Gender-Based Trading: Evidence from a Classroom Experiment

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ABSTRACT

Is there a difference in the trading behavior of men and women? The question stems from research suggesting that men tend to be more overconfident than women, trade more and earn lower portfolio returns. Moreover, men appear to be less risk-averse than women. We present evidence from a student investment market simulation, Stock-Trak©, conducted in an upper division college finance course.

Introduction

"Men, especially young men, made a mess of things. There is a strong discussion that women would have taken a more cautious approach in the financial sector." (Spokesperson for Iceland's new female prime minister as quoted in the Washington Post - February 11, 2009)

"If more women and older men were trading, the markets would be more stable." (John Coates, a researcher at Cambridge University, as quoted in the New York Times - April 19, 2008)

Women control a significant portion of the investment assets in the U.S. More than 40 percent of households with assets greater than $600,000 are headed by women and more than half of all private wealth in the U.S. is controlled by women. Moreover, women are expected to control two-thirds of all private wealth in the country in two decades (Bliss & Potter, 2002).

Existing research shows that men and women view money, risk and investing differently. Barber and Odean (2001), for instance, show that men tend to be more overconfident than women, trade more and earn lower portfolio returns. Moreover, men appear to be less risk-averse than women. According to the Washington Post (February 11, 2009) a recent study concluded that French companies with the greatest percentage of women in management have performed the best during the [current credit] crisis.

Thus, in addition to subprime mortgages, credit default swaps and lax government oversight, another factor may need to be added to the list of culprits responsible for the current economic recession: testosterone. A study conducted by the University of Minnesota concluded that "Testosterone is the hormone of irrational exuberance…The bubble preceding the current crash may have been due to euphoria related to high levels of testosterone, or high sensitivity to it" (Stein, 2009).

This study asks: Is there a difference in the trading behavior of male and female students? We present evidence from Stock-Trak©, a student investment simulation game, conducted in an upper division college finance course for each of two semesters. While much of the literature on gender differences in risk-taking and investment choices are based on surveys and actual outcomes, this analysis has the potential to add insight to the literature by studying a situation where students make choices based on a simulation. In the Stock Trak© simulation, the incentives to perform are controlled and equal for all, regardless of socio-economic or racial differences. We link our findings to existing research on gender-based investing.

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Literature Review

Gender differences in overconfidence are found to be largest for tasks that are considered "masculine" or for tasks that occur in a masculine domain (Deaux & Farris, 1977; Lenny, 1977; Beyer & Bowden, 1997). Bliss & Potter (2002) argue that women make up a low enough proportion in the financial services industry, to where it would be reasonable to classify stock trading as essentially "masculine". Lewellen, Lease and Schlarbaum (1977) found that men spent more time and money on security analysis, trusted the advice of brokers less and traded more often than women – all behaviors predicted by models of overconfidence.[2]

Theoretical models predict that overconfident investors trade excessively. Psychological research demonstrates that, in areas such as finance, men are more overconfident than women. Thus, theory predicts that men will trade more excessively than women. In fact, Barber and Odean (2001) document that men trade 45 percent more than women. Trading reduces men's net returns by 2.65 percentage points a year as opposed to 1.72 percentage points for women.

Hersch (1996) and Pacula (1997) provide evidence that women are more risk-averse in general than men. Moreover, women are more averse to financial risk than men based on 1989 Federal Reserve survey data as reported in Jianakoplos and Bernasek (1998). Barber and Odean (2001) found that men invest in riskier positions than women when risk is measured in terms of portfolio volatility, individual stock volatility, beta and size. And, Niessen and Ruenzi (2005) find that female mutual fund managers take less risk and have more stable investment styles than male managers. In this study, male mutual fund managers have more active investment styles and higher turnover ratios than their female counterparts.

With women beginning to ascend the ranks in the financial services industry, Bliss and Potter (2002), in a study of 3,200 equity mutual funds, examined the role of manager gender on fund performance. Somewhat surprisingly, they found no discernible difference in fund turnover (trading) between the two groups of managers. Moreover, women were willing to bear a little more risk, but also earned higher raw returns than men.

Bajtelsmit and Bernasek (1996) provide a summary of the explanations for gender differences that have been offered in a variety of fields, including economics, sociology, education and gender studies. They point out that ultimately all the explanations have their root in discrimination and/or differences in individual preferences.

Expected utility theory suggests that risk aversion decreases with wealth. To the extent that women, on average, have lower levels of wealth than men, they are likely to hold smaller dollar values of risky assets and will exhibit relatively more risk aversion than men.

