JENA ECONOMIC RESEARCH PAPERS

2010 – 004

Sense of Control Affects Investment Behavior

by

Li King King

www.jenecon.de

ISSN 1864-7057

The JENA ECONOMIC RESEARCH PAPERS is a joint publication of the Friedrich Schiller University and the Max Planck Institute of Economics, Jena, Germany. For editorial correspondence please contact markus.pasche@uni-jena.de.

Impressum:

Friedrich Schiller University Jena
Carl-Zeiss-Str. 3
D-07743 Jena
www.uni-jena.de

Max Planck Institute of Economics
Kahlaische Str. 10
D-07745 Jena
www.econ.mpg.de

Jena Economic Research Papers 2010 - 004

Sense of Control Affects Investment Behavior

Li King King*

January 19, 2010

Abstract

Preference for control affects investment behavior. Participants of laboratory experiments invest different amount of money in a risky asset when face with two different methods of control which have identical payoff structure and probability distribution, but provide different sense of control. Preference for controlling and not controlling are both observed. Participants increase their investment when their preferred method of control is used. Participants who prefer to control more reduce their investment more strongly when face with less control. Preference for control has larger effect on investment behavior when participants are induced to have a comparative mindset rather than non-comparative mindset.

Keywords: Preference for control, sense of control, risk attitudes, illusion of control, source preference, portfolio choice, behavioral finance, comparative mindset, non-comparative mindset

JEL Codes: B49, C91, D81, G11, G19

* Strategic Interaction Group, Max Planck Institute of Economics, Kahlaische Straße 10 D-07745 Jena, Germany; Tel: +49 3641 686 631; Fax: +49 3641 686 667; Email: Kingli@econ.mpg.de

1. Introduction

When you buy lottery tickets, do you prefer to choose the numbers yourself or taking random numbers generated by the computer? In an hypothetical game, Langer (1975) found that people will have higher valuation towards the lottery tickets if they can choose their own numbers than the case where they are assigned random numbers. Looking at this puzzling finding, Langer suggested that these people suffer from *illusion of control* – defined by him as the "expectancy of a personal success probability inappropriately higher than the objective probability would warrant" – because the winning probability under both case are objectively the same.

In this study, I propose a new explanation for the puzzle: instead of assuming illusion of control, I argue that whether one prefers to control (e.g., choose the numbers) or not control (e.g., take random numbers) are actually a reflection of the individual's preference and thus does not necessary involve difference in probability belief over the options. This preference based interpretation is connected to the more general notion of *source preference* (Craig R. Fox and Amos Tversky, 1995). More specifically, a decision maker is said to exhibit source preference if he/she prefers to take identically distributed risk arising from one source of uncertainty over those from others. In the example of lottery ticket, picking numbers by oneself or taking random numbers can be considered as two distinctive sources because they induce different sense of control, while any theory that is based on probabilistic sophistication (e.g., Subjective Expected Utility Theory (Leonard J. Savage, 1954)) does not make distinction between these two. Hence, the motivation of individuals choosing to pick their own numbers is distinct from the motivation assumed in illusion of control, while the observed choice is the same. Another advantage of the source preference perspective is that it can also accommodate the preference for not controlling which the illusion of control explanation won't be able to explain. The preference for not controlling or randomization (Howard Raiffa, 1961; Peter Klibanoff, 1993; Jürgen Eichberger and David Kelsey, 1996; King Chung Lo, 1996) can be possibility due to psychological factors such as regret and responsibility aversion (Terry Connolly et al., 1997). In fact, in many lottery

tickets games, buyers are given the option to take randomly generated numbers by the computer.[1,2]

Understanding the relationship between preference for control and investment is important because it may help to resolve several important puzzles in the financial market, e.g., the stock market non-participation puzzle (N. Gregory Mankiw and Stephen P. Zeldes, 1991) and the equity premium puzzle (Rajnish Mehra and Edward C. Prescott, 1985).[3,4] For example, consider two risky assets with identical payoff structure and probability distribution, but differ in sense of control perceived by the investor. If the investor chooses to invest a lower proportion of wealth on a risky asset when his preferred sense of control is not accommodated, it implies that the investor is more risk averse. On the contrary, any models that based on probabilistic sophistication will predict that the decision maker's degree of risk aversion is invariant with the sense of control (i.e., the investor will invest the same amount). Taking this perspective, it is possible that some individuals may refuse to invest any amount of money in the stock market because of low sense of control, while these individuals may at the same time take other investments which are objectively much riskier but they provide a higher sense of control. Notice that the reason for not investing in the stock market discussed here is different from those suggested in the narrow framing (Nicholas Barberis et al., 2006) perspective where individuals evaluate a new gamble, e.g., stock investment opportunity, in isolation instead of merge it with the preexisting risks for consideration, as assumed in classical economic models. As such, individuals with narrow framing will reject investment opportunity in the stock market while those taking the aggregate view will do the opposite. Our perspective is also different from the *myopic loss aversion* perspective (Shlomo Benartzi and Richard H. Thaler, 1995; Uri Gneezy and Jan Potters, 1997) which has the prediction that if an investor evaluates his portfolio more frequently, he will allocate less proportion of risky assets in his portfolio.

[1] One example is the mark-six lottery in Hong Kong.
[2] From the perspective of source preference, one need not be indifferent when the lottery numbers are randomly chosen by computer or by another human being.
[3] The stock marker non-participation puzzle refers to the observation that even though the stock market has high average returns, many individuals are reluctant to allocate any money to it.
[4] The equity premium puzzle refers to the observation that average return on equity in the United States has been historically much higher than government bonds. To explain this difference in return, standard economic models imply that individuals must have unreasonably high degree of risk aversion.

Do investors also suffer from illusion of control? Little empirical works has been done to date on the relationship between illusion of control and investment in risky assets. The only paper that directly studies this issue is by Charness and Gneezy (Forthcoming).[5] After reviewing the literature on illusion of control, the authors wrote "to our knowledge this phenomenon (*illusion of control*) has not been tested in an investment experiment in which decisions are implemented with real money."[6] In their experiment, subjects need to decide how much to invest in a risky asset which payoff will contingent on the outcome of a dice roll. In one treatment, subjects were given an option of choosing between rolling a dice by themselves or by the experimenter. Notice that whether the dice is rolled by the subject or the experimenter, the objective probability should remain the same. They have two major findings. The first finding is that most of subjects prefer to roll the dice themselves when it is free to do so, and the authors interpreted it as illusion of control. The second finding is that the preference to roll the dice does not affect investment behavior. In particular, there are no significant differences in investments across treatments with different methods of control: (1) subject rolls, (2) experimenter rolls, (3) free to choose between 1 & 2, (4) costly to choose between 1 & 2.

To the best of my knowledge, this experiment is the first on investigating the relationship between preference for control and investment at the within-subjects level. In terms of experiment design, my study complements previous studies in the following way. First, this study uses both within-subjects design and between-subjects design. Notice the finding of Charness and Gneezy (Forthcoming) that illusion of control does not affect investment behavior (i.e., how much invested in the risky asset) is based on between-subjects comparisons.[7] Therefore, it appears to be important to see if the same conclusion holds at the within-subjects level. More specifically, the within-subjects design will allow us to observe both preference for controlling and not controlling, and if individuals will invest less, if so by how much, when they are not given their preferred method of control. Second, this study also contributes to the literature by investigating the role of comparative and non-comparative mindset on the

[5] Charness and Gneezy (Forthcoming) suggest that illusion of control is related to the more general notion of *overconfidence*, which is studied quite extensively in behavioral finance and is typically defined as over-estimation of the precision of one's information signals (Terrance Odean, 1998; 1999; Bruno Biais et al., 2005).

[6] See Presson and Benassi (1996) for a meta-analysis of experiments on illusion of control.

[7] Charness and Gneezy's study can also be interpreted as an experimental investigation on preference for control. However, the authors interpreted their results in lights of illusion of control instead of source preference approach taken in this study.

investment behavior. In particular, we observe how much participants choose to invest in the risky asset when they evaluate both investment methods (i.e., under comparative mindset) versus when they evaluate one of the methods in isolation (i.e., under non-comparative mindset).

The influence of mindset on human decision making has received very little attention in economics, both theoretically and empirically. More specifically, a mindset is a disposition of cognitive process in the course of decision making. Examples of mindset include: deliberative and implemental mindset (Peter M. Gollwitzer et al., 1990) and prevention focus mindset (E. Tory Higgins, 1997; 1998). Empirical evidences on the influence of mindset has been reported in the context of consumer purchase decisions (Donnel A. Briley and Robert S. Wyer, 2002; Alison Jing Xu and Robert S. Wyer, 2007) and valuation on lotteries tickets (Craig R. Fox and Amos Tversky, 1995).

Fox and Tversky's (1995) is the only paper in economics, as we are aware of, that investigates the implications of comparative and non-comparative mindset on decision making. In their experiment, they elicited subjects' willingness to pay on lottery tickets condition on two different sources of uncertainty respectively: the temperature of San Francisco and Istanbul. They find that subjects are willing to pay more for the more familiar San Francisco bet under the comparative context, i.e., the valuation towards San Francisco and Istanbul are both elicited, but not in non-comparative context, i.e., subjects only evaluate one prospect but not both.[8] Fox and Tversky (1995) termed such behavior as "comparative ignorance". In addition, the authors suggest that the subjects of the experiment are exhibiting source preference, by preferring to take risk arising from the more familiar source (i,e., San Francisco). They suggest that the concept of source preference can be used to explain for ambiguity aversion under Ellsberg paradox (Daniel Ellsberg, 1961).[9]

This study has three surprising findings. First, in contrast to the finding of Charness and Gneezy (Forthcoming), I find that preference for control affects investment behavior (how much to invest in a risky asset). In particular, individuals tend to reduce investment amount when they are not given their preferred method, and the degree of reduction is higher for subjects preferring

[8] In the current study, we use the term "mindset" and "contex" interchangeably. Notice that the term "mindset" is more commonly used in the literature of Psychology and Marketing.
[9] See Chew and Sagi (2008) for theoretical modeling of source preference. See Fox and See (2003) for a survey of behavioral evidences of source preference, and Chew et al. (2008) for neuro-imaging evidences of source preference.

higher sense of control. In other words, individuals who exhibit preference for control are more risk averse when the available investment method is not in line with their preference. Second, preference for control affects investment behavior in comparative context, as well as non-comparative context. This is in contrast to the "comparative ignorance" hypothesis by Fox and Tversky (1995) which, in the context of the current study, predicts that the preference for control will only affect investment behavior in comparative context. Third, the influence of preference for control on investment behavior appears to be stronger under the comparative context.

The rest of the paper is organized as follows. Section 2 presents the experimental design, while the results are presented in section 3. Section 4 concludes.

2. Experimental Design

In order to study how sense of control affects investment behavior, we implemented two investment methods which have identical payoff structure and probability distribution, but differ in sense of control. More specifically, each participant was endowed with 10000 points (1000 points = 0.5 Euro) and need to decide how much to invest on a risky asset. The return of the asset will depend on the outcome of a ball randomly drawn from an urn that contains 10 balls numbered from 1 to 10. In the first method of control, subjects choose three numbers from 1 to 10 and a ball will be drawn from the urn and if the ball drawn belongs to one of the number chosen, the subject will win 2.5 times of the amount invested; If not, he/she loses the amount invested. The second method is identical as the first method except that the three numbers will be chosen by the experimenter. There are four different treatments: (1) Self: the numbers are chosen by the subject, (2) Exp: the numbers are chosen by the experimenter, (3) Choice: subject are free to choose between choosing the numbers by themselves or by the experimenter (4) Dice: subjects decide how much to invest in both cases, then a dice will be randomly rolled to determine which option will be implemented. In all treatments, a ball will be randomly drawn by the experimenter in front of each subject privately, and subjects are paid for each point they have in the end of the experiment. When the method of "experimenter chooses" needs to be implemented, subjects will be informed of the three numbers after they chosen the investment amount and before the ball is drawn.

The comparative and non-comparative mindsets are induced in the following way. Recall that, it is only under the Choice and Dice treatment that the subjects are aware of both methods of control at the time of choosing the investment level (which is incentivized). Therefore, in the Choice and Dice treatments, the investment decisions are supposed to be made under comparative mindset, while those made in the Self and Exp treatments are under non-comparative mindset.

I use questionnaires (non-incentivized) to elicit subject's preference over control (this question is asked in Self and Exp treatment) and how much the subject will invest if they are given another method of control (this question is asked in Self, Exp, and Choice treatment). For example, in the Choice treatment, if the subject chose to choose the numbers then he will be asked in the questionnaire how much he will invest if the numbers will be chosen by the experimenter. In all treatments, after the investment amount was chosen, we announced that we need each of them to fill-in questionnaire, and the questionnaire was collected before the ball was drawn.

A total of 117 subjects participated in the experiment. All subjects were undergraduate students in Jena, Germany and they were randomly recruited from a poll of approximately 2500 subjects using an e-mail recruitment system. The number of subjects in each treatment ranged from 28 to 30. Each treatment has two sessions. Each subject only participated in one of the sessions. The sessions were conducted in German language in the laboratory where subjects were randomly seated in partitioned cubicles. Each session lasted about 35 minutes. At the end of the experiment, subjects were paid privately in cash. Subjects on average earned 7.7 Euro, including a show-up fee of 2.5 Euro.

3. Experimental Results

3.1 Preference for Control

Our first finding confirms that significant proportion of subjects exhibit preference for control, i.e., many subjects prefer to choose the numbers by themselves (denote this method as SELF) or let the experimenter (denote this method as EXP) to choose the numbers. In general, the proportion of subjects preferring SELF is larger. This is in-line with the finding of Charness

and Gneezy (Forthcoming) that most subjects prefer to roll the dice by themselves. What are newly found here are, that the preference for control appears to be sensitive on whether the participant has made investments under a particular method of control previously, and if the preference is elicited implicitly or explicitly. We now turn to a detailed presentation of the findings.

Let us first have a look on the result from the Choice treatment where subjects need to choose between SELF and EXP. Figure 1 presents the core result. In this treatment, 67.8 percent of subjects chose to select the numbers themselves (see also Table 1, panel B). If subjects are choosing randomly between the two options, then we should expect to observe 50 percent of subjects choosing each option. However, the observed choice is significant from the random prediction as suggested by the binomial test, $p = 0.04$ (one-tailed). Therefore, the result of this treatment clearly demonstrate that individuals exhibit preference over control, and the proportion of individuals prefer "controlling" is higher.

Preference for control is sensitive to the preference elicitation procedure. In the Self treatment and Exp treatment, we elicit subject's preference for control using a post-experiment questionnaire, on whether he/she prefers SELF, EXP, or Indifferent. The data reveals that in the Self treatment, 46.7 percent of subjects prefer SELF to EXP, and only 6.7 percent of subjects prefer the other way. However, in the Exp treatment, 27 percent of subjects prefer SELF to EXP, while 31.03 percent of subjects prefer EXP to SELF. The difference in proportion of subjects preferring SELF in the Self and Exp treatment is possibly due to *endowment effect* (Daniel Kahneman et al., 1990) as subjects appear to more likely to prefer the original method.

Recall that in the dice treatment, subjects choose how much they will invest if the ball will be drawn by themselves as well as by the experimenter, then a dice will be randomly rolled to determine which method will be implemented. Therefore, in this treatment, the preference for control is considered as elicited implicitly, as compared to the Choice treatment. We find that 23.3 percent of subjects choose to invest more under SELF, while 33.3 percent of subjects choose to invest more under EXP. This suggest that participants still exhibit preference for control (either revealed to prefer EXP or SELF) even when they are not asked explicitly to indicate the preference. However, the ratio between number of subjects preferring SELF and

EXP is more balanced (in the choice treatment, 20 percent of subjects chose to invest higher under SELF and only 3.3 percent of subjects chose to invest higher under EXP).

3.2 The Effect of Preference for Control on Investment Behavior

We now turn to another important question: Does preference for control affect investment behavior (how much to invest)? Let us first focus on the dice treatment. Figure 2 plots the investment percentage (out of 10000 points) of the "prefer SELF" group and "prefer EXP" group. For the purpose of our analysis, a subjects is classified as "prefer SELF" (prefer EXP) if the subject chose to invest higher under SELF (EXP). We first compare the level of investment of the two groups in each of the method of control. From figure 2, we can see that when the method of control is for the participants to choose the numbers (i.e., SELF), the "prefer SELF" group invested higher than the "prefer EXP" group, which is confirmed in two samples t-test, $p < 0.1$ (one-tailed). When the method of control is for the experimenter to choose the numbers (i.e., EXP), the "prefer EXP" group invested significantly higher than the "prefer SELF" group, $p < 0.05$ (two-tailed).

We now proceed to compare the level of investment within each group under each method of control. It is easy to see from figure 2 that subjects in both groups invested lower when they were not given their preferred method of control. This is confirmed by t-tests which compare the amount of investment under both methods for each group (see Table 1, panel B; DSS vs DSE and DES vs DEE). However, the degree of response, when being offered a non-preferred method of control, on investment is not the same for the group of subjects preferring SELF and the group preferring EXP. In particular, the "prefer SELF" group reduced their investment by 63.7 percent which is higher than the 23.6 percent reduction observed in the "prefer EXP" group, and the difference is significant, $p < 0.01$ (two-tailed). Therefore, this suggests that the impact of preference of control on investment is higher for the "prefer SELF" group.

Figure 3 plots the percentage reduction in investment amount when the method of control is not the preferred one for all treatments (See Table 1 for summary statistics under all treatments). If we poll the data from all treatments together, subjects on average invested 44.1 percent less when they are not given their prefer method, $p < 0.001$ (two-tailed). Moreover, when

being offered a non-preferred method of control, the "prefer SELF" group on average reduced their investment by 55.226 percent, while the "prefer EXP" group on average reduced their investment by 25.812 percent, and the difference is significant, $p < 0.001$. In summary, the analysis so far has showed clear evidence that preference for control affects investment behavior.

3.3 The Effect of Comparative and Non-comparative Mindset

In this section, we proceed to investigate if subjects invest different amount of money when they evaluate both methods of control (i.e., under comparative mindset) versus when they evaluate one of the methods in isolation (i.e., under non-comparative mindset). We first access if the "comparative ignorance" hypothesis holds in our context. Recall that according to the "comparative ignorance" hypothesis, we should only expect a difference in investment level when subjects are in the comparative mindset. To test this hypothesis, we compare the investment level (under SELF) of subjects revealed to invest lower under EXP in the self treatment, with those revealed to be indifferent. Notice that subjects choose the investment level under SELF without knowing that they will be asked about their preference towards EXP in the questionnaire, i.e., the investment level under SELF is elicited under non-comparative mindset. Therefore, if the "comparative ignorance" hypothesis holds, we should not find any significant difference between subjects revealed to invest lower under EXP versus subjects revealed to be indifferent. However, the result shows that subjects preferring SELF invested significantly higher than subjects who are indifferent, $p < 0.1$ (one-tailed; Table 1, Panel A). This result suggests that preference for controlling is quite strong and affects investment behavior even when subjects are not in comparative mindset. In other words, the influence of the preference for control seems stronger than implied by the "comparative ignorance" hypothesis.

However, it appears that the effect of preference for control on investment behavior is larger in the context of comparative mindset. First, we find that there is higher proportion of subjects exhibiting preference for control (choosing a different investment amount under SELF and EXP) under comparative mindset. In particular, the proportion of subjects exhibiting preference for control in the Self, Exp, and Dice treatment are 20, 20.7, and 53.3 percent respectively. Two-sample test of proportion shows the proportion in the Dice treatment is significantly higher than the Self and the Exp treatment, $p < 0.01$ (two-tailed). In addition, it also appears that subjects are becoming more risk averse, when the numbers will be chosen by

the experimenter, in the Dice treatment than in the Exp treatment. More specifically, we find that there are only 13.8 percent of subjects in the Exp treatment invested less or equal to 1500 points. But the percentage increases to 33.3 percent in the Dice treatment, and the difference in percentage is significant, $p = 0.08$ (two-tailed). On the other hand, there are higher percentages of subjects investing more or equal than 5000 points in the Dice treatment (53.3 percent) than in the Self treatment (36.7 percent) and in the Exp treatment (34.5%), $p < 0.1$ (one-tailed).

Recall that our analysis so far, has found that majority of subjects prefer to choose the numbers by themselves, and the effect of the preference for control on investment is stronger for this group of subjects than those who prefer to let the experimenter choose the numbers. With this in mind, we hypothesize that the investment level under the Self treatment is higher than the Exp treatment. To test this hypothesis, we first compare the average investment level of subjects under the Self and Exp treatments (see Figure 4 and Table 1). However, we find that there are no significant difference (mean difference=-310.253), $p = 0.672$ (one-tailed). A different picture emerges when we perform the same comparison under Dice treatment where subjects were induced to have comparative mindset. We find that the investment under SELF is higher than the investment under EXP, with mean difference equal to 613.333, $p = 0.115$ (one-tailed). This finding constitutes as another evidence that the influence of preference for control is stronger under comparative mindset.

In summary, our results suggest that preference for control is a significant factor influencing investment level under *both* comparative and non-comparative mindset, but the influence is higher under the comparative mindset.

3.4 Further Results on the Influence of Comparative Mindset

Suppose there is a participant who prefers to choose the numbers by himself. Will this participant choose the same investment level (under the method of choosing the number by oneself) under the Self and the Dice treatment? Classical economic thinking suggests that the participant should invest the same amount in both cases. In other words, adding a "dominated choice" into a choice set will not change the outcome (amount of investment). However, there are some reasons to expect a difference. For instance, with the EXP method in consideration, the SELF method may appear to become more attractive. To test this hypothesis, we first compare

the investment level in the Dice treatment (under SELF method) to the Self treatment. Recall that the influence of preference for control is much higher for people preferring to choose the numbers. Therefore, we may observe that the aggregate investment level under SELF in the dice treatment higher than the Self treatment. While the investment level is, in fact, higher in the dice treatment, the difference is not significant. However, if we only consider a subset of the data, investments less than 9000 points (n=26 in Self treatment; n=28 in Dice treatment), then the difference is significantly positive, $p = 0.09$ (one tailed; see Figure 5, panel A). This suggests that subjects are less risk averse when they can choose the numbers by themselves under comparative mindset than non-comparative mindset. We also compare the investment level in the Dice treatment (under EXP method) to the Exp treatment, and found that the former is significantly lower when the observations are those with less than 5000 points investment, $p < 0.001$ (two-tailed; see Figure 5, panel B).

We now proceed to compare the level of investment conditioning on the preference of control. Notice that the preference of control in the Self treatment and Exp treatment is elicited in non-incentivized way while it is incentivized in the dice treatment. In light of this, I compare the investment level (under SELF) of the "prefer SELF" group in the Dice treatment to those in Self treatment. I find that the investment level is higher in the Dice treatment by 773.8 points, but the difference is not statistically significant, $p > 0.1$ (one-tailed). On the other hand, we compare the investment level of the "prefer SELF" group in the Dice treatment to "INDIF" group in the Self treatment. It appears that the difference is highly significant, $p < 0.05$ (two-tailed). Moreover, the degree of difference, which is 2731 points, is also higher than the observed difference in the Self treatment which is 1957.5 points. Taken together, we have found some preliminary evidences that the presence of dominated method may induce subjects preferring SELF to invest higher (under SELF) in the comparative mindset.

4. Conclusion

The main conclusion of our findings is that preference for control is an important determinant of risk attitude. Classical economic thinking assumes that an individual will have the same risk attitude towards two events which are identical in terms of payoff structure and

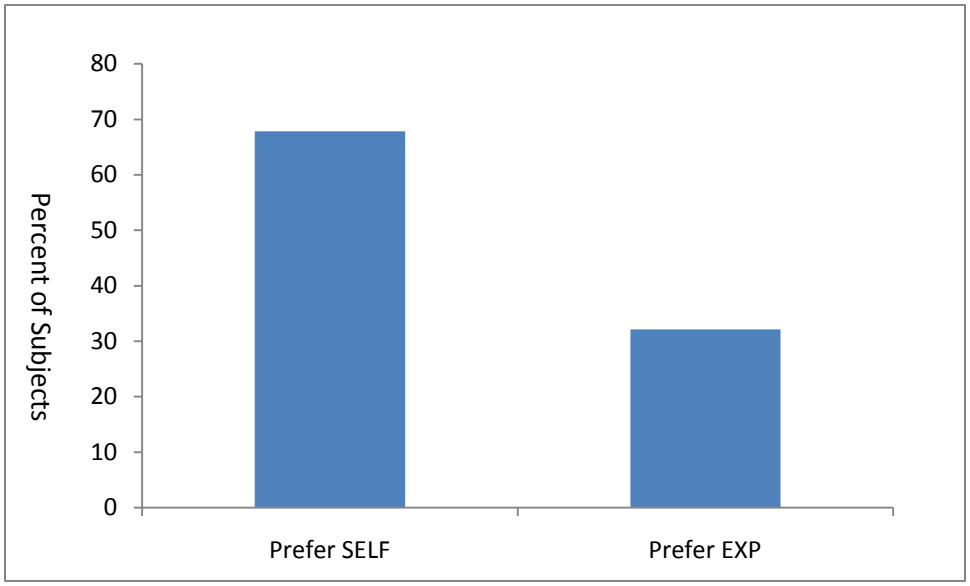
probability distribution but differs in terms of sense of control. Our experimental result shows that individuals will invest less amount of money when the investment method does not follow their preferred method of control. In other words, individuals are more risk averse when the investment method does not satisfy their preference in terms of sense of control. In stark contrast to our finding, most commonly used models of decision making under risk, as well as asset pricing models, imply that the investment level should not change with the method of control. The other important finding is that preference for control not only affects investment behavior when subjects are induced to have comparative mindset but also under non-comparative mindset. However, the impact is larger in the comparative mindset. Taken together, our results suggest that preference for control affects investment behavior.

At the heart of any asset pricing model is the measure of risk aversion of investors.[10] As discussed, our findings uncover an important determinant of risk attitude: sense of control, which is overlook by existing models of asset pricing. Therefore, our findings suggest that the preference for control approach is a visible possibility to resolve the stock market participation puzzle and equity premium puzzle. For example, as mentioned in the introduction, an individual may refuse to participate in the stock market because of low sense of control, while the same individual may at the same time take other investments options which are objectively much riskier but providing a higher sense of control. However, considerable caution is necessary before we can conclude. Much would need to be done, both in terms of theory and empirical evidence. We hope the present work will stimulate further works on this important area.

[10] See Cochrane (2001) for an extensive survey of asset pricing models. See Barberis and Huang (2007) for a survey on using the loss aversion/narrow framing approach to solve the equity premium puzzle.

FIGURE 1

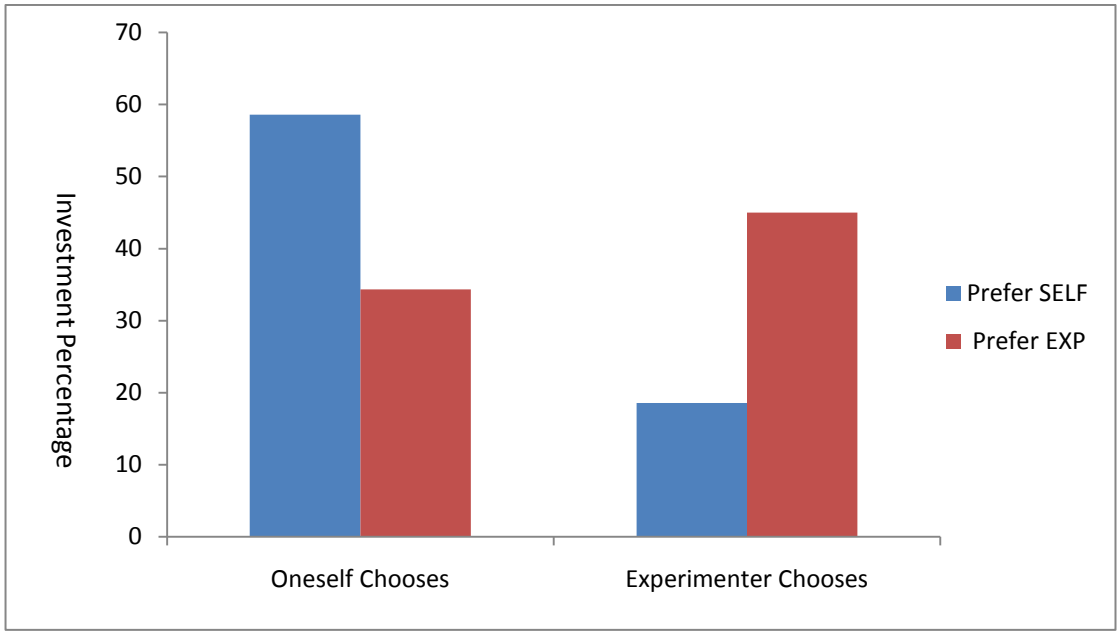
Preference for Control in Choice Treatment



Notes: SELF denotes the method that the numbers will be chosen by oneself. EXP denotes the method that the numbers will be chosen by experimenter. A subject is classified as prefer SELF (prefer EXP) if the amount invested under SELF is higher than under EXP (SELF).

