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Socially responsible investment and fund performance: The moderating roles of mutual funds' operating environments

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ABSTRACT

Mutual fund managers are increasingly inclined to demonstrate their social responsibility (SR) by adopting SR standards and integrating SR funds into investment portfolios. However, a debated question is whether the net effect of SR integration on fund performance is positive. This study proposes an inverted U-shaped relationship between SR integration and fund performance based on the trade-off between the benefits and costs associated with SR integration from the perspectives of legitimacy theory and transaction cost economics. We further hypothesise that this relationship is moderated by mutual funds' trading and regulatory environments. Our results from a sample of 1145 Chinese mutual funds support that fund performance improves with SR integration at low SR integration intensities but deteriorates as the integration increases from a medium level to a high level. Moreover, this inverted U-shaped relationship is weakened by market uncertainty but strengthened by the implementation of government-mandated SR disclosure. Our study provides practical guidance for investors, fund managers, and policymakers in striking a balance between financial performance and social responsibility.

1. Introduction

The United Nations Department of Economic and Social Affairs (UNDESA) established Sustainable Development Goals in 2015 and called for actions to address climate change and pursue sustainable prosperity (UNDESA, U. N, 2015). Since then, investors concerned about ecosystem destruction and resource depletion have expressed interest in funds emphasising corporate sustainability. In response, mutual fund managers started to offer socially responsible (SR) funds that included environmentally friendly stocks and excluded those in controversial industries such as alcohol, tobacco, and gambling (Bertrand & Lapointe, 2015) and gradually integrated these SR funds into conventional funds (Van Duuren et al., 2016). By the end of 2021, the total value of global Environmental, Social and Governance (ESG) assets managed by mutual funds reached $37.8 trillion and may surpass $50 trillion by 2025 (Bloomberg Intelligence Report, 2022).

As fund managers try to align their financial goals with social values, scholars have analysed the effect of SR integration on financial performance from either a legitimacy logic or a transaction cost economics perspective. Hamilton et al. (1993) argued that screening costs associated with SR integration negatively affect fund performance, while others, such as Kempf and Osthoff (2007), showed that improved reputation and legitimacy through SR integration can lead to better value creation. These studies collectively deepen our understanding of the distinct effects of legitimacy benefits and screening costs on the performance of funds that incorporate SR criteria into their portfolio selections.

However, the net effect of SR integration on fund performance remains theoretically indeterminate (Auer & Schuhmacher, 2016; Statman & Glushkov, 2009). Although Barnett and Salomon (2006) examined the net effect of SR integration on fund performance based on the trade-off between the benefits and costs associated with SR screening, their assumptions about SR stocks are very restrictive, at least for emerging stock markets. Barnett and Salomon (2006) argued that SR stocks are better managed, less volatile, and can offset the cost of poor diversification, leading them to outperform the market portfolio at high levels of SR screening. We join the debate on the relationship between SR integration and fund performance, as this relationship is crucial for fund managers in their attempt to allocate resources effectively while striking a balance between social responsibility and financial returns. Following Statman (2000) and Kempf and Osthoff (2007), we submit that mutual funds that pursue SR investments present a socially

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responsible image so that they can attract more investments and increase their funds' returns. However, this legitimacy benefit cannot increase continuously. It will reach an upper bound (Renneboog et al., 2008a), and even decrease (Wu & Shen, 2013), as SR integration intensifies. We posit that the trade-off between this legitimacy benefit and the logarithmically growing total cost associated with SR integration, as Barnett and Salomon (2006) observed, results in an inverted U-shaped relationship between SR integration and fund performance.

Funds vary in their level of commitment to SR integration at the discretion of fund managers. While we deal with the endogeneity caused by the unobservable factor econometrically, we further consider that fund managers' decision-making is influenced by the trading and regulatory environments in which they operate. Given that fund managers are expected to adjust their funds' SR criteria dynamically (Abdelsalam et al., 2014) and adopt more risk-averse investment strategies and allocate resources more cautiously under heightened market uncertainty (Lin & Su, 2020), we propose that market uncertainty, measured by category-level return dispersion, alters the total costs associated with SR integration. The trade-off between the changed total cost due to market uncertainty and the unaffected total benefit results in a less pronounced inverted U-shaped relationship between SR integration and fund performance. In other words, we expect market uncertainty to weaken the net impact of SR integration on fund performance.

On the other hand, to prevent suboptimal decisions such as engaging in greenwashing or symbolic SR investments, financial services authorities, such as the Asset Management Association of China (AMAC), have mandated fund managers to disclose their SR strategies in a standardised format. Rhodes (2010) and Ioannou and Serafeim (2017) showed that mandatory SR disclosures can improve operational efficiency and fund performance. We propose that SR disclosure mandate speeds up the growth of legitimacy benefits derived from SR integration at low levels of SR integration. However, at high integration levels, the burden of compliance with regulations is substantial, whereas the marginal benefit of legitimacy is minimal. The domination of total benefit over total cost at low levels of SR integration and the reverse domination at high intensities lead to an accentuated inverted U-shaped net effect of SR integration on fund performance. We hypothesise that government-mandated SR disclosure strengthens the net effect of SR integration on fund performance.

We test these hypotheses using data from Chinese mutual funds between 2014 and 2022. Since 2014, the China Sustainable Investment Forum (China SIF) has encouraged fund management companies to invest in SR firms as part of China's green finance reform (China SIF, 2014). The huge response of fund management firms to this initiative provides a large sample for examining the effects of SR integration. Peng et al. (2023) observed that the declaration of socially responsible investments is not just for show, as they found evidence of the positive impact of SR investments on the ESG performance of a sample of Chinese firms between 2010 and 2020. Furthermore, Chinese fund managers were required by the AMAC to disclose their SR strategies in a standardised format and report their development goals in 2018 (AMAC, 2018), making Chinese mutual funds a suitable context for assessing the moderating effect of government-mandated disclosure requirements. We anticipate that our study offers insights into SR investments in the less-explored Chinese fund market and serves as a valid reference point for comparison with widely studied developed markets.

This empirical study employs a two-stage least square (2SLS) approach to estimate the net effect of SR integration on fund performance. We use the total number of localised extreme natural disasters and health-and-safety accidents and category-averaged SR integration intensity as instrumental variables to address any potential endogeneity arising from the omission of unobservable factors, such as fund managers' discretion to commit to a specific SR intensity. To test for the moderating effects of market uncertainty and the SR disclosure mandate, we include the interaction terms between each moderator and the linear and squared terms of SR integration intensity in the outcome model. We find that fund performance initially increases with SR integration intensity but starts to decrease once SR integration intensity increases beyond a certain level. Furthermore, market uncertainty weakens the inverted U-shaped relationship between fund performance and SR integration, whereas an SR disclosure mandate strengthens this relationship.

This study contributes to the literature on the complex link between fund managers' responsible conduct and value creation. While Renneboog et al. (2008a) studied how SR integration directly affects fund performance, our research considers how market uncertainty and the SR disclosure mandate moderate the impact of SR integration on fund performance. Through the analysis of the changes in the effects of SR integration on fund performance, we offer practical guidance for fund managers in their attempt to optimise SR intensity and verify whether the disclosure mandate provides a valid solution as intended by policymakers to improving market integrity and the information efficiency of financial markets.

The remainder of this paper is organised as follows. Section 2 reviews the relevant literature and develops the hypotheses. Section 3 presents our empirical methods, and Section 4 provides details of the data and variables. We report and discuss the empirical results in Section 5, while Section 6 concludes.

2. Literature review and hypothesis development

2.1. The heterogenous effects of SR integration on fund performance

Many studies have argued that SR funds outperform conventional mutual funds. For instance, Herremans et al. (1993) proposed that SR integration can attract resources and enhance reputation and legitimacy, which in turn leads to better value creation for mutual funds. Statman (2000) concurred that SR integration can resonate with social stakeholders' beliefs, and thus have a positive impact on fund performance. To test these propositions, Kempf and Osthoff (2007) analysed SR-integrated portfolios compiled from stocks included in the S&P 500 and DS 400 during 1992–2004 and found that portfolios with greater proportions of SR stocks yield, on average, a significant abnormal return of up to 8.7 % per year when compared with those with lower proportions.