Studies of gender differences in employment show that women are more likely to be concentrated in low-paying occupations, and have a greater likelihood of being employed in part-time and temporary occupations. Moreover, women are more likely than men to change jobs. The implications are that women are less likely to have employer-sponsored pension plans and rely more on their own savings for retirement income.

Human capital theory (Becker, 1975) states that women rationally choose to invest less in human capital than men, which in turn affects their employment opportunities and ability to accumulate wealth. Women make different choices than men primarily due to the gender-based division of labor within the family stemming from inherent biological or socialization causes.

More recently, John Coates, a researcher at Cambridge University who once ran a trading desk on Wall Street, conducted a novel survey that analyzed saliva from 17 male traders in London's financial district (Sullivan & Jordan, 2009). Coates concluded that traders made the highest profits when they had the highest levels of testosterone in their spit. The downside, he said, was that elevated testosterone also led to riskier behavior, a formula for disaster as well as profit. Studies such as this are beginning to support the notion that biology, sex hormones in particular, plays a role in complex human behaviors and thus in financial decision-making.

[2] Overconfidence is also found to be strongest for difficult tasks, forecasts with low levels of predictability, and in situations where feedback on the decision is lacking (Bliss and Potter, 2002).

Project Design

The study is conducted in a senior-level finance course at a metropolitan U.S. university with about 10,000 students. The course is called "Security Analysis and Portfolio Management" and all finance majors are required to take this course. This study is intended to provide some baseline estimates on gender-based differences in decision-making and draws inferences directly from the results of an investment project given to students in the course. While the study is limited by the lack of certain student demographic data such as age, race, and socio-economic condition, the guided Stock Trak© simulation project provides incentives to perform that are controlled and equal for all, regardless of demographic features.

The Stock-Trak© project exposes students to managing a portfolio using "real world" asset prices. Each student begins with a $500,000 portfolio invested in cash. The goal is to accumulate the most wealth. The trading timeline for a semester is typically 10 weeks long. Students keep a trader's log where they record their transactions, reasons for their transactions, news that affected their choices, the value of their portfolio and certain popular asset index values.

Portfolios are expected to have a majority of their capital invested in non-cash assets such as stocks, options, futures, bonds, mutual funds, and international stocks throughout the trading horizon. Each student is allowed 100 transactions, with a commission fee of $12 per trade. Students must establish a minimum of one options or futures positions, one short sale (of a stock), and a minimum of 30 total transactions during the semester-long simulation. Portfolio performance is evaluated both in terms of absolute returns and in terms of the Sharpe Ratio.[3]

Students discuss their trading strategies and results in a summary report due at the end of the semester that includes both qualitative and quantitative analysis. Quantitative questions include computing the Sharpe ratio, Treynor ratio, Jensen's alpha, standard deviation, and beta. Students must use these measures to compare their portfolio risk with the risk of the S&P 500.

Student responses to the qualitative questions reported in the traders log revolve around the following themes. Students tend to trade on company-specific news articles. Another popular strategy among students is to make bets on market movements following announcements made by the Federal Reserve or key political figures. And, several students report buying stocks simply because they purchase or like the company's products.

Grades for the Stock-Trak© project are largely determined by student answers to quantitative and qualitative questions in the final report. The simulation project in total contributes 10 percent to a student's course grade. The points received for the project are directly related to the absolute returns earned in the simulation. Points for portfolio performance are segregated into six tiers related to final portfolio absolute return.[4] Each account is restricted in terms of the amount of cash that can be held at any time and the minimum number of trades that can be made each week. Importantly, each student has the same set of instructions and incentives to perform, regardless of socio-economic background, age, race or gender.

Weekly bonus points are awarded to those students earning the highest absolute returns, subject to cash and trading constraints. Bonus points are also awarded at the end of semester to those students who earn the top five absolute returns and those students who outperformed the professor's absolute return.[5]

The experiment has a few limitations which should be noted. First, the study only encompasses two semesters. The authors will continue the study for five years, in order to relate the results to the business cycle. Second, we assume that short selling and derivatives transactions are risky. The students in this experiment were required to do one short sell and one derivative or options position in order to complete the requirements of the game. Those students who traded more than the requirement for these securities

[3] The Sharpe ratio is a measure of the risk-adjusted returns for a portfolio. It is among the most popular measures of portfolio performance used in the financial services industry. Other measures such as the Treynor Measure and Jensen's Alpha may also be reported, although students tend not to report these consistently.

[4] The point system is not designed to heavily penalize poor portfolio performance for such a small time frame (10-12 weeks). For example, the tiers for the Spring 2008 semester were as follows: Greater than 4%; 0% to 4%; -10% to 0%; -25% to -10%; -45% to -25%; Less than -45%.

[5] The professor uses the efficient frontier strategy based upon the stock returns of either the S&P 400 or the S&P 600. Stocks chosen by this method are limited to a maximum allocation of 10%. The efficient frontier method produced returns that underperformed the S&P 500 and outperformed the S&P 600. For example, During the Spring 2008 semester, the professor earned 6.6% versus 7.1% using the S&P 400 returns. Then, during the Fall 2008 semester, the professor earned -14.76 % versus -112% using the S&P 600 returns.

were taking extra risky positions to enhance their returns as opposed to hedging their existing portfolio. Third, students were given a large sum of money to start the game. There is the concern that students from different demographic backgrounds might change their behavior. The options within the Stock Trak game were either a $100,000 initial investment or a $500,000 initial investment. The professor chose the larger of the two to allow the futures requirement to be fulfilled. For example, only one futures contract of light sweet crude oil could cost $100,000.

Empirical Analysis

Hypotheses

The empirical analysis to follow is based on the following three hypotheses:
Null Hypothesis 1**:** Men are no more overconfident than women. In particular,

a) There is no difference in the amount of time spent on the project[6]
b) There is no difference in the number of trades executed
c) There is no difference in the number of different assets traded

Null Hypothesis 2: There is no difference in risk aversion between male and female students as exhibited in trading/portfolio choices. In particular,

a) there is no difference in the number of short stock sales executed
b) there is no difference in the number of derivatives transactions executed
c) there is no difference in the portfolio volatility (standard deviation)
d) there is no difference in the beta of the portfolios

Null Hypothesis 3: There is no difference in the returns earned by male and female students. In particular,

a) there is no difference in net returns (adjusted for transactions costs)
b) there is no difference in the risk adjusted returns (Sharpe Ratio)

Results

The sample consists of 47 male and 19 female students during the spring and fall 2008 semesters. Table 1 contains descriptive statistics of the variables of interest in this study. Casual observation suggests that men trade differently than women. Moreover, men engage more in complex transactions, such as derivatives, than women. The portfolios of male students appear to have greater volatility as measured by standard deviation, and men appear to earn higher returns than women, both in absolute terms as well as in risk-adjusted terms.

Table 1. Descriptive Statistics

Variable		Full sample		Spring 2008		Fall 2008	
		Male	**Female**	**Male**	**Female**	**Male**	**Female**
A. Trading Behavior							
Time spent on project (min /week)	Median	90	40	90	90	90	28
	Mean	107	73	110	97	93	32
	Std. Dev.	84	69	86	77	80	15
Number of trades	Median	66	35	69	37	49	32
	Mean	80	40	86	41	54	37
	Std. Dev.	58	18	63	18	24	19
Number of	Median	45	34	62	36	26	19

[6] This aspect of the project is self-reported and cannot be verified by the instructor.

different	Mean	65	35	75	40	26	26
assets traded	Std. Dev.	50	18	51	17	8	16
B. Risk Aversion							
Short stock	Median	2	1	2	1	3	1
	Mean	4	1	3	1	8	1
	Std. Dev.	6	1	3	1	10	1
Buy futures	Median	3	1	3	1	1	0
	Mean	5	2	6	2	2	1
	Std. Dev.	6	2	6	2	2	2
Sell futures	Median	3	0	3	0	1	0
	Mean	4	1	5	1	2	0
	Std. Dev.	5	2	5	2	1	0
Buy options	Median	1	0	1	1	0	0
	Mean	3	1	3	1	1	0
	Std. Dev.	6	1	6	1	1	0
Sell options	Median	0	0	0	0	0	0
	Mean	2	0	2	0	1	0
	Std. Dev.	4	0	5	0	1	0
Derivatives trades (all)	Median	7	2	9	3	4	1
	Mean	14	3	16	4	4	1
	Std. Dev.	17	4	19	4	4	2
Standard deviation of returns	Median	5.60%	2.70%	5.10%	2.70%	13.60%	6.20%
	Mean	12.60%	4.00%	9.10%	2.70%	28.00%	6.26%
	Std. Dev.	21.00%	3.20%	11.90%	0.70%	40.80%	4.70%
Portfolio beta	Median	0.59	0.53	0.56	0.53	0.61	0.66
	Mean	0.59	0.49	0.55	0.41	0.72	0.62
	Std. Dev.	1.00	0.46	1.02	0.37	0.92	0.58

