

# US EQUITY MUTUAL FUNDS AND THE IMPACT OF GENDER

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## **Abstract**

*It is widely known that women are underrepresented in the mutual fund industry compared to men. In this paper, I specifically examine how the gender of US equity mutual fund managers impacts risk, trading activity, and fund performance to explore potential reasons for this gender inequality. I then explore how fund managers differentially react to stress based on gender, using the 2008 Financial Crisis as a proxy. In doing so, I examine data from January 2004 to December 2018 and find that female fund managers trade significantly less and take slightly less risk compared to male fund managers. I also find that female-managed funds perform slightly worse than male-managed funds, but that only certain performance measures are significant at the 5% level, and none were significant at the 1% level; therefore, I cannot make a robust conclusion that managerial gender directly impacts performance. I then separate the dataset into three segments: The Pre-Crisis Period of 2004-2007, the Crisis Period of 2008-2009, and the Recovery Period of 2010-2018 to examine the impact of stress on risk, trading activity, and performance. My most substantial finding reveals that female fund managers significantly reduced their trading activity during the Financial Crisis of 2008, while male fund managers contrarily increased their trading activity. This difference may correlate with a higher overconfidence level in males and a heightened psychological stress response in females.*

## **I. Introduction**

Women are significantly underrepresented in the mutual fund industry. Between 1990 and 2017, the distinct number of U.S. active equity and fixed-income funds grew from approximately 1,900 to 8,500 (Sargis & Wing, 2018). Simultaneously, the number of fund manager positions increased; however, this growth has disproportionately benefitted men. Males have secured about 85-90% of these newly created roles, indicating that women have failed to gain a more dominant presence in the mutual fund industry despite increased opportunities (Sargis & Wing, 2018).

Is there a behavioral avenue that can be used to investigate the disproportionate prevalence of male mutual fund managers? If markets were perfectly efficient, certain manager characteristics would not be associated with various successful fund characteristics. However, previous literature has found that markets are not efficient in that some mutual fund managers perform differently than others or exhibit varying behavioral tendencies. These findings are relevant for fund investors because the fund manager's gender is easily attainable and observable information that can be used as an indication for managerial behavior.

In this paper, I choose to analyze the characteristics of mutual funds for several reasons. First, the mutual fund industry creates a reliable setting to analyze gender discrepancies because the observed behavior is not skewed by an artificial, experimental setting. In addition, quantitative statistics reflect behavioral consequences and can be reviewed and manipulated for analysis. Lastly, focusing on professional money managers allows me to control for wealth and knowledge differences between individuals.

Based on the body of existing literature, I hypothesize that female fund managers take less risk and trade less relative to male fund managers, but do not differ significantly in fund performance. I also hypothesize that these differences in trading activity and risk will be more pronounced during times of financial distress due to males' overconfidence and females' heightened neurobiological responses to stressful events.

In order to test these hypotheses, I begin by analyzing risk, trading activity, and fund performance of male managers versus female managers between January 2004 and December 2018. I then separate the full dataset into 3 periods: 2004 – 2007 (pre-crisis), 2008 – 2009 (crisis), and 2010 – 2018 (recovery). During each time period, I analyze all three variables (risk, trading activity, and performance) to determine the financial crisis's impacts on managers based on their genders.

I ultimately find that female fund managers trade significantly less and take slightly less risk compared to

male fund managers, but I cannot reliably conclude that there is a significant difference in fund performance based on gender. In addition, I find that female fund managers greatly reduced their trading activity compared to males during the 2008 Financial Crisis (at a 1% significance level), while male fund managers increased their trading activity during this time of stress. After summarizing my findings, I discuss the limitations and implications of my research and propose potential explanations for the underrepresentation of women in the mutual fund industry.

## II. Literature Review

*Sex Matters: Gender and Mutual Funds* by Niessen & Ruenzi (2006) serves as the foundation for my research, and I contribute to this literature by updating a portion of their studies with more recent data (January 2004 to December 2018). The authors investigate gender differences among US equity mutual fund managers in terms of levels of risk-taking, investment styles, fund performance, trading activity, asset inflows, size/establishment level, and geographic location from January 1994 to December 2003. Through this analysis, they find that women take fewer risks, exhibit more moderate and stable investment styles, but do not differ in overall fund performance compared to male managers. They also find that female-led funds experience lower inflows. In terms of size/establishment level, they find that the large/well-established fund families are more likely to employ women, while fund companies located in conservative states and states with more negative attitudes towards women employ less women. I base my regressions off of Niessen and Ruenzi's empirical framework in an attempt to determine if their findings on risk, fund performance, and trading activity have changed for the more recent time period of 2004 - 2018. I also build upon their research by examining each of these variables in the context of the Financial Crisis of 2008 in order to investigate the differing impacts of financial stress based on gender.