However, other studies have observed that mutual funds sacrifice financial performance in pursuit of social responsibility. Hamilton et al. (1993) argued that SR integration negatively influences fund performance by highlighting the considerable financial expenses associated with screening SR funds. Renneboog et al. (2008a) analysed six European and Asia-Pacific countries for 1991–2003 and observed that SR funds in these countries strongly underperform their respective national benchmark portfolios. Borgers et al. (2015) further emphasised the adverse impact on financial performance of excluding profitable 'sin' companies in the alcohol, tobacco, and gambling industries.

Barnett and Salomon (2006) advanced this debate by arguing that SR integration has heterogeneous effects. They proposed a U-shaped net effect of SR screening on fund performance, based on the assumption that the total cost outweighs the total benefit of screening out poorly managed firms at low levels of SR screening, while the total benefit dominates the total cost at high screening intensities. However, their assumption that SR stocks are better managed and can outperform the market portfolio is restrictive and unreasonable for emerging stock markets. By analysing 1250 Chinese and Taiwanese firms from 2008 to 2014, Kao et al. (2018) found that Corporate Social Responsibility (CSR) engagement by firms in emerging economies reduces firm performance. They pointed out that firms in emerging markets face soft budget constraints because of their implicit government guarantees. With such less stringent financial discipline, firms tend to over-invest in CSR to enhance their reputation instead of maximising shareholder value, leading to inefficient use of resources and reducing firm performance.

In contrast to the benefit of filtering out poorly managed companies

through SR screening, Statman (2000) and Lounsbury and Glynn (2001) argued for the benefits of reputation building and investor satisfaction derived from SR integration. As funds gradually increase their involvement in SR investment, even to a small extent, they can accumulate skills and abilities to improve relationships with stakeholders (Barnett & Salomon, 2012). Funds with such abilities are likely to receive positive media coverage and increased capital inflows, leading to an increase in fund performance (Renneboog et al., 2011). As fund managers' skills in selecting and managing SR stocks become more refined, average administrative costs decrease with the intensity of SR integration. As the expected growth in total benefits outpaces that in total costs, we assume that the net effect of SR integration on fund performance will be positive at low levels of SR integration.

However, the total benefits of SR integration cannot continuously increase. While Renneboog et al. (2008b) observed an upper limit to the legitimacy benefit that funds can gain from the inclusion of SR stocks, Wu and Shen (2013) suggested an eventual decrease in the perceived legitimacy of SR integration. Wu and Shen (2013) argued that excessive reliance on SR integration can give rise to concerns among stakeholders that fund managers may use SR investments as a strategy to conceal or divert attention from their self-interested behaviours. Furthermore, beyond a certain level of SR integration, funds experience insufficient diversification and are exposed to greater unsystematic risk, leading to lower risk-adjusted returns. In other words, the advantage of risk diversification through mutual fund investments diminishes as SR integration intensifies. Therefore, at high levels of SR integration, the total benefit is dominated by the total cost, resulting in a negative net effect of SR integration. Overall, we expect the net effect of SR integration to grow at low levels of SR integration and decrease at high levels of SR integration:

Hypothesis 1. The relationship between SR integration and fund performance is inverted U-shaped.

2.2. The negative moderating effect of market uncertainty

Market uncertainty refers to the unpredictability of market changes in the form of dramatic stock-price movements. Under market uncertainty, fund managers face greater challenges in gaining an informational edge. According to the uncertainty aversion view of Hansen et al. (1999), in markets that are full of ambiguous information, fund managers tend to become averse to future uncertainty and assume the worst outcome as what will eventually happen. To navigate this uncertain landscape, Lin and Su (2020) suggested that managers adopt more conservative investment strategies and allocate resources more cautiously. By holding less-volatile stocks, these conservative strategies reduce funds' exposure to the market risk. Furthermore, Abdelsalam et al. (2014) and Sun et al. (2023) argued that under heightened uncertainty about stock returns, fund managers are expected to dynamically adjust their SR criteria while adopting more rigorous risk-mitigation strategies.

Naturally, adopting these adaptive strategies under market uncertainty, as suggested by Abdelsalam et al. (2014) and Lin and Su (2020), incurs additional costs for SR-integrated funds to different extents. SR investments are more exploratory at low integration levels. Adopting these adaptive strategies incurs greater costs for managers of low SR integrated funds. Because these fund managers lack screening experience and expertise in SR investment, they require additional research, management, and due diligence to a greater extent. Furthermore, these managers adjust their SR investments more frequently under market uncertainty, thereby incurring greater screening and administrative costs. Thus, the trade-off between a drastically rising total cost under heightened market uncertainty and an unchanged total benefit dampens the positive effect of SR integration on fund performance at low levels of SR integration.

At high levels of SR integration, fund managers have gained, through learning-by-doing, an in-depth understanding of the screening and management of SR stocks and will be capable of a more accurate interpretation of the performance of SR funds (Beer et al., 2005). When market uncertainty increases, experienced managers can select more stable SR stocks and hold them for longer periods, thereby reducing funds' exposure to the market risk (Lin & Su, 2020). SR screening experience also reduces the time and effort required for frequent trading and monitoring, rendering adaptive strategies more feasible and effective. Therefore, fund managers are better able to mitigate risk and control transaction and management costs, thereby slowing the increase in total costs associated with SR integration. The difference in the costs of adjusting to market uncertainty at distinct levels of SR integration results in the attenuation of the relationship between fund performance and SR integration, that is, a slower growing fund performance at low levels of SR integration and a slower declining fund performance at high levels of SR integration:

Hypothesis 2. Market uncertainty attenuates the impact of SR integration on fund performance.

2.3. The positive moderating effect of the SR disclosure mandate

Unlike voluntary SR disclosures, in which funds can choose to disclose their SR practices, mandatory SR disclosures require a broader scope of SR disclosure in a standardised format, limiting fund managers' discretion to deviate from mandated screening standards. According to Rhodes (2010), mandatory disclosures prompt fund managers to adopt better-defined strategies and improve management practices, which can increase fund performance. By analysing 209 funds in countries that enacted mandatory SR disclosures during 2005–2012, Ioannou and Serafeim (2017) showed that mandatory SR disclosures can improve the operational efficiency and financial performance of these funds.

We argue that the benefits of mandatory SR disclosure can offset the additional costs of complying with regulations for funds at low levels of SR integration, thus strengthening the net effect of SR integration on fund performance. Drawing on the agency perspective, we expect that mandatory SR disclosures reduce information asymmetry between fund managers and investors and align fund managers' actions with investor expectations. By ensuring the completeness of SR reporting, mandatory SR disclosures provide investors with essential information to gain an in-depth understanding of the SR integration process (Du & Yu, 2021). While the disclosure mandate ensures fund managers' compliance with regulatory screening criteria, it also guarantees the appropriate selection of SR stocks. Transparency facilitated by standardised disclosures helps foster investor confidence and trust, strengthening the legitimacy of SR integration practices (Rhodes, 2010). We argue that lowly SR-integrated funds will benefit significantly from the disclosure mandate, with their benefits more than offsetting the additional costs of compliance incurred. Therefore, the implementation of the disclosure mandate has a greater positive effect on the fund performance of SR integration at low levels of SR integration.

However, for highly SR-integrated funds, the additional costs of complying with the regulations outweigh the additional benefits associated with the disclosure mandate. Under mandatory SR disclosures, fund managers must adhere to official screening criteria and gather additional SR information on both the stocks to be included and those already included in their investment portfolios. For highly SR-integrated funds, the total workload of complying with the regulations is substantial. This is particularly true for funds that comprehensively focus on societal impacts, including environmental responsibility, governance practices, and employee welfare. Thorough and transparent disclosure practices, such as extensive data collection and broader stakeholder engagement, incur substantial costs at high SR intensities. While costs continue to rise proportionately, the incremental benefits associated with increasing SR integration are minimal (Renneboog et al., 2008b; Wu & Shen, 2013). Consequently, the growing costs associated with

these additional layers of complexity and the required rigor outweigh the benefits of SR integration. Therefore, the trade-off between rising total costs and limited additional benefits results in an accelerated decline in performance at high levels of SR integration. Overall,

Hypothesis 3. The SR disclosure mandate accentuates the impact of SR integration on fund performance.

