Fund ESG performance and downside risk: Evidence from China

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Abstract

Whether responsible investing reduces portfolio risk remains open to discussion. We study the relationship between ESG performance and downside risk at fund level in the Chinese equity mutual fund market. We find that fund ESG performance is positively associated with fund downside risk during the period between July 2018 and March 2021, and that the positive relationship weakens during the COVID-19 pandemic. We propose three channels through which fund ESG performance could affect fund downside risk: (i) the firm channel in which the risk-mitigation effect of portfolio firms' good ESG practices could be manifested at fund level, (ii) the diversification channel in which the portfolio concentration of high ESG-rated funds could amplify fund downside risk, and (iii) the flow channel in which fund ESG performance may attract greater investor flows that could reduce fund downside risk. We show evidence that the observed time-varying relationship between fund ESG performance and downside risk is driven by the relative force of the three channels.

Keywords: Downside Risk, ESG, Equity Mutual Fund, Portfolio Diversification, COVID-19

JEL Classification: G11, G23, M14

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1 Introduction

The importance of downside risk management in the financial market is pronounced amidst the significant health shocks the COVID pandemic poses to the world (Baldwin et al., 2020). While integrating environmental, social and governance (ESG) considerations into the investment process has become an important strategy for global institutional investors to tackle portfolio risks over the past decade in practice (Blackrock and Ceres, 2015; Bailey et al., 2016; Blackrock, 2017)[1], limited research has been done on its effectiveness as a tool for portfolio risk management, especially under extreme market conditions such as the COVID-19 crisis. To shed some light on this issue, with a focus on the Chinese mutual fund market, this paper intends to investigate whether fund ESG performance is associated with different levels of fund downside risk, and if so, whether the relationship varies across market conditions, and the channels through which fund ESG performance could exert an impact.

Much evidence has been provided that better ESG performance is associated with lower risk at firm level (e.g., Benlemlih et al., 2018; Albuquerque et al., 2019; Bae et al., 2020). Consistently, Maxfield and Wang (2021) argue that such a relationship at firm level is also manifested at portfolio level, and find supportive evidence on the US mutual fund market. However, given that mutual funds are subject to sources of downside risk inherent in constituent stocks as well as those originated from portfolio characteristics (see, e.g., Coval and Stafford, 2007; Daniel and Moskowitz, 2016; Karagiannis and Tolikas, 2019), it is important to consider whether and how fund ESG performance affects portfolio characteristics. In the light of this, we propose three channels through which ESG performance could impact fund downside risk, i.e. one from the perspective of individual portfolio firms, and two from the perspective of portfolio characteristics.

First, in line with Maxfield and Wang (2021), the risk-reduction effect of individual portfolio firms' good ESG practices would suggest a negative relationship between fund ESG performance and downside risk, and we refer to it as the firm-level channel. Second, the tendency of funds with better ESG performance tilting their investments towards firms of good ESG practices and excluding those 'sin' stocks (Guenster, 2012; Trinks and Scholtens, 2017; Joliet and Titova, 2018) could result in lower diversification benefits and thus higher downside risk. We refer to it as the

[1]Taking the five major markets for example, over 2014-2020 the compound annual growth rates of the total assets under management of ESG-mandated funds are 1%, 17%, 21%, 36% and 168% in Europe, United States, Canada, Australia and Japan, respectively (GSIA, 2020).

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diversification channel. Third, as fund outflows may destabilize fund performance especially during market turmoil (Coval and Stafford, 2007; Rakowski, 2010; Goldstein et al., 2017; Falato et al., 2021; Jiang et al., 2021), and ESG performance can attract greater fund flows and in particular flows from long-term investors (Starks et al., 2017; Shive and Forster, 2020; Krueger et al., 2020; Liang et al., 2022; Kim and Yoon, 2022), it is expected that if Chinese investors value fund ESG attributes, better fund ESG performance would mitigate downside risk. This is referred to as the flow channel. Then the natural question arises of which channel(s) dominates in practice.

We conjecture that the force of the diversification channel would prevail that of the other two channels in the Chinese market, leading to a positive relationship between fund ESG performance and downside risk. The reason is twofold. First, the fact that as of September 2020, only a quarter of the listed firms in China file ESG reports (China SIF, 2020) indicates that ESG-aware fund managers are not only restrained from investing in firms with bad ESG performance, but also may be restrained from investing in firms which insufficiently disclose ESG-related information. In other words, the poor ESG disclosure environment narrows the range of options ESG-aware fund managers have when selecting firms of good ESG practices and thus may lead to more concentrated portfolios with lower diversification benefits. Second, the Chinese market is characterized by the dominance of short-term oriented retail investors who tend not to value ESG performance (both at firm level and at fund level) as much as long-term institutional investors do (Döttling and Kim, 2020). This may weaken the negative relationship between fund ESG performance and downside risk through both the firm-level channel and the flow channel.

Using a dataset of 2,129 Chinese actively managed equity mutual funds during the period between July 2018 and March 2021, we find a positive relationship between fund ESG performance and fund downside risk and such a relationship weakens during the COVID-19 period. The results are robust to different measures for fund ESG performance (i.e. fund ESG score rated by Morningstar and Syntao[2]), alternative measures for fund downside risk (i.e. second-order lower partial moment, Value-at-Risk, and Expected Shortfall) and alternative COVID-19 period. The time-varying relationship between fund ESG performance and downside risk provides supportive evidence for the existence of the proposed three channels. Dur-

[2]Syntao is a well-recognized independent rating agency and provides comprehensive data related to green finance in China.

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ing the whole sample period, as expected, higher ESG-rated funds are associated with lower diversification benefits and the force of the diversification channel overwhelms that of the firm-level channel and the flow channel. However, the force of the firm-level channel and of the flow channel is shown to be stronger during the COVID-19 period in comparison with the non-COVID period. This is consistent with the existing literature showing that the risk-reduction effect of firms' good ESG practices is more pronounced in market turmoil (Albuquerque et al., 2020; Capelle-Blancard et al., 2021; Ding et al., 2021; Garel and Petit-Romec, 2021) and that funds with higher ESG ratings attract larger inflows in particular during the COVID-19 (Hartzmark and Sussman, 2019; Pástor and Vorsatz, 2020).

As an additional test, we interpret fund downside risk from the perspective of systematic downside risk and of idiosyncratic downside risk. Fund systematic downside risk is related to the common return dynamics across funds and attributable to the overall market downside risk (Karagiannis and Tolikas, 2019), which is captured by fund-level sensitivity to systematic downside risk in our paper. In contrast, fund idiosyncratic downside risk is associated with fund characteristics such as the degree of portfolio diversification and managerial performance, and thus represents fund-specific risk. The results show that the impact of fund ESG performance on downside risk is driven by its impact on fund idiosyncratic downside risk, and it is not manifested in funds' exposure to systematic downside risk. It confirms the importance of considering how the ESG investing strategy impacts fund-specific characteristics such as portfolio diversification and the associated exposure to downside risk. Moreover, this analysis disapproves the market-wise influence of ESG performance as evidenced by the insignificant contribution of fund ESG performance to the overall market risk.

The paper contributes to three strands of literature. First, it adds to the literature discussing whether incorporating ESG issues into investment processes delivers pecuniary benefits to investors. While there is extensive research showing that ESG incorporation has an impact on fund performance albeit the results are mixed (Edmans, 2011; Guenster, 2012; Nofsinger and Varma, 2014; Nagy et al., 2016; Nakai et al., 2016; Trinks and Scholtens, 2017; Pástor and Vorsatz, 2020; Pedersen et al., 2021; Atz et al., 2021; Chen et al., 2020), the effectiveness of ESG incorporation as a risk management tool is still under-researched. In contrast to Maxfield and Wang (2021) that shows a risk-mitigation effect of sustainable funds, our paper reveals the possibility that the cost of portfolio concentration prevails the benefit of the

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risk-reduction effect of tilting investments towards high ESG-rated firms.

Second, the paper contributes to the growing body of research regarding investor beliefs on ESG investing. The existing literature documents that investors diverge in their views on fund ESG engagement (Hartzmark and Sussman, 2019), and such discrepancies are associated with investor characteristics and market conditions (Starks et al., 2017; Hartzmark and Sussman, 2019; Krueger et al., 2020; Pástor and Vorsatz, 2020; Shive and Forster, 2020; Liang et al., 2022; Kim and Yoon, 2022). The paper builds on this literature by showing that Chinese investors value fund ESG performance during the COVID-19 crisis period more than during other times.

Finally, the paper adds to the understanding of fund liquidity management strategies under extreme market conditions. Extensive evidence shows that the strategic complementarities among investor-redemption decisions lead to fund illiquidity and price reduction during market turmoil (Coval and Stafford, 2007; Rakowski, 2010; Goldstein et al., 2017; Jiang et al., 2021; Falato et al., 2021). Our paper provides direct evidence that fund exposure to high ESG-rated firms reduces investor redemption during crisis periods and thus could be a potential preemptive liquidity management tool in addition to cash buffers and swing pricing etc. (Giuzio et al., 2021; Jiang et al., 2021).

This paper proceeds as follows. Section 2 develops hypotheses built upon the existing literature. Sections 3 and 4 present data sources and variable definitions, respectively. Section 5 reveals the relationship between fund ESG performance and downside risk through different channels. Section 6 shows the results for robustness tests, and Section 7 concludes.

2 Literature review and hypothesis development

The financial fragility of mutual funds exhibited during the COVID-19 pandemic (Choi et al., 2020; Falato et al., 2021; Fricke and Fricke, 2021; Kargar et al., 2021) highlights the importance of downside risk management for both asset managers and investors. There is evidence that funds with better ESG performance outperform during the COVID crisis.[3] Does it indicate the effectiveness of ESG incorporation for tackling portfolio downside risk under extreme market conditions? If so, is the risk-reduction effect of ESG incorporation also present in calm periods?

[3]See `https://www.ubs.com/global/en/assetmanagement/insights/investment-outlook/panorama/panorama-mid-year-2020/articles/covid-19-impacted-esg-investing.html`.

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It is well established in the literature that better ESG profiles are associated with lower firms' risk exposure as good ESG practices may prevent managerial opportunism and cultivate 'social capital' that preserves firm value in the event of negative shocks (Mishra and Modi, 2013; Hoepner et al., 2022; Benlemlih and Girerd-Potin, 2017; Lins et al., 2017; Benlemlih et al., 2018; Albuquerque et al., 2019; Bae et al., 2020) and this association is more pronounced in market turmoil such as the COVID pandemic (Albuquerque et al., 2020; Capelle-Blancard et al., 2021; Ding et al., 2021; Garel and Petit-Romec, 2021; Olofsson et al., 2021). In the context of mutual funds, higher fund ESG ratings show managers' preference for stocks of the firms that are extensively engaged in ESG activities and thus are less prone to negative external shocks (Renneboog et al., 2008; Nofsinger and Varma, 2014; Becchetti et al., 2015; Maxfield and Wang, 2021). Following this line of thought, we should observe that higher ESG-ranked funds are associated with lower downside risk, and that the risk-reduction effect of fund ESG performance is more pronounced during the COVID than during other times.

However, to understand the downside risk at fund level is more complex in comparison with that at firm level. This is because mutual funds are subject to sources of downside risk inherent in constituent stocks as well as those originated from portfolio characteristics (see, e.g., Coval and Stafford, 2007; Daniel and Moskowitz, 2016; Karagiannis and Tolikas, 2019). In addition, we expect that the portfolio-level sources of downside risk may dominate those at firm level particularly in the Chinese market, for at least two reasons.

First, the degree of diversification affects portfolio risks. The pioneering modern portfolio theory of Markowitz (1952) shows that diversification among securities helps reduce portfolio risk. The diversification effect is also manifested with respect to reducing downside risk (Markowitz, 1959; Hyung and De Vries, 2005). It is expected that funds with higher ESG ratings are more concentrated given that they tend to exclude 'sin' stocks and put more weights on socially responsible stocks (Guenster, 2012; Trinks and Scholtens, 2017; Joliet and Titova, 2018; Cerqueti et al., 2021), leading to lower portfolio diversification benefits and consequently higher downside risk. Thus, the 'diversification' channel through which fund ESG performance affects downside risk suggests a positive relationship between fund ESG rating and downside risk.

Moreover, we argue that the diversification channel plays a prominent role in particular in the Chinese market given its low level of ESG disclosure. China SIF

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(2020) reports that only a quarter of Chinese listed firms file ESG reports as of 2020, and this level of ESG disclosure ranks 21st among 25 sample countries examined in Krueger et al. (2021). Such a lack of public ESG information may on one hand hamper voluntary responsible investing (Ilhan et al., 2021; Krueger et al., 2021), and on the other hand, may constrain ESG-aware investors to invest in the firms that provide sufficient ESG information. In other words, the diversification benefits of high ESG-ranked funds are reduced not only by excluding 'sin' stocks from portfolios, but also by excluding the stocks of the firms of low ESG transparency.

