event themselves or, if no choice is possible, where the realisa-

tion of the random event has already taken place (the dice is thrown but no information is visible). Hence, the respective treatment features might be seen as increasing a perception of control.

3.2. Moderation Effect of Risk Preferences

In general, it seems plausible to assume that risk preferences might correlate with behavioural changes between treatments. Accordingly, we investigated a potential moderation effect of risk preferences on the timing effect for both the *No Choice* treatments and the *Choice* treatment.

In particular, we used a PROCESS Model 1 (Hayes 2013, Version 3) with 5000 bootstrap samples to regress the timing dimension (1 = buy before dice throw, 0 = buy after dice throw) x risk preferences on the amount of tickets bought in the investment game. The interactions were insignificant in both the *No Choice* treatment, $b = 0.18, SE = 0.17$, $t = 1.01, p = 0.31$, 95% bootstrap CI $[-0.17, 0.52]$, and the *Choice* treatment, $b = 0.04$, $SE = 0.25, t = 0.15, p = 0.88$, 95% bootstrap CI $[-0.45, 0.54]$.

The main effect of risk preferences—risk-seeking subjects buying more lottery tickets—is significant only in the *No Choice* treatment, $b = 0.29, SE = 0.12, t = 2.41, p < 0.05$, 95% bootstrap CI [0.05, 0.52]. Taken together, we find no significant moderation effect of risk preference on the timing in both conditions.

Result 2. *In both the Choice and No Choice treatments, risk preferences do not moderate the timing effect. More risk-seeking subjects, however, buy more tickets in the No Choice treatment.*

3.3. Moderation Effect of Sensation Seeking

Furthermore, we investigated a potential moderation effect of sensation seeking on the timing effect for the *No Choice* and the *Choice* treatment. This seemed plausible as sensation seeking is generally associated with a higher willingness to take risks (e.g., Zuckerman 1994).

As before, we used a PROCESS Model 1 (Hayes 2013, Version 3) with 5000 bootstrap samples to regress the timing dimension (1 = buy before dice throw, 0 = buy after dice throw) x sensation seeking on the amount of tickets bought in the investment game. In the *No Choice* treatment, the interaction is insignificant, $b = 0.16, SE = 0.54, t = 0.29, p = 0.77$, 95% bootstrap CI $[-0.90, 1.22]$. By contrast, in the *Choice* treatment, a significant interaction effect is found, $b = 1.66, SE = 0.69, t = 2.40, p < 0.05$, 95% bootstrap CI [0.29, 3.03]; cf. Figure 1.

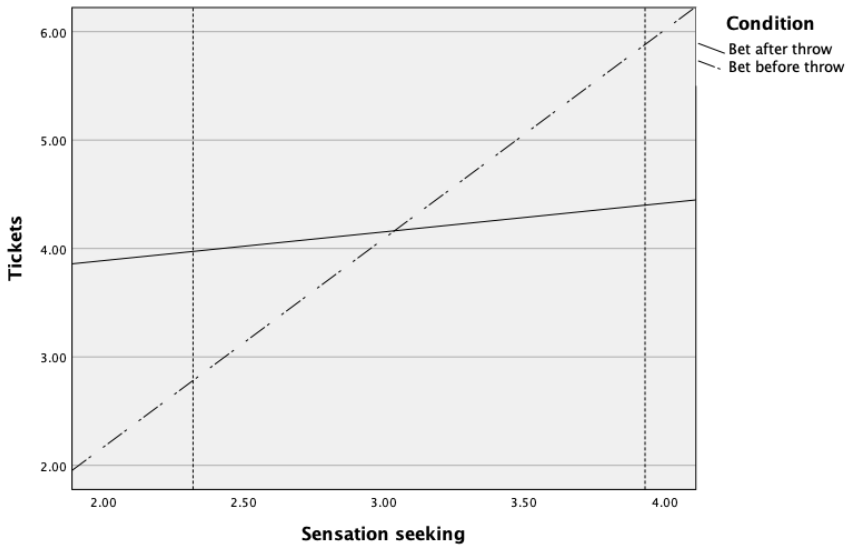

Figure 1. Condition × sensation seeking effects on tickets bought in free choice condition. Vertical dotted lines indicate +/− 1 SD of sensation seeking.