The literature regarding the risk aversion of males versus females has produced mixed results. *Do Female Mutual Fund Managers Manage Differently?* by Atkinson, Baird, and Frye (2003) examines the performance and investment behavior of female fixed-income mutual fund managers compared to male fixed-income mutual fund managers. They find that male- and female-managed funds do not differ significantly in terms of performance or risk, but that net asset flows into funds managed by females are lower than the funds managed by males. They also find evidence that gender influences the decision-making of mutual fund investors. However, a meta-analysis of 150 studies performed by Byrnes, Miller, and Schafer (1999) revealed that women exhibit greater risk aversion than their male counterparts.

Barber and Odean (2001) found that men trade more frequently than women, and this increased trading

activity (higher turnover ratio) can hurt fund performance. They find a negative relationship between turnover and fund performance, attributing this correlation to fund managers' overconfidence about their trading abilities. Excessive trading then leads to higher transaction costs that do not yield higher fund returns. Estes and Hosseini (1988) and Gysler, Kruse, and Schubert (2002) also found that the degree of overconfidence is higher for men than for women. However, Sargis & Wing (2018) argue that there are no significant performance differences between U.S. funds managed by men versus those managed by women between 2003 and 2018. Since the existing literature on the levels of risk aversion and performance patterns based on gender is inconsistent, I chose to research this topic further.

Purely psychological literature has found that women exhibit a greater and more intense neurobiological response to stress in the brain (Handa & Mcgovern, 2017). When exposed to a stressor, women experience greater and more prolonged secretions of ACTH and adrenal corticosteroids, hormones involved in the brain's stress response (Handa & Mcgovern, 2017). This research provides evidence that females experience more sensitive and intense stimulus reactivity, which may stem from the interaction of estrogen with these stress hormones (Handa & Mcgovern, 2017). Understanding the differences in stress responses between males and females is relevant because it may help explain or predict fund managers' behavior during times of financial distress.

## III. Data & Hypotheses Construction

To investigate such gender-based differences between fund managers, I gathered my data from CRSP Mutual Fund Database. It covers U.S. open-end mutual funds and contains information on returns, management structures, total net assets, turnover ratios, fund managers' identity, and other fund characteristics. In the CRSP database, a field denoting the gender of the fund's manager does not exist. However, the first name of the manager is listed. Using a list published by the U.S. Social Security Administration on baby names, I sorted the first names of the manager into a male and female category. To analyze this information, I created a dummy variable denoted FemDummy; this variable equals 1 if the manager is classified as female and 0 if the manager is classified as male. Between January 2004 and December 2018, I collected panel data on 84,175 different funds, of which 8,922 were female-managed (10.6%) and 75,2523 were male-managed (89.4%).

Baer, Kempf, and Ruenzi (2005) find that team- and single-managed funds behave differently. To limit these confounding effects, I only analyze single-managed funds and drop team-managed funds and funds that have multiple managers listed in CRSP from my dataset. This choice enables me to distinguish between differences due

to management structure (team- vs. single-managed) from differences due to gender (female- vs. male-managed).

In addition, I control for a variety of variables in my regressions in order to more robustly distinguish the effect of gender. For example, I take into account the fund size – I place each unique fund into an even quartile based on the fund’s net total assets. I also control for the expense ratio, which is the ratio of the total investment shareholders pay for the fund’s operating expenses. I control for manager tenure, which is the difference between the current date and the date the manager took control of the fund. In each regression, I also include year fixed effects and fund type effects. I created “fund type” dummy variables in which I placed each fund into one of five groups based on the four most prevalent categories of funds (large-cap, mid-cap, small-cap, and multi-cap), and then the fifth category encompasses “all other”. Including these variables in the regressions allows me to attribute my results to the manager’s gender with a greater level of certainty and reliability.

I am modeling my empirical format off of Niessen and Ruenzi’s (2006) framework and contribute to their work by updating three of their hypotheses with more recent data. Furthermore, I am building upon their research by also evaluating how an environment characterized by financial stress impacts these variables. Below are the time-series regressions I run for each hypothesis:

#### Hypothesis 1: Risk-Taking

I hypothesize that female mutual fund managers take less risk. I test this hypothesis by running the regression below:

$$\text{FundRisk}_{i,t} = \beta 1(\text{FemDummy})_{i,t} + \beta 2(\text{Size})_{i,t} + \beta 3(\text{Tenure})_{i,t} + \sum_{y=2004}^{2018} D_y + \sum_k \beta_k (\text{Fund Type}) + \epsilon_{i,t}$$

$\text{FundRisk}_{i,t}$  is given by fund  $i$ ’s monthly return standard deviation in year  $t$ .  $\text{FemDummy}_{i,t}$  is an indicator variable that equals 1 if the manager of the respective fund is female and equals 0 otherwise.  $\text{Size}_{i,t}$  denotes the size of the fund and is separated into four, even quartiles by net total assets (in millions USD); it serves as a control to account for differences in fund size.  $\text{Tenure}_{i,t}$  denotes the fund manager’s tenure (in years), calculated as the difference between the current date and the date the manager started at the fund.  $D_y$  is a set of yearly dummy variables to account for year-specific effects.  $\text{FundType}_{i,t}$  is a set of dummy variables to account for effects specific to fund-type: large-cap, mid-cap, small-cap, multi-cap, and all other.  $\epsilon_{i,t}$  is the error term, which is clustered by fund number.