Second, the open-end nature of mutual funds makes managers' trading decisions subject to fund investors' subscription and redemption decisions. A large number of studies find that funds' extreme flows could result in managers' fire sales of stocks, inducing large downside swings in stock prices and fund returns (Coval and Stafford, 2007; Rakowski, 2010; Goldstein et al., 2017; Huang et al., 2020; Jiang et al., 2021; Falato et al., 2021). If it is true as documented that ESG performance attracts greater fund flows and in particular flows from long-term socially responsible investors (Starks et al., 2017; Shive and Forster, 2020; Krueger et al., 2020; Sangiorgi and Schopohl, 2021; Kim and Yoon, 2022; Liang et al., 2022), we should observe that funds with better ESG exposure experience less volatile investor flows and thus lower return volatility. Yet, the fact that Chinese mutual fund market is dominated by unsophisticated retail mutual fund investors who are more likely to be short-term oriented than institutional investors (Döttling and Kim, 2020) may weaken the impact of ESG performance on stabilizing fund returns.[4] Thus, it is unclear how the flow channel would affect funds' ESG rating-downside risk relationship. However, during the pandemic, the stabilizing effect of ESG performance on fund flows and downside risk may be more pronounced than in other times, as it is found that funds with higher ESG ratings experience less fund outflows in particular during the COVID-19 crisis since market-wide investors value sustainability as a necessity (Hartzmark and Sussman, 2019; Pástor and Vorsatz, 2020).

Thus, the relationship between fund ESG performance and fund downside risk is affected by forces at two levels, one at firm level and the other at portfolio level. Following our expectation that the risk-amplifying effect through the diversification channel may be particularly pronounced in the Chinese market, the following hy-

[4]Summary statistics in Table 1 show that the mean (median) of asset fractions held by institutional investors across the sample funds is 0.298 (0.144). In addition, China SIF (2020) states that "This year's survey results indicate that 17% of individual investors 'have heard of and understand (sustainable investment)'...".

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pothesis is proposed:

H1. There is a positive relationship between fund ESG rating and fund downside risk.

In addition, we conjecture that funds' ESG rating-downside risk relationship varies across market conditions. As discussed above, the risk-reduction effect of firm-level ESG performance and that of flows attracted by fund ESG performance may strengthen during the COVID crisis, which may weaken funds' positive ESG rating-downside risk relationship. Following this line of thought, we propose the hypothesis as below:

H2. The positive relationship between fund ESG rating and fund downside risk weakens during the COVID-19 pandemic.

3 Data and sample

We utilize data from diverse sources. China Stock Market and Accounting Research (CSMAR) Database is used to obtain mutual fund data. We investigate actively managed equity open-ended mutual funds during the period between July 2018 and March 2021. Following the existing literature on Chinese equity funds (e.g. Chen et al., 2018; Chua and Tam, 2020), we exclude passively managed funds (i.e. index funds and enhanced index funds), bond funds, money market funds, and Qualified Domestic Institution Investor (QDII) funds from the sample, and define actively managed equity funds as the funds holding at least 60 percent of their assets in domestic stocks, including stock funds and mixed funds. Only primary share classes of funds are examined. In total, we have 2,129 actively managed equity funds in operation during the sample period after the screening.

For these funds, we collect information from CSMAR about funds' investment styles, daily and monthly net returns, quarterly total assets under management (AUM), quarterly fees including management fee, distribution fee, custodian fee, subscription and redemption fees, the fund-family a fund belongs to, the asset fraction of funds held by institutional investors, manager characteristics including manager gender and education level, and semi-annual stock holdings.[5] Quarterly stock-level returns and accounting data of the firms held by the sample funds are also

[5]China Securities Regulatory Commission (CSRC) requires mutual funds to disclose their top-ten stock holdings in quarterly reports and complete stock holdings in semi-annual reports since 2003. To obtain holdings data as complete as possible, the paper uses semi-annual stock holdings data as reported at the end of June and December of each year.

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extracted.

Monthly fund-level ESG rating data is from Morningstar Direct. Since March 2016, Morningstar started to evaluate the ESG performance of mutual funds around the world on a monthly basis via its Morningstar Sustainability Ratings system in which a fund is assigned one to five globes based on the value-weighted average sustainability score of its underlying holdings, with a requirement that at least 67% of the fund's qualified holdings are eligible to be rated. Each rated fund is ranked based on its sustainability score within the group of funds of the same investment objective. This ranking is the basis of the Morningstar Sustainability Ratings in which higher Sustainability Ratings (indicated by more globes) represent lower ESG risk relative to a fund's peer group.[6] We collect information about the sample funds' monthly Sustainability Ratings and each of 2,129 funds has at least one rating during the sample period.[7]

Semi-annual firm-level ESG rating data is collected from WIND.[8] WIND provides the ESG performance data of Chinese listed firms rated by SynTao Green Finance, a leading responsible investment professional service institution in China.[9] The rating system classifies firms into ten grades between A+ and D with A+ (D) as an indication of the best (worst) ESG practice regardless of the industry a firm comes from. Out of the 4,181 firms of which the sample funds have stock holdings, we have SynTao ratings for 993 firms.

The data for the counts of COVID-19 cases in China is from WHO.[10] Figure 1 plots the number of newly reported cases in each month during the period between January 2020 and March 2021. The newly reported cases has seen an upward trend since the start of 2020 and soared to the peak on February 2020 before starting to decline. While the surge in reported cases ended in the first quarter of 2020, it is possible that investors' reactions lagged behind the sudden negative shock. Thus, to fully consider the impacts of the COVID crisis in the equity mutual fund market,

[6]Details of the rating methodology can be found at `https://corporate1.morningstar.com/Morningstar-Sustainability-Rating-Methodology-2/`.

[7]While the Morningstar Sustainability Ratings was launched in 2016, the ratings data for Chinese mutual funds are available since July 2018 only.

[8]Morningstar only provides a static and most recent rating for individual listed firms in China. Given this limitation, we utilize firm-level ratings data from WIND, a leading financial data provider in China.

[9]SynTao rating has gained popularity in studies on ESG performance in China (e.g., Broadstock et al., 2021). Also see `http://syntaogf.com/Menu_EN.asp?ID=34fordetailedinformationoftheratingmethodologyofSynTao`.

[10]The data is downloaded from `https://covid19.who.int/WHO-COVID-19-global-data.csv`.

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we take the first two quarters of 2020 as the COVID period in our sample. As such, we split the sample period into two sub-periods, one for the COVID period covering 2020 Q1 and 2020 Q2, and the other for the non-COVID period covering the periods between 2019 Q3 and 2019 Q4, and between 2020 Q3 and 2021 Q1.

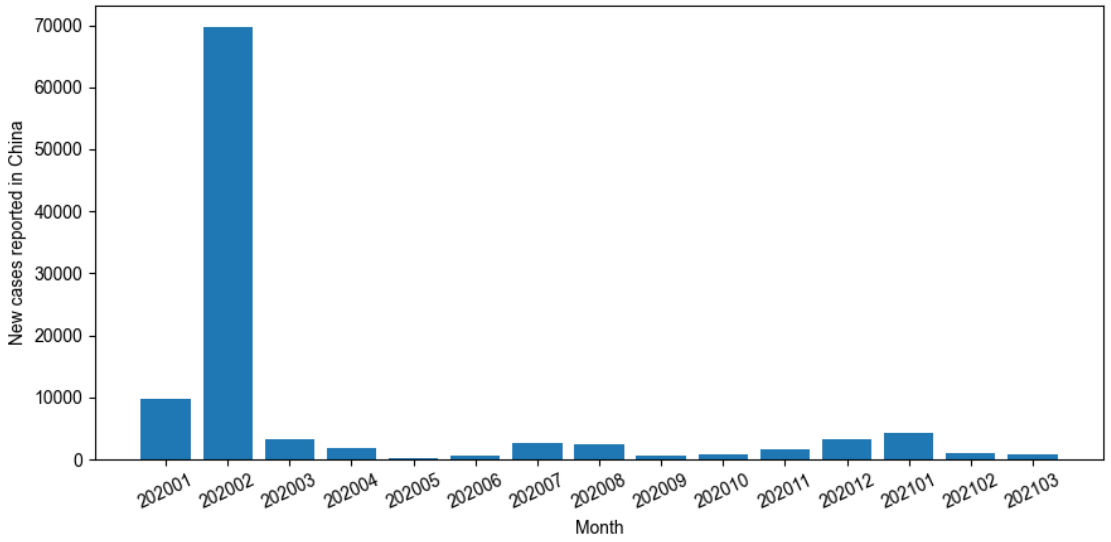

Figure 1: New COVID-19 cases reported in China for each month from Jan, 2020 to March, 2021.

4 Variable construction

4.1 Fund-level variables

To ensure the robustness of the results, we use two measures to quantify fund downside risk. For each fund, our quarterly measures of fund downside risk are calculated based on the time series of daily fund returns within that quarter. The first measure is the second-order lower partial moment (LPM), capturing the fund risk characteristics in the whole left tail of the return distribution. This measure is defined as the square root of the average of squared deviations below a target return which, in our case, is set to 0. For each fund within that quarter, LPM is calculated as:

$$LPM = \sqrt{\frac{\sum_{j=1}^{K}(r_{n,j} - \bar{r}_n)^2}{K-1}}, \tag{1}$$

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where $\bar{r}_n$ represents the average of negative daily returns $\{r_{n,j}\}_{j=1}^{K}$ and K is the number of negative return observations during a given quarter. The second downside risk measure is Value-at-Risk (VaR) which is widely used to quantify the extreme level of financial risk. We calculate VaR as the negative of the empirical quantile (e.g., 5% and 10%) of daily returns at the fund-quarter level. The 5% and 10% VaR are denoted by VaR_5 and VaR_{10}, respectively. In the rest of the paper, LPM, VaR_5 and VaR_{10} are used as alternative variables to measure fund-level downside risk.

A fund's ESG rating (ESG_{f_M}) is the average monthly value of the sustainability ratings given by Morningstar across a calendar quarter where the value one to five represents the five ratings from one to five globes, respectively.

The current literature has not yet documented a widely accepted measure of portfolio diversification. To assess portfolio diversification, four measures are constructed to show robustness. The first is the Herfindahl-Hirschman Index (HHI) of the percentage weights in a fund's stock holdings, calculated as the sum of the squared percentage weights, consistent with the existing literature on portfolio concentration (e.g., Kacperczyk et al., 2005; Fulkerson and Riley, 2019). The second is the Security Concentration Index (SCI) proposed in Sapp and Yan (2008), calculated as below:

$$SCI = \sum_{i=1}^{N} (w_{f,i} - w_{m,i})^2, \tag{2}$$

where $w_{f,i}$ and $w_{m,i}$ are the weight on stock i in the fund f's portfolio and in the market-cap weighted market portfolio m, respectively, and N is the number of stocks in fund f's portfolio.[11]

The third is the number of stocks in a fund's portfolio (Num_s), following Ivković et al. (2008). Recently, Pástor et al. (2020) introduce a novel portfolio liquidity measure (Liq) that is built upon the measures of HHI and Num_s. This measure (Liq), as an additional measure of portfolio diversification, takes into account the

[11]The market portfolio used in the calculation of SCI and the following Liq measure is the CSI 800 stock market index.

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stock liquidity held in the portfolio and the degree of portfolio diversification:[12]

$$Liq = \text{stock liquidity} \cdot \text{diversification} = \left(\sum_{i=1}^{N} \frac{w_{f,i}^2}{w_{m,i}} \right)^{-1}, \tag{3}$$

By construction, a lower HHI and SCI, and a higher Num_s and Liq indicate a better diversified portfolio. Given that only semi-annual data for funds' stock holdings are available, the diversification measures for the first and the third quarters are assumed to be equal to the value in the second and the fourth quarter of the same calendar year.

To control for fund and fund-family characteristics, for each fund and for each calendar quarter, we calculate a fund's objective-adjusted quarterly return ($Return$) as its cumulative monthly net return in a quarter minus the median return for that quarter of the funds with the same investment objective, following Tufano and Sevick (1997). A fund's volatility (Vol_f) is the standard deviation of daily net returns across a quarter. A fund's size ($Size_f$) is the total value of net assets at the end of a given quarter. A fund's flow ($Flow$) is the difference between current-quarter fund size and the product of last–quarter size and the current–quarter net return plus one, divided by last–quarter fund size. A fund's age (Age) is the number of years a fund has been in operation since its inception till a given quarter. Fee is the sum of reported management fees, distribution fees, custodian fees, front-end and back-end loads in a given quarter. $Size_{FF}$ is the sum of the total net asset value across all the funds within the fund-family as of a given quarter.

In addition, we control for investor and manager characteristics. A fund's ownership by institutional investors ($Inst$) is the reported asset fraction held by institutional investors. Num_{mng} is the number of managers of a fund in a given quarter. The gender of a fund's manager(s) ($Gender_{mng}$) is the average value of individual manager(s)' gender, one for male managers and zero for female managers. The education level of a fund's manager(s) (Edu_{mng}) is the average value of individual manager(s)' education level, one for under-bachelor degree, two for bachelor degree, three for master degree, four for MBA/EMBA degree and five for PhD degree. The busyness of a fund's manager(s) (Num_{fund_mng}) is measured by the average number of funds managers manage within a fund-family in a given quarter. The active man-

[12] Pástor et al. (2020) decomposes the portfolio liquidity measure of a given fund into two components, i.e. stock liquidity and diversification, with detailed formulations in equation (23) of their paper.

