Impact of Academic Experience in Economics on Risk Preferences and Rationality: An Empirical Investigation

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Impact of Academic Experience in Economics on Risk Preferences and Rationality:

An Empirical Investigation

Zhengyi Zhou

Economics Honors Thesis

Professor Slavov

04/06/2010
When we model human choices under risk, the standard is to apply a rational choice model such as Expected Utility Theory (EUT). However, humans are not always rational, and Kahneman and Tversky developed Prospect Theory (PT) to account for people’s cognitive limitations in decision-making. However, both EUT and PT do not differentiate among individuals, nor discuss factors that lead to different risk preferences and rationality for different individuals. This study examines whether academic experience in economics reduces risk aversion and irrationality. A survey was administered to economics and non-economics majors in Occidental College. The survey was designed as pairs of gambling choices to detect subjects’ risk preferences and responses when induced to display certainty, framing, reflection and lottery effect as defined in PT. It was found that economics majors had lower risk aversion, and generally behaved differently from non-economics majors in rationality tests, although their behaviors were not always more consistent with EUT than those of non-economics majors. Academic experience in economics, in most cases, significantly reduced risk aversion and irrationality among non-economics students, but this learning effect was not observed among economics majors. A further test of self-selection among economics and non-economics major with little economics training showed that economics majors were born rather than made. It is further shown that the monetary incentives used in this study reduced risk aversion, but did not have much impact on rationality. It is also found that
risk aversion and irrationality were positively correlated, and math/science majors were more rational than humanities majors.

**Key words:** risk preferences, rationality, economic training
1. Introduction

Economic theories of consumer behavior strive to understand the trade-offs economic agents face and the motivations behind their choices. These theories have historically assumed that each economic agent is rational, and is, in Herbert Simon’s words, “a maximizer, who will settle for nothing less than the best”. Here, rationality means for each individual to achieve his or her own personal goals, whatever the goals are. Along this line, Jon von Neumann and Oskar Morgenstern (1944) developed Expected Utility Theory (EUT) to mathematically model people’s rational choices under risk, taking into account their risk preferences. Modern evidence has suggested, however, that people are not always rational, and their behaviors systematically deviate from EUT predictions. In response, an important behavioral model, Prospect Theory (PT), was invented by Daniel Kahneman and Amos Tversky (1979) to explain these deviations from EUT.

Both EUT and PT are overarching theories that do not acknowledge individual differences; people may have different risk preferences and levels of rationality. Thus, it is an interesting question whether academic experience in economics has any impact on these measures. This empirical study will compare risk preferences and rationality between economics majors, who have more economic training, and non-economics
majors, who have less economic exposure. The major motivation here is to separate the
effect of economic learning from self-selection. Specifically, the research will analyze:
1) whether economics majors are less risk averse than non-economics majors;
2) whether economics majors better fit in the profile of EUT, while non-economics
majors better fit in the profile of PT; and
3) whether disparities in behaviors between economics and non-economics majors is due
to academic training in economics (learning hypothesis), or self-selection into different
majors (self-selection hypothesis).

This paper is organized as follows. Section 2 presents some background theory
and literature review. Section 3 introduces the methodology, and section 4 discusses
collection and profile of the data. Then, section 5 presents findings on risk preferences
and section 6 demonstrates findings on rationality tests. Section 7 discusses the effect of
monetary incentives on my subjects’ choices. Section 8 further extends the study by
looking at the correlation between risk preferences and rationality, and section 9 analyzes
whether math/science majors behave differently from humanities majors. Finally, section
10 concludes.

2. Background Theory and Literature Review

Expected Utility Theory (EUT) is a model of rational decision-making where a
decision maker seeks to maximize her welfare in her self-interest, after evaluating each
choice’s possible outcomes and the outcomes’ probabilities of occurrence. Each outcome
is assigned an ordinal value, called utility, that measures the decision-maker’s well-being if that outcome is obtained. Then expected utility of the choice is \( \sum_i p_i u_i \), where \( u_i \) is the utility of the \( i^{th} \) outcome, and \( p_i \) is the probability that the \( i^{th} \) outcome will become true. An individual is said to be rational if she chooses the option that gives the highest expected utility. EUT, thus, provides a framework where a rational being’s choice under risk can be determined.

Also, Von Neumann and Morgenstern stipulated a list of mathematical axioms that a rational individual’s preferences must satisfy. It is assumed that a rational person’s preferences should be complete (either A is preferred to B or the reverse or they are equally desirable), transitive (if A is preferred to B and B is preferred to C, then A is preferred to C), reflexive (A is at least as good as itself), and invariant (preferences between A and B is unaffected by the manner in which these two options are presented).

Von Neumann-Morgenstern EUT further assumes individuals to be risk averse. This is to assume that people tend to choose safer options with lower expected gains over riskier options with higher expected gains. The reason for this risk aversion is diminishing marginal utility of wealth, and manifests itself in a concave utility function. Risk aversion can be approximated by the relative size of expected gains given up for a certain prospect. Risk aversion has been found to fall with income and wealth (Hartog et al, 2000). Women are also shown to be more risk averse than men (Hartog et al, 2000).

However, EUT has frequently been attacked as an unrealistic model of human decision-making. It over-emphasizes the choices themselves, but fails to model the
motivations, preferences and perceptions in the processes of decision-making (Anslie, 1982). Also, EUT assumes that people have full knowledge of the available choices, and can accurately make calculations to determine which choice gives the best expected utility. However, there are limits to which information is available and complex calculations can be done. These limits, termed “bounded rationality” by Herbert Simon (1957), are what prevent people from always making the best decisions. Therefore, it is not too surprising that ample empirical evidence shows that people often deviate from what EUT expects them to do (Allais, 1953; McFadden, 1999).

In 1979, Kahneman and Tversky proposed the Prospect Theory (PT) as an alternative model for decision-making under risk. PT is based on empirical results, and it draws on psychology and focuses on the decision-making process. Kahneman and Tversky found that individuals make decisions by looking at whether they gain or lose from their current states, which are set as neutral reference points, instead of their final state of wealth as assumed by EUT. They also found the following important violations of rational choice theory in actual human decision-making.

**Certainty Effect**: Changes in people’s utilities are not linear to changes in outcome probabilities. People usually overweigh certain options. For example, Kahneman and Tversky found that the utility gained when the probability of winning something changes from 0.99 to 1 was greater than the utility gained when the probability changes from 0.33 to 0.34.
**Reflection Effect:** People frequently switch from being risk averse in the positive domain of gains to being risk seeking in the negative domain of losses, relative to their neutral reference points. Kahnemand and Tversky commented that, “the preference between negative prospects is the mirror image of the preference between positive prospects. Thus, the reflection of prospects around 0 reverses the preference order” (1979).

