Strong Evidence for Gender Differences in Investment

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Abstract: Are men more willing to take financial risks than women? The answer to this question has immediate relevance for many economic issues. We propose a novel approach in which we assemble the data from 10 sets of experiments with one simple underlying investment game. Most of these experiments were not designed to investigate gender differences and were conducted by different researchers in different countries, with different instructions, durations, payments, subject pools, etc. The fact that all data come from the same basic investment game allows us to test the robustness of the findings. We find a very consistent result that women invest less, and thus appear to be more financially risk averse than men.

Keywords: Gender differences; experiment; risk attitudes

JEL Codes: B49, C91, D81, G11, G19, J16

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1. Introduction

Many economic interactions involve some form of risk. Thus, it is not surprising that a substantial body of research in social science has tried to understand how decision makers incorporate risk in their choices. Expected utility, the dominant theory of decision under risk, makes some testable empirical predictions. However, under expected utility the actual level of risk-taking behavior by the agent is left as a free parameter, allowing for individual differences.

In this paper we study one important systematic difference in risk taking between groups. In particular, we study the interaction of risk-taking with the gender of the decision maker. The common stereotype is that women are more risk averse than men; this stereotype is important since it can potentially explain important economic phenomena.[1] Empirical investigation of gender differences in risk taking do point in the direction of less risk taking by women than by men (see the surveys in Eckel and Grossman, forthcoming and Croson and Gneezy, 2004).

A major problem with the empirical investigation of individual differences in risk taking is the variation in the methods used to study the phenomenon. Considering only the experimental work (done mostly by psychologists), each experiment uses a different decision problem, which makes it hard to compare results. In addition, some of these papers found gender differences without looking for them and others were specifically designed to test for these differences. The problem with the former approach is that these papers report the results of one experiment, and we do not know how many experiments have looked for a difference and did not find one. We are left with a selection bias of papers with a positive finding. The problem with the latter approach is that when the goal is to find (or not to find) a gender

[1] Some might argue that this difference across gender seems grounded in evolutionary psychology, given our role-differentiated hunter-gatherer roots (for a background to the evolutionary psychology literature, see. for example, Tooby and Cosmides (1990), Cosmides, Tooby, and Barkow (1992), and Tooby and Cosmides (1992). However, it is not completely clear how the hunter-gatherer origins map into contemporary financial behavior.

difference, the design of the experiment may be based on a small set of incidents in which the researchers expect to find the results they are after; here again, finding no difference can lead to the researcher shelving the project. It is easier to publish a paper that reports a gender difference in risk taking than a study that reports no difference.[2] For example, when a study finds that women are more risk taking than men ("man bites dog"), this study has a much higher chance of being published than a study that finds no difference in risk taking. This bias in publication also creates incentives for researchers to design studies that will generate such a difference.

The novelty of our paper is in using existing empirical results that were collected in a systematic way using thousands of observations by different researchers in a variety of setups, but based on one simple investment game.[3] Most of the data were collected not in order to study gender differences but rather to study other hypotheses regarding investment behavior, and they vary with respect to the subject pools, country, age, different incentives and probabilities, repeated versus one-shot interaction, laboratory versus Internet, known probabilities versus uncertainty, and framing. Moreover, since the original data were not collected in order to facilitate comparisons, there was no effort made by the researchers to have a uniform design (e.g., use the same instructions). This variety allows us to test the robustness of the hypothesis.

The data are based on an investment decision that was introduced by Gneezy and Potters (1997). In this choice, the decision maker receives $\$X$ and is asked to choose how much of it, $\$x$, she or he wishes to invest in a risky option and how much to keep. The amount invested yields a dividend of $\$kx$ ($k>1$) with probability p and is lost with probability $1-p$. The money not invested $\$(X-x)$ is kept by the investor. The payoffs are then $\$(X - x + kx)$ with probability p, and $\$(X - x)$ with $1-p$. In all cases, p and k are chosen so that $p*k > 1$, making the expected value of

[2] And of course we report a difference.

[3] For a similar idea regarding testing the deadline effect in bargaining, see Roth, Murnighan and Schoumaker (1988).

investing higher that the expected value of not investing; thus, a risk-neutral (or risk-seeking) person should invest $\$X$, while a risk-averse person will invest less. The choice of x is the only decision the participants make in the experiment.

The striking and consistent result is that despite the large environmental differences among the sets of experiments, a consistent gender difference is reported: Men choose a higher x than women do.