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agement performance of a fund's manager(s) ($Perf_{mng}$) is proxied by the average performance across all managers of the fund where the performance of a manager is measured by the value-weighted average objective-adjusted return across all the funds the manager manages within a fund-family in a given quarter.

After excluding the observations with any missing values for the above variables, we have 8,711 fund-quarter observations for 1,945 funds.

4.2 Firm-level variables

The analogous downside risk measures to those for funds are also calculated for portfolio firms using firm's daily stock returns and are denoted as LPM_s, VaR_{5_s}, and VaR_{10_s} respectively. A firm's ESG rating is the value of the grade rated by SynTao in which one to ten represents the ten grades from D to A+ respectively in a given quarter. As the ESG performance and investors' perceptions of the relationship between ESG performance and stock returns are expected to vary across industries (Gibson Brandon et al., 2021), we focus on a firm's ESG rating in relative terms rather than in absolute terms. Thus, we define a firm's ESG score (ESG_s) as the industry-adjusted ESG ratings, calculated as its ESG rating minus the median ESG rating of the firms coming from the same industry. Given that SynTao rates the firms at the end of June and December of a year only, the ESG score for the first and the third quarters is assumed to be equal to the value in the last quarter.

To control for firm characteristics, for each portfolio firm and for each quarter, we construct the following variables. $Mktcap$ is the natural logarithm of the market capitalization. A firm's quarterly volatility of stock returns (Vol_s) is the standard deviation of daily returns across a quarter. Following Amihud (2002) and Nofsinger and Varma (2014), we define daily illiquidity as the ratio of the absolute value of daily return to a thousand RMB volume of trades. $Illiq$ is the average daily illiquidity across a quarter. A firm's profitability (ROA) is the reported return on assets. A firm's leverage ratio (Lev) is the ratio of debt to equity. After excluding the observations with any missing values for the above variables, we have 8,253 firm-quarter observations for 973 firms.

Table 1 Panels A and B report the summary statistics for the fund-level and firm-level variables defined as above, respectively.[13] The statistics for the non-COVID and COVID periods are shown separately. To shed light on whether fund (firm)

[13]Detailed variable definitions are shown in Appendix Table A.1.

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ESG performance is associated with different levels of downside risk and other fund (firm) characteristics, for each period, the left panel shows the statistics for the funds (firms) with ESG scores higher than the ESG score of the median fund (firm), and the right panel shows the statistics for the funds (firms) with ESG scores equal to or lower than the ESG score of the median fund (firm).

Table 1 Panel A shows that the high ESG-rated funds, on average, are larger in size and younger than the low ESG-rated funds. Regardless of market conditions, the portfolios of the funds with higher ESG scores are less diversified, indicated by all the four diversification measures, consistent with our expectation and the existing literature (Guenster, 2012; Trinks and Scholtens, 2017; Cerqueti et al., 2021). The statistics for *Return* show that high ESG-rated funds outperform low-rated ones during the COVID period, whereas the opposite is true during the non-COVID period. This adds support to the argument in Becchetti et al. (2015) and Nofsinger and Varma (2014) that ESG funds outperform conventional funds during crisis periods but the downside risk-reduction effect comes at a cost of worse performance during non-crisis periods. In addition, $Flow$ and $Inst$ also show interesting time-varying differences between the two groups of funds. Although the average low ESG-rated fund has higher fund flows of 7.6% than the average high ESG-rated fund during the non-COVID period (statistically significant at 1%), the opposite is true for the COVID period (statistically insignificant). It suggests that while investors do not value fund ESG performance during non-crisis periods, their preference for ESG performance strengthens during the COVID crisis. Moreover, while the average asset fraction held by institutional investors for low ESG-rated funds is higher than that for the high ESG-rated funds (30.3% versus 29.3%, statistically insignificant) during the non-COVID period, the reversal is exhibited during the COVID period.

More importantly, Panel A shows that during the non-COVID period, the high ESG-rated funds are exposed to larger downside risk and volatility in comparison with low ESG-rated funds, regardless of which measures of financial risk are assessed (statistically significant at 1%), whereas better ESG profiles are associated with lower downside risk at firm level although the difference in downside risk between the two groups of firms is statistically insignificant, as shown in Panel B. The evidence is consistent with the existing literature that good ESG practices could preserve firm values in the event of negative shocks. It also supports our argument that the relationship between ESG performance and downside risk at fund level is related to portfolio-level characteristics, e.g. diversification, rather than being a simple

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Table 1: Means, medians, and standard deviations of the fund-level (Panel A) and the firm-level (Panel B) variables for the non-COVID (2018Q3-2019Q4 and 2020Q3-2021Q1) and the COVID (2020Q1-2020Q2) sub-periods.

	Non-COVID								COVID							
	High ESG			Low ESG					High ESG			Low ESG				
	Mean	Median	Std Dev	Mean	Median	Std Dev	Low-High	p-vlue	Mean	Median	Std Dev	Mean	Median	Std Dev	Low-High	p-vlue
Panel A. Fund-level variables																
LPM	0.995	0.935	0.545	0.926	0.798	0.557	-0.069	0.000***	1.147	0.924	0.660	1.164	1.029	0.671	0.017	0.514
VaR_5	2.291	2.116	1.050	2.115	1.897	1.035	-0.177	0.000***	2.531	2.028	1.460	2.593	2.282	1.488	0.062	0.280
VaR_{10}	1.725	1.556	0.819	1.592	1.385	0.810	-0.133	0.000***	1.803	1.475	0.977	1.844	1.638	0.989	0.040	0.292
ESG_{f_M}	2.273	2.000	0.567	1.050	1.000	0.160	-1.224	0.000***	2.199	2.000	0.471	1.028	1.000	0.116	-1.171	0.000***
$HHI(\times 100)$	3.828	3.773	1.491	3.530	3.421	1.478	-0.298	0.000***	3.568	3.373	1.613	3.330	3.180	1.402	-0.239	0.000***
$SCI(\times 100)$	3.120	3.067	1.371	2.910	2.799	1.416	-0.210	0.000***	3.031	2.884	1.522	2.878	2.728	1.377	-0.152	0.007***
Num_s	74.749	68.000	57.193	77.671	69.000	53.598	2.922	0.040**	61.431	50.000	50.329	63.445	52.000	45.714	2.014	0.282
Liq	0.038	0.024	0.050	0.048	0.027	0.069	0.010	0.000***	0.038	0.022	0.058	0.043	0.022	0.066	0.004	0.085*
$Return$ (%)	1.522	1.231	7.298	1.997	1.713	7.496	0.475	0.013**	2.227	1.396	8.757	1.513	0.382	8.522	-0.714	0.034**
Vol_f	1.493	1.492	0.539	1.411	1.376	0.571	-0.082	0.000***	1.603	1.546	0.600	1.600	1.558	0.605	-0.003	0.883
$Size_f$ (mil CNY)	1322.968	326.208	3464.863	1170.464	330.313	2881.554	-152.503	0.061*	833.398	205.315	1827.763	777.106	222.746	1714.945	-56.292	0.414
Age (yrs)	4.794	4.252	3.344	6.094	4.756	4.377	1.300	0.000***	4.789	4.252	3.294	6.166	4.922	4.329	1.377	0.000***
$Flow$	0.039	-0.077	0.739	0.115	-0.060	0.908	0.075	0.000***	0.007	-0.111	0.698	-0.033	-0.096	0.596	-0.040	0.117
Fee (%)	3.231	3.383	0.451	3.224	3.373	0.458	-0.007	0.554	3.212	3.383	0.462	3.254	3.383	0.416	0.043	0.012**
$Size_{FF}$ (bil CNY)	163.650	94.722	172.306	144.710	75.695	155.039	-18.940	0.000***	126.153	71.870	126.038	126.519	71.870	125.451	0.366	0.940
$Inst$	0.293	0.141	0.335	0.303	0.148	0.342	0.010	0.246	0.312	0.155	0.340	0.285	0.120	0.332	-0.027	0.038**
Num_{mng}	1.261	1.000	0.491	1.230	1.000	0.480	-0.031	0.012**	1.259	1.000	0.514	1.223	1.000	0.471	-0.035	0.066*
$Gender_{mng}$	0.822	1.000	0.352	0.828	1.000	0.350	0.006	0.508	0.833	1.000	0.345	0.827	1.000	0.350	-0.006	0.673
Edu_{mng}	3.245	3.000	0.689	3.243	3.000	0.671	-0.002	0.894	3.233	3.000	0.671	3.261	3.000	0.692	0.027	0.305
Num_{fund_mng}	5.379	4.000	3.859	5.337	4.000	3.894	-0.042	0.674	4.919	4.000	3.565	4.948	4.000	3.504	0.030	0.829
$Perf_{mng}$ (%)	1.228	0.909	6.027	1.584	1.181	6.052	0.356	0.022**	2.126	1.368	7.210	1.423	0.333	6.923	-0.704	0.011**
No. of observations		2,855			3,214					1,326			1,316			
Panel B. Firm-level variables																
LPM_s	1.399	1.334	0.539	1.410	1.339	0.559	0.011	0.578	1.587	1.564	0.718	1.637	1.777	0.697	0.050	0.301
VaR_{5_s}	3.288	3.091	1.271	3.353	3.122	1.407	0.065	0.170	3.659	3.290	1.826	3.707	3.356	1.768	0.047	0.698
VaR_{10_s}	2.443	2.311	0.892	2.489	2.343	1.028	0.046	0.177	2.738	2.500	1.252	2.801	2.595	1.277	0.063	0.460
ESG_s	1.281	1.000	0.559	-1.076	-1.000	0.374	-2.357	0.000***	1.323	1.000	0.554	-1.100	-1.000	0.379	-2.423	0.000***
ROA	0.038	0.026	0.043	0.038	0.028	0.066	0.000	0.869	0.016	0.010	0.023	0.018	0.009	0.032	0.002	0.219
$Mktcap$ (mil CNY)	64.802	23.552	157.445	36.762	15.457	111.539	-28.040	0.000***	57.365	24.135	126.696	41.099	17.458	134.825	-16.265	0.065*
Vol_s	0.019	0.018	0.009	0.019	0.018	0.009	0.000	0.953	0.021	0.020	0.010	0.022	0.020	0.010	0.001	0.259
$Illiq$	0.014	0.008	0.041	0.018	0.012	0.024	0.004	0.001***	0.012	0.008	0.012	0.015	0.011	0.020	0.004	0.001***
Lev	1.907	1.193	4.985	2.145	1.115	3.013	0.238	0.119	1.944	1.199	2.602	1.893	1.150	2.522	-0.051	0.772
No. of observations		1,880			1,351					575			350			

Notes: This table shows the summary statistics of key variables used in this paper, for funds (firms) with ESG ratings above the median fund (firm) shown in Column High ESG and otherwise for funds (firms) shown in Column Low ESG, over the non-COVID and COVID periods. The variables in Panel A are calculated at the fund-quarter level. LPM, VaR_5 and VaR_{10} represent fund-level downside risk; ESG_{f_M} indicates fund ESG scores given by Morningstar; HHI and SCI are measures for portfolio concentration, and Num_s, and Liq are measures for portfolio diversification; $Return$ is the fund's objective-adjusted quarterly return; Vol_f represents the fund's return volatility; $Size_f$ is the total net assets of a fund in a given quarter; Age is the number of years a fund has been in operation till a given quarter; $Flow$ is quarterly net fund flows; Fee is the sum of fees incurred; $Size_{FF}$ is the sum of the total net assets of all funds offered by a fund-family; $Inst$ measures the institutional ownership; Num_{mng} is the number of managers of a fund; $Gender_{mng}$ is the average value of individual manager(s)' gender; Edu_{mng} is the average value of individual manager(s)' education level; Num_{fund_mng} shows the busyness of a fund's manager(s); $Perf_{mng}$ is the active management performance of a fund's manager(s). The variables in Panel B are calculated at the firm-quarter level. LPM_s, VaR_{5_s} and VaR_{10_s} represent firm-level downside risk; ESG_s is the industry-adjusted firm ESG ratings; ROA indicates the firm's profitability; $Mktcap$ is a firm's market capitalization; Vol_s is a firm's quarterly volatility of stock returns; $Illiq$ is the average daily illiquidity across a quarter; Lev is the leverage ratio of debt to equity. ***, ** and * indicate statistical significance at 1%, 5% and 10%, respectively.

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reflection of the ESG-risk relationship at firm level. Interestingly, Panel A also shows that the positive relationship between fund ESG rating and downside risk in normal times turns negative during the COVID period, showing evidence in support of the second hypothesis, although there is an evident increase in fund downside risk during the COVID regardless of how funds perform in their ESG profiles.[14]

5 Empirical analysis

5.1 Relationship between fund ESG performance and fund downside risk

To test our hypotheses, pooled OLS regressions in which the fund downside risk measures (denoted by LPM, VaR_5 and VaR_{10}, respectively) are the dependent variables are adopted. The independent variables include fund ESG rating (ESG_{f_M}), fund, investor, manager and fund-family characteristics. Following Agarwal et al. (2017) and Albuquerque et al. (2019), all the independent variables are one-quarter lagged to identify the sources of fund downside risk and avoid the effect of reverse causality. All the regressions have fund investment objective-, fund-family-, and year-fixed effects and are double-clustered by fund and year. Table 2 reports the regression results when investor and manager characteristics are not included (in Panel A) and are controlled (in Panel B) separately to show the robustness of the results.