3. Methodology

3.1. The baseline model

To test Hypothesis 1, we regress fund performance on both the linear and squared terms of SR integration intensity in the presence of control variables as follows:

$$R_{it} = \alpha_0 + \beta_1 \text{SR Intensity}_{it} + \beta_2 \text{SR Intensity}^2{}_{it} + \gamma_1 \text{Dispersion}_{it} + \gamma_2 \text{Post}_t + \lambda_h \sum_{h=1}^{4} X_{hit-1} + Q_t + Y_f + Y_i + \mu_{it} \quad (1)$$

where R represents fund performance and is measured by the CAPM-adjusted alpha or the alpha of the Fama and French 3-factor asset pricing model of fund i in quarter t. The coefficients, β_1 and β_2, measure the responses of fund performance to changes in the linear and squared terms of SR integration intensity, respectively. According to Hypothesis 1, β_1 must be positive while β_2 is negative. The coefficients, γ_1 and γ_2, capture the direct effects on fund performance of market uncertainty, denoted by Dispersion, and the implementation of the SR disclosure mandate, denoted by Post, respectively. Based on the discussion in sections 2.2 and 2.3, we expect these coefficients to be negative and positive, respectively.

The coefficients, λ_h (h = 1, 2, … and 4), capture the effects of the control variables, such as family size, fund size, expense ratio, and fund flow. According to Fu et al. (2022) and Liang et al. (2022), larger fund families can disseminate timely and high-quality information among affiliated fund members. Furthermore, their greater bargaining power to secure favourable commission fees for funds within families reduces transaction costs and enhances fund performance (Chen et al., 2004). Larger funds are likely to operate more efficiently, potentially incurring lower costs and achieving higher returns (Bollen, 2007). We, therefore, expect a positive correlation between fund performance and fund family size. The expense ratio, which represents the percentage of a fund's assets used to cover its operating expenses, is expected to directly reduce its overall returns. Fund flows capture investors' redemption demand, reducing the likelihood of fund managers selling their holdings at unfavourable times (Ben-Rephael et al., 2011). This restriction on hasty asset sales leads to lower brokerage fees, taxes, and transaction costs, thus contributing to the preservation of fund value. Therefore, fund flows positively affect fund performance. To avoid reverse causality that fund performance may have on fund characteristics, these characteristics are lagged by one period. Quarter-fixed effects Q_t are included to account for common time trends that may affect all the funds under study. Family- and fund-fixed effects, Y_f and Y_i, respectively control for the unobserved time-invariant characteristics of the fund family and individual funds that may concurrently affect both SR integration intensity and the financial returns of funds.

To address the potential endogeneity caused by the omission of unobservable factors that could have affected fund managers' decision-making regarding SR integration (Ben-Rephael et al., 2011; Chen et al., 2004), we estimate Eq. (1) using the 2SLS approach. Specifically, we model the linear and squared terms of SR integration as a function of two instrumental variables, namely the total number of localised extreme natural disasters and health-and-safety accidents (hereafter referred to as the number of disasters and accidents) and category-averaged SR integration, together with the other variables on the right-hand side of Eq. (1). That is, we estimate the SR integration functions as the first-stage equations and the fund performance equation (Eq. 1) as the second-stage equation.

3.2. The moderating effects of market uncertainty and the SR disclosure mandate

To investigate the moderating effects of external environmental conditions on the hypothesised nonlinear relationship between SR integration and fund performance, we include the interactions between the moderators and the linear and squared terms of SR integration intensity separately in the second-stage equation of the 2SLS model:

$$R_{it} = \alpha_0 + \beta_1 \text{SR Intensity}_{it} + \beta_2 \text{SR Intensity}^2{}_{it} + \gamma_1 \text{Dispersion}_{it} + \gamma_2 \text{Post}_t + \varphi_{1g}(\text{SR Intensity}_{it} * \text{External condition}_{git}) + \varphi_{2g}(\text{SR Intensity}^2{}_{it} * \text{External condition}_{git}) + \lambda_h \sum_{h=1}^{4} X_{hit-1} + Q_t + Y_f + Y_i + \mu_{it} \quad (2)$$

where coefficients, φ_{1g} and φ_{2g} (g = 1 or 2), capture, separately, the moderating effects of market uncertainty or the SR disclosure mandate on the quadratic relationship between SR integration and fund performance. We expect a negative φ_{11} and a positive φ_{21} for the weakening effect of market uncertainty as proposed in Hypothesis 2 and a positive φ_{12} and a negative φ_{22} for the strengthening effect of the SR disclosure mandate as stated in Hypothesis 3. We will estimate and graph the predicted marginal effects when the coefficients of the interactions are statistically significant.

4. Data and generation of variables

We source our data on mutual fund characteristics and the two instrumental variables from the CSMAR database. All Chinese mutual funds, except global funds (i.e., funds with less than 75 % of their assets invested in Chinese stock markets) and index funds, were eligible to be included in the sample. For mutual funds with complete quarterly data on raw returns, total assets, and the number of fund family members from 2014 to 2022, we further collect their fund portfolio details, such as stock components and their weights. Once we remove funds with missing data, non-listed funds, and funds with total net assets below 10 million CNY, we are left with 1145 funds.

Following Barnett and Salomon (2006) and Leite and Cortez (2015), we measure fund performance using the fund's alpha intercepts of the Capital Asset Pricing Model (CAPM) and Fama and French 3-factor model, respectively. Using a rolling window spanning the previous 36 months, we regress each fund's risk premium on the market risk premium, alone and together with the size and value premiums, to obtain the CAPM-adjusted and the 3-factor model-adjusted monthly alpha intercepts. The monthly alpha intercepts are then converted into quarterly intercepts.

We downloaded ESG rating data for the firms in this study from the website of Sino-Securities Index Information Service (Shanghai) Co. Ltd, which considers stocks that received a BBB rating or higher (out of seven levels: AAA, AA, A, BBB, BB, B, and CCC) as indicative of leading performance in environmental, social, and corporate governance aspects. Therefore, we treated stocks receiving a BBB rating or higher as SR stocks. To fully account for a fund's commitment to SR investments, we generate a value-weighted measure, like Morningstar's historical portfolio sustainability score, to proxy for SR integration intensity. That is, SR intensity is the quarterly ratio of the total market value of SR stocks held by fund i to the total market value of all stocks in the fund.

Following Moreno et al. (2018), we measure market uncertainty using category-level return dispersion, which is calculated as the standard deviation of stock returns within the same category divided by the

largest standard deviation of any of the eight categories[1] in a specific quarter. As the Asset Management Association of China enacted mandatory disclosures in 2018, we proxy the SR disclosure mandate with a time dummy, *Post*, which takes the value of one if calendar quarter *t* is after 2018, and zero otherwise. Among the control variables, fund family size is the natural logarithm of the number of fund members under the same fund company at quarter *t*. Fund size is the natural logarithm of the total net assets of fund *i* at quarter *t*, while fund flow is calculated as the difference between its total net assets at quarter *t* and at *t-1,* with the latter adjusted for investment return at *t*, divided by its total net asset at *t-1* (Bollen, 2007; Guo et al., 2023). We measure the expense ratio as the quarterly ratio of management fees to the total assets of fund *i*.

The instrumental variables included in the 2SLS analysis are constructed as follows to meet the requirement that they are correlated with SR integration intensity but are unrelated to fund performance. The number of disasters and accidents was the sum of the quarterly counts of these occurrences. Fund managers are more likely to adopt SR practices with an increasing number of these localised events to prevent net capital outflows to other funds. While they can serve as indicators of social and environmental risks, these localised extreme accidents, as specific risks, do not directly impact the financial performance of funds. Category-averaged SR integration captures the average SR integration intensity for each fund category in each quarter. This category-averaged SR integration is expected to correlate with the SR integration intensity of the individual funds within that category. Even if funds within the same category share similar sustainability goals, the way they implement SR practices can vary; some funds integrate SR more effectively into their investment portfolios, whereas others do not rigorously execute these practices. Therefore, category-averaged SR integration is unlikely to directly determine the financial performance of individual funds.