2. Data

2.1 Yu (2006)

Yu (2006) collected data both online and in the laboratory to study the separate effects of alternative feedback-information rules and the freedom to change the investment in a repeated environment; this approach attempts to decompose into components the effects observed in Gneezy and Potters (1997).

Design

The participants in the online experiment were recruited using an email list of students who register in order to be invited to participate in experiments, plus MBA students who took a decision making class; 177 students replied to this message. The participants were divided randomly into three equal-sized groups, and they then received the instructions for the experiment. About 60% (114) of the respondents actually participated in the experiment after receiving the instructions.

In all treatments, participants were told that the experiment consists of 15 successive investment days. Each investment day lasted from 7:00 a.m. until midnight. In each investment

day they received 100 points, and were asked to choose the portion of this amount (between 0 points and 100 points, inclusive) they wish to invest in a risky option. The rest of the points (those not invested) were accumulated in the participant's total balance.

Investing in the risky option meant that in any particular investment day there is a $p = 2/3$ probability that the investment will fail, and a $1 - p = 1/3$ probability that the investment will succeed. If the investment failed, the participant lost the entire amount she or he invested. If the investment was successful, she or he received 3.5 times the amount invested (i.e., $k = 3.5$). The computer randomly chose whether the participant won or lost in any given day.

To make their investment decisions, participant had to log on to our webpage using the username and password assigned to each of them personally in an email. There were three treatments in the online experiment:

1. Daily condition: In this treatment participants could log in to the webpage at anytime during the investment day to observe the performance of their investment or to change the amount invested in the risky investment. If no change was made, the computer used the amount invested in the previous period.

2. Intermediate condition: This treatment was the same as the daily treatment, except that participants only made investment choices on the first day of each investment week (day 1, 6, and 11). This investment was then in effect for all five days in the investment week. Participants could still log on to the web page to check the realization of the risky investment, but could not change the fraction invested in it during the week.

3. Weekly condition: In this treatment participants could change their investment and/or check the performance of their portfolio only once a week (day 1, 6 and 11). The realization for each day was still reported, but it was only received once a week.

In all treatments, participants were told that at the end of the three weeks one participant would be chosen at random for actual payment, calculated as the sum of the earnings in each of the 15 investment days; this person was paid $100 for each 200 points accumulated.

The participants in the laboratory experiment were recruited using ads posted on campus. They were promised at least $10 for a one-hour experiment. The experiment was conducted during few afternoons, and each participant performed her part individually. Participants were given instructions that were very similar to those of the online study. Each "investment day" took two minutes.

Results

As can be seen from the results presented in Figure 1 and Table 1, there is a substantial and consistent gender differences in investment choices.

<INSERT FIGURE 1>

Table 1: Yu (2006)

Treatment	Avg. Male Investment (N)	Avg. Female Investment (N)
Laboratory		
Daily	52.65 (19)	37.26 (9)
Intermediate	49.03 (13)	35.53 (15)
Weekly	67.06 (17)	47.81 (14)
All laboratory choices	*56.69*	*40.46*
Internet		
Daily	61.52 (22)	38.07 (18)
Intermediate	58.39 (22)	34.67 (11)
Weekly	72.23 (19)	45.81 (18)
All Internet choices	*63.66*	*40.08*
All choices	*60.61*	*40.26*

The average investment for males in each condition is between 28% and 68% higher than the average investment for females, half again as much (51%) overall. This difference is substantially larger in the on-line treatments (62%) than in the lab condition (36%). Using an OLS regression Yu (2006) finds that the gender dummy is highly significant. Regression results treating these data as panel data also provide strong support for the hypothesis that men invest more in the risky option than women in each of the treatments.

2.2 Charness and Gneezy (2003)

In Charness and Gneezy (2003) we consider whether psychological biases such as ambiguity aversion and the illusion of control affect the rate of investment in a risky asset.

Design

Data were collected from two large classes at UCSB, in which each student who was willing to participate (in fact all students) was randomly assigned to one of our treatments. A total of 200 people participated, 136 males and 64 females. Eight separate sets of instructions (four ambiguity-aversion conditions and four illusion-of-control conditions) were passed out, with each person randomly assigned one of these. Each participant was endowed with 100 units, which could be kept or invested in a risky asset. If successful, this asset paid 2.5 times the amount invested (i.e., $k = 2.5$); the chance of success was $p = 1/2$.

