



Team gender diversity and investment decision-making behavior

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Abstract

Purpose – The purpose of this paper is to investigate whether the gender composition of a fund management team influences investment decision-making behavior. Specifically, we focus on how portfolio choice is affected by team risk aversion and loss aversion.

Design/methodology/approach – Using an experimental economics approach, the paper examines the relationship between gender diversity and investment decisions. Teams of four persons each were given the task of making investment portfolio management decisions.

Findings – The paper finds that team composition does influence financial decisions with regard to the assessment of risk and loss. The paper finds evidence that a male presence increases the probability of selecting a higher risk investment. However, the all male teams are not the most risk seeking. Moreover, having a male presence can increase loss aversion.

Originality/value – In the context of workforce composition, these results could have important implications for team investment decisions driven by the assessment of risk and return tradeoffs. To curb excessive risk taking and loss aversion, the findings would suggest that understanding the role of gender diversity in risk management would be useful in effecting change.

Keywords Risk aversion, Investment decisions, Gender diversity, Loss aversion

Paper type Research paper

1. Introduction

Investment management is a sizable and important sector of the US economy that is driven in large part by the assessment of risks[1]. As such, there exists extensive research (academic literature as well as practical methodologies) devoted to determining the characteristics of mutual (or hedge) funds associated with delivering superior returns. Diversification of securities, for the purpose of lowering the overall price variance (risk) of a portfolio, has been a core finance principle since Markowitz (1952). Thus, the ability of fund management teams to make decisions that generate abnormal positive returns and/or reduce risk is a salient issue for academics and practitioners alike.

JEL classification – G11

The authors would like to thank Cornell University's Institute for Social Sciences and the Cornell University Lab for Experimental Economics and Decision Research (LEEDR) for financial support. The authors thank Catherine Eckel, David Ng, William Schulze, seminar participants at the Duke University Terry Sanford Institute of Public Policy RNREI Research Conclave and seminar participants in the Department of Economics seminar at the Iowa State University for useful suggestions and discussions. They also thank Weiqin Dong, Hao Jin, Joe Lu, Sayako Seto, Feng Wang, and Joyce Wang for research assistance. They also thank Annemie Maertens and the LEEDR lab staff for lab assistance. All errors are their own.



Normative models of economic and investment behavior usually identify a single objective function that implicitly treats all decisions as individual ones (Shupp and Williams, 2008). However, it has been well documented that group psychology often leads people to make different decisions when they operate as part of a group than when they act as individuals (Shefrin, 2007; Kerr *et al.*, 1996). While there are many funds that are managed by a single fund manager, the majority of larger funds are managed by teams[2]. Thus, understanding the implications of team composition for portfolio management decisions has important consequences for this major industry.

Several recent studies have demonstrated that groups do make decisions that are significantly different from individuals when faced with identical information about uncertain outcomes. Shupp and Williams (2008) show that the variance of risk preferences is generally smaller for groups than individuals. They also find that the average group is more risk averse than the average individual in high-risk situations but groups tends to be less risk averse in low-risk situations. Baker *et al.* (2008) show that in lottery-choice experiments, groups tend to make decisions that are more consistent with risk-neutral preferences in the lowest and highest risk lotteries. Yet, Masclet *et al.* (2009) find that groups are more likely than individuals to choose safe lotteries. Sutter (2007) finds that team decision making attenuates myopic loss aversion but that teams still are prone to myopic loss aversion. Adams and Ferreira (2010) also provide evidence to support the hypothesis that group decisions are more moderate than individual decisions. Rockenbach *et al.* (2007) find that teams take “better” risks. They show that compared to individuals, teams accumulate significantly more expected value (EV) at a significantly lower total risk.

Cox and Hayne (2006) find not only that there are systematic differences between group and individual decisions but also that the group decisions are affected by the defining characteristics of the group. They find that groups having individuals with distinct information make different decisions than groups with common information. While there are many types of team characteristics that could be salient, we expand on this literature by exploring the question of whether gender diversity in investment management group composition influences decision-making behavior.

To our knowledge, an open question remains in the financial economics literature as to whether team gender diversity leads to any measurable differences with respect to portfolio choice decisions. It previously has been shown that individually females are more risk averse than males (Jianakoplos and Bernasek, 1998). However, since teams have been shown to make different decisions than individuals, it is not clear that team risk seeking (or loss aversion) is monotonically increasing with the number of male team members.

We test our hypotheses using an experimental economics approach. As with previous economics literature in this area, we focus on team decisions involving identical information with uncertain outcomes (Baker *et al.*, 2008; Shupp and Williams, 2008; Adams and Ferreira, 2010) and loss aversion (Sutter, 2007). Specifically, we focus on how portfolio choice is affected by risk aversion and loss aversion. We find that a male presence increases team risk seeking and increases team loss aversion. Interestingly, we find that the homogeneous teams (be they all female or all male) are neither the most risk seeking nor the most loss averse. This suggests that team gender composition influences a team’s process for evaluating risk and loss.

The remainder of the paper is organized as follows. Section 2 discusses individual and team decision-making theory. Section 3 describes the experimental study. Section 4

discusses the data. Section 5 presents econometric analysis and results. Section 6 summarizes key findings and provides concluding remarks.