**Lottery Effect:** People also switch from being risk averse to risk seeking when they face extremely low probabilities of winning large payoffs.

**Loss Aversion:** A potential loss looms larger than a potential gain of the same size. This asymmetry in attitude is too large to be explained by income effects alone. As a results, people exhibit “endowment effect”, where they value a good more once it rightfully belongs to them, because the pain of losing it far outweighs the benefit of obtaining another similarly priced good.

**Framing Effect:** Framing of choices sometimes influences people’s decisions. People separate a pair of prospects into common and distinctive components, and tend to ignore the common component and over-emphasize the differences.

Therefore, the utility of wealth function in PT is concave for gains (risk averse) and convex for losses (risk seeking), with the function for losses being steeper than that for gains (loss aversion). An example of utility of wealth function is shown below in Figure 1.
PT provides much insight into how people may deviate from the predictions of a rational choice theory such as EUT, and make choices that do not maximize their well-being. However, PT does not quantify the extent of this irrationality for different groups of people, nor does it discuss any factor that may have led to different levels of irrationality. On the other hand, as some literature suggests, if an economic activity is carried out by a specialist who is repeatedly exposed to the task, the performance may be much better modeled by classical rational choice theory (Rabin, 1998). A study by John List (2004) examines how experience affects consumers in the marketplace. He ran field experiments in natural marketplace and observed whether people displayed the endowment effect predicted by PT. He concluded that “prospect theory adequately organizes behavior among inexperienced consumers, whereas consumers with intense market experience behave largely in accordance with neoclassical predictions”. This
study shows that expertise does improve rationality. Thus, it remains a question whether academic experience in economics has a similar effect.

A number of studies have shown that economics majors adhere more closely to the rational and self-interested outlook of traditional economic theories. In a study by Marwell and Ames (1981), economics graduate students are found to be much more likely to free-ride than any other students. Carter and Irons (1991) also found economics students are more selfish when playing ultimatum bargaining games, and this selfishness is mainly because of self-selection rather than learning. In another study by Bauman and Rose (2009), economics majors were again found to be more selfish in making donations to social programs. Again, “this lack of generosity is due to selection, not indoctrination”, although indoctrination was found to be effective in reducing donations among non-economics majors.

The author conducted a preliminary study of this topic (Zhou, 2009). A survey was administered to junior and senior economics and non-economics majors in Occidental College. The survey consisted of pairs of gambling choices to detect the subjects’ risk preferences and their responses when induced to display certainty and reflection effect under the prediction of PT. It was found that economics majors were significantly less risk averse, and were more likely to follow EUT, while non-economics majors were more likely to follow PT. Academic experience in economics significantly reduced risk aversion and irrationality among non-economics students, but this learning effect was not significant among economics majors. This could be because economics
majors self-selected into studying economics, or because returns to economics training were diminishing.

In the past research that explored subjects’ risk preferences and rationality, some provided the subjects with monetary incentives in the experiments, while others did not. Camerer (1989) and Battalio et al. (1990) found that inclusion of monetary incentives induces slightly higher risk aversion. Kachelmeier & Shehata (1992) further discovered that subjects were more risk-averse when the monetary incentives were large. Moreover, Harrison (1994) reported that actually playing the gambles significantly reduced irrationality as opposed to putting forward purely hypothetical choices, while Camerer (1989) and Battalio et al. (1990) found no such effect on rationality. As Kagel & Roth (1995) summarized, “paid subjects probably do exert extra mental effort, which improves their performance, but choice over money gambles is not likely to be a domain in which effort will improve adherence to rational axioms. Subjects with well-formed preferences are likely to express them truthfully, whether they are paid or not” (pp. 635).

3. Methodology

This study is an extension of the work of Kahneman and Tversky (1979). The survey used in this study is inspired, modified and extended from the original survey designed by Kahneman and Tversky that enabled them to formulate PT. My survey attempts to detect each subject’s degree of risk aversion, and whether he or she displays certainty effect, framing effect, reflection effect and lottery effect. Overall, this study
differs most significantly from that of Kahneman and Tversky in that it differentiates
subjects according to their economic training. In Kahneman and Tversky’s work, there
was no background information on the academic composition of their participants, but in
this study, subjects’ major (actual or intended primary major) and number of economics
classes completed were recorded. They were further asked whether they have taken
ECON101: Principles of Economics I, ECON102: Principles of Economics II or
ECON250: Intermediate Microeconomic Theory. These classes introduce and teach the
microeconomic theory related to tradeoffs and EUT. In this study, risk preferences and
irrationality can be compared between economics and non-economics majors, and across
different levels of economics expertise.

This study further extends Zhou (2009) in its attempt to separate self-selection
and learning effects. Specifically, I ran two kinds of regression:

Dependent Variable = \( \alpha_0 + \alpha_1 \text{ECON} + \{\text{demographic controls}\} + \epsilon \)

Dependent Variable = \( \beta_0 + \beta_1 \text{ECON} + \beta_2 \text{CLASSES} + \beta_3 \text{ECON*CLASSES} + \{\text{demographic controls}\} + \epsilon \)

In the first regression, \( \alpha_1 \) demonstrates the behavioral difference between economics and
non-economics majors. This behavioral difference is either due to learning or self-
selection. The second regression differentiates between two effects. Holding
demographic controls constant, \( \beta_1 \) represents the self-selection effect. Theoretically, \( \beta_1 \) is
the impact of being an economics majors when \( \text{CLASSES} = 0 \). \( \beta_2 \) is the learning effect
among non-economics majors (\( \text{ECON} = 0 \)). \( \beta_2 + \beta_3 \) shows the learning effect among
economics majors.
One-sided Wald tests are used to test the significance of sums of variables. The results of this method of analysis is shown in the result sections of this paper. Demographic controls include gender, GPA (self-reported), age, class year and race. Age and class year accounts for any maturity effect.

It is worth noting that non-economics majors who choose to take economics classes may be quite different from those who avoid economics classes. Therefore, some of the learning effect among non-economics majors may be partially because of self-selection. Also, it is possible for freshmen and sophomores to switch majors. Some of those who now intend to major in economics may not relate to the “economic way of thinking” and later decide to switch to other majors, or some non-economics majors who later become interested in economics after taking some classes and switch to be economics majors. As a result, learning effects in this study may be biased upward, because self-selection effect may not be fully realized for some freshmen and sophomores.

In this study, monetary incentive was provided; actual gambles were run after each subject completed the survey. This monetary incentive helped to elicit subjects’ true risk preferences and rationality levels. Thus, this study can be compared with the preliminary study where no such incentive was offered, to see whether the introduction of monetary incentive reduces irrationality or increases risk aversion.