In the first ambiguity condition, participants were told that there was one container with 50 red balls and 50 black balls and another container with an unknown composition of 100 red or black balls. People then chose how much to invest, the 'success' color that would pay if drawn, and the container from which to draw the ball. In the second (third) condition, only the container with the known (unknown) distribution was mentioned, and people chose how much to invest

and the success color. In the final condition, the participant faced the same choice of the two containers as in the first condition, but was required to pay five units (out of the 100 endowment) if she or he wished to draw from the container with the known distribution.

In the first illusion condition, participants were told that a 6-sided die would be rolled to determine success. Each person then chose how much to invest, three 'success' numbers that would pay if rolled, and who would roll the die (the experimenter or the investor). In the second (third) condition, only the investor (experimenter) could roll the die. In the final condition, the participant chose as in the first condition, but was required to pay five units (out of the 100 endowment) if she or he wished to personally roll the die.

One of every 10 participants was (randomly) chosen to actually receive payment, at the rate of $0.25 for every unit. Each person who was selected then met individually with the experimenter and was paid privately after the realization of the risky asset.

Results

Once again, we see a strong difference in investment behavior across gender:

Table 2: Investment with Ambiguity Aversion and Illusion of Control

Treatment	Avg. Male Investment (N)	Avg. Female Investment (N)
Illusion – free choice	76.11 (18)	57.22 (9)
Illusion – investor rolls	79.69 (16)	49.29 (7)
Illusion – experimenter rolls	71.20 (20)	69.83 (6)
Illusion – costly choice	83.21 (14)	58.33 (9)
All illusion choices	*76.97 (68)*	*58.19 (31)*
Ambiguity –free choice	75.26 (19)	61.43 (7)
Ambiguity – known only	64.69 (16)	62.75 (8)
Ambiguity – unknown only	70.81 (16)	67.50 (10)
Ambiguity – costly choice	82.22 (18)	55.63 (8)
All ambiguity choices	*74.68 (68)*	*62.18 (33)*
All choices	*75.82 (136)*	*60.25 (64)*

In all eight independent comparisons, males invested more than females. Again, we can apply the binomial test, comparing the average investment for males and females in each of the eight conditions. The likelihood that either gender would invest more than the other in all eight treatments is $p = 0.008$, indicating a significant difference.[4] The overall average male investment in the ambiguity (illusion) treatments was 32% (26%) higher than the average female investment.

2.3 Charness and Gneezy (2004)

In Charness and Gneezy (2004) we consider whether framing differences affect the choice of investment in a risky asset. To the extent that we find a framing effect, we examine whether this effect is stronger for men or for women. Some experiments do not find gender differences in differently-framed gambles. For example, in Eckel and Grossman (2002a) participants chose among gambles that differed in expected return and variance, and were presented either as a loss or as no-loss. Eckel and Grossman found that women are more risk averse across all frames. Another example is presented in Eckel and Grossman (2002b), who studied gamble and investment frames with the possibility of losses, and a gamble frame with no losses. Again, women were more risk averse than men in all three framings (see also Powell and Ansic, 1997).

On the other hand, several studies do find gender differences by frame. In an abstract lottery choice, Schubert, Gysler, Brown and Brachinger (1999) frame choices as either potential gains or as potential losses. They find that women were more risk averse than men in the gain-domain frame, consistent with the evidence presented earlier. For the loss-domain gambles, however, this result is reversed: men are more risk averse than women. In contextual

[4] If we presume a directional hypothesis, the likelihood that males invest more than females in all eight treatments is $p = 0.004$.

environment gambles (e.g. investment and insurance), Schubert, Gysler, Brown and Brachinger (1999) subjects exhibited no evidence of systematic gender differences in risk attitudes.

Design

We conducted experiments at both The University of Chicago and UCSB. Participants at UCSB were recruited by sending out an e-mail message to a list of people who had signed up to be contacted about experiments. These people were drawn from the general student population. The Chicago participants were recruited using campus ads. People came to the lab individually; the instructions were presented and the experimenter answered any questions.

Each person then made an investment choice for the first period and observed the results of the roll of an 8-sided die; this continued for 10 periods. In each period, each participant was endowed with 100 units, which could be kept or invested in a risky asset. If successful, this asset paid six times the amount invested (i.e., $k = 6$); the chance of success was $p = 1/4$. We paid each person $1 for every 100 units they had aggregated over the course of the 10 periods. Each individual session lasted 10-15 minutes.

