

Gender, Childcare Responsibilities, and Mutual Fund Performance under External Shocks

Peili Zhou

University of Bristol

Email: OL22313@bristol.ac.uk

Abstract

This study examines how the COVID pandemic as external shocks affected mutual fund performance, focusing on gender and childcare responsibilities. We use U.S. mutual fund data from 2018 to 2023. Female managers, especially those likely to have childcare duties, performed worse during COVID and some negative effects continued in the post COVID period. Performance declines were significant among single manager teams, or the fund headquarter in Republican states. Using traffic data as a new measure variable for COVID, we show that mobility declines are linked to worse outcomes for female managers with likely childcare responsibilities. Additionally, we examine manager-level career changes and show that female managers were more likely to reduce fund task number or exit the industry during the pandemic. The results highlight gender inequalities still happen during crisis even though it is in the high skill and high education workforce.

Key words: Gender, COVID, Childcare, Fund performance, Team structure, Political states, Traffic volume

1. Introduction

In modern society, men and women still have different roles in the family. Usually, women take more responsibilities at home. Even though more women are working now, they are still expected to do most of the family work (Coltrane, 2000; Bianchi et al., 2012; Yavorsky et al., 2015; Craig and Churchill, 2021). Traditional gender roles often make women face more pressure between job and family. This work-family conflict becomes worse as women grow older (Hall, 1975). To deal with this, many women reduce their working time or even leave their jobs (Rosen and Jerdee, 1974).

Gender differences in mutual fund performance have long been a topic of interest in finance literature. Although female fund managers remain underrepresented in the industry, prior research has shown mixed evidence regarding their performance. Some studies suggest that female managers perform as well as or even better than their male counterparts. For example, Bliss and Potter (2002) found that female managers of U.S. and international equity funds achieved higher raw returns, while Barber and Odean (2001) reported that women traded less frequently and achieved superior risk-adjusted returns, likely due to lower overconfidence. Atkinson, Baird, and Frye (2003) also concluded that there were no significant gender differences in fund returns or risk profiles. However, other studies highlight underperformance for female managers. Clare (2017), for instance,

reported lower benchmark-adjusted returns for female-managed funds. In addition, Niessen-Ruenzi and Ruenzi (2019) found that although female managers had more stable investment styles, they were not received higher fund inflows due to investor bias. Consistent with this literature, our results show that female fund managers, particularly those likely to have childcare responsibilities, performed worse during the Covid and showed weaker recovery ability in the post-COVID period.

The COVID-19 pandemic provided a unique and unexpected setting to examine this. As schools and childcare facilities closed during lockdowns, working parents faced increased demands at home. In many households, traditional gender norms meant that women—especially mothers—assumed the bulk of caregiving duties. According to global estimates, women performed nearly three times as much unpaid caregiving as men during the pandemic (Ferrant et al., 2014; UN, 2020). This imbalance likely affected female fund managers' ability to maintain professional performance, offering a natural experiment to assess the impact of gender and childcare responsibilities in high-skill financial professions. However, the negative impact of COVID-19 on women was not only during the pandemic period. The effect also continued after the pandemic, especially for women who had to take care of young children (Alon et al., 2020; Alon et al., 2022; Collins et al., 2021). Many women found it hard to return to normal work conditions, and some had long-term career problems because of the childcare problem during the lockdown. These long-lasting effects made it more difficult for women to catch up in their careers, especially in high-pressure and competitive jobs.

According to the International Labour Organization (2021), around 13 million women were pushed out of employment between 2019 and 2021, largely due to the economic disruptions and increased care responsibilities caused by the COVID-19 pandemic. But men's employment levels went back to normal. This means that female workers were more negatively affected by the pandemic. Many women had to choose between their jobs and their children, and some even had to stop working. The pandemic made it harder for women to stay in the labor market, which shows that gender inequality in work and family continues (Alon et al., 2020; Alon et al., 2020; Lim and Zabek, 2024).

In this paper, we study the impact of childcare responsibilities on the performance of female fund managers during and after the COVID-19 pandemic. The pandemic increased the difficulties of family care, and this problem was not only seen in low-income families, but also in high-income and highly educated ones. The finance industry is one field where many high-income and highly educated work. Recent research has shown that women in both the finance industry and academic field were affected by the pandemic. Tommar, Kolokolova, and Mura (2022) collected data on hedge fund managers and their children. They found that during school closures, female managers with young children had worse fund performance, while male managers and those without children did not show this decline. On average, their ability to generate abnormal returns dropped by 9%. Other studies like Li and Wang (2021) and Du (2023) also found that female analysts had lower forecast accuracy and slower response during the COVID, especially when schools were closed. These effects were linked to gender differences of childcare work, not job

competition, since similar gender gaps results were not found during the 2008 financial crisis. In addition, Landier and Thesmar (2020) also looked at the effect of COVID-19 on analysts, though they did not study gender differences. Their research showed that COVID-19 had a big influence on the stock market and analyst behavior in general.

Building on these insights, we first compare funds managed by female managers with those managed by male or mixed-gender teams to examine whether there are performance differences during the COVID-19 period. Our intuition is that females are taking a higher level of childcare responsibilities compared to males in general, while the national lockdown and closure of nurseries exaggerates the burden. We group the funds by creating dummy variables. We measure fund performance using monthly abnormal returns relative to Fama and French (2012) and Berk and van Binsbergen (2015).

Since we do not have direct data on fund managers' family data, we estimate the potential childcare information based on their age. This approach allows us to classify managers into groups with and without likely childcare responsibilities. Information on fund manager age is collected from Morningstar or public information on fund websites. We then use statistics from the U.S. Centers for Disease Control and Prevention (CDC) on the average age at which men and women have the first child to build our classification. Importantly, even if a fund manager has children, not all of them require care during the pandemic. Children over the age of 12 are generally more independent and may not need daily care from their parents. Therefore, we divide funds into groups such as: (1) those with children who are likely to need parent's care, and (2) those with children who are older and likely do not need too much care during the COVID period. We consistently find that fund managers with childcare responsibilities performed worse during the COVID period, especially female fund managers. Our tests show that even among funds managed only by women, those managed by female managers with childcare duties performed worse than those managed by female managers who had children but did not have too much childcare responsibilities.

Next, we explore a possible moderate variable for the performance is team structure. Some female fund managers work alone, while others are part of a team. We hypothesize that single-managed funds suffered more during the COVID period, particularly those managed by female managers with childcare responsibilities. In contrast, multi-manager teams may have helped distribute working tasks and reduce the performance impact of external stress, such as childcare duties during COVID. In contrast, multi-manager teams may have helped distribute responsibilities and reduce the performance impact of external stress, such as childcare duties. Previous research supports this idea that team-managed funds benefit from shared experience and risk diversification (Chen et al., 2004; Bar et al., 2011). Team diversity and collaboration have also been shown to contribute positively to fund outcomes under uncertainty (Bar et al., 2011; Pastor et al., 2015). Therefore, we expect that female fund managers working alone experienced more performance decline compared to those working in a team during COVID.

The next step we run the sub-sample test under the geographic location of the fund's

headquarters belongs to Democrats party or Republican party. This because we expect the social norms in terms of who should take more family duties may differ between Democrats or Republican-led states. Policies in states led by Democrats (“blue” states) generally difference from whereas Republican-led (“red” states). We use the 2020 U.S. presidential election results to classify each fund’s as “red” or “blue” by their headquarters location. States led by Democrats generally imposed stricter policies whereas Republican-led states tended to have looser restrictions. In the red states, loosen COVID policies often meant less government support (like remote schooling support or childcare benefits), so these parents had to look after their children while also expected to decrease less time on working or working quality (Goolsbee and Syverson, 2021; Hartney and Finger, 2021). In addition to policy differences, there are differences in industrial structures across states. Blue states tend to have a higher concentration of finance, technology, and healthcare sectors, which were more stable, and their related fund might benefit during the pandemic. In contrast, red states rely more on traditional industries like energy and manufacturing, which were more negatively impacted during COVID. Third, political beliefs and local attitudes toward the pandemic may have influenced behavior. In red states, lower perceived risk and weaker adherence to health guidelines could have increased uncertainty and stress.

Our main hypothesis is that female mutual fund managers with potential childcare responsibilities performed worse than male or mixed-gender fund during the COVID-19 period (From January 2020 to February 2021), and they also have slower recovery in the post-COVID period (from March 2021 to December 2023). The expectation of underperformance during the pandemic is based on the large increase in unpaid domestic work that mostly affected women (Alon et al., 2020). School and daycare closures made childcare much harder, especially for working mothers, and likely reduced their attention and energy for professional tasks (Collins et al., 2021). Finally, we use traffic data to measure the strictness of lockdowns across different states. Mobility data can effectively reflect the level of lockdown policies during the pandemic, when traffic volume decreases more, the stricter lockdown policy (Bonaccorsi et al., 2020) In addition, the time-series pattern of traffic data helps capture the different stages of the pandemic. This provides an alternative way to track the different stages of COVID across pre-COVID, COVID, and post-COVID periods, which offer a new dimension to analysis the mutual fund performance during COVID (Badr et al., 2020).

This study contributes to existing literature in several ways, while many COVID-related studies have examined gender differences in the finance sector, few have focused on the mutual fund (Agarwal et al., 2023; Du, 2021; Landier and Thesmar, 2020; Li and Wang, 2021; Tommar, Kolokolova, and Mura, 2022). Also, research on mutual fund managers during COVID often ignores gender factor (Pastor, 2020). By combining these two perspectives, our paper fills this gap. While our study is closely related to Tommar, Kolokolova, and Mura (2022), it offers several important contributions. Their study focuses on hedge fund managers, whereas we examine mutual fund managers. Second, we extend the analysis beyond the COVID period to investigate whether the effects of the pandemic persist in the post-COVID period. Furthermore, we incorporate state level

differences such as state-level political orientation and lockdown level (proxied by traffic data), providing a richer understanding of how external environments interact with gender and family responsibilities. Finally, we examine the consequences of the pandemic at the manager's level, including leaving the industry, task changes, and job mobility, and compare these changes with the 2008 global financial crisis. Together, these contributions offer a broader and more view of how COVID effected gender difference in possible childcare outcomes in the mutual fund industry. Our findings suggest that female fund managers who are likely to have children and face childcare responsibilities performed worse than their counterparts during and after the COVID-19 period. Although the world around has been making efforts to promote gender equality in the financial sector, it is still far from being succeed and having a lot of challenges.

