

Common institutional ownership and corporate environmental performance

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Abstract

We investigate the influence of common institutional ownership on corporate environmental performance. Using a large sample of Chinese listed firms, we find that firms having an institutional cross-owner are associated with significantly higher corporate green performance compared with those who do not have such a cross-owner. Further analysis indicates that institutional cross-owners enhance corporate green innovation and increase firm productivity, which explains the positive effect of common ownership on corporate green performance. Moreover, institutional cross-owners facilitate industry coordination and increase industry's green total factor productivity. This result supports the coordination effects of institutional cross-owners. We also explore the role of state-owned institutional cross-owners on corporate environmental engagement and find that state-owned institutional cross-owners improve environmental performance in general, but the effect is only significant in privately-owned firms but not in state-owned enterprises (SOEs), which have strong social objectives naturally.

Key words: Common institutional ownership, coordination, monitoring, corporate environmental performance, China

1. Introduction

The widespread of common ownership, e.g., institutional investors own block crossholdings within an industry, has raised increasing interest in the finance literature (Azar et al., 2018; Koch et al., 2021; Lewellen and Lowry, 2021). The density of the ownership network increases substantially due to common ownership in the U.S. financial market (Azar, 2018). It is suggested that 81% of S&P 500 firms had at least one blockholder that owned shares in rival firms at the end of 2015 (Lewellen and Lowry, 2021). Lewellen and Lewellen (2022) indicate that institutional cross-owners have strong incentives to influence corporate decisions, but the debate on how they affect underlying corporations is still ongoing.

Institutional ownership is found to promote environmental and social performance motivated by both financial and social returns (Dyck et al., 2019). However, institutional investor may behave differently when they own block crossholdings within an industry. We study the role of common owners on corporate green performance to shed light on this stream of research. Environmental pollution has also become a serious issue in China despite the continuous GDP growth, which raises the serious concern on the quality of China's economic growth (Zhang et al., 2020). According to the 2020 World Air Quality Report, although air quality in China has been improving, it remains the largest producer and consumer of coal, which is the principal producer of air pollution¹. At the firm level, it is also a big challenge for Chinese corporations to maintain a fast growth and contribute to green environment simultaneously. According to Zhou et al., (2021), about 800 Chinese listed firms were labelled as heavily polluting firms at the end of 2018². Therefore, environmental protection has garnered the wide attention of researchers and the public in China.

¹ The 2020 World Air Quality Report is available at Greenpeace<https://www.greenpeace.org>.

² According to the Classified Management List of Environmental Protection Verification Industry of Listed Companies issued in June 2008, 15 industries, e.g., thermal power, steel, cement, electrolytic aluminium, coal,

Having an institutional cross-owner introduces firms a significant set of dynamics Chen et al., (2021). The anti-competition view proposes that common ownership reduces managers' incentive to compete because the gains of one profile firm come at the expense of other profile firms, leading to overall reduced total portfolio value of a common owner (Azar et al., 2018). Empirical evidence shows that common ownership can lead to anti-competitive behaviors that lessen intra-industry competition (Hansen and Lott, 1996; Gilo et al., 2006; He et al., 2017). In addition, according to the limited attention argument, institutional cross-owners face time constraints in monitoring portfolio firms, as such, crossholdings reduce institutional shareholders' monitoring effectiveness (Kang et al., 2018). If this is the case, institutional cross-owners will have a negative impact on firm green engagement. On the contrary, the coordination view demonstrates that institutional cross-owners can facilitate industry coordination via enhancing information sharing, thereby improving portfolio firms' product market performance (He and Huang, 2017). In addition, the monitoring view argues that institutional cross-owners are industry specialists with superior information (Chen et al., 2021), and they gain substantial monitoring experience from block crossholdings, which reduce both information uncertainties and the cost of monitoring due to the economy of scale (Edmans, et al., 2019; Kang et al., 2018). As such, common owners can better discipline managers and thereby promote corporate green engagement.

We study the role of institutional cross-owners on corporate green performance in China's setting. According to our preliminary analysis, the presence of institutional cross-owners has reached 11.34% in Chinese listed firms at the end of 2019³. As such, the impact of common institutional investors, who on average cross hold more than 10% of China's A-Shares listed firms, on corporate decisions cannot be ignored. Different from other economies, state-owned

metallurgy, chemical engineering, construction materials, papermaking, brewing, pharmacy, fermentation, textile, leather, and mining are classified as heavily polluting industries in China (Zhou et al., 2021).

³ We report the preliminary results in Table 1.

institutional investors play a critical role in Chinese financial markets. For example, Chinese government is the largest owner of sovereign wealth funds globally (Megginson et al., 2021). In addition, eight out of the ten major security companies are owned by the Chinese government (Lin and Puchniak, 2021)⁴. Therefore, we also investigate the role of state-owned institutional cross-owners on corporate environmental engagement. Due to the sustainability objectives assigned to state-owned institutions, state-owned institutional investors can be more active on environmental engagement (Megginson et al., 2021).

Using a large sample of Chinese A-share firms listed on the Shanghai and Shenzhen Stock Exchanges for the period from 2008 to 2019, we find that institutional cross-owners enhance corporate environmental performance significantly. Such a positive effect is both statistically and economically significant, and is robust upon alternative measures of common ownership and corporate environmental performance. Our mechanism analysis indicates that firms having an institutional cross-owner are associated with greater green innovation output, thus leading to better green performance. In addition, institutional cross-owners lead to higher firm productivity which allows firms investing more on green production sectors, thus ultimately enhancing corporate environmental performance. In addition, we find that institutional cross-owners facilitate industry coordination and increase industry's green total factor productivity. This result supports the coordination effects of institutional cross-owners. We also explore the impact of common state owners on corporate green performance. In general, state-owned institutional cross-owners promote corporate environmental engagement. Given a firm may be held by both state- and privately-owned cross-owners, we construct a clear state cross-owner dummy to clean the setting that a firm has only state-owned cross-owners and without

⁴ According to Lin and Puchniak (2021), eight major Chinese securities companies are ultimately controlled by the government, including Huatai Securities Co., Ltd., Guotai Junan Securities Co., Ltd., China Merchants Securities Co., Ltd., Shenwan Hongyuan Group Co., Ltd., Haitong Securities Co., Ltd., China Galaxy Securities Co., Ltd., CICC, and China Securities Co., Ltd.

privately-owned institutional cross-owners. The subsample analysis suggests that state-owned cross-owners improve environmental engagement only in privately-owned corporations but not in state-owned enterprises (SOEs). We argue that this is because SOEs have strong social objectives naturally, and therefore, the effects of state-owned cross-owners become insignificant. We use multiple approaches to justify the causal relationship between common ownership and corporate green performance, which include the propensity score matching analysis, two-stage least squares (2SLS) instrumental variable estimator, and placebo tests. Our results are robust after addressing different types of endogeneity concerns.

This study first contributes to the developing interest on the role of common ownership on corporate decisions. We find that institutional cross-owners promote green innovation and facilitate industry coordination. Our study adds new evidence to the monitoring effect of institutional cross-owners in terms of that institutional cross-owners exist strong monitoring effects on corporate environmental engagement, as such, we support the argument that institutional cross-owners provide more efficient monitoring due to their industry expertise and the accumulated monitoring experience from block crossholdings (Chen et al., 2021; Edmans, et al., 2019; Kang et al., 2018). Moreover, our mechanism analysis adds new evidence to support the proposal that institutional cross-owners increase firm coordination. Our study expands the finding regarding the activism of institutional investors in environmental commitment in general (Dyck et al., 2019). We find that a higher propensity of common institutional ownership within an industry is associated with greater industry green total factor productivity. That is, institutional cross-owners promote green innovation within the whole industry.

Our study further contributes to the literature on the global rise of state as an important investor (Megginson et al., 2021). There is a rich literature examining the government's role as a block shareholder in corporations, for example Boubakri et al., (2020), Megginson and

Netter (2001), Megginson (2017), Xie et al., (2019), among others. However, there are very limited studies investigate the impact of state-owned institutional investors, the unique category of investor, on corporate decisions. According to Megginson et al., (2021), state-owned investors are one of the most important private equity investors. Moreover, two of the most important state-owned investors, e.g., sovereign wealth funds and public pension funds, served as the third largest group of asset owners globally by the end of 2020 (Megginson et al., 2021). Literature has documented the positive effects of institutional investors in corporate environmental performance (Dyck et al., 2019), while social pressures and public scrutiny may have stronger significance for state-owned investors compared to privately-owned institutions. Interestingly, although our results indicate that the presence of state-owned institutional cross-owners improves environmental engagement overall, the subsample analysis indicates that the positive effect is only salient in privately-owned corporations but not in SOEs. We argue that the dynamic features of state being both the ultimate controller and institutional investors call for more future research.

The remainder of the paper is organized as follows: Section 2 discusses the background of institutional investors in China, relevant literature and hypothesis development. The data and variable construction are reported in Section 3, while the baseline results, endogeneity and mechanism checks are presented in Section 4. Section 5 concludes the study.

2. Literature and hypothesis development

2.1. Institutional investors in China

The institutional investors in China's A-share market can be categorized in eight major institutions (Lin and Puchniak, 2021), e.g., trust companies and securities companies, mutual funds, brokerage firms, insurance companies, pension funds, banks, foreign institutional investors (QFIIs), and other legal entities, such as government institutions and financial assets

management companies. Based on the ultimate controller of the institutions, institutional investors in China can be categorized as state-owned institutional investors, private-owned domestic institutional investors, and foreign investors (including QFIIs and others). The nature and extent of the role of state-owned institutional investors in the capital markets has been continuously emphasized by the Chinese government. According to Megginson et al., (2021), sovereign wealth funds and public pension funds are the two major state-owned investors globally, and Chinese government is the largest owner of sovereign wealth funds. Beside, the State-owned Assets Supervision and Administration Commission (SASAC) initiated the pilot program of establishing state-owned capital investment and operating companies in 2014 to expand the state's role beyond holding block ownership in SOEs. The introduction of the pilot program signals the rise of the state as an important force in Chinese capital markets (Chen and Rithmire, 2020). State-owned capital investment and operating companies, who do not engage in any production and operation activities, were established to strengthen the state's role in the capital markets. The government has the ultimate control over the decision-making and appointments of the management in those state-owned investment companies. In particular, the governments may use of state-owned institutional investors to achieve their social and political goals (Lin and Puchniak, 2021).

2.2. Common ownership and corporate green performance

Environmental, social and governance (ESG) has gained increasing attention and topics related to ESG have been widely addressed (Khan, 2019; Drempetic et al., 2020; Clementino and Perkins, 2021; Gillan et al., 2021). Among them, corporate environmental performance and environmental protection are at the center of attention. Air pollution, water pollution, and other environmental problems that are induced by industrialization have posed a significant challenge to the living environment and health conditions of human beings (Ebenstein, 2012; Min et al., 2018; Khajavi et al., 2019). Firms' generation and emission of pollutants may

directly cause irreversible damage to the local environment and the health conditions of residents (Chen et al., 2013; Chen et al., 2020b).

It is a theoretical and empirical challenge to explore the impact of institutional investors on corporate governance and managers' incentives when they invest multiple firms in an industry. Lewellen and Lowry (2021) indicate that the increasing presence of institutional cross-owners in rival firms has important implications to academics and policymakers and it is critical to consider the potential consequences of the occurrence of institutional cross-owners on the underlying corporations.

2.2.1. The anti-competition effects of common ownership

A stream of literature indicates that the presence of institutional cross-owners may not be beneficial to underlying corporations. The anti-competition view demonstrates that the level of market concentration that accounts for the extent to which rival firms are owned by the same institutional cross-owner reduces top executives' incentive to compete in an industry and leads to decreased efficiency of the economy (Azar et al., 2018). These findings challenge the value-maximization objective of corporations when the institutional cross-owners are not price takers due to their monopoly power (Azar et al., 2018). In addition, Lewellen and Lewellen (2022) indicate that active involvement in corporate governance requires institutional investors to spend substantial resources to monitor underlying corporations and engage with management. Given firms might be cross owned by competing investors, it is possible that engagement of one institution will benefit the competing institution, common ownership therefore may exacerbate the free-rider problem in corporate governance. In addition, common owners would have an incentive to collude with competitors especially in concentrated industries (Lewellen and Lewellen, 2022). Gilje et al., (2020) argue that managers may have the incentive to internalize the preferences of institutional cross-holders and they examine whether common ownership affects managers' incentive to internalize their actions. They find no evidence that

institution's crossholding promotes firm coordination, such as strategic alliances.

There are empirical evidence supports the anti-competitive effects of common ownership. For example, Azar et al., (2018) find that the occurrence of common ownership reduces the competition of product market and results in higher product prices in the U.S. airline industry via promoting less performance-sensitive contracts. Azar et al., (2019) document that the anti-competitive effects of common ownership lead to lower deposit account interest rates, higher maintenance fees and fee thresholds in the U.S. banking industry. Moreover, Antón et al., (2018) suggest that common ownership tends to weaker managerial incentives to compete, which leads to less competitive product market behavior. Park et al., (2019) find that firms with institutional cross-owners are more likely to report voluntary disclosures because they are less concerned about disclosing proprietary information.

Dimson et al., (2015) indicate that given environmental and social engagements are costly to implement, the coordination and partnership among institutional investors and stakeholders is particularly important to convince the management to make environmental and social investment. Using a large sample of U.S. firms from 1991 to 2015, Cheng et al., (2021) find common ownership is negatively related to corporate social responsibility (CSR) performance, and this relationship is more pronounced in more competitive industries, supporting the anti-competitive effect of common ownership.

2.2.2. The monitoring and coordination effects of common ownership

The other stream of literature indicates that the presence of institutional cross-owners can be beneficial to corporations. First, institutional cross-owners can better monitor managers' behaviors and firms' activities due to their information advantage and coordination of their invested firms (Edmans et al., 2019). He et al., (2019) document that institutional cross-owners are active monitors, and they are more likely to vote against management in shareholder-

sponsored governance proposals. Kang et al., (2018) suggest that institutional cross-owners can rely on their information advantage and governance expertise to perform effective monitoring, leading to better governance outcome. Ramalingegowda et al., (2020) find that common ownership reduces firm earnings management by improving monitoring effectiveness. The improved monitoring effectiveness of common ownership also promotes corporate innovation (Gao et al., 2019) and motivates philanthropy giving (Fu and Qin, 2021). Brooks et al., (2018) show that cross-owners have better monitoring and negotiating power that can decrease the information asymmetric between acquirer and target shareholders. Using a sample of U.S. firms, Chen et al., (2021) find that firms with common owners have better access to financing, and they argue that the results indicate that common owners mitigate creditors' concerns about adverse selection. They further find that the monitoring effect is more salient in firms lack financial statement transparency. Overall, there are empirical evidence that the enhanced monitoring of common ownership improves corporate governance and leads to better firm outcomes.

Second, common ownership is suggested to facilitate industry coordination, such as strategic alliances, which in turn boost firm performance. Due to intense competition, rivals operating in the same industry may impose negative externalities, such as interfirm lawsuits, advertising wars, and R&D races that hurt portfolio returns of common owners (He and Huang, 2017). He and Huang (2017) suggest that institutional cross-owners offer strategic benefits to portfolio firms by fostering explicit coordination, which in turn enhance their produce market performance measured by profit margins, market share growth, and innovation efficiency. This result is in line with Hansen and Lott (1996) that cross-holders intend to make portfolio firms reduce rivalry against each other, indicating an important bridge-building role of common ownership.

Using survey data, McCahery et al., (2016) demonstrate that institutional investors either

engage with executives to affect firm management via direct intervention or they leave the firm by selling shares (voting with their feet), which offers indirect influence on top executives. Both the “voice” mechanism or the threat of “exit” may induce managers to work for the preferences of institutional cross-owners (Edmans et al., 2019). In addition, it is argued that institutional cross-owners can mitigate free-riding concerns via coordinating firms in an industry, which would lead to higher gains from socially responsible engagement (Cheng et al., 2021). Dyck et al., (2019) find that institutional investors promote environmental and social performance especially in countries that are ranked high on environmental and social norms. Krueger et al., (2020) conduct surveys to explore whether, why, and how institutional investors take account climate risks into their investment decisions, and they find that institutional investors have real concerns about the effects of climate risks on their portfolios. In addition, reputation concern, moral or legal considerations, and the financial implications of climate are identified as the most common motives to commit to environmental improvement (Krueger et al., 2020). Based on the above literature analyses, we construct our hypothesis as follows:

Hypothesis 1: Common ownership is positively associated with corporate environmental performance *ceteris paribus*.

3. Research design

3.1. Data and sample

Our initial sample includes all Chinese companies listed on the A-share market in the Shanghai and Shenzhen Stock Exchanges from 2008 to 2019. We select our sample from 2008 because the data on corporate green performance is available from 2008. The data used to construct corporate green engagement measurements is retrieved from Wind, Chinese Research Data Services Platform (CNRDS), and the Chinese Stock Market and Accounting Research (CSMAR) databases. Common institution ownership measurements are manually collected at quarterly level from the Institutional Investor database from the CSMAR.

Following prior literature, we exclude (1) financial firms, (2) special treatment (ST) firms, and (3) firm-year observations with missing data for variable construction. To avoid the impact of outliers, all continuous variables are winsorized at the 1% and 99% levels. Our final sample includes 3,208 listed firms that consist of 24,706 firm-year observations.

3.2. Common institutional ownership

Following He and Huang (2017), Chen et al., (2018) and Chen et al., (2020b), we construct three measures to proxy common institutional ownership. (1) Cross-ownership dummy (*Cross5Dum*), a dummy variable equals one if the firm has at least one common institutional owner in any of the four quarters of a fiscal year, and zero otherwise. A common institutional owner refers to the institutional investor that holds at least 5% shares outstanding in at least two firms in the same industry. (2) Number of cross-owners (*Cross5Num*), the natural logarithm of one plus the average number of institutional cross-owners in the focal firm across the four quarters of a fiscal year. (3) Proportion of common ownership (*Cross5Prop*), the proportion of shareholding held by all institutional cross-owners in the focal firm, averaged over the four quarters in a year.

3.3. Corporate environmental performance (CEP)

Various attempts have been made by researchers to measure CEP (Xie and Hayase, 2007; Escrig-Olmedo et al., 2017). Following Yao et al., (2022) and prior studies, we construct a more comprehensive CEP index. Specifically, the CEP index is measured based on three aspects, e.g., corporate environmental awareness, green emission, and environmental investment. The three sub-measurements of CEP are constructed as follows:

Environmental awareness index (*Awareness*) is measured based on eight indicators that take the value of either one or zero, including whether (i) the firm releases environmental protection concept, environmental guidelines, environmental management organizational structure, recycling economy development model, and green development in the annual report;

(ii) the firm releases the achievement of environmental targets in the past year and the future environmental targets; (iii) the firm formulates relevant environmental management system, regulations, and obligations; (iv) the firm implements environmental education and training; (v) the firm engages in environmental protection public welfare activities; (vi) the firm implements emergency response mechanisms for major environment-related emergencies; (vii) the firm receives awards for environmental protection; and (viii) the firm implements the “Three Simultaneity” system⁵. We aggregate the value of the above eight indicators as the environmental awareness score and *Awareness* is calculated as (the awareness score of a firm – the minimum awareness score of the year)/(the maximum awareness score of the year - the minimum awareness score of the year). Accordingly, the values of *Awareness* range from zero to one.

Green emission index (*Green Emission*) is measured by a dummy variable that takes the value of one if the firm adopts policies, measures, or techniques that lead to a reduction of either wastewater, gas, sludge, or greenhouse gas discharge, and zero otherwise. Green Emission evaluates firm environmental performance from an output perspective. Environmental investment index (*Investment*) is measured based on three indicators that take the value of either one or zero, including whether (i) the firm exploits or adopts innovations that are beneficial to the environment; (ii) the firm adopts renewable energy policies and measures of circular economy; (iii) the firm adopts policies, measures, or techniques to save energy and resources. Similarly, the environmental investment score is the aggregation of the three indicators, and *Investment* is defined as (the investment score of a firm - the minimum investment score of the year)/(the maximum investment score of the year - the minimum investment score of the year). The values of *Investment* range from zero to one, and it evaluates

⁵ The “Three Simultaneity” system refers to the designing, building, and operating facilities for prevention and containment of pollution and other environmental protection facilities in the productive process. This system was proposed by the Chinese government in *the Provisions Concerning the Protection and Improvement of the Environment* in 1973.

a firm's environmental performance from an input perspective. It focuses on whether the firm has made investments and efforts to promote energy conservation and sustainable energy utilization.

Finally, our CEP index (*CEP index*), which measures the overall CEP of listed firms, is calculated as the equal-weighted average of *Awareness*, *Green Emission*, and *Investment*.

3.4. Control variables

Following Earnhart and Lizal (2006), Flammer (2015), and Dixon-Fowler et al., (2017), we control for series of variables that may explain corporate environmental performance. The controls include the size of the company (*Firm size*), leverage ratio (*Leverage*), return on assets (*ROA*), growth of operating income (*Sales growth*), net cash flow (*OCF*), institutional investor ownership (*IO*), auditing quality (*Big4/10*), board size (*Board size*), board independence (*Independence*), CEO duality (*Duality*), state ownership (*SOE*), the largest shareholding (*Top1*), firm age (*Firm age*), the proportion of tangible assets (*Tangible*). We also include the macro-economic variables, e.g., regional GDP growth rate (*GDPG*) and regional population growth rate (*POPG*). The variable definitions are presented in Appendix A.

3.5. Model specification

To examine the relationship between common institutional ownership and corporate environmental performance, we use the following regression model:

$$CEP_{i,t} = \beta_0 + \beta_1 Common_{i,t} + \sum_k \beta_k Controls_{k,i,t} + \epsilon_{i,t} \quad (1)$$

where $CEP_{i,t}$ is the CEP measures of listed firm i in year t , including *CEP index*, *Awareness*, *Green Emission*, and *Investment*. $Common_{i,t}$ represents the three measures of common institutional ownership in year t . $Controls_{k,i,t}$ refers to a set of control variables, including *Firm size*, *Leverage*, *ROA*, *Sales growth*, *OCF*, *IO*, *Big4/10*, *Board size*, *Independence*, *Duality*, *SOE*, *Top1*, *Firm age*, *Tangible*, *GDPG*, and *POPG*. Industry and year fixed effects are

included with robust standard errors clustered by firm in all regressions. All continuous variables are winsorized at the 1% level in each tail.

4. Empirical results

4.1. Descriptive statistics and correlation matrix

Table 1 reports the descriptive statistics of key variables. The mean value of *Cross5Dum* is 0.103, which suggests that 10.3% of our sample firm-years have at least one institutional cross-owner. The maximum value of *Cross5Prop* is 0.544, indicating that cross-ownership tends to play a significant role in listed firms in China. In addition, the mean value of the *CEP index* is 0.145, with the range from 0 and 1, indicating that the CEP varies widely across firms.

[Insert Table 1 about here]

Table 2 provides the correlation matrix for main variables. Common institutional ownership measures (*Cross5Dum*, *Cross5Num*, and *Cross5Prop*) are positively correlated with corporate environment performance measures (*CEP index*, *Awareness*, *Green Emission*, and *Investment*). The preliminary results support the positive effects of institutional cross-owners on environmental performance, which supports Hypothesis 1. Moreover, the correlation coefficients between the independent variables are relatively small and the maximum (mean) variables inflation factor is 2.12 (1.54), far below the critical rule of thumb value of 10. This suggests that the multicollinearity is not a serious issue in our case.

[Insert Table 2 about here]

4.2. Baseline results

We report the baseline results of the impact of common institutional ownership on corporate green performance in Table 3. *Cross5Dum* is employed as our main variable of interest here. We begin our analysis by running an ordinary least square (OLS). As shown in Column (1), common institutional ownership (*Cross5Dum*) is positively and significantly

associated with *CEP index*. The coefficient of *Cross5Dum* is 0.049 and statistically significant at the 1% level⁶. In terms of economic significance, a firm's CEP index is 4.9% higher if it is cross-held compared with those who are not cross-held. The results of the other variables are similar with those of relevant studies (Dixon-Fowler et al., 2017; Du et al., 2018). Firms with larger size, higher return on assets, and higher net cash flows are more likely to have better CEP. In addition, driven by the government's endeavor to reduce corporate environmental pollution, SOEs tend to have better CEP than non-SOEs.

It is a concern that OLS coefficient estimates might be inconsistent because our dependent variable ranges from 0 and 1. To tackle this issue, we estimate a Tobit regression in Column (2) and the results remain robust. We also estimate a weighted least squares (WLS) regression where the weighting is the inverse number of firm-year observations per industry as shown in Column (3) since the number of firms varies across industries. Moreover, we test the robustness of our main evidence to alternative methods of estimating standard errors. Specifically, we employ the Newey–West estimator in Column (4) and Prais-Winsten regression in Column (5). The results remain robust, suggesting that common institutional ownership promotes building eco-friendly corporations. These findings support the monitoring effects of institutional cross-owners.

[Insert Table 3 about here]

4.3. Robustness check

4.3.1. Alternative CEP measures

We further examine the impact of common institutional ownership on the three sub-measures of CEP, e.g., environmental awareness (*Awareness*), green emission (*Green Emission*), and environmental investment (*Investment*). We report the regression results in table

⁶ For robustness check, we use one-year lagged value.

4. As shown in Columns (1) to (3), the coefficients of *Cross5Dum* are all positive and significant at the 1% level, suggesting that common institutional ownership can improve firm green performance. In terms of economic significance, a firm's environmental awareness index and investment index is 3.23%⁷ and 18.1%⁸ higher, respectively, when it is cross-held compared with those who are not cross-held. Similarly, a firm with institutional common-owner is 17.1% more likely to implement green emission than a firm without common ownership. Therefore, common institutional ownership enhances corporate green performance, and these results support the monitoring effects of institutional cross-owners.

[Insert Table 4 about here]

4.3.2. Alternative measures of common institutional ownership

We employ the alternative measures of common institutional ownership to examine the robustness of our baseline results. Table 5 reports the regression results using the alternative common ownership variables. In Columns (1) and (2), we use the number of cross-owners (*Cross5Num*) and the proportion of common ownership (*Cross5Prop*). Both measures are positively associated with *CEP index*, which is consistent with our baseline finding as shown in Table 3.

Following Gao et al., (2019) and Fu and Qin, (2021), we further gauge common institutional ownership if the institutional investor holds at least 3% shares outstanding in at least two rival firms in the same industry. Thus, we construct *Cross3Dum*, *Cross3Num*, and *Cross3Prop* to measure common institutional ownership as defined in Appendix A. As shown in Columns (3) to (5), the coefficients of *Cross3Dum*, *Cross3Num*, and *Cross3Prop* are positive and significant at the 1% level. In addition, the results remain robust when we use alternative

⁷ Economic significance is calculated as $0.022 \times 0.304 / 0.207$.

⁸ Economic significance is calculated as $0.157 \times 0.304 / 0.264$.

CEP measures from Table 4 as dependent variables. Overall, our results still hold by using the alternative measures of common institutional ownership.

[Insert Table 5 about here]

4.4. State institutional cross-owners

4.4.1. State common ownership

State ownership accounts for a large proportion of shareholding in Chinese listed firms. In this subsection, we examine the effects of state common ownership on corporate green performance. State common owners are identified as those institutions ultimately controlled by the government. Similar to three common institutional ownership measures, we construct three measures to gauge state common institutional ownership (*Common_State*) including the state common ownership dummy (*Cross5Dum_State*)⁹, the number of state cross-owners (*Cross5Num_State*), and the proportion of state common ownership (*Cross5Prop_State*). *Cross5Dum_State* is a dummy variable that equals one if a firm has at least one common state owner (at least 5% shareholding) in a year, and zero otherwise. *Cross5Num_State* is the average value of the natural logarithm of one plus the number of state cross-owners in a firm across the four quarters of a year. *Cross5Prop_State* refers to the proportion of shareholding held by all state cross-owners in a firm, averaged over the four quarters in a year.

We replace $Common_{i,t}$ with $Common_State_{i,t}$ and re-estimate Eq (1). As shown in Table 6, the coefficients of *Cross5Dum_State*, *Cross5Num_State*, and *Cross5Prop_State* are all positive and significant at the 1% level. In addition, the results remain robust when we use alternative CEP measures as dependent variables. The results show the important monitoring effects of state common owners, that is, firms with state common institutional ownership are associate with better corporate green performance.

⁹ 7.35% of our sample firm-years have at least one state common institutional owner.

[Insert Table 6 about here]

4.4.2. Pure state common ownership

It is possible that a firm could be cross-owned by both state-owned institutional cross-owners and privately-owned institutional cross-owners, we therefore construct a more precise state cross-owner dummy which is *Pure Cross5Dum_State*¹⁰ to capture the setting that a firm only has state cross-owners while without the representative of privately owned cross-owners. Also, we construct *Pure Cross5Dum_Private*¹¹ which is a dummy variable that equals one if the firm is cross-held by only privately-owned cross-owners, and zero otherwise.

Table 7 reports the regression results of the effects of pure state common ownership and pure private common ownership on *CEP index*. We divide the full sample to SOE and Non-SOE subsamples based on firms' ultimate controller. As shown in Column (1) of Table 7, the coefficients of *Pure Cross5Dum_State* and *Pure Cross5Dum_Private* are both significant in the Non-SOE subsample, but the effects are insignificant in the SOE subsample. The results suggest the presence of state-owned institutional cross-owners enhances environmental engagement only in privately owned firms but not in SOEs. We argue that the results indicate that cross-owners tend to have less influence on corporate decisions in SOEs compared with in Non-SOEs because SOEs are associated with social objectives naturally.

[Insert Table 7 about here]

4.5. Mechanism analysis

In this sub-section, we analyze the mechanisms through which institutional cross-owners promote corporate green performance. As documented before, the information advantage and governance skills of institutional cross-owners can increase their monitoring effectiveness in portfolio firms. Institutional cross-owners can also facilitate industry coordination between

¹⁰ 6.46% of our sample firm-years only have pure-state cross- owners.

¹¹ 3.03% of our sample firm-years only have pure-private cross-owners.

invested firms. Thus, institutional cross-owners may enhance invested firms' green development and promote the spread of green technology within portfolio firms. And such collaboration can benefit all firms in an industry. Therefore, we expect that institutional cross-owners can facilitate the green technology development within their portfolio firms and promote the industry coordination, which in turn improve corporate environmental performance.

4.5.1. Improving corporate green innovation

Green innovation is one of the most important strategies to achieve sustainable growth since it enables firms to create competitive advantage while protecting the environment (Berry & Rondinelli, 1998; Porter & van der Linde, 1995). Thus, green innovation has important strategic values to the sustainable development of firms and society (Huang & Li, 2017; Xie et al., 2016). We expect that common institutional ownership may play a monitor role in promoting corporate green innovation which leads to better corporate environmental performance.

We examine whether common institutional ownership can improve firm environmental performance through increasing corporate green innovation in Table 8. In the first-stage analysis, we analyze whether institutional cross-owners increase green innovation (*Green innovation*). *Green innovation* is calculated as the natural logarithm of one plus the number of patents applied that are "green." The coefficient of *Cross5Dum* is positive and significant at the 1% significance level, which suggests that common institutional ownership promotes green innovation. In the second-stage estimation, the fitted values generated from the first-stage estimation are used as the main independent variable which captures the level of green innovation that can be explained by common institutional ownership. As shown in Columns (1) to (4), the coefficients of *Predicted-Green innovation* are all positive and significant at the 1%

significance level. Overall, the results in Table 8 suggest that institutional cross-owners enhance corporate green innovation, thus improving corporate environmental performance.

[Insert Table 8 about here]

4.5.2. Increasing firm productivity

The increase of firm productivity reduces production costs and optimizes resource allocation (Chen et al., 2021), which enables more investment in cleanliness and high-efficiency production sectors, and ultimately benefit to environmental performance. We expect that the monitoring role of institutional cross-owners can promote corporate productivity to reduce production costs and increase the efficiency of resources allocation, thus leading to better green performance.

We examine whether common institutional ownership can improve firm environmental performance through increasing corporate productivity in Table 9. Firm total factor productivity (*TFP*) is a proxy for firm productivity, and it measures the improvement in productivity after input contributions are excluded. Total factor productivity can be regarded as the transformation efficiency of total inputs into total outputs (Diewert and Nakamura, 2007, Tian and Yu, 2012). We follow the methodology of Levinsohn and Petrin, (2003) to estimate *TFP*. In the first-stage analysis, we examine whether institutional cross-owners enhance firm *TFP*. The coefficient of *Cross5Dum* is positive and significant at the 1% significance level, which is in line with our expectation. In the second-stage estimation, as shown in Columns (1) to (4), the coefficients of *Predicted-TFP* are all positive and significant at the 1% significance level. Therefore, the results in Table 9 indicate that institutional cross-owners are associated with higher resource allocation efficiency and increased productivity, thus leading to better corporate environmental performance.

[Insert Table 9 about here]

4.5.3. Promoting industry coordination

Common institutional ownership plays an important role in fostering industry coordination of their invested firms (He and Huang, 2017; Lu et al., 2021). Thus, all firms in the industry may benefit from such a coordination effect on environmental and social issues (Chen et al., 2022). As such, we expect that common institutional ownership can promote industry coordination and benefit all listed firms in an industry. To examine whether common institutional ownership enhances industry coordination and performance, we conduct a pre-test using the following regression model:

$$Ind_benefit_{i,t} = \beta_0 + \beta_1 Cross5 - ratio_{i,t} + \sum_k \beta_k Controls_{k,i,t} + \epsilon_{i,t} \quad (2)$$

where $Ind_benefit_{i,t}$ refers to three measures of industry coordination - industry green total factor productivity ($Ind-GTFP$), industry return on invested capital ($Ind-ROIC$), and industry return on long term invested capital ($Ind-ROLC$). Green total factor productivity (GTFP) can better reflect sustainable economic growth because it takes energy constraint and environmental performance into account (Xia and Xu, 2020; Wang and Lee, 2022). Thus, an industry with a higher level of GTFP has better green development. We adopt the epsilon-based measure (EBM) model developed by Tone and Tsutsui (2010) to measure the GTFP of each industry in each year. $Ind-ROIC$ and $Ind-ROLC$ represent the profitability of each industry in each year. $Cross5-ratio_{i,t}$ represents the proportion of listed firms owned by common owners in each industry and year. $Controls_{k,i,t}$ includes $SOE-ratio$, HHI , $Ind-Size$, and $Ind-Lev$. The variable definitions are presented in Appendix A. Industry and year fixed effects are controlled for.

Table 10 reports the results of the effects of common institutional ownership on industry coordination and performance. In Column (1), the coefficient of $Cross5-ratio$ is positive and significant at the 5% level, which suggests that institutional cross-owners can increase industry GTFP. The results indicate that common institutional ownership can enhance industry

coordination thus leading to improved green and sustainable development of the whole industry. In Columns (2) and (3), *Cross5-ratio* is significantly positive associated with *Ind-ROIC* and *Ind-ROLC*. The results suggest that an industry with a higher proportion of firms owned by institutional cross-owners has better profitability. Overall, the results in Table 10 indicate that common owners facilitate industry coordination and improve industry GTFP and profitability, thus leads to better green performance of portfolio firms.

[Insert Table 10 about here]

4.6. Endogeneity

In this section, we address potential endogeneity. The documented results may be affected by selection bias, some omitted variables (such as government policies) or may be driven by reverse causality. For example, when a firm has better environmental performance, it may attract more institutional cross-owners. To address those concerns, we use four approaches for robustness checks that include controlling for firm fixed effects, a propensity score matching (PSM) analysis, instrumental variable approach, and placebo test.

4.6.1. Including firm fixed effects

Table 11 shows the relation between common institutional ownership and corporate environmental performance by re-estimating Equation (1) with firm and year fixed effects to account for any unidentified time-invariant firm factors. We find that the coefficients of *Cross5Dum* (Columns (1)-(4)) are positive and significant, at least at the 10% significance level. In addition, larger firms are more likely to have better CEP. Thus, our results are still robust after controlling for firm fixed effects.

[Insert Table 11 about here]

4.6.2. PSM Analysis

Following Cheng et al., (2021), we employ the PSM analysis to examine whether the baseline results are subject to sample selection bias. We first estimate a probit model to predict the likelihood of the presence of institutional cross-owners (*Cross5Dum*) by including all control variables in Equation (1). The aim of the PSM is to produce two statistically similar samples with and without institutional cross-owners, respectively. To improve matching accuracy, we exclude matched peers with propensity score difference that is larger than 1%. Then, we re-estimate Equation (1) using the matched sample.

Table 12 reports the regression results. Panel A shows the determinants of the presence of institutional cross-owners. Firms with larger size, higher levels of institutional ownership, better auditing quality, and SOEs are more likely to have common institutional ownership. Panel B shows the regression result of the PSM sample. The coefficients of *Cross5Dum* remain positive and significant at the 1% level in Columns (1)-(4). Panel C reports the comparison of the mean value of the variables considered to determine the presence of *Cross5Dum* in the matched sample. The differences in means between the covariates of the treated and control groups are all insignificant, suggesting that our PSM procedure is successful.

Overall, the results suggest that the documented positive relation between common institutional ownership and corporate environmental performance is robust after mitigating the sample selection concern.

[Insert Table 12 about here]

4.6.3. Instrumental variable analysis

We further address the endogeneity concern by using the instrumental variable approach. We construct two instrumental variables including *HSR* and *Airport_Dis*. *HSR* is a dummy variable equals one if the headquarter of a firm is in a city that has high-speed railway (HSR) station, and zero otherwise. *Airport_Dis* indicates the average distance between a listed firm's registered address and the nearest two international airports. We manually collect the high-

speed railway data from the “China Railway Yearbook”, the National Railway Administration and the China Railway Corporation Website. Also, we manually collect the data of international airports from web search engines (such as Wikipedia). The distance is calculated based on the longitude and latitude of listed firm’s registered address and the nearest two international airports. It is more convenient for institutional investors to interact with firms located in cities with a high-speed railway station and those are closer to international airports (Zhang et al., 2020). However, the construction of high-speed railway and airports are unlikely to affect corporate green performance.

Table 13 presents the results of the instrumental variable estimation. In the first-stage analysis, we regress *HSR* and *Airport_Dis* on *Cross5Dum* with other control variables as the same in the baseline regression. The coefficient of *HSR* (*Airport_Dis*) is significantly positive (negative). The results are in line with our expectation that firms in cities with high-speed railway have higher common institutional ownership. Also, firms far from international airports are less likely to have institutional cross-owners. In the second-stage analysis, the fitted values generated from the first-stage estimation are used as the instrumental variables of cross-ownership measures. The positive coefficients of *Cross5Dum*, *Cross5Num*, and *Cross5Prop* in the second-stage estimation confirm the positive association between common institutional ownership and corporate environmental performance. We also perform the weak identification test (Wald F statistic >10) and over-identification test (Sargan statistics are not statistically significant), indicating that our instrumental variables are valