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Ownership by Mutual Funds and Corporate Reporting of Environmental Responsibility: Empirical Evidence from China 2007–2019

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Abstract: After 40 years of economic ascendancy, China's environmental challenges and public awareness of them have swelled substantially. Both concern mutual funds that invest in publicly traded Chinese firms, many of which have shown questionable environmental responsibility. This study investigates whether mutual fund ownership of Chinese corporations influences firms' disclosures of environmental responsibility by empirical methodologies. Annual data for 25,188 firm-year observations of corporations trading as A-shares in Shanghai and Shenzhen from 2007–2019 revealed that ownership by mutual funds, and especially by leading funds, correlates strongly and positively with environmental disclosures. These results imply that mutual funds were activist investors that influenced sampled firms to disclose their environmental responsibility during the period 2007–2019. We also examine environmental reporting and mutual fund stock ownership in relation to security analyst coverage, whether sampled firms are government-owned, and periods before and after the implementation of China's New Environmental Protection Law. Results are heterogeneous with respect to all three considerations. Our findings are significant for regulators, investors, and corporate managers.

Keywords: environmental awareness; shareholder activism; mutual fund; listed company; supervisory role

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1. Introduction

In recent years, Chinese companies have committed a series of environmentally damaging acts, including water pollution by Zijin Mining, illegal disposal of hazardous waste by Bohui Study, and ubiquitous dumping of sludge by other companies. From June 2012 to June 2020, reports show 19,770 infractions of social and corporate governance involving 1293 listed Chinese companies, of which 8447 (43%) entailed environmental damage. These infractions occasioned losses to investors, notably mutual funds that held their stocks. According to China Fund Industry Responsible Investment Surveys in 2013 and 2014, nearly 80% of mutual fund companies incurred losses from the Zijin incident, after which they started integrating indicators of environmental responsibility into their investing criteria.

Because mutual fund companies are a force in Chinese financial markets, their attention to firms' social and environmental responsibility compelled listed companies to respond. Chen et al. [1] found that funds intervene in corporate decisions through voting rights. Firth et al. [2] found that funds' activist influence is strong when the proportion of fund holdings is high. Cox and Wicks [3] assert that long-term institutional investors exercise shareholder oversight to improve information disclosure. Njah and Jarboui [4] found that institutional investors intervene to inhibit "managed" earnings.

In 2020, such global challenges as the corona virus, climate change, and depletion of natural resources forced countries to monitor corporate activities [5]. The integration of environmental responsibility into monitoring is now the consensus position of regulators and market participants. Although environmental responsibility is non-financial information, it bears value [6]. It can offer companies competitive advantage [7] and improve both performance [8] and the quality of financial reporting [9].

Numerous studies have investigated factors that influence environmental disclosure. Darnall et al. [10] relate it to the legal and regulatory regimes of countries where firms locate. Social and political pressures underlie disclosure of environmental responsibility. Clarkson et al. [11], Liu and Anbumozhi [12], Zeng et al. [13], and Gray et al. [14] associate large and more profitable companies with greater environmental disclosure. The attributes of a company's industry drive voluntary environmental disclosure [15]. Liu and Anbumozhi [12] found that transitioning from planned to market economies correlates positively with corporate disclosures of environmental responsibility. Kock et al. [16] showed that corporate governance structures influence senior managements' disclosure of information in relation to environmental responsibility. Kumar et al. [17] reviewed the influential journal, *Business Strategy and the Environment* (BSE), which is committed to interdisciplinary research and the promotion of business practices to improve environmental performance and contributes to business strategy and sustainability. China is one of the top three countries contributing to BSE.

Although research has examined mutual funds as monitoring and governance entities, no prior study correlates A-listed Chinese firms' disclosure of environmental responsibility with mutual fund ownership of their stock. This study fills that void in the literature.

This study relates stock ownership by mutual funds to firms' environmental reporting. Based on 25,188 annual firm-year observations of A-share listed companies on two Chinese stock exchanges from 2007 to 2019, we find that the larger the proportion of a firm's outstanding shares held by mutual funds, the greater is a firms' motivation to report their environmental responsibility. The greater the proportion of leading mutual funds among firms' shareholders, the more likely that the surveyed firms would disclose information concerning environmental responsibility.

This study also examines environmental reporting and mutual fund stock ownership in relation to security analyst coverage, whether firms are government-owned, and periods before and after implementation of China's New Environmental Protection Law. Results are heterogeneous with respect to all three considerations.

This study makes two contributions to the literature. First, it adds to the understanding of factors that underlie corporate disclosure of environmental responsibility. Second, results imply that mutual funds as activist investors influence firms' disclosure of environmental responsibility and firms' commitment to environmental responsibility itself. Our findings are relevant for regulators, investors, and corporate managers. In particular, they show regulators the importance of leveraging mutual funds' influence on environmental responsibility in meeting their public mission, and they demonstrate, for corporate managers, the importance of disclosing their responsibilities toward the environment.

This study proceeds as follows. Section 2 develops hypotheses in light of previous research and theory. Section 3 describes our research design, including sample selection, model specification, and variable measurements. Section 4 presents and discusses the empirical results. Section 5 concludes.

2. Hypothesis Development

Shareholder activism originated in the United States during the 1980s and intensified during the 1990s as institutional investors came to own more than 50% of the shares of major publicly traded U.S. companies [18]. Shareholder activism entails shareholders using their voting power to involve themselves in numerous aspects of corporate governance [19]. Institutional investors have influenced the governance of listed companies [17,20,21]. Alshabibi [22] studies the role of institutional investors in the improvement of corporate

governance and found that the activism of shareholders is contingent on the institutional settings. Sakawa and Watanabel [23] showed that the supervision role of institutional shareholders functions effectively in Japanese companies.

Morck et al. [24] found that mutual funds serve their long-term interests by exercising oversight of listed companies, and their motivation to do so increases with the proportion of a firm's shares that they own. Ownership by mutual funds influences companies' governance, responses to social and political issues [25], and acceptance of corporate social responsibility [26–28]. Chung and Talaulicar [29] found that mutual funds push their invested companies toward social responsibility, and thereby, firms build reputations that enhance their ability to attract investment and enhance returns.