More specifically, at high (+1 SD) levels of sensation seeking, the conditional effect of the temporal dimension is significant ($b = 3.93, SE = 0.77, t = 1.91, p = 0.0576$, 95% bootstrap CI [−0.48, 3.00]). Thus, the results show that buying tickets before instead of after the dice is thrown increases the number of lottery tickets bought for subjects with high levels of sensation seeking. The results remain robust if we control for risk preferences.

Result 3. *Subjects high in sensation seeking buy more lottery tickets if they choose the winning numbers themselves (Choice treatment) before the dice is thrown. We find no significant moderation effect in the No Choice treatment.*

Interpreted in terms of illusion of control, subjects scoring high in sensation seeking are prone to such effects if, for given probabilities, they can themselves choose which realisation of a future random event is beneficial (i.e., if they have a higher involvement in the chance event).

3.4. Moderation Effect of Attachment Style

Finally, we addressed a potential interaction of attachment style and treatment variations.

In psychology, attachment as a concept originated in the study of infant behaviour in relation to primary caregivers (cf. Bowlby 1982). Later research classified attachment styles in adults into essentially three categories (secure, anxious, avoidant) and showed that similar patterns in behaviour and perception of a (social) environment can be identified in adults (cf. Mikulincer and Shaver 2007).

For the present purposes, attachment was included as a possibly relevant individual characteristic because avoidant subjects are known to suppress or deny emotions and emotion-related thoughts (e.g., Mikulincer and Shaver 2007, Mikulincer and Shaver 2019; Shaver and Mikulincer 2012) as well as to have a high need of self-reliance (e.g., Wei et al. 2007). Both suggest that avoidant characteristics might correlate with a tendency to be less affected (and more self-contained) in response to changes in the environment in connection with the randomisation procedure. Thus, we would expect less illusion of control for avoidant subjects.

In the following, we report the effects for subjects showing avoidant and anxious attachment styles.

3.4.1. Attachment Avoidance

For our analysis, we investigated a potential moderation effect of attachment avoidance on the timing effect for the *No Choice* treatment and the *Choice* treatment. Again, we used a PROCESS Model 1 (Hayes 2013, Version 3) with 5000 bootstrap samples to regress the timing dimension (1 = buy before dice throw, 0 = buy after dice throw) x attachment avoidance on the amount of tickets bought in the investment game. In the *No Choice* treatment, the interaction is significant, $b = 1.73, SE = 0.43, t = 4.00, p = 0.0001$, 95% bootstrap CI [0.88, 2.57]; cf. Figure 2. In the *Choice* treatment, the interaction is insignificant, $b = 0.23, SE = 0.62, t = 0.37, p = 0.71$, 95% bootstrap CI [−1.00, 1.45].

More specifically, at low (−1 SD) and mean values of attachment avoidance, the conditional effect of the temporal dimension in the *No Choice* treatment is significant ($b = -2.84, SE = 0.59, t = -4.78, p = 0.0000$, 95% bootstrap CI [−4.01, −1.67]; mean level: $b = -1.14, SE = 0.42, t = -2.71, p < 0.01$, 95% bootstrap CI [−1.97, −0.31]). Thus, a change from buying tickets after instead of buying tickets before the dice is thrown correlates with an increase in the number of tickets bought when winning numbers are predetermined but only for subjects with low and mean levels of attachment avoidance. Avoidant subjects show no such response. The results remain robust if risk is controlled for.

In addition, two linear regressions confirm that attachment avoidance has a positive effect on risk taking in the *before* condition, $b = 0.53, SE = 0.31, t = 1.73, p = 0.086$, and a negative effect in the *after* condition, $b = -1.19, SE = 0.30, t = -4.00, p = 0.000$.