The rest of the paper is structured as follows. Section 2 presents the data. Section 3 outlines the methodology and discusses the empirical results. Section 4 provides robustness checks. Section 5 concludes the paper.

2. DATA

2.1 DATA source

Mutual fund data are obtained from Morningstar. We focus on U.S. actively managed mutual funds with headquarters located in the United States. To be included in our sample, a fund must have available data records during the COVID period, before and post period.

We define the COVID period as January 2020 to February 2021, aligning with the initial outbreak and widespread impact of the pandemic in the US. This period captures the main state-level lockdowns, school closures, and disruptions to normal working conditions. According to the U.S. Centers for Disease Control and Prevention (CDC) and other government sources, most states began implementing stay-at-home orders and school closures between March and April 2020, with varying degrees of restrictions continuing throughout 2020 and into early 2021. While the intensity and duration of lockdowns varied across states, most mobility and workplace restrictions occurred from March 2020 to around February 2021 (Adolph et al., 2021; Amuedo-Dorantes et al., 2023)

To ensure comparability, we define the post-COVID period as March 2021 to December 2023, a time when most restrictions had been removed but long-term effects on labour markets and childcare remained. To match the post-COVID period in length, we select March 2018 to December 2019 as the pre-COVID period. The final sample includes 1,013 actively managed U.S. mutual funds, with observations spanning March 2018 to December 2023 and covering all three periods: pre-COVID, COVID, and post-COVID.

Morningstar also provides mutual fund manager information. Using a combination of API access to their LinkedIn profiles and manual collection, we obtain basic manager characteristics such as education background, gender, age, and ownership level. For missing information, we first manually collect the data from their LinkedIn or personal webpages and official fund websites.

2.2 Inference of childcare responsibilities

In our study, the key point is whether a fund manager is likely to have childcare responsibilities. Unlike Tommar, Kolokolova, and Mura (2022), given the large sample that we are dealing with, and not all fund managers would post family-related information on public platforms, we did not manually collect the children related information of each fund manager. Instead, we estimate the possibility of having childcare duties based on each manager's age, educational background, and average parental age statistics provided by the U.S. Centers for Disease Control and Prevention (CDC). According to CDC data,¹ we assume that male fund managers have their first child at age 30, and female fund managers at age 27. We further assume that once a manager's first child reaches age 12, they no longer have significant childcare responsibilities. Based on this, we divide the funds into different groups: funds managed by female managers who are likely to have childcare responsibilities, funds managed by female managers who are likely not to have childcare responsibilities, funds managed by male managers who are likely to have childcare responsibilities, and funds managed by male managers who are not likely to have childcare responsibilities.

2.3 Team structure variable

To explore the team structure variable, we collect each fund manager's tenure within each fund. This allows us to identify whether a fund is managed by a single manager or by a team. We exclude the data record where a fund manager works for only one month in a fund. Based on this information, we can determine which funds are managed by a team with childcare responsibilities or by one manager with childcare responsibilities. This setting enables us to test whether female managers with childcare responsibilities working alone suffered more during the COVID period compared to those in a team. For the second mechanism, we classify each fund based on the political party of the state according to their headquarters' location. To best reflect the political party leaning during the COVID period, we use the results of the 2020 U.S. presidential election as the standard for each state's political leaning. Because this time point is closer to the COVID period, it can better reflect the situation at that time. States that voted for the Democratic candidate are classified as "blue states," while those that voted for the Republican candidate are classified as "red states."

2.4 Traffic data

To use a new proxy to measure the intensity of lockdowns and changes in mobility during the pandemic, we use monthly traffic data from the *Traffic Volume Trends* reports published by the U.S. Department of Transportation (USDOT).² This dataset provides state-level information based on continuous hourly traffic counts collected by sensors installed across major roads and highways. It serves as a reliable proxy for mobility and social activity at the state level.

¹ <https://www.cdc.gov/nchs/fastats/births.htm>

² https://www.fhwa.dot.gov/policyinformation/travel_monitoring/tvt.cfm

However, since states differ in their geographic size, population density, and infrastructure, raw traffic volumes are not directly comparable across states. To standardise the measure and remove the state differences, we construct a traffic-based dummy variable that captures reductions in mobility. Specifically, we use traffic volume in each state and month from 2019, the year before the pandemic, as the baseline reference point. We then compare monthly traffic volume in other periods with the same month in 2019. If the traffic volume in each month and state is lower than its 2019 counterpart, we assign a dummy variable equal to 1, indicating reduced mobility or stricter lockdown conditions; otherwise, the dummy is set to 0. This method allows us to capture relative mobility restrictions across states and time.

2.5 Summary statistics

Panel A of Table 1 presents summary statistics for abnormal returns among different genders of fund management teams. The results show that funds managed by male managers, by female managers, and mixed-gender teams have similar abnormal return summary statistics. The mean and median abnormal returns for all-male funds are 0.23% and -0.935%; for all-female funds, they are -0.15% and -1.00%; and for mixed-gender funds, they are 0.22% and -1.06%. However, during the COVID period, the average abnormal return for female manager funds dropped to -0.75%, which is lower than that of male funds (-0.13%) and mixed-gender funds (-0.11%).

Panel B of Table 1 presents summary statistics for all-male and all-female funds grouped by whether the managers are likely to have childcare responsibilities. During the COVID period, funds managed by women with likely childcare responsibilities generated a mean abnormal return of -0.99%, which is lower than the values for male funds without childcare responsibilities (0.01%). Even for the female-managed funds without childcare responsibilities, the average return remained low at -0.33%. In the post-COVID period, the average abnormal return for female-managed funds with childcare responsibilities improved to -0.39%, with a median of -0.83%, while those without childcare responsibilities had a lower average of -0.28% and a median of -0.59%. This pattern appears counterintuitive, as one might expect funds with managers without childcare responsibilities to recover more strongly. However, the sample sizes of these two groups are extremely small—only 19 funds are classified as “female with childcare responsibilities” and 10 as “female without,” compared to 531 and 135 funds for the male-managed funds in the same categories. So, it is difficult to draw firm conclusions from the statistical comparison. Therefore, we turn to a multiple regression framework that allows us to jointly account for gender and childcare responsibilities, to better identify the performance differences.

[Table 1 around here.]

2.6 Trend Charts of Abnormal Returns

To provide a first overview of performance patterns between different male and female manager groups, we begin by presenting trend charts of abnormal returns from 2018

March to 2023 December. These charts track the evolution of monthly abnormal returns. For better comparison, we normalise an index to 100 in December 2019, then transform the rest period's abnormal return based on the 100 index. By comparing trends across gender groups, childcare responsibilities, and fund headquarter locations, we aim to capture early signs of fund performance that may be linked to differences in gender roles and external unpaid housework during the pandemic. These visual charts provide the first step in the empirical analyses and allow us to point out the hypothesis for the next step.

Figure 1 shows the time-series trends of abnormal returns for male only managed funds, female only managed funds, and the market average performance. The abnormal returns are normalised to 100 at the baseline month (December 2019). Three vertical lines mark important time points: the baseline (dashed grey line), the start of the COVID period (solid red line, January 2020), and the start of the post COVID period (dashed blue line, March 2021). Before the Covid period, male- and female-managed funds show similar trends. However, following the outbreak of the pandemic, the two began to diverge. Funds managed by women saw a greater decline during the pandemic and this continued into the post pandemic period. In contrast, funds managed by men still closely aligned with the market trend. This pattern suggests that there may be gender-related differences impacting fund performance during and after the pandemic.

Figure 1 Gender Differences Performance Trends

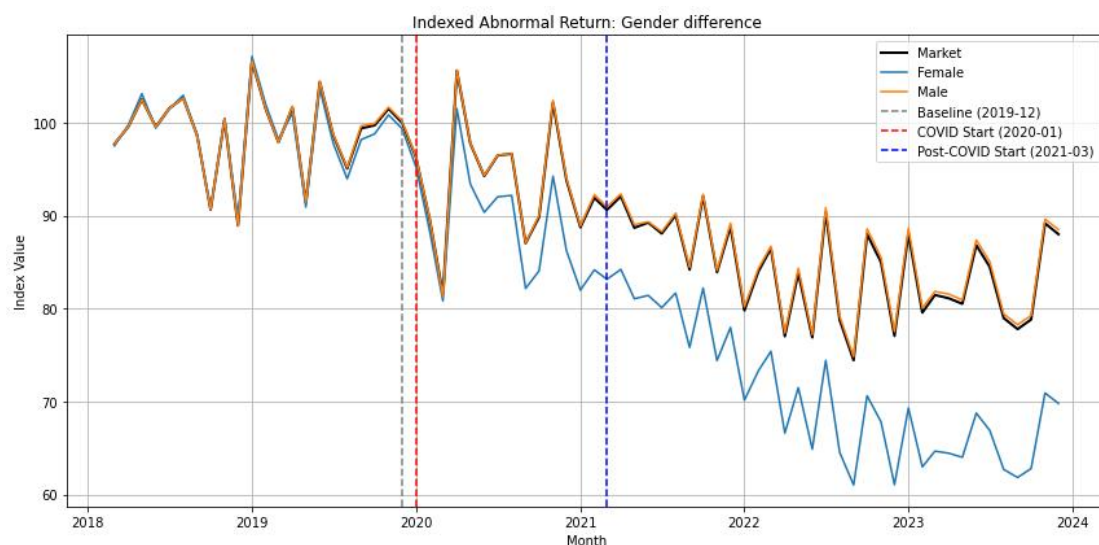
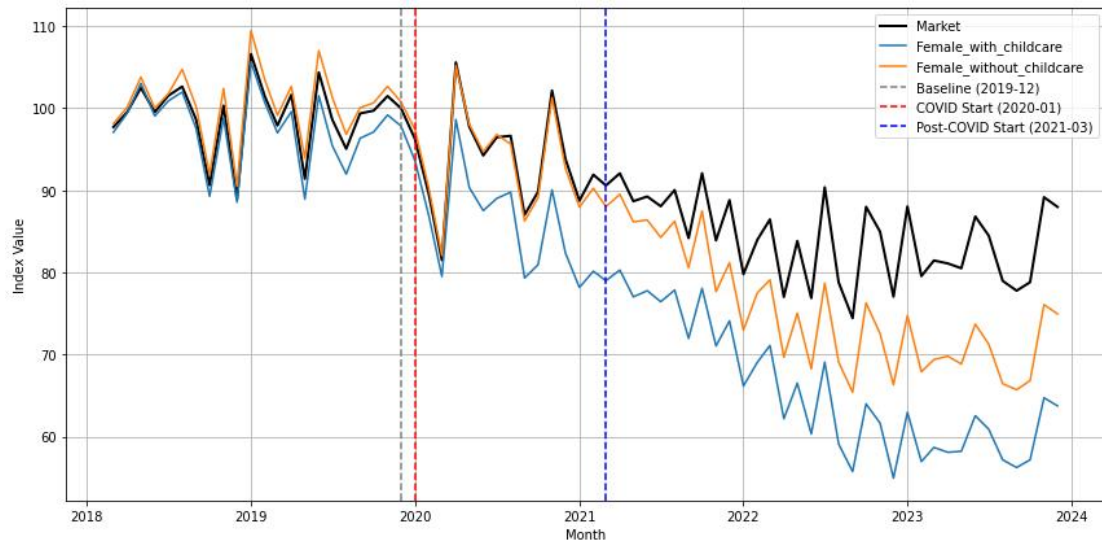