Table 2 Panels A and B show that the funds with better past performance, larger fund size, higher fees, lower past return volatility and smaller fund-family size have larger downside risk. In addition, Panel B shows that the funds held by larger percentage of institutional investors are associated with lower downside risk, as a supportive evidence for the stronger monitoring ability of institutional investors in comparison with retail investors (Li et al., 2021). Panel B also shows that the funds overseen by the mangers with better performance in the last quarter tend to have higher downside risk, adding to the evidence documented in Ryan (2022) that fund manager's good performance is associated with excessive risk-taking behavior in good times, thereby incurring huge losses in the following turbulent periods. Most importantly, all the six coefficients of the one-quarter lagged ESG ratings are positive and highly statistically significant (at 1%), suggesting a positive relationship between fund-level ESG ratings and fund downside risk. Previewing the negative relationship

[14]The quarterly fund downside risk over time is presented in Appendix Figure A.1.

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Table 2: Relationship between fund ESG performance and fund downside risk.

	Panel A			Panel B			Panel C		
	LPM	VaR_5	VaR_{10}	LPM	VaR_5	VaR_{10}	LPM	VaR_5	VaR_{10}
$L.ESG_{f_M}$	0.052***	0.084***	0.061***	0.055***	0.091***	0.065***	0.080***	0.167***	0.121***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
D_{CV}							0.321***	0.770***	0.507***
							(0.000)	(0.000)	(0.000)
$D_{CV} \times L.ESG_{f_M}$							-0.017	-0.067**	-0.052**
							(0.241)	(0.041)	(0.021)
$L.Return$	0.015***	0.032***	0.020***	0.007***	0.015***	0.011***	0.009***	0.020***	0.014***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$L.Vol_f$	-0.348***	-0.606***	-0.359***	-0.360***	-0.644***	-0.384***	-0.384***	-0.780***	-0.507***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$L.Size_f$	0.022***	0.060***	0.042***	0.026***	0.072***	0.052***	0.027***	0.084***	0.063***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$L.Age$	-0.011	-0.120***	-0.071***	-0.018	-0.136***	-0.082***	0.040**	0.016	0.036
	(0.537)	(0.000)	(0.001)	(0.318)	(0.000)	(0.000)	(0.032)	(0.670)	(0.201)
$L.Flow$	-0.017**	-0.008	-0.006	-0.013*	0.008	0.006	-0.026***	-0.026	-0.022*
	(0.022)	(0.553)	(0.513)	(0.083)	(0.564)	(0.525)	(0.001)	(0.108)	(0.071)
$L.Fee$	0.088***	0.247***	0.182***	0.065***	0.179***	0.131***	0.072***	0.196***	0.144***
	(0.000)	(0.000)	(0.000)	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$L.Size_{FF}$	-0.461***	-1.093***	-0.734***	-0.459***	-1.082***	-0.724***	0.225***	0.813***	0.759***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$L.Inst$				-0.134***	-0.449***	-0.328***	-0.134***	-0.462***	-0.342***
				(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$L.Num_{mng}$				0.011	0.046	0.052**	-0.006	-0.001	0.016
				(0.506)	(0.114)	(0.014)	(0.734)	(0.987)	(0.533)
$L.Gender_{mng}$				0.037*	0.056*	0.034	0.034	0.053	0.034
				(0.060)	(0.097)	(0.138)	(0.112)	(0.177)	(0.238)
$L.Edu_{mng}$				0.004	0.026	0.020	0.001	0.016	0.012
				(0.759)	(0.211)	(0.155)	(0.958)	(0.487)	(0.468)
$L.Num_{fund\_mng}$				-0.003	-0.014***	-0.012***	-0.002	-0.009*	-0.008**
				(0.213)	(0.003)	(0.000)	(0.408)	(0.069)	(0.043)
$L.Perf_{mng}$				0.012***	0.023***	0.013***	0.015***	0.033***	0.021***
				(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Constant	6.148***	14.079***	9.342***	6.227***	14.277***	9.438***	-1.573***	-7.281***	-7.266***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No
FF FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
IS FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Fund-Year clustered SE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	7,397	7,397	7,397	7,137	7,137	7,137	7,137	7,137	7,137
Adj R^2	0.279	0.434	0.482	0.288	0.454	0.500	0.207	0.284	0.268

Notes: Panels A-C report the results when the dependent variable, fund-level downside risk, is measured by LPM, VaR_5 and VaR_{10}, respectively. The variable D_{CV} takes the value of one during the COVID-19 period starting from 2020 Q1 to 2020 Q2; otherwise it is set to zero. The other independent variables are one-quarter lagged (indicated by $L.$) and defined as below: ESG_{f_M} indicates fund ESG scores given by Morningstar; $Return$ is the fund's objective-adjusted quarterly return; Vol_f represents the fund's return volatility; $Size_f$ is the total net assets of a fund in a given quarter; Age is the number of years a fund has been in operation till a given quarter; $Flow$ is quarterly net fund flows; Fee is the sum of fees incurred; $Size_{FF}$ is the sum of the total net assets of all funds offered by a fund-family; $Inst$ measures the institutional ownership; Num_{mng} is the number of managers of a fund; $Gender_{mng}$ is the average value of individual manager(s)' gender; Edu_{mng} is the average value of individual manager(s)' education level; Num_{fund_mng} shows the busyness of a fund's manager(s); $Perf_{mng}$ is the active management performance of a fund's manager(s). All the models are estimated by ordinary least squares. Standard errors are White-corrected for heteroskedasticity and double-clustered by fund and year. p–values are in parentheses. ***, ** and * indicate statistical significance at 1%, 5% and 10%, respectively.

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between firm-level ESG scores and firm downside risk in Table 3, we argue that the effect of stock-level ESG performance on stock downside risk is dominated by the force of fund-level characteristics associated with fund-level ESG performance, in support of our first hypothesis.

Adding investor and manager characteristics does not change the main findings and increases the fitness of the specifications. Thus, to save space we only report the results after controlling for investor and manager characteristics in the following analyses where applicable.

As a further step, to test whether the relationship between fund ESG rating and fund downside risk varies across market conditions, we add the dummy D_{CV} as an indication of the COVID sub-period, and its interaction term with ESG_{f_M} to the regressions after dropping the year dummies, and report the results in Table 2 Panel C. The results for the control variables are quite similar to those in Panels A and B except that Panel C shows a positive relationship between fund-family size and fund downside risk whilst Panels A and B show a negative relationship. Turning to the variables of the greatest interest, Panel C shows that all the three coefficients of the interaction term of D_{CV} with ESG_{f_M} are negative and two of them are statistically significant (at 10% and 5%, respectively). It confirms our second hypothesis that the positive relationship between fund ESG ratings and downside risk weakens during the COVID period. This foreshadows the risk-mitigation effect of firm-level ESG performance and/or the stabilizing effect of fund inflows to high ESG-rated funds in the face of negative shocks.

5.2 Channels through which fund ESG performance affects downside risk

This section intends to investigate three channels, i.e. the firm-level ESG performance channel, the portfolio diversification channel and the fund flow channel, through which fund ESG performance may affect downside risk of equity mutual funds.

First, to test the firm ESG performance channel, we run pooled OLS regressions of firm-level downside risk on firm ESG rating after controlling for various firm characteristics as described in Section 4.2. All the independent variables are one-quarter lagged. All the regressions have firm industry- and time-fixed effects, and are double-clustered by firm and year. Table 3 Panel A reports the regression

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results when LPM_s, VaR_{5_s} and VaR_{10_s} are considered as the dependent variable, respectively.

Table 3: Relationship between firm ESG performance and firm downside risk.

	Panel A			Panel B		
	LPM_s	VaR_{5_s}	VaR_{10_s}	LPM_s	VaR_{5_s}	VaR_{10_s}
$L.ESG_s$	-0.020***	-0.053***	-0.033***	-0.013*	-0.046***	-0.022*
	(0.002)	(0.001)	(0.002)	(0.068)	(0.007)	(0.058)
D_{CV}				0.236***	0.479***	0.395***
				(0.000)	(0.000)	(0.000)
$D_{CV} \times L.ESG_s$				-0.041***	-0.050	-0.062**
				(0.004)	(0.165)	(0.015)
$L.ROA$	0.557***	0.168	0.084	0.725***	0.511	0.349
	(0.003)	(0.719)	(0.782)	(0.000)	(0.275)	(0.255)
$L.Mktcap$	-0.000***	-0.001***	-0.001***	-0.000***	-0.001***	-0.001***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$L.Vol_s$	0.129***	0.429***	0.335***	0.137***	0.449***	0.352***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$L.Illiq$	0.458*	0.177	0.284	0.422	0.008	0.113
	(0.094)	(0.609)	(0.217)	(0.147)	(0.983)	(0.647)
$L.Lev$	0.003	0.017*	0.014**	0.005	0.020*	0.016***
	(0.327)	(0.096)	(0.010)	(0.180)	(0.062)	(0.004)
Constant	1.382***	3.069***	2.368***	1.207***	2.631***	2.021***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Year FE	Yes	Yes	Yes	No	No	No
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Firm-Year clustered SE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	8,127	8,127	8,127	8,127	8,127	8,127
Adj R^2	0.196	0.261	0.307	0.193	0.244	0.284

Notes: Panels A and B report the results when the dependent variable, firm-level downside risk, is measured by LPM_s, VaR_{5_s} and VaR_{10_s}, respectively. The variable D_{CV} takes the value of one during the COVID-19 period starting from 2020 Q1 to 2020 Q2; otherwise it is set to zero. The other independent variables are one-quarter lagged (indicated by $L.$) and defined as below: ROA indicates the firm's profitability; $Mktcap$ is a firm's market capitalization in million CNY; Vol_s is a firm's quarterly volatility of stock returns; $Illiq$ is the average daily illiquidity across a quarter; Lev is the leverage ratio of debt to equity. All the models are estimated by ordinary least squares. Standard errors are White-corrected for heteroskedasticity and double-clustered by firm and year. p–values are in parentheses. ***, ** and * indicate statistical significance at 1%, 5% and 10%, respectively.

Table 3 shows that the stocks of companies with larger market capitalization, lower return volatility, and lower leverage ratios tend to have lower downside risk. In light of abundant evidence that good ESG profiles at the firm-level lower firm risk measured by volatility (Albuquerque et al., 2019) and by downside risk (Hoepner et al., 2022), in the Chinese stock market we also find that the three coefficients of the variable of interest, i.e. lagged ESG_s, are all negative and statistically significant (at 5% and 1%, respectively), and confirm that better firm ESG performance is associated with lower stock downside risk. To further test whether firms' ESG

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performance matters more in reducing downside risk in stressed times than in good times, we add the dummy D_{CV} and its interaction term with ESG_s to the regressions above and report the results in Table 3 Panel B. Panel B shows that the coefficients of the interaction term of D_{CV} with ESG_s are all negative and two of them are statistically significant (at 1% and 5%, respectively). It suggests that the firms' good ESG performance plays a more significant role in alleviating firm downside risk in bad times than in good times, adding to the literature that high ESG-rated firms show the resilience in the volatility of firm returns during the COVID-19 period (Albuquerque et al., 2020).

Second, to test the diversification channel, i.e. whether funds achieve better ESG ratings at the expense of portfolio diversification benefits, pooled OLS regressions of the four portfolio diversification measures (HHI, SCI, Num_s and Liq) on a fund's ESG rating (ESG_{f_M}), after controlling for fund, investor, manager and fund-family characteristics are adopted. The measures of Num_s and Liq show the degree of portfolio diversification; whilst HHI and SCI measure the degree of portfolio concentration, implying that a large value of HHI and SCI represents a low level of portfolio diversification. Table 4 Panel A reports the regression results. To examine whether the association varies across market conditions, the COVID dummy D_{CV} and its interaction term with ESG_{f_M} are added to the specifications, and the results are reported in Panel B. All the independent variables are one-quarter lagged. All the regressions have fund investment objective-, fund-family-, and year-fixed effects (except for the regressions with the COVID dummy) and are double-clustered by fund and year.

Table 4 Panels A and B show that funds with higher past return volatility, managed by busier managers and smaller fund-family size are less diversified. Importantly, the eight coefficients of ESG_{f_M} are all statistically significant at 1 percent in expected directions, confirming the argument that better fund ESG performance reduces portfolio diversification benefits. Specifically, an increase in a fund's ESG rating is associated with higher HHI and SCI index, lower number of portfolio firms and lower portfolio liquidity. In addition, we do not find any evidence that the effect of fund ESG ratings on portfolio diversification varies across market conditions, i.e. none of the four coefficients of the interaction term of D_{CV} with one-lagged ESG scores is statistically significant.

Finally, to investigate the fund flow channel, i.e. whether better ESG performance attracts greater fund flows in particular during market turmoil, we run pooled

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Table 4: Relationship between fund ESG performance and portfolio diversification.