FIGURE 2

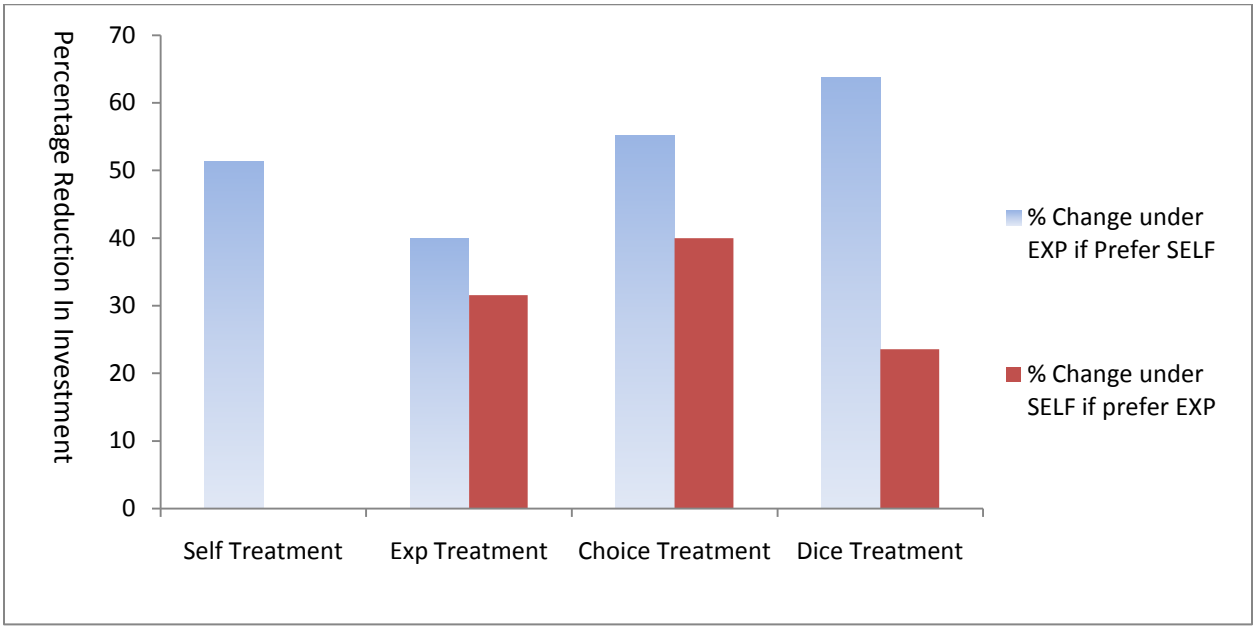
Effect of Preference for Control on Investment in Dice Treatment



Notes: SELF denotes the method that the numbers will be chosen by oneself. EXP denotes the method that the numbers will be chosen by experimenter. A subject is classified as prefer SELF (prefer EXP) if the amount invested under SELF is higher than under EXP (SELF).

FIGURE 3

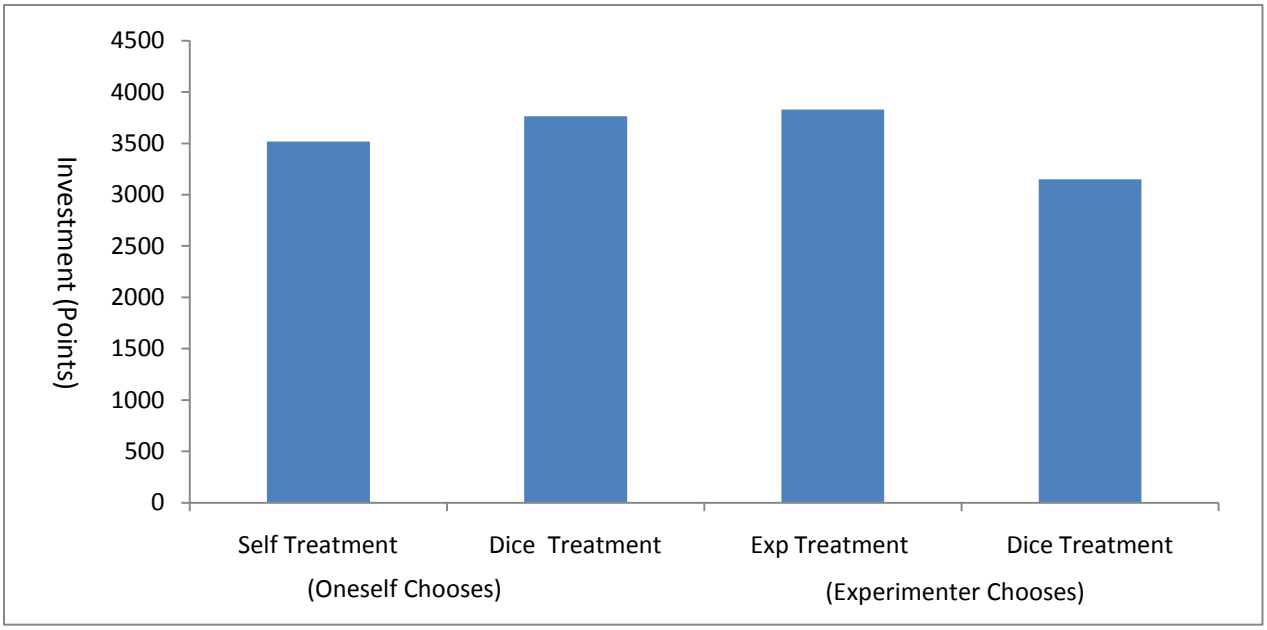
Participants Invest Less When the Investment Method Does Not Follow Their Preferred Method of Control



Notes: EXP refers to the case where the numbers will be chosen by the experimenter. SELF refers to the case where the numbers will be chosen by oneself. A subject is classified as prefer SELF (prefer EXP) if the amount invested under SELF is higher than under EXP (SELF). In the Self treatment, there are no subject in the prefer EXP group.