There were two separate treatments, differing only in some phrasing in the instructions, which are shown in Appendix A. A total of 94 people participated, 48 in the Natural condition (22 males and 26 females) and 46 in the Frame condition (21 males and 25 females).[5] In the Natural condition, the second sentence of the instructions read that "In each period you will receive 100 points," while in the Frame condition this read "In each period you will receive 100 points to invest in a risky asset." Two sentences followed immediately in the Natural condition, mentioning that the participant could choose which portion of the 100 points to invest and that

[5] We also have data from a Natural treatment in which a decision was only made for one period, with 100 points worth $10. The average investment for 15 males was 48.30 and the average investment for 13 females was 33.46. As shall be seen, this differs little from the 10-period Natural results.

the points not invested would accumulate in the total balance; in the Frame condition, these two sentences came after two intervening paragraphs.

Results

The results are shown in Figures 2 and 3, and are summarized in Table 3.

FIGURE 2

FIGURE 3

Table 3: Investment with Different Framing Conditions

Treatment	Avg. Male Investment (N)	Avg. Female Investment (N)	Difference
Natural	52.43 (22)	34.25 (26)	18.18 (53%)
Frame	81.33 (21)	67.56 (25)	13.77 (20%)
All choices	*66.54 (43)*	*50.58 (51)*	*15.96 (32%)*

First, we see that investment rates differ considerably across treatments – the average investment is 73.77 in the Frame condition, compared to 42.54 in the Natural condition. A Wilcoxon-Mann-Whitney ranksum test (see Siegel and Castellan 1988) using each individual's average investment rate indicates that this difference is highly significant ($Z = 4.92$, $p < .00001$). The small difference in the language used in the instructions makes a big difference in investment behavior, suggesting that financial decisions may be easily influenced by the manner of presentation.

Second, we see that males consistently invest at a higher rate in each period in both the Natural and Frame treatments, so the average investment for males is always higher than that for females. Tobit regressions (reflecting the censoring at 100; no one invested 0) with investment as the dependent variable find that the $t = 2.60$ ($p = 0.006$, one-tailed test) for the gender dummy

in the Natural condition and $t = 1.85$ ($p = 0.036$, one-tailed test) for the gender dummy in the Frame condition. The gender difference is more significant if we pool the data across treatments.

Finally, regarding the question of whether the frame has differential effects on males and females, we see that the investment rate increases by 28.90 points for males and by 33.28 points for females. The difference between these differences is not large, only 4.41 points, and is not significant. On the other hand, if we instead look at the percentage change in the investment rates, we see that the average investment nearly doubles (up 97%) for females, but increases by only just over half (55%) for males.[6] A test of the difference in proportions (see Glasnapp and Poggio 1985), using the difference in the percentage difference from the mean investment for each gender for each treatment, gives $Z = 2.19$, $p = 0.029$, two-tailed test. Thus, our simple framing device has a major effect on the investment rate and our evidence suggests that women may indeed be more susceptible to this framing.

2.4 Other studies

In this section we consider all the other studies that gather gender data on risk and investment that we found.[7] Langer and Weber (2004), Haigh and List (2005), Fellner and Sutter (2004), Charness and Genicot (2004), Bellemare, Krause, Kroger, and Zhang (2004), Dreber and Hoffman (2007) and (Gneezy, Leonard and List, 2007).

These papers examine various aspects of risk taking in multi-period designs, using the same type of investment choice as described above. It is interesting that the subject pools vary

[6] The difference in the female investment rate across framing conditions is dramatic. While 21 of 26 females (81%) invested less than 50 in the Natural condition, only 5 of 25 (20%) did so in the Frame condition.

[7] Some of the studies that used this game did not record the gender of participants (e.g., Gneezy and Potters, 1997, and the student data in Haigh and List, 2005) and are hence excluded from our analysis. .

widely across these experimental studies. The language of the instructions, the parameters used, and the length of the experiment all vary between the experiments.

We present these data in Table 4; we aggregate across multiple treatments in a study, as the number of female observations would otherwise sometimes be very small.