#### Hypothesis 2: Trading Activity

I hypothesize that female mutual fund managers trade less compared to male fund managers. I test this hypothesis by running the regression below:

$$\text{Turnover}_{i,t} = \beta 1(\text{FemDummy})_{i,t} + \beta 2(\text{Size})_{i,t} + \beta 3(\text{Tenure})_{i,t} + \sum_{y=2004}^{2018} D_y + \sum_k \beta_k (\text{Fund Type}) + \epsilon_{i,t}$$

$\text{Turnover}_{i,t}$  is a fund’s annual turnover ratio, as defined above.  $\text{Size}_{i,t}$  denotes the size of the fund and is separated into four, even quartiles by net total assets (in millions USD). It serves as a control to account for differences in fund size.  $\text{Tenure}_{i,t}$  denotes the fund manager’s tenure (in years), calculated as the difference between the current date and the date the manager started at the fund.  $D_y$  is a set of yearly dummy variables to account for year-specific effects.  $\text{FundType}_{i,t}$  is a set of dummy variables to account for effects specific to fund-type: large-cap, mid-cap, small-cap, multi-cap, and all other.  $\epsilon_{i,t}$  is the error term, which is clustered by fund number.

#### Hypothesis 3: Performance

I hypothesize that female mutual fund managers do not significantly differ in fund performance compared to male managers. I test this hypothesis by running the regression below:

$$\text{Perf}_{i,t} = \beta 1(\text{FemDummy})_{i,t} + \beta 2(\text{Size})_{i,t} + \beta 3(\text{Expenses})_{i,t} + \beta 4(\text{Tenure})_{i,t} + \sum_{y=2004}^{2018} D_y + \sum_k \beta_k (\text{Fund Type}) + \epsilon_{i,t}$$

$\text{Size}_{i,t}$  denotes the size of the fund and is separated into four, even quartiles by net total assets (in millions USD). It serves as a control to account for differences in fund size.  $\text{Expenses}_{i,t}$  denotes fund  $i$ ’s yearly total expense ratio in year  $t$ , which equals the ratio of total investment that shareholders pay for the fund’s operating expenses.  $\text{Tenure}_{i,t}$  denotes the fund manager’s tenure (in years), calculated as the difference between the current date and the date the manager started at the fund.  $\text{FundType}_{i,t}$  is a set of dummy variables to account for effects specific to fund-type: large-cap, mid-cap, small-cap, multi-cap, and all other.  $\epsilon_{i,t}$  is the error term, which is clustered by fund number. The dependent variable is  $\text{Perf}_{i,t}$ , which is the performance of fund  $i$  in year  $t$ , and it is measured by abnormal returns from the one-, three-, and four-factor models. These were calculated by estimating the following

OLS regressions using the Ken French Fama/French Factors:

$$R_{i,m,t} - R_{f,m,t} = \alpha_{i,t} + \beta_{i,M,t}(R_{M,m,t} - R_{f,m,t}) + \varepsilon_{i,m,t},$$

$$R_{i,m,t} - R_{f,m,t} = \alpha_{i,t}^{TF} + \beta_{i,M,t}(R_{M,m,t} - R_{f,m,t}) + \beta_{i,S,t}SMB_{m,t} + \beta_{i,H,t}HML_{m,t} + \varepsilon_{i,m,t}^{TF},$$

$$R_{i,m,t} - R_{f,m,t} = \alpha_{i,t}^{FF} + \beta_{i,M,t}(R_{M,m,t} - R_{f,m,t}) + \beta_{i,S,t}SMB_{m,t} + \beta_{i,H,t}HML_{m,t} + \beta_{i,MO,t}MOM_{m,t} + \varepsilon_{i,m,t}^{FF},$$

$R_{i,m,t} - R_{f,m,t}$  denotes fund  $i$ 's excess return over the risk-free rate in month  $m$  of year  $t$ .  $R_{M,m,t} - R_{f,m,t}$  denotes the excess return of the market segment the fund operates in over the risk-free rate, respectively.  $SMB_{m,t}$  is the return difference between small and large capitalization stocks.  $HML_{m,t}$  denotes the return difference between high and low book-to-market stocks.  $MOM_{m,t}$  is the return difference between stocks with high and low previous year returns in month  $m$  of year  $t$ . The resulting estimated alphas (CAPM, three-factor, and four-factor) serve as my performance measures for fund  $i$  in year  $t$ .