2. Individual and team decision-making theory

Various aspects of group diversity in a variety of different contexts have been studied in the economics and management literature. Within the management literature, numerous disparate and conflicting theories have been developed with respect to group diversity and group performance (Williams and O'Reilly, 1998; Cummings, 2004; Hamilton *et al.*, 2012; Apesteguia *et al.*, 2012).

The nascent economics literature analyzing when and how group decisions differ from individual decisions in economic contexts has focussed primarily on lottery-choice decisions in experimental settings (see e.g. Baker *et al.*, 2008; Shupp and Williams, 2008; Rockenbach *et al.*, 2007; Masclet *et al.*, 2009; Sutter, 2007). Additionally, Dufwenberg and Muren (2006) show that gender composition affects the generosity of teams in the context of a dictator game and Ambrus *et al.* (2009) find evidence of gender effects in gift-exchange games. However, the effect of group diversity on investment decisions in general and within fund management teams in particular is a much less explored field of study.

The empirical literature focussed specifically on group composition and fund management is limited and inconsistent at best. Prather and Middleton (2000) find that there is no appreciable difference between the outcomes of team-managed and individually managed mutual funds. Chevalier and Ellison (1999) demonstrate that mutual fund managers from more competitive undergraduate institutions have systematically higher risk-adjusted excess returns. Analyzing a sample of management teams from the US mutual fund industry, Bär *et al.* (2007) conclude that gender diversity is negatively related to fund performance while informational diversity is positively related to fund performance. More specifically, teams composed of heterogeneous industry tenure and education backgrounds outperform teams with a more homogeneous composition. Bär *et al.* (2007) also conclude that age diversity has no impact on returns and that single-gender teams outperform mixed-gender teams.

Atkinson *et al.* (2003) compare fixed-income mutual funds and find that male- and female-managed funds do not differ significantly in terms of performance, risk, or other fund characteristics. Their results suggest that differences in investment behavior often attributed to gender may be related to investment knowledge and wealth constraints. Niessen and Ruenzi (2007, 2009) find that female and male mutual fund managers do not differ in average performance but female managers do receive significantly lower inflows. They also show that although average performance does not differ between male and female managers, male managers achieve more extreme performance outcomes and show less performance persistence.

Behavioral economics evidence suggests that males and females possess differing strengths and weaknesses with respect to the requisite skills for investment management (Croson and Gneezy, 2009). Barber and Odean (2001) find that with respect to trading strategies, men are more overconfident than women; trading stock as much as 45 percent more than women. Being overconfident, men make more trades that result in lower returns once transaction costs are incorporated. Fehr-Duda *et al.* (2006) conclude that women's probability weighting functions (used to weigh uncertain outputs in gambles) are strongly susceptible to mood states while men's are not. Kumar (2010) finds that female equity analysts issue bolder and more accurate forecasts and that stock market participants react to this male-female skill difference.

Jianakoplos and Bernasek (1998) show that women are more risk averse with respect to financial decisions. Powell and Ansic (1997) demonstrate that males and females adopt different strategies in financial decision environments but that these strategies have no significant impact on ability to perform. Consequently, in our study we focus on how differences in team gender composition affect investment decisions. Specifically, we focus on two key factors that have been previously shown to influence investment decisions: risk aversion and loss aversion.

Using experimental data, we seek to answer the following question: “Do gender diverse portfolio (mutual fund) management teams make different decisions than homogeneous teams with respect to risk aversion and loss aversion?” From Jianakoplos and Bernasek (1998) one could infer that female dominated fund management teams would be more risk averse than male dominated teams. However, since teams have been shown to make different decisions than individuals, it is not clear that risk seeking would be increasing with male team member representation. From Sutter (2007) we know that teams also are prone to myopic loss aversion but the gender composition effect of the teams was not analyzed.

3. Experimental study

Given the conflicting empirical evidence and the limited power of the empirical tests due to the small relative numbers of females in most samples of fund management teams, we use an experimental approach which has been used by many to study the effects of risk attitudes on individual portfolio choice (see e.g. Charness and Gneezy, 2010). There are several benefits to an experimental approach over the traditional approach prevalent in the extant literature. First, controlled laboratory experiments provide the benefit of eliminating the numerous complicating factors of the real world while maintaining enough realism in its use of human subjects to test theories empirically. Second, even if the data in the real world are straightforward enough to facilitate empirical study, the empirical differences within the data may be insufficient to grant enough power to make hypothesis tests significant. For instance, Chevalier and Ellison (1999) state that their sample was only 7 percent female managers, thus preventing them from making conclusions on how significant of a role gender plays in mutual fund returns. Conversely, in the laboratory, we can construct mutual fund management groups such that stronger conclusions can be drawn. Third, by choosing mutual funds as the vehicle through which we examine the role of team diversity, our results are easily standardized and compared to real world investment decisions.

3.1 *Experimental procedure*

In an experimental economics laboratory, subjects were randomly placed in teams of four persons each[3]. Teams were created such that there were several teams in each of five categories. Each team contained exactly: four males; three males; two males; one male; or zero males. To be consistent with our real-world context, we do not explicitly prime subjects on gender before the experiment. Subjects interact face-to-face in their teams and thus can observe the team gender composition. While explicit gender priming has the advantage of potentially generating stronger experimental effects, the benefit of subtle gender priming is that we can more easily justify the generalizability of the results.

Our experiment was designed to replicate an actual investment selection setting so that our results could be easily related to real-world investment management decisions.