I hypothesize noticeable differences in both risk preferences and degrees of irrationality between economics and non-economics majors. Specifically, economics majors are more risk neutral and rational, while non-economics majors are more risk averse and irrational. Also, similar to my preliminary study, economic training should
reduce risk aversion and irrationality among non-economics majors, while this learning
effect is not necessarily evident among the economics majors. I suspect there is
significant self-selection among economics students, consistent with the findings of
Carter and Irons (1991) and Bauman and Rose (2009).

Other demographic factors may play a role, too. For example, I hypothesize
female subjects to be more risk-averse and irrational than male subjects, in line with the
finding by Hartog et al. I also think that subjects with higher GPAs should be more
rational than those with lower GPAs; subjects with higher GPAs may be more open to
risk and more capable of making optimal choices under risk, which are two
characteristics that may have helped them in test-taking. Age may also positively affect
risk aversion and rationality. However, given paramount evidence on irrational behaviors,
it is not too surprising if subjects from both groups show significant irrationality.

4. Data and Procedure

A total of 114 subjects took the surveys, out of which 108 were valid and
complete. All participants were students in Occidental College. Upon further
categorization, there were 30 TE subjects, 21 IEs, 34 TNs and 23 INs. In this study, all
data were self-reported. For non-economics majors, I deliberately chose subjects from a
wide range of majors, spanning from humanities, arts, math, sciences to non-economics
social sciences. Table 1 provides a statistical description of the demographics of the
subjects. The mean statistics of each demographic category is stated, and the standard deviation is included in a bracket below.

<table>
<thead>
<tr>
<th>Gender % male</th>
<th>TE (trained econ)</th>
<th>IE (inexperienced econ)</th>
<th>TN (trained non-econ)</th>
<th>IN (inexperienced non-econ)</th>
<th>All</th>
</tr>
</thead>
<tbody>
<tr>
<td>% male</td>
<td>67</td>
<td>71</td>
<td>44</td>
<td>30</td>
<td>53</td>
</tr>
</tbody>
</table>

| GPA           | 3.44 (0.35)       | 3.27 (0.29)             | 3.41 (0.34)          | 3.60 (0.29)                 | 3.43 (0.34) |

| Age           | 20.8 (1.0)        | 18.8 (0.8)              | 19.9 (1.5)           | 19.7 (1.5)                  | 19.9 (1.4) |

| Year % Freshmen | 24 | 35 | 28 |
| Year % Sophomore | 32 | 17 | 27 |
| Year % Junior   | 26 | 31 | 21 |
| Year % Senior   | 18 | 17 | 24 |

| Race % White    | 73 | 44 | 70 | 65 |
| Race % Asian    | 27 | 29 | 22 | 22 |
| Race % Other    | 0  | 27 | 8  | 13 |

| # Econ Classes | 7.5 (3.4) | 0.9 (0.3) | 1.4 (1.1) | 0 (3.5) | 2.7 |

| % Taken ECON101 | 100 | 90  | 100 | 0  | 77 |
| % Taken ECON102 | 100 | 0   | 18  | 0 | 33 |
| % Taken ECON250 | 77  | 0   | 6   | 0  | 23 |
| Sample Size     | 30  | 21  | 34  | 23 | 108 |

Table 1. summary statistics of data
It is worth noting that TE subjects were predominantly upper-classmen, while IEs were all freshmen and sophomores. Non-economics majors were more evenly spread out across all class years. Expectedly, TE subjects have completed, on average, much more economics classes than TNs, while IEs and INs were the most inexperienced in economics training. The sample mainly consisted of white and Asian subjects.

The survey was administered online from February 15th to 28th, 2010. A target pool of students was selected from the Occidental College Student Directory according to major and class year; a subset of these students were randomly chosen to be my subjects. They were then emailed about the survey; approximately half of them completed the survey. The subjects were informed about the intent of the study, and that they should respond according to their personal preferences. They were further told that after completing the survey, the author would take the gambles of their choice using a mathematical program, MATLAB, and they would win 0.1% of the winnings. The average winning was $4 if all the subjects were risk neutral and made optimal choices in each survey question. The actual winning for each subject depended on her actual choices and luck. The survey consisted of 20 questions, including 8 pairs of gamble or lottery choices and 10 questions on demographic information (see Appendix 1 for the print-out of the online survey).

As promised, after data collection, the author took the gambles for each of the subjects and rewarded them accordingly. The random integer generator in MATLAB was used to ensure fairness of gamble outcomes. The actual winning ranged from -$6 to $10,
but subjects with negative winnings were not charged. The total payout was $430 for 114 subjects ($3.77 per subject on average). The money were put in the subjects’ mailboxes anonymously.

5. Results on Risk Aversion

The survey questions that examine risk preferences are problem 3 to 5. The problems and their results are shown below:

Problem 3: For each option, the first number is the prize of the gamble, and the second number is the probability of winning that prize. Therefore, ($3000, 80%) means an 80% chance of winning $3000, and a 20% chance of winning nothing.

Choose between the following two gambles:

A: ($3000, 2/3)                               B: ($2000, 100%)

Expected Value (EV) = $2000                         EV = $2000

Problem 4: Choose between:

A: ($3000, 80%)                               B: ($2000, 100%)

EV = $2400                                      EV = $2000

Problem 5: Choose between:

A: ($3000, 90%)                               B: ($2000, 100%)

EV = $2700                                      EV = $2000
These three questions attempt to detect a subject’s risk preference in stages. Problem 3 tests whether a subject is risk averse or risk seeking. If an individual prefers A in Problem 3, she is risk seeking; if she prefers B, she is risk averse. Problem 4 and 5 tries to quantify how risk-averse a subject is. Choosing B in Problem 4 means that one would at least sacrifice $400 out of a risky $2400 for a sure $2000. The level of risk aversion can approximated by the relative size of expected gains given up for a certain prospect, so in this case, risk aversion is at least at $400/$2400, or 17%. Similarly, for Problem 5, choosing B means a willingness to sacrifice at least $700 out of $2700 for a sure $2000, so the level of risk aversion is at least 26% ($700/$2700 ≈ 26%).