After running each regression for the full time period of 2004 to 2018, I subsequently separate the dataset into three different segments to account for the 2008 Financial Crisis. The first time period is 2004-2007 (pre-crisis), the second is 2008-2009 (during the crisis), and the last is 2010-2018 (recovery from the crisis). I re-run each regression for each distinct time period in order to compare the results and determine how stress impacts risk, trading activity, and performance.

## IV. Results and Discussion

Overall, my findings are consistent with Niessen and Ruenzi's findings – women trade less and take less risk compared to male fund managers, but I cannot make a definite conclusion that fund performance differs based on gender.

### IV. A. Male versus Female Managers: 2004-2018

To analyze the data from January 2004 to December 2018, I identify five significant fund characteristics in Table I below: fund size, the expense ratio, the fund's turnover ratio, manager tenure, and the fund's risk. I also

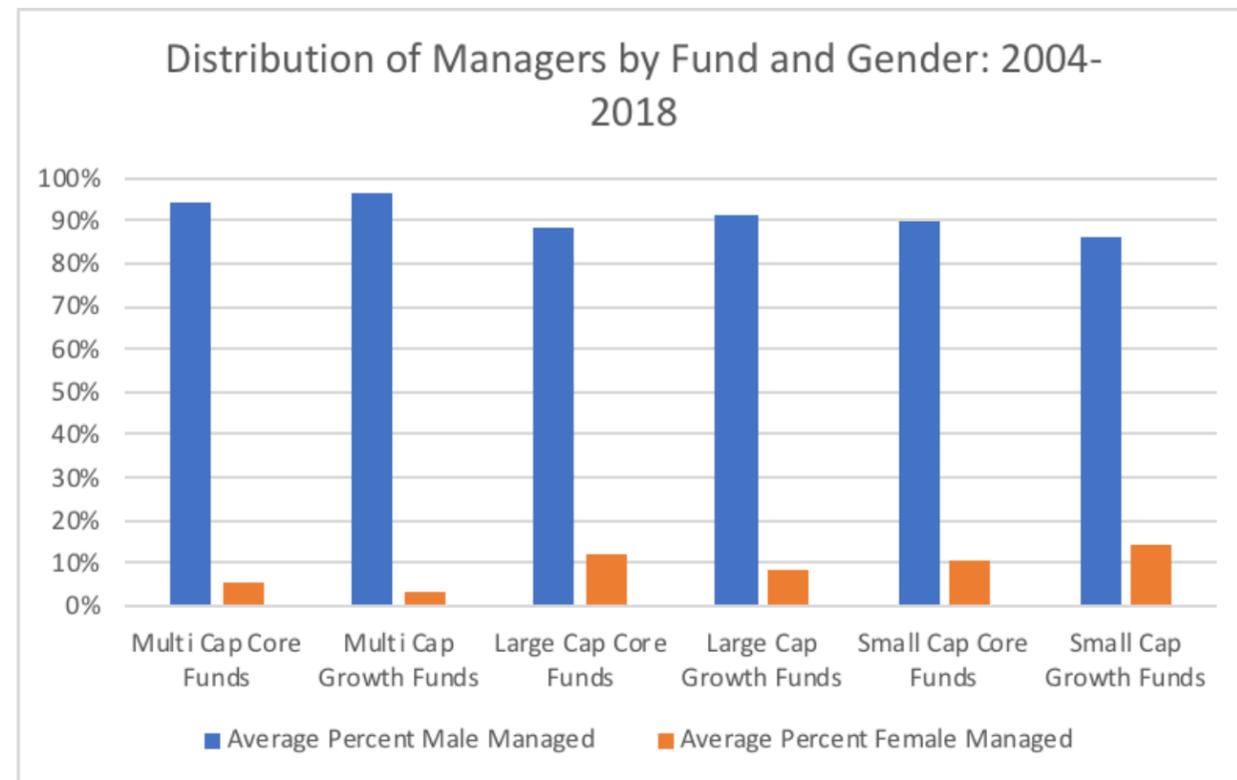
record the total number of observations. I find that males hold significantly larger funds than female managers. They also exhibit a higher turnover ratio, which means they trade more. They also take more risk, but only slightly more than female fund managers. I do not see a difference in the expense ratio based on gender, but it appears that males have a slightly higher tenure than females. Lastly, there are significantly more male-managed funds in the sample than female-managed funds (75,253 male-managed versus 8,922 female-managed).