Although disclosure of environmental information by Chinese firms is in its nascence, listed companies must disclose it, which is an issue of rising concern for and involvement by mutual funds [30]. Pucheta-Martínez and García-Meca [31] found that low proportional shareholdings by fund-type investors dampens confidence in the dialog with listed companies, and it is difficult to establish effective constraints on listed companies. Funds that own a high proportion of a firm's outstanding shares can intervene in governance and prompt companies to disclose information that provides a more comprehensive understanding of them.

Activist mutual funds can influence other investors and stakeholders and instill a commitment to environmental responsibility that elevates a firm's profile among stakeholders, its social reputation, its sustainable advancement, and it resilience during crises [32]. From this perspective, the value of disclosing environmental information sought by mutual funds may exceed that of financial disclosures. Therefore, listed companies often perform well in environmental responsibilities, providing assurance for shareholder wealth [7,33,34], which motivates mutual funds to urge firms toward environmental responsibility.

Therefore, researchers argue that leading funds are more likely to be activist investors than other funds, even if both own an equal percentages of a firm's shares. The reason for this is that leaders have the financial strength, professional capabilities, information, reputation, and market influence that firms must consider. Their opinion can raise or deflate a firm's share price and access to financing, and firms cannot dismiss their requirements for information [35,36]. These characteristics also make mutual funds desirable shareholders for their insight into financial, social, political, and environmental issues [1,37]. For that reason, also, firms cannot dismiss their involvement in corporate governance and reporting [38–41].

In China today, the public's awareness of environmental protection has been awakened, and the government punishes pollution and controls chaos. They notice that the impact of listed company environmental events on capital markets must be strictly supervised in order to prevent portfolios losses. Therefore, only leading mutual funds can maintain a good reputation in the industry and continue to win the favor of fund investors to maintain their leading position in the industry [42]. Top-level mutual fund companies are more motivated to stimulate the awareness of the environmental responsibility of listed companies they invest in, and to supervise their performance of environmental responsibilities. This influence changes with their increased right to have their say in the dealings of listed companies [2,43]. Specifically, the greater the voice of leading mutual funds in listed companies, the more they can urge awareness of environmental responsibility.

We propose Hypotheses 1 and 2.

Hypothesis H1. *Firms are more likely to disclose information concerning environmental responsibility if mutual funds hold a greater proportion of their outstanding shares.*

Hypothesis H2. *Firms are more likely to disclose information concerning environmental responsibility if leading mutual funds hold a greater proportion of their outstanding shares.*

3. Research Design

3.1. Sample and Data Sources

We drew data for firms listed as A-shares on the Shanghai and Shenzhen Stock Exchanges spanning the period 2007–2019. We obtained data concerning environmental disclosures, the percentage of outstanding shares held by mutual fund, and annual data from the China Stock Market Accounting Research database. We rejected observations with missing values and Winsorized all continuous variables at 1% and 99%. These restrictions yielded a usable sample of 25,188 firm-year observations.

3.2. Variable Definitions

Table 1 displays variables for testing Hypotheses 1 and 2.

Table 1. Definitions of Key Variables.

Variables	Variables Name	Variable Definitions
Dependent variable	*PDERI*	Public disclosure of environmental responsibility information takes 1, 0 for otherwise
Independent variable	*Total_FH*	The sum of the proportions of shares held by all mutual fund companies of the listed company (decimal)
	Top_FH	Proportion of shares held by top mutual fund companies (top 10 in the industry) of listed company shares (decimal)
Controlled variable	*Size*	The natural logarithm of the current market value (10,000 RMB) of individual stocks in the listed company
	Lev	Long-term debt to equity ratio of listed companies in the current period
	Roa	The ratio of the net profit of listed company to the total beginning assets in the current period
	Loss	Loss for current period takes 1, 0 for otherwise
	Growth	Revenue growth rate for current period
	Dual	Dual CEO-chairman role takes 1, 0 for otherwise
	Top1	Shareholding ratio of the largest shareholder at the end of the period
	Board	Natural logarithm of the number of board members plus 1
	Indep	Proportion of independent directors in the board of directors
	Age	years of the listed company registered in the current financial period
	Div	The ratio of the cumulative cash dividend per share of the current listed company to the stock price per share at the end of the period
	Liquid	The ratio of the cumulative trading volume of the listed company in the current period to the market value of individual stocks
	BTM	Book-to-market ratio in the current financial period

Based on Gisbert and Navallas [44], Eugene et al. [45], and Chau and Gray [46], the dependent variable in Table 1 is the sampled firms' public disclosures of information concerning environmental responsibility (*PDERI*). The variable receives a value of 1 if a firm has issued a public disclosure concerning its environmental responsibility and 0 otherwise. Chinese firms normally issue environmental disclosures in an omnibus report on social responsibility. Few disclose that information in a self-standing report on environmental responsibility, and if they do, it appears in the social responsibility report. Therefore, we based the dependent variable on environmental disclosures in the social responsibility reports of sampled firms.

Our two independent variables are the proportion of sampled firms' shares held by all mutual fund companies at yearend (*Total_FH*) and the proportion held by leading fund companies (*Top_FH*) at yearend. *Total_FH* intimates how much influence all mutual funds

exert on the sampled firms. The greater its value, the greater is the presumed likelihood that ownership by mutual funds overall translates into influence over environmental disclosure. Leading mutual fund companies are defined as the largest 10 fund companies, measured by equity assets managed during the current year. The greater the value of *Top_FH*, the greater is the presumed likelihood that leading funds influence environmental disclosure.

Following Huang and Kung [47] and D'Amico et al. [48], we include as control variables the market value of the sampled companies (*Size*), financial leverage (*Lev*), return on assets (*Roa*), losses (*Loss*), income growth rate (*Growth*), dual role (*Dual*), holdings by the largest shareholder (*Top1*), number of directors (*Board*), the proportion of independent directors (*Indep*), company age *(Age*), dividends *(Div*), stock liquidity (*Liquid*), book-to-market ratio (*BTM*), year, industry, and other factors.

Size is the natural logarithm of the market value of outstanding common stock at year end (in RMB 10,000). *Lev* is the ratio of long-term liabilities to shareholder equity at yearend. *Roa* is net income divided by average total assets at the start of the year. *Loss* takes the value of 1 if the sampled firm reported a loss during the year (0 otherwise). *Growth* is the rate of growth in total operating income rate during the current year. *Dual* takes the value of 1 if the chief executive officer is concurrently chairman of the board (0 otherwise). *Top1* is the proportion of outstanding common stock held by the largest shareholder at yearend. *Board* is the natural logarithm of the number of board members at yearend plus one. *Indep* is the proportion of independent directors at yearend. *Age* is the number of years the sampled firm had been established at the end of the financial year. *Div* is cumulative cash dividends per share divided by stock price per share at yearend. *Liquid* is cumulative trading volume during the current year divided by the firm's market value at yearend. *BTM* is the book value of equity at yearend divided by market value.

3.3. Research Model

3.3.1. Model for Hypothesis 1

Model 1 tests Hypothesis 1.

$$PDERI_{i,t} = \beta_0 + \beta_1 \times Total_FH_{i,t} + \beta_n \times Control_{i,t} + e_{i,t}. \quad (1)$$

$PDERI_{i,t}$ takes 1 if company i disclosed information concerning environmental responsibility during year t (0 otherwise). If $Total_FH_{i,t}$ for company i rises at the end of year t, ownership by all mutual fund companies is presumed to exert a rising influence on environmental disclosure. Following Huang and Kung [47] and D'Amico et al. [48], $Control_{i,t}$ controls the market value of the sampled companies (*Size*), leverage (*Lev*), return on assets (*Roa*), loss (*Loss*), income growth rate (*Growth*), dual role integration (*Dual*), largest shareholder (*Top1*), number of board of directors *(Board*), proportion of independent directors (*Indep*), company age (*Age*), dividends (*Div*), liquidity (*Liquid*), book-to-market value ratio (*BTM*), year, industry, and other factors.

If β_1 in Model 1 is significantly positive, a greater proportion of outstanding shares held by all mutual fund companies is presumed to increase the likelihood that a sampled firm disclosed information concverning environmental responsibility during the period 2007–2019. Hypothesis 1 is valid.

3.3.2. Model for Hypothesis 2

Model 2 tests Hypothesis 2.

$$PDERI_{i,t} = \beta_0 + \beta_1 \times Top_FH_{i,t} + \beta_n \times Control_{i,t} + e_{i,t}. \quad (2)$$

$PDERI_{i,t}$ takes the value of 1 if company i disclosed information concerning environmental responsibility in year t (0 otherwise). Higher values for $Top_FH_{i,t}$ suggests that greater ownership by leading mutual fund companies implies their greater involvement in company activities and therefore greater environmental disclosure. Following Huang and

Kung [47] and D'Amico et al. [48], $Control_{i,t}$ governs *Size*, *Lev*, *Roa*, *Loss*, *Growth*, *Dual*, *Top1*, *Board*, *Indep*, *Age*, *Div*, *Liquid*, *BTM*, year, industry and other factors.

If β_1 is significantly positive, a greater proportion of outstanding shares held by leading mutual fund companies is presumed to increase the likelihood that a sampled firm disclosed information concerning environmental responsibility during the period 2007–2019. Hypothesis 2 holds.

4. Empirical Results and Discussion

4.1. Descriptive Analysis

In Table 2, the average value of *PDERI* (26.00%) indicates that 26.00% of the sampled firms disclosed information concerning environmental responsibility in social responsibility reports during the period 2007–2019. The average value of *Total_FH* is 3.79%, its median is 0.96%, its minimum is 0.00%, its maximum is 30.90%, and its standard deviation is 6.17%. These results indicate the sampled firm is held by mutual funds. The disparity in total proportion is consistent with the standard deviation. That the average exceeds the median indicates that the total proportion of shares held by funds for most sampled firms is below the average.

Table 2. Summary statistics of key variables.

Variable	N	Mean	p50	Min	Max	sd
PDERI	25,188	0.2600	0.0000	0.0000	1.0000	0.4390
Total_FH	25,188	0.0379	0.0096	0.0000	0.3090	0.0617
Top_FH	25,188	0.0093	0.0006	0.0000	0.1050	0.0193
Size	25,188	12.9900	12.9100	10.5800	16.4500	1.1450
Lev	25,188	0.2290	0.0672	0.0000	2.1430	0.3830
Roa	25,188	0.0561	0.0417	−0.0827	0.3450	0.0619
Loss	25,188	0.0413	0.0000	0.0000	1.0000	0.1990
Growth	25,188	0.2330	0.1230	−0.5280	4.3700	0.5870
Dual	25,188	0.2250	0.0000	0.0000	1.0000	0.4180
Top1	25,188	0.3530	0.3330	0.0877	0.7500	0.1520
Board	25,188	2.2720	2.3030	1.7920	2.7730	0.1850
Indep	25,188	0.3720	0.3330	0.3080	0.5710	0.0529
Age	25,188	16.5100	16.3000	4.1480	31.0200	5.7170
Div	25,188	0.0087	0.0048	0.0000	0.0577	0.0114
Liquid	25,188	6.0120	4.8040	0.4750	24.2000	4.5490
BTM	25,188	0.4090	0.3450	0.0480	1.3930	0.2700

Note: No dummy variables are Winsorized at 1% and 99%.

The mean value of *Top_FH* is 0.93%, its median is 0.06%, its minimum is 0.00%, its maximum is 10.50%, and the standard deviation is 1.93%. These results indicate that the total proportion of shares in sampled firms held by funds differs greatly from the standard deviation. The numerical value is consistent, and the average exceeds the median, indicating that proportional ownership by the largest fund companies is below the average value.

Turning to control variables, average values are *Size*, RMB 4380,113,100; *Lev*, 22.90%; *Roa*, 5.61%; *Loss*, 4.13%; and *Growth*, 23.30%. With an average value of 22.50%, *Dual* indicates the CEO and chairman of the board is the same person at slightly less than one sampled firm in four.

Average values are 35.30% for *Top1*, 9.7 for *Board*, 37.20% for *Indep*, 16.51 years for *Age*, 0.87% for *Div*, 6.0120 for *Liquid*, and 0.4090 for *BTM*.

4.2. Correlation Analysis

Table 3 shows that correlations of *Total_FH* (0.0875) and *Top_FH* (0.0650) with *PDERI* are significant at 1%. The greater the proportion of shares held by all funds and by leading funds intimates their greater likely involvement in sampled firms' activities and therefore disclosures of environmental responsibility. Hypotheses 1 and 2 are supported.

Table 3. Pearson pairwise correlation coefficients for variables.

	PDERI	*PDERI*	*Top_FH*	*Size*	*Lev*	*Roa*	*Loss*	*Growth*
PDERI	1.0000							
Total_FH	0.0875 ***	1.0000						
Top_FH	0.0650 ***	0.8028 ***	1.0000					
Size	0.4348 ***	0.2976 ***	0.2086 ***	1.0000				
Lev	0.1707 ***	−0.0390 ***	−0.0275 ***	0.2236 ***	1.0000			
Roa	−0.0089	0.2946 ***	0.2278 ***	0.0838 ***	−0.1982 ***	1.0000		
Loss	−0.0161 **	−0.0709 ***	−0.0607 ***	−0.0321 ***	0.0514 ***	−0.3357 ***	1.0000	
Growth	−0.0471 ***	0.0484 ***	0.0330 ***	−0.0048	0.0328 ***	0.3712 ***	−0.0926 ***	1.0000
Dual	−0.0883 ***	−0.0044	−0.0099	−0.1136 ***	−0.1048 ***	0.0547 ***	0.0046	0.0102 *
Top1	0.0738 ***	−0.0632 ***	−0.0386 ***	0.0682 ***	0.0722 ***	0.0947 ***	−0.0335 ***	0.0204 ***
Board	0.1576 ***	0.0720 ***	0.0709 ***	0.2148 ***	0.1615 ***	−0.0287 ***	−0.0231 ***	−0.0282 ***
Indep	0.0336 ***	−0.0197 ***	−0.0212 ***	0.0524 ***	0.0021	−0.0112 *	0.0123 *	0.0075
Age	0.1241 ***	−0.1173 ***	−0.1119 ***	0.2396 ***	0.1653 ***	−0.1094 ***	0.0172 ***	−0.0096
Div	0.2191 ***	0.0278 ***	0.0240 ***	0.2323 ***	0.0795 ***	0.2000 ***	−0.1328 ***	−0.0457 ***
Liquid	−0.2212 ***	−0.1793 ***	−0.1374 ***	−0.4203 ***	−0.1392 ***	−0.0279 ***	0.0433 ***	−0.0029
BTM	0.2190 ***	−0.2151 ***	−0.1710 ***	0.0854 ***	0.2343 ***	−0.2537 ***	0.0402 ***	−0.1013 ***
	Dual	*Top1*	*Board*	*Indep*	*Age*	*Div*	*Liquid*	*BTM*
Dual	1.0000							
Top1	−0.0594 ***	1.0000						
Board	−0.1794 ***	0.0084	1.0000					
Indep	0.1016 ***	0.0442 ***	−0.4660 ***	1.0000				
Age	−0.0728 ***	−0.1328 ***	0.0068	0.0043	1.0000			
Div	−0.0436 ***	0.1666 ***	0.1657 ***	−0.0238 ***	0.0534 ***	1.0000		
Liquid	0.0977 ***	−0.0964 ***	−0.1190 ***	−0.0030	−0.1755 ***	−0.2150 ***	1.0000	
BTM	−0.0991 ***	0.0581 ***	0.1435 ***	0.0189 ***	0.1824 ***	0.3699 ***	−0.2491 ***	1.0000

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

4.3. Regression Analysis

Table 4 shows regression results for *Size*, *Lev*, *Roa*, *Loss*, *Growth*, *Dual*, *Top1*, *Board*, *Indep*, *Age*, *Div*, *Liquid*, *BTM*, year, industry and other factors. Coefficients of *Total_FH* (0.7726) and *Top_FH* (2.2155) with *PDERI* are significant at 5%. A greater proportion of shares held by all mutual funds and by leading funds intimates their greater likely involvement in sampled firms' activities and therefore disclosures of environmental responsibility. Hypotheses 1 and 2 are confirmed.

Table 4. Regression analysis.

	(1) *PDERI*	(2) *PDERI*
Total_FH	0.7726 **	
	(2.3323)	
Top_FH		2.2155 **
		(2.2848)
Size	1.0420 ***	1.0471 ***
	(42.2848)	(43.4433)
Lev	0.2312 ***	0.2327 ***
	(4.5033)	(4.5355)
Roa	−0.5042	−0.4409
	(−1.2997)	(−1.1514)
Loss	−0.0322	−0.0292
	(−0.3528)	(−0.3198)
Growth	−0.1455 ***	−0.1465 ***
	(−3.8764)	(−3.9084)

Table 4. *Cont.*

Dual	−0.1600 ***	−0.1600 ***
	(−3.5865)	(−3.5865)
Top1	0.3033 **	0.2878 **
	(2.4332)	(2.3257)
Board	0.7329 ***	0.7309 ***
	(6.2422)	(6.2259)
Indep	1.4279 ***	1.4200 ***
	(3.8801)	(3.8589)
Age	0.0115 ***	0.0112 ***
	(3.1381)	(3.0671)
Div	10.0869 ***	10.0453 ***
	(5.8582)	(5.8372)
Liquid	0.0135 ***	0.0131 **
	(2.5886)	(2.5171)
BTM	1.2406 ***	1.2338 ***
	(14.6102)	(14.5938)
Year	Yes	Yes
Industry	Yes	Yes
cut1_cons	−18.8264 ***	−18.8585 ***
	(−35.0928)	(−35.2374)
N	25,188	25,188
pseudo R^2	0.232	0.232
chi2	6.5×10^3	6.5×10^3

z statistics in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

4.4. Heterogeneity Test

4.4.1. Analyst Coverage

Analyst coverage may affect fund managers' involvement with listed companies. Therefore, we divided our sample into firms that were and were not covered by securities analysts during the period 2007–2019. *Analyst* takes the value of 1 if the sampled firm was followed by an analyst during the year (0 otherwise). We then regressed the two groups based on data in the main effects models 1 and 2. Results appear in Table 5.