Table 1 Continued. Descriptive Statistics

Variable		**Full sample**		**Spring 2008**		**Fall 2008**	
		Male	**Female**	**Male**	**Female**	**Male**	**Female**
C. Returns							
Returns (net)	Median	0.76%	0.47%	2.10%	1.60%	-28.50%	-20.00%
	Mean	-4.60%	-7.23%	2.62%	3.10%	-31.50%	-29.70%
	Std. Dev.	34.00%	24.25%	31.00%	4.80%	32.20%	34.20%
Sharpe ratio	Median	0.22	-1.11	0.79	-0.24	-1.93	-3.49
	Mean	-0.14	-1.01	0.38	0.06	-2.52	-3.01
	Std. Dev.	3.44	2.37	3.18	2.22	3.76	0.84

In Table 2 we report results from Mann-Whitney-Wilcoxon (MWW) non-parametric tests for differences in medians. The null hypothesis in the Mann–Whitney test is that the two samples are drawn from a single population, and therefore that their probability distributions are equal. It requires the two samples to be independent, and the observations to be ordinal or continuous measurements.

In Panel A, we report statistically significant differences in the trading behavior of male and female students. In particular, males spend more time (or at least report that they do) on the project, ostensibly in security analysis and trading strategy, than females. Moreover, men make more trades and also trade in more (different) assets than women.

Table 2. Mann-Whitney-Wilcoxon tests for differences in medians (p-values)

Variable	Full sample	Spring 2008	Fall 2008
A. Trading Behavior			
Time spent on project	**0.088**	0.736	0.168
Number of trades	**0.001**	**0.004**	0.129
Number of different assets traded	**0.025**	**0.001**	0.551
B. Risk Aversion			
Short stock	**0.001**	**0.006**	**0.036**
Buy futures	**0.005**	**0.013**	0.274
Sell futures	**0.000**	**0.004**	**0.014**
Buy options	0.224	0.352	0.567
Sell options	**0.035**	0.125	0.176
Derivatives trades (all)	**0.002**	**0.013**	**0.061**
Std. dev of returns	**0.003**	**0.003**	**0.081**
Portfolio beta	0.816	0.697	0.949
C. Returns			
Returns (net)	0.713	0.982	0.704
Sharpe ratio	0.143	0.444	0.298

Notes: Bold p-values represent a 10 percent level of significance or better.

These results are consistent with the research relating to gender differences in tendencies toward overconfidence. Lewellen, Lease and Schlarbaum (1977) and Barber and Odean (2001) also show that men spend more time on security analysis and trade more than women. This evidence rejects the first hypothesis that males are no more overconfident than females.

We also find evidence rejecting the (second) hypothesis that men and women are equally risk-averse. From Panel B, we find that men short stocks more than women and engage in more risky derivatives transactions than women. Moreover, at least one measure of portfolio risk (standard deviation) is higher for men than women. Overall, the evidence for differences in risk aversion is consistent with prior studies of gender dissimilarities (Hersch, 1996; Pacula, 1997; Jianakoplos & Bernasek, 1998; Barber & Odean, 2001).[7] In terms of the full sample, men purchased 244 futures contracts versus 30 contracts purchased by women. Likewise, men sold 195 futures contracts versus 15 sold by women. Finally, buying and selling options totaled 202 for men and only 17 for women.

[7] Derivative choices available for student trading include futures in financial indices, currencies, petroleum, metals, interest rates, grain and oil seeds, food and fibers, and livestock. Options are available for stocks and futures.

Our third hypothesis proposed that there is no difference in the returns earned by male and female students. Interestingly, we find no significant gender-based differences in the net or risk-adjusted returns (Panel C).[8] These results are not consistent with previous findings of Bliss and Potter (2002), where women earned significantly higher (raw) returns than men. We speculate that this could be because of the nature of the classroom simulation. In particular, the fact that students are constrained for pedagogical purposes by a certain *minimum* number and type of trades might actually take away from the overall profitability of some of the strategies employed.

Conclusions

Stock-Trak© provides students with a reasonably realistic market simulation in order to familiarize students with managing a portfolio in the "real world." The goal for each student is to accumulate the most wealth by investing in stocks, bonds, mutual funds, and derivatives. The data from the project provides an interesting opportunity to examine differences in trading conduct by gender. This is because particular socio-economic conditions do not play a direct part in decision-making. It might well be that gender-based differences, if any, stem from the way men and women are inherently or biologically "wired".

Our study provides evidence that there are differences in the trading behavior of men and women students. First, we find that males appear to be overconfident relative to females. Males spend more time on the project, make more trades, and trade in more assets than women. Second, we provide some evidence that men are less risk-averse than women. Men are involved in more short sales and enter more derivatives transactions than women. Additionally, portfolio standard deviations are higher for males than for females. Third, we find no differences in returns between genders. This result is contrary to prior literature documenting significant differences in gender-based returns.

The riskier behavior of men has recently been linked to high testosterone, which is a result of biological traits developed in the womb. Accordingly, some point out that the differences in overconfidence and risk-aversion between males and females may have played a role in the current credit crisis. The implication is that a greater percentage of women in the financial sector might have balanced out the riskier behavior of men.

As the global financial crisis deepens, the first rumblings of a gender revolution are underway in an industry long controlled by men.[9] Banks, hedge funds and other financial organizations that have led the international economy's downward spiral are overwhelmingly male-dominated. The regulators and legislators assigned to oversee the financiers are also mostly men. Iceland is leading the way in attempting to alter the gender balance in finance. Since its economic collapse in January 2009, the island nation now has a female prime minister, and women lead two of its three major banks, replacing men who were blamed for crashing the institutions with reckless excess.

Amid the debate about whether the financial crisis would have happened, or been as severe, if more women had been in charge, it is likely that more women will be taking part in the global rescue. Thus the need for gender-based analysis of financial decision-making assumes even greater importance.

References

Bajtelsmit, Vickie, and Alexandra Bernasek. 1996. "Why do Women Invest Differently than Men?" *Financial Counseling and Planning* 7: 1-10.

Barber, Brad, and Terrance Odean. 2001. "Boys will be Boys: Gender, Overconfidence, and Common Stock Investment." *The Quarterly Journal of Economics* 116: 261-293.

Becker, Gary S. (1975). *Human Capital* (2nd ed.). New York, NY. National Bureau of Economic Research.

Beyer, S., and E.M. Bowden. 1997. "Gender Differences in Self-perceptions: Convergent Evidence from Three Measures of Accuracy and Bias." *Personality and Social Psychology Bulletin* 23: 157-172.

[8] Students did not consistently report the Treynor Measure or Jensen's Alpha and so we ignore these in the analysis.

[9] In the United States, women hold 17 percent of the corporate directorships and 2.5 percent of the CEO posts in the finance and insurance industries, according to Catalyst, a U.S.-based nonprofit group that promotes opportunities for women in business.

Bliss, Richard, and Mark Potter. 2002. "Mutual Fund Managers: Does Gender Matter?" *The Journal of Business and Economic Studies* 8: 1-17.

Deaux, Kay, and Elizabeth Farris. 1977. "Attributing Causes for One's Own Performance: The Effects of Sex, Norms, and Outcome." *Journal of Research in Personality and Social Psychology* 11: 59-72.

Hersch, Joni. 1996. "Smoking, Seat Belts, and Other Risky Consumer Decisions: Differences by Gender and Race." *Managerial and Decision Economics* 17: 471-481.

Jianakoplos, Nancy A., and Alexandra Bernasek. 1998. "Are Women More Risk Averse?" *Economic Inquiry* 36: 620-630.

Lenny, E. (1977). "Women's Self-confidence in Achievement Settings." *Psychological Bulletin* 84: 1-13.

Lewellen, Wilbur G., Ronald C. Lease, and Gary Schlarbaum. 1977. "Patterns of Investment Strategy and Behavior among Individual Investors." *Journal of Business* 50: 296-333.

Mitchell, Dan. 2008. April 19. "Trading on Testosterone." *The New York Times.*

Niessen, Alexandra, and Stefan Ruenzi. 2005. "Sex Matters: Gender and Mutual Funds." University of Cologne: Department of Corporate Finance & Centre for Financial Research. Retrieved December 2009 from
http://www.econ-pol.unisi.it/labsi/papers2006/Niessen.pdf

Pacula, Rosalie L., 1997. "Women and Substance Use: Are Women Less Susceptible to Addiction?" *The American Economic Review* 87: 454-459.

Stein, Rob. 2009. January 13. "Born to be a Trader? Fingers Point to Yes." *The Washington Post*.

Sullivan, Kevin, and Mary Jordan. 2009. February 11. "In Banking Crisis, Guys Get the Blame." *The Washington Post*.