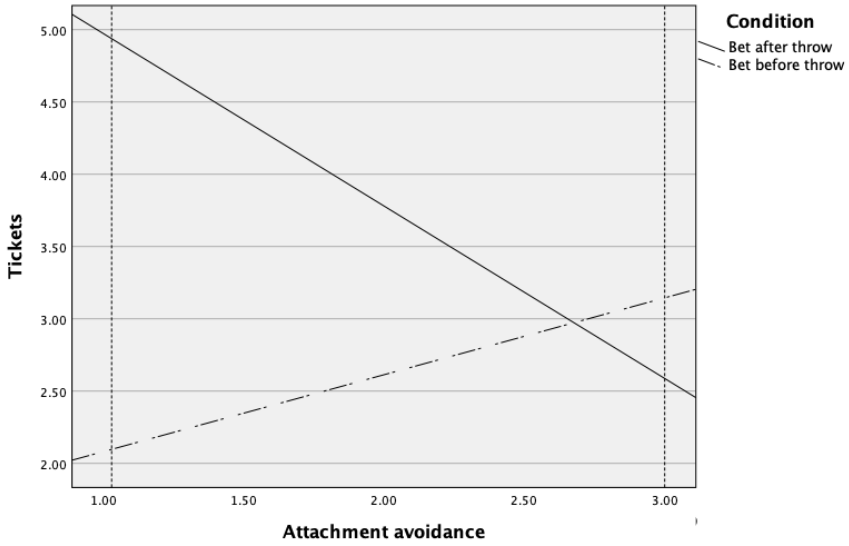

Figure 2. Condition × attachment avoidance effects on tickets bought in *No Choice* treatment. Vertical dotted lines indicate +/− 1 SD of attachment avoidance.

Result 4. *If winning numbers are predetermined (No Choice treatment), subjects with intermediate to low levels of attachment avoidance buy significantly more lottery tickets after the dice throw than before; subjects with high levels of attachment avoidance are unaffected by the timing of the realisation of the chance event. No significant moderation effect is found for the Choice treatment.*

Regarding interpretation, the observations are compatible with the idea of avoidant people often being emotionally less responsive (e.g., Mikulincer and Shaver 2007). While apparently for low and medium levels of avoidance, confidence in the lottery—in terms of tickets bought—seems to vary depending on whether lottery tickets have an aspect of guessing (buying after throw) or predicting (buying before), subjects with high levels of avoidance are essentially unaffected by circumstances.

3.4.2. Attachment Anxiety

A similar analysis was conducted to establish a potential moderation effect of attachment anxiety on the timing effect for the *No Choice* and the *Choice* treatments. Again, we used a PROCESS Model 1 (Hayes 2013, Version 3) with 5000 bootstrap samples to regress the timing dimension (1 = buy before dice throw, 0 = buy after dice throw) x attachment anxiety on the number of tickets bought. The interaction is significant in the *No Choice* treatment, $b = 1.05, SE = 0.37, t = 2.82, p < 0.01$, 95% bootstrap CI [0.32, 1.79]; cf. Figure 3. In the *Choice* treatment, the interaction is insignificant, $b = -0.44, SE = 0.52, t = -0.85, p = 0.40$, 95% bootstrap CI [−1.48, 0.59].

As in the case of attachment avoidance, at low (−1 SD) and mean values of attachment anxiety, the conditional effect of the temporal dimension is significant ($b = -2.33$, $SE = 0.60, t = -3.87, p = 0.0001$, 95% bootstrap CI $[-3.51, -1.14]$; mean level: $b = -1.12, SE = 0.43, t = -2.63, p < 0.01$, 95% bootstrap CI $[-1.96, -0.28]$). The results show that changing from buying tickets after instead of before the dice is thrown correlates with an increase in the number of tickets bought for subjects with low and mean levels of attachment anxiety. The results remain robust if we control for risk preferences. Moreover, two additional linear regression analyses confirm that attachment anxiety has no effect in the *before* condition, $b = 0.15, SE = 0.26, t = 0.58, p = 0.56$, but has a negative effect in the *after* condition, $b = -0.90, SE = 0.27, t = -3.39, p = 0.001$.