Table 5. Security analyst following.

	Analyst = 0		*Analyst* = 1	
	(1) *PDERI*	(2) *PDERI*	(3) *PDERI*	(4) *PDERI*
Total_FH	6.6271 ***		0.2562	
	(2.9575)		(0.7351)	
Top_FH		7.2811		1.0495
		(1.2463)		(1.0386)
Size	0.9581 ***	0.9933 ***	1.0421 ***	1.0419 ***
	(12.3052)	(12.9165)	(38.5222)	(39.1857)
Lev	0.2050 *	0.2068 *	0.2359 ***	0.2366 ***
	(1.8531)	(1.8688)	(3.9896)	(4.0014)
Roa	−0.0671	−0.1002	−0.5459	−0.5433
	(−0.0599)	(−0.0897)	(−1.2930)	(−1.3011)
Loss	0.1617	0.1621	−0.0779	−0.0773
	(0.8876)	(0.8907)	(−0.7208)	(−0.7155)
Growth	−0.0333	−0.0334	−0.1823 ***	−0.1825 ***
	(−0.4118)	(−0.4139)	(−4.2349)	(−4.2411)
Dual	−0.4665 ***	−0.4729 ***	−0.1207 **	−0.1212 **
	(−3.7071)	(−3.7605)	(−2.4885)	(−2.4984)
Top1	0.7443 **	0.7217 **	0.1700	0.1700
	(2.4152)	(2.3447)	(1.2273)	(1.2392)

Table 5. *Cont.*

Board	0.7358 **	0.7288 **	0.6886 ***	0.6882 ***
	(2.2848)	(2.2677)	(5.3676)	(5.3650)
Indep	−0.5328	−0.5718	1.7142 ***	1.7131 ***
	(−0.5225)	(−0.5616)	(4.2710)	(4.2686)
Age	0.0081	0.0080	0.0151 ***	0.0150 ***
	(0.8470)	(0.8365)	(3.7411)	(3.7297)
Div	10.5895 **	10.7282 **	9.3369 ***	9.3477 ***
	(2.0449)	(2.0748)	(4.9975)	(5.0078)
Liquid	0.0040	0.0044	0.0124 **	0.0124 **
	(0.3520)	(0.3842)	(2.0607)	(2.0731)
BTM	0.8337 ***	0.8272 ***	1.3345 ***	1.3354 ***
	(4.4350)	(4.4040)	(13.5799)	(13.6746)
Year	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes
cut1_cons	−16.0138 ***	−16.4235 ***	−19.0553 ***	−19.0465 ***
	(−11.1623)	(−11.5051)	(−31.8035)	(−31.8220)
N	5675	5675	19,513	19,513
pseudo R^2	0.171	0.170	0.237	0.237
chi2	742.8164	736.0970	5.5×10^3	5.5×10^3

z statistics in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Among the sampled firms not covered by analysts, coefficients of *Total_FH* (6.6271) and *Top_FH* (7.2811) with *PDERI* are, respectively, significant at 1% and not statistically significant. Among the sampled firms covered by analysts, coefficients of *Total_FH* (0.2562) and *Top_FH* (1.0495) are not statistically significant. We interpret these results to mean that mutual funds can be more activist investors when sampled firms are not followed by analysts, intimating greater disclosure of information concerning environmental responsibility.

4.4.2. Ownership

China has established capital markets to assure financing for state-owned enterprises (SOEs), and SOEs constitute an important proportion of equities traded on China's capital markets. To consider the effects of ownership on our hypotheses, we divided our sample into SOEs and non-SOEs and assigned the value of 1 if a sampled firm is state-owned (0 otherwise). We then re-regressed based on data in the main effects model. Results appear in Table 6.

Table 6. Correlations for SOEs and non-SOEs.

	SOE = 0		*SOE* = 1	
	(1) *PDERI*	(2) *PDERI*	(3) *PDERI*	(4) *PDERI*
Total_FH	−0.3985		1.5973 ***	
	(−0.8349)		(3.2409)	
Top_FH		−0.5883		4.3899 ***
		(−0.4248)		(3.0280)
Size	1.0389 ***	1.0326 ***	1.0342 ***	1.0456 ***
	(28.6756)	(29.2763)	(27.5594)	(28.3800)
Lev	0.3007 ***	0.3005 ***	0.1266 **	0.1298 **
	(3.1543)	(3.1512)	(1.9847)	(2.0356)
Roa	1.1299 **	1.0676 **	−1.6344 **	−1.5049 **
	(2.2775)	(2.1818)	(−2.4550)	(−2.2808)
Loss	0.1060	0.1029	−0.0340	−0.0279
	(0.7764)	(0.7541)	(−0.2595)	(−0.2128)
Growth	−0.1400 ***	−0.1392 ***	−0.1027 *	−0.1056 *
	(−2.7376)	(−2.7195)	(−1.8238)	(−1.8780)
Dual	−0.0626	−0.0630	−0.0269	−0.0241

Table 6. *Cont.*

	(−1.1174)	(−1.1247)	(−0.3135)	(−0.2812)
Top1	−0.3761 **	−0.3605 *	0.2581	0.2256
	(−1.9700)	(−1.8993)	(1.3617)	(1.1986)
Board	0.7706 ***	0.7721 ***	0.4532 ***	0.4521 ***
	(4.0734)	(4.0806)	(2.8097)	(2.8017)
Indep	2.6050 ***	2.6066 ***	0.0952	0.0574
	(4.5160)	(4.5188)	(0.1852)	(0.1117)
Age	0.0127 **	0.0130 **	−0.0206 ***	−0.0209 ***
	(2.4708)	(2.5323)	(−3.3947)	(−3.4395)
Div	17.3645 ***	17.4452 ***	6.2034 **	6.2107 **
	(7.2564)	(7.2971)	(2.3529)	(2.3543)
Liquid	0.0195 ***	0.0200 ***	0.0028	0.0019
	(2.7753)	(2.8596)	(0.3318)	(0.2238)
BTM	1.1484 ***	1.1601 ***	1.1052 ***	1.0949 ***
	(8.8516)	(9.0051)	(9.0530)	(8.9904)
Year	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes
cut1_cons	−18.3015 ***	−18.2519 ***	−17.3640 ***	−17.4520 ***
	(−22.1490)	(−22.1308)	(−22.4889)	(−22.6563)
N	14,081	14,081	11,107	11,107
pseudo R^2	0.205	0.205	0.252	0.252
chi2	2.7×10^3	2.7×10^3	3.4×10^3	3.4×10^3

z statistics in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Among non-SOEs owned by mutual funds, the coefficients of *Total_FH* (−0.3985) and *Top_FH* (–0.5883) are not statistically significant. Among SOEs, coefficients of *Total_FH* (1.5973) and *Top_FH* (4.3899) with *PDERI* are significant at 1%.