5. Results

5.1. Descriptive statistics

Table 1 presents summary statistics of the characteristics of the Chinese mutual funds under study. We observe that compared with lowly SR-integrated funds, highly SR-integrated funds are more likely to belong to large fund families and fall into categories with lower return dispersions. In addition, highly SR-integrated funds are larger, have lower management fees, and attract greater capital inflows. Fig. 1 presents the average SR integration intensity of the funds under study from 2014 to 2022 and shows the increasing adoption of SR practices by fund managers during the sample period.

Table 2 presents the correlation coefficients of the variables. The correlation coefficients between the fund characteristics do not indicate multicollinearity. In addition, the average Variance Inflation Factor (VIF) of 1.55, which is well below 10 for all explanatory variables, further confirms that our analysis is not affected by multicollinearity problems.

5.2. Empirical results

5.2.1. Direct effect of SR integration on fund performance

Columns 1 and 4 of Table 3 report the estimates of Eq. (1) by OLS for the cases where fund performance is measured by the CAPM-adjusted alpha and the 3-factor model-adjusted alpha, respectively. In both cases, we observe a statistically significant and positive coefficient for SR integration intensity and a statistically significant but negative coefficient for squared SR integration intensity, supporting an inverted U-shaped relationship between SR integration and fund performance. Similarly, the coefficients estimated using the 2SLS technique (columns 1 and 4 of Table 4) have the expected signs and are statistically significant. These results robustly show that fund performance initially increases with SR integration intensity but starts to decrease once SR integration intensifies beyond a certain level. In the case of the OLS estimates (Table 3), we observe that the turning points are located at an SR integration of 22.08 % when fund performance is proxied by the CAPM-adjusted alpha and 29.99 % when fund performance is measured by the 3-factor model-adjusted alpha. Once we control for potential endogeneity using the instrumental variable approach (Table 4), these turning points are located at SR intensities of 22.49 % and 30.16 %, respectively. Although the two measures of fund performance vary, these turning points suggest a relatively short interval for SR integration to have a positive impact on fund performance. Finally, the coefficients of the linear and squared terms of SR integration are jointly statistically significant in affecting fund performance in all cases; for example, at the chi-square statistics of 3630.4 ($p = 0.000$) and 926.3 ($p = 0.000$) in columns 1 and 4 of Table 4. These results support Hypothesis 1, which proposes that the relationship between SR integration and fund performance follows an inverted U shape, emphasising the need for fund managers to carefully determine their level of SR integration to optimise performance outcomes.

Note that the two selected instrumental variables, namely the total number of disasters and accidents and category-averaged SR integration intensity, passed the instrument relevance test and Sargan over-identification test. In columns 1 and 4 of Table 4, while the Wald F-statistics of 65.32 ($p = 0.000$) and 64.79 ($p = 0.000$) suggest a strong relevance of these instruments to SR integration intensity, the Sargan statistics of 1.430 ($p = 0.489$) and 1.135 ($p = 0.567$) show that our instruments are uncorrelated with fund performance. The selected instruments satisfied the exclusion condition, presenting no evidence of over-identification in the models.

5.2.2. Moderating effect of market uncertainty

While we find a small negative or insignificant direct effect of market uncertainty measured by category-level return dispersion on fund performance in columns 1 and 4, we observe a substantial moderating effect of market uncertainty in columns 2 and 5 of Tables 3 and 4. Regardless of how we estimate Eq. (2), the coefficients of the interactions between market uncertainty and the linear and squared terms of SR integration are jointly statistically significant in support of market uncertainty moderating the inverted U-shaped relationship between fund performance and SR integration, as stated in Hypothesis 2. For instance, in columns 2 and 5 of Table 4, in which fund performance is captured by the CAPM-adjusted alpha and the 3-factor model-adjusted alpha, respectively, the chi-square statistics for the null hypothesis that both coefficients are zero are 15.35 ($p = 0.000$) and 48.44 ($p = 0.000$). Furthermore, the coefficients of the interactions between market uncertainty and the linear and squared terms of SR integration have correct signs and are individually statistically significant. in support of market uncertainty weakening the inverted U-shaped relationship, as hypothesised. In particular, the positive signs of the interactions between the squared SR integration intensity and market uncertainty, 21.49 ($p = 0.000$) and 27.99 ($p = 0.000$) (columns 2 and 5 of Table 4), suggest that market uncertainty flattens the slopes of the inverted U-shaped relationship between fund performance and SR integration. Based on the estimates in Table 4, we generate the predicted marginal effects of market uncertainty when fund performance is proxied by the CAPM-adjusted alpha and the 3-factor model-adjusted alpha, respectively, and present them in Graphs A and B of Fig. 2. These graphs confirm that the slopes on both sides of the inverted U are less steep when market uncertainty is high. In other words, market uncertainty slows the growth of fund performance at low levels of SR integration and its decline at high intensities. These results support our Hypothesis 2 that market

[1] The eight categories are equity funds, income funds, value funds, growth funds, balanced funds, active growth funds, stable growth funds, and stable equity funds.

Table 1
Summary statistics of the variables from 2014 to 2022.

	All funds				Lowly SR-integrated funds				Highly SR-integrated funds			
Variables	Mean	SD	Min	Max	Mean	SD	Min	Max	Mean	SD	Min	Max
CAPM-adjusted return (%)	0.831	0.452	−1.546	1.258	1.047	0.084	0.823	1.258	0.603	0.558	−1.546	1.236
3-factor model-adjusted return (%)	0.488	0.213	−0.815	0.834	0.552	0.095	0.387	0.778	0.421	0.274	−0.815	0.834
SR integration intensity (%)	33.36	24.26	0	96.89	15.34	10.66	0	39.94	52.32	19.67	0	96.89
Market uncertainty	0.654	0.210	0.199	1	0.660	0.209	0.199	1	0.647	0.212	0.199	1
Fund family size	3.011	0.839	0.693	4.510	2.989	0.828	0.693	4.511	3.034	0.851	0.693	4.511
Fund size	19.90	1.752	16.12	25.08	19.82	1.768	16.12	25.08	19.98	1.732	16.12	25.08
Fund flow	0.014	1.063	−25.47	28.87	0.008	0.004	0.002	0.025	0.016	0.978	−20.37	19.13
Expense ratio	0.008	0.003	0.001	0.025	0.012	1.139	−25.47	28.87	0.007	0.003	0.001	0.025
No. disasters and accidents	168.3	54.97	63	333	169.1	54.89	63	333	167.4	55.06	63	333
Category-level SR integration intensity	11.47	6.808	2.708	38.71	11.35	6.612	2.708	37.53	11.60	7.007	2.708	38.71

Note: Total sample size is 16,861 fund-quarter observations.

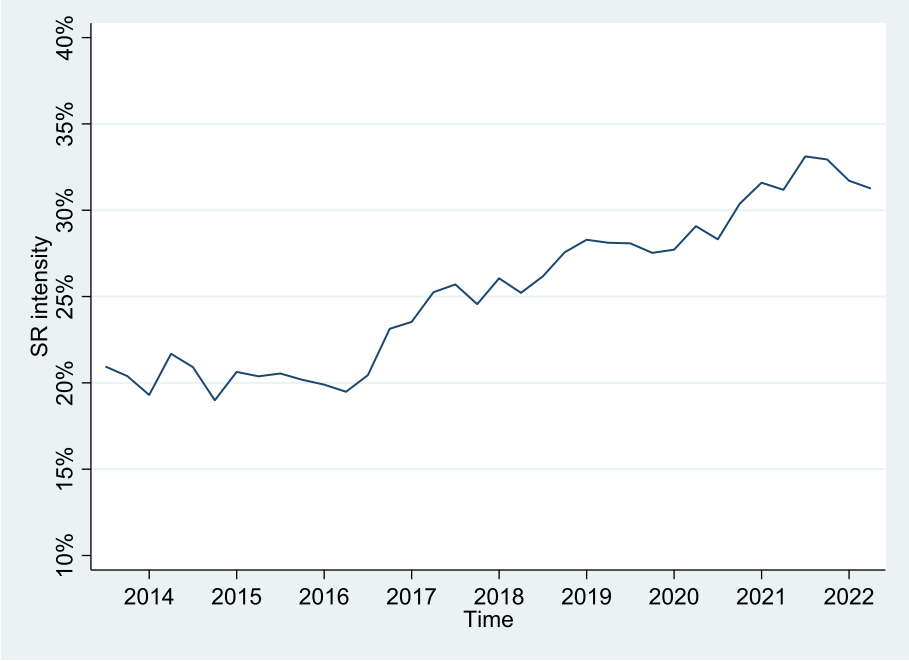


Fig. 1. The adoption of SR practices by the Chinese mutual funds during 2014–2022.