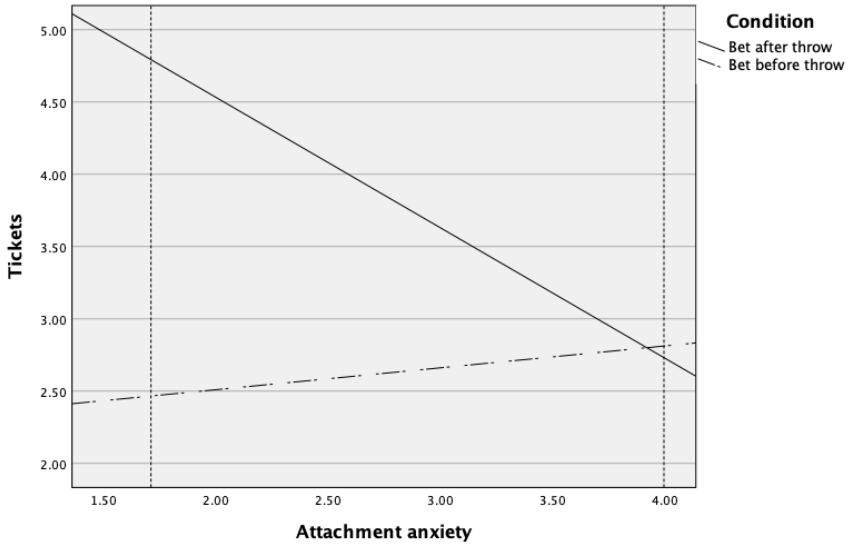

Figure 3. Condition × attachment anxiety effects on tickets bought in the *No Choice* treatment. Vertical dotted lines indicate +/− 1 SD of attachment anxiety.

Result 5. *In the No Choice treatment, a change from betting after instead of before the dice throw correlates with an increase in the number of tickets bought for subjects with low and mean levels of attachment anxiety. No significant moderation effect is found in the Choice treatment.*

Similar to subjects with high levels of attachment avoidance, subjects with high levels of attachment anxiety remain unaffected by changes in the decision environment in the present study. While people with an anxious attachment style are generally also known to have difficulties in emotion regulation, they usually do not show the same level of self-sufficiency as avoidant people (cf. Mikulincer and Shaver 2007). Accordingly, compared to attachment avoidance, we would have expected the correlation of attachment anxiety and ticket purchases to be weaker. A possible explanation for the observation might be that we have a slightly higher correlation between attachment avoidance and attachment anxiety in the present sample (Pearson correlation $\rho = 0.360$, $p = 0.0000$) than is usually found (cf. Wei et al. 2007).

In terms of illusion of control, the two previous results could be expressed as saying that subjects with high levels of attachment avoidance and attachment anxiety are comparably stable in their lottery choice behaviour regarding changes in conditions (timing of random event). Subjects with low or intermediate levels of either, by contrast, become more risk seeking if the realisation of the corresponding random event lies in the past (and what would be the positive outcome is fixed externally).

4. Concluding Remarks

In this paper, we presented data from a modified lottery task based on work by Gneezy and Potters (1997) while controlling for individual background characteristics (risk preferences, sensation seeking, attachment style). Subjects in the experiment could invest a given amount in lottery tickets with a correlated winning probability of 50% and an expected return of 12.5%. Treatments varied in whether the random device/procedure determining the outcome of the lottery (dice) was administered before or after tickets were bought (with no information being revealed until after purchase decisions) and whether subjects could choose the winning event (winning numbers; not affecting winning probability). The variations were chosen in order to test how illusion of control effects are related to psychological individual characteristics.

The results suggest that the timing of a chancy event affects the illusory control over its outcome and that this effect is moderated by various psychological constructs. In particular, if personal involvement in the random decision is required (choice of winning numbers), sensation seekers show higher risk taking, i.e., increased illusion of control, if the chancy

event lies still in the future. Moreover, if personal involvement in the random decision is lower (fixed winning numbers), individual attachment styles moderate decisions. More specifically, subjects with lower avoidant or lower anxious attachment styles become more willing to take risks if the random event lies in the past and only information about the outcome is missing. Risk preferences, by contrast, do not moderate the timing effect.