We interpret these results to mean that mutual funds can be more activist investors in SOEs, intimating a greater likelihood of their disclosing environmental responsibility. The more shares held by the largest fund companies, the stronger is the likelihood.

4.4.3. New Environmental Protection Law

On 24 April 2014, the eighth meeting of the Standing Committee of the 12th National People's Congress amended China's Environmental Protection Law. After its implementation on 1 January 2015, listed companies faced stricter environmental supervision and enforcement. Therefore, we examined the periods before and after implementation to re-examine our hypotheses. For years 2015 and after (pre-2015) the variable *New* bears a value of 1 (0). We then regressed this dummy based on data in the main effects model. Results appear in Table 7.

Table 7. Effects of China's New Environmental Protection Law.

	New = 0		*New* = 1	
	(1) *PDERI*	(2) *PDERI*	(3) *PDERI*	(4) *PDERI*
Total_FH	0.5991 **		−0.4807	
	(2.5431)		(−1.2750)	
Top_FH		2.9477 **		−2.1111
		(2.5610)		(−0.9726)
Size	1.0188 ***	1.0285 ***	1.1332 ***	1.1262 ***
	(28.8525)	(29.5706)	(31.2243)	(32.0159)
Lev	0.3306 ***	0.3343 ***	0.1143	0.1138
	(4.4094)	(4.4614)	(1.5421)	(1.5342)
Roa	0.5084	0.6412	−1.8122 ***	−1.8851 ***

Table 7. *Cont.*

	(0.9506)	(1.2154)	(−3.1181)	(−3.2783)
Loss	0.0327	0.0371	−0.1405	−0.1445
	(0.2241)	(0.2542)	(−1.1714)	(−1.2052)
Growth	−0.1044 *	−0.1063 *	−0.1686 ***	−0.1675 ***
	(−1.9078)	(−1.9467)	(−3.2273)	(−3.2037)
Dual	−0.1521 **	−0.1507 **	−0.1545 **	−0.1547 **
	(−2.2862)	(−2.2666)	(−2.5346)	(−2.5384)
Top1	0.1127	0.0786	0.4172 **	0.4335 **
	(0.6458)	(0.4540)	(2.2842)	(2.3905)
Board	0.5796 ***	0.5798 ***	0.9054 ***	0.9088 ***
	(3.5515)	(3.5516)	(5.2037)	(5.2239)
Indep	0.9757 *	0.9684 *	1.8873 ***	1.9008 ***
	(1.9005)	(1.8865)	(3.4815)	(3.5074)
Age	0.0037	0.0032	0.0187 ***	0.0190 ***
	(0.6925)	(0.5950)	(3.6913)	(3.7532)
Div	13.6890 ***	13.5731 ***	6.3698 ***	6.4251 ***
	(5.3855)	(5.3445)	(2.6684)	(2.6932)
Liquid	0.0197 **	0.0182 **	0.0115 *	0.0117 *
	(2.4384)	(2.2657)	(1.6556)	(1.6926)
BTM	1.4041 ***	1.3844 ***	1.0389 ***	1.0455 ***
	(10.2194)	(10.1285)	(9.2688)	(9.3650)
Year	Yes	Yes	Yes	Yes
Industry	Yes	Yes	Yes	Yes
cut1_cons	−17.6201 ***	−17.6841 ***	−20.6911 ***	−20.6258 ***
	(−24.0359)	(−24.1452)	(−25.4993)	(−25.5429)
N	13,932	13,932	11,256	11,256
pseudo R^2	0.235	0.235	0.235	0.235
chi2	3.3×10^3	3.3×10^3	3.2×10^3	3.2×10^3

z statistics in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Among the pre-2015 sample, coefficients of *Total_FH* (0.5591) and *Top_FH* (2.9477) with *PDERI* are significant at 5%. Among the post-2015 group, coefficients of *Total_FH* (−0.4807) and *Top_FH* (−2.111) with *PDERI* are not statistically significant. Comparing these results implies that, before 2015, mutual funds exercised the role later filled by changing the law. We interpret these results as again suggesting that mutual fund activism correlates with firms disclosing environmental responsibility.

4.5. Robustness Test

4.5.1. Endogeneity Test

Reverse Causality

Our results potentially suffer from reverse causality. That is, funds did not prompt sampled companies to disclose environmental responsibility; rather, firms disclosed it to curry favor with mutual funds. To address this problem, we regressed values for *Total_FH* and *Top_FH* with one-period lags ($t-1$). In Table 8, their correlations with PDERI (1.5611 and 4.6146, respectively) are significant at 1%. The greater the proportion of outstanding stock held by institutional investors, such as mutual funds, the more environmental information they disclosed during the period 2007–2019. Again, these results imply the activist role of mutual funds in firms' tendency to disclose environmental information. Hypotheses 1 and 2 remain valid.

Next, we regressed the independent and control variables by one period ($t-1$). Results in Table 9 show that the coefficients of *Top_FH* (0.9269) and *PDERI* (3.1145) are significant at 1%. The greater the proportion of outstanding shares held by investors, and leading funds, the more likely it was that sampled companies disclosed environmental responsibility during the period 2007–2019. Again, the implication is that mutual fund activism encouraged environmental disclosures. Hypotheses 1 and 2 remain valid.

Table 8. Variables lagged one period.