	Panel A				Panel B			
	HHI	SCI	Num_s	Liq	HHI	SCI	Num_s	Liq
$L.ESG_{f\_M}$	0.232***	0.120***	-0.041***	-0.004***	0.210***	0.106***	-0.041**	-0.004***
	(0.000)	(0.001)	(0.008)	(0.000)	(0.000)	(0.002)	(0.016)	(0.001)
D_{CV}					-0.272***	-0.078	-0.051	-0.000
					(0.001)	(0.337)	(0.142)	(0.870)
$D_{CV} \times L.ESG_{f\_M}$					0.008	0.004	-0.023	0.000
					(0.858)	(0.926)	(0.239)	(0.920)
$L.Return$	0.006*	0.009***	0.007***	-0.000*	0.005	0.008**	0.007***	-0.000**
	(0.075)	(0.007)	(0.000)	(0.054)	(0.169)	(0.012)	(0.000)	(0.049)
$L.Vol_f$	0.310***	0.348***	-0.084***	-0.018***	0.335***	0.353***	-0.045***	-0.018***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$L.Size_f$	0.111***	0.098***	0.078***	-0.004***	0.108***	0.096***	0.074***	-0.004***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$L.Age$	-0.078	-0.004	0.057***	0.003	-0.076	0.012	0.067***	0.002
	(0.221)	(0.944)	(0.006)	(0.136)	(0.233)	(0.838)	(0.002)	(0.259)
$L.Flow$	-0.068	-0.084	-0.053**	-0.011***	-0.069	-0.081	-0.052**	-0.011***
	(0.292)	(0.156)	(0.028)	(0.000)	(0.290)	(0.170)	(0.033)	(0.000)
$L.Fee$	-0.050	-0.214***	0.293***	0.011***	-0.113*	-0.097	0.328***	0.004
	(0.467)	(0.001)	(0.000)	(0.000)	(0.092)	(0.123)	(0.000)	(0.161)
$L.Size_{FF}$	-0.050	-0.214***	0.293***	0.011***	-0.113*	-0.097	0.328***	0.004
	(0.467)	(0.001)	(0.000)	(0.000)	(0.092)	(0.123)	(0.000)	(0.161)
$L.Inst$	-0.784***	-0.811***	0.240***	0.044***	-0.784***	-0.811***	0.245***	0.044***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$L.Num_{mng}$	-0.110*	-0.162***	-0.076***	-0.007***	-0.106*	-0.163***	-0.077***	-0.007***
	(0.053)	(0.002)	(0.002)	(0.002)	(0.061)	(0.002)	(0.002)	(0.003)
$L.Gender_{mng}$	0.182**	0.200***	0.008	0.005**	0.180**	0.198***	0.005	0.005**
	(0.010)	(0.002)	(0.766)	(0.049)	(0.011)	(0.003)	(0.847)	(0.042)
$L.Edu_{mng}$	-0.075*	-0.083**	0.026*	0.004***	-0.075*	-0.084**	0.026*	0.004***
	(0.067)	(0.035)	(0.061)	(0.004)	(0.069)	(0.033)	(0.067)	(0.004)
$L.Num_{fund\_mng}$	-0.012	-0.009	0.020***	0.001*	-0.014	-0.010	0.019***	0.001**
	(0.188)	(0.286)	(0.000)	(0.053)	(0.136)	(0.250)	(0.000)	(0.048)
$L.Perf_{mng}$	0.014***	0.009**	-0.005***	-0.000**	0.013***	0.009**	-0.006***	-0.000***
	(0.002)	(0.032)	(0.003)	(0.010)	(0.003)	(0.022)	(0.000)	(0.006)
Constant	3.894***	5.511***	0.198	-0.041	5.275***	4.896***	-0.068	0.028
	(0.000)	(0.000)	(0.588)	(0.256)	(0.000)	(0.000)	(0.856)	(0.432)
Year FE	Yes	Yes	Yes	Yes	No	No	No	No
FF FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
IS FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Fund-Year clustered SE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	7,178	7,178	7,178	6,827	7,178	7,178	7,178	6,827
Adj R^2	0.280	0.284	0.326	0.275	0.283	0.283	0.322	0.273

Notes: The dependent variable is the portfolio concentration (diversification), denoted by HHI or SCI (Num_s or Liq). The variable D_{CV} takes the value of one during the COVID-19 period starting from 2020 Q1 to 2020 Q2; otherwise it is set to zero. The other independent variables are one-quarter lagged (indicated by $L.$) and defined as below: ESG_{f_M} indicates fund ESG scores given by Morningstar; $Return$ is the fund's objective-adjusted quarterly return; Vol_f represents the fund's return volatility; $Size_f$ is the total net assets of a fund in a given quarter; Age is the number of years a fund has been in operation till a given quarter; $Flow$ is quarterly net fund flows; Fee is the sum of fees incurred; $Size_{FF}$ is the sum of the total net assets of all funds offered by a fund-family; $Inst$ measures the institutional ownership; Num_{mng} is the number of managers of a fund; $Gender_{mng}$ is the average value of individual manager(s)' gender; Edu_{mng} is the average value of individual manager(s)' education level; Num_{fund_mng} shows the busyness of a fund's manager(s); $Perf_{mng}$ is the active management performance of a fund's manager(s). All the models are estimated by ordinary least squares. Standard errors are White-corrected for heteroskedasticity and double-clustered by fund and year. p–values are in parentheses. ***, ** and * indicate statistical significance at 1%, 5% and 10%, respectively.

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OLS regressions of $Flow$ on ESG_{f_M} after controlling for fund, investor, manager and fund-family characteristics. Consistent with the rest of the paper, we first present the results in Table 5 Panel A when D_{CV} is not included in the regressions and then show the results in Table 5 Panel B when D_{CV} and its interaction term with ESG_{f_M} are considered. To shed some light on whether fund ESG performance attracts fund flows from the institutional investors and from retail investors to different degrees, in each panel, the results for all the sample funds, for institutional funds and for retail funds are reported separately. The institutional (retail) funds are defined as the funds of which over 55 percent of the assets are held by institutional (retail) investors. All the regressions have fund investment objective-, fund-family-, and year-fixed effects (except for the regressions with D_{CV}) and are double-clustered by fund and year.

Consistent with the existing literature (e.g. Berk and Green, 2004; Del Guercio and Tkac, 2008; Cao et al., 2008; Cumming et al., 2019), Table 5 shows that investors are attracted to funds with better past performance (indicated by the positive coefficients of $Return$) and that are managed by better performing managers (indicated by the positive coefficients of $Perf_{mng}$). It also shows that fund flows are negatively associated with fund size, and fund-family size, and positively associated with fund age.

Turning to the key variables of interest, the first column of Table 5 Panel A shows that there is no statistically significant relationship between fund flows and ESG rating, consistent with our expectation that in the market dominated by ESG-unaware retail investors, fund ESG performance does not attract greater flows. The next two columns show a positive (negative) effect of fund ESG rating on flows for institutional (retail) funds, although it is statistically insignificant. This is consistent with the existing literature that long-term institutional investors value ESG performance to a higher degree than short-term oriented retail investors. In contrast, the first column of Panel B shows that the coefficient of $D_{CV} \times L.ESG_{f\_M}$ is positive and statistically significant at 5%, suggesting that while higher fund ESG rating does not attract greater flows during the non-COVID period, it succeeds in doing so during the crisis period. In other words, fund ESG performance is valued by investors during the COVID crisis period more than during other times. The last two columns of Panel B show that such an effect is more pronounced for retail funds in comparison with institutional funds.

In summary, in the Chinese equity mutual fund market, the positive effect of fund

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Table 5: Relationship between fund ESG performance and fund flows.

	Panel A			Panel B		
	All	Institutional	Retail	All	Institutional	Retail
$L.ESG_{f\_M}$	-0.009	0.041	-0.024	-0.031*	0.003	-0.038*
	(0.584)	(0.261)	(0.187)	(0.090)	(0.952)	(0.054)
D_{CV}				-0.203***	-0.272**	-0.149***
				(0.000)	(0.015)	(0.001)
$D_{CV} \times L.ESG_{f\_M}$				0.059**	0.072	0.044*
				(0.015)	(0.227)	(0.080)
$L.Return$	0.012***	0.005	0.015***	0.011***	0.005	0.014***
	(0.000)	(0.328)	(0.000)	(0.000)	(0.317)	(0.000)
$L.Vol_f$	0.027	0.013	0.049***	0.058***	0.078*	0.065***
	(0.122)	(0.769)	(0.003)	(0.000)	(0.062)	(0.000)
$L.Size_f$	-0.076***	-0.196***	-0.050***	-0.079***	-0.208***	-0.051***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$L.Age$	0.040*	0.187**	0.040*	0.040*	0.159**	0.043*
	(0.073)	(0.019)	(0.080)	(0.068)	(0.036)	(0.059)
$L.Fee$	-0.029	0.044	-0.025	-0.029	0.041	-0.023
	(0.210)	(0.374)	(0.300)	(0.200)	(0.417)	(0.330)
$L.Size_{FF}$	-0.021	-0.028	-0.041	-0.080***	-0.195***	-0.047
	(0.601)	(0.776)	(0.399)	(0.007)	(0.009)	(0.186)
$L.Num_{mng}$	-0.021	0.121	-0.049**	-0.019	0.114	-0.048**
	(0.467)	(0.195)	(0.024)	(0.495)	(0.221)	(0.028)
$L.Gender_{mng}$	0.070***	0.037	0.037	0.068***	0.037	0.036
	(0.003)	(0.608)	(0.152)	(0.005)	(0.613)	(0.166)
$L.Edu_{mng}$	0.007	-0.027	0.013	0.009	-0.030	0.014
	(0.584)	(0.486)	(0.401)	(0.526)	(0.441)	(0.355)
$L.Num_{fund\_mng}$	0.004	-0.009	0.004	0.003	-0.008	0.003
	(0.284)	(0.370)	(0.308)	(0.426)	(0.427)	(0.422)
$L.Perf_{mng}$	0.007**	0.013*	0.002	0.006**	0.012	0.002
	(0.011)	(0.094)	(0.400)	(0.030)	(0.116)	(0.506)
Constant	0.594	1.308	0.631	1.353***	3.523***	0.699
	(0.188)	(0.294)	(0.237)	(0.000)	(0.001)	(0.102)
Year FE	Yes	Yes	Yes	No	No	No
FF FE	Yes	Yes	Yes	Yes	Yes	Yes
IS FE	Yes	Yes	Yes	Yes	Yes	Yes
Fund-Year clustered SE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	7,179	1,880	4,913	7,179	1,880	4,913
Adj R^2	0.055	0.085	0.081	0.058	0.086	0.083

Notes: The dependent variable is the quarterly net fund flows (*Flow*). The variable D_{CV} takes the value of one during the COVID-19 period starting from 2020 Q1 to 2020 Q2; otherwise it is set to zero. The other independent variables are one-quarter lagged (indicated by *L.*) and defined as below: ESG_{f_M} indicates fund ESG scores given by Morningstar; *Return* is the fund's objective-adjusted quarterly return; Vol_f represents the fund's return volatility; $Size_f$ is the total net assets of a fund in a given quarter; *Age* is the number of years a fund has been in operation till a given quarter; *Fee* is the sum of fees incurred; $Size_{FF}$ is the sum of the total net assets of all funds offered by a fund-family; Num_{mng} is the number of managers of a fund; $Gender_{mng}$ is the average value of individual manager(s)' gender; Edu_{mng} is the average value of individual manager(s)' education level; Num_{fund_mng} shows the busyness of a fund's manager(s); $Perf_{mng}$ is the active management performance of a fund's manager(s). All the models are estimated by ordinary least squares. Standard errors are White-corrected for heteroskedasticity and double-clustered by fund and year. *p*–values are in parentheses. ***, ** and * indicate statistical significance at 1%, 5% and 10%, respectively.

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ESG performance on fund downside risk is mainly driven by ESG-concentration at the portfolio level. This effect weakens during the COVID crisis period as a result of the risk-reduction effect of firm-level ESG traits and the rising investor awareness of sustainable investing.

5.3 Idiosyncratic and systematic downside risk

In this section, we investigate whether and how fund ESG performance contributes to fund-specific exposure to systematic downside risk and idiosyncratic downside risk. As discussed in Karagiannis and Tolikas (2019), mutual funds are differentially exposed to the systematic downside risk dynamics underlying a single process across all the funds. In addition, idiosyncratic volatility risk of funds is noticeable in the UK mutual funds and negatively affects funds' financial performance (Vidal-García and Vidal, 2014; Vidal-García et al., 2019). Likewise, idiosyncratic downside risk may also be not well-diversified at the portfolio level (Long et al., 2018). Sections 5.1 and 5.2 already show that the risk-amplifying effect of high fund ESG rating is driven by the lower diversification benefits. If such a channel is true, we should observe that the positive relationship between fund ESG rating and downside risk is at least manifested in idiosyncratic downside risk.

The fund-level idiosyncratic downside risk measure is calculated based on abnormal fund returns which are extracted based on the capital asset pricing model (CAPM) (Sharpe, 1964):

$$er_i = \alpha_i + \beta_i \times MKT + \epsilon_i, \tag{4}$$

where er_i represents excess daily returns of fund i and MKT is the excess market return.[15] Using a rolling window scheme with length of 250 days on each fund's daily returns, we estimate the model parameters in equation (4) and then obtain CAPM-adjusted returns. Based on abnormal returns, we construct three alternative idiosyncratic downside risk measures on a quarterly basis for each fund, namely LPM^{idio}, VaR_5^{idio} and VaR_{10}^{idio}, in similar fashion to downside risk measures as shown in section 4.1.