Table 4: Investment Choices in Other Studies

Study	Participants	Periods	Avg. Male Investment (N)	Avg. Female Investment (N)
Langer and Weber	Finance students, Mannheim	30	64.62 (93)	58.70 (14)
Haigh and List	Professional traders, CBOT	9	58.30 (50)	55.59 (8)
Fellner and Sutter	Undergrads, Jena	18	57.44 (39)	49.04 (79)
Bellemare *et al.*	Undergrads, Tilburg	9	45.48 (95)	42.73 (40)
Charness and Genicot	Undergrads, UCLA	1	59.22 (41)	52.23 (53)
Dreber and Hoffman	Students, Stockholm	1	69.60 (92)	50.00 (55)
Gneezy, Leonard and List	Villagers in Tanzania and India	1	50.00 (157)	50.06 (157)

In the first six experiments in Table 4 men invested more than females. These data support the consistent pattern of greater risk-taking by males. Only in the final experiment in reported in the table there is no gender difference in risk taking. Note that this experiment is the only one reporting data from non-Western societies, so perhaps there is something different in the applicable social norms.

We can apply the simple binomial test to the 10 studies we mention in this paper (the seven above and the three in earlier sections). If we exclude the virtual tie in the villagers' data,

we have nine studies in which males invest more and none in the other direction; the likelihood of this occurring at random is $p = 0.002$.[8] The pattern seems compelling.

3. Conclusion

The results reported in this paper are obtained by using data from previous studies based on one similar design in which the data of interest was recorded independently of the goal of the study. The field of experimental economics is growing quite rapidly, with experiments being relatively easy to run (compared with, e.g., analyzing real world data). There is a natural tendency to continue to collect new evidence without fully considering what we might learn from the data that are already available. We suspect that as the field of experimental economics matures, the approach taken in the current paper will become more common and will help to provide answers to important economic questions.

The answer to the question we posed at the beginning of this article is clear: Women make smaller investments than do men, and so appear to be financially more risk averse. We believe that this very clear and consistent result answers an open question in the literature. We do not argue that women are always more risk averse than men, and clearly a research into the boundaries of these findings should be encouraged. However, one should be careful not to base counter-arguments regarding no difference or difference in the other direction on one or two studies. Rather, a more comprehensive investigation of the boundary conditions based on substantial experiments and robustness checks should be encouraged. As a first step in this direction, researchers running experiments should be encouraged to record as much background information about the participants as possible.

[8] We could alternatively count the villagers' data as showing more female investment than male investment, as there is a tiny difference in this direction. Even in this case, the likelihood that a random realization would result in males investing more in nine studies and females investing more in one study is $p = 0.018$.

The economic implications of our results are important. For example, investment behavior by men and women (an inherently high-payoff decision) may differ. Few papers (e.g., Sunden and Surette, 1998; Finucane et al, 2000; Jianakoplos and Bernasek, 1998; Hinz, McCarthy and Turner, 1997; Bajtelsmit and Van Derhei, 1997) investigate allocation of portfolio assets and find that gender is significantly related to asset allocation. Women's portfolios are less risky than men's. However, studying investments in field data has certain limitations. For example, it is hard to know how investment decisions are reached in households with married couples (Bernasek and Shwiff, 2001). We believe that the convergence of the laboratory findings such as we report in this paper with empirical findings from investment decisions is an important step in understanding the important features of gender differences in risk taking.

References

Bellemare, C., M. Krause, S. Kroger, and C. Zhang (2004), "Myopic Loss Aversion, Information Dissemination, and the Equity Premium Puzzle," mimeo, Tilburg.

Charness, G. and G. Genicot (2004), "An Experimental Test of Inequality and Risk-sharing Arrangements," mimeo, UCSB.

Charness, G. and U. Gneezy (2003), "Portfolio Choice and Risk Attitudes: An Experiment," mimeo, UCSB.

Cosmides, L., J. Tooby, J. & J. Barkow (1992), "Evolutionary psychology and conceptual integration," In J. Barkow, L. Cosmides, & J. Tooby (Eds.), *The adapted mind: Evolutionary psychology and the generation of culture*, New York: Oxford University Press.

Croson, R. and U. Gneezy (2004), "Gender Difference in Preferences," mimeo, The University of Chicago.

Eckel, C., and P. Grossman (2002a), "Sex Differences and Statistical Stereotyping in Attitudes Toward Financial Risk," *Evolution and Human Behavior*, 23, 281-295.

Eckel, C. and P. Grossman (2002b), "Forecasting Risk Attitudes: An Experimental Study of Actual and Forecast Risk Attitudes of Women and Men," mimeo, Virginia Tech.