	(1)	(2)
	PDERI	*PDERI*
Total_FH	1.5611 ***	
	(4.9879)	
Top_FH		4.6146 ***
		(4.9668)
Size	1.0419 ***	1.0519 ***
	(39.0967)	(40.1689)
Lev	0.1970 ***	0.2007 ***
	(3.5118)	(3.5797)
Roa	−1.3229 ***	−1.1857 ***
	(−3.0075)	(−2.7309)
Loss	−0.0751	−0.0666
	(−0.7861)	(−0.6980)
Growth	−0.1863 ***	−0.1876 ***
	(−4.1844)	(−4.2229)
Dual	−0.1624 ***	−0.1629 ***
	(−3.3723)	(−3.3826)
Top1	0.2280 *	0.1969
	(1.6955)	(1.4739)
Board	0.7063 ***	0.7027 ***
	(5.6445)	(5.6141)
Indep	1.6052 ***	1.5913 ***
	(4.1067)	(4.0704)
Age	0.0167 ***	0.0162 ***
	(4.2280)	(4.1043)
Div	10.9605 ***	10.9025 ***
	(5.9773)	(5.9472)
Liquid	0.0070	0.0070
	(1.1580)	(1.1672)
BTM	1.2057 ***	1.1988 ***
	(13.2949)	(13.2339)
Year	Yes	Yes
Industry	Yes	Yes
cut1_cons	−18.9268 ***	−18.9658 ***
	(−33.0391)	(−33.1299)
N	20,167	20,167
pseudo R^2	0.232	0.232
chi2	5.7×10^3	5.7×10^3

z statistics in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 9. One-period lagged values of independent and control variables.

	(1)	(2)
	PDERI	*PDERI*
Total_FH	0.9269 ***	
	(2.8417)	
Top_FH		3.1145 ***
		(3.2505)
Size	1.0808 ***	1.0836 ***
	(40.2290)	(41.0692)
Lev	0.2288 ***	0.2310 ***
	(4.0784)	(4.1183)
Roa	0.4341	0.4802
	(1.0899)	(1.2190)
Loss	0.0473	0.0515

Table 9. *Cont.*

	(0.4341)	(0.4722)
Growth	−0.1082 ***	−0.1096 ***
	(−2.8593)	(−2.8980)
Dual	−0.1467 ***	−0.1466 ***
	(−3.0503)	(−3.0475)
Top1	0.3376 **	0.3258 **
	(2.5450)	(2.4729)
Board	0.6729 ***	0.6722 ***
	(5.4098)	(5.4033)
Indep	1.3778 ***	1.3732 ***
	(3.4924)	(3.4807)
Age	0.0132 ***	0.0129 ***
	(3.3272)	(3.2581)
Div	11.3255 ***	11.3122 ***
	(5.9383)	(5.9332)
Liquid	0.0200 ***	0.0196 ***
	(3.5751)	(3.5116)
BTM	1.1449 ***	1.1414 ***
	(11.5682)	(11.5869)
Year	Yes	Yes
Industry	Yes	Yes
cut1_cons	−19.7978 ***	−19.7971 ***
	(−33.8051)	(−33.8258)
N	20,167	20,167
pseudo R^2	0.236	0.236
chi2	5.8×10^3	5.8×10^3

z statistics in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Propensity Score Matching

Companies might disclose their environmental responsibility for reasons other than ownership by mutual funds. Therefore, we adopted propensity score matching (PSM) to identify sampled companies with similar characteristics. We used the propensity score for one-to-one matching and re-ran the main effects model based on the matched samples. The procedure involved four steps. We first constructed a PSM sample and divided samples into two groups according to median values of *Total_FH* and *Top_FH*. We set high *Total_FH* and *Top_FH* companies as the experimental group (dummy = 1) and low *Total_FH* and *Top_FH* companies as the control group (dummy = 0). Second, we calculated the propensity matching score. Using data for the control variable, we used a logit model to calculate the probability that the sampled company will become a high *Total_FH* and high *Top_FH*. Third, we matched the samples using one-to-one nearest-neighbor matching and used the matches to regress the main effects model.

Results for *t*-tests after grouping and matching appear in Table 10. Except for the dependent variable, the fact that there were no significant differences among control variables indicates that the sampled firms disclosed environmental information. Hypotheses 1 and 2 remain valid.

Table 10. *t*-test results for intra-group differences.

Panel A	*Dummy_Total_FH* = 1		*Dummy_Total_FH* = 0		MeanDiff
	G2(1)	Mean2	G1(0)	Mean1	
PDERI	5793	0.2270	5793	0.2130	0.0140 *
Size	5793	12.7700	5793	12.8000	−0.0300
Lev	5793	0.2210	5793	0.2230	−0.0020
Roa	5793	0.0490	5793	0.0510	−0.0020

Table 10. *Cont.*

Loss	5793	0.0490	5793	0.0480	0.0010
Growth	5793	0.2250	5793	0.2300	−0.0050
Dual	5793	0.2320	5793	0.2310	0.0010
Top1	5793	0.3500	5793	0.3530	−0.0030
Board	5793	2.2620	5793	2.2650	−0.0030
Indep	5793	0.3720	5793	0.3710	0.0010
Age	5793	16.5000	5793	16.5700	−0.0700
Div	5793	0.0080	5793	0.0080	0.0000
Liquid	5793	6.4560	5793	6.4360	0.0200
BTM	5793	0.4070	5793	0.4100	−0.0030
Panel B	*Dummy_Top_FH* = 1		*Dummy_Top_FH* = 0		MeanDiff
	G2(1)	Mean2	G1(0)	Mean1	
PDERI	5818	0.2180	5818	0.1990	0.0190 ***
Size	5818	12.7400	5818	12.7700	−0.0300
Lev	5818	0.2130	5818	0.2170	−0.0040
Roa	5818	0.0500	5818	0.0510	−0.0010
Loss	5818	0.0470	5818	0.0470	0.0000
Growth	5818	0.2220	5818	0.2280	−0.0060
Dual	5818	0.2330	5818	0.2300	0.0030
Top1	5818	0.3510	5818	0.3510	0.0000
Board	5818	2.2580	5818	2.2600	−0.0020
Indep	5818	0.3720	5818	0.3710	0.0010
Age	5818	16.4500	5818	16.4100	0.0400
Div	5818	0.0080	5818	0.0080	0.0000
Liquid	5818	6.5010	5818	6.4690	0.0320
BTM	5818	0.4020	5818	0.4010	0.0010

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Results of re-regression using the matched samples appear in Table 11. Coefficients of *Total_FH* (1.7585) and *Top_FH* (2.7695) with *PDERI* are significant at 1% and 10%, respectively. The greater the proportions of outstanding shares held by mutual funds and by leading mutual funds, the more likely sampled firms were to disclose environmental responsibility during the period 2007–2019. Evidence again implies the effect of mutual fund activism on environmental disclosure. Hypotheses 1 and 2 remain valid.