Table 2
Correlation coefficients.

	CAPM-adjusted return	3-factor model-adjusted return	SR integration intensity	Market uncertainty	Fund family size	Fund size	Expense ratio	Fund flow	No. disasters and accidents
3-factor model-adjusted return	0.612								
SR integration intensity	−0.295	−0.027							
Market uncertainty	−0.094	−0.246	−0.094						
Fund family size	0.073	0.097	0.147	−0.248					
Fund size	0.359	−0.031	0.034	−0.026	0.110				
Expense ratio	0.170	0.188	−0.175	0.183	−0.248	0.169			
Fund flow	0.018	−0.011	0.015	−0.011	0.011	0.062	−0.031		
No. disasters and accidents	−0.026	−0.082	−0.081	0.333	−0.232	0.017	0.096	0.010	
Category-level SR integration intensity	0.229	0.316	−0.114	0.038	−0.151	0.200	0.598	−0.025	−0.036

uncertainty weakens the impact of SR integration on fund performance.

5.2.3. Moderating effect of the mandatory disclosure requirements

Although columns 1 and 4 show a small negative or insignificant direct effect of the SR disclosure mandate on fund performance, columns 3 and 6 of Tables 3 and 4 report that the coefficients of the interactions between the SR disclosure mandate and the linear and squared terms of SR integration are individually and jointly statistically significant, regardless of the proxy for fund performance. For instance, the joint statistical significance of the two interaction coefficients in columns 3

Table 3
Estimates of Eqs. (1) and (2) by OLS.

	1	2	3	4	5	6
	CAPM-adjusted alpha			3-factor model-adjusted alpha		
SR intensity	1.699***	3.392***	1.019***	1.323***	3.351***	0.639***
	(0.014)	(0.024)	(0.003)	(0.011)	(0.010)	(0.006)
SR intensity^2	−3.848***	−7.347***	−1.998***	−2.205***	−5.851***	−0.655***
	(0.016)	(0.030)	(0.004)	(0.013)	(0.012)	(0.007)
Market Uncertainty	−0.021***	−0.046***	−0.136***	−0.123***	0.015***	−0.227***
	(0.007)	(0.006)	(0.001)	(0.006)	(0.003)	(0.002)
SR intensity *Market Uncertainty		−2.652***			−3.178***	
		(0.036)			(0.015)	
SR intensity^2 *Market Uncertainty		5.523***			5.743***	
		(0.044)			(0.018)	
SR disclosure mandate	−0.094***	0.001	−0.019***	−0.033***	−0.003	−0.061***
	(0.011)	(0.005)	(0.001)	(0.009)	(0.002)	(0.002)
SR intensity * SR disclosure mandate			0.980***			1.022***
			(0.004)			(0.007)
SR intensity^2 * SR disclosure mandate			−2.601***			−2.227***
			(0.004)			(0.009)
Fund family size	0.007***	0.011***	0.012***	0.008***	0.010***	0.012***
	(0.001)	(0.001)	(0.0002)	(0.001)	(0.0003)	(0.0004)
Fund size	0.019***	0.019***	0.019***	−0.011***	−0.010***	−0.0102***
	(0.001)	(0.0004)	(0.0001)	(0.0005)	(0.000152)	(0.000167)
Expense ratio	−0.132	−0.785***	−0.0715*	0.366	−0.287***	0.266***
	(0.330)	(0.191)	(0.0434)	(0.258)	(0.080)	(0.087)
Fund flow	−0.0005	0.0001	0.00001	−0.0006	−0.00002	−0.0002
	(0.001)	(0.0006)	(0.0001)	(0.0008)	(0.0002)	(0.0003)
Quarter fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Family fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Fund fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
χ^2(2) for linear and squared SR integration	70,782.04***			21,247.1***		
χ^2(2) for interactions		16,441.3***	47,234.1***		79,311.4***	64,558.2***
No. Observations	16,744			16,695		

Note: Constants are omitted to save space. *, **, and *** denote significance levels at 10 %, 5 %, and 1 %, respectively. Robust standard errors are indicated in the parentheses.

and 6 of Tables 3 and 4, as evidenced by their respective chi-square statistics of 47,234.1 ($p = 0.000$) and 64,558.2 ($p = 0.000$), and 1276.1 ($p = 0.000$) and 411.5 ($p = 0.000$), suggests that the mandatory disclosure requirements moderate the influence of SR integration on fund performance. Furthermore, the negative sign of the coefficients, −2.854 ($p = 0.000$) and − 1.826 ($p = 0.000$), of the interaction between the SR disclosure mandate and the squared term of SR integration suggests that, following the implementation of the SR disclosure mandate, the inverted U-shaped relationship between SR integration and fund performance is strengthened. Graphs A and B in Fig. 3, based on the estimates in Table 4 and illustrating the predicted marginal effects of mandatory SR disclosure in cases where fund performance is proxied by the CAPM-adjusted alpha and the 3-factor model-adjusted alpha, confirm that the introduction of mandatory SR disclosures makes the inverted U shapes more curved. That is, after the implementation of mandatory SR disclosure, fund performance accelerates more quickly at low levels of SR integration and declines more rapidly at high intensities. These results support Hypothesis 3, which states that the SR disclosure mandate, a regulatory framework that ensures transparency and consistency in disclosure practices, strengthens the effect of SR integration on fund performance.

5.3. Verification tests

5.3.1. The inverted U-shaped net effect of SR integration

In Section 5.2.1, we observed an inverted U-shaped net effect of SR integration on fund performance. Following the approach of Haans et al. (2016), in this section, we verify this inverted U shape for the case in which we estimate Eq. (2) using the 2SLS approach.[2] We aim to confirm whether the turning point, measured as $-\frac{\beta_1}{2\beta_2}$, is located within the data range of SR integration intensity and whether the slopes, calculated as $\beta_1 + 2\beta_2\ SR\ intensity_{Low}$, on the left-hand side of this inverted U-shaped relationship are positive while those, calculated as $\beta_1 + 2\beta_2\ SR\ intensity_{High}$, on the right-hand side are negative.

As Panel A of Table 5 reports, the turning points of the inverted U-shaped curve are at 22.49 % and 30.16 % of SR integration intensity when fund performance is proxied by the CAPM-adjusted alpha and the 3-factor model-adjusted alpha, respectively. The 95 % confidence intervals of these two turning points are between 21.99 % and 22.99 % and between 29.76 % and 30.56 %, both falling within the data range of the SR integration intensity (from 0 % to 96.89 %). As expected, the slopes on the left of the curve are positive, whereas those on the right are negative. For instance, when fund performance is proxied by the CAPM-adjusted alpha, the slope of the inverted U-shaped relationship is 1.077 ($p = 0.000$) when SR integration is at a low intensity of 10 % and − 1.509 ($p = 0.000$) at a high intensity of 40 %. The statistics presented in Panel A of Table 5 also confirm an inverted U-shaped relationship between SR integration and fund performance when fund performance is proxied by the 3-factor model-adjusted alpha.

5.3.2. The moderating mechanism of market uncertainty

The statistically significant and positive coefficients of the interaction between market uncertainty and the squared term of SR integration in all cases (columns 2 and 5 of Tables 3 and 4) suggest that market uncertainty interacts with SR integration to weaken fund performance by flattening the curvature of the relationship between fund

[2] The results of the verification of the inverted U-shaped relationship and the moderating mechanisms of market uncertainty and the mandatory disclosures based on the estimates by OLS (Table 3) are available upon request.

Table 4
Estimates of Eqs. (1) and (2) by 2SLS.

	1	2	3	4	5	6
	CAPM-adjusted alpha			3-factor model-adjusted alpha		
SR intensity	1.940***	3.230***	1.078***	1.639***	3.530***	1.089***
	(0.0684)	(0.435)	(0.0530)	(0.0546)	(0.342)	(0.0620)
SR intensity^2	−4.312***	−7.455***	−1.753***	−2.717***	−6.918***	−1.068***
	(0.112)	(0.964)	(0.123)	(0.0893)	(0.756)	(0.143)
Market Uncertainty	−0.0134	−0.0870***	−0.186***	−0.141***	−0.0155	−0.270***
	(0.00868)	(0.0262)	(0.00704)	(0.00690)	(0.0207)	(0.00824)
SR intensity *Market Uncertainty		−9.414***			−13.34***	
		(2.551)			(2.001)	
SR intensity^2 *Market Uncertainty		21.49***			27.99***	
		(5.614)			(4.402)	
SR disclosure mandate	−0.070***	−0.013	0.015***	−0.060***	0.040***	−0.003
	(0.008)	(0.019)	(0.003)	(0.006)	(0.015)	(0.004)
SR intensity * SR disclosure mandate			0.928***			0.581***
			(0.054)			(0.063)
SR intensity^2 * SR disclosure mandate			−2.854***			−1.826***
			(0.123)			(0.144)
Fund family size	0.011***	0.010***	0.011***	0.011***	0.010***	0.011***
	(0.002)	(0.002)	(0.001)	(0.001)	(0.001)	(0.001)
Fund size	0.019***	0.019***	0.019***	−0.011***	−0.011***	−0.011***
	(0.001)	(0.001)	(0.0001)	(0.001)	(0.001)	(0.0002)
Expense ratio	−2.310***	−0.538	0.732***	−1.640***	0.340	0.357
	(0.576)	(0.391)	(0.212)	(0.463)	(0.306)	(0.248)
Fund flow	0.0004	−0.001	−0.0002	0.0003	−0.001	−0.0001
	(0.001)	(0.001)	(0.0003)	(0.0008)	(0.001)	(0.0003)
Quarter fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Family fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Fund fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
χ^2(2) for linear and squared SR integration	3630.4***			926.3***		
χ^2(2) for interactions		15.35***	1276.1***		48.44***	411.5***
Wald F-statistic	65.32***	19.01***	7.167***	64.79***	18.89***	7.132**
Sargan statistic	1.430	10.11*	0.805	1.135	8.125	4.217
No. Observations	16,744			16,695		

Note: Constants are omitted to save space. *, **, and *** denote significance levels at 10 %, 5 %, and 1 %, respectively. Robust standard errors are indicated in the parentheses. The Wald F-statistic tests the relevance of an instrumental variable to SR integration intensity, whereas the Sargan statistic tests the correlation between the instrument and fund performance.

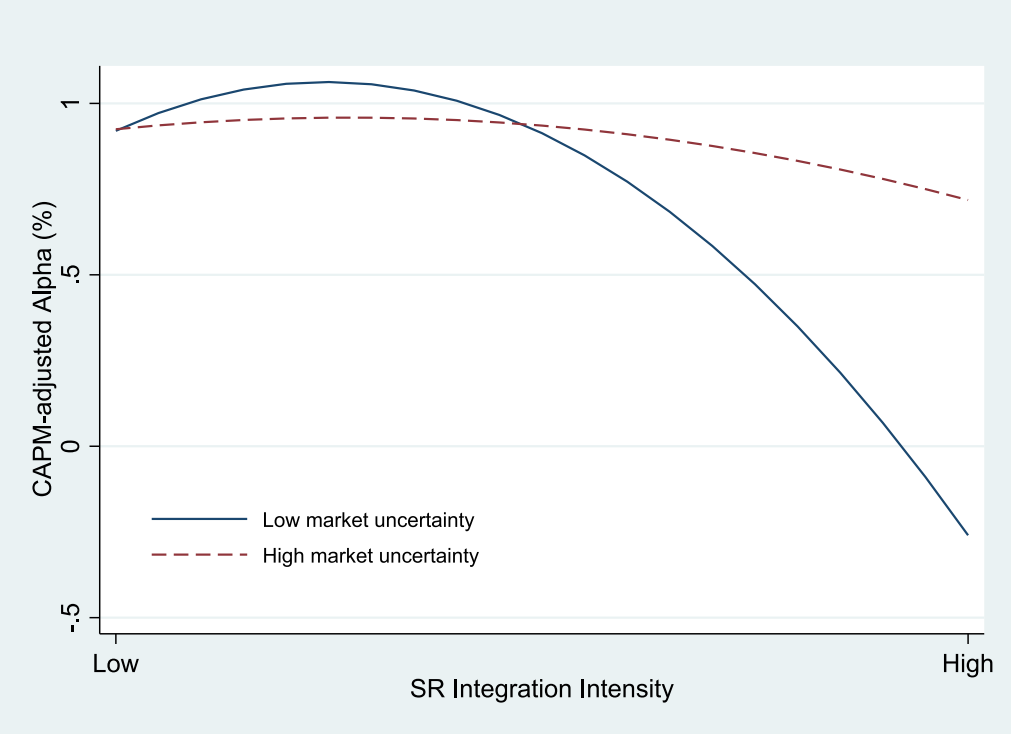
performance and SR integration. Following the approach detailed in Appendix 4 of Haans et al. (2016), we verify the hypothesised flattening of the curve due to market uncertainty for the case in which we estimate Eq. (2) using 2SLS. Specifically, we firstly capture turning points under low and high levels of market uncertainty by $Z_i^* = \frac{-\beta_1 - \varphi_{11} Dispersion_{it}}{2\beta_2 + 2\varphi_{21} Dispersion_{it}}$; secondly, we calculate the slope at a given distance n from each of the turning points Z_i^* by $Slope_i = \beta_1 + 2\beta_2 (Z_i^* \pm n) + \varphi_{11} Dispersion + 2\varphi_{21} (Z_i^* \pm n) Dispersion$; finally, we test whether the slope differences between low and high levels of market uncertainty are statistically significant and negative. Panel B of Table 5 presents these results.

When we measure fund performance with the CAPM-adjusted alpha, we observe the following results. The turning point of the inverted U-shaped relationship is at 22.60 % ($p = 0.000$) of SR integration when market uncertainty is as low as 0.463 (25th percentile) or at 22.07 % (p = 0. 000) when the uncertainty is as high as 0.838 (75th percentile). As we move to SR intensity that is 4 percentage points left to the turning point of 22.07 % (under high market uncertainty), the slope is 0.200 ($p = 0.021$). In contrast, at the same distance to the left to the turning point of 22.60 % (under low market uncertainty), the slope is 0.825 ($p = 0.013$). The statistically significant difference of −0.625 ($p = 0.000$) between these two slopes supports the flattening of the left-hand side of the inverted U-shaped curve as market uncertainty increases. We observe a similarly flatter slope under high market uncertainty as we move 8 percentage points to the left of the turning points. As we repeat the process for the movements of 4 or 8 percentage points to the right of the turning points, we also observe flatter slopes on the right side of the inverted U-curve under high market uncertainty (see Panel B of Table 5). The results are similar when we measure fund performance by the 3-factor model-adjusted alpha. We confirm that market uncertainty flattens the slopes of the inverted U-shaped effect of SR integration on fund performance.

Because a change in curvature typically accompanies a shift in the turning point, we now determine whether a turning point shift should have been included in the hypothesised moderating mechanism of market uncertainty. Following the procedure detailed in Appendix 3 of Haans et al. (2016), we obtain the derivative of the turning point with respect to market uncertainty as $\frac{\partial Z^*}{\partial Dispersion} = \frac{\beta_1 \varphi_{21} - \beta_2 \varphi_{11}}{2(\beta_2 + \varphi_{21} Dispersion)^2}$. As suggested by Haans et al. (2016), the direction of the turning point shift depends on the sign of the derivative numerator, given that the denominator is strictly positive. If the numerator is positive (negative), the turning point Z^* moves to the right (left) as market uncertainty increases. As reported in Table 5, the numerators were mostly statistically insignificant. For instance, the numerators of the derivatives of turning points with respect to market uncertainty are −0.751 ($p = 0.565$) when fund performance is proxied by the CAPM-adjusted alpha, and 0.646 ($p = 0.485$) when it is proxied by the 3-factor model-adjusted alpha. Based on these statistically insignificant estimates, we conclude that the turning point of the inverted U-shaped relationship does not shift to the right or left when market uncertainty increases. The primary mechanism for the moderating effect of market uncertainty is changing the slopes of the relationship between SR integration and fund performance.

5.3.3. *The moderating mechanism of the SR disclosure mandate*

Since the disclosure indicator, Post, only takes on the value of 0 or 1, we evaluate the mechanism on the basis of the turning points at $Z_0^T = \frac{-\beta_1}{2\beta_2}$ and $Z_1^T = \frac{-(\beta_1 + \varphi_{12})}{2(\beta_2 + \varphi_{22})}$, respectively. Based on the estimates in columns 3 and 6 of Table 4, we calculate the turning points before and after the disclosure mandate and report them in Panel C of Table 5. The turning



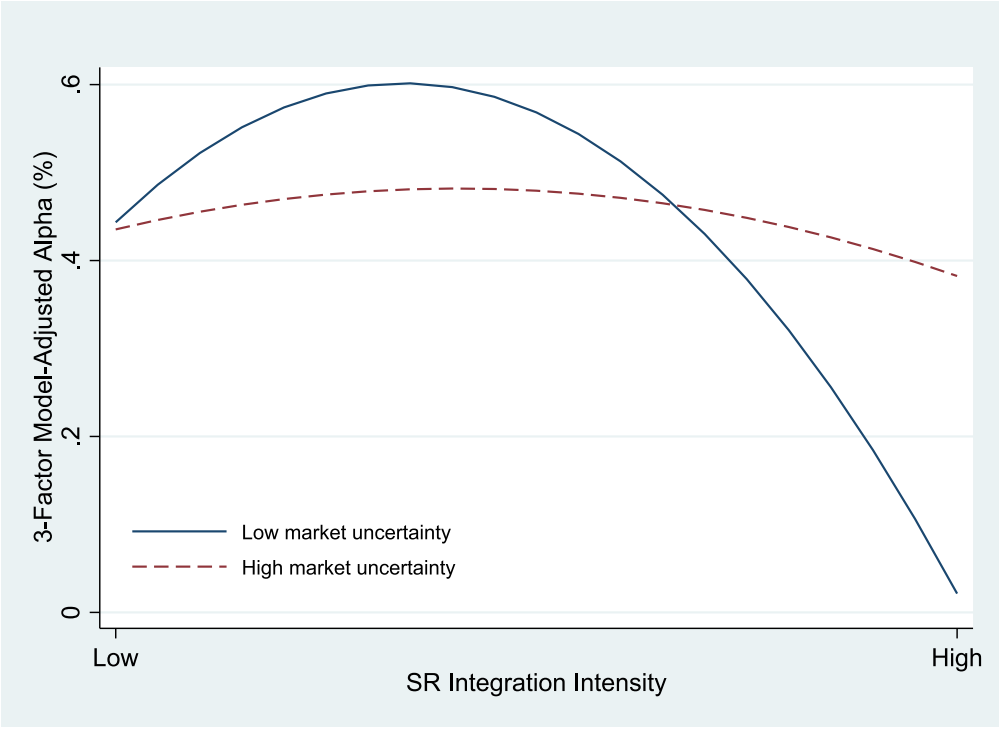


Fig. 2. The marginal effects of market uncertainty, based on the estimates reported in Table 4.

points of the inverted U-shaped relationship are at 30.74 % ($p = 0.000$) of SR intensity before the disclosure mandate and at 21.77 % ($p = 0.000$) after the mandate when fund performance is measured by the CAPM-adjusted alpha. Given the statistically significant and negative difference, −8.97 % ($p = 0.000$), between the locations of the turning points, we can say that the optimal level of SR integration has decreased–that is, shifted to the left–since the implementation of the disclosure mandate. We draw a similar conclusion when fund performance is proxied using the 3-factor model-adjusted alpha. It seems that we have omitted the turning-point shift as a mechanism through which the SR disclosure mandate could have influenced the inverted U-shaped relationship between SR integration and fund performance.

Next, we calculate the slopes at a given distance n from the turning points Z_0^T and Z_1^T as $Slope_0 = \beta_1 + 2\beta_2 \left(Z_0^T \pm n\right)$ and $Slope_1 = (\beta_1 + \varphi_{12}) + 2(\beta_2 + \varphi_{22}) \left(Z_1^T \pm n\right)$ respectively. We observe consistently greater slopes at the SR intensities, which are 4 or 8 percentage points to

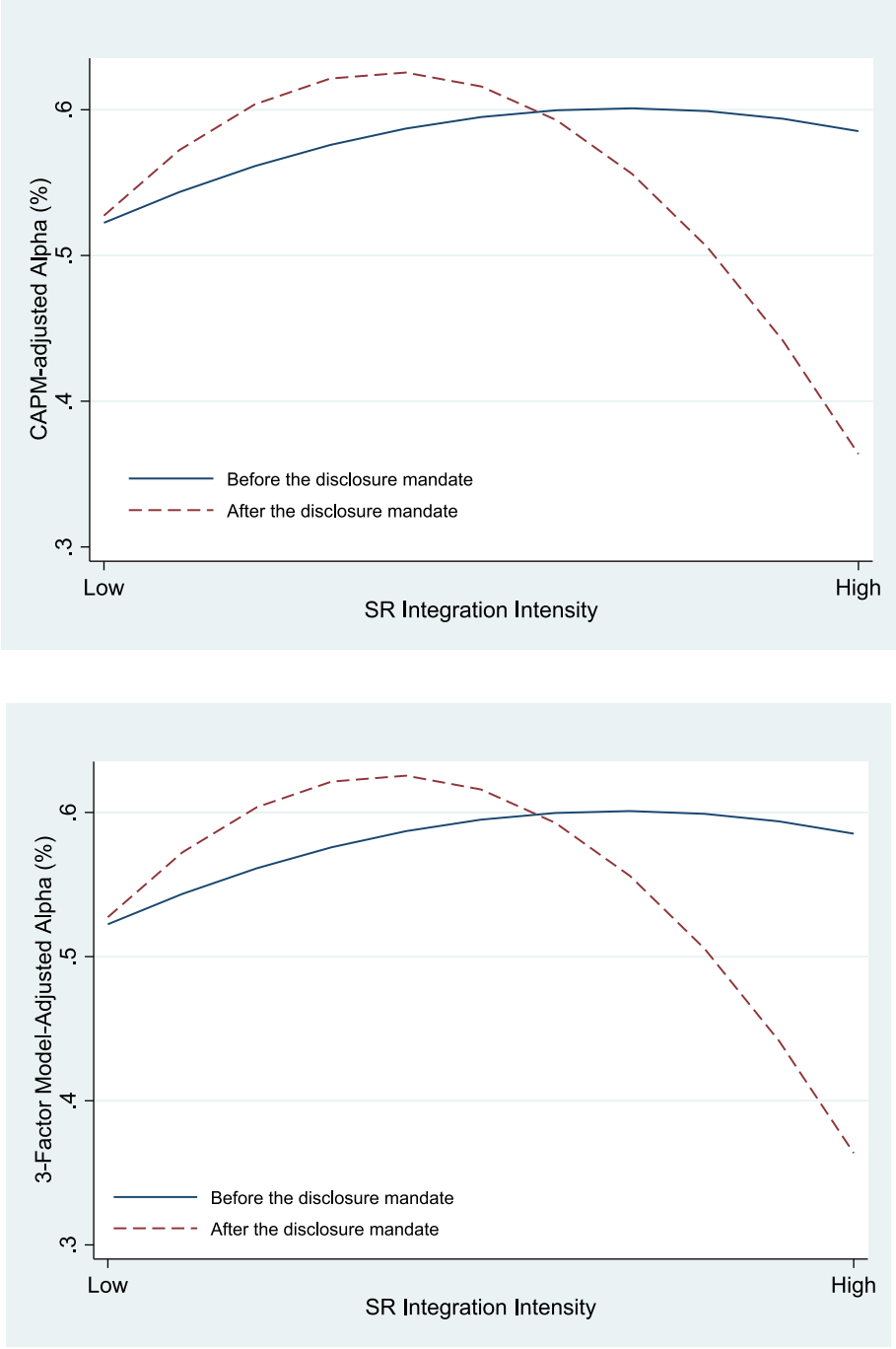


Fig. 3. The marginal effects of the SR disclosure mandate, based on the estimates reported in Table 4.

the left of the turning points after the disclosure mandate. For instance, at SR intensity, which is 4 percentage points to the left of the turning point of 21.77 % (after the disclosure mandate), the slope is 0.366 ($p = 0.000$). In contrast, at the same distance to the left of the turning point of 30.74 % (before the mandate), the slope is 0.142 ($p = 0.000$). The statistically significant and positive slope difference of 0.224 ($p = 0.000$) indicates a steepening curve on the left-hand side following the implementation of the disclosure mandate. A similar pattern was observed for the slopes as we moved 8 units to the left of the turning points. As we experiment with the movements to the right-hand side of the inverted U shape, we find similar results for the steepening curves (see Panel C of Table 5). Based on these statistics, we confirm that mandatory SR disclosures steepen the slopes of the inverted U-shaped effect of SR integration on fund performance and shift the turning point to the left. We can conclude that mandatory disclosure requirements influence the net effect of SR integration on fund performance by reducing the optimal intensity of SR integration and by speeding up growth rates.

6. Conclusion

This study examined the impact of SR integration on the financial performance of mutual funds using Chinese data. We found an inverted U-shaped relationship between SR integration and fund performance, with SR integration impacting fund performance positively initially and negatively relatively shortly thereafter. This nonlinear relationship was attenuated by market uncertainty but accentuated by mandatory SR

Table 5
Verifications based on the estimates of Table 4.

Panel A The inverted U-shaped relationship				
	CAPM-adjusted return		3-factor model-adjusted return	
Turning point at SR intensity of	22.49 %		30.16 %	
95 % confidence interval of the turning point	21.99 % ~ 22.99 %		29.76 % ~ 30.56 %	
Data range of SR intensity	0 % ~ 96.89 %		0 % ~ 96.89 %	
Slope at a low level of SR integration (10 %)	1.077 ($p = 0.000$)		1.096 ($p = 0.000$)	
Slope at a high level of SR integration (40 %)	−1.509 ($p = 0.000$)		−0.535 (p = 0.000)	
Panel B The moderating mechanisms of market uncertainty				
Market uncertainty	0.463 (25 percentile)	0.838 (75 percentile)	0.463 (25 percentile)	0.838 (75 percentile)
Turning point at SR integration intensity of	22.60 % (p = 0.000)	22.07 % (p = 0.000)	21.92 % (p = 0.000)	23.12 % (p = 0.000)
Slope at (the turning point – 4 %)	0.825 (p = 0.013)	0.200 (p = 0.021)	1.283 (p = 0.000)	0.481 (p = 0.000)
The slope difference	−0.625 (p = 0.000)		−0.802 (p = 0.000)	
Slope at (the turning point – 8 %)	1.644 ($p = 0.005$)	0.399 ($p = 0.015$)	2.572 (p = 0.000)	0.964 (p = 0.000)
The slope difference	−1.244 (p = 0.000)		−1.608 (p = 0.000)	
Slope at (the turning point +4 %)	−0.812 ($p = 0.07$)	−0.197 (p = 0.021)	−1.296 (p = 0.000)	−0.486 ($p = 0.001$)
The slope difference	0.613 ($p = 0.007$)		0.810 (p = 0.000)	
Slope at (the turning point +8 %)	−1.631 (p = 0.013)	−0.399 (p = 0.015)	−2.585 (p = 0.000)	−0.969 (p = 0.000)
The slope difference	1.232 (p = 0.001)		1.616 (p = 0.000)	
Numerator of the derivative of the turning point	−0.751 (p = 0.565)		6.484 (p = 0.485)	
Panel C The moderating mechanisms of the SR disclosure mandate				
	Before	After	Before	After
Turning point at SR integration intensity of	30.74 % (p = 0.000)	21.77 % (p = 0.000)	51.02 % (p = 0.000)	28.86 % (p = 0.000)
Differences in turning points	−8.97 % (p = 0.000)		−22.16 % (p = 0.000)	
Slope at (the turning point – 4 %)	0.142 (p = 0.000)	0.366 (p = 0.000)	0.086 ($p = 0.254$)	0.229 (p = 0.000)
The slope difference	0.224 (p = 0.000)		0.143 ($p = 0.056$)	
Slope at (the turning point – 8 %)	0.282 (p = 0.000)	0.734 (p = 0.000)	0.171 (p = 0.007)	0.460 (p = 0.000)
The slope difference	0.452 (p = 0.000)		0.289 (p = 0.000)	
Slope at (turning point +4 %)	−0.139 (p = 0.000)	−0.372 (p = 0.000)	−0.085 ($p = 0.085$)	−0.234 (p = 0.000)
The slope difference	−0.233 (p = 0.000)		−0.149 ($p = 0.087$)	
Slope at (turning point +8 %)	−0.279 (p = 0.000)	−0.740 (p = 0.000)	−0.170 ($p = 0.079$)	−0.466 (p = 0.000)
The slope difference	−0.461 (p = 0.000)		−0.295 (p = 0.007)	

Note: A value of 0.463 represents low market uncertainty, whereas 0.838 indicates high market uncertainty. For market uncertainty, the turning point is calculated by $Z_i^* = \frac{-\beta_1 - \varphi_{11} Dispersion_{it}}{2\beta_2 + 2\varphi_{21} Dispersion_{it}}$ and the derivative of it is $\frac{\partial Z^*}{\partial Dispersion} = \frac{\beta_1\varphi_{21} - \beta_2\varphi_{11}}{2(\beta_2 + \varphi_{21} Dispersion)^2}$. Slope at a distance n from the turning point is $Slope_i = \beta_1 + 2\beta_2 (Z_i^* \pm n) + \varphi_{11} Dispersion + 2\varphi_{21} (Z_i^* \pm n) Dispersion$. Since the disclosure mandate indicator, Post, only takes on values of 0 or 1, its turning points are calculated by $Z_0^T = \frac{-\beta_1}{2\beta_2}$ and $Z_1^T = \frac{-(\beta_1 + \varphi_{12})}{2(\beta_2 + \varphi_{22})}$, respectively. Slopes at a distance n from each of the turning points Z_0^T and Z_1^T are $Slope_0 = \beta_1 + 2\beta_2 (Z_0^T \pm n)$ and $Slope_1 = (\beta_1 + \varphi_{12}) + 2(\beta_2 + \varphi_{22}) (Z_1^T \pm n)$ respectively.

disclosure. While market uncertainty only changed the growth rate of fund performance as SR integration intensifies, mandatory disclosure requirements changed the growth rate and decreased the optimal SR intensity at which fund performance was maximised.

Our research offers valuable insights into the intricate relationship between SR integration and fund performance, and provides practical implications for investors, fund managers, and policymakers. First, given the inverted U-shaped relationship between SR integration intensity and fund performance, and the relatively short interval for a positive impact of SR integration on fund performance, investors should recognise that the optimal level of SR integration where fund performance is maximised is rather low, below 30 %, in the case of China. Beyond this point, further increases in the intensity of SR integration can negatively affect fund performance. Investors, especially those in emerging markets, must adjust their expectations of financial returns on socially responsible investments. Second, with a comprehensive understanding of the moderating effects of market uncertainty and mandatory SR disclosures, fund managers must optimise their funds' overall performance by adjusting their SR investment strategies in response to dynamic market conditions, while ensuring regulatory compliance. Although the SR disclosure mandate is a valuable tool for enhancing the transparency and accountability of SR information within funds, its negative impact on fund performance at high levels of SR integration requires nuanced policy considerations. Therefore, policymakers attempting to refine the SR disclosure mandate should ensure that regulations do not overly impede the flexibility and adaptability of investment strategies of mutual funds that adopt more extensive SR practices.

Note that our inverted U-shaped relationship between SR intensity and fund performance is most likely observed in developing countries such as China, where socially responsible initiatives are viewed as legal compliance rather than a voluntary commitment (Capelle-Blancard & Monjon, 2014). We anticipate that, as the economy develops, SR efforts will extend beyond legal obligations. As SR intensity becomes highly valued by market investors, the relationship between SR intensity and fund performance could be U-shaped as Barnett and Salomon (2006) observed. Thus, investors should be cautious when applying our findings to developed markets.

Declaration of competing interest

None

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Data availability

Data will be made available on request.

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