FIGURE 4

Average Investment Amount

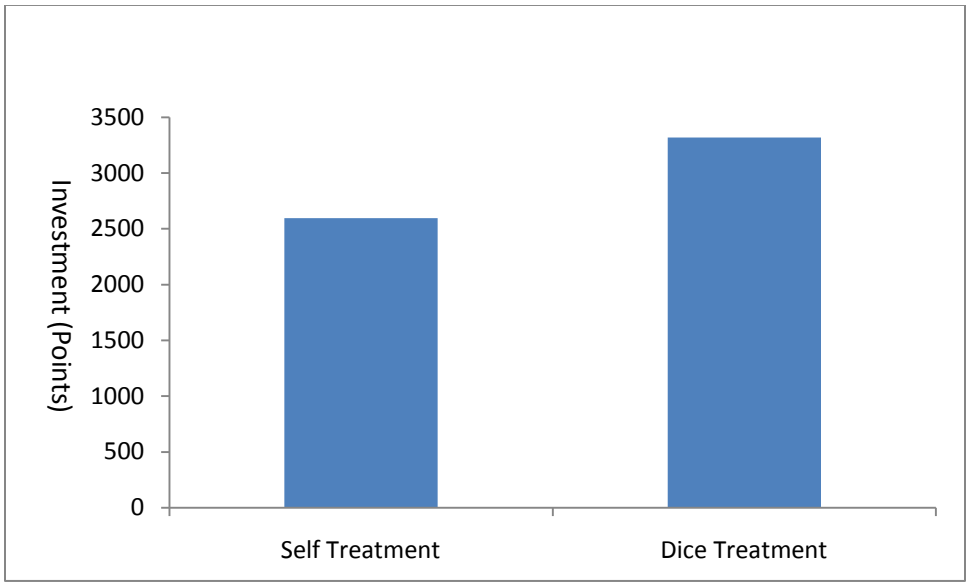


Notes: Subjects in the Self and Exp are induced to have non-comparative mindset. Subjects in the Dice treatment are induced to have comparative mindset.

FIGURE 5

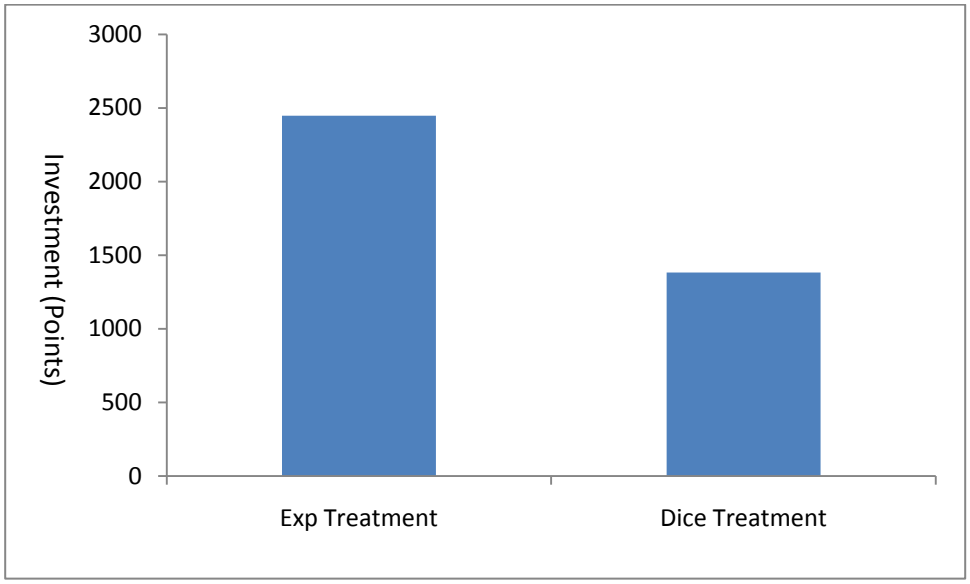
Effect of Comparative and Non-Comparative Mindset on Investment

Panel A. Average Investment Amount when the Numbers are Chosen by Oneself



Notes: The observations include investment less than 9000 points in the SELF method where the numbers will be chosen by the subject.

Panel B. Average Investment Amount when the Numbers are Chosen by Experimenter



Notes: The observations include investment less than 5000 points in the EXP method where the numbers will be chosen by the experimenter.

TABLE 1

Summary Statistics

Panel A. Investment under Self and Experimenter Treatment

		Self					Exp			
Preference	**N**	**Method**	**Notation**	**Mean (Std)**	**% Change**	**Preference**	**N**	**Method**	**Notation**	**Mean (Std)**	**% Change**
SELF	6	SELF	SSS	5083.333 (3625.144)		**SELF**	2	SELF	ESS	7000 (1414.214)	
		EXP	SSE	2166.667 (614.636)	-51.296 (16.725)			EXP	ESE	5000 (0.00)	-40 (28.284)
EXP	0	SELF	SES	-		**EXP**	4	SELF	EES	3000 (1825.742)	-31.548 (10.889)
		EXP	SEE	-				EXP	EEE	4250 (2179.449)	
INDIF	24	SELF	SIS	3125.833 (2587.599)		**INDIF**	23	SELF	EIS	3652.174 (2560.339)	
		EXP	SIE	3125.833 (2587.599)				EXP	EIE	3652.174 (2560.339)	
Overall	30	SELF	SOS	3517.333 (2865.378)		**Overall**	29	SELF	EOS	3793.103 (2533.762)	
		EXP	SOE	2934 (2491.388)				EXP	EOE	3827.586 (2410.082)	

Mean comparison	**Mean Difference**	**t-Test**	**Mean comparison**	**Mean Difference**	**t-Test**
SOS vs SOE	583.333	1.929*	EOS vs EOE	-34.483	-0.235
SSS vs SSE	2916.667	1.820*	ESS and EEE vs EIS	1514.493	1.315#
SSS vs SIS	1957.5	1.531#	EEE vs EIS	597.826	0.438
SSE vs SIS	-959.167	-0.865			

Notes: SELF denotes the method that the numbers will be chosen by oneself. EXP denotes the method that the numbers will be chosen by experimenter. A subject is classified as prefer SELF (prefer EXP, INDIF) if the amount invested under SELF is higher (less, equal to) than under EXP. Mean refers to the amount of investment out of 10000 points. "% change" refers to the percentage change in investment under the less preferred method of control. *,**,*** represents significance at the 10, 5, and 1 percent level (two-tailed). # represents significance at 10 percent level (one-tailed).

Panel B. Investment under Choice and Dice Treatment

Choice						Dice					
Preference	**N**	**Method**	**Notation**	**Mean (Std)**	**% Change**	**Preference**	**N**	**Method**	**Notation**	**Mean (Std)**	**% Change**
Choosing SELF	19	SELF	CSS	4157.895 (2789.129)		**SELF**	7	SELF	DSS	5857.143 (3496.597)	
		EXP	CSE	3342.105 (2646.028)	-18.380 (27.455)			EXP	DSE	1857.143 (1886.67)	-63.702 (32.948)
Choosing EXP	9	SELF	CES	2872.222 (2752.852)	-5.714 (15.119)	**EXP**	9	SELF	DES	3433.333 (2006.863)	-23.580 (13.074)
		EXP	CEE	2983.333 (2710.397)				EXP	DEE	4500 (2397.916)	
INDIF	N.A					**INDIF**	14	SELF	DIS	2928.571 (2208.873)	
								EXP	DIE	2928.571 (2208.873)	
Overall	28	SELF	COS	3744.643 (2793.821)		**Overall**	30	SELF	DOS	3763.333 (2693.733)	
		EXP	COE	3226.786 (2621.721)				EXP	DOE	3150 (2345.759)	

Mean comparison	**Mean Difference**	**t-Test**	**Mean comparison**	**Mean Difference**	**t-Test**
COS vs COE	517.857	1.990*	DSS vs DSE	4000	2.653**
CSS vs CSE	815.790	2.246**	DSS vs DIS	2928.571	2.358**
CSS vs CES	1285.673	1.144	DES vs DEE	-1066.667	-4.257***
CSS vs CEE	1174.561	1.050	DEE vs DIE	1571.429	1.611#
CSE vs CEE	358.772	0.333	DSS vs DES	2423.81	1.751#
CES vs CEE	-111.111	-1.000	DSE vs DEE	-2642.857	-2.391**

Notes: SELF denotes the method that the numbers will be chosen by oneself. EXP denotes the method that the numbers will be chosen by experimenter. A subject is classified as prefer SELF (prefer EXP, INDIF) if the amount invested under SELF is higher (less, equal to) than under EXP. Choosing SELF refers to subjects who opt for SELF in the choice treatment. Choosing EXP refers to subjects who opt for EXP in the choice treatment. Mean refers to the amount of investment out of 10000 points. "% change" refers to the percentage change in investment under the less preferred method of control. *,**,*** represents significance at the 10, 5, and 1 percent level (two-tailed). # represents significance at 10 percent level (one-tailed). N.A stands for not applicable.