We can only speculate about the reasons for the different moderator effects of the psychological determinants. A possible explanation for the results might be that sensation seeking as a trait is forward looking. Hence, sensation seeking is arguably intuitively closer connected to choices related to a chance event the realisation of which still lies in the future. Similarly, avoidant and anxious attachment styles implicitly (and mostly subconsciously) link present experiences to past events, thereby focusing on potential threats and uncertainties. Thus, more secure (attachment) subjects may be more wiling to take risks if the actual chance event is already past, while anxious and avoidant subjects act more risk averse both towards future and past events irrespective of circumstances.

Regarding applications of the results, our findings are related to the discussion about individual assessments of investment risks (e.g., Olsen 1997; Duxbury and Summers 2004; Sachse et al. 2012) but seem also pertinent to financial decision making more generally (e.g., in view of insurance decisions regarding risk factors with already given but unknown realisations, or investment/pension plans that may or may not entail more involvement of the decision maker). Apparently, the willingness to take risks may be moderated by sensation-seeking tendencies if the risk event lies in the future and there is room to determine the value of different outcomes. Additionally, it seems to be moderated by attachment style if the risk event lies in the past but information on outcomes is still lacking. Moreover, regarding the discussion about illusion of control, our data indicate potential psychological underpinnings of such effects, suggesting that they are less about an actual illusion of control but more about emotional states or preferences (see also Li 2011).

Author Contributions: Methodology, U.S., C.S. and P.C.W.; software, T.S.; validation, T.S.; formal analysis, T.S. and P.C.W.; investigation, T.S.; resources, P.C.W.; data curation, T.S.; writing—original draft preparation, P.C.W.; writing—review and editing, T.S. and P.C.W.; visualisation, T.S.; supervision, P.C.W.; project administration, P.C.W.; funding acquisition, C.S. and P.C.W. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Data Availability Statement: The data presented in this study are available on request from the corresponding author.

Acknowledgments: We thank Fynn Kemper for helping with research assistance and Lina Maria Ellegård as well as three anonymous reviewers for their helpful comments. Wichardt thanks the Arne Ryde Foundation for financial support. The usual disclaimer applies.

Conflicts of Interest: The authors have no conflict of interest to declare.

Appendix A. Descriptive Statistics

Table A1. Descriptive statistics on age, number of observations and frequencies of gender, subject of study, the current semester, religious community, the highest level of education and whether the person is currently in a romantic relationship.

		N	Frequency	Mean	Std.
Age		419		20.86	2.89
Gender:	Female	167	39.76%		
	Male	253	60.24%		
	Diverse	0	0.00%		
Subject:	Medicine	331	77.81%		
	Economics	89	22.19%		

Table A1. *Cont.*

		N	Frequency	Mean	Std.
Semester:	1	285	67.86%		
	5 (Only Medicine)	119	28.33%		
	7 (Only Medicine)	16	3.81%		
Religious community:	Christian	198	47.14%		
	Muslim	8	1.90%		
	Other	4	0.95%		
	None	210	50.00%		
Highest level of education:	A-level	404	96.19%		
	University	13	3.10%		
	Other	2	0.48%		
	None	1	0.24%		
Romantic relationship:	Yes	230	54.76%		
	No	190	45.24%		

Notes

[1] Charness and Gneezy (2010) study a situation in which subjects win two and a half times the amount they invested if a dice shows one of three self-chosen success numbers. They find that subjects prefer to roll the dice themselves but are not willing to invest more if they do so. Li (2011) varies whether the success numbers are chosen by the subject or the experimenter. The results indicate that subjects have heterogeneous preferences for the degree of control over the task, which, as argued by Li, suggests preferences over the source of uncertainty rather than an illusion of control.

[2] As an example, consider genetic conditions regarding health. Also investments in the exploration and extraction of natural resources depend on past random events with (partly) unknown realisation and future consequences.

[3] As Lotto (choosing 6 out of 49 numbers) is a common lottery in Germany, we can safely presume that students are generally familiar with the concept of a lottery.

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