Putting these three problems together, subjects can be categorized into four levels of risk aversion (see Table 2):

<table>
<thead>
<tr>
<th>Risk Preferences</th>
<th>Level 1 (Not Risk Averse)</th>
<th>Level 2 (Low Risk Aversion)</th>
<th>Level 3 (Medium Risk Aversion)</th>
<th>Level 4 (High Risk Aversion)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Answer to #3</td>
<td>A (took a chance)</td>
<td>B (stayed safe)</td>
<td>B (stayed safe)</td>
<td>B (stayed safe)</td>
</tr>
<tr>
<td>Answer to #4</td>
<td>A (took a chance)</td>
<td>A (took a chance)</td>
<td>B (stayed safe)</td>
<td>B (stayed safe)</td>
</tr>
<tr>
<td>Answer to #5</td>
<td>A (took a chance)</td>
<td>A (took a chance)</td>
<td>A (took a chance)</td>
<td>B (stayed safe)</td>
</tr>
<tr>
<td>Risk Preferences</td>
<td>Risk-seeking</td>
<td>Risk-averse at a level below 17%</td>
<td>Risk-averse at a level between 17% to 26%</td>
<td>Risk-averse at the level above 26%</td>
</tr>
</tbody>
</table>

Table 2. Categorization of risk preferences
It was possible to categorize all subjects this way, except for 2 subjects who did not have consistent risk preferences; both of them took a chance for Problem 3 but stayed safe in Problem 4 and switched back to take a chance in Problem 5. We test the remaining 106 data in an ordered probit model with an interaction term. The dependent variable in this model, RA, is measured according to the previous categorization, with an ordinal value of 1 assigned for no risk aversion, 2 for low risk aversion, 3 for medium and 4 for high. The regression result is shown below in Table 3:
<table>
<thead>
<tr>
<th></th>
<th>Risk Aversion</th>
<th>Risk Aversion</th>
<th>Risk Aversion</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>ECON</td>
<td>CLASSES</td>
<td>ECON*CLASSES</td>
</tr>
<tr>
<td>Risk Aversion</td>
<td>-0.49**</td>
<td>-0.36***</td>
<td>0.34**</td>
</tr>
<tr>
<td></td>
<td>(0.23)</td>
<td>(0.15)</td>
<td>(0.15)</td>
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<tr>
<td></td>
<td>-0.73**</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>(0.34)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>-0.36***</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>(0.34)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.40**</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>(0.23)</td>
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<tr>
<td></td>
<td>0.44**</td>
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<td>(0.23)</td>
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<td></td>
<td>-0.19</td>
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<td>(0.14)</td>
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<td>0.24</td>
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<td>0.41</td>
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<td>0.34</td>
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<td>(0.40)</td>
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<td></td>
<td>0.059</td>
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<td></td>
<td>0.081</td>
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<td></td>
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<tr>
<td>N</td>
<td>106</td>
<td>106</td>
<td></td>
</tr>
<tr>
<td>( \bar{R}^2 )</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Notes:
1. The results are presented in the format of coefficient (standard error).
2. Very similar results were obtained when ordered logit were used instead, showing the results are robust (results available upon request).
3. * significant on a 10% significance level; ** 5%; *** 1%; **** 0.1%. One-tail hypothesis tests were performed.

Table 3. regression results for risk aversion
From these results, we can conclude that economics majors were less risk averse, even after controlling for gender, GPA, age, year and race. Also, there was significant learning effect among non-economics majors; taking an additional economics class reduced risk aversion level by 0.36. However, this learning effect was not evident among economics majors; more economics training did not affect economics majors’ risk preferences. Self-selection of economics majors was apparent.

Some demographic controls played a role, too. Higher GPA significantly reduced risk aversion, while females had higher risk aversion. Older subjects were also less risk averse. Class year and race did not affect risk aversion significantly. These results are generally consistent with my hypothesis.

6. Results on Rationality

6.1. Certainty Effect

As mentioned before, Kahneman and Tversky found that people display certainty effect, where they tend to give a certain option much more weight. This phenomenon is manifested in the comparison of results between problem 4 and 10:

**Problem 4**: Choose between:

A: ($3000, 80%)  
**EV = $2400**

B: ($2000, 100%)  
**EV = $2000**
**Problem 10:** Choose between:

- C: ($3000, 20%)  
  EV = $600
- D: ($2000, 25%)  
  EV = $500

If a subject follows EUT, she should choose C if she has chosen A, and should choose D if she has chosen B. To see why this is true, without loss of generality, consider a subject who is less than 17% risk averse and chose A in problem 4. This means, according to EUT, \( u(3000) \times 0.8 > u(2000) \times 1 \), or \( u(3000)/u(2000) > 1.25 \). Then she should choose C in Problem 10 because \( u(3000)/u(2000) > 1.25 \) means \( u(3000) \times 0.2 > u(2000) \times 0.25 \). Thus, Choosing A and D, or B and C are not acting consistently with EUT. Especially, choosing B and C reflects the certainty effect in PT. The certain prospect of B induces one to choose B over A, while she is really not that risk averse if no certain prospect is present.

Eight subjects chose A and D, and were excluded from the analysis because they followed neither EUT nor PT. A binary probit regression, in which the dependent variable is equal to 1 when the subject demonstrates the certainty effect, was performed on the remaining 100 subjects, and the results are shown in Table 4.
As seen from the regression results, we do not have enough evidence to show that economics majors were less likely to exhibit certainty effect. Self-selection of economics major was also not significant. Among economics majors, holding all demographic

### Note:
Again, very similar results were obtained using binary logit (available upon request)

#### Table 4. Regression results for certainty effect

<table>
<thead>
<tr>
<th></th>
<th>Certainty Effect</th>
<th>Certainty Effect</th>
<th>Certainty Effect</th>
<th>Certainty Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECON</td>
<td>-0.10</td>
<td>-0.25</td>
<td>Econ Behavioral</td>
<td>-0.10</td>
</tr>
<tr>
<td></td>
<td>(0.29)</td>
<td>(0.44)</td>
<td>Differences</td>
<td>(0.29)</td>
</tr>
<tr>
<td>CLASSES</td>
<td>-0.55**</td>
<td></td>
<td>Learning among</td>
<td>-0.55**</td>
</tr>
<tr>
<td></td>
<td>(0.24)</td>
<td></td>
<td>Non-Econ</td>
<td>(0.24)</td>
</tr>
<tr>
<td>ECON*CLASSES</td>
<td>0.48**</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.24)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FEMALE</td>
<td>0.88***</td>
<td>0.84***</td>
<td>Learning among</td>
<td>-0.063</td>
</tr>
<tr>
<td></td>
<td>(0.29)</td>
<td>(0.30)</td>
<td>Econ</td>
<td>(0.066)</td>
</tr>
<tr>
<td>GPA</td>
<td>-0.80**</td>
<td>-0.94**</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.43)</td>
<td>(0.45)</td>
<td>Self-Selection</td>
<td>-0.25</td>
</tr>
<tr>
<td>AGE</td>
<td>-0.09</td>
<td>-0.14</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.17)</td>
<td>(0.18)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>YEAR</td>
<td>0.08</td>
<td>0.31</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.21)</td>
<td>(0.25)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>WHITE</td>
<td>-0.20</td>
<td>-0.50</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.43)</td>
<td>(0.50)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ASIAN</td>
<td>-0.43</td>
<td>-0.56</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.49)</td>
<td>(0.55)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$\bar{R}^2$</td>
<td>0.10</td>
<td>0.081</td>
<td></td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>100</td>
<td>100</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: Again, very similar results were obtained using binary logit (available upon request)
variables constant, learning didn’t reduce certainty effect, but economics training

significantly reduced display of certainty effect among non-economics majors. Some
demographic controls had some impacts on certainty effect. Being female increased the

chance of exhibiting certainty effect, while higher GPA reduced occurrence of certainty
effect. Age, year and race, again, had minimal impacts.