References

Barberis, Nicholas and Ming Huang. 2007. "The Loss Aversion/Narrow Framing Approach to the Equity Premium Puzzle," In *Handbook of the Equity Risk Premium,* ed. R. Mehra. North Holland, Amsterdam.

Barberis, Nicholas; Ming Huang and Richard H. Thaler. 2006. "Individual Preferences, Monetary Gambles, and Stock Market Participation: A Case for Narrow Framing." *American Economic Review*, 96(4), pp. 1069-90.

Benartzi, Shlomo and Richard H. Thaler. 1995. "Myopic Loss Aversion and the Equity Premium Puzzle." *Quarterly Journal of Economics*, 110(1), pp. 73-92.

Biais, Bruno; Denis Hilton; Karine Mazurier and Sébastien Pouget. 2005. "Judgemental Overconfidence, Self-Monitoring, and Trading Performance in an Experimental Financial Market." *Review of Economic Studies*, 72(2), pp. 287-312.

Briley, Donnel A. and Robert S. Wyer. 2002. "The Effect of Group Membership Salience on the Avoidance of Negative Outcomes: Implications for Social and Consumer Decisions." *Journal of Consumer Research*, 29(3), pp. 400-15.

Charness, Gary and Uri Gneezy. Forthcoming. "Portfolio Choice and Risk Attitudes." *Economic Inquiry*.

Chew, Soo Hong and Jacob S. Sagi. 2008. "Small Worlds: Modeling Attitudes toward Sources of Uncertainty." *Journal of Economic Theory*, 139(1), pp. 1-24.

Chew, Soo Hong; King King Li; Robin Chark and Song Fa Zhong. 2008. "Source Preference and Ambiguity Aversion: Models and Evidence from Behavioral and Neuroimaging Experiments," In *Neuroeconomics, Advances in Health Economics and Health Services Research,* ed. D. Houser and K. McCabe, 179-201. London: Emerald Insight.

Cochrane, John H. 2001. *Asset Pricing*. Princeton, NJ: Princeton University Press

Connolly, Terry; Lisa D. Ordóñatez and Richard Coughlan. 1997. "Regret and Responsibility in the Evaluation of Decision Outcomes." *Organizational Behavior and Human Decision Processes*, 70(1), pp. 73-85.

Eichberger, Jürgen and David Kelsey. 1996. "Uncertainty Aversion and Preference for Randomisation." *Journal of Economic Theory*, 71(1), pp. 31-43.

Ellsberg, Daniel. 1961. "Risk, Ambiguity, and the Savage Axioms." *Quarterly Journal of Economics*, 75(4), pp. 643-69.

Fox, Craig R. and Kelly E. See. 2003. "Belief and Preference in Decision under Uncertainty," In *Thinking: Current Perspectives on Reasonsing, Judgement, and Decision Making,* ed. D. Hardman and L. Macchi. Hoboken, NJ: Wiley.

Fox, Craig R. and Amos Tversky. 1995. "Ambiguity Aversion and Comparative Ignorance." *Quarterly Journal of Economics*, 110(3), pp. 585-603.

Gneezy, Uri and Jan Potters. 1997. "An Experiment on Risk Taking and Evaluation Periods." *Quarterly Journal of Economics*, 112(2), pp. 631-45.

Gollwitzer, Peter M.; Heinz Heckhausen and Birgit Steller. 1990. "Deliberative and Implemental Mind-Sets: Cognitive Tuning toward Congruous Thoughts and Information." *Journal of Personality and Social Psychology*, 59(6), pp. 1119-27.

Higgins, E. Tory. 1997. "Beyond Pleasure and Pain." *American Psychologist*, 52, pp. 1280-300.

____. 1998. "Promotion and Prevention: Regulatory Focus as a Motivational Principle." *Advances in experimental social psychology*, 30, pp. 1-46.

Kahneman, Daniel; Jack L. Knetsch and Richard H. Thaler. 1990. "Experimental Tests of the Endowment Effect and the Coase Theorem." *Journal of Political Economy*, 98(6), pp. 1325.

Klibanoff, Peter. 1993. "Uncertainty, Decision, and Normal Form Games." *Manuscript, MIT.*

Langer, Ellen J. 1975. "The Illusion of Control." *Journal of Personality and Social Psychology*, 32(2), pp. 311-28.

Lo, King Chung. 1996. "Equilibrium in Beliefs under Uncertainty." *Journal of Economic Theory*, 71(2), pp. 443-84.

Mankiw, N. Gregory and Stephen P. Zeldes. 1991. "The Consumption of Stockholders and Non-Stockholders." *Journal of Financial Economics*, 29(1), pp. 97-112.

Mehra, Rajnish and Edward C. Prescott. 1985. "The Equity Risk Premium: A Puzzle." *Journal of Monetary Economics*, 15(2), pp. 145-61.

Odean, Terrance. 1999. "Do Investors Trade Too Much?" *American Economic Review*, 89(5), pp. 1279-98.

____. 1998. "Volume, Volatility, Price, and Profit When All Traders Are above Average." *Journal of Finance*, 53(6), pp. 1887-934.

Presson, Paul K. and Victor A. Benassi. 1996. "Illusion of Control: A Meta-Analytic Review." *Journal of Social Behavior & Personality*, 11(3), pp. 493-510.

Raiffa, Howard. 1961. "Risk, Ambiguity, and the Savage Axioms: Comment." *Quarterly Journal of Economics*, 75(4), pp. 690-94.

Savage, Leonard J. 1954. *The Foundations of Statistics*. New York: Wiley.

Xu, Alison Jing and Robert S. Wyer. 2007. "The Effect of Mind-Sets on Consumer Decision Strategies." *Journal of Consumer Research*, 34(4), pp. 556-66.

Subject I.D:_____

Appendix (Not for Publication): Instructions

The experiment was conducted in German language, and the original instructions were also in German (available upon request).The treatment titles were not shown in the original instructions.

Instructions *(Self Treatment)*

Welcome to our experimental study on decision-making. The experiment will take about 30 minutes. Each participant will receive a show up fee of 2.5 Euro at the end of the experiment. In addition, each participant will have the chance to earn more money according to the instructions below.

You are endowed with 10000 points (1000 points = 0.5 Euro). You can invest any point between 0 and 10000 on the following investment option. There is an urn which contains 10 balls that are numbered from 1 to 10. You will be asked to choose 3 numbers from 1 to 10. Then, the experimenter will randomly draw a ball from the urn in front of you. You will win 2.5 points for every point invested if the ball drawn belongs to one of the numbers you chose, otherwise you loss the points invested.