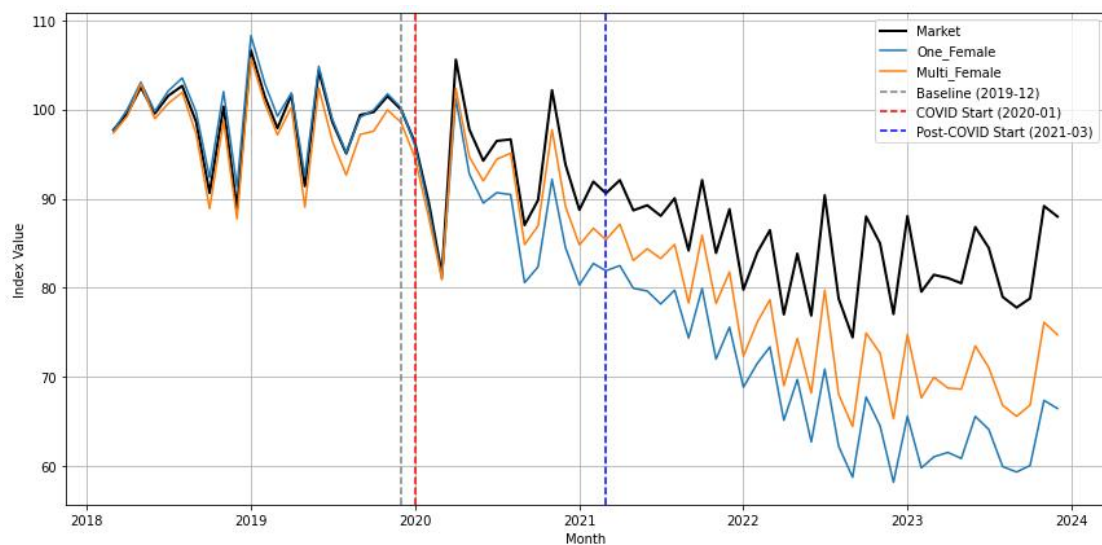
Figure 2 shows the indexed abnormal returns of female fund managers, grouped by whether they likely have childcare responsibilities with the same setting in Figure 1. Before Covid, the two groups show similar performances. After the pandemic started, female managers with likely childcare responsibilities experienced a significant decline. In contrast, those without childcare responsibilities performed relatively better, although their performance is still worse compared to the market. This pattern suggests that the female fund manager who possibly had childcare responsibilities had worse fund performance during and after the Covid period.

Figure 2 Childcare Responsibility Trend Chart



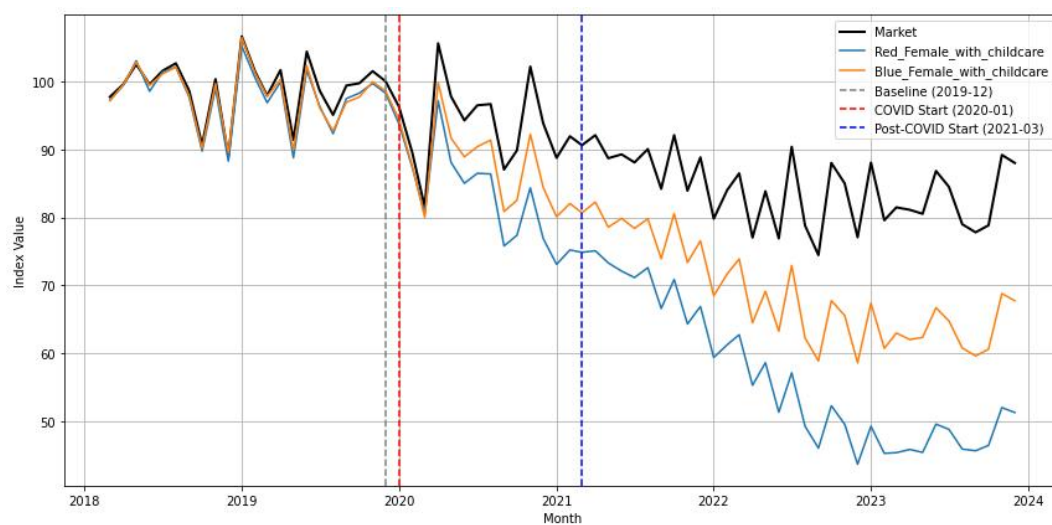
As an initial analysis of the team effect, the Figure 3 presents the indexed abnormal returns of female-managed funds, grouped by team structure: single female manager (One_Female) and multiple female managers (Multi_Female). As for Figures 1 and 2, before COVID-19, both groups performed similarly. After January 2020, funds managed by a single female manager showed a larger decline in performance. Funds managed by a team of female managers performed better than those managed by a single female, although still below the market average. This line trend suggests that being in a team may have helped female managers better handle the difficulties brought by the pandemic.

Figure 3 Team Structure Trends



As we know, the policy and culture might be different between each state. Figure 4 shows the indexed abnormal returns of female fund managers with possible childcare responsibilities, separated by whether their fund's headquarters are based in Democrat states or Republican states. Before the pandemic, the two groups performed similarly. However, after COVID began, female managers with likely childcare in Republican states experienced a more significant decline compared to their counterparts in Democrat states. This gap remained even in the post-COVID period. This difference may be related to differences in state-level policies during the pandemic, such as school closures, childcare support, female welfare, work-from-home flexibility. In addition, traditional gender norms may have been stronger in Republican states, potentially placing more pressure on women during this time.

Figure 4 Democrats vs. Republicans State Trends



3. Methodology and Empirical Results

3.1 Hypotheses Development

The COVID pandemic introduced significant effects to both professional and parents' lives, particularly affecting working parents. In the asset management industry, female fund managers may have faced more challenges due to structural inequalities, traditional gender roles, and increased childcare during Covid period. To explore these potential mechanisms, we develop three hypotheses based on family responsibility, team structure, and geographic policy differences.

Hypothesis 1: Childcare Responsibilities Effect

The responsibility of childcare increased significantly during COVID-19 due to school closures and reduced access to support services. Female fund managers with possible childcare responsibilities likely experienced more disruption compared to those without such responsibilities or other fund group.

H1: Female fund managers with possible childcare responsibilities experienced a larger

decline in fund performance than those without childcare responsibilities or male/mixed gender fund during and after Covid.

Hypothesis 2: Team Structure difference

Working in a team may provide mutual support and help distribute workload, which could reduce the negative effects of external shocks. Female managers working alone may have been more vulnerable to the disruptions caused by the pandemic.

H2: Single female managers underperformed those working in multi-manager teams during and after the Covid period.

Hypothesis 3: State-Level Policy and Cultural Differences

Democrat and Republican states differed in their policy responses to COVID-19, including school closures, lockdown strictness, and work-from-home flexibility. In addition, gender role expectations may differ, with red states often associated with more traditional norms.

H3: Among female managers with possible childcare responsibilities, those in Republican states underperformed those in Democrat states during and after the COVID-19 period.

3.2 Baseline Evidence on Gender and Fund Performance

To estimate abnormal returns, we use the 24 months prior to each month as the estimation window. For each mutual fund i , we estimate the Carhart (1997) four-factor model to obtain the β_{it} and compute the abnormal return AR_{it} throughout the period.

We use a two-way fixed effect difference-in-differences (DiD) to examine the baseline result. Unlike the traditional DiD model with a single post-treatment period, our model includes two post-period indicators: CovidPeriod, which equals 1 for months between January 2020 and February 2021, and PostCovid, which equals 1 for months between March 2021 and December 2023. The treatment group indicator is equal to 1 and is a fund classification based on gender and childcare responsibilities. In the regression, abnormal returns were regressed on the interaction terms between treatment group indicators and the two post-period dummies.