6.2. Framing Effect

As discussed before, Kahneman and Tversky found that people’s choices are
subject to the framing of choices. Specifically, when people compare pairs of choices,
they tend to ignore the common components of the choices and over-emphasize on the
differences. Problem 8 and 10 examine this framing effect.

**Problem 8:** Consider the following two-stage game. In the first stage, there is a 75%
chance to end the game without winning anything and a 25% chance to move to the
second stage where you then have a choice between: (Your choice must be made before
the game starts, i.e. before the outcome of the first stage is known)

A: ($3000, 80%)  
EV = $600

B: ($2000, 100%)  
EV = $500

**Problem 10:** Choose between:

C: ($3000, 20%)  
EV = $600

D: ($2000, 25%)  
EV = $500
Problem 8 and 10 are actually identical under EUT. Option A in Problem 8 is a 75% chance of getting $0 and a 25% chance of getting a 80% chance of $3000, which is equal to a 20% chance of getting $3000 (25%*80% = 20%). Similarly, option B in Problem 8 is really D in Problem 10, as 25% chance of getting $2000 for sure is 25% chance of getting $2000. Therefore, a rational subject should choose either A and C, or B and D. If a subject chooses A and D or B and C, she switches her preferences under framing influences. Especially, subjects are likely to neglect the first stage in Problem 8 since it’s common to option A and B.

Using a similar method of analysis as before, we ran another binary probit regression, in which the dependent variable, Framing Effect, is a dummy variable with a value of 1 when a subject displays framing effect (choosing B & C or A & D) and 0 when the subject makes choices consistent to EUT (choosing A & C or B & D). The regression results are shown below in Table 5.
<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Standard Error</th>
<th>Variable</th>
<th>Coefficient</th>
<th>Standard Error</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECON</td>
<td>-0.45*</td>
<td>0.28</td>
<td>Econ Behavioral Differences</td>
<td>-0.45*</td>
<td>0.28</td>
</tr>
<tr>
<td>CLASSES</td>
<td>-0.03</td>
<td>0.18</td>
<td>Learning among Non-Econ</td>
<td>-0.03</td>
<td>0.18</td>
</tr>
<tr>
<td>ECON*CLASSES</td>
<td>-0.13</td>
<td>0.18</td>
<td>Learning among Econ</td>
<td>-0.16**</td>
<td>0.07</td>
</tr>
<tr>
<td>FEMALE</td>
<td>0.91***</td>
<td>0.27</td>
<td>Self-Selection</td>
<td>0.22</td>
<td>(0.41)</td>
</tr>
<tr>
<td>GPA</td>
<td>-0.43</td>
<td>0.42</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AGE</td>
<td>-0.04</td>
<td>0.17</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>YEAR</td>
<td>0.005</td>
<td>0.21</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>WHITE</td>
<td>-0.31</td>
<td>0.41</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ASIAN</td>
<td>0.06</td>
<td>0.47</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$R^2$</td>
<td>0.14</td>
<td>0.18</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>108</td>
<td>108</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: A regression model using a binary logit model with the same variables yields very similar results (available upon request).

Table 5. Regression results for framing effect

The regression results show that economics majors demonstrated significantly less framing effect than non-economics majors, and this was due to learning among
economics majors. Self-selection was not evident, and learning was not significant among non-economics majors, after controlling for demographic variables. Again, females tended to exhibit more framing effect, and subjects with higher GPA displayed less framing effect. Age, year and race did not seem to matter in this analysis.

6.3 Reflection Effect

Kahneman and Tversky found that people exhibit reflection effect, and switch from being risk averse in gains to risk seeking in losses. Problem 3 and 7 were designed to examine how economics and non-economics majors react to a situation like this.

**Problem 3**: Choose between the following two gambles:

A: ($3000, 2/3)  
EV = $2000

B: ($2000, 100%)  
EV = $2000

**Problem 7**: Choose between:

C: (-$3000, 2/3)  
EV = -$2000

D: (-$2000)  
EV = -$2000

If a subject chose B in problem 3, she is risk averse, but if she switched to the risk seeking option of C in problem 7, she is not acting consistently with EUT, but rather, following PT’s prediction on reflection effect. The following binary probit model analyzes reflection effect in a similar way as before (see Table 6). The dependent variable, Reflection Effect, is again a dummy variable equal to 1 when the subject
displays reflection effect (choosing B & C or A & D) and 0 when the subject does not
(choosing A & C or B & D).

<table>
<thead>
<tr>
<th>Reflection Effect</th>
<th>Reflection Effect</th>
<th>Reflection Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECON</td>
<td>-0.42*</td>
<td>Econ Behavioral</td>
</tr>
<tr>
<td></td>
<td>(0.31)</td>
<td>Differences</td>
</tr>
<tr>
<td>CLASSES</td>
<td>-0.23</td>
<td>Learning among</td>
</tr>
<tr>
<td></td>
<td>(0.20)</td>
<td>Non-Econ</td>
</tr>
<tr>
<td>ECON*CLASSES</td>
<td>0.20</td>
<td>Learning among</td>
</tr>
<tr>
<td></td>
<td>(0.20)</td>
<td>Econ</td>
</tr>
<tr>
<td>FEMALE</td>
<td>-0.10</td>
<td>Learning among</td>
</tr>
<tr>
<td></td>
<td>(0.29)</td>
<td>Self-Selection</td>
</tr>
<tr>
<td>GPA</td>
<td>-0.29</td>
<td>-0.03</td>
</tr>
<tr>
<td></td>
<td>(0.42)</td>
<td>(0.07)</td>
</tr>
<tr>
<td>AGE</td>
<td>-0.28*</td>
<td>-0.30**</td>
</tr>
<tr>
<td></td>
<td>(0.17)</td>
<td>(0.43)</td>
</tr>
<tr>
<td>YEAR</td>
<td>0.41**</td>
<td>0.51**</td>
</tr>
<tr>
<td></td>
<td>(0.22)</td>
<td>(0.27)</td>
</tr>
<tr>
<td>WHITE</td>
<td>0.22</td>
<td>-0.10</td>
</tr>
<tr>
<td></td>
<td>(0.43)</td>
<td>(0.45)</td>
</tr>
<tr>
<td>ASIAN</td>
<td>0.55</td>
<td>0.49</td>
</tr>
<tr>
<td></td>
<td>(0.51)</td>
<td>(0.52)</td>
</tr>
<tr>
<td>$\bar{R}^2$</td>
<td>0.06</td>
<td>0.067</td>
</tr>
<tr>
<td>N</td>
<td>108</td>
<td>108</td>
</tr>
</tbody>
</table>

Note: repeating using a binary logit model yields similar results (available upon request).