The decisions were simple versions of actual investment portfolio management decisions. Each team was given the task of making six completely separate decisions. To avoid company and/or industry-related framing effects, there were two decisions for companies in each of three industries: health care sector, industrials sector, and materials sector. For each decision, the team could select one of two options (Choice A or Choice B). Three of the decisions were buy decisions in which the team was required to choose between two investing options (high-risk option, low-risk option) for an equity portfolio. Three of the decisions were sell decisions in which the team was required to choose between selling two securities (selling one stock for a bigger loss while keeping the stock with the higher future return; selling one stock for a smaller loss while keeping the stock with the lower future return) in an equity portfolio. The order of each specific decision was randomized across teams. An example of both a buy decision and a sell decision follows[4].

Buy decision example. This mutual fund (mutual fund description provided to subjects and available upon request) just received a cash infusion of \$1 million. Your team is responsible for making a \$1 million equity purchase for this fund. You must invest all \$1 million in one of two stocks. You cannot divide the \$1 million investment between the two choices. Your investment choices are:

Choice A: 20,284 shares of Healthgen Inc. Choice A has a 0.5 probability of earning 15 percent by January 1, 2010 and a 0.5 probability of earning 0 percent by January 1, 2010.

Choice B: 29,665 shares of PharmInc. Choice B has a 0.5 probability of earning 8 percent by January 1, 2010 and a 0.5 probability of earning 7 percent by January 1, 2010.

Sell decision example[5]. This mutual fund (mutual fund description provided to subjects and available upon request) needs \$1 million in cash. Your team is responsible for selling \$1 million worth of stock from this fund. You must sell \$1 million worth of one of two stocks. You cannot divide the \$1 million sold between the two choices (if you sell a stock for a loss, the portfolio will realize the loss in 2009). Your choices of stock to sell are:

Choice A: 22,758 shares of Carson Laboratories (originally purchased at \$49.05/share). By selling Carson stock, you will incur a certain loss of 10 percent. In keeping Smith stock you will have a 0.5 probability of earning 20 percent and a 0.5 probability of earning 0 percent.

Choice B: 42,301 shares of Smith Pharmaceuticals (originally purchased at \$25.55/share). By selling Smith stock, you will incur a certain loss of 5 percent. In keeping Carson stock you will have a 0.5 probability of earning 6 percent and a 0.5 probability of earning 4 percent.

There were five different treatments of the experimental design. The treatments differ by whether or not the two choices have the same expected value (EV) and by the amount of stock choice information provided. A summary of the different treatments is presented in Table I.

Another advantage of our experimental approach is that diverse prior knowledge of subjects (information diversity à la Bär *et al.*, 2007; Cummings, 2004) is unlikely to influence the results. Nonetheless, we further control for the various types of available stock information. Within our experiment, all teams in every treatment were given information on each fund (stated fund strategy, sector, fund size, historical performance, etc.). However, the specific information on the investment options varied by treatment[6]. The information treatments varied across teams not within teams.

These treatments were designed to control for information effects that could influence the results.

In one treatment, teams were given detailed information on the investment options (P/E ratios, historical average returns, etc.) and no probability of returns information on each stock choice. In a second treatment, teams were given detailed information on the investment options and probability of returns information for each stock choice in which the two stock choices had the same EV. In a third treatment teams were given detailed information on the investment options and probability of returns information for each stock choice in which the two stock choices did not have the same EV. A fourth treatment provided no detailed investment option information but did provide probability of returns information on the stock choices in which the choices had the same EV. The fifth treatment provided no detailed investment option information but did provide probability of returns information on the stock choices in which the choices did not have the same EV. With regard to the information treatments, for the full sample analysis all data were pooled and we controlled for information treatment type in the econometric analysis. We also analyzed subsamples of specific treatments. While we will show that the differences in stock choice EVs did affect the results, we found no significant information effects.

Teams were given an unlimited amount of time to make their decisions. Each team was told that if, at any time, it could not reach a decision for one of the six portfolios, one of the team members would be chosen at random to make that particular portfolio decision for the team[7], [8]. The time taken to reach each decision was recorded[9]. All members of a team received the same payment after every team member completed an exit survey. Team payments were based upon the performance of one of the team's portfolio choices chosen at random from all of the team's decisions in the experiment[10]. The average payout was \$15 per student (for detailed experiment instructions and payout determination procedure, see Appendix 1). We conducted the experiment using 364 undergraduate student subjects that voluntarily registered to participate in the experiment through a university experimental economics web site. All subjects were required to complete both a preliminary survey and an exit survey.

3.2 Subject pool

We conducted four rounds of the experiment using undergraduate business and economics students. We drew from the population of undergraduate business and economics students to ensure that any gender differences were not associated with non-specialist populations. The population also provided that subjects were familiar with financial decisions. The investment decisions presented were designed to mimic the types of exercises presented in business classroom exercises.

Treatments	Both stock choices have same expected value	Probability of returns information	Detailed information on stock choices
1	–	No	Yes
2	Yes	Yes	Yes
3	No	Yes	Yes
4	Yes	Yes	No
5	No	Yes	No

Table I.
Experimental treatments:
expected value and stock
choice information

Haigh and List (2005) show that professionals display more loss aversion than students in an experimental context. Further, von Gaudecker *et al.* (2012) show that sampling from a student population leads to lower estimates of average risk aversion and loss aversion. Given our student subject pool, this would suggest that any results and findings would be a lower bound when considering the application or generalizability of our results to professional fund management team settings.

4. Data

There were a total of 2,184 decision observations from the experiments made by 364 students within 91 teams. Individual subject risk and loss preferences obtained from the pre-experiment survey are presented in Table II [11], [12]. Consistent with Jianakoplos and Bernasek (1998) and Croson and Gneezy (2009) in Table II we see that the individual females in the sample are more risk averse than the individual males in the sample and the difference is statistically significant (*p*-value of 0.0000). Females also have a statistically significant difference in loss loving (*p*-value of 0.0124). Table II also shows that males are more risk loving and less loss averse than females. However, these differences are not statistically significant (*p*-values of 0.8360 and 0.1736, respectively).

The gender and ethnicity composition of our sample is contained in Table III. The teams were created to have sufficient variation in gender composition (see Table IV). While we did collect data on the ethnicity of each subject, there was insufficient ethnic variation within our 364 student sample to study the effects of team ethnic diversity on decisions. However, we control for both team ethnic diversity and total number of risk averse (loss averse) individuals on each team[13]. Table V summarizes team choice information for the three team decisions that were related to risk choices and the three team decisions that were related to loss choices. Table V also shows the average return

Table II.
Individual risk
and loss preference
summary statistics

	Males (%)	Females (%)
Risk averse	9.49	18.12
Risk loving	1.46	1.34
Loss averse	70.37	73.33
Loss loving	2.92	5.33

Table III.
Subject pool
summary statistics

	Mean	SD
Age	20.18	1.41
Percent male	52.20	49.96
Percent African American	7.69	26.65
Percent Southeast/East Asian	34.07	47.40
Percent South Asian	5.77	23.32
Percent Hispanic	6.32	24.34
Percent Caucasian	44.51	49.71
Percent other race	0.02	0.13
Body mass index (BMI)	22.61	3.34
Semesters completed	4.30	2.29
Percent who have taken a finance class	36.54	48.16
Percent holding a leadership position	91.21	28.32

earned by each team type. Notably, the two-male two-female teams earn the lowest average team return.

5. Econometric analysis and results

To analyze the effect of team composition on the portfolio risk choices, we utilize probit models in which the dependent variable is a binary variable that is given a value of 1 if the high-risk stock was selected and is given a value of 0 if the low risk stock was selected. Similarly, to evaluate the effect of team composition on portfolio loss choices, we use a probit model in which the dependent variable is a binary variable that is given a value of 1 if the large loss choice is selected and is given a value of 0 if the smaller loss choice is selected. We perform the analysis both using a univariate probit model and a random effects probit model for: the full sample, the treatments when the two choices have the same EV and the treatments when the two choices have different EVs.

5.1 Univariate probit model

For the team level analysis, we control for team ethnic diversity, number of risk averse members on the team, the number of loss averse members on the team, specific decision, decision order, industry of stocks involved in decision, and treatment. The full model specification is:

$$TEAMCHOICE_j = \beta_0 + \sum_{k=1}^K \beta_k TEAMGENDERCOMP_{jk} + \sum_{l=5}^L \beta_l X_{jl} + \varepsilon_j \tag{1}$$

	Percent of teams
All males	21.98
Three males	23.08
Two males	14.29
One male	21.98
No males	18.68
One ethnicity represented	37.36
Two ethnicities represented	42.86
Three ethnicities represented	18.68
Four ethnicities represented	1.10

Table IV.
Team composition

	Percent selecting high risk choices		Percent selecting large loss choices		Average team return (%)	
	Mean	SD	Mean	SD	Mean	SD
All males	35.29	48.26	56.86	50.02	5.11	5.21
Three males	38.33	49.03	58.33	49.72	3.99	4.18
Two males	46.15	50.50	41.03	49.83	3.36	3.07
One male	47.62	50.34	47.62	50.34	4.24	4.69
No males	38.33	49.03	46.67	50.31	4.34	3.89
Observations						546

Table V.
Team choices and returns

where X_{ji} is the set of team composition and experimental control variables. Standard errors are clustered at the team level (a detailed description of the variables used can be found in Appendix 2).

Table VI shows the results from Equation (1). From Table VI, we generally find that having a male presence on the team increases the probability of selecting a higher risk investment. In the full sample, teams with three males have the highest probability of selecting a higher risk investment and this result is significant at the 15 percent level. The treatments in which the probability of returns for the two stock choices have the same EV (Treatments 2 and 4) theoretically should generate different results from the treatments in which the EVs are not the same (Treatments 3 and 5); since the riskier choice in Treatments 2 and 4 represents added risk without added expected return. Consequently, we also look separately at the results of the two types of treatments: Treatments 2 and 4 – both choices have the same EV and Treatments 3 and 5 – the choices do not have the same EV. The results from Treatments 2 and 4 are particularly compelling. All risk averse individuals should prefer lower risk at the same EV while only more risk averse subjects will be willing to give up some EV to achieve lower risk. Yet, in this sample, having a three male team increases the probability of selecting the higher risk investment and the result is significant at the 5 percent level. Having one male on the team increases the probability of selecting a higher risk investment and this result is weakly significant at the 15 percent level.

With regard to loss aversion, having a male presence on the team decreases the probability of selecting the investment that will require the realization of a larger loss but has the potential for a higher return. In the full sample, teams that have two males and two females have the lowest probability of choosing the investment that will require the team to recognize a larger loss and this result is significant at the 10 percent level.

5.2 Random effects probit model

Both Bär *et al.* (2007) and Atkinson *et al.* (2003) suggest that knowledge and/or educational differences of fund managers influence mutual fund performance. Additionally, Dwyer *et al.* (2002) find gender differences in risk taking for mutual fund investors are attenuated once they control for individual financial investment knowledge. Since we drew from the population of undergraduate business and economics students, our subject population is relatively homogeneous, familiar with financial decisions and less likely to have any gender differences associated with non-specialist populations. However, in the random effects model specification, we can utilize the individual subject data collected from both the preliminary survey and the exit survey to control for other specific subject characteristics that could influence the team investment decisions while controlling for team level effects.

For our analysis, the random effects specification is preferable to a fixed effects model by saving on degrees of freedom. Moreover, since the collective influence of any potential unmeasured variables that give rise to the different intercepts is uncorrelated with the included explanatory variables, there is no bias in the estimation.

The subject characteristic control variables include age, race, risk aversion disposition, loss aversion disposition, semesters of college completed, and a dummy variable if the student has taken a finance class. Since physical appearance has been shown to affect individual behavior in trust experiments (Eckel and Petrie, 2011), we also control for physical attractiveness. For a subsample of the data, we also have individual height and weight information. As a proxy for physical attractiveness, we

	Risk choice decisions		Loss choice decisions	
	Treatments 2 & 4 choices have same EV	Treatments 3 & 5 choices have different EV	Treatments 2 & 4 choices have same EV	Treatments 3 & 5 choices have different EV
All male team dummy variable	0.0787 (0.1115)	0.1705 (0.1596)	-0.1341 (0.2153)	-0.0346 (0.1483)
Three male team dummy variable	0.1629† (0.1064)	0.1721 (0.1435)	-0.0013 (0.2461)	-0.0664 (0.1460)
Two male team dummy variable	0.1343 (0.1388)	0.2738† (0.1694)	-0.0878 (0.2569)	-0.1256 (0.1705)
One male team dummy variable	0.0530 (0.1137)	0.0506 (0.1269)	-0.1064 (0.1914)	0.0934 (0.1546)
Team ethnic diversity controls	Yes	Yes	Yes	Yes
Team risk/loss aversion control	Yes	Yes	Yes	Yes
Experiment controls	Yes	Yes	Yes	Yes
Observation	266	147	55	147
Log likelihood	-148.88	-79.63	-22.83	-74.83
			Full sample	
			-0.0193 (0.1120)	
			-0.0931 (0.1166)	
			-0.2058* (0.1115)	
			0.0089 (0.1249)	
			Yes	Yes
			Yes	Yes
			Yes	Yes
			259	147
			-123.94	-22.83

Notes: Standard errors in parentheses are clustered at the team level. ***, †, ‡ Significant at the 5, 10 and 15 percent levels, respectively

Table VI.
Marginal effects of
gender composition on
investment decisions –
probit model

use a body mass index (BMI) measure (Tovée and Cornelissen, 2001; Swami, 2005)[14], [15]. Experimental controls for the team ethnic diversity, the specific decision, the decision order, the industry of the stocks involved in the decision, and the treatment also are included.

The full model specification is:

$$CHOICE_{ij} = \beta_0 + \sum \beta_k TEAMGENDRCOMP_{ijk} + \sum \beta_l X_{ijl} + \sum \beta_m Z_{ijm} + u_j + \varepsilon_{ij} \quad (2)$$

where X_{ijl} is the set of team ethnic composition and experimental control variables and Z_{ijm} is the set of subject characteristic control variables (a detailed description of the variables used can be found in Appendix 2).

Table VII shows the full sample results from Equation (2) with regard to the risk choices in the first three columns and loss choices in the last three columns. Standard errors in parentheses are clustered at the individual subject level. Consistent with Table VI, overall, having a male presence on the team increases the probability of selecting the higher risk investment choice. However, the effects are not increasing in the number of males on the team. Specifically, having a team with three men or a team with two men increases the probability of selecting the higher risk investment choice by the greatest amount. The effects for the three male team dummy and the two male team dummy are significant across all versions of the specification. Notably, the all male teams are not the most risk seeking. The teams with a majority male or a balanced gender composition are more risk seeking than all male teams.

	Dependent variable					
	Risk choice				Loss choice	
All male team dummy variable	0.0931* (0.0572)	0.1146 (0.0875)	0.1165 (0.0874)	-0.0310 (0.0555)	-0.1137 (0.0826)	-0.1106 (0.0837)
Three male team dummy variable	0.1806*** (0.0542)	0.2061*** (0.0744)	0.2064*** (0.0742)	-0.0940† (0.0578)	-0.0361 (0.0731)	-0.0352 (0.0732)
Two male team dummy variable	0.1431** (0.0696)	0.2813*** (0.0791)	0.2820*** (0.0792)	-0.2334*** (0.0511)	-0.2027*** (0.0741)	-0.2022*** (0.0741)
One male team dummy variable	0.0500 (0.0570)	0.0993† (0.0622)	0.0992† (0.0622)	-0.0144 (0.0606)	0.0154 (0.0666)	0.0145 (0.0662)
Student characteristic controls	No	Yes	Yes	No	Yes	Yes
Student appearance controls	No	No	Yes	No	No	Yes
Team ethnic diversity controls	Yes	Yes	Yes	Yes	Yes	Yes
Experiment controls	Yes	Yes	Yes	Yes	Yes	Yes
Observation	1,064	824	824	1,036	793	793
Log likelihood	-599.53	-449.36	-449.32	-498.32	-400.55	-400.28

Table VII. Marginal effects of gender composition on investment decisions – random effects probit model, full sample

Notes: Standard errors in parentheses are clustered at the subject level. For the marginal effects, the derivative is evaluated at each observation and the mean of these marginal effects is calculated and reported. ***, **, †Significant at the 1, 5, 10 and 15 percent levels, respectively

With regard to loss aversion, the two male team dummy variable decreases the probability of selecting the investment that causes the team to recognize a larger loss and is significant at the 1 percent level across all versions of the specification. In the specifications with no subject characteristic controls, the three male team dummy variable is negative and significant at the 15 percent level.

For this analysis, we also look separately at the results of the two types of treatments (see Table VIII). Within these subsamples, we observe similar patterns to the ones in Table VII. Having a male presence on the team increases the probability of selecting the higher risk investment. With respect to the loss choice decisions, the two male team dummy variables decrease the probability of selecting the investment that will require the realization of a larger loss.

5.3 Risk-adjusted return analysis

The raw data presented in Table V indicate differences in returns by team gender composition. Consequently, we also analyze the effect of team composition on team returns using an OLS regression model in which the dependent variable is risk-adjusted return. Risk-adjusted return is defined as: $\frac{\mu_{choiceB} - \mu_{choiceA}}{\sigma_{choiceB}^2 - \sigma_{choiceA}^2}$ [16]. Both a team level analysis and an analysis in which we also control for subject characteristics, do not indicate any economically meaningful relationships between team composition and risk-adjusted returns. This is a striking result given the previous findings regarding risk-taking behavior. In contrast to Rockenbach *et al.* (2007), we find that the team types that accept more risk do not systematically earn a higher risk-adjusted return.

6. Discussion and concluding remarks

Given the economic importance of risk taking in financial decision making, factors that influence risk analysis are key. Using an experimental economics approach, we find that team composition does influence financial decisions with regard to the assessment of risk and loss. A male presence on a team can increase the probability of selecting a higher risk investment and can decrease the probability of choosing an investment that will require realizing a larger loss. Our results are complementary to other research by Castillo *et al.* (2012) who show that merely being in the same room with males causes females to be more risk taking.

Since it has been well established that men individually exhibit more risk seeking behavior than women, the fact that a male presence increases team risk seeking behavior is not surprising. What is intriguing is that the risk seeking behavior of a team is not necessarily increasing with the number of males on the team. All male teams, while more risk seeking than all female teams, are not the most risk seeking. This non-monotonicity of risk seeking (and loss aversion) with respect to the number of men on a team reinforces the premise that team decisions are different from individual decisions. Better understanding the sources of these differences, whether a mixed gender presence (Castillo *et al.*, 2012) or a gender influence, is a rich area for future research.

When one considers these results in the context of workforce composition in the finance industry, these are especially compelling results that could have critical implications for team investment decisions driven by the assessment of risk and return tradeoffs. The effects of team diversity could have important economic consequences for firms in general and for the finance industry in particular. Moreover, it is easy to see how Wall Street, with a largely male workforce, could be driven to take higher risks than a workforce which is more reflective of the general population. To curb excessive

Table VIII.
Marginal effects of gender composition on investment decisions – random effects model, subsamples

	Risk choice decisions		Loss choice decisions								
	Treatments 2 & 4 choices have same EV	Treatments 3 & 5 choices have different EV	Treatments 2 & 4 choices have same EV	Treatments 3 & 5 choices have different EV							
All male team dummy variable	0.2577*** (0.0998)	0.2683* (0.1417)	0.1952** (0.0795)	0.1348 (0.1051)	0.1338 (0.1043)	-0.1188 (0.1126)	-0.0287 (0.1275)	-0.0273 (0.1284)	-0.0610 (0.0695)	-0.0578 (0.0969)	-0.0427 (0.0990)
Three male team dummy variable	0.3178*** (0.0806)	0.4214*** (0.1164)	0.4267*** (0.1161)	0.1672** (0.0861)	0.1669** (0.0859)	0.0196 (0.1195)	-0.0960 (0.1068)	-0.0563 (0.1119)	-0.0493 (0.0726)	-0.0400 (0.0846)	-0.0323 (0.0848)
Two male team dummy variable	0.3580*** (0.1351)	0.4613*** (0.1524)	0.4640*** (0.1505)	0.2821*** (0.0856)	0.2818*** (0.0979)	0.2818*** (0.1242)	-0.0914 (0.1158)	-0.2432* (0.1125)	-0.2576** (0.0699)	-0.2288*** (0.0885)	-0.2325*** (0.0869)
One male team dummy variable	0.3714*** (0.1258)	0.4062*** (0.1315)	0.4190*** (0.1341)	0.0575 (0.0639)	0.0120 (0.0662)	0.0118 (0.1018)	-0.0938 (0.1073)	-0.0174 (0.1176)	0.0334 (0.0745)	0.0787 (0.0756)	-0.2325*** (0.0869)
Student characteristic controls	No	Yes	Yes	No	Yes	No	Yes	Yes	No	Yes	Yes
Student appearance controls	No	No	Yes	No	Yes	No	No	Yes	No	No	Yes
Team ethnic diversity controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Experiment controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	248	245	245	588	579	220	214	214	588	579	579
Log likelihood	-134.77	-128.64	-128.54	-319.73	-311.67	-91.49	-81.83	-80.53	-306.67	-297.80	-295.94

Notes: Standard errors in parentheses are clustered at the subject level. For the marginal effects, the derivative is evaluated at each observation and the mean of these marginal effects is calculated and reported. ***, **, * Significant at the 1, 5 and 10 percent levels, respectively

risk taking and loss aversion, our findings would suggest that understanding the role of gender diversity in risk management would be useful in effecting change.

Notes

1. In 2008, the US mutual fund market managed assets worth almost \$9 trillion. Source: January 2009 – The Cerulli Edge Global Edition (published by Cerulli Associates a financial research firm).
2. A random sample in 2009 of 50 large cap and mid cap mutual funds shows that: first, the average size of a large cap fund management team is three people with a maximum of nine managers and a minimum of one manager. Second, the average size of a mid cap fund management team is two people with a maximum of five managers and a minimum of one manager (Source: www.morningstar.com).
3. Typically, the experimental literature involving group decisions uses three-person groups (see e.g. Baker *et al.*, 2008; Shupp and Williams, 2008; Sutter, 2007; Rockenbach *et al.*, 2007; Masclet *et al.*, 2009). We utilize four-person groups so that we can observe the decisions of teams with a balanced number of males and females.
4. While there is little consensus on the nature of the “willingness to pay” (WTP) and “willingness to accept” (WTA) situation gap (Coursey *et al.*, 1987; Plott and Zeiler, 2005), our comparisons are within each type of situation not across WTP-WTA situations.
5. The sell decisions were created to be consistent with our real-world context. Each sell decision was constructed in such a way that within each choice (A or B) the magnitude of the EV of the gain from the stock retained was always equivalent to the magnitude of the loss realized by selling the other stock.
6. Information on investment options was based upon historical information from actual companies. Company names were changed to avoid any framing effects. Additionally, future returns for each investment option were extrapolated to eliminate the opportunity for experimental subjects to “game” the experiment by trying to guess the true identity of each company to gain an advantage for selection. Specific examples of the company information provided are available upon request.
7. No explicit instructions about how to reach a decision were provided. Subjects were asked about the team decision process in an exit survey.
8. It was not necessary for any team to make a decision in this manner during any round of the experiment.
9. The average time for teams to complete all decisions was 23.18 minutes.
10. This procedure has been well tested in experimental economics as a method of inducing good performance and encouraging subjects to treat each decision as an independent decision. When subjects undertake a series of separate decisions knowing that they will be paid for their performance from one randomly selected decision, they will treat each decision as if it is the one for which they will be paid (Butler and Hey, 1987; Hey, 1991).
11. I. Subject is considered risk averse if he/she answers b to the following hypothetical question: Please circle which of the following two situations (a or b) you would prefer. (a) A fair coin is flipped. If the coin comes up heads you will be given \$0. If the coin comes up tails, you will be given \$120. (b) You are given \$30.
II. Subject is considered risk loving if he/she answers a to the following hypothetical question: Please circle which of the following two situations (a or b) you would prefer. (a) A fair coin is flipped. If the coin comes up heads you will be given \$0. If the coin comes up tails, you will be given \$120. (b) You are given \$90.
III. Subject is considered loss averse if he/she answers b to the following hypothetical question: Please circle which of the following two situations (a or b) you would prefer.

(a) You are given \$120 and a fair coin is flipped. If the coin comes up heads you will be asked to pay \$0. If the coin comes up tails, you will be asked to pay \$120. (b) A fair coin is flipped. If the coin comes up heads you will be given \$0. If the coin comes up tails, you will be given \$120.

IV. Subject is considered loss loving if he/she answers a to the following question: Please circle which of the following two hypothetical situations (a or b) you would prefer. (a) You are given \$120 and a fair coin is flipped. If the coin comes up heads you will be asked to pay \$0. If the coin comes up tails, you will be asked to pay \$120. (b) A fair coin is flipped. If the coin comes up heads you will be given \$0. If the coin comes up tails, you will be given \$180.

12. The pre-experiment survey was done immediately before the start of the experiment. Due to time and logistic considerations we elicited individual risk and loss aversion with a context-free hypothetical survey instrument. However, Pennings and Smidts (2000) and Pennings and Garcia (2001) both demonstrate that individual risk attitude lotteries are strong predictors of actual individual market behavior.
13. The average number of risk averse individuals on each team was 0.43 and the average number of loss averse individuals on each team was 2.23.
14. English BMI = $\frac{\text{weight in pounds}}{(\text{height in inches})^2} \times 703$.
15. For a subsample of the data we also have information on leadership experience. Using this data, we create an individual leadership dummy variable which we use to control for leadership experience. There is very little variation in this variable. In total, 91.2 percent of the sample held a leadership position. Thus, when we also include this variable in our analysis, we find consistent results.
16. Where μ is the mean return of the choice and σ^2 is the standard deviation of the choice return.
17. The buy and sell payoffs are calculated differently because the sell decisions could generate a net loss and the experimental format dictates that we should have a minimum payout for each decision.

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Appendix 1. Experimental procedure: subject instructions

It is January 1, 2009. You are a portfolio management team working for a large asset management company. Your team has been given the task of making independent selections for six separate equity portfolios. You will be shown a series of six equity mutual funds and asked to choose between two investment options for each mutual fund. Some decisions will require you to choose a stock to purchase for the mutual fund. Other decisions will require you to choose a stock to sell for the mutual fund. You will be given information on each stock portfolio (stated fund strategy, sector, fund size, historical performance, etc.) and specific information on the investment options (P/E ratios, historical average returns, etc.). Information on investment options will be based upon historical information from actual companies. Future returns for each investment option have been extrapolated. All of the information provided is not necessarily needed to make each decision. Remember that each decision is independent. There can only be one team choice for each mutual fund. For any decision, you will not be able to divide the amount to be invested between the two options given. You will have an unlimited amount of time to make each decision. If at any time, your team cannot reach a decision for one of the six portfolios, one of your team members will be chosen at random to make that particular portfolio decision for your team.

After all team decisions have been made, your performance for each decision will be based upon the stock returns (as of January 1, 2010) of your selections. Your team payment will be based upon the performance of one of your team's decisions chosen at random from all of your team's decisions in the experiment. If a buy decision is selected, each person will be paid \$10 plus an additional \$2 for each 1 percent return earned by the decision. If a sell decision is selected, each person will be paid \$15 plus an additional \$2 for each 1 percent net return earned by the decision. Net return will be calculated as the return earned by the stock that is retained minus

the return loss on the stock that is sold[17] (e.g. If your team decision number 3 is randomly chosen for payout purposes and your team's buy selection for decision number 3 had a 10 percent net return, then you would be paid \$30). In order to be eligible for a payout, each team must submit a decision for all six portfolios and every team member must fill out a preliminary survey and an exit survey.

Please ask any questions before the start of the experiment. After the experiment has started, no questions about the content of the experiment can be answered.

Appendix 2. Econometric analysis: definition of variables used

Team composition variables:

- All male team dummy variable – a dichotomous dependent variable that is given a value of 1 if the team is comprised of four males. The variable is 0 otherwise.
- Three male team dummy variable – a dichotomous dependent variable that is given a value of 1 if the team is comprised of three males and one female. The variable is 0 otherwise.
- Two male team dummy variable – a dichotomous dependent variable that is given a value of 1 if the team is comprised of two males and two females. The variable is 0 otherwise.
- One male team dummy variable – a dichotomous dependent variable that is given a value of 1 if the team is comprised of one male and three females. The variable is 0 otherwise.
- All female team dummy variable – a dichotomous dependent variable that is given a value of 1 if the team is comprised of four females. The variable is 0 otherwise.
- Two ethnicities represented dummy variable – a dichotomous dependent variable that is given a value of 1 if the team has members that represent two different ethnicities. The variable is 0 otherwise.
- Three ethnicities represented dummy variable – a dichotomous dependent variable that is given a value of 1 if the team has members that represent three different ethnicities. The variable is 0 otherwise.
- Total number of risk averse team members – the total number of team members that are classified as having a risk aversion disposition based upon the pre-experiment survey.
- Total number of loss averse team members – the total number of team members that are classified as having a loss aversion disposition based upon the pre-experiment survey.

Subject characteristic control variables:

- Age of respondent – the age of the subject.
- Male dummy variable – a dummy variable that is given a value of 1 if the subject is male and is set to 0 otherwise.
- Body mass index – the English BMI measure calculated as $\frac{\text{subject weight in pounds}}{(\text{subject height in inches})^2} \times 703$.
- Number of semesters completed – the number of college semesters that the subject had completed.
- Taken finance class dummy variable – a dummy variable that is given a value of 1 if the subject had taken a finance class and is set to 0 otherwise.
- African-American dummy variable – a dummy variable that is given a value of 1 if the subject was African American and is set to 0 otherwise.

- Southeast/East Asian dummy variable – a dummy variable that is given a value of 1 if the subject was Asian and is set to 0 otherwise.
- South Asian dummy variable – a dummy variable that is given a value of 1 if the subject was South Asian and is set to 0 otherwise.
- Hispanic dummy variable – a dummy variable that is given a value of 1 if the subject was Hispanic and is set to 0 otherwise.
- Other race dummy variable – a dummy variable that is given a value of 1 if the subject reported being of a race other than white, African American, Hispanic, Asian, or South Asian and is set to 0 otherwise.
- Leadership dummy variable – this variable is given a value of 1 if the student indicated holding a leadership position either within the university or outside the university. The variable is given a value of 0 if no leadership positions were reported.
- Risk aversion disposition dummy variable – a dummy variable that is given a value of 1 if the subject prefers to be given a certain amount of \$30 to playing a lottery with a 0.5 chance of being given \$0 and a 0.5 chance of being given \$120. The variable is set to 0 if the subject prefers the lottery.
- Loss aversion disposition dummy variable – a dummy variable that is given a value of 1 if the subject prefers a lottery with a 0.5 chance of receiving \$0 and a 0.5 chance of receiving \$120 to being given \$120 and also being required to play a lottery with a 0.5 chance of having to pay \$0 and a 0.5 chance of having to pay \$120. The variable is set to 0 otherwise.

Experiment control variables:

- Decision dummies – dummy variables for the specific investment decision.
- Order of decision – the order of the investment decision out of the six decisions.
- Investment choice industry dummies – dummy variables for the industries represented by the investment choices.
- Treatment dummies – dummy variables representing the treatment for the decision.