Table I: Average Fund Characteristics: 2004-2018

	Full Sample	Female Manager	Male Manager
<b>Fund Size</b> (Total net assets, millions)	679.793	435.154	708.849
<b>Expense Ratio</b> (%)	0.0121	0.0120	0.0121
<b>Turnover Ratio</b>	0.9496	0.6963	0.9768
<b>Tenure</b> (years)	5.31	4.94	5.36
<b>Risk</b> (standard deviation of monthly returns)	0.03231	0.02735	0.03223
<b>Total Count of Unique Funds</b>	84,175	8,922	75,253

I then constructed Figure 1 using the five most prevalent fund types in the dataset (containing the most observations) in order to examine the breakdown of gender based on the type of fund being managed. I find that all five largest fund types are male-dominated by a significant amount. Females exhibit the largest managerial presence in small cap growth funds, but there is not a significant difference compared to the other four funds. In each of the regressions I conduct, I control for fund type by separating the funds into five groups: large-cap, mid-cap, small-cap, multi-cap, and all other.

Figure I: Average Distribution by Gender and Fund Type: 2004-2018



In terms of risk-taking, I find that female fund managers take slightly less risk than males, and that this difference is statistically significant at the 1% level (as shown in Table II). They also have a much lower turnover ratio than males at the 1% significance level, meaning they trade less than male fund managers (as shown in Table III). However, only the CAPM-alpha and the Four-Factor alpha were significant at the 5% level when all control variables and fixed effects were included (Tables IV, V, VI). All other performance measures were not significant, and none were significant at the 1% level. For the two measures that were significant, the coefficients on FemDummy (the dummy variable equaling 1 if the manager is female) were extremely small. This result suggests that female fund managers are associated with only a very *slightly* lower performance measure compared to male fund managers. Thus, given that the R-Squared values are so low and the coefficients on FemDummy are not significant at the 1% level, I cannot make a robust conclusion that managerial gender impacts fund performance. Moreover, as I will analyze later in the paper, trimming the full dataset into segments does not produce any significant disparity in performance (for any of the three measures) based on gender. This finding is important because it suggests that a difference in performance is not a valid explanation for the underrepresentation of female managers in the mutual fund industry.

Table II: Risk: 2004-2018

Dependent variable: risk (standard deviation of monthly returns for fund  $i$  in year  $t$ )

	(1)	(2)	(3)
<b>Regressors</b>			
<b>FemDummy</b>	-0.00215***	-0.00222***	-0.00181***
<b>Size</b>	--	-0.00156***	-0.00144***
<b>Tenure</b>	--	--	-0.00019***
<b>Fund Type Effects</b>	No	No	Yes
<b>Year Fixed Effects</b>	Yes	Yes	Yes
<b>R Squared</b>	0.1536	0.1564	0.2329
<b>Observations</b>	82,755	82,105	81,295
<b>Errors</b>	Clustered by fund number	Clustered by fund number	Clustered by fund number

\*\*\* 1% significance, \*\* 5% significance, \* 10% significance

Table III: Trading Activity: 2004-2018

Dependent Variable: turn\_ratio

(the ratio of the fund's holdings that have been replaced in a given year; Minimum of aggregated sales divided by the average 12-month net total assets of the fund)

	(1)	(2)	(3)
<b>Regressors</b>			
<b>FemDummy</b>	-0.2982***	-0.3041***	-0.3364***
<b>Size</b>	--	-0.1133***	-0.0842***
<b>Tenure</b>	--	--	-0.0253***
<b>Fund Type Effects</b>	No	No	Yes
<b>Year Fixed Effects</b>	Yes	Yes	Yes
<b>R Squared</b>	0.0010	0.0015	0.0023
<b>Observations</b>	78,344	77,826	77,205
<b>Errors</b>	Clustered by fund number	Clustered by fund number	Clustered by fund number

\*\*\* 1% significance, \*\* 5% significance, \* 10% significance

Table IV: Performance: 2004-2018 – CAPM Alpha

Dependent Variable: capm\_alpha

	(1)	(2)	(3)
<b>Regressor</b>			
<b>FemDummy</b>	-0.00015	-0.00012	-0.0002**
<b>Size</b>	--	0.0006***	0.0005***
<b>Expense Ratio</b>	--	--	-0.06162***
<b>Tenure</b>	--	--	-0.00002**
<b>Fund Type Effects</b>	No	No	Yes
<b>Year Fixed Effects</b>	Yes	Yes	Yes
<b>R Squared</b>	0.0857	0.0899	0.0979
<b>Observations</b>	84,169	83,491	82,357
<b>Errors</b>	Clustered by fund number	Clustered by fund number	Clustered by fund number

\*\*\* 1% significance, \*\* 5% significance, \* 10% significance

Table V: Performance: 2004-2018 –Three-Factor Alpha

Dependent Variable: ff3\_alpha

	(1)	(2)	(3)
<b>Regressor</b>			
<b>FemDummy</b>	-0.000028	-7.25e-06	-0.00013
<b>Size</b>	--	0.00049***	0.00029***
<b>Expense Ratio</b>	--	--	-0.10594***
<b>Tenure</b>	--	--	8.18e-06
<b>Fund Type Effects</b>	No	No	Yes
<b>Year Fixed Effects</b>	Yes	Yes	Yes
<b>R Squared</b>	0.0752	0.0783	0.0895
<b>Observations</b>	84,169	83,491	82,357
<b>Errors</b>	Clustered by fund number	Clustered by fund number	Clustered by fund number