We also control for fund-level and manager-level characteristics. Fund-level controls include net assets, fund size, turnover ratio, and capital market exposure. Manager-level controls include educational background, ownership level, and whether the manager works in a team or not. In all regressions, we include both fund fixed effects (v_i) and month fixed effects (τ_t) and standard errors are clustered at the fund level. X_{it} stands for the control variables. Table 2 lists all the definitions for TreatGroup and the control variables used in the regression.

$$R_{it} - R_{ft} = \alpha_i + \beta_i^{\{MKT\}} \cdot (R_{mt} - R_{ft}) + \beta_i^{\{SMB\}} \cdot SMB_t + \beta_i^{\{HML\}} \cdot HML_t + \beta_i^{\{UMD\}} \cdot UMD_t + \varepsilon_{it}$$

$$AR_{it} = R_{it} - \hat{R}_{it}$$

$$AR_{it} = TreatGroup_i \cdot CovidPeriod + TreatGroup_i \cdot PostCovid + X_{it}\gamma + v_i + \tau_t + \mu_{it}$$

In our baseline regression, we begin by comparing funds managed by female-only, male-only, and mixed-gender teams. We omit *Male* funds from the treatment group and use them as the reference category. The variable *Female* in the *TreatGroup* indicates that the fund is managed entirely by female managers, while *Mix_gender* represents funds managed by both male and female managers. Next, we consider childcare responsibilities in the analysis. In this model, the treatment groups include female funds possibility with and without childcare responsibilities, mixed gender funds possibility with and without childcare responsibilities, and male funds possibility with childcare responsibilities. Male funds without childcare responsibilities are set as the reference group for comparison.

If the COVID pandemic imposed greater household and childcare responsibilities on women, we would expect to observe significantly negative interaction effects between the female-related treatment groups and the *CovidPeriod* / *PostCovid* indicators.

The baseline regression in Table 2 shows that funds managed entirely by female managers performed significantly worse during and after the COVID period compared to male funds and mixed gender fund. The significant coefficient for *Female* is -0.43, indicating a decline in performance during the pandemic. The effect remains negative in the post-COVID period, with a significant coefficient of -0.20. For mixed-gender funds, the coefficients are 0.04 for the COVID period but it is not significant and 0.10 for post COVID with significance at the 5% level, suggesting little difference from male funds.

The second regression results shows that female fund managers who are likely to have childcare responsibilities performed significantly worse during the COVID period, with a coefficient of -0.43. This suggests that increased family duties during lockdowns may have affected their ability to manage funds effectively. However, in the post-COVID period, the coefficient is not statistically significant, indicating that the negative effect did not clearly continue. Also, female managers without possible childcare responsibilities experienced a significant performance decline in the COVID and post-COVID periods, with coefficients of -0.29 and -0.34, respectively.

Male fund managers with likely childcare responsibilities have coefficients of -0.03 and 0.03, respectively, but these estimates are not statistically significant. This suggests that male managers may also have likely childcare duties or did not generate any differences in performance. In contrast, mixed-gender teams with likely childcare responsibilities showed significantly better performance during the pandemic, with a coefficient of 0.25. This suggests that having both male and female managers in a team may have helped balance the increased pressures during the COVID period. However, this positive effect did not persist in the post-pandemic period, as the coefficient dropped to 0.01 and was not statistically significant. This indicates that the advantage seen during the unique pandemic situation may have been temporary.

[Table 2 around here.]

3.3 Team structural effect

To explore the mechanism behind the baseline results, we first examine the team structure effect. We assume that if a fund is managed by one female manager who is also likely to have childcare responsibilities, its performance may be worse during the COVID period and post Covid period. To test this, we continue to use the baseline regression framework but modify the treatment groups. Specifically, we divide *TreatGroup* into two categories: those managed by a single manager and those managed by two or more managers. For reference, we omit funds managed by one male manager, as well as those managed by a single male manager without childcare responsibilities in the first and second regressions.

The regression results are in Table 3. The first set of regressions focuses on differences in team structure within gender groups. The results suggest that funds managed by one female manager experienced a significant decline in performance during the COVID period, with a coefficient of -0.56. The effect remains negative in the post-COVID period at -0.28 and is significant. Funds managed by multiple female managers also show a significant performance drop (-0.38) during COVID period, but this trend did not show in the post period. This indicates that lone-working female managers may have suffered more during the pandemic and recovered more slowly afterward. Being part of a team may have been helpful for female managers during Covid but the performance of female only funds managed by teams still suffered from the COVID-effect. This result is also consistent with the findings of Patel and Sarkissian (2017), that team management has a positive impact on fund performance. For comparison, funds managed by male managers or mixed gender funds performed significantly better, and their coefficients are both significant.

The second regression focuses on childcare responsibilities. The results show that funds managed by one female manager with possible childcare responsibilities experienced significant underperformance during the COVID period, with a coefficient of -0.53. However, the corresponding coefficient in the post-COVID period is not significant. Multi-female funds with possible childcare responsibilities performed worse after the pandemic, with a coefficient of -0.25 but the coefficient is not significant. Similarly, multi-female funds likely without childcare responsibilities also underperformed after COVID, with a coefficient of -0.21, and this effect lasts for the post-COVID period. In contrast, male fund managers with childcare responsibilities show no significant performance decline. Single male funds with possible childcare have a significant positive coefficient (0.20) during COVID. Mixed gender teams without likely childcare responsibilities experienced a significantly higher performance, with a significant coefficient of 0.32, suggesting that these teams may have been less affected by pandemic disruptions. In contrast, mixed-gender teams with likely childcare responsibilities did not show a statistically significant effect during COVID, but their performance improved in the post-COVID period, with a significant coefficient of 0.14.

[Table 3 around here.]

3.4 Democrats VS Republicans

The second mechanism examines whether the political party of a fund's headquarters state affects the performance of female funds with possible childcare responsibilities during the COVID period. We classify each state as either Republican state or Democrat state based on the results of the 2020 U.S. presidential election. In our sample, 228 funds are in Republican states and 785 are in Democratic states. To compare the difference, we continue use the same baseline regression within these two subsamples: Republican state funds and Democrat state funds.

Table 4 presents the regression results for both subgroups. The performance patterns differ noticeably across political lines. In Democratic states, female-managed funds show a significant decline during the COVID period with coefficient -0.44. This effect becomes less pronounced and statistically insignificant in the post-COVID period. In contrast, in Republican states, the coefficients for female managers are small and statistically insignificant, indicating no clear pattern.

When considering childcare responsibilities, the pattern remains in Democratic states. Female managers with likely childcare duties show a significant performance decline during COVID with coefficient -0.47 and continue to face challenges in the post-COVID period (-0.32). Still, these effects are again not statistically significant in Republican states. While male managers with childcare responsibilities also show negative coefficients in both states, none are statistically significant.

Although the regression results for Republican states do not show statistically significant coefficients, Figure 4 reveals a clear downward trend in performance for funds located in Republican states during the pandemic compare with the funds located in Democratic states. This visual evidence suggests that managers in Republican states, particularly those with possible childcare responsibilities, may have been more adversely affected, even if the regression lacks power to detect it statistically.

One possible explanation relates to sample selection effects. Female fund managers are substantially underrepresented in Republican states, and the subset of women who do manage funds in these states may differ systematically from their counterparts in Democratic states. For example, women in Republican states may be more likely to delay or forgo childbirth and concentrate more heavily on their careers, which could attenuate the observed impact of childcare responsibilities during the pandemic. While this conjecture is consistent with the observed patterns, we are unable to directly test it with the available data. Another possible reasons is due to the smaller sample size, we only have three mutual funds with possible childcare responsibilities located in Republican states, and Democratic states have 15 such funds. Overall, the contrast between the two groups highlights how local political and social environments may have shaped pandemic-related work–family challenges.

[Table 4 around here.]

3.5 Gender equality index

The previous analysis comparing Republican and Democratic states gave partly insignificant results, even though the visual evidence had suggested performance differences in the trend charts. One possible reason is that the political effect alone may not fully capture differences in gender-related family roles under the pandemic. To address this limitation, we incorporate a state-level gender equality index from Sugarman and Straus (1988). This index has been applied in CEO analysis (Huang and Kisgen, 2013; Ho et al., 2015) to capture the state's characteristics and the extent of support for women. A higher value indicates a more 'female-friendly' environment. Based on this index, we create a dummy variable equal to 1 if a state's index value is below the average, and 0 otherwise. We then extend our baseline regression by adding a triple interaction term between the treatment group, the COVID period/ Post COVID period, and the gender equality dummy. This new variable allows us to test whether the childcare effect in fund performance patterns during and after the pandemic differs between states with lower versus higher levels of gender equality. The regression model is:

$$\begin{aligned} AR_{it} = & TreatGroup_i \cdot CovidPeriod + TreatGroup_i \cdot CovidPeriod \cdot Equityindex \\ & + TreatGroup_i \cdot PostCovid + TreatGroup_i \cdot PostCovid \cdot Equityindex + X_{it}\gamma \\ & + v_i + \tau_t + \mu_{it} \end{aligned}$$

Table 5 reports the regression results, and the first regression shows that the triple interaction coefficient between Female and Covid period with the Equality Index is negative and significant (-0.85), indicating that female-managed funds located in states with lower gender equality experienced substantially larger performance declines during the pandemic compared to those in more female-friendly states. This negative effect persists in the post-COVID period, with a similarly large and significant coefficient, -0.82.

When focusing on childcare responsibilities, the pattern becomes even clearer. The triple interaction coefficient for female funds with likely childcare and COVID period with quality index is negative (-0.95) and significant at 1%, implying that female managers with possible childcare duties in low gender equality states were the most affected. And the post-COVID coefficient remains negative and significant (-1.09).

By contrast, for female-managed fund without possible childcare, the triple interaction term during COVID is insignificant, but the post-COVID coefficient is significant and negative (-0.32), better than female-managed funds with possible childcare. For male-managed funds, the triple interactions are generally small and insignificant, and mixed gender teams show varied results, with no consistent significance.

Overall, the results highlight that state-level gender equality substantially moderates the pandemic's impact on fund performance, with persistent negative effects concentrated among female-managed funds, especially those with possible childcare responsibilities and located in states with lower gender equality.

[Table 5 around here.]

