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Gender differences in performance of hedge fund managers

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Abstract

This paper investigates the impact of the fund manager's gender on the hedge fund's performance. The main motivation for this paper is the underrepresentation of women in the hedge fund industry. This research was based on studies highlighting the social impediments women face and the behavioral differences across genders. This paper based its conclusion on an empirical analysis of a sample of 2176 hedge funds between January 2011 and December 2020. The results showed that female and male managed funds do not differ in performance, implying that women and men hedge fund managers have similar skills. An investigation of the risk taken by the managers showed that women hedge fund managers are more risk-seeking than their men counterparts, unlike what previous studies would have predicted. Finally, the results found in this paper indicated that the relative performance of men and women managers is not influenced by their cultural environment but that their risk preferences are. This study adds on the knowledge of gender effects but also contributes to showing that discrimination against women is not backed by any empirical grounds.

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Introduction

Even though gender balance was proven beneficial for a long time now, the finance industry remains largely male-dominated (Girardone et al., 2021). In 2019, women represented only 20% of executives and 23% of board members in the major financial services firms (Clempner et al., 2020). The hedge fund industry displays some of the strongest gender imbalances. Hedge funds are specific investment funds that are able to use complex trading techniques such as short-selling, derivatives or leverage. They are usually invested in by institutional investors and high net worth individuals, and their goal is to produce positive absolute returns. In 2017, only 1% of the assets under management of the hedge fund sector were managed by women (Fortado, 2017). Furthermore, these inequalities continue after having reached top positions as women hedge fund managers struggle to raise capital and to survive (Aggarwal & Boyson, 2016). These extreme disparities are even more striking after multiple researches pointed out that women in finance perform no worst than men, and may even outperform men (Luongo, 2011; Pham, 2015; Aggarwal & Boyson, 2016; Gan, 2016). Further research showing that women fund managers perform at least as well as their men counterparts could help change mentalities, especially in the sector of hedge funds where there are severe imbalances. In fact, showing empirically that gender discrimination is not backed by a rational explanation could change the assumptions of certain recruiters and investors. In turn, this would allow to enhance performance by taking the best of the whole population rather than only its male part. According to the World Economic Forum's Global Gender Gap Report (Schwab et al., 2017), "Female talent remains one of the most underutilized business resource". From a policy point of view, this could push governments to implement quotas in the sector of hedge funds in order to reduce discrimination and increase welfare. This is why I decided to analyze the relative performance of women and men hedge fund managers. The main question I would like to address in this paper is:

How does the hedge fund manager's gender affect the fund's performance?

This question is relevant as little research has been done on the hedge fund sector. In fact, many academic researches about the gender differences across CEOs and board members have been done (Ibrahim & Angelidis, 1994; Adams et al., 2007; Ding et al., 2013; Khan & Vieito, 2013; Wang et al., 2018) but only a few have been interested in looking at hedge fund managers (Luongo, 2011; Pham, 2015; Aggarwal & Boyson, 2016; Gan, 2016). Furthermore, the past literature on this subject does not give a definitive conclusion to this question as multiple papers contradict each other. Therefore, this paper contributes to reaching an actual conclusion. Furthermore, the use of more recent data may help to spot an evolution as compared with results found in previous researches.

This question is especially interesting as women and men are different both on a social aspect and a behavioral aspect. First, women and men are not subject to the same social norms. This leads to discrimination of women in the labor market in a lot of countries and sectors (Lyness & Thompson, 1997; Eagly & Carli, 2007; Chisholm-Burns et al., 2017; Ng & Sears, 2017; Inam et al., 2020). The difficulties women face throughout their careers could translate in needing to outperform their male counterparts. Furthermore, men and women have different investment behaviors and are more prone to specific behavioral biases which could affect their performance (Lewellen et al., 1977; Bengentsson et al., 2005; Kudryavtsev & Cohen, 2011; Buser et al., 2014; Baker et al., 2019). The field of behavioral finance has proven the impact of behavioral traits on performance and therefore it is interesting to research whether the behavioral differences across genders translate into performance differences in the sector of hedge funds.

To complement this question, I investigated whether potential differences in performance are also associated with differences in risk preferences. Some studies showed that women tend to be more risk-averse than men (Arch, 1993; Jianakoplos & Bernasek, 1998; Byrnes et al., 1999) and I decided to analyze whether such evidence is also found across hedge fund managers. Furthermore, this potential difference in risk preferences could give an explanation to a difference in performance.

I also decided to investigate whether the results found in the performance analysis and the risk analysis differ across countries by looking at where the hedge fund is implanted. There are strong differences across countries regarding the view of women in society. Among less developed countries especially, the societal place of women and men are seen as different. These anti-egalitarian views translate in stronger discrimination and glass ceiling against women which may reinforce the performance gap between female and male fund managers. Furthermore, as investment behavior is impacted by some cultural influences, the fund manager's work place may impact its investment behavior. To my knowledge, no research has been done on this aspect of the subject and it could therefore add on the knowledge of this topic.

I will start this paper with a literature review in order to build the theoretical framework of this research and derive some hypotheses. I will continue by describing the data I used for my empirical analysis and the methods I applied to draw conclusions. Then, I will present my results and conclude.

Theoretical Framework

A) Previous literature on the topic

A few researches on this topic have already been done even if it has not been extensively researched (Luongo, 2011; Pham, 2015; Aggarwal & Boyson, 2016; Gan, 2016). The previous pieces of literature covering the topic diverge in their conclusions which makes further research on the topic relevant.

Concerning the performance, some studies found that women fund managers outperform men (Luongo, 2011) while others found that they both have the same performance (Aggarwal & Boyson, 2016). These differences can arise from the fact that those studies used different measures of performance, different databases and different time frames. The study conducted by Lungo (2011) based its conclusion on the Jensen's alpha and the Sharpe ratios of the funds using the Bloomberg terminal database. On the other hand, the study by Aggarwal and Boyson (2016) measured performance as the fund's return in excess of the return of the style index corresponding to the fund's style, using the Thomson-Reuters database.

Additionally, studies going more in-depth found that women outperformed in certain circumstances while men did in others (Pham, 2015; Gan, 2016). Pham (2015) found that women outperformed during times of financial crises. Gan (2016) found that women tend to outperform during post-crisis times while men outperformed during pre-crisis times. He also adds that women outperform in certain investment styles and investment locations while men do in others.

Concerning risk preferences, similarly, some studies found that women fund managers conduct less risky investments (Luongo, 2011; Aggarwal & Boyson, 2016) while other studies found that both have similar investment risks (Pham, 2015). Again, these differences can arise from multiple factors such as the method applied or the data used.

B) Social impediments against women

The concept of "glass ceiling" refers to social barriers that prevent women from rising beyond a certain level of hierarchy. A lot of previous studies have depicted the great number of barriers that prevent women from reaching top leadership positions such as vestiges of prejudice against women, stereotypes, lack of mentors and sponsors, or family responsibilities (Eagly & Carli, 2007; Chisholm-Burns et al., 2017). A research conducted back in 1997 comparing women and men financial executives across different organizations showed that women had less authority, received fewer stock options, and had less international mobility than men (Lyness & Thompson, 1997). Nowadays, women still face a number of barriers and challenges throughout their careers as highlighted by more recent

researches (Chisholm-Burns et al., 2017; Ng & Sears, 2017; Inam et al., 2020). Progress in the field of gender equality has been made but these barriers still exist despite the fact that the inclusion of women was proven to be beneficial (Chisholm-Burns et al., 2017). This is relevant for this topic as it shows that women who became hedge fund managers had to go through a number of challenges. This could imply that women fund managers may have to outperform their male counterparts to be able to reach those positions.

Another evidence of discrimination against women is the fact that they manage smaller funds even though they offer the same returns. It was proven in a number of researches that women fund managers have fewer assets under management and lower capital inflows than men fund managers (Atkinson et al., 2003; Aggarwal & Boyson, 2016). This lack of capital translates into a higher probability of the fund's liquidation. Therefore, women may have to perform better than men in order to raise enough capital to survive.

Furthermore, it was also argued by some researchers that large capital inflows tend to deteriorate the performance of funds in the future (Ciccotello & Grant, 1996; Fung et al., 2008). Ciccotello and Grant (1996) explain that the best-performing equity funds get inflows of capital due to their success but that once they become larger they stop outperforming. When the equity funds get larger, they need to hold more stocks which dilutes the managers' best ideas. This could mean that the lack of attention and capital women face could contribute to higher performance.

The above-mentioned social impediments against women led me to the hypothesis that women hedge fund managers have to outperform men to reach and keep their position:

H1: Female hedge fund managers outperform male hedge fund managers

C) Behavioral differences of men and women

Previous literature documents differences in behavioral biases across genders. A lot of evidence was found to prove that men and women are different in terms of behavior and more or less sensitive to certain behavioral biases (Lewellen et al., 1977; Bengentsson et al., 2005; Kudryavtsev & Cohen, 2011; Buser et al., 2014; Baker et al., 2019). This forms a base for this research as we can assume that part of the performance difference across female and male fund managers is due to behavioral aspects. For instance, some studies showed that men are more overconfident (Bengentsson et al., 2005; Baker et al., 2019) or that they are more competitive (Buser et al., 2014). On the other hand, some studies found that women are more sensitive to the hindsight bias and anchoring bias (Kudryavtsev & Cohen, 2011). Lewellen et al. (1977) even found that gender is one of the most important determinants of investors' investment strategy. Therefore, adding to the social impediments, these differences in

sensitivity towards behavioral biases may lead to different investment behaviors which translate into differences in performance.

Furthermore, a lot of psychology and sociology researches found that women tend to be more risk-averse than men (Arch, 1993; Jianakoplos & Bernasek, 1998; Byrnes et al., 1999). Risk- aversion is the tendency of people to prefer low uncertainty outcomes rather than high uncertainty outcomes, even if the expected value is the same for both. On the contrary, someone being risk-seeking (or risk-prone) would prefer the high uncertainty outcomes. Someone who is indifferent and bases his choices only on the expected value is called risk-neutral. Arch's (1993) explanation for this difference in risk preference is that men tend to see risk as an attractive challenge while women tend to see risk as a threat to avoid. Other explanations include differences in the evaluation of risk and culture (Croson & Gneezy, 2009).

Concerning the literature directly related to risk preferences in terms of financial investments, again previous research found that women are more risk-averse than men (Hinz et al., 1996;

Sunden & Surette, 1998; Jianakoplos & Bernasek, 1998; Bernasek & Shwiff, 2001). For instance, Hinz, McCarthy and Turner (1996) showed that when choosing how to invest their pension assets, a lot of women, unlike men, chose to invest in the minimum-risk portfolio available. This is relevant for our research as investments and investment styles which are strongly related to risk preferences, in turn, can affect performance.

In contrast, studies looking at managers (mutual fund managers, management students, company managers, or entrepreneurs) usually find that women and men in these positions display little difference in risk-taking (Masters & Meier, 1988; Johnson & Powell, 1994; Atkinson et al., 2003). This could be due to the nature of their profession which requires a certain taste for risk. Therefore, this nuance makes it even more interesting to look at the risk-taking behavior of hedge fund managers. This paper could help to show whether hedge fund managers' risk preferences resemble the ones of the whole population or the ones of other types of managers.

Due to the large panel of studies showing that women tend to be more risk-averse than men, I decided to test this second hypothesis:

H2: Female hedge fund managers are more risk-averse than male hedge fund managers

D) Differences across countries

Differences across countries have been highlighted both in terms of social impediments against women and behavioral biases. In fact, both of these aspects are influenced by culture, traditions and social norms which differ across countries.

A lot of studies found differences across countries in terms of sensitivity to behavioral biases and investment behaviors (Zinkhan & Karande,1990; Chen et al., 2007). For instance, Zinkhan and Karande (1990) found in their experiment that Spanish students show greater risk-prone behaviors than American students, while Chen et al. (2007) found that Chinese investors are more overconfident than American investors.

Another way to highlight the impact of socialization on behaviors is to look at studies and experiments conducted on children. For instance, Arenson (1978) showed that across children, boys and girls do not display any difference in risk-taking behavior. This implies that risk preferences may be due to social norms and that the gender difference in risk behaviors may therefore differ across countries.

Hence, women may be more influenced by behavioral biases arising from stereotypes and social norms in countries where there is a larger gender gap.

Additionally, some studies also showed that the discrimination and glass ceiling against women is also influenced by culture and is stronger in certain countries (Fortin, 2005; Demirgüç-Kunt et al., 2013). For example, a study by Fortin (2005) showed that anti-egalitarian views are the strongest obstacle to female employment and the reduction of the gender pay gap. Another paper by Demirgüç-Kunt et al. (2013) highlighted the impact of social norms on women's access to finance in developing countries. Therefore, women may tend to outperform men more in countries with greater discrimination as they face stronger barriers in becoming and staying hedge fund managers.

Overall, this led me to my third hypothesis:

H3: The differences in performance and risk preferences between men and women are stronger in countries displaying greater gender inequalities

Data

The data I used to conduct my analysis comes from the Thomson Reuters Lipper Hedge Fund database. This database was found to be the best for academic research due to its relative completeness and accuracy (Getmansky et al., 2015). The data reports monthly values and covers the period from January 2011 to December 2020. I chose this period to get some more recent results as compared to previous literature. This database reports information about a large number of hedge funds over the world. The information included covers the fund's performance, strategy and details. Especially, it provides information about the fund manager which is particularly useful for my research.

For my analysis, I kept only the funds that are actively managed and the ones that have only one fund manager. The data provides the name of the fund manager as well as its prefix ("Mr.", "Mrs.", "Miss"…) that is useful in determining the gender. If the prefix was not available, I added the gender of the manager based on its name. For example, if the fund manager's name was "Michael", which is in a great majority of times given to boys, I classified the fund as male managed. The funds for which the manager's gender could not be identified have been dropped. The final sample contains a total of 2176 actively managed funds among which 2093 are managed by a male fund manager and 83 by a female fund manager. This represents a percentage of 3.8% of female-managed funds which is really low, consistent with the underrepresentation of women in the sector of hedge funds as mentioned earlier. However, this small number of female-managed funds included in the sample may be a problem because it may lead to insignificant results. In fact, a smaller number of observations leads to weaker statistical power and therefore weaker results. Yet, this small number of women in the industry is one of the primary motivations of this research and therefore was expected. Additionally, the sample contains a large number of graveyard funds (liquidated funds or funds that stopped reporting) as they represent 82.2% of the sample.

The other major variable of interest in the data is the rate of return of the funds. The returns of the funds are net of fees which allows to measure the performance of the managers irrespective of the fee structure of the fund. The descriptive statistics of the rate of return of the female and male managed funds can be found in Table 1. The statistics show that the mean return is greater for female-managed funds but that the median return is approximately similar for both genders. The standard deviations of returns are also similar across genders. Another important piece of information derived from the summary statistics is the distribution of returns. The distribution of returns is positively skewed for both male and female managed funds, implying that an investor may expect frequent small returns or losses and a few large gains from its investment in the fund. The kurtosis is also high for both genders which shows the presence of extreme values. However, the kurtosis is much larger for male-managed funds.

Table 1

Summary statistics of the rate of return for female and male managed funds

	Number of observations	Mean	Median	Standard deviation	Skewness	Kurtosis
Female managed funds	4978	0.3479 %	0.34 %	4.7850	0.9401	29.5037
Male managed funds	108,708	0.2580 %	0.35 %	4.3963	0.8518	61.1178

Note: This table reports the descriptive statistics of the monthly rate of return for female and male managed hedge funds separately. The second row reports the statistics for female managed funds and the third row reports the statistics for male managed funds. Each column reports a certain statistic mentioned in the first row (number of observations, mean, median, standard deviation, skewness and kurtosis).

The dataset also provides information on where the hedge fund is based and therefore where the hedge fund managers are working. This is relevant for the third hypothesis. The list of all the different countries in which the hedge funds are implanted as well as the number of hedge funds in each country and the percentage of hedge funds managed by women in the country can be found in Table 2, in the Appendix A. Among the sample, most of the hedge funds are based in the United States (37.58%) and the United Kingdom (19.00%). The percentage of women fund managers is heterogeneous across countries ranging from 0, in most countries, to 43.9%, in Japan.

Commercial databases providing information about hedge funds are prone to a number of biases. Therefore, I decided to discuss those biases and how they could affect the results obtained.

A first bias common to hedge fund databases is the survivorship bias which refers to the fact that unsuccessful funds are excluded from the data, leading to an upward bias. However, this bias is controlled for in the database used in this paper as it includes both live and dead funds.

The second bias which may have influenced the data is the backfill bias. This bias refers to the fact that hedge funds entering the database are allowed to provide information about their past performance. Therefore, funds usually join a database after a period of outperformance and report this in the data. On the contrary, funds with bad past performance do not report their past returns. This creates an upward bias. To deal with this bias, I dropped the funds' returns which correspond to the period prior to their entry in the database. Therefore, my analysis is not influenced by the backfill bias.

Finally, the data is probably influenced by a self-reporting bias because the hedge funds' choice to disclose their information is made completely voluntarily. As hedge funds report their returns and details for marketing purposes, they generally do so when they are outperforming. This implies that again the data is affected by an upward bias. This is supported by a study by Aiken et al. (2013) who provide evidence of a significant positive bias in commercial databases. However, Agarwal et al.

(2010) found that reporting and non-reporting funds have similar returns. They explain that this may be due to the fact that funds that are highly outperforming do not need to attract more capital and therefore choose not to disclose their information. Therefore, the non-reporting funds include both underperforming and highly outperforming funds averaging out to a similar performance to the reporting funds. Even though there is no strict evidence of the impact of the self-reporting bias, one should be aware of it when reading this paper. Furthermore, even if this bias does impact the results, if we assume that this bias affects female and male managed funds similarly, we are still able to draw conclusions on the gender differences across hedge fund managers. This assumption may not be true due to behavioral differences between men and women. As discussed earlier men and women differ in terms of behaviors and this could affect their reporting. For instance, men were shown to be more competitive (Buser et al., 2014); this could incentivize male managers to report more often when their performance is high as compared to female managers. However, for the sake of this research, it is assumed that the self-reporting bias affects both male and female managed funds similarly.

To conclude, such biases are important to notice but it is reasonable to say that the conclusions drawn in this paper are reliable.

Methodology

A) Performance

To test my first hypothesis, I used different measures of performance to draw conclusions. As mentioned, previous papers differ in their conclusions partly due to the different methods they applied. Therefore, I decided to use four different methods to be able to compare the results found using each method and to get an accurate conclusion.

The first measure of performance I used is the Sharpe ratio. The Sharpe ratio is measured as the fund's return in excess of the risk-free rate divided by the standard deviation of returns, representing risk:

$$\text{Sharpe Ratio}_{i,t} = \frac{R_{i,t} - R_{f,t}}{\sigma_{i,t}} \quad (1)$$

$R_{i,t}$ = the hedge fund's return at time t

$R_{f,t}$ = the risk-free rate at time t

$\sigma_{i,t}$ = the standard deviation of returns at time t calculated over the returns of the last 12 months

I will compare the average Sharpe ratio of women-managed funds to the one of men-managed fund to conclude on the relative performance of women fund managers. The significance of the difference in average Sharpe ratios was computed using a t-test. The proxy I used for the risk-free rate in this calculation and in the other methods I applied is the one-month Treasury bill rate.

This is a very straightforward and simple measure of performance that can be used as a first indication. However, it may be ambiguous in the sense that we do not know whether a higher Sharpe ratio is due to higher returns or lower risk. Furthermore, this metric penalizes both upside and downside volatility, while upside volatility is desirable. Therefore, I decided to look into other measures of performance.

The second measure of performance I used is the Jensen's alpha. This is a measure of abnormal returns based on the CAPM:

$$R_{i,t} - R_{f,t} = \alpha_i + \beta(R_{m,t} - R_{f,t}) + \varepsilon_{i,t} \quad (2)$$

$R_{i,t}$ = the hedge fund's return at time t

$R_{m,t}$ = the market portfolio return at time t

$R_{f,t}$ = the risk-free rate at time t

The Jensen's alpha helps measuring the systematic risk-adjusted performance of the fund and therefore the stock-picking ability of the fund manager. I calculated the Jensen alpha for women-managed funds and then for men-managed funds using OLS regressions. I used Newey-West standard errors with this model as well as with all the OLS regressions in this paper to account for heteroskedasticity and potential correlated errors. I then compared both alphas to conclude on the relative performance of men and women fund managers. The significance of the difference in Jensen's alphas between men and women was computed using a Wald test, which allows to test hypotheses about parameters of a regression. I used the value-weight return of all NYSE, AMEX, and NASDAQ stocks as a proxy for the market portfolio return. This large range of stocks gives a good representation of the market portfolio.

The Jensen's alpha is a common measure of hedge funds performance, as hedge funds seek positive absolute returns irrespective of the market conditions. However, this measure has also been criticized. Roll in 1978 argued that the performance of funds should be compared to a specific benchmark corresponding to the fund's style, rather than a broad market benchmark, to offer meaningful results. This is why we should not rely entirely on this metric.

The third measure of performance I used is based on the three factors model of Fama and French (1993). The Fama and French three factors model controls for the size of firms (SMB), the book-to-market value (HML) and the excess return over the market:

$$R_{i,t}-R_{f,t} = \alpha_i + \beta_1(R_{m,t}-R_{f,t}) + \beta_2 SMB_t + \beta_3 HML_t + \varepsilon_{i,t} \qquad (3)$$

$R_{i,t}$ = the hedge funds return at time t

$R_{m,t}$ = the market portfolio return at time t

$R_{f,t}$ = the risk-free rate at time t

HML_t = the historic excess returns of small-cap companies over large cap companies

SMB_t = the historic excess returns of value stocks (high book-to-price ratio) over growth stocks (low book-to-price ratio)

The SMB factor accounts for the outperformance of small-cap stocks and the HML factor accounts for the outperformance of value stocks. I again looked at the alphas for both men- and women-managed funds resulting from the model and compared them to conclude on both genders' relative performance. The alphas were estimated through OLS regressions and the significance of the difference between men and women was computed using a Wald test.

This allows me to measure the performance of the fund manager beyond the benchmark imposed by the factors included, which highlights the stock-picking skills of the manager that go beyond known

strategies. It also allows to compare the active hedge funds' returns with the returns of specific strategies which could be invested in through passive funds. Furthermore, it allows us to look at the funds' exposures to the size and value factors. However, this three-factor model does not include all market anomalies and potential strategies reported over the years in the literature. Therefore, it does not give any indication on the other potential strategies the hedge fund managers have exploited.

The last measure of performance I used is based on the Treynor and Mazuy (TM) model (1966). This model is similar to the CAPM but it includes an additional factor which is the squared market portfolio return:

$$R_{i,t}-R_{f,t} = \alpha_i + \beta(R_{m,t}-R_{f,t}) + c(R_{m,t}-R_{f,t})^2 + \varepsilon_{i,t} \qquad (4)$$

$R_{i,t}$ = the hedge fund's return at time t

$R_{m,t}$ = the market portfolio return at time t

$R_{f,t}$ = the risk-free rate at time t

This model helps measuring the timing ability of fund managers, through the coefficient c. In fact, if the hedge fund manager increases its market exposure prior to a market increase then the coefficient c will be positive. On the contrary, the coefficient c is negative. Therefore, this gives us an additional insight on the performance of fund managers. I will again compute the model, through OLS regressions, separately for the women- and men-managed funds and look at the resulting coefficients c to conclude on their market timing performance. The significance of the difference in coefficients between men and women was computed using a Wald test.

B) Risk

In a second part, I investigated the risk behavior of hedge fund managers to test my second hypothesis. The goal was to determine wether women hedge fund managers undertake less risk than their men counterparts. Then, I tested whether the difference in risk behavior explained the difference in performance between genders.

I decided to measure the risk taken by the manager as the standard deviation of returns. The standard deviation indicates how much the returns from the fund's portfolio is straying from the expected return, based on the fund's historical performance. Therefore, the smaller the standard deviation, the less dispersed the returns are and the less risky the investment is. More precisely, I calculated the standard deviation monthly over the returns of the last 12 months. I then compared the average of these standard deviations between men and women managed funds to conclude on their relative risk

behaviors. The significance of the difference in standard deviation between men and women was computed using a t-test. The advantage of this metric is that it is simple and model-free.

Then, to add on the results found for the performance, I investigated whether the larger risk-aversion of women fund managers can explain their outperformance relative to men. To do this, I regressed the difference in the Jensen's alphas between men and women on the difference in the standard deviation of returns between men and women:

$$(\alpha_{f,t}-\alpha_{m,t}) = a + b(\sigma_{f,t}-\sigma_{m,t}) + \varepsilon_t \quad (5)$$

$\alpha_{f,t}$ = the average Jensen's alpha of female managed hedge funds at time t

$\alpha_{m,t}$ = the average Jensen's alpha of male managed hedge funds at time t

$\sigma_{f,t}$ = the average standard deviation of returns of female managed hedge funds at time t

$\sigma_{m,t}$ = the average standard deviation of returns of male managed hedge funds at time t

The coefficient b of the regression above therefore represents how the gender difference in risk impacts the gender difference in performance. I estimated this model using an OLS regression. The gender difference in risk, $(\sigma_{f,t}-\sigma_{m,t})$, is expected to be negative while the gender difference in performance, $(\alpha_{f,t}-\alpha_{m,t})$, is expected to be positive. Therefore, the coefficient b is expected to be negative. Furthermore, if it is significant, this implies that the gender difference in risk explains the difference in performance.

C) Differences across countries

In the last part of my analysis, I tested my third hypothesis. I looked at whether the results differ across countries to check for the impact of culture and norms on the previous results. To do this, I formed three groups of countries based on their score in the Women's workplace equality index conducted in 2018 by the Council on Foreign Relations. This index ranks countries based on their legal treatment of gender inequalities. The ranking is based on 56 legal gender inequalities which are part of one of seven categories: accessing institutions, building credit, getting a job, going to court, protecting women from violence, providing incentives to work, and using property. I chose this index because I think it is a good representation of the conditions in which women are treated in the country. The index allowed to rank 43 countries. The countries with a score larger than 80 are part of the top group, the countries with a score between 80 and 70 are part of the middle group and the countries with a score lower than 70 are part of the bottom group. The list of countries in each group as well as their scores can be found in the Appendix B.

Then to highlight the difference between the country groups, I conducted the same analysis as for the performance section for each of the groups individually and then compared the results I got.

Similarly, I derived the standard deviation of returns of men and women-managed funds for each country group separately and compared the results.

Results

A) Performance

In this section, I present the results obtained when investigating the relative performance of female and male managed funds. This analysis aims at testing the first hypothesis of this paper which states that female-managed funds outperform male-managed funds.

The first metric I used to estimate the performance of the funds is the Sharpe ratio. The average and median Sharpe ratios of the female and male managed funds can be found in Table 3. The average Sharpe ratio of female managed funds is 0.1993 while the average Sharpe ratio of male managed funds is 0.3282. They were found to be significantly different. Therefore, this metric suggests that male-managed funds outperform female-managed funds as they have larger returns per unit of risk, on average. Looking at the median Sharpe ratio, again the one of male managed funds is greater than the one of female managed funds, even though the difference is much smaller.

Table 3

Sharpe ratios of female and male managed funds

	Number of observations	Average Sharpe ratio	Median Sharpe ratio
Female managed funds	4104	0.1993	0.2136
Male managed funds	89029	0.3282	0.2598
Difference		-0.1289***	-0.0462***

Note: This table reports the average and median Sharpe ratios of female and male managed funds separately. The first row includes the values for the female managed funds, the second row includes the ones for the male managed funds, and the third row includes the difference between both groups. The first column includes the number of observations in each group, the second column includes the average Sharpe ratios and the third column includes the median Sharpe ratios. The significance of the differences is indicated by the asterisks (***p<0.01). The significance of the difference in average Sharpe ratios was tested using a t-test and the significance of the difference in median Sharpe ratios was tested using a Wilcoxon rank sum test.

The second metric used is the Jensen alpha derived from the CAPM (Equation 2). The results of the CAPM regressions for female and male managed funds can be found in Table 4. The alpha obtained for the female-managed funds is -0.1666 and the alpha for male-managed funds is -0.1201. These negative alphas indicate that, based on this analysis, both female and male managed funds underperform the market. This would imply that an investor would be better of by investing in a passive fund tracking the market rather than in a hedge fund irrespective of the manager's gender. The alpha of male-managed funds is slightly greater than the one of female-managed funds. However, the difference in alphas is not statistically significant, suggesting that their performance is similar.

Looking at the betas, the female managed funds have a greater exposure to the market risk than the male managed funds.

Table 4

Results of the CAPM regressions for female and male managed funds

	Jensen alpha (α)	Market (β)
Female managed funds	-0.1666**	47.0940***
Male managed funds	-0.1201***	34.6272***
Difference	-0.0465	12.4668***

Note: This table reports the constants and coefficients resulting from the CAPM regressions (Equation 2) for both the female and male managed funds. The results for the female managed funds are in the first row and the results for the male managed funds are in the second row. The third row shows the difference between the female and male managed funds. The first column includes the Jensen alpha (the constant) and the second column includes the the coefficient for the Market factor (β). The significance of the results is indicated by the asterisks (***p<0.01; **p<0.05); if there is none it is not significant. The significance of the regression results was estimated with t-tests and the significance of the differences was estimated with Wald tests.

The third metric used to measure the performance is the alpha resulting from the three factors model of Fama and French (1993) (Equation 3). The results of the three factors model regressions can be found in Table 5. The alpha obtained for the female-managed funds is -0.1282 and the alpha obtained for the male-managed funds is -0.0848. Again, both are negative indicating an underperformance relative to the market. Additionally, the difference in alphas between both genders is not significant, indicating a similar performance irrespective of the manager's gender. The exposure to market risk is significantly higher for female-managed funds. Concerning the other factors, male managed funds appear to have a greater exposure to small-cap stocks while female managed funds appear to have a greater exposure to value stocks. However, these differences are not significant.

Lastly, I measured the market timing ability of both genders through the Treynor and Mazuy model (1966) (Equation 4). The results of the regressions conducted based on this model can be found in Table 6. The market timing coefficient is negative for both female and male managed funds which implies that they both have bad market timing abilities. The coefficient is slightly worst for women managers than for men managers but the difference is not significant. Therefore, there is no evidence of different market timing abilities between men and women fund managers.

Table 5

Results of Fama and French three factors model regressions for female and male managed funds

	Alpha (α)	Market (β_1)	SMB (β_2)	HML (β_3)
Female managed funds	-0.1282	45.4476***	3.8296	6.5642
Male managed funds	-0.0848***	32.9913***	4.3308***	5.5277***
Difference	-0.0434	12.4563***	-0.5012	1.0365

Note: This table reports the constants and coefficients resulting from the three factors model regressions (Equation 3) for both the female and male managed funds. The results for the female managed funds are in the first row and the results for the male managed funds are in the second row. The third row shows the difference between the female and male managed funds. The first column includes the Alpha (the constant), the second column includes the coefficient of the Market factor (β1) the third column includes the coefficient of the SMB factor (β2), and the fourth column includes the coefficient of the HML factor (β3). The significance of the results is indicated by the asterisks (***p<0.01); if there is none it is not significant. The significance of the regression results was estimated with t-tests and the significance of the differences was estimated with Wald tests.

Table 6

Results of Treynor and Mazuy model regressions for female and male managed funds

	Constant (α)	Market (β)	Market timing
Female managed funds	0.0080	48.5788***	-121.5991***
Male managed funds	-0.0032	35.7216***	-83.4571***
Difference	0.0112	12.8572***	-38.1420

Note: This table reports the constants and coefficients resulting from the Treynor and Mazuy model regressions (Equation 4) for both the female and male managed funds. The results for the female managed funds are in the first row and the results for the male managed funds are in the second row. The third row shows the difference between the female and male managed funds. The first column includes the constant, the second column includes the coefficient of the Market factor (β), and the third column includes the coefficient for the Market timing ability (squared Market factor). The significance of the results is indicated by the asterisks (***p<0.01); if there is none it is not significant. The significance of the regression results was estimated with t-tests and the significance of the differences was estimated with Wald tests.

To summarize, all methods used to measure the relative performance of women and men fund managers indicated a slightly higher performance of men managers which was found to be insignificant, except for the Sharpe ratio. The fact that the difference in performance is only significant for the Sharpe ratio is most probably due to the fact that it is the only metric which takes into consideration the risk of the fund. In fact, the significance of the difference in Sharpe ratios is most probably influenced by a strong difference in risk taken by the managers instead of an actual difference in performance. This difference in risk taken is discussed in part B.

Due to the insignificance of an outperformance of men managers for most measures, it can be concluded that men and women managers depict the same performance. This contradicts my first hypothesis which stated that women managers would outperform their male counterparts. This implies that the social impediments faced by women and the behavioral differences across genders do not translate in an outperformance of female-managed funds.

B) Risk

In the second part of my analysis, I looked at the risk taken by the female and male managers. This part of the analysis aims at testing the second hypothesis which states that women hedge fund managers are more risk-averse than men hedge fund managers.

The risk was measured through the standard deviation of returns. The standard deviations found for the sample investigated can be found in Table 7. The average standard deviation of returns for female managed funds is 3.4980 and the average standard deviation of returns for male managed funds is 3.0233. The difference in average standard deviation between both genders is significant. The standard deviation representing risk, these results imply that female fund managers undertake more risk than their male counterparts. This contradicts my second hypothesis which stated that women hedge fund managers are more risk-averse than men hedge fund managers. Indeed, according to the data analyzed, women hedge fund managers are found to be more risk-seeking than men hedge fund managers.
This also contradicts the great number of research stating that women tend to be more risk- averse than men (Arch, 1993; Jianakoplos & Bernasek, 1998; Byrnes et al., 1999). The contradicting findings of this analysis may be due to the nature of the job. Being a hedge fund manager implies some risk and therefore attracts mostly risk-seeking individuals. In this sense, the hedge fund managers are not representative of the whole population. This could explain why women may be less risk-averse than men in this sub-group of the population.

Table 7

Standard deviation of returns of female and male managed funds

	Number of observations	Average Standard deviation
Female managed funds	4144	3.4980
Male managed funds	89107	3.0233
Difference		0.4747***

Note: This table reports the average standard deviation of returns, calculated monthly over the returns of the last 12 months, for both female and male managed funds. The first row includes the value for the female managed funds, the second row includes the one for the male managed funds, and the third row includes the difference between both groups. The first column includes the number of observations in each group and the second column includes the average standard deviations. The significance of the differences is indicated by the asterisks (***$p<0.01$). The significance of the difference in average standard deviations was tested using a t-test.

Then, I looked at whether the difference in risk taken explained the difference in performance between female and male managers. To do this, I ran the regression of Equation 5. The coefficient b I obtained is 0.1355, which is consistent with my previous results. It is significant at a 1% level which implies that the gender difference in risk taken plays a role in the gender relative performance.

C) Differences across countries

In the last part of my analysis, I looked at whether my results differed across countries due to culture and social norms. The hypothesis which was derived is that the differences in performance and risk preferences between men and women are stronger in countries displaying greater gender inequalities. As mentioned, I formed three groups of countries based on how women are treated in the countries and reproduced the performance and risk analysis.

To take a first glance at the different groups, I looked at the percentage of women hedge fund managers in each group. The top group includes 3.76% of women managers, the middle group includes 5.17% of women and the bottom group includes 7.41% of women. The percentage of women hedge fund managers decreases as the country score increases. This seems surprising as the glass ceiling was expected to be stronger in countries with larger gender disparities.

The different performance measures for each country group can be found in Table 8.

Concerning the difference in Sharpe ratios, it was found that men significantly outperformed in the top group and the middle group but that women insignificantly outperformed in the bottom group. This reversal may be a sign of the glass ceiling in countries that tend to display greater inequalities. However, as the difference in Sharpe ratios in the bottom group is not significant, a definitive conclusion cannot be made.

Concerning the Jensen alphas and the alphas based on the three factors model, again men were found to outperform in the top and middle group while women seem to outperform in the bottom group. This again would imply a reversal in relative performance in countries with large gender inequalities. However, these differences are not significant and therefore no difference in performance is proven.

Finally, looking at the Market timing coefficient, men seem to have better timing abilities for all groups, but these differences are not statistically significant. Both men and women seem to have poor market timing abilities in every country group.

This performance analysis across countries suggests that there is a potential reversal in relative performance when looking at countries with different social and legal norms concerning women. However, the results being insignificant, further research should be made to reach an actual conclusion. Based on the current values obtained for most measures, we may conclude that women and men hedge fund managers do not display any difference in performance across all country groups. The performance insight of my third hypothesis is therefore rejected. Again the insignificant differences across men and women may be influenced by the small number of female managed funds in the dataset.

Table 8

Performance measures across different country groups

Country groups		Sharpe ratio	Jensen's alpha	Alpha based on the three factors model	Market timing ability coefficient
Top group	Women	0.2435	-0.2073**	-0.1441	-159.1659***
	Men	0.3281	-0.0819***	-0.0374*	-79.8924***
	Difference	-0.0846***	-0.1254	-0.1067	-79.2735
Middle group	Women	0.0791	-0.3216**	-0.3193***	-102.6211*
	Men	0.4165	-0.1281***	-0.1355***	-77.2795***
	Difference	-0.3374***	-0.1935	-0.1838	-25.3416
Bottom group	Women	0.2062	-0.1237	-0.1844	-145.7080
	Men	0.1564	-0.2862***	-0.2414***	-99.7493
	Difference	0.04976	0.1625	0,057	-45.9587

Note: This table reports different performance measures (Equation 1, 2, 3 & 4) for both the female and male managed funds across different country groups. The results for the top country group can be found the first row, the results for the middle country group can be found the second row and the results for the bottom country group can be found the third row. Each row contains the measure for female managed funds, male managed funds and their difference. Each column reports the results for one measure (Sharpe ratio, Jensen's alpha, Fama & French alpha, Market timing ability coefficient). The significance of the female and male results was estimated with t-tests and the significance of the differences was estimated with Wald tests (except for the difference in Sharpe ratios which was estimated using t-tests). The significance of the results is indicated by the asterisks (***p<0.01; **p<0.05; *p<0.01); if there is none it is not significant.

The results concerning the risk analysis across countries can be found in Table 9. This analysis shows a reversal in risk taking across country groups. In fact, men were found to be significantly taking less risk in the top and middle group while women are significantly taking less risk in the bottom group. These results imply that women are more risk-averse in countries with larger inequalities. This is consistent with the mentioned fact that risk behavior is influenced by culture and norms. Women living in discriminatory countries may be influenced by the norms and therefore they are more risk-averse. Furthermore, men are more risk-prone in the bottom group which implies that they may also be influenced by a cultural pressure. This conclusion is in line with the second hypothesis and the third hypothesis as it shows that women hedge fund managers are more risk-averse than their men counterparts in countries where norms are different across genders.

Table 9

Standard deviation of returns of female and male managed funds across country groups

Country groups		Number of observations	Average Standard deviation
Top group	Women	2403	3.4562
	Men	60853	2.9134
	Difference		-0.5427***
Middle group	Women	624	3.5480
	Men	11085	2.8793
	Difference		-0.6687***
Bottom group	Women	378	2.8885
	Men	4365	4.6663
	Difference		1.7778***

Note: This table reports the average standard deviation of returns, calculated monthly over the returns of the last 12 months, for both female and male managed funds across different country groups. The results for the top country group can be found the first row, the results for the middle country group can be found the second row and the results for the bottom country group can be found the third row. Each row contains the measure for female managed funds, male managed funds and their difference. The first column reports the number of observations used to calculate the value of the average Standard deviation and the second column reports the average Standard deviation for each group. The significance of the differences were estimated using t-tests. The significance is indicated by the asterisks (***$p<0.01$).

Conclusion

The analysis conducted in this paper aimed at investigating the relative performance of men and women hedge fund managers. The results did not show any difference in performance between women and men hedge fund managers. In other words, women and men fund managers were found to have similar skills.

In the second part, the risk behaviors of fund managers were investigated. The goal was to determine whether the gender of the fund manager affected the risk taken and whether this difference in risk, in turn, led to a difference in performance. The results showed that on average women fund managers take more risk than men fund managers. It was also found that the difference in risk taken between genders is correlated with the relative performance between genders. This implies that the risk behaviors play a role in the performance of women and men hedge fund managers.

In the last part, the influence of culture on the results was investigated by looking at different country groups separately. The results did not prove that the relative performance of men and women is impacted by culture. Women and men fund managers have similar performances irrespective of their cultural environment. However, the risk behaviors were found to be influenced by culture. In fact, men are more risk-averse than women in countries displaying little gender inequalities but women are more risk-averse than men in countries with larger gender inequalities. It showed that both women and men are influenced by culture and social norms as men tend to be more risk-prone and women tend to be more risk-averse when in an environment with larger gender gaps.

The results, therefore, contradict the hypothesis that women hedge fund managers would outperform men hedge fund managers. This shows that the glass ceiling assumed to develop this hypothesis may not require women to outperform their men counterparts or may simply not exist. Concerning the difference in behaviors and behavioral biases, no precise conclusion may be drawn from this analysis as no particular bias was investigated. However, it shows that despite potential differences in behavioral biases, men and women fund managers still achieve similar performances.

The results also contradict the hypothesis that women hedge fund managers would be more risk averse than men hedge fund managers. This shows that the theories concerning risk behaviors that apply to the whole population do not apply to hedge fund managers.

Finally, the results also partly contradict the third hypothesis which stated that the differences in performance and risk behaviors between genders would be larger in countries with larger inequalities. The performance difference did not vary across country groups which implies that the larger discrimination and stronger gender norms of certain countries do not affect the relative performance of men and women fund managers. However, the results still showed the influence of culture on the risk behaviors of both genders.

The small number of female-managed funds included in the dataset is a limitation to this research as it contributes to a number of insignificant results. Additional research on the topic could be made by combining multiple databases in order to gather a larger number of female-managed funds and obtain stronger results.
Another limitation of this research concerns the analysis of the cultural influence. In fact, the funds included were implanted in a small panel of countries and therefore the results may not be completely reliable. Furthermore, the analysis was based according to the countries in which the fund managers work. However, these countries may not be their strongest cultural influence. For example, they may have been influenced by the countries in which they were born or in the countries they lived most of their life in and these may not be the ones reported in the data. Therefore, further research on the cultural influence could be done to check the results obtained in this paper.

To conclude, this paper adds to the knowledge on gender effects which are investigated both in the field of behavioral finance and the field of psychology. From a social point of view, the results show that the discrimination women hedge fund managers face is not founded as they have the same performance as their male counterparts. This research may help investors to realize that they should not choose where to invest according to the gender of the hedge fund manager. Furthermore, it shows that the implementation of quotas in the sector of hedge funds by policymakers could be beneficial as women are underrepresented despite their equal performance.

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Appendix

A) Descriptive statistics of countries

Table 2

Number of hedge funds and percentage of women fund managers across countries

Countries	Number of hedge funds	Percentage of female managed funds
Anguilla	3	0
Aruba	1	0
Australia	36	0
Bahamas	9	0
Barbados	1	0
Bermuda	73	1.2
Brazil	18	34.65
Canada	69	0.99
Cayman Islands	219	7.45
Chile	1	0
China	8	0
Curacao	3	0
Cyprus	1	0
Denmark	6	0
Finland	1	0
France	29	2.78
Germany	1	0
Gibraltar	2	0
Greece	1	0
Grenada	2	0
Guernsey	13	0
Hong Kong	70	7.26
Indonesia	1	0
Ireland	24	0
Italy	1	0
Japan	10	43.9

Jersey	3	0
Kuwait	2	0
Liechtenstein	5	0
Luxembourg	21	0
Malta	31	8.91
Mauritius	11	0
Monaco	2	0
Netherlands	15	0
New Zealand	1	0
Norway	12	0
Pakistan	1	0
Panama	1	0
Poland	1	0
Russia	1	0
Saint Kitts and Nevis	5	0
Saint Martin	5	0
Saint Vincent and the Grenadines	1	0
Singapore	60	8.52
South Africa	4	0
Spain	3	0
Sweden	25	1.72
Switzerland	91	0
Thailand	3	0
Turkey	1	0
United Arab Emirates	6	0
United Kingdom	413	0.84
United States	817	5.7
Uruguay	1	0
Virgin Islands	29	0
Total	2174	4.32

Note: This table reports the number of hedge funds in each country as well as the percentage of female fund managers in each country. The name of the countries can be found in the first column, the number of hedge funds in the second column and the percentage of women in the third column. The last row reports the total number of hedge funds and the average percentage of women fund managers.

B) *Groups of countries and their score*

Top group:
Australia: 94.9; Canada: 94.5; New Zealand: 93.6; Spain: 92.9; United Kingdom: 91.8; Denmark: 89.3; Netherlands: 89; France: 87.6; United States: 85.8; Sweden: 85.1; Malta: 84.1; South Africa: 84; Mauritius: 83.3; Germany: 83.1; Italy: 80.8; Ireland: 80.4

Middle group:
Luxembourg: 79.9; Panama: 79.6; Cyprus: 79.5; Finland: 79.4; Greece: 79.3; Brazil: 79.3; Norway: 78.9; Poland: 76.5; Hong Kong: 75.5; Switzerland: 75.1; Uruguay: 71.1; Turkey: 70.1

Bottom group:
China: 68.3; Japan: 66.7; Thailand: 66.2; Chile: 65.1; Singapore: 63.4; Bahamas: 62.6; Barbados: 59.7; Grenada: 59.4; Russia: 58.5; Saint Vincent and the grenadines: 54.6; Saint Kitts and Nevis: 53.9; Indonesia: 50; Pakistan: 44.3; United Arab Emirates: 36.6; Kuwait: 32.2