Eckel, C. and P. Grossman (forthcoming), "Men, Women and Risk Aversion: Experimental Evidence," *The Handbook of Experimental Economics Results*, C. Plott and V. Smith, eds.

Fellner, G. and M. Sutter (2004), "How to Overcome the Negative Effects of Myopic Loss Aversion - An Experimental Study, mimeo, MPI Jena.

Glasnapp, D. and J. Poggio (1985), *Essentials of Statistical Analysis for the Behavioral Sciences*, Columbus: Merrill.

Gneezy, U. and J. Potters (1997), "An Experiment on Risk Taking and Evaluation Periods," *Quarterly Journal of Economics*, 112, 631-645.

Gneezy, U, R. Thaler and F. Yu (2004), "Information Availability and Investment Behavior," mimeo, University of Chicago.

Haigh, M. and J. List (forthcoming), "Do Professional Traders Exhibit Myopic Loss Aversion? An Experimental Analysis," *Journal of Finance*.

Langer, T. and M. Weber (2004), "Does Binding or Feedback Influence Myopic Loss Aversion? An Experimental Analysis," mimeo, Mannheim.

Moore, E. and C. Eckel (2003), "Measuring Ambiguity Aversion," mimeo, Virginia Tech.

Powell, M. and D. Ansic (1997), "Gender Differences in Risk Behaviour in Financial Decision-Making: An Experimental Analysis," *Journal of Economic Psychology* 18, 605-628.

Roth, A., K. Murnighan, and F. Schoumaker (1988), "The Deadline Effect in Bargaining: Some Experimental Evidence," *American Economic Review*, 78, 806-823.

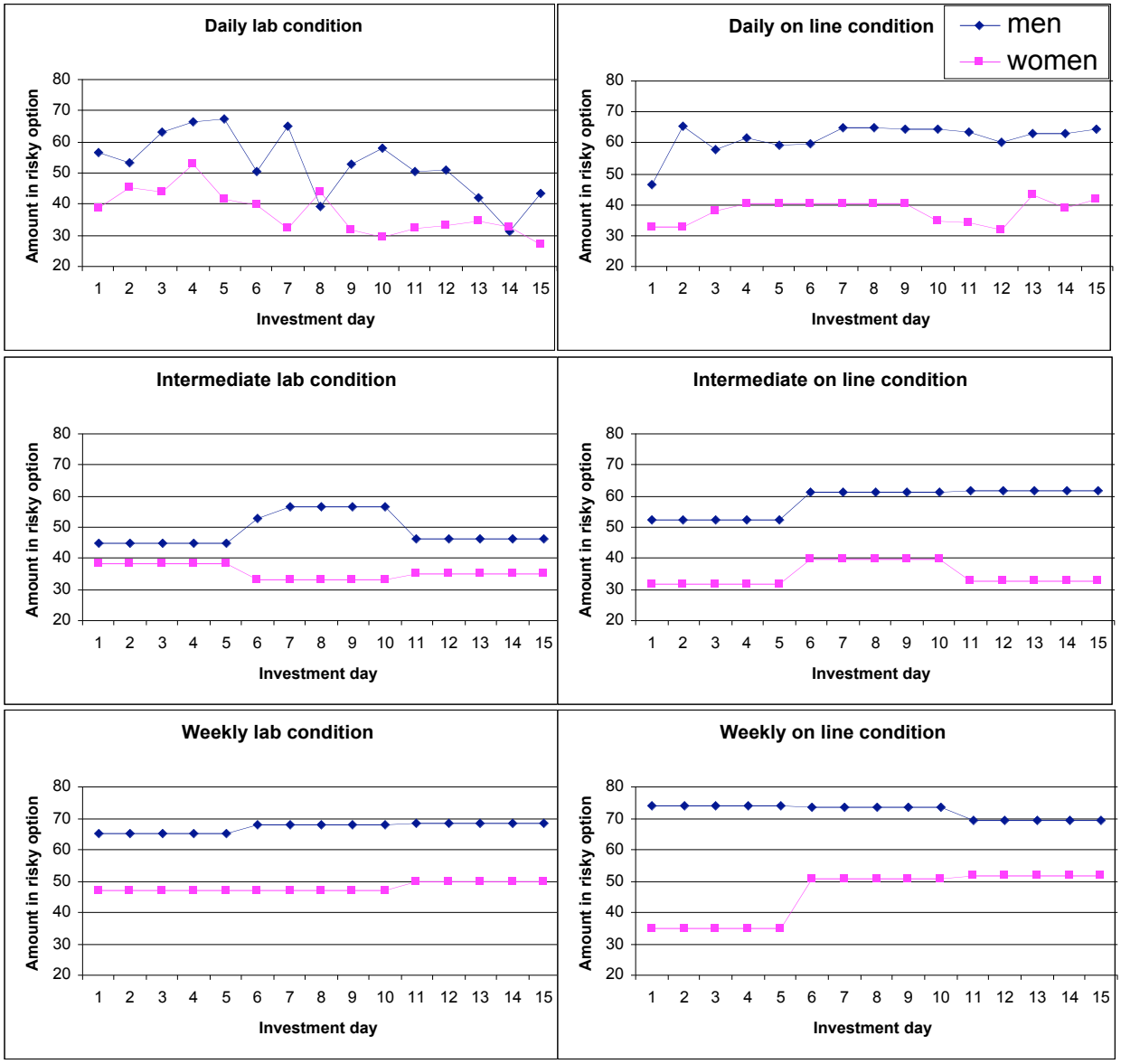
Schubert, R., M. Gysler, M. Brown, and H. Brachinger (1999), "Financial Decision-Making: Are Women Really More Risk Averse?" *American Economic Review Papers and Proceedings*, 89, 381-385.