Table 11. PSM sample paired test results.

	(1)	(2)
	PDERI	*PDERI*
Total_FH	1.7585 ***	
	(3.1897)	
Top_FH		2.7595 *
		(1.6687)
Size	0.9677 ***	0.9888 ***
	(24.6396)	(24.8465)
Lev	0.2654 ***	0.2637 ***
	(3.5639)	(3.4576)
Roa	−1.0216 *	−0.8738
	(−1.6851)	(−1.3871)
Loss	−0.1305	−0.0315
	(−1.0125)	(−0.2440)
Growth	−0.0318	−0.1288 **
	(−0.6312)	(−2.3615)
Dual	−0.1571 **	−0.2259 ***
	(−2.3289)	(−3.2974)

Table 11. *Cont.*

Top1	0.5454 ***	0.2985
	(2.9356)	(1.6081)
Board	0.6506 ***	0.4369 **
	(3.5882)	(2.4110)
Indep	0.9135	0.6796
	(1.5997)	(1.1856)
Age	0.0085	0.0088
	(1.5461)	(1.6032)
Div	9.3108 ***	11.6488 ***
	(3.3954)	(4.3059)
Liquid	0.0030	−0.0017
	(0.3991)	(−0.2156)
BTM	1.1545 ***	1.1869 ***
	(9.2466)	(9.2921)
Year	Yes	Yes
Industry	Yes	Yes
cut1_cons	−17.6300 ***	−16.7071 ***
	(−20.1609)	(−20.0024)
N	11,586	11,636
pseudo R^2	0.195	0.183
chi2	2.3×10^3	2.1×10^3

z statistics in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

4.5.2. Substituting Variables

Some companies disclose social responsibility only in their annual reports. Therefore, we reconstructed the dependent variable (*PDERI*) according to whether sampled firms disclosed environmental responsibility in their annual reports. If a sampled firm did so, *N_PDERI* = 1 (0 otherwise), and we re-regressed the main effects model using that new dependent variable. Results appear in Table 12.

Table 12. Substituting dependent variables.

	(1)	(2)
	N_PDERI	*N_PDERI*
Total_FH	0.7215 **	
	(2.3813)	
Top_FH		1.8050 **
		(2.0289)
Size	0.1441 ***	0.1503 ***
	(6.3969)	(6.8322)
Lev	0.0340	0.0354
	(0.6566)	(0.6822)
Roa	−0.8782 ***	−0.8143 **
	(−2.5853)	(−2.4205)
Loss	−0.0009	0.0020
	(−0.0103)	(0.0218)
Growth	0.0096	0.0079
	(0.3214)	(0.2671)
Dual	0.0034	0.0042
	(0.0852)	(0.1034)
Top1	0.4127 ***	0.3973 ***
	(3.5642)	(3.4488)
Board	0.0478	0.0471
	(0.4301)	(0.4237)
Indep	−0.5197	−0.5259

Table 12. *Cont.*

	(−1.4665)	(−1.4841)
Age	−0.0024	−0.0027
	(−0.6911)	(−0.7943)
Div	−1.2208	−1.2551
	(−0.6787)	(−0.6978)
Liquid	0.0098 **	0.0094 **
	(2.2494)	(2.1517)
BTM	0.2549 ***	0.2441 ***
	(2.7988)	(2.6920)
Year	Yes	Yes
Industry	Yes	Yes
cut1_cons	0.0971	0.0491
	(0.2047)	(0.1039)
N	25,188	25,188
pseudo R^2	0.161	0.160
chi2	4.5×10^3	4.5×10^3

z statistics in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Coefficients of *Total_FH* (0.7215) and *Top_FH* (1.8050) with *N_PDERI* are significant at 5%. The greater the proportion of outstanding shares held by institutional investors such as funds, and by leading funds, the more likely sampled companies were to disclose environmental responsibility information in social responsibility reports during the period 2007–2019. Results again imply evidence of mutual fund activism. Hypotheses 1 and 2 remain valid.

5. Conclusions

Drawing 25,188 annual firm-year observations for A-share listed companies on two Chinese stock exchanges spanning the period 2007–2019, this study examined the correlation between stock ownership by mutual funds and corporate disclosure of environmental responsibility. Two findings emerged. First, the greater the proportion of outstanding shares held by mutual funds, the more likely the sampled Chinese firms were to disclose information concerning environmental responsibility. Second, the greater the proportion of listed shares held by leading mutual fund companies, the more likely sampled firms were to disclose environmental responsibility information. These results imply that mutual fund activism influenced the sampled firms toward such disclosures during the period 2007–2019. We separately found that mutual funds might exercise that same influence on companies without a security analyst and on China's publicly traded SOEs. Results also suggest that mutual funds exercised functions that were later brought about by the national enactment of new environmental protections. All hypotheses remained confirmed after a series of robustness tests. Future research can explore if mutual fund holdings will prompt listed companies to respond to the public's concerns in relation to carbon dioxide emissions and carbon neutrality.

The research findings of this paper, in theory, not only enrich the research literature on the economic consequences of mutual funds practicing shareholder activism but also enrich the research literature on the factors affecting the environmental responsibility information disclosure of listed companies. In practice, there are two-point implications to policymakers: on the one hand, to clear up the legal barriers for mutual funds to participate in the governance of listed companies as soon as possible, so as to better play the role of mutual funds in supervising listed companies, and on the other hand, they are encouraged to strengthen information disclosure supervision and urge listed companies to respond promptly to public concerns regarding environmental incidents.

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