3.6 Traffic data

To further validate our findings and provide an alternative method to measure the pandemic's impact, we use traffic data as an alternative indicator to stand for lockdown level. Unlike the binary variable used in the DiD method, traffic data is a monthly time series to measure mobility across time and states. We use a traffic dummy variable to capture the extent of traffic restrictions across states during the sample period. The dummy is constructed based on monthly traffic volume data, where a value of 1 indicates that the traffic volume in each state and month is lower than the same month in 2019. This reflects a stricter level of lockdown or reduced mobility in that period, showing another effect caused by COVID. A value of 0 indicates that traffic volume has recovered to or exceeded the baseline level. By using this dummy, we can compare the relative level of traffic disruption during the COVID period against the normal pre-COVID level. This variable provides a proxy for the local lockdown level and helps identify the extent that reduced mobility may have influenced fund performance by disrupting the usual childcare and social support networks. The regression model is:

$$AR_{it} = TreatGroup_i \cdot Traffic_{Dummy} + X_{it}\gamma + v_i + \tau_t + \mu_{it}$$

The regression results for the traffic dummy variable are presented in Table 6. We omit the male-managed funds as the reference category in the first regression. The results show that female fund managers were significantly more affected by lockdown conditions, particularly those with childcare responsibilities.

The coefficient for Female funds is -0.34 and significant, suggesting that female-managed funds tended to perform worse when traffic volume decreased. This result aligns with the hypothesis that stricter lockdowns (lower traffic volume) may have had a greater impact on female-managed funds, while traffic recovery allowed their performance to also recover. The coefficient for mixed gender funds is positive and statistically significant (0.08), suggesting there is evidence on traffic conditions have an impact on performance in mixed gender funds.

The second regression results consider possible childcare duties and omit male funds without possible childcare duties as the reference category. For female-managed funds with possible childcare responsibilities, the coefficient is -0.48 and is significant, indicating that in states with more restricted traffic conditions, these managers experienced significantly lower abnormal returns. This provides strong evidence that mobility restrictions intensified the work-life conflict for female fund managers who were also likely the primary person to take care of children. These findings are consistent with the previous literature showing that women had to take more caregiving responsibilities during the pandemic, which negatively impacted their professional outcomes (e.g., Alon et al., 2020; Alon et al., 2022; Collins et al., 2021). For female managers without likely childcare responsibilities, the coefficient is also negative (-0.28), although it is negative, this coefficient is better than that for women with likely childcare. This implies that even when

women did not have childcare duties, female managers may have faced other gendered barriers under stricter lockdowns, even though this reduced some of the negative effect.

In contrast, the coefficients for male managers with childcare responsibilities are close to zero and statistically insignificant. This suggests that male managers' performance was largely unaffected by changes in mobility, consistent with the result that men were less likely to experience more stress or unpaid work during the pandemic. For mixed gender teams with childcare responsibilities, the coefficient is 0.08, which is positive but not significant. This may indicate that team-based fund structures provided some buffering effect against the challenges of lockdown. However, this effect is not strong enough to reach a significant level.

Overall, the results from Table 5 reinforce the mechanism that mobility restrictions bring by the pandemic impacted women, especially those likely with childcare duties, and it had limited effects on male managers. This analysis consistent with earlier results and further highlights the importance of considering gender alongside the consequences of COVID-related policies.

[Table 6 around here.]

3.7 Comparison with the crisis period

To explore whether the gender difference and potential childcare effect on performance patterns observed during the pandemic were unique to that episode or normal responses to external shocks, we conduct a baseline regression under the background of the 2007–2008 global financial crisis. We selected the crisis period from January 2007 to December 2008, the pre-crisis period from January 2005 to December 2006 and the post crisis period from January 2009 to December 2010. We use the same criteria to group the funds by the manager(s)' genders and whether they have possible childcare responsibilities. This comparison allows us to test whether gender-related performance gaps, particularly those linked to potential childcare responsibilities, also existed in this previous significant market shock period. But in the case of the financial crisis, there was no lockdown, and therefore no disruption to childcare arrangements or social support networks. By applying the same empirical model as in the COVID setting, we aim to assess the consistency of gender and possible childcare-related performance dynamics across different types of crises.

Table 7 reports the regression results for the 2007–2008 global financial crisis. Most coefficients related to gender and potential childcare responsibilities are statistically insignificant. This finding is unexpected but can be explained by the fundamental difference of the financial crisis compared to the pandemic shock. The 2007–2008 crisis was primarily a market and liquidity shock, which did not involve widespread disruptions to schools, childcare facilities, or household routines. As a result, fund managers, particularly women, were less likely to face intensified work–family conflicts during this period. In contrast, the COVID shock directly affected both professionals and family.

In addition, the composition of female fund managers during the financial crisis period may differ from that during the pandemic. Given the lower representation of women in fund management in earlier years, those who remained in the industry during the crisis may have been less exposed to childcare duties, either because they did not have young children or had already established stable support structures.

The only significant coefficient appears for mixed-gender funds in the post-crisis period, which is negative and inconsistent with our main hypothesis. We interpret this result with caution and view it as exploratory, possibly reflecting post-crisis team restructuring or coordination challenges rather than childcare-related reasons. Overall, the lack of significant childcare-related effects during the financial crisis reinforces the view that the patterns documented during the pandemic are not a general feature of all market downturns but are closely linked to the unique work–family conflicts associated with COVID-19.

These results suggest that the performance gap brought by likely childcare duties during COVID-19 did not appear during the financial crisis. The 2007–2008 global financial crisis was largely driven by systemic risks in the financial system, including the collapse of major banks, tightening of credit in the markets, and a huge decline in asset prices. While it caused substantial economic disruption and job losses, it did not lead to country level large-scale school closures or stay-at-home orders. In contrast, COVID brought a unique combination of economic and social shocks. Stay at home orders, school shutdowns, and the closure of childcare facilities significantly increased the burden on working parents, especially for mothers under traditional roles. During the financial crisis, fund managers were affected by market volatility and liquidity concerns, but their professional responsibilities were not compounded by increased domestic duties. In contrast, COVID forced many parents to adapt to remote work while simultaneously caring for children at home. This dual burden would have affected women more than men due to traditional gender roles in childcare.

Overall, this comparison supports the idea that the COVID-19 shock was unique in nature. The performance decline for female managers with likely childcare responsibilities seems to be closely linked to the unique effects of the pandemic, rather than a general pattern during any crisis.

[Table 7 around here.]

3.8 Manager-Level Consequence Under the Shock

To further find out the evidence of external shocks on fund managers, this section analyses manager level transitions during three key periods: pre-shock, shock, and post-shock, with a focus on the COVID period and a comparison with the 2007–2008 global financial crisis. Specifically, we classify fund manager status changes into five categories: Move to other funds, Task number increases, Task number reduces, Leave the industry, and Unchanged. These transitions help capture the career dynamics and workload changes that fund managers experienced under the shock.

Fund managers often exhibit a certain level of job mobility, so we define the reference point for each period based on the numbers of managers who were actively managing at least one fund on one day before the period begins. For example, the reference day we choose for the COVID period is 29 February, 2020. The analysis is conducted at the manager level, due to the complexity of fund manager transitions, a substantial portion of this work required manual data collection and validation – for instance, identifying whether a manager switched funds, exited the industry, or reduced their task load often involved tracking fund histories, comparing Morningstar data, and cleaning overlapping timelines. This working process was repeated not only for the COVID period, but also for the financial crisis period, allowing for a consistent shock comparison. Finally, we calculate the proportional of each transition type and the gender differences, offering further insight into how female and male fund managers might have faced different consequences under the COVID and financial crisis periods.

Table 8 presents the changes in manager status during the COVID period and grouped by gender. In the pre-COVID period, most managers, both male and female, experienced no change in their responsibilities. Specifically, 73.5% of male managers and 68.9% of female managers remained unchanged. During the COVID period, we observe a clear shift. The percentage of female managers experiencing negative outcomes increased, particularly in terms of leaving the industry, 11.3% compared with male managers at 6.8%, and reducing task numbers (17.0% vs. 11.3%). Meanwhile, the percentage of female managers with no change in consequences dropped to 73.0%, compared to 85.3% for male managers. This indicates that women faced greater disruption, likely due to the dual burden of working responsibilities and increased childcare duties during COVID period.

In the post-COVID period, the gap further widened. While most male managers (84.9%) maintained their roles, only 51.9% of female managers did so. The percentage of female managers reducing fund tasks (28.1%) or exiting the industry (9.4%) remained significantly higher than that of male managers, 5.0% and 3.4% respectively. Notably, 37.5% of female managers either reduced their workload or left the job, compared to just 8.4% of male managers, a 29.1 percentage point difference. This suggests a long-lasting effect of the pandemic on women's career paths, possibly reflecting delayed exits or long-term fatigue from balancing work and family responsibilities.

[Table 8 around here.]

Table 9 presents the career consequences for male and female fund managers under the 2007–2008 Global Financial Crisis setting. In the Pre-Crisis period, most fund managers remained unchanged in their positions, with 62.8% of female and 56.9% of male managers experiencing no change. This period shows relatively small gender differences across most categories, which suggests a relatively stable environment for both male and female managers before the shock hit.

During the crisis from 2007 to 2008, fund manager movement became more dynamic. Notably, 22.8% of male managers either reduced their number of tasks or exited the

workforce, compared to 18.9% of female managers, a difference of nearly four percentage points. Interestingly, the percentage of female managers leaving the workforce rose to 18.2%, slightly higher than the percentage of male managers at 15.9%, but the percentage of women reducing their number of tasks was significantly lower (0.6% vs. 6.8%). One possible explanation is that female managers either stayed in their roles or left entirely, rather than reducing their responsibilities.

In the post-crisis period, patterns appeared to return to their pre-crisis levels. The percentage of unchanged managers increased across both genders, reaching 70.6% for women and 69.0% for men. However, some gender gaps remained. Male managers were more likely to reduce task numbers or leave the workforce (13.8%), compared to 9.4% of female managers.

Overall, the financial crisis period shows some gender differences, but the impact was lower and more balanced than we observe during the COVID shock. Importantly, the post-crisis recovery for female managers was relatively strong compared to men, in contrast to the post-COVID period. This indicates that the COVID shock imposed not only financial market-related declines and stress, but also additional personal and family burdens, especially affecting women. In contrast, the 2008 crisis did not have the same level of gender difference in its impact on mutual fund managers.

[Table 9 around here.]