Schubert, R., M. Gysler, M. Brown and H. Brachinger (2000), "Gender Specific Attitudes Towards Risk and Ambiguity: An Experimental Investigation," mimeo, Center for Economic Research, Swiss Federal Institute of Technology.

Siegel, S. and N. Castellan, Jr. (1988), *Nonparametric Statistics for the Behavioral Sciences*, Boston: McGraw-Hill.

Tooby, J. & L. Cosmides (1990), "On the universality of human nature and the uniqueness of the individual: The role of genetics and adaptation," *Journal of Personality*, 58, 17-67.
Tooby, J. & L. Cosmides (1992), "The psychological foundations of culture," In J. Barkow, L. Cosmides, & J. Tooby (Eds.), *The adapted mind: Evolutionary psychology and the generation of culture*, New York: Oxford University Press.

Figure 1


Daily lab condition
Daily on line condition
men
women
Intermediate lab condition
Intermediate on line condition
Weekly lab condition
Weekly on line condition
Amount in risky option
Investment day
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30
40
50
60
70
80
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Figure 2

Natural

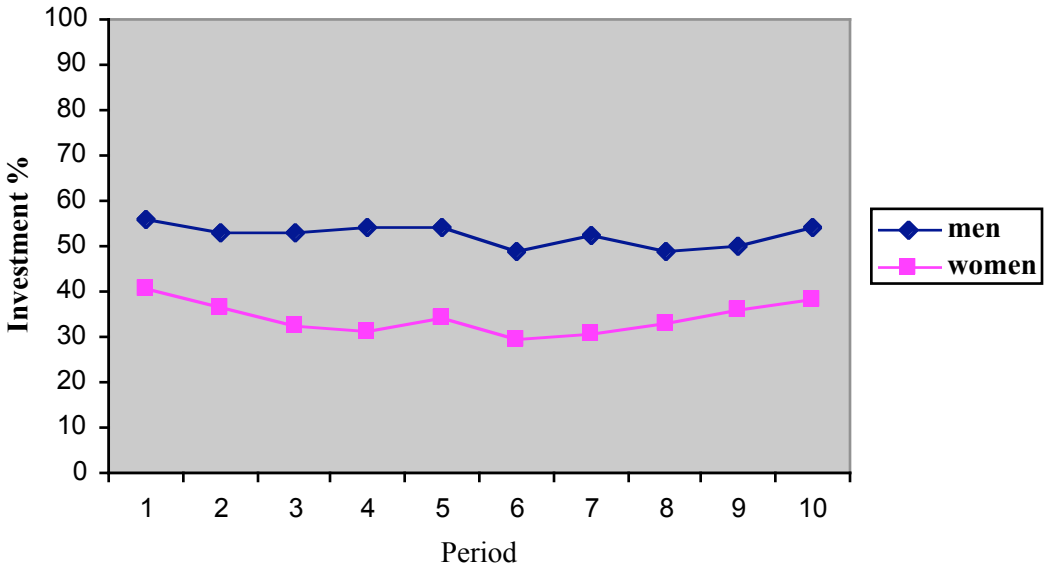
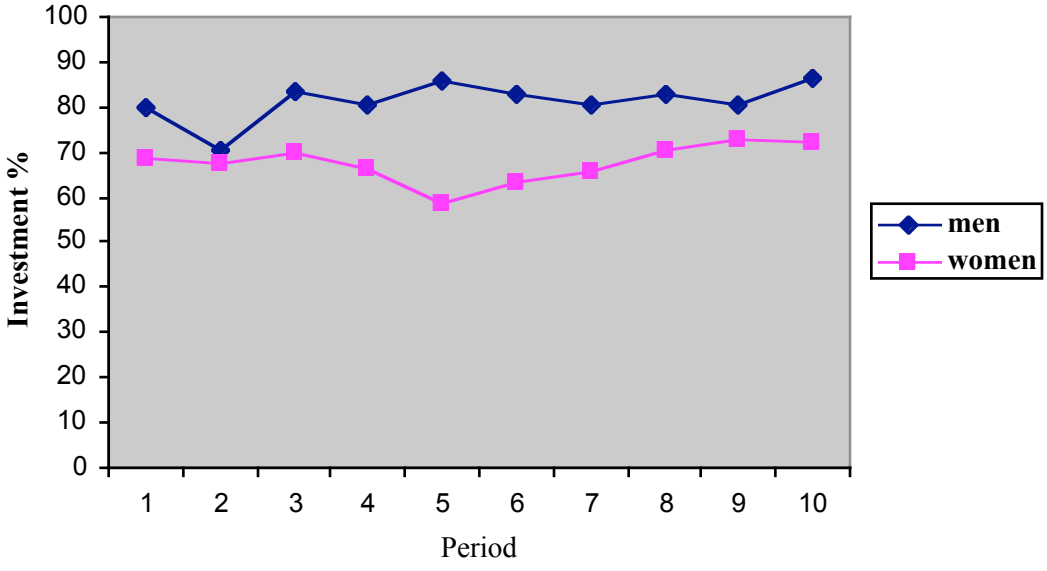