To quantify fund's exposure to systematic downside risk, following Karagiannis and Tolikas (2019), we first compute the monthly systematic downside risk in the Chinese equity mutual funds including ESG-rated funds and non-ESG-rated funds,

[15]Daily data of the market risk factor and risk-free rate are downloaded from CSMAR.

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by using the cross-sectional daily returns of equity funds in each month.[16] The systematic downside risk (λ_t^{Hill}, also known as the Hill power law estimator) is calculated as below (Kelly and Jiang, 2014):

$$\lambda_t^{Hill} = \frac{1}{K_t} \sum_{k=1}^{K_t} [ln(R_{k,t}) - ln(u_t),] \tag{5}$$

where $R_{k,t}$ is the k^{th} daily fund return in month t that is lower than the threshold u_t; we set u_t as the 5% quantile of daily returns of Chinese equity funds in month t; K_t denotes the total number of return observations below this threshold. Subsequently, for each fund we run the following regression of monthly returns on systematic downside risk λ_t^{Hill} to obtain fund-level exposures to the estimated systematic downside risk λ_t^{Hill}:

$$r_{i,t} = \gamma_{i,t} + \delta_{i,t} \times \lambda_t^{Hill} + \theta_{i,t}, \tag{6}$$

where $r_{i,t}$ is the fund i's monthly return in month t and $\delta_{i,t}$ of our interest, denoting the sensitivity to systematic downside risk in month t, is estimated by using a rolling window with length of 60 months. To keep consistency with the frequency of other variables considered, we use the average sensitivity to systematic downside risk (denoted by $\bar{\delta}$) over a given quarter as exogenous variable studied in Table 6 Panel A.

Table 6 Panels A and B reports the results for the the analogous regressions to those in Table 2 but use the average sensitivity of systematic downside risk ($\bar{\delta}$) and idiosyncratic downside risk (LPM^{idio}, VaR_5^{idio} and VaR_{10}^{idio}) as the dependent variables, respectively. To make sure that the results for the systematic downside risk and for the idiosyncratic downside risk are comparable, the sample for the regressions of the idiosyncratic downside risk is restricted to the funds with non-missing values of sensitivity to systematic downside risk.

Panel A shows that, consistent with the findings in Agarwal et al. (2017), funds with worse past performance tend to take larger risks. It is also shown that the funds experiencing larger outflows tend to take more risks, consistent with the findings in Massa and Patgiri (2009) and Ma and Tang (2019), and that smaller funds and the funds managed by busier managers tend to take less risks. Importantly, the coefficients of $L.ESG_{f\_M}$ are both statistically insignificant, suggesting that a fund's

[16] The ESG-rated funds on average accounts for about 68% in our sample of Chinese equity funds; also, see the time-varying proportion of (non-)ESG-rated funds in Appendix Figure A.2.

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ESG performance does not explain its sensitivity to the systematic downside risk. In addition, there is no variation in the relationship between ESG rating and downside risk betas across market conditions, indicated by the statistically insignificant coefficient of $D_{CV} \times L.ESG_{f\_M}$.

In contrast, the results as shown in Panel B manifest similar patterns to those shown in Table 2. All of the coefficients for $L.ESG_{f\_M}$ are positive and statistically significant at 1 to 10 percent, suggesting that the observed positive relationship between fund ESG rating and downside risk is driven by the effect on idiosyncratic downside risk. In addition, the three coefficients of $D_{CV} \times L.ESG_{f\_M}$ are all negative and one of them is statistically significant at 10 percent. In summary, the evidence supports our expectation that the findings in Sections 5.1 and 5.2 are driven by the effect of fund ESG performance on idiosyncratic downside risk rather than on sensitivity to systematic downside risk.

6 Robustness tests

6.1 Alternative downside risk measure

The results documented in Section 5 are based on the LPM and VaR measures. As these two measures fail to fully consider the magnitude of losses at the extreme level, Expected Shortfall (ES) is used as a complementary downside risk measure. The 5% (10%) ES is calculated as the average of daily fund returns below the 5% (10%) VaR, denoted by ES_5 (ES_{10}). To show the robustness of our results, we consider ES_5 and ES_{10} as fund downside risk variables and repeat the regressions of downside risk on fund ESG ratings as in Table 2. The regression results are reported in Table 7.

Table 7 Panels A and B show that there is a statistically significant and positive relationship between fund ESG ratings and ES_5 (ES_{10}). The results are robust to whether we control for investor and manager characteristics or not. Panel C shows that the coefficients of the interaction term of D_{CV} with ESG_{f_M} are both negative and are statistically significant at 10 or 5 percent. The results confirm the finding that fund ESG rating is positively related to downside risk and that such a positive relationship weakens during the COVID.

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Table 6: Systematic downside risk versus idiosyncratic downside risk.

	Panel A. sensitivity of systematic downside risk ($\bar{\delta}$)		Panel B. idiosyncratic downside risk					
			LPM^{idio}	VaR_5^{idio}	VaR_{10}^{idio}	LPM^{idio}	VaR_5^{idio}	VaR_{10}^{idio}
$L.ESG_{f\_M}$	-0.001	0.002	0.025*	0.047***	0.038***	0.037**	0.078***	0.058***
	(0.706)	(0.211)	(0.071)	(0.002)	(0.002)	(0.019)	(0.000)	(0.000)
D_{CV}		0.030***				0.036	0.114**	0.065*
		(0.000)				(0.319)	(0.011)	(0.056)
$D_{CV} \times L.ESG_{f\_M}$		-0.001				-0.001	-0.047*	-0.032
		(0.606)				(0.955)	(0.095)	(0.143)
$L.Return$	-0.001***	-0.001***	0.003*	0.009***	0.008***	0.003	0.008***	0.007***
	(0.000)	(0.000)	(0.072)	(0.000)	(0.000)	(0.143)	(0.000)	(0.000)
$L.Vol_f$	-0.001	-0.007***	-0.015	0.008	0.006	-0.052***	-0.056***	-0.037**
	(0.257)	(0.000)	(0.258)	(0.659)	(0.647)	(0.001)	(0.006)	(0.012)
$L.Size_f$	0.003***	0.003***	0.029***	0.050***	0.040***	0.031***	0.053***	0.043***
	(0.003)	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$L.Age$	0.005	0.004	0.077**	-0.155***	-0.133***	0.090**	-0.131***	-0.116***
	(0.226)	(0.260)	(0.016)	(0.000)	(0.000)	(0.012)	(0.006)	(0.001)
$L.Flow$	-0.004***	-0.002*	-0.004	0.016	0.012	-0.007	0.006	0.004
	(0.006)	(0.067)	(0.729)	(0.225)	(0.198)	(0.508)	(0.742)	(0.743)
$L.Fee$	0.003	0.003	-0.007	0.034	0.013	-0.005	0.037	0.015
	(0.118)	(0.146)	(0.738)	(0.166)	(0.451)	(0.821)	(0.166)	(0.418)
$L.Size_{FF}$	-0.062***	-0.062***	-0.058*	-0.221***	-0.154***	0.299***	0.513***	0.380***
	(0.000)	(0.000)	(0.084)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$L.Inst$	0.008*	0.006	-0.050	-0.266***	-0.199***	-0.050	-0.264***	-0.196***
	(0.056)	(0.126)	(0.162)	(0.000)	(0.000)	(0.176)	(0.000)	(0.000)
$L.Num_{mng}$	0.004	0.002	0.005	0.011	0.012	0.000	0.004	0.008
	(0.147)	(0.429)	(0.816)	(0.675)	(0.560)	(0.987)	(0.900)	(0.746)
$L.Gender_{mng}$	0.000	0.000	0.053**	0.068**	0.037*	0.054**	0.069**	0.038*
	(0.927)	(0.932)	(0.030)	(0.016)	(0.075)	(0.038)	(0.024)	(0.093)
$L.Edu_{mng}$	-0.000	-0.000	0.000	0.008	-0.003	-0.001	0.004	-0.006
	(0.836)	(0.765)	(0.995)	(0.603)	(0.787)	(0.916)	(0.807)	(0.658)
$L.Num_{fund\_mng}$	-0.001**	-0.001*	-0.007*	-0.014***	-0.011***	-0.005	-0.011**	-0.009**
	(0.022)	(0.099)	(0.052)	(0.000)	(0.000)	(0.203)	(0.027)	(0.018)
$L.Perf_{mng}$	-0.000	-0.000	0.005**	0.010***	0.007***	0.007***	0.014***	0.010***
	(0.233)	(0.797)	(0.010)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Constant	0.718***	0.691***	0.899**	3.732***	2.880***	-3.118***	-4.399***	-3.028***
	(0.000)	(0.000)	(0.045)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Year FE	Yes	No	Yes	Yes	Yes	No	No	No
FF FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
IS FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Fund-Year clustered SE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2,938	2,938	2,938	2,938	2,938	2,938	2,938	2,938
Adj R^2	0.426	0.468	0.156	0.420	0.430	0.102	0.273	0.283

Notes: The dependent variable in Panel A is fund's exposure to systematic downside risk ($\bar{\delta}$), calculated based on the cross-sectional systematic downside risk across funds as in Karagiannis and Tolikas (2019), whereas the dependent variable in Panel B is fund-level idiosyncratic downside risk, denoted by LPM^{idio}, VaR_5^{idio} and VaR_{10}^{idio}, respectively, calculated based on abnormal fund returns which are extracted based on the CAPM model. The variable D_{CV} takes the value of one during the COVID-19 period starting from 2020 Q1 to 2020 Q2; otherwise it is set to zero. The other independent variables are one-quarter lagged (indicated by $L.$) and defined as below: ESG_{f_M} indicates fund ESG scores given by Morningstar; $Return$ is the fund's objective-adjusted quarterly return; Vol_f represents the fund's return volatility; $Size_f$ is the total net assets of a fund in a given quarter; Age is the number of years a fund has been in operation till a given quarter; $Flow$ is quarterly net fund flows; Fee is the sum of fees incurred; $Size_{FF}$ is the sum of the total net assets of all funds offered by a fund-family; $Inst$ measures the institutional ownership; Num_{mng} is the number of managers of a fund; $Gender_{mng}$ is the average value of individual manager(s)' gender; Edu_{mng} is the average value of individual manager(s)' education level; Num_{fund_mng} shows the busyness of a fund's manager(s); $Perf_{mng}$ is the active management performance of a fund's manager(s). All the models are estimated by ordinary least squares.Standard errors are White-corrected for heteroskedasticity and double-clustered by fund and year. p–values are in parentheses. ***, ** and * indicate statistical significance at 1%, 5% and 10%, respectively.

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Table 7: Alternative risk measure.

	Panel A		Panel B		Panel C	
	ES_5	ES_{10}	ES_5	ES_{10}	ES_5	ES_{10}
$L.ESG_{f\_M}$	0.145***	0.113***	0.154***	0.120***	0.244***	0.198***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
D_{CV}					1.032***	0.855***
					(0.000)	(0.000)
$D_{CV} \times L.ESG_{f\_M}$					-0.074*	-0.066**
					(0.066)	(0.048)
$L.Return$	0.045***	0.037***	0.020***	0.017***	0.027***	0.023***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$L.Vol_f$	-0.981***	-0.762***	-1.022***	-0.799***	-1.120***	-0.910***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$L.Size_f$	0.076***	0.064***	0.090***	0.076***	0.097***	0.085***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$L.Age$	-0.053	-0.075**	-0.074	-0.093**	0.111**	0.070*
	(0.269)	(0.042)	(0.122)	(0.013)	(0.033)	(0.093)
$L.Flow$	-0.040**	-0.024	-0.024	-0.009	-0.066***	-0.046**
	(0.050)	(0.132)	(0.244)	(0.595)	(0.003)	(0.012)
$L.Fee$	0.298***	0.264***	0.219***	0.192***	0.241***	0.211***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$L.Size_{FF}$	-1.428***	-1.195***	-1.418***	-1.185***	0.822***	0.799***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$L.Inst$			-0.495***	-0.453***	-0.498***	-0.461***
			(0.000)	(0.000)	(0.000)	(0.000)
$L.Num_{mng}$			0.064	0.056*	0.007	0.006
			(0.133)	(0.091)	(0.882)	(0.865)
$L.Gender_{mng}$			0.095*	0.073*	0.086	0.066
			(0.058)	(0.060)	(0.122)	(0.130)
$L.Edu_{mng}$			0.015	0.020	0.005	0.011
			(0.618)	(0.389)	(0.879)	(0.676)
$L.Num_{fund\_mng}$			-0.014**	-0.014***	-0.011	-0.010*
			(0.030)	(0.008)	(0.134)	(0.078)
$L.Perf_{mng}$			0.036***	0.028***	0.047***	0.038***
			(0.000)	(0.000)	(0.000)	(0.000)
Constant	19.078***	15.648***	19.329***	15.852***	-6.384***	-6.753***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Year FE	Yes	Yes	Yes	Yes	No	No
FF FE	Yes	Yes	Yes	Yes	Yes	Yes
IS FE	Yes	Yes	Yes	Yes	Yes	Yes
Fund-Year clustered SE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	7,397	7,397	7,137	7,137	7,137	7,137
Adj R^2	0.369	0.417	0.384	0.435	0.264	0.288

Notes: The dependent variable is fund-level downside risk, measured by ES_5 and ES_{10}. The variable D_{CV} takes the value of one during the COVID-19 period starting from 2020 Q1 to 2020 Q2; otherwise it is set to zero. The other independent variables are one-quarter lagged (indicated by $L.$) and defined as below: ESG_{f_M} indicates fund ESG scores given by Morningstar; $Return$ is the fund's objective-adjusted quarterly return; Vol_f represents the fund's return volatility; $Size_f$ is the total net assets of a fund in a given quarter; Age is the number of years a fund has been in operation till a given quarter; $Flow$ is quarterly net fund flows; Fee is the sum of fees incurred; $Size_{FF}$ is the sum of the total net assets of all funds offered by a fund-family; $Inst$ measures the institutional ownership; Num_{mng} is the number of managers of a fund; $Gender_{mng}$ is the average value of individual manager(s)' gender; Edu_{mng} is the average value of individual manager(s)' education level; Num_{fund_mng} shows the busyness of a fund's manager(s); $Perf_{mng}$ is the active management performance of a fund's manager(s). All the models are estimated by ordinary least squares. Standard errors are White-corrected for heteroskedasticity and double-clustered by fund and year. p–values are in parentheses. ***, ** and * indicate statistical significance at 1%, 5% and 10%, respectively.