3.9 Discussion of results

Our findings highlight how gender and childcare responsibilities impacted mutual fund manager performance during the COVID period. Specifically, we observe that female fund managers, particularly those likely to have childcare responsibilities, underperformed during the pandemic. And in many situations, this effect continued in the post-COVID period with worse recovery ability. This phenomenon supports the argument that external shocks, such as the pandemic, more seriously impact women due to unequal unpaid housework (Alon et al., 2020; Collins et al., 2021). When mobility was restricted and schools were closed, many female fund managers were likely to have to spend more time on family responsibilities, which limited their time to devote to professional work, resulting in gender differences in performance.

These findings are consistent with prior studies in the finance industry that gender performance gaps are not due to skill differences. Atkinson, Baird, and Frye (2003) and Niessen-Ruenzi and Ruenzi (2019) find no significant differences in fund performance between male and female managers but they highlight that investor bias against female managers lead net asset flows to female-managed funds to be less than to those managed by men. More recent evidence points out that gender roles in families directly affect investment outcomes. Ginzinger et al.'s (2024) results suggested a temporary underperformance in female managers surrounding childbirth, and Tommar, Kolokolova, and Mura (2023) show that female hedge fund managers with young children suffered declines in abnormal returns precisely during periods of COVID-related school closures.

These studies offer evidence that more time on unpaid housework is responsible for short term underperformance. Our study builds on this literature by providing three key contributions. First, we expand the scope to include not only female managers but also male managers, mixed-gender teams and teams member number, allowing us to compare gendered results within different team structures. Second, we examine variation across political and regional contexts, including an examination of Republican states vs. Democratic states, showing that local policy and cultural attitudes also shape the performance impact. Third, we use state-level traffic data as a new proxy to capture how the lockdown level might affect work–family balance.

Our analysis also shows that team structure is a key factor in fund performance during the COVID period. Female managers who worked alone experienced sharper performance declines, while those in multi-manager teams or mixed gender teams were more stable. This supports earlier evidence that team-managed funds exhibit greater stability and lower idiosyncratic risk (Bar, Kempf and Ruenzi, 2011), and especially that mixed gender teams tend to perform better under stress (Lu, Naik and Teo, 2024). While team management does not guarantee higher average returns (Patel and Sarkissian, 2017), it may provide support and flexibility when one manager suffers from external shocks such as additional childcare responsibilities and housework during COVID.

Regarding the political and policy environment, we did not find any regression evidence supporting the notion that female-managed funds located in Republican states where there is less childcare support and fewer ‘female-friendly’ policies tended to experience larger performance declines than their counterparts in Democratic states. But we found the pattern shown in Figure 4, and in line with Landivar et al.’s (2023) result that women’s labour was more negatively affected by remote schooling during COVID. Similarly, Heggeness (2020) report that school closures and childcare were the main reasons why women left the workforce during the pandemic. To further analyse the state-level effect, we introduce the Gender Equality Index (Sugarman and Straus, 1988) in our baseline regression. Results show that female managers, particularly those with possible childcare responsibilities, experienced larger and more persistent performance declines in states with lower gender equality, while no similar effect was observed for male managers. This result highlights the differences in gender roles across states and their impacts on gender-related differences in performance during the pandemic.

Traffic data was used as a new proxy to measure the lockdown level, and we use traffic volume data to create a dummy variable for the lockdown severity level. We showed that reduced mobility and heightened restrictions resulted in gender performance gaps, especially among women with childcare duties. During months of lower traffic volumes (indicating strict lockdowns during the COVID period), female managers with likely childcare duties experienced the largest performance declines. This result also provides new perspectives for research on mutual funds, because traffic data can somewhat reflect the intensity of external shocks. Taken together, these results suggest that a crisis such as COVID enhanced existing inequalities in the workforce. Even in a high-skill, high-education industry like asset management, gender roles and childcare

responsibilities continue to impact professional work in a different way.

To further understand whether the performance drop among female fund managers with likely childcare responsibilities was specific to the COVID-19 shock or part of a more normal crisis response, we conduct a same-setting analysis using the background under 2008 Global Financial Crisis. By applying the same framework to the crisis period and its surrounding years, we can assess whether similar gendered patterns emerged in a different type of economic shock period. However, the performance impact on female managers was much smaller and often statistically insignificant. In contrast, during the COVID-19 period, we observe a sharper and more persistent decline in performance for female managers with likely childcare responsibilities. This suggests that the pandemic created a unique environment which combined both professional and unpaid work pressures that traditional economic crises did not.

Finally, we compare the changes in fund manager status across the COVID period and the Financial Crisis to generate evidence regarding the pandemic that had a direct effect on manager-level career outcomes. Our findings reveal that during the COVID period, female fund managers were more likely to reduce their numbers of tasks or exit the industry compared to male managers. In contrast, during the 2008 crisis, the gender gap in these outcomes was notably smaller or the opposite. This result reinforces the idea that the COVID-19 shock was not a typical economic downturn, it is a combination of work and family conflicts, especially for women. The greater numbers leaving the industry or reducing their responsibilities among female managers during the pandemic likely reflect the additional unpaid work pressure created by school closures, limited childcare, and stay-at-home policies, which were not shown during the financial crisis.

4. Robustness tests

To ensure the validity and consistency of our main findings, we conduct a series of robustness tests. These test results still support our findings. The robustness tests undertaken are described below, while detailed results are reported in the Appendix.

4.1 Separate Estimation by Treatment Group

We re-estimate the baseline regressions separately for each treatment group rather than pooling them together in a single regression. This allows us to examine whether the main effects observed in the pooled model are consistent within each subgroup, such as female managers with possible childcare responsibilities, female managers without, male managers with childcare duties, and other relevant categories. By estimating the model separately for each group, we can better understand whether the observed performance differences are driven by one group or whether the interaction patterns. This also helps to reduce potential biases from fund group-level heterogeneity.

4.2 Using Benchmark Returns as an Alternative Performance Measure

To further test the robustness of our findings, we replace the dependent variable with

benchmark returns instead of abnormal returns. Benchmark returns are widely used in the mutual fund literature (Berk and van Binsbergen, 2017) and offer an alternative way to evaluate fund performance relative to passive investment strategies. We rerun the baseline regressions and each treatment group regression using benchmark returns and find that the core results remain consistent.

4.3 Using Tracking Error as an Alternative Dependent Variable

As an additional robustness check, we use tracking error as the dependent variable to examine whether the COVID bring negative effects to the female managers. Tracking error measures the volatility of a fund's return relative to its benchmark and reflects the extent to which managers deviate from passive strategies. The results are consistent with our primary findings, suggesting that the performance differences across fund groups are also reflected in variations in risk-taking behaviour during the pandemic.

4.4 Using volatility as an Alternative Dependent Variable

This test allows us to examine whether differences in return volatility across gender and possible childcare responsibility groups are consistent with the patterns observed in abnormal returns. Higher volatility may reflect greater uncertainty or instability in fund management during the COVID- or post-COVID period. The results show that female-managed funds, particularly those with likely childcare responsibilities, exhibited increased volatility during the pandemic, consistent with our main conclusions.

5. Conclusions

This paper analyses how the COVID pandemic affected the performance of mutual fund which are female funds and possible have childcare responsibilities. Using the U.S. actively managed mutual funds data from March 2018 to December 2023, we find that female funds underperformed during the pandemic relative to male funds and mix gender funds. Female fund managers who were likely to have childcare responsibilities were more affected during the COVID period, as they had to spend more time on housework and take care of children. This reduced their ability and time to concentrate on their work, leading to weaker fund performance. Moreover, this negative effect persisted into the post-COVID period, they recovery ability is worse than male and mix gender funds.

To better understand the behind mechanisms, we explore two key channels: team structure effect and geographic political environment. Results show that if the fund only have one female manager, particularly those with childcare responsibility, experienced larger performance declines compared to those working in teams or male/mix gender funds. Additionally, the negative impact was more severe for female funds headquarter located in Republican states. Republican states lockdown policies and belief were generally less supportive of work-family balance, compared to those in Democratic states (Adolph et al., 2022).

We further validate our findings using traffic data. By using traffic volume data and

year-over-year changes, we provide a new and dynamic method to measure the lockdown restriction level in time series. We find that female funds manager, with likely childcare responsibilities, were more negatively affected during periods of reduced mobility. This result proved again that work-family conflicts was increase during COVID were effect more to the female manager, especially those possible have childcare responsibilities.

To explore whether these effects were specific to COVID or more general responses to external shocks, we conduct a baseline analysis using the 2007–2008 global financial crisis as a reference point. In addition, we examine fund manager career outcomes by comparing the percentage of managers who changed tasks, moved funds, or exited the industry across different periods. Results show that female managers were more likely to reduce responsibilities or leave the industry compared to their male counterparts during COVID and post COVID. In these two comparisons, we don't see the same patterns in the financial crisis.

Our findings contribute to the literature on gender and labor market inequality by offering new evidence from the mutual fund during COVID. These results highlight the unequal impact of external shocks like COVID on female, even if highly qualified, skilled and educated women are not exempted, and point out the importance of considering family responsibilities balance with working. While progress toward gender equality has been made in the finance industry, our results suggest that inequality phenomenon remains, especially when external shocks happen.

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Table 1 Summary statistics

This table reports the summary statistics of the abnormal returns in our sample for each treatment group. The statistics are reported for the complete sample period, as well as for the pre COVID period from March 2018 to December 2019; COVID period from January 2020 to February 2021; post COVID period from March 2021 to December 2023. Abnormal returns are measured as monthly percentages, represented by the difference between the fund's return and the expected return based on the Carhart four-factor model. All values are expressed in percentage points.