Table 6. regression results for reflection effect
It is apparent from the regression results that economics majors displayed less reflection effect than non-economics majors, significant at less than 10% level. However, it seems that in this case, learning effect was not evident among both economics majors and non-economics majors, although learning among non-economics majors significantly reduced reflection effect at 12% significance level. Self-selection effect was also marginally significant at 12% level. Gender and GPA failed to have significant impacts, but age and year seemed to have some impacts.

6.4. Lottery Effect

As Kahneman and Tversky found out, people usually switch their risk preferences when they face a small probability of winning a large payoff. This study calls this phenomenon the lottery effect. Problem 3 and 6 analyze this behavior:

**Problem 3:** Choose between the following two gambles:

- A: ($3000, 2/3)  
  EV = $2000
- B: ($2000, 100%)  
  EV = $2000

**Problem 6:** Choose between:

- C: ($6000, 0.1%)  
  EV = $6
- D: ($6, 100%)  
  EV = $6

In this pair of problems, if a subject chooses B in Problem 3, she is risk averse, so she should opt for the safer choice in Problem 6, which is D. Similarly, if a subject is risk
seeking, she should choose A and C. Switching from B to C or from A to D characterizes the lottery effect. The following binary probit regression model analyzes what my subjects actually chose (see Table 7). Again, the dependent variable, Lottery Effect, is a dummy variable equal to 1 when a subject displays lottery effect (choosing B & C or A & D), and equal to 0 otherwise.
<table>
<thead>
<tr>
<th></th>
<th>Lottery Effect</th>
<th>Lottery Effect</th>
<th>Lottery Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>ECON</td>
<td>0.36*</td>
<td>0.62*</td>
<td>Econ Behavioral Differences 0.36*</td>
</tr>
<tr>
<td></td>
<td>(0.28)</td>
<td>(0.40)</td>
<td>(0.28)</td>
</tr>
<tr>
<td>CLASSES</td>
<td>-0.02</td>
<td></td>
<td>Learning among Non-Econ -0.02</td>
</tr>
<tr>
<td></td>
<td>(0.18)</td>
<td></td>
<td>(0.18)</td>
</tr>
<tr>
<td>ECON*CLASSES</td>
<td>-0.04</td>
<td></td>
<td>Learning among Econ -0.06</td>
</tr>
<tr>
<td></td>
<td>(0.17)</td>
<td></td>
<td>(0.06)</td>
</tr>
<tr>
<td>FEMALE</td>
<td>-0.04</td>
<td>-0.07</td>
<td>Learning among Econ -0.06</td>
</tr>
<tr>
<td></td>
<td>(0.27)</td>
<td>(0.26)</td>
<td>(0.27)</td>
</tr>
<tr>
<td>GPA</td>
<td>0.75**</td>
<td>0.81**</td>
<td>Self-Selection 0.62*</td>
</tr>
<tr>
<td></td>
<td>(0.40)</td>
<td>(0.41)</td>
<td>(0.40)</td>
</tr>
<tr>
<td>AGE</td>
<td>0.05</td>
<td>0.04</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.16)</td>
<td>(0.16)</td>
<td></td>
</tr>
<tr>
<td>YEAR</td>
<td>-0.14</td>
<td>-0.03</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.20)</td>
<td>(0.23)</td>
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</tr>
<tr>
<td>WHITE</td>
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<td>-0.47</td>
<td></td>
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<tr>
<td></td>
<td>(0.40)</td>
<td>(0.41)</td>
<td></td>
</tr>
<tr>
<td>ASIAN</td>
<td>0.04</td>
<td>0.09</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.45)</td>
<td>(0.45)</td>
<td></td>
</tr>
<tr>
<td>$\bar{R}^2$</td>
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<td>0.051</td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>108</td>
<td>108</td>
<td></td>
</tr>
</tbody>
</table>

Note: Upon repeating the analysis with a binary logit model, it produces results with similar coefficients and significance (available upon request)

Table 7. regression results for lottery effect
The regression results for lottery effect are very interesting. Economics majors behaved differently from non-economics majors, but economics majors tended to display significantly more lottery effect. The same pattern showed in the test of self-selection. Learning effect, in this case, did not have significant impact among either the economics or the non-economics group.

This outcome may not be entirely surprising given the design and incentives of Problem 7. All other questions in the survey have face-value incentives in the order of thousands of dollars, and thus the real incentives are in the order of dollars (award = 0.1% of face-value). Problem 7 has a face-value incentive in the order of dollars (EV=$6), and thus has a negligible real incentive. Therefore, subjects were more likely to take risks when the stake was small; this is consistent with according to the theory of Kachelmeier & Shehata (1992). It is likely, as Smith & Walker (1993) suggested, that the monetary incentives were not enough to dominate over non-monetary incentives, such as excitement of taking the lottery or boredom from not participating in the lottery.

Although in this case economics majors were less likely to follow EUT, they still acted significantly differently from non-economics majors, and this difference in behavior was shown to be mainly due to self-selection.

Higher GPA increased the exhibition of lottery effect. Other demographic variables did not have significant impacts.
6.5. Summary

This study attempts to analyze subjects’ rationality by looking at whether they would follow PT’s four predictions of irrationality: certainty effect, framing effect, reflection effect and lottery effect. The regression results on behavioral differences, learning and self-selection effect were not as straightforward as those of risk aversion. Table 8 below summarizes the results on rationality.

<table>
<thead>
<tr>
<th></th>
<th>Certainty Effect</th>
<th>Framing Effect</th>
<th>Reflection Effect</th>
<th>Lottery Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Did economics majors behave differently?</td>
<td>No</td>
<td>Yes</td>
<td>Yes, followed EUT</td>
<td>Yes, didn’t follow EUT</td>
</tr>
<tr>
<td>Learning effect among econ majors</td>
<td>Insignificant</td>
<td>Significant</td>
<td>Insignificant</td>
<td>Insignificant</td>
</tr>
<tr>
<td>Learning effect among non-econ</td>
<td>Significant</td>
<td>Insignificant</td>
<td>Significant at 12%</td>
<td>Insignificant</td>
</tr>
<tr>
<td>Self-selection</td>
<td>Insignificant</td>
<td>Insignificant</td>
<td>Significant at 12%</td>
<td>Significant</td>
</tr>
</tbody>
</table>

Table 8. summary of rationality results

From this summary, we can see that economics majors did, in most cases, have significantly different behaviors from non-economics majors, although there was not strong evidence that economics majors behaved more in accordance with EUT.
Economics majors were less likely to exhibit reflection effect and framing effect, while they actually displayed more lottery effect.