If you win, your payoff will be equal to

$$10000 + 2.5x$$

where x is the number of points invested.

If you lose, your payoff will be equal to

$$10000 - x$$

You will be paid in cash for the points you have at the end of the experiment.

We now ask you to indicate your decision.

I wish to invest ____ points.

I would like to choose the following 3 numbers (please mark).

1	2	3	4	5
6	7	8	9	10

Subject I.D:_____

Instructions *(Exp Treatment)*

Welcome to our experimental study on decision-making. The experiment will take about 30 minutes. Each participant will receive a show up fee of 2.5 Euro at the end of the experiment. In addition, each participant will have the chance to earn more money according to the instructions below.

You are endowed with 10000 points (1000 points = 0.5 Euro). You can invest any point between 0 and 10,000 on the following investment option. There is an urn which contains 10 balls that are numbered from 1 to 10. The experimenter will choose 3 numbers for you and distribute the numbers to you after you choose your investment level. Then, the experimenter will randomly draw a ball from the urn in front of you. You will win 2.5 points for every point invested if the ball drawn belongs to one of 3 numbers you have, otherwise you loss the points invested.

If you win, your payoff will be equal to

$$10000 + 2.5x$$

where x is the number of points invested.

If you lose, your payoff will be equal to

$$10000 - x$$

You will be paid in cash for the points you have at the end of the experiment.

We now ask you to indicate your decision.

I wish to invest ____ points.

Subject I.D:_____

Instructions *(Choice Treatment)*

Welcome to our experimental study on decision-making. The experiment will take about 30 minutes. Each participant will receive a show up fee of 2.5 Euro at the end of the experiment. In addition, each participant will have the chance to earn more money according to the instructions below.

You are endowed with 10000 points (1000 points = 0.5 Euro). You can choose to invest any point between 0 and 10,000 on **one** of the following two possibilities (but not both).

Possibility I. You choose the numbers

There is an urn which contains 10 balls that are numbered from 1 to 10. You will be asked to choose 3 numbers from 1 to 10. Then, the experimenter will randomly draw a ball from the urn in front of you. You will win 2.5 points for every point invested if the ball drawn belongs to one of the numbers you chose, otherwise you loss the points invested.

Possibility II. Experimenter chooses the numbers

There is an urn which contains 10 balls that are numbered from 1 to 10. The experimenter will choose 3 numbers for you and distribute the numbers to you after you choose your investment level. Then, the experimenter will randomly draw a ball from the urn in front of you. You will win 2.5 points for every point invested if the ball drawn belongs to one of 3 numbers you have, otherwise you loss the points invested.

You will be paid in cash for the points you have at the end of the experiment.

If you win, your payoff will be equal to

$$10000 + 2.5x$$

where x is the number of points invested.

If you lose, your payoff will be equal to

$$10000 - x$$

You will be paid in cash for each point you have at the end of the experiment.

Subject I.D:_____

We now ask you to indicate your decision.

I wish to choose possibility I / II.

Please proceed to A in below if you choose possibility I.

Please proceed to B in below if you choose possibility II.

A. Possibility I. You choose the numbers

I wish to invest ____ points.

I would like to choose the following 3 numbers (please mark).

1	2	3	4	5
6	7	8	9	10

B. Possibility II. Experimenter chooses the numbers

I wish to invest____ points.

Subject I.D:_____

Instructions *(Dice Treatment)*

Welcome to our experimental study on decision-making. The experiment will take about 30 minutes. Each participant will receive a show up fee of 2.5 Euro at the end of the experiment. In addition, each participant will have the chance to earn more money according to the instructions below.

You are endowed with 10000 points (1000 points = 0.5 Euro). You can invest any point between 0 and 10,000 on each of the following two possibilities, yet **only one** of them will be implemented. After we collect your decisions for each possibility, the experimenter will roll a dice and possibility I will be implemented if the number is greater than or equal to 4. Possibility II will be implemented if the number is equal or smaller than 3.

Possibility I. You choose the numbers

There is an urn which contains 10 balls that are numbered from 1 to 10. You will be asked to choose 3 numbers from 1 to 10. Then, the experimenter will randomly draw a ball from the urn in front of you. You will win 2.5 points for every point invested if the ball drawn belongs to one of the numbers you chose, otherwise you loss the points invested.

Possibility II. Experimenter chooses the numbers

There is an urn which contains 10 balls that are numbered from 1 to 10. The experimenter will choose 3 numbers for you and distribute the numbers to you after you choose your investment level. Then, the experimenter will randomly draw a ball from the urn in front of you. You will win 2.5 points for every point invested if the ball drawn belongs to one of 3 numbers you have, otherwise you loss the points invested.

If you win, your payoff will be equal to

$$10000 + 2.5x$$

where x is the number of points invested.

If you lose, your payoff will be equal to

$$10000 - x$$

You will be paid in cash for each point you have at the end of the experiment.

We now ask you to indicate your decision for each possibility

The decision sheets for possibility I and possibility II are put inside two separate envelopes, labeled I and II. Please open the envelopes and write down your decisions. After that, please put back the decision sheet to the corresponding envelope.

Subject I.D:_____

Possibility I. You choose the numbers

I wish to invest ____ points if the numbers are chosen by myself.

I would like to choose the following 3 numbers (please mark).

1	2	3	4	5
6	7	8	9	10

Possibility II. Experimenter chooses the numbers

I wish to invest____ points if the numbers are chosen by the experimenter.

Subject I.D:_____

Questionnaire *(Self Treatment)*

Thanks for your participation. Now we have two more questions for you. Please answer it carefully. Your answers will **not** influence your final payoff.

Q1. Do you prefer to choose the three numbers by yourself or by experimenter? (Circle one)

1. I prefer to choose the numbers by myself.

2. I prefer to let the experimenter to choose the numbers for me.

3. I am indifferent.

Q2. Now, suppose the **experimenter** will choose the numbers for you, how many points will you invest?

I will invest ____ points out of 10000 points.

Subject I.D:_____

Questionnaire *(Exp Treatment)*

Thanks for your participation. Now we have two more questions for you. Please answer it carefully. Your answers will **not** influence your final payoff.

Q1. Do you prefer to choose the three numbers by yourself or by experimenter? (Circle one)

1. I prefer to choose the numbers by myself.

2. I prefer to let the experimenter to choose the numbers for me.

3. I am indifferent.

Q2. Now, suppose **you** will choose the numbers yourself, how many points will you invest?

I will invest ____ points out of 10000 points.

Subject I.D:_____

Questionnaire ***(Choice Treatment for Subjects Who Have Chosen Possibility I)***

Thanks for your participation. Now we have one more question for you. Please answer it carefully. Your answer will **not** influence your final payoff.

Now, suppose the **experimenter** will choose the numbers for you, how many points will you invest?
I will invest ____ points out of 10000 points.

Subject I.D:_____

Questionnaire ***(Choice Treatment for Subjects Who Have Chosen Possibility II)***

Thanks for your participation. Now we have one more question for you. Please answer it carefully. Your answer will **not** influence your final payoff.

Now, suppose **you** will choose the numbers yourself, how many points will you invest?

I will invest ____ points out of 10000 points.