Panel A: Grouped by gender

Fund Group			
Whole period	Female	Male	Mixgender
Mean	-0.15	0.23	0.22
St.Dev.	8.41	8.88	8.74
Median	-1.00	-0.93	-1.06
p25	-5.99	-5.97	-5.89
p75	3.72	4.22	4.25
Pre-COVID			
Mean	0.44	0.49	0.45
St.Dev.	7.59	7.70	7.62
Median	-0.29	-0.23	-0.28
p25	-4.63	-4.64	-4.47
p75	3.47	3.59	3.56
COVID			
Mean	-0.75	-0.13	-0.11
St.Dev.	9.83	10.52	10.54
Median	-3.03	-2.88	-3.12
p25	-7.67	-7.37	-7.11
p75	2.42	2.73	2.90
Post-COVID			
Mean	0.19	0.19	0.21
St.Dev.	8.63	8.63	8.61
Median	-0.80	-0.80	-0.98
p25	-6.14	-6.14	-6.06
p75	5.67	5.67	5.88
Total	33	779	201

Panel B: Grouped by possible childcare

Fund Group				
Whole period	Female_with_childcare	Female_without_childcare	Male_with_childcare	Male_without_childcare
Mean	-0.26	-0.03	0.22	0.25
St.Dev.	8.36	8.81	8.86	8.97
Median	-1.00	-1.10	-0.94	-0.88
p25	-6.13	-6.42	-5.97	-5.95
p75	3.95	3.79	4.21	4.25
Pre-COVID				
Mean	0.37	0.53	0.49	0.48
St.Dev.	7.50	8.08	7.66	7.86
Median	-0.28	-0.48	-0.23	-0.22
p25	-4.72	-4.72	-4.59	-4.71
p75	3.51	3.49	3.55	3.68
COVID				
Mean	-0.99	-0.33	-0.11	0.01
St.Dev.	9.52	10.50	10.90	11.11
Median	-2.95	-3.16	-3.19	-2.90
p25	-7.68	-7.59	-7.33	-7.52
p75	2.41	2.56	3.17	3.26
Post-COVID				
Mean	-0.37	-0.28	0.19	0.20
St.Dev.	8.37	8.50	8.63	8.64
Median	-0.83	-0.59	-0.82	-0.75
p25	-6.53	-6.60	-6.12	-6.17
p75	5.57	4.83	5.63	5.77
Total	19	10	531	185

Table 2 Baseline regression result

This table reports the estimation results for the regression in 3.2 of the mutual fund abnormal returns from March 2018 to December 2023 with different treat groups of managers. All variable definitions are reported in Appendix 1. Standard errors are clustered by fund level. Abnormal returns are measured as monthly percentages, represented by the difference between the fund's return and the expected return based on the Carhart four-factor model. All values are expressed in percentage points.

Variable	Coefficient	pValue	Variable	Coefficient	pValue
Intercept	3.52	0.00	Intercept	3.54	0.00
Female * CovidPeriod	-0.43	0.00	Female_with_childcare * CovidPeriod	-0.43	0.03
Female * PostCovid	-0.20	0.08	Female_with_childcare * PostCovid	-0.08	0.70
Mix_gender * CovidPeriod	0.04	0.44	Female_without_childcare * CovidPeriod	-0.29	0.08
Mix_gender * PostCovid	0.10	0.01	Female_without_childcare * PostCovid	-0.34	0.00
			Male_with_childcare * CovidPeriod	-0.03	0.61
			Male_with_childcare * PostCovid	0.03	0.52
			Mix_gender_with_childcare * CovidPeriod	0.00	0.96
			Mix_gender_with_childcare * PostCovid	0.14	0.01
			Mix_gender_without_childcare * CovidPeriod	0.25	0.02
			Mix_gender_without_childcare * PostCovid	0.01	0.90
Control Variables	YES			YES	
Fund and Month FE	YES			YES	
Adj_R_squared	0.90			0.90	
Nobs	56814			56814	

Table 3 Team structure effect regression result

This table reports the estimation results for the regression in 3.3 of the mutual fund abnormal returns from March 2018 to December 2023 with different treat group of managers under team structure effect. All variable definitions are reported in appendix 1. Standard errors are clustered by fund level. Abnormal returns are measured as monthly percentages, represented by the difference between the fund's return and the expected return based on the Carhart four-factor model. All values are expressed in percentage points.

Variable	Coefficient	pValue	Variable	Coefficient	pValue
Intercept	3.52	0.00	Intercept	3.55	0.00
One_Female * CovidPeriod	-0.56	0.00	One_Female_with_childcare * CovidPeriod	-0.53	0.05
One_Female * PostCovid	-0.28	0.06	One_Female_with_childcare * PostCovid	-0.22	0.46
Multi_Female * CovidPeriod	-0.38	0.02	One_Female_without_childcare * CovidPeriod	-0.22	0.37
Multi_Female * PostCovid	-0.19	0.30	One_Female_without_childcare * PostCovid	-0.34	0.05
Multi_Male * CovidPeriod	-0.07	0.25	Multi_Female_with_childcare * CovidPeriod	-0.25	0.37
Multi_Male * PostCovid	-0.05	0.29	Multi_Female_with_childcare * PostCovid	0.17	0.59
Mix_gender * CovidPeriod	-0.01	0.85	Multi_Female_without_childcare * CovidPeriod	-0.21	0.08
Mix_gender * PostCovid	0.06	0.26	Multi_Female_without_childcare * PostCovid	-0.34	0.04
			One_Male_with_childcare * CovidPeriod	0.20	0.02
			One_Male_with_childcare * PostCovid	0.11	0.14
			Multi_Male_with_childcare * CovidPeriod	0.02	0.78
			Multi_Male_with_childcare * PostCovid	0.01	0.86
			Multi_Male_without_childcare * CovidPeriod	0.23	0.06
			Multi_Male_without_childcare * PostCovid	-0.01	0.89
			Mix_gender_with_childcare * CovidPeriod	0.08	0.30
			Mix_gender_with_childcare * PostCovid	0.14	0.02
			Mix_gender_without_childcare * CovidPeriod	0.32	0.00
			Mix_gender_without_childcare * PostCovid	0.01	0.93
Control Variables	YES		YES		
Fund and Month FE	YES		YES		
Adj_R_squared	0.90		0.90		
Nobs	56814		56814		

Table 4 Democratic vs. Republican regression result

This table reports the estimation results for the regression in 3.4 of the mutual fund abnormal returns from March 2018 to December 2023 with different treat group of managers under Democratic or Republican states. All variable definitions are reported in appendix 1. Standard errors are clustered by fund level. Abnormal returns are measured as monthly percentages, represented by the difference between the fund's return and the expected return based on the Carhart four-factor model. All values are expressed in percentage points.

Variable	Republican		Democratic		Variable	Republican		Democratic	
	Coefficient	pValue	Coefficient	pValue		Coefficient	pValue	Coefficient	pValue
Intercept	2.69	0.00	3.65	0.00	Intercept	2.74	0.00	3.68	0.00
Female * CovidPeriod	-0.01	0.98	-0.44	0.00	Female_with_childcare * CovidPeriod	-0.10	0.75	-0.47	0.02
Female * PostCovid	0.08	0.76	-0.20	0.10	Female_with_childcare * PostCovid	0.02	0.95	-0.03	0.87
Mix_gender * CovidPeriod	0.06	0.63	0.03	0.56	Female_without_childcare * CovidPeriod	0.00	0.00	-0.27	0.10
Mix_gender * PostCovid	0.12	0.19	0.09	0.05	Female_without_childcare * PostCovid	0.00	0.00	-0.32	0.01
					Male_with_childcare * CovidPeriod	-0.17	0.35	-0.01	0.85
					Male_with_childcare * PostCovid	-0.15	0.21	0.06	0.20
					Mix_gender_with_childcare * CovidPeriod	-0.07	0.75	0.00	0.97
					Mix_gender_with_childcare * PostCovid	-0.06	0.65	0.18	0.00
					Mix_gender_without_childcare * CovidPeriod	0.31	0.42	0.23	0.02
					Mix_gender_without_childcare * PostCovid	0.19	0.65	-0.02	0.84
Control Variables	YES		YES			YES		YES	
Fund and Month FE	YES		YES			YES		YES	
Adj_R_squared	0.90		0.90			0.90		0.90	
Nobs	12661		44153			12661		44153	

Table 5 Gender equality index result

This table reports the estimation results for the regression in 3.5 of the mutual fund abnormal returns from March 2018 to December 2023 with triple interaction variable. Equalityindex equal to 1 if that fund's state gender equality index is below the average index value. All variable definitions are reported in appendix 1. Standard errors are clustered by fund level. Abnormal returns are measured as monthly percentages, represented by the difference between the fund's return and the expected return based on the Carhart four-factor model. All values are expressed in percentage points.

Variable	Coefficient	pValue	Variable	Coefficient	pValue
Intercept	3.79	0.00	Intercept	3.85	0.00
Female * CovidPeriod	-0.18	0.15	Female_with_childcare * CovidPeriod	-0.12	0.53
Female * PostCovid	-0.18	0.12	Female_with_childcare * PostCovid	-0.08	0.70
Female * CovidPeriod * EqualityIndex	-0.85	0.00	Female_with_childcare * CovidPeriod * EqualityIndex	-0.95	0.00
Female * PostCovid * EqualityIndex	-0.82	0.00	Female_with_childcare * PostCovid * EqualityIndex	-1.09	0.00
Mix_gender * CovidPeriod	0.16	0.00	Female_without_childcare * CovidPeriod	-0.14	0.39
Mix_gender * PostCovid	0.10	0.02	Female_without_childcare * PostCovid	-0.27	0.03
Mix_gender * CovidPeriod * EqualityIndex	-0.11	0.28	Female_without_childcare * CovidPeriod * EqualityIndex	0.00	0.00
Mix_gender * PostCovid * EqualityIndex	0.03	0.69	Female_without_childcare * PostCovid * EqualityIndex	0.00	0.00
			Male_with_childcare * CovidPeriod	-0.01	0.88
			Male_with_childcare * PostCovid	0.02	0.63
			Male_with_childcare * CovidPeriod * EqualityIndex	-0.09	0.08
			Male_with_childcare * PostCovid * EqualityIndex	0.01	0.87
			Mix_gender_with_childcare * CovidPeriod	0.12	0.12
			Mix_gender_with_childcare * PostCovid	0.14	0.02
			Mix_gender_with_childcare * CovidPeriod * EqualityIndex	-0.19	0.08
			Mix_gender_with_childcare * PostCovid * EqualityIndex	-0.01	0.90
			Mix_gender_without_childcare * CovidPeriod	0.32	0.00
			Mix_gender_without_childcare * PostCovid	0.08	0.32
			Mix_gender_without_childcare * CovidPeriod * EqualityIndex	0.08	0.86
			Mix_gender_without_childcare * PostCovid * EqualityIndex	0.17	0.58
Control Variables	YES			YES	
Fund and Month FE	YES			YES	
Adj_R_squared	0.90			0.90	
Nobs	56814			56814	

Table 6 Traffic data result

This table reports the estimation results for the regression in 3.6 of the mutual fund abnormal returns from March 2018 to December 2023 with different treat groups of managers by using traffic data dummy. All variable definitions are reported in appendix 1. Standard errors are clustered by fund level. Abnormal returns are measured as monthly percentages, represented by the difference between the fund's return and the expected return based on the Carhart four-factor model. All values are expressed in percentage points.