Each additional economics taken did not seem to change economics majors’ behaviors in most situations, but economics training did bring down the occurrences of certainty and reflection effect among the non-economics majors. Whenever economics majors behaved differently from non-economics majors, this was mostly due to self-selection of economics majors, so economics majors were mainly born not made. These results correspond well with previous studies done by Carter and Irons (1991), Bauman and Rose (2009) and Zhou (2009). It seems that economics majors are characteristically quite different from non-economics majors in a number of aspects (risk preferences, some aspects of rationality, selfishness etc.). This study also echoes Bauman and Rose’s and Zhou’s finding where indoctrination (learning) is only effective among the non-economics majors, but not among the economics majors.

7. Monetary Incentives

It is interesting to compare this study with that of Zhou (2009). Both studies have similar subject pools and methodologies. One of the most important distinctions is that in this study, subjects actually took the gambles of choice and received payments proportional to their gamble winnings, but Zhou (2009) did not have any monetary incentives. Therefore, it remains a question whether offering performance-related monetary incentives changes people’s risk preferences and rationality.
Zhou (2009) only surveyed juniors and seniors at Occidental College, so to make the two sets of data comparable, only 49 juniors and seniors in the current 108 subjects were considered. Adding 70 data points from Zhou (2009), the pooled data has 119 subjects, out of which 53 are economics majors and 66 are non-economics majors (see Appendix 2 for Zhou 2009’s survey). For risk preferences, Zhou (2009) asked the identically phrased Problem 4 and 5 in this study; it did not differentiate between subjects with no risk aversion and those with low risk aversion. Therefore, the risk aversion scale here is modified to take the value of 1 if a subject has low or no risk aversion, 2 for medium risk aversion and 3 for high risk aversion. For rationality tests, Zhou (2009) only collected data on certainty effect and reflection effect, so only those two rationality tests were compared across the two samples. Regression results using ordered probit (risk aversion) and binary probit (certainty and reflection effects) are shown below in Table 9. Only information on major, number of economics classes taken, gender and GPA was collected in Zhou (2009), so only these variables were included as controls.
It is apparent from the above regression results that monetary incentives significantly decreased risk aversion and display of certainty effect, while having no impact on reflection effect. The mixed results for rationality echo those from past studies, but the fact that monetary incentives actually reduced risk aversion in this study contradicts previous literature. Perhaps subjects in my study were indifferent between not earning any money and earning a very small amount of money. There might be a threshold earning for each of my subjects, and only getting beyond that threshold
increased her utility. Therefore, the subjects in my study might feel like taking excessive risks in the hope of earning beyond their own respective thresholds.

It also may be because of the different incentives the two sets of subjects faced. In Zhou (2009), subjects were given the survey with hypothetical rewards in the scale of thousands of dollars. It is possible that these subjects pictured themselves deciding between thousands of dollars for each question. In this study, however, subjects were explicitly told before the start of survey that they would get 0.1% of the specified rewards, which were in the order of thousands, so they might have calculated their real stakes and were deciding between options with several dollars of value. Thus, it is not surprising that subjects in this study were more risk taking because they were facing smaller stakes (Kachelmeier & Shehata, 1992).

Confirming my results in the previous section, economics majors behaved significantly differently in risk aversion and reflection effect. Female also had higher risk aversion and greater likelihood to display certainty effect.

8. Risk Preferences and Irrationality

In this section, we will see whether a person’s risk preference and irrationality are correlated. To find out, a series of binary probit regression tests were performed to assess the impact of risk aversion (ordinal rank from 1 to 4 as defined in section 5) on whether a subject displays certainty, framing, reflection and lottery effect (see Table 10). ECON, CLASSES and all other demographic variables are included as controls.
We can see from the above results that higher risk aversion level is correlated with higher irrationality, as measured by certainty, framing and reflection effect. The role of risk aversion is not significant in the case of lottery effect. Therefore, in most of the
cases, a more risk averse subject is more likely to follow PT’s irrationality prediction, while a less risk averse subject is more rational and follow EUT.

9. Math and Science Majors

During the data collection process in this study and in Zhou (2009), the author observed that math or science majors made choices that were quite different from those of humanities majors. To test this hypothesis, four regressions were performed among non-economics majors (Table 11). Math, Physics, Chemistry and Biology majors were classified as math/science majors. An ordered probit model was used to analyze risk aversion, binary probit models were used for certainty, framing and lottery effect. Using binary probit model failed for the case of reflection effect, because MATHSCI= 1 perfectly predicted binary response success (all math/science majors displayed reflection effect). Instead, a least square model was performed for reflection effect.
<table>
<thead>
<tr>
<th></th>
<th>Risk Aversion</th>
<th>Certainty Effect</th>
<th>Framing Effect</th>
<th>Reflection Effect</th>
<th>Lottery Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATHSCI</td>
<td>-0.04</td>
<td>-0.63*</td>
<td>-1.35***</td>
<td>0.30**</td>
<td>-0.96**</td>
</tr>
<tr>
<td></td>
<td>(0.39)</td>
<td>(0.49)</td>
<td>(0.54)</td>
<td>(0.15)</td>
<td>(0.53)</td>
</tr>
<tr>
<td>CLASSES</td>
<td>-0.08*</td>
<td>-0.08</td>
<td>-0.25</td>
<td>0.02</td>
<td>-0.13</td>
</tr>
<tr>
<td></td>
<td>(0.16)</td>
<td>(0.20)</td>
<td>(0.21)</td>
<td>(0.06)</td>
<td>(0.19)</td>
</tr>
<tr>
<td>FEMALE</td>
<td>0.65**</td>
<td>0.88**</td>
<td>0.64*</td>
<td>-0.11</td>
<td>-0.72**</td>
</tr>
<tr>
<td></td>
<td>(0.33)</td>
<td>(0.41)</td>
<td>(0.41)</td>
<td>(0.12)</td>
<td>(0.39)</td>
</tr>
<tr>
<td>GPA</td>
<td>-1.23***</td>
<td>-0.71</td>
<td>0.16</td>
<td>0.19</td>
<td>0.82*</td>
</tr>
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<td></td>
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<td>(0.64)</td>
<td>(0.61)</td>
<td>(0.18)</td>
<td>(0.59)</td>
</tr>
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<td>-0.02</td>
<td>-0.06</td>
<td>0.11</td>
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<tr>
<td></td>
<td>(0.19)</td>
<td>(0.23)</td>
<td>(0.26)</td>
<td>(0.06)</td>
<td>(0.20)</td>
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<tr>
<td>YEAR</td>
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<td>0.58**</td>
<td>0.52*</td>
<td>0.08</td>
<td>0.16</td>
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<td></td>
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<td>(0.32)</td>
<td>(0.37)</td>
<td>(0.09)</td>
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<tr>
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<td>-0.50</td>
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<tr>
<td></td>
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<td>(0.57)</td>
<td>(0.53)</td>
<td>(0.16)</td>
<td>(0.51)</td>
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<tr>
<td>ASIAN</td>
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<td>0.19</td>
<td>0.23</td>
<td>-0.32</td>
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<tr>
<td></td>
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<td>(0.63)</td>
<td>(0.61)</td>
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<tr>
<td>$\bar{R}^2$</td>
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<td>0.18</td>
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<td>0.11</td>
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<tr>
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<td>56</td>
<td>51</td>
<td>56</td>
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</table>

Table 11. math/science majors

It follows from the regression results that math/science majors did not have a significantly different risk preferences from other non-economics majors. Math/science majors displayed less certainty, framing and lottery effect than humanities majors, but demonstrated more reflection effect. It is reasonable to conclude that in most case,
math/science majors acted more in accordance with EUT. Perhaps math/science majors were more likely to approach each question in the survey mathematically, for example they would probably calculate and compare the expected values of each option, which is what EUT predicts a rational being should do.