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Table 8: Alternative fund ESG rating measure.

	Panel A					Panel B				
	LPM	VaR_5	VaR_{10}	ES_5	ES_{10}	LPM	VaR_5	VaR_{10}	ES_5	ES_{10}
$L.ESG_{f\_s}$	0.020	0.166***	0.181***	0.129	0.147**	0.086*	0.374***	0.384***	0.372***	0.369***
	(0.605)	(0.006)	(0.000)	(0.157)	(0.032)	(0.087)	(0.000)	(0.000)	(0.001)	(0.000)
D_{CV}						0.241***	0.658***	0.477***	0.814***	0.700***
						(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$D_{CV} \times L.ESG_{f\_s}$						-0.084	-0.279**	-0.339***	-0.343**	-0.318**
						(0.208)	(0.020)	(0.000)	(0.034)	(0.012)
$L.Return$	0.005**	0.011***	0.008***	0.014**	0.012***	0.005**	0.010**	0.007**	0.014**	0.012**
	(0.023)	(0.005)	(0.001)	(0.011)	(0.005)	(0.026)	(0.025)	(0.033)	(0.020)	(0.017)
$L.Vol_f$	-0.439***	-0.789***	-0.471***	-1.256***	-0.979***	-0.502***	-1.024***	-0.671***	-1.486***	-1.201***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$L.Size_f$	0.037***	0.090***	0.062***	0.118***	0.098***	0.040***	0.107***	0.080***	0.131***	0.112***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$L.Age$	-0.065***	-0.233***	-0.139***	-0.211***	-0.204***	-0.039	-0.156***	-0.081**	-0.123*	-0.125**
	(0.008)	(0.000)	(0.000)	(0.001)	(0.000)	(0.131)	(0.002)	(0.028)	(0.079)	(0.023)
$L.Flow$	-0.010	0.023	0.018	-0.013	0.005	-0.014	0.004	-0.001	-0.029	-0.012
	(0.326)	(0.222)	(0.162)	(0.640)	(0.831)	(0.194)	(0.856)	(0.942)	(0.332)	(0.603)
$L.Fee$	0.032	0.126***	0.101***	0.126*	0.124**	0.038	0.144***	0.114***	0.146**	0.142***
	(0.234)	(0.001)	(0.000)	(0.058)	(0.010)	(0.170)	(0.001)	(0.000)	(0.036)	(0.007)
$L.Size_{FF}$	-0.482***	-1.222***	-0.815***	-1.543***	-1.312***	0.028	0.540***	0.628***	0.268***	0.390***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.386)	(0.000)	(0.000)	(0.002)	(0.000)
$L.Inst$	-0.193***	-0.549***	-0.385***	-0.641***	-0.573***	-0.193***	-0.563***	-0.402***	-0.646***	-0.582***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$L.Num_{mng}$	-0.002	0.018	0.037	0.030	0.026	-0.014	-0.033	-0.008	-0.014	-0.019
	(0.933)	(0.621)	(0.160)	(0.612)	(0.547)	(0.584)	(0.444)	(0.797)	(0.815)	(0.698)
$L.Gender_{mng}$	0.037	0.060	0.036	0.101	0.078*	0.034	0.061	0.040	0.093	0.075
	(0.147)	(0.138)	(0.184)	(0.109)	(0.099)	(0.198)	(0.181)	(0.238)	(0.164)	(0.150)
$L.Edu_{mng}$	0.005	0.038	0.021	0.027	0.030	0.002	0.025	0.011	0.015	0.019
	(0.760)	(0.178)	(0.269)	(0.533)	(0.351)	(0.907)	(0.430)	(0.640)	(0.738)	(0.592)
$L.Num_{fund\_mng}$	-0.004	-0.020***	-0.017***	-0.020**	-0.020***	-0.003	-0.013**	-0.011**	-0.015	-0.014*
	(0.237)	(0.001)	(0.000)	(0.023)	(0.004)	(0.402)	(0.048)	(0.033)	(0.104)	(0.056)
$L.Perf_{mng}$	0.013***	0.024***	0.012***	0.039***	0.029***	0.016***	0.034***	0.021***	0.049***	0.039***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Constant	6.607***	15.853***	10.538***	20.749***	17.358***	1.267***	-3.009***	-5.004***	1.698	-0.693
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.000)	(0.000)	(0.110)	(0.408)
Year FE	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No
FF FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
IS FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Fund-Year clustered SE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	4,953	4,953	4,953	4,953	4,953	4,953	4,953	4,953	4,953	4,953
Adj R^2	0.254	0.433	0.483	0.345	0.403	0.241	0.330	0.291	0.312	0.341

Notes: The dependent variable is fund-level downside risk, measured by LPM, VaR_5, VaR_{10}, ES_5 and ES_{10}, respectively. The variable D_{CV} takes the value of one during the COVID-19 period starting from 2020 Q1 to 2020 Q2; otherwise it is set to zero. The other independent variables are one-quarter lagged (indicated by $L.$) and defined as below: ESG_{f_s} indicates fund ESG scores, calculated as the value-weighted average of firm-level ESG scores in a fund's portfolio, with a requirement that at least 60% of the firms of which the fund has stock holdings in have SynTao ratings; $Return$ is the fund's objective-adjusted quarterly return; Vol_f represents the fund's return volatility; $Size_f$ is the total net assets of a fund in a given quarter; Age is the number of years a fund has been in operation till a given quarter; $Flow$ is quarterly net fund flows; Fee is the sum of fees incurred; $Size_{FF}$ is the sum of the total net assets of all funds offered by a fund-family; $Inst$ measures the institutional ownership; Num_{mng} is the number of managers of a fund; $Gender_{mng}$ is the average value of individual manager(s)' gender; Edu_{mng} is the average value of individual manager(s)' education level; Num_{fund_mng} shows the busyness of a fund's manager(s); $Perf_{mng}$ is the active management performance of a fund's manager(s). All the models are estimated by ordinary least squares. Standard errors are White-corrected for heteroskedasticity and double-clustered by fund and year. p–values are in parentheses. ***, ** and * indicate statistical significance at 1%, 5% and 10%, respectively.

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6.2 Alternative fund-level ESG rating measure

As it is common that funds' ESG ratings given by different institutions diverge in the rating methodologies and resulting scores (Berg et al., 2019), we construct another fund-level ESG rating variable ESG_{f_s} to ensure robustness using firm-level ESG scores. ESG_{f_s} is calculated as the value-weighted average of ESG_s in a fund's portfolio, with a requirement that at least 60% of the firms of which the fund has stock holdings in have SynTao ratings. Using ESG_{f_s}, we repeat the regressions as in Tables 2 and 7, and the results are presented in Table 8.

Table 8 Panel A shows that all the five coefficients of ESG_{f_s} are positive and three of them are statistically significant at 5 or 1 percent, in support of the previous findings. In addition, Panel B shows that all of the coefficients of the interaction term of D_{CV} with ESG_{f_s} are negative and four of them are statistically significant (at 5 or 1 percent). It confirms the finding that the positive relationship between fund ESG rating and fund downside risk weakens during the COVID period.

6.3 Alternative COVID period

Figure 1 shows that the number of COVID cases declined sharply in the second quarter of 2020. To rule out the possibility that the results regarding the impact of the COVID are 'contaminated' by the observations for 2020 Q2, we re-define the COVID period as the first quarter of 2020 only and repeat the regressions as in Table 8 Panel B when the two measures for fund downside risk are used. The results for ESG_{f_M} and ESG_{f_s} are reported in Table 9 Panels A and B respectively. Table 9 shows that nine of the ten coefficients of the interaction terms of D_{CV} with fund ESG score are negative and four of them are statistically significant at 10 or 5 percent. Thus, it confirms the results that the risk-amplifying effect of fund ESG performance weakens during the COVID crisis.

7 Conclusion

Using a sample of 2,129 Chinese actively managed equity mutual funds during the period between July 2018 and March 2021, we study how fund ESG performance is related to fund downside risk under different market conditions. We show that during the non-COVID period, fund ESG performance is positively related to fund downside risk, and that such a positive relationship weakens during the COVID-19

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Table 9: Alternative COVID-19 period.

	Panel A					Panel B				
	LPM	VaR_5	VaR_{10}	ES_5	ES_{10}	LPM	VaR_5	VaR_{10}	ES_5	ES_{10}
$L.ESG_{f_M}$	0.075***	0.141***	0.102***	0.220***	0.174***					
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)					
D_{CV}×$L.ESG_{f_M}$	-0.028*	-0.004	0.000	-0.072	-0.034					
	(0.087)	(0.934)	(0.997)	(0.101)	(0.383)					
$L.ESG_{f\_s}$						0.045	0.255***	0.273***	0.236***	0.244***
						(0.272)	(0.000)	(0.000)	(0.009)	(0.000)
D_{CV}×$L.ESG_{f\_s}$						-0.049	-0.149	-0.206**	-0.268*	-0.213*
						(0.390)	(0.263)	(0.017)	(0.071)	(0.075)
D_{CV}	0.866***	1.933***	1.300***	2.679***	2.193***	0.727***	1.811***	1.270***	2.350***	1.981***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$L.Return$	0.008***	0.019***	0.013***	0.026***	0.022***	0.006***	0.014***	0.009***	0.019***	0.016***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$L.Vol_f$	-0.098***	-0.115***	-0.063***	-0.229***	-0.169***	-0.231***	-0.347***	-0.212***	-0.620***	-0.469***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$L.Size_f$	0.018***	0.062***	0.049***	0.067***	0.060***	0.027***	0.076***	0.059***	0.091***	0.079***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$L.Age$	0.055***	0.052	0.060**	0.157***	0.109***	-0.002	-0.067	-0.020	-0.007	-0.028
	(0.001)	(0.103)	(0.015)	(0.000)	(0.002)	(0.927)	(0.115)	(0.551)	(0.902)	(0.543)
$L.Flow$	-0.036***	-0.049***	-0.037***	-0.097***	-0.071***	-0.032***	-0.041**	-0.031**	-0.086***	-0.060***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.013)	(0.016)	(0.000)	(0.001)
$L.Fee$	0.060***	0.168***	0.126***	0.202***	0.180***	0.030	0.125***	0.102***	0.122**	0.121***
	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)	(0.220)	(0.001)	(0.000)	(0.040)	(0.005)
$L.Size_{FF}$	0.328***	1.067***	0.943***	1.143***	1.074***	0.271***	1.110***	1.040***	1.022***	1.025***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$L.Inst$	-0.085***	-0.346***	-0.265***	-0.345***	-0.332***	-0.139***	-0.429***	-0.310***	-0.473***	-0.437***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$L.Num_{mng}$	-0.008	-0.004	0.013	0.003	0.003	-0.021	-0.049	-0.020	-0.037	-0.037
	(0.639)	(0.884)	(0.570)	(0.945)	(0.936)	(0.350)	(0.178)	(0.491)	(0.487)	(0.360)
$L.Gender_{mng}$	0.025	0.033	0.020	0.059	0.044	0.028	0.045	0.030	0.073	0.058
	(0.181)	(0.328)	(0.428)	(0.212)	(0.231)	(0.254)	(0.259)	(0.333)	(0.218)	(0.201)
$L.Edu_{mng}$	-0.001	0.013	0.010	0.001	0.007	-0.001	0.018	0.006	0.005	0.011
	(0.957)	(0.505)	(0.500)	(0.970)	(0.729)	(0.933)	(0.506)	(0.782)	(0.896)	(0.719)
$L.Num_{fund\_mng}$	0.000	-0.004	-0.004	-0.003	-0.004	-0.000	-0.006	-0.006	-0.006	-0.007
	(0.980)	(0.386)	(0.250)	(0.566)	(0.408)	(0.957)	(0.270)	(0.181)	(0.449)	(0.303)
$L.Perf_{mng}$	0.012***	0.027***	0.017***	0.038***	0.030***	0.013***	0.027***	0.016***	0.041***	0.032***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Constant	-3.145***	-11.103***	-9.993***	-11.292***	-10.920***	-1.939***	-10.569***	-10.428***	-8.277***	-9.089***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Year FE	No	No	No	No	No	No	No	No	No	No
FF FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
IS FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Fund-Year SE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	7,137	7,137	7,137	7,137	7,137	4,953	4,953	4,953	4,953	4,953
Adj R^2	0.344	0.485	0.445	0.445	0.488	0.335	0.492	0.436	0.446	0.496