Variable	Coefficient	pValue	Variable	Coefficient	pValue
Intercept	3.70	0.00	Intercept	3.69	0.00
Female * Traffic_Dummy	-0.34	0.00	Female_with_childcare * Traffic_Dummy	-0.48	0.00
Mix_gender * Traffic_Dummy	0.08	0.09	Female_without_childcare * Traffic_Dummy	-0.28	0.06
			Male_with_childcare * Traffic_Dummy	-0.01	0.88
			Mix_gender_with_childcare * Traffic_Dummy	0.08	0.13
			Mix_gender_without_childcare * Traffic_Dummy	-0.01	0.91
Control Variables	YES		Control Variables	YES	
Fund and Month FE	YES		Fund and Month FE	YES	
Adj_R_squared	0.89		Adj_R_squared	0.89	
Nobs	56814		Nobs	56814	

Table 7 Financial crisis baseline regression result

This table reports the estimation results for the regression in 3.7 of the mutual fund abnormal returns from January 2005 to December 2010 with different treat groups of managers by using traffic dummy variable. All variable definitions are reported in Appendix 1. Standard errors are clustered by fund level. Abnormal returns are measured as monthly percentages, represented by the difference between the fund's return and the expected return based on the Carhart four-factor model. All values are expressed in percentage points.

Variable	Coefficient	pValue	Variable	Coefficient	pValue
Intercept	-2.74	0.00	Intercept	-2.74	0.00
Female * CrisisPeiod	0.12	0.30	Female_with_childcare * CrisisPeiod	0.09	0.44
Female * PostCrisis	0.03	0.80	Female_with_childcare * PostCrisis	0.23	0.15
Mix_gender * CrisisPeiod	-0.04	0.51	Female_without_childcare * CrisisPeiod	0.09	0.65
Mix_gender * PostCrisis	-0.07	0.15	Female_without_childcare * PostCrisis	-0.10	0.61
			Male_with_childcare * CrisisPeiod	-0.03	0.57
			Male_with_childcare * PostCrisis	0.04	0.40
			Mix_gender_with_childcare * CrisisPeiod	-0.03	0.65
			Mix_gender_with_childcare * PostCrisis	0.02	0.72
			Mix_gender_without_childcare * CrisisPeiod	-0.12	0.23
			Mix_gender_without_childcare * PostCrisis	-0.22	0.02
Control Variables	YES		Control Variables	YES	
Fund and Month FE	YES		Fund and Month FE	YES	
Adj_R_squared	0.89		Adj_R_squared	0.89	
Nobs	65887		Nobs	65887	

Table 8 Manager level changing consequences in COVID

This table presents the changes in fund manager status before, during, and after the pandemic. Status categories include “Unchanged”, “Moved to other funds”, “Task number increase”, “Task number reduce”, and “Left the work”. Manager numbers reference point is one day before the period. The analysis is conducted at the manager level and compares male and female fund managers.

Pre-COVID Period					
Consequences	Female	%	Male	%	%diff(M-F)
Move to other funds	0	0.0%	0	0.0%	0.00%
Task number increase	27	18.2%	102	7.7%	-10.57%
Task number reduce	9	6.1%	67	5.0%	-1.04%
Leave the work	10	6.8%	184	13.8%	7.08%
No change	102	68.9%	977	73.5%	4.54%
Manager Number	148		1330		
Task number reduce and leave the work	19	12.84%	251	18.87%	6.03%
COVID Period					
Consequences	Female	%	Male	%	%diff(M-F)
Move to other funds	1	0.6%	2	0.2%	-0.47%
Task number increase	15	9.4%	41	3.2%	-6.25%
Task number reduce	9	5.7%	59	4.6%	-1.08%
Leave the work	18	11.3%	87	6.8%	-4.56%
No change	116	73.0%	1098	85.3%	12.36%
Manager Number	159		1287		
Task number reduce and leave the work	27	17.0%	146	11.3%	-5.64%
Post-Covid Period					
Consequences	Female	%	Male	%	%diff(M-F)
Move to other funds	1	0.6%	3	0.2%	-0.39%
Task number increase	16	10.0%	84	6.5%	-3.51%
Task number reduce	45	28.1%	65	5.0%	-23.10%
Leave the work	15	9.4%	44	3.4%	-5.97%
No change	83	51.9%	1098	84.9%	32.98%
Manager Number	160		1294		
Task number reduce and leave the work	60	37.5%	109	8.4%	-29.1%

Table 9 Manager level changing consequences in financial crisis

This table presents the changes in fund manager status before, during, and after the financial crisis. Status categories include "Unchanged", "Moved to other funds", "Task number increase", "Task number reduce", and "Left the work". Manager numbers reference point is one day before the period. The analysis is conducted at the manager level and compares male and female fund managers.

Pre-Crisis Period					
Consequences	Female	%	Male	%	%diff(M-F)
Move to other funds	0	0.0%	3	0.2%	0.23%
Task number increase	12	8.1%	113	8.5%	0.39%
Task number reduce	8	5.4%	76	5.7%	0.31%
Leave the work	0	0.0%	10	0.8%	0.75%
No change	93	62.8%	757	56.9%	-5.92%
Manager Number	113		959		
Task number reduce and leave the work	8	7.08%	86	8.97%	1.89%
Crisis Period					
Consequences	Female	%	Male	%	%diff(M-F)
Move to other funds	3	1.9%	3	0.2%	-1.65%
Task number increase	17	10.7%	147	11.4%	0.73%
Task number reduce	1	0.6%	88	6.8%	6.21%
Leave the work	29	18.2%	205	15.9%	-2.31%
No change	82	51.6%	703	54.6%	3.05%
Manager Number	132		1146		
Task number reduce and leave the work	30	18.9%	293	22.8%	3.90%
Post-Crisis Period					
Consequences	Female	%	Male	%	%diff(M-F)
Move to other funds	0	0.0%	5	0.4%	0.39%
Task number increase	12	7.5%	139	10.7%	3.24%
Task number reduce	5	3.1%	58	4.5%	1.36%
Leave the work	10	6.3%	120	9.3%	3.02%
No change	113	70.6%	893	69.0%	-1.61%
Manager Number	140		1215		
Task number reduce and leave the work	15	9.4%	178	13.8%	4.4%

Appendix 1 Treat group definition and control variable definition

Panel A reports the definition for each treat group used in regressions, and the number of funds within each group, Panel B reports the definition for the control variable used in regressions, including fund characteristic and manager characteristic.

Panel A: Treat group definition

TreatGroup	Definition	Number
Male	The fund's management team is all male	779
Female	The fund's management team is all female	33
Mix_gender	The fund is managed by male fund manager and female fund manager	201
One_Male	The fund is managed by one male manager	226
One_Female	The fund is managed by one female manager	22
Multi_Male	The fund is managed by two or more male managers	553
Multi_Female	The fund is managed by two or more female managers	11
Male_with_children	Male fund managers likely have children among fund management team is all male	716
Male_with_childcare	Male fund managers likely with children under 12 among fund management team is all male	531
Male_without_childcare	Male fund managers likely with children over 12 among fund management team is all male	185
Female_with_children	Female fund managers likely have children among fund management team is all female	29
Female_with_childcare	Female fund managers likely with children under 12 among fund management team is all female	19
Female_without_childcare	Female fund managers likely with children over 12 among fund management team is all female	10
Mix_gender_with_children	In mix gender team, fund managers likely have children	174
Mix_gender_with_childcare	In mix gender team, fund managers likely have children under 12	149
Mix_gender_without_childcare	In mix gender team, fund managers likely have children over 12	25
One_Female_with_children	The fund is managed by one female manager and likely have children	19
One_Female_with_childcare	The fund is managed by one female manager and likely have children under 12	12
One_Female_without_childcare	The fund is managed by one female manager and likely have children over 12	7
One_Male_with_children	The fund is managed by one male manager and likely have children	188
One_Male_with_childcare	The fund is managed by one male manager and likely have children under 12	80
One_Male_without_childcare	The fund is managed by one male manager and likely have children over 12	108
Multi_Female_with_children	The fund is managed by two or more female managers and likely have children	10
Multi_Female_with_childcare	The fund is managed by two or more female managers and likely have children under 12	7
Multi_Female_without_childcare	The fund is managed by two or more female managers and likely have children over 12	3
Multi_Male_with_children	The fund is managed by two or more male managers and likely have children	528
Multi_Male_with_childcare	The fund is managed by two or more male managers and likely have children under 12	451
Multi_Male_without_childcare	The fund is managed by two or more male managers and likely have children over 12	77

Panel B: Control variable definition

Control variables	Definition
NetAsset	Monthly share-class level total net assets
TurnoverRatio	The frequency of an investment buys or sells it's holding
Size	The sum of share class net assets (Monthly) for the month when all existingshare classes of the fund have reported month-end assets
CapitalMarket	The proportion of a portfolio that is invested in equity-related businesses within the capital markets sector
CFA	1 if the manager is a CFA Charter holder; 0 otherwise
Doctorate	1 if the manager holds a doctoral degree; 0 otherwise
MBA	1 if the manager has an MBA; 0 otherwise
BUS	1 if the manager has completed a business-related undergraduate programme; 0 otherwise
QUANT	1 if the manager completed a quantitative degree programme (eg. maths, CS, engineering, etc); 0 otherwise
Team	1 if the manager works in a team; 0 otherwise
Owner	1 if the manager has a personal investment in the fund; 0 otherwise