10. Conclusions

This study confirmed that economics majors as a group were less risk averse and acted differently from non-economics majors, although it was not necessarily true that economics majors acted more in accordance with EUT while non-economics majors behaved more in line with PT. When all demographic variables were held constant, academic experience in economics seemed to reduce non-economics majors’ risk aversion and irrationality as dictated by PT, but this learning effect was not apparent among economics majors. At instances when economics majors behaved significantly differently from non-economics majors, self-selection of economics majors dominated over learning.

Higher GPA and being male were generally found to be correlated with lower risk aversion and a lower tendency to follow PT, although these impacts were not observed consistently throughout.

It was also found that monetary incentives in this study reduced risk aversion, but failed to have any impact on rationality. Subjects with higher risk aversion were found to be more likely to follow the predictions of PT. Math/science majors did not have
different risk preferences from humanities majors, but they mostly acted more consistently with EUT than humanities majors.

11. Acknowledgements

I would like to thank my thesis advisor, Professor Sita Slavov, for her tremendous help and guidance on this project. Monetary payments to my subjects were jointly provided by an Academic Student Project (ASP) award from Undergraduate Research Center, Occidental College and the Bennett W. Schwartz Study Grant from Economics Department, Occidental College. I would also like to thank the whole Economics Department, for the superb education, and all my friends, for their unconditional support and patience.
References


Kachelmeier, S. & Shehata, M. “Examining Risk Preferences Under High Monetary


Appendix 1. online survey

Impact of Academic Experience in Economics on Risk Preference and Rationality

By Zhengyi Zhou
For ECON499: Economics Honors Thesis

* 1. You have to be at least 18 years old to take this survey.

Your participation is voluntary. You can withdraw at any time. All disclosed information will be kept strictly confidential. If you have any question about the research or your rights, please contact me at zzhou@oxy.edu or Professor Sita Slavov at sslavov@oxy.edu.

The first 8 questions will be 8 pairs of gamble choices. After submitting your preferred choices, I will take the actual gambles for you using a mathematical program, MATLAB, and I will reward you 0.1% of your winnings (I will put the money in your campus mail box). You will not be charged if you lose more than you win.

Do you agree with the terms detailed above?
- Agree
- Disagree

Reset

* 2. Your Oxy campus mailbox number: (so that I can pay you. Please indicate "shared" if your campus mailbox is shared)
Impact of Academic Experience in Economics on Risk Preference and Rationality

* 3. For each option, the first number (e.g., $3000) means the prize of the gamble, and the second number (e.g., 80%) means the probability of winning that prize. Therefore, ($3000, 80%) means you have an 80% chance of winning $3000, and a 20% chance of winning nothing.

Choose between the following two gambles:
- ($3000, 2/3)
- ($2000, 100%)

* 4. Choose between:
- ($3000, 80%)
- ($2000, 100%)

* 5. Choose between:
- ($3000, 90%)
- ($2000, 100%)

* 6. Choose between:
- ($6000, 0.1%)
- ($6, 100%)

* 7. You are asked to choose between: (negative numbers mean you are losing money, instead of winning)
- (-$3000, 2/3)
- (-$2000, 100%)

* 8. Consider the following two-stage game. In the first stage, there is a 75% chance to end the game without winning anything and a 25% chance to move to the second stage where you then have a choice between: (Your choice must be made before the game starts, i.e. before the outcome of the first stage is known)
- ($3000, 80%)
- ($2000, 100%)

Reset
* 9. Choose between:
- (-$3000, 80%)  
- (-$2000, 100%)
Reset

* 10. Choose between:
- ($3000, 20%)
- ($2000, 25%)
Reset
Impact of Academic Experience in Economics on Risk Preference and Rationality

* 11. Identify your sex.
   - Male
   - Female

* 12. What is your class year?
   - Frosh
   - Sophomore
   - Junior
   - Senior

* 13. What is your age?

* 14. What is your race?
   - White / Caucasian
   - Black / African American
   - Hispanic
   - Asian / Pacific Islander
   - Arabic / Middle Eastern
   - Native American

* 15. What's your current college GPA?

* 16. Have you declared your major?
   - Yes
   - No

17. What is your primary or intended major?
   - Economics
   - Other (Please specify)

* 18. How many college-level Economics classes have you completed (not counting those in progress)?
19. Check all classes you have completed:

☐ ECON101: Principle of Economics I
☐ ECON102: Principle of Economics II
☐ ECON250: Intermediate Microeconomic Theory

Reset
Appendix 2. Zhou (2009) survey

Survey

Irrationality, Risk Aversion and Academic Experience in Economics
Zhengyi Zhou ECON495&498

**Return your completed survey to me in person, or put it in my Oxy mailbox, #1734**

In the first 5 questions, you will see 5 pairs of gamble choices. For each gamble choice, the **first number** (eg $3000) means the **prize** of the gamble, and the **second number** (eg 80%) means the **probability of winning** that prize. Therefore, ($3000, 80%) means you have an 80% chance of winning $3000, and a 20% chance of winning nothing.

1. Choose between the following two gambles:
   A: ($3000, 80%)  B: ($2000, 100%)

2. Choose between the following two gambles:
   A: ($6000, 0.1%)  B: ($3000, 0.2%)

3. In addition to what you own, you have been given $3000. You are asked to choose between:
   A: (-$3000, 80%)  B: (-$2000)

4. Choose between the following two gambles:
   A: ($3000, 90%)  B: ($2000, 100%)

5. Choose between the following two gambles:
   A: ($3000, 20%)  B: ($2000, 25%)

6. Identify your sex.
   A: Male  B: Female

7. What is your current college GPA?
   A: less than 2.50  B: 2.50 - 2.99  C: 3.00 - 3.49  D: 3.50 - 4.00
8. What is your primary major?
   A: Economics            B: Non-Economics

9. How many college-level Economics classes have you completed?
   ______________________