Figure 3

Framing



Appendix A

INSTRUCTIONS

[Natural]

The experiment consists of 10 successive periods. In each period you will receive 100 points. You are asked to choose the portion of this amount (between 0 points and 100 points, inclusive) that you wish to invest in a risky option. The rest of the points (those you don't invest) will be accumulated in your total balance.

The risky investment: In any particular period, there is a 75% probability that the investment will fail. If the investment fails, you lose the amount you invested. If the investment succeeds, you receive 6 times the amount invested.

How do we determine if the risky asset succeeds? At the beginning of each period, you are asked to choose **two** numbers from the set 1, 2, 3, 4, 5, 6, 7, 8. These two numbers will be your "winning numbers" for the period.

At the beginning of each period we will ask you to record on a Registration Form the three success numbers for the period, as well as the amount you wish to allocate to the risky investment.

You will roll an 8-sided die at the end of each period. Your investment succeeds if the die comes up one of the three numbers you chose for that period.

After the die has been rolled, you will be asked to record your earnings in the column "Total Earnings," in the row of the corresponding round. You will then be asked to record your choice for the next period. The same procedure as described above determines your earnings for this round. Your total earnings for the experiment are the sum of the earnings in each of the 10 periods. You will be paid $1 for each 100 points you will accumulate.

Please note that you get 100 points in each period for potential investment.

Do you have any questions?

INSTRUCTIONS

[Framing]

The experiment consists of 10 successive periods. In each period you will receive 100 points to invest in a risky investment.

The risky investment: In any particular period, there is a 75% probability that the investment will fail. If the investment fails, you lose the amount you invested. If the investment succeeds, you receive 6 times the amount invested.

How do we determine if the risky asset succeeds? At the beginning of each period, you are asked to choose **two** numbers from the set 1, 2, 3, 4, 5, 6, 7, 8. These three numbers will be your "winning numbers" for the period.

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You will roll an 8-sided die at the end of each period. Your investment succeeds if the die comes up one of the three numbers you chose for that period.

After the die has been rolled, you will be asked to record your earnings in the column "Total Earnings," in the row of the corresponding round. You will then be asked to record your choice for the next period. The same procedure as described above determines your earnings for this round. Your total earnings for the experiment are the sum of the earnings in each of the 10 periods. You will be paid $1 for each 100 points you will accumulate.

Please note that you get 100 points in each period for potential investment.

Do you have any questions?