\*\*\* 1% significance, \*\* 5% significance, \* 10% significance

Table VI: Performance: 2004-2018 – Four-Factor Alpha

Dependent Variable: ff4\_alpha

	(1)	(2)	(3)
<b>Regressor</b>			
<b>FemDummy</b>	-0.00010	-0.00007	-0.00020**
<b>Size</b>	--	0.00045***	0.00017**
<b>Expense Ratio</b>	--	--	-0.13870***
<b>Tenure</b>	--	--	5.42e-06
<b>Fund Type Effects</b>	No	No	Yes
<b>Year Fixed Effects</b>	Yes	Yes	Yes
<b>R Squared</b>	0.0804	0.0834	0.0978
<b>Observations</b>	84,169	83,491	82,357
<b>Errors</b>	Clustered by fund number	Clustered by fund number	Clustered by fund number

\*\*\* 1% significance, \*\* 5% significance, \* 10% significance

#### IV. B. Average Fund Characteristics: By Time Period

Next, I analyze average fund characteristics during three distinct time periods based on the 2008 Financial Crisis, as shown in Table VII. When both male and female managers were included together, I found that the average fund size was the largest during the recovery period, and the expense ratio, risk, and turnover ratio were all the greatest during the crisis. It is important to take into account that risk measure during 2008 - 2009 likely captures the high volatility of holdings due to increased financial distress during this time.

Table VII: Full Sample

	<b>Full Sample 2004-2007</b>	<b>Full Sample 2008-2009</b>	<b>Full Sample 2010-2018</b>
<b>Fund Size</b> (Total net assets, mil- lions)	570.039	538.663	766.087
<b>Expense Ratio</b> (%)	0.0087	0.1244	0.0116
<b>Turnover Ratio</b>	0.9857	1.1327	0.8921
<b>Risk</b> (standard deviation of monthly returns)	0.02513	0.05494	0.03043
<b>Total Count of Unique Funds</b>	24,067	11,302	48,806

Table VIII displays the results of examining only female-managed funds. I found that fund size and risk generally mirrored the full sample trends; however, turnover was the highest in the recovery period and lowest during the crisis. All of the numbers were below the average full sample results, though this trend likely results from the fact that the amount of female-managed funds is much lower than the amount of male-managed funds.

Table VIII: Average Female-Managed Fund Characteristics: By Time Period

	<b>Female Manager 2004-2007</b>	<b>Female Manager 2008-2009</b>	<b>Female Manager 2010-2018</b>
<b>Fund Size</b> (Total net assets, millions)	359.411	371.411	514.792
<b>Expense Ratio</b> (%)	0.0122	0.0119	0.0119
<b>Turnover Ratio</b>	0.6695	0.6030	0.7435
<b>Risk</b> (standard deviation of monthly returns)	0.01705	0.04534	0.02893
<b>Total Count of Unique Funds</b>	3,196	1,493	4,223

Table XI shows the average characteristics segmented by time period of only male-managed funds. All variables followed the full sample trends, which stands to reason given that the full sample is comprised of 89.4% male-managed funds. Notably, in direct contrast to female-managed funds, male managers actually increased their trading during the time of the crisis.

Table IX: Average Male-Managed Fund Characteristics: By Time Period

	<b>Male Manager 2004-2007</b>	<b>Male Manager 2008-2009</b>	<b>Male Manager 2010-2018</b>
<b>Fund Size</b> (Total net assets, millions)	602.499	564.19	789.941
<b>Expense Ratio</b> (%)	0.0081	0.0125	0.0116
<b>Turnover Ratio</b>	1.0269	1.2049	0.9056
<b>Risk</b> (standard deviation of monthly returns)	0.02292	0.05557	0.03148
<b>Total Count of Unique Funds</b>	20,871	9,809	44,573

#### IV. C. Risk: By Time Period

Next, I examined risk during each time period, and Table X summarizes my regression results. I found that female fund managers take less risk than males in each period by a very small amount, though statistically significant, amount at the 1% level. They exhibit the largest difference in risk (take the least amount of risk) compared to male managers during the financial crisis.

Table X

Dependent variable: Risk

<i>Regressors</i>	<b>2004-2007</b>	<b>2008-2009</b>	<b>2010-2018</b>
<b>FemDummy</b>	-0.00244***	-0.00598***	-0.00165***
<b>Size</b>	-0.00041***	-0.00287***	-0.00102***
<b>Tenure</b>	-0.00016***	-0.00580***	-0.00027***
<b>Fund Type Effects</b>	Yes	Yes	Yes
<b>Year Fixed Effects</b>	Yes	Yes	Yes
<i>R Squared</i>	0.2176	0.2238	0.1257
<i>Observations</i>	23,411	10,832	47,052
<i>Errors</i>	Clustered by fund number	Clustered by fund number	Clustered by fund number

\*\*\* 1% significance, \*\* 5% significance, \* 10% significance

#### IV. D. Trading Activity: By Time Period

In addition to risk, I examine trading activity by time period, and my regression results are summarized in Table XI. I found that female fund managers have a lower turnover ratio than male managers in all three time periods. They exhibit the greatest difference in turnover compared to male managers during the crisis and the smallest difference pre-crisis; these results are statistically significant at the 1% level. This outcome likely arises from a higher level of overconfidence in men compared to women, as previously established in existing literature (Barber & Odean, 2001). Due to this overconfidence, male managers overestimate their abilities, knowledge, and future prospects which causes them to trade more excessively than female managers. Rational theory states that investors will trade only if their expected gains are greater than their transaction costs. However, overconfident investors overestimate their potential trading gains and thus engage in trades even when their expected gains are minimal or negative (Barber & Odean, 2001). Psychological differences could serve as an additional contributory explanation. In particular, previous research has established that women experience more intense

neurobiological stress responses compared to men, which might explain their extreme reduction in trading activity during the crisis. The interaction of psychological factors with a stressful environment may intensify the overconfidence effect that men tend to exhibit causing them to trade more, while it may serve as negative feedback for women and cause them to pull back their trading activity even further.

Table XI

Dependent Variable: turn\_ratio

<i>Regressors</i>	<b>2004-2007</b>	<b>2008-2009</b>	<b>2010-2018</b>
<b>FemDummy</b>	-0.07757*	-0.5495***	-0.2009**
<b>Size</b>	-0.07025***	-0.08751***	-0.07420***
<b>Tenure</b>	0.00072	-0.01146	-0.03010***
<b>Fund Type Effects</b>	Yes	Yes	Yes
<b>Year Fixed Effects</b>	Yes	Yes	Yes
<i>R Squared</i>	0.0121	0.0145	0.0017
<i>Observations</i>	21,403	10,155	45,647
<i>Errors</i>	Clustered by fund number	Clustered by fund number	Clustered by fund number

\*\*\* 1% significance, \*\* 5% significance, \* 10% significance

#### IV. E. Performance: By Time Period – Four-Factor Alpha

Table XII includes my regression results measuring performance based on the three time periods. I utilized the four-factor alpha for this analysis because it seems to be the most robust and comprehensive measure for performance, as it takes into account small versus large cap stocks, high versus low book-to-market stocks, and high versus low previous year returns. I found that none of the three time periods yielded a significant difference in performance if the fund manager is female versus male.

Table XII

Dependent Variable: ff4\_alpha

<i>Regressors</i>	<b>2004-2007</b>	<b>2008-2009</b>	<b>2010-2018</b>
<b>FemDummy</b>	-0.00009	0.000076	-0.00026
<b>Size</b>	-0.00008	0.00022***	0.00028***
<b>Expense Ratio</b>	-0.17596***	-0.03392**	-0.12801*
<b>Tenure</b>	-0.00004***	0.00007***	0.00002*
<b>Fund Type Effects</b>	Yes	Yes	Yes
<b>Year Fixed Effects</b>	Yes	Yes	Yes
<b>R Squared</b>	0.1361	0.0737	0.0934
<b>Observations</b>	23,771	11,032	47,554
<b>Errors</b>	Clustered by fund number	Clustered by fund number	Clustered by fund number

\*\*\* 1% significance, \*\* 5% significance, \* 10% significance

#### IV. F. Validity of Findings

In order to properly evaluate the validity of these findings, it is important to examine both internal and external validity. Internal validity refers to the approximate truth about the inferences regarding causal relationships that have been generated through my regressions, while external validity refers to the ability to generalize my findings to a larger context.

In terms of internal validity, it is important to note that I do not account for lagged performance or other lagged variables in my regression analyses. Though I attempted to control for the managers' education level, I could not locate information on CRSP on managers' educational background. I also did not have data on the specific holdings of these funds, so I was unable to control for that variable when running my regressions. Collectively, these factors may lead to omitted variable bias, which could have several implications for my research. For one, it could be argued that female managers' lower trading activity could be explained by the fact that females manage,

on average, smaller funds and thus trade smaller stocks, which are typically more expensive. While obtaining information on the holdings of funds would allow me to rule out this potential line of thinking using regression analysis, I believe my research can refute this explanation. When I examined turnover by time period, I found that females held an average fund size of \$359.411 million in 2004-2007 and \$371.411 million in 2008-2009. Even though their fund size was smaller in 2004-2007, their average turnover ratio was actually larger in this period (0.6695 in 2004-2007 and 0.6030 in 2008-2009). As such, managing a smaller fund does not seem to have a strong, direct impact on trading activity.