Notes: The dependent variable is fund-level downside risk, measured by LPM, VaR_5, VaR_{10}, ES_5 and ES_{10}, respectively. The variable D_{CV} takes the value of one during the COVID crisis (2020 Q1); otherwise it is set to zero. The other independent variables are one-quarter lagged (indicated by $L.$) and defined as below: ESG_{f_M} indicates fund ESG scores given by Morningstar; ESG_{f_s} represents fund ESG scores, calculated as the value-weighted average of firm-level ESG scores in a fund's portfolio, with a requirement that at least 60% of the firms of which the fund has stock holdings in have SynTao ratings; $Return$ is the fund's objective-adjusted quarterly return; Vol_f represents the fund's return volatility; $L.Size_f$ is the total net assets of a fund in a given quarter; Age is the number of years a fund has been in operation till a given quarter; $Flow$ is quarterly net fund flows; $L.Fee$ is the sum of fees incurred; $Size_{FF}$ is the sum of the total net assets of all funds offered by a fund-family; $Inst$ measures the institutional ownership; Num_{mng} is the number of managers of a fund; $Gender_{mng}$ is the average value of individual manager(s)' gender; Edu_{mng} is the average value of individual manager(s)' education level; Num_{fund_mng} shows the busyness of a fund's manager(s); $Perf_{mng}$ is the active management performance of a fund's manager(s). All the models are estimated by ordinary least squares. Standard errors are White-corrected for heteroskedasticity and double-clustered by fund and year. p–values are in parentheses. ***, ** and * indicate statistical significance at 1%, 5% and 10%, respectively.

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crisis.

We reveal three channels through which fund ESG performance exerts an impact on downside risk and provide evidence that the relative strength of the three channels varies across market conditions. First, we confirm that better firm ESG performance reduces firm downside risk in the Chinese stock market. This firm-level channel is strengthened over the COVID-19 period, adding evidence to the current literature on the risk-reduction effect of firm-level ESG practices. Second, we find that higher ESG ratings lead to lower portfolio diversification and thus make funds suffer from a higher level of portfolio downside risk. Third, we highlight investors' time-varying ESG preferences. Though better fund ESG performance does not attract greater fund flows during the normal times, higher ESG-rated funds experience larger net inflows over the crisis period, weakening the positive relationship between fund ESG rating and downside risk.

The paper provides direct evidence that the 'side effect', i.e. the risk-amplifying effect due to low diversification benefits, of ESG-concentrated portfolios could prevail the risk-reduction effect of individual firms' good ESG practices. We also point out the possibility that the difficulty of asset managers obtaining firms' ESG information may further lower portfolios' diversification benefits. In other words, the diversification cost of ESG-concentrated portfolios and the consequent higher fund-level downside risk may be related to the ESG disclosure environment. Thus, the paper provides academic evidence in support of the efforts the authorities around the globe make to improve ESG disclosure.

The paper also shows that when investors value fund ESG performance more, the risk-reduction effect of tilting investment towards firms of good ESG practices becomes stronger. Thus, the paper reveals the importance of nurturing investors' ESG awareness in making ESG investing a more effective tool for downside risk management.

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Appendix

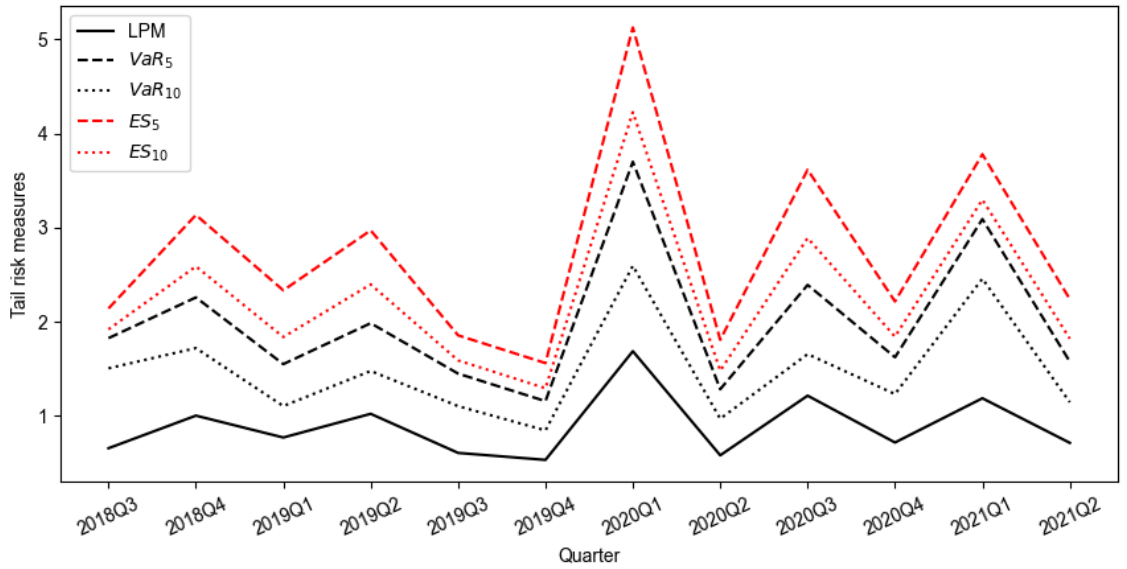

Figure A.1: Fund downside risk over time during the period 2018 Q3 – 2021 Q2.

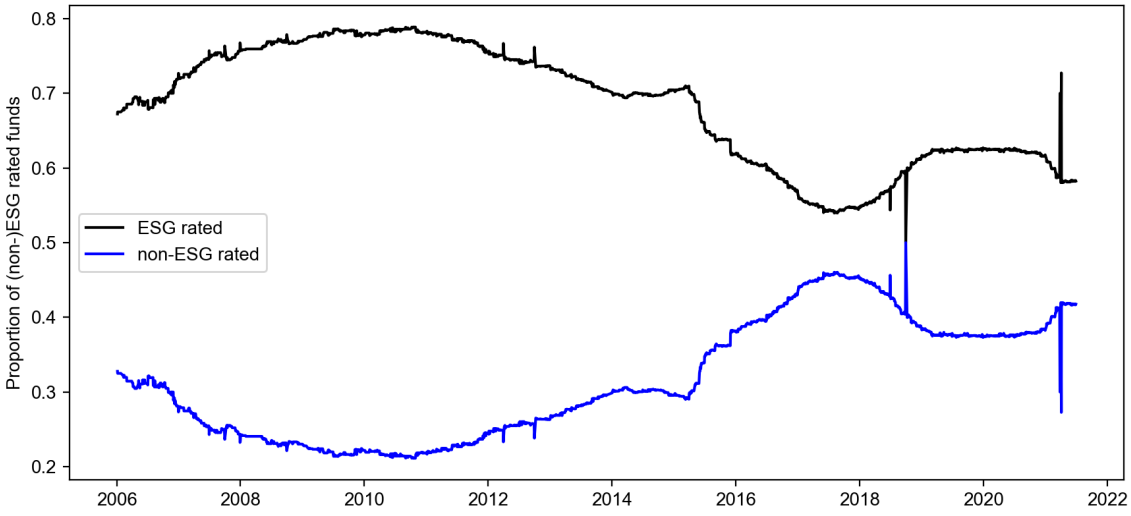

Figure A.2: The time-varying proportion of (non-)ESG rated funds in our sample of Chinese equity funds, ranging from Jan, 2006 to June, 2021.

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Table A.1: Variable definitions corresponding to Table 1.

Variable	Definition	Source
LPM	LPM measures downside risk of a given fund; it is calculated as the semi-variance in this paper, specified as $\sqrt{\frac{\sum_{j=1}^{K}(r_{n,j}-\bar{r}_n)^2}{K-1}}$, where $\bar{r}_n$ represents the average of negative daily returns $\{r_{n,j}\}_{j=1}^{K}$ and K is the number of negative return observations during a given quarter.	CSMAR
VaR_5	VaR_5 measures downside risk of a given fund; it is computed as the negative of the empirical 5% quantile of daily returns at the fund-quarter level.	CSMAR
VaR_{10}	VaR_{10} measures downside risk of a given fund; it is computed as the negative of the empirical 5% quantile of daily returns at the fund-quarter level.	CSMAR
ESG_{f_M}	ESG_{f_M} is the average monthly value of the sustainability ratings given by Morningstar across a calendar quarter.	Morningstar Direct
D_{CV}	D_{CV} is the dummy variable and equal to one during the COVID period; otherwise, it is zero.	WHO
$HHI(\times 100)$	HHI is the Herfindahl-Hirschman Index of the percentage weights in a fund's stock holdings, calculated as the sum of the squared percentage weights on portfolio holdings.	CSMAR
Num_s	Num_s represents the number of stocks held in a fund portfolio.	CSMAR
$SCI(\times 100)$	SCI is the Security Concentration Index proposed in Sapp and Yan (2008), calculated as $\sum_{i=1}^{N}(w_{f,i}-w_{m,i})^2$, where $w_{f,i}$ and $w_{m,i}$ are the weight on stock i in the fund f's portfolio and in the market-cap weighted market portfolio m, respectively, and N is the number of stocks in fund f's portfolio.	CSMAR
Liq	Liq is the portfolio liquidity measure of a given fund, as an additional measure of portfolio diversification, calculated as $\left(\sum_{i=1}^{N}\frac{w_{f,i}^2}{w_{m,i}}\right)^{-1}$.	CSMAR
$Return$ (%)	$Return$ is a fund's objective-adjusted quarterly return, computed as its cumulative monthly net return for that quarter minus the median return for that quarter of the funds with the same investment objective.	CSMAR
Vol_f	Vol_f is defined as the standard deviation of daily net returns within that quarter.	CSMAR
$Size_f$ (mil CNY)	A fund's size ($Size_f$) is the total value of net assets at the end of a given quarter.	CSMAR
Age (yrs)	A fund's age (Age) is the number of years a fund has been in operation since its inception till a given quarter.	CSMAR
$Flow$	A fund's flow ($Flow$) is the difference between current-quarter fund size and the product of last–quarter size and the current–quarter net return plus one, divided by last–quarter fund size.	CSMAR
Fee (%)	Fee is the sum of reported management fees, distribution fees, custodian fees, subscription and redemption fees in a given quarter.	CSMAR
$Size_{FF}$	A fund family's size ($Size_{FF}$) is the sum of the total net asset value across all the funds within the fund-family as of a given quarter.	CSMAR
$Inst$	A fund's ownership by institutional investors ($Inst$) is the reported asset fraction held by institutional investors.	CSMAR
Num_{mng}	Num_{mng} is the number of managers of a fund in a given quarter.	CSMAR
$Gender_{mng}$	$Gender_{mng}$ is the average value of individual manager(s)' gender, one for male managers and zero for female managers.	CSMAR
Edu_{mng}	The education level of a fund's manager(s) (Edu_{mng}) is the average value of individual manager(s)' education level, one for under-bachelor degree, two for bachelor degree, three for master degree, four for MBA/EMBA degree and five for PhD degree.	CSMAR
Num_{fund_mng}	The busyness of a fund's manager(s) (Num_{fund_mng}) is measured by the average number of funds which managers manage within a fund-family in a given quarter.	CSMAR
$Perf_{mng}$ (%)	The active management performance of a fund's manager(s) ($Perf_{mng}$) is proxied by the average performance across all managers of the fund where the performance of a manager is measured by the value-weighted average objective-adjusted return across all the funds the manager manages within a fund-family in a given quarter.	CSMAR
LPM_s	LPM_s measures firm-level downside risk; it is calculated similarly with LPM, but using daily returns of a given firm within that quarter.	CSMAR
VaR_{5_s}	VaR_{5_s} measures firm-level downside risk; it is calculated similarly with VaR_5, but using daily returns of a given firm within that quarter.	CSMAR
VaR_{10_s}	VaR_{10_s} measures firm-level downside risk; it is calculated similarly with VaR_{10}, but using daily returns of a given firm within that quarter.	CSMAR
ESG_s	ESG_s is the industry-adjusted ESG ratings for a given firm, calculated as its ESG rating minus the median ESG rating of the firms coming from the same industry.	SynTao Green Finance and WIND
ROA	ROA indicates a firm's profitability, defined as the reported return on assets	CSMAR
$Mktcap$ (mil CNY)	$Mktcap$ is a firm's market capitalization.	CSMAR
Vol_s	Vol_s is a firm's quarterly volatility of stock returns, defined as the standard deviation of daily returns across a quarter.	CSMAR
$Illiq$	$Illiq$ is the average daily illiquidity across a quarter.	CSMAR
Lev	Lev is a firm's leverage ratio, defined as the ratio of debt to equity.	CSMAR

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