Omitted variable bias could also potentially explain why most of the coefficients on FemDummy in the performance regressions were not statistically significant, despite significant increased turnover for male managers compared to female managers. Barber and Odean (2001) previously established that increased trading activity is associated with lower returns (worse performance), but I did not find that to be true in my research. Although an internal validity problem could be masking this pattern, an alternative explanation could be that turnover is not tied as tightly to performance because many other factors impact fund returns (IQ, educational background, firm characteristics, etc.).

Another restriction of my research is that my risk measure is not fully comprehensive because I do not specifically evaluate systematic risk versus unsystematic risk or that smaller funds are likely riskier. Consequently, analyzing more specific measures of risk could yield different results. In the future, further research on this area can be conducted to more thoroughly investigate risk taken on by mutual funds based on managerial gender.

My utilization of an unbalanced panel dataset poses a third limitation of my research. Specifically, each fund may not have data for all of the years in the sample period. However, when I balanced the dataset and dropped any fund that did not have data for all 15 years in the full sample, my sample size was reduced down to only 409 total funds. Having such a small sample size seemed like a greater threat to internal validity, so I kept the data unbalanced. Furthermore, I expected the number of female fund managers to increase over time due to industry cultural changes and pushes for diversity. An unbalanced dataset would account for these factors, thereby supporting my decision to keep it in its current form.

Lastly, I acknowledge that the R-squared in all of my regressions is extremely small. This result likely corresponds to the large size of the dataset, which inherently contains some degree of unexplainable variation, and the very small proportion of female managers in the dataset (~10%). However, I argue that high-variability

data can still demonstrate significant trends – even if the R-squared is low, low P values can still indicate a strong relationship. Measures of risk and turnover were both significant at the 1% value, so the low R-squared is not a large internal validity concern.

In terms of external validity, I only use mutual funds from the United States in my research, and they are only equity funds (investing in common stock). Therefore, my results might not apply to funds that invest in debt or a mixture of both. The results also may not be generalizable outside of the United States due to differing macroeconomic conditions in each country.

## V. Conclusion

In this paper, I aim to explore how the gender of US equity mutual fund managers impacts risk-taking, trading activity, and fund performance. I also examine how the Financial Crisis of 2008 affects these variables in order to investigate how female managers behave under stress compared to their male counterparts. Using the full dataset from 2004 – 2018, I find that female fund managers trade less and take less risk than male fund managers, but that there is no significant difference in performance. Analyzing the time period of 2008 – 2009 in comparison to 2004 – 2007 and 2010 – 2018 reveals that female fund managers reduce trading significantly under stress, while male fund managers increase trading activity.

My research has numerous important implications, but my most substantial finding is that women significantly decrease their trading during a stressful financial situation, whereas male fund managers trade more. Previous literature established that men are more overconfident than women, and it seems that stress increases the magnitude of their overconfidence because they overestimate their abilities to handle problems. On the other hand, since women exhibit more reactive stress responses, situations of financial distress may create a negative feedback loop, causing women to pull back their trading even further. This information may serve as a useful indicator to predict managerial behavior if the markets start to plummet or if an alternate stress-inducing event occurs.

My research also suggests implications for gender-based hiring or promoting. If males are known to be more likely to take risks and exhibit confidence, especially in times of financial stress, funds may promote or hire certain people based on these characteristics. They also may align company objectives or values with the general personality and behavioral trends associated with males or females in order to accomplish these goals. Thus,

funds may not be hiring or promoting based on merit or performance but instead using gender cues and patterns as motivation.

Ultimately, my research aims to explore the underrepresentation of women as mutual fund managers and determine how their behavior differs from males under stress. Because performance is not a robust explanation, I suggest other potential reasons for this observed gender inequality. For example, the underrepresentation of women could be linked to general differences in personality traits – research suggests that males have higher overconfidence, greater sensation seeking behavior, and are more likely to take on more risk (Barber & Odean, 2001; Estes & Hosseini, 1988). Thus, depending on the specific fund's goals and values, males may receive preferential treatment for managerial positions. Time serves as an additional potential factor; it often takes at least 20 years to rise to become a fund manager, and in the 1980s and 1990s, women were even more underrepresented. Resultantly, it could simply require more time for women to rise up in the ranks and transition into these roles. Lastly, it is possible that culture plays a factor in terms of societal gender roles. Portfolio management is generally a time-consuming profession, and thus it might be difficult to hold such a high position (and be successful at it) while also bearing children and raising a family.

Looking forward, it is important to continue to explore fund management diversity – understanding gender disparities is an area that deserves more research and attention. There are also other related managerial characteristics that may be interesting to further explore, such as educational background (college attended, business school, etc.) or professional certifications, to name a few. More generally, a more psychological approach to financial research could help better understand the neurobiological impact of stress on men versus women. With these topics in mind, I hope that my research provides insight into how gender impacts the behavior of mutual fund managers, encouraging further research to explore to the disproportionate representation of women in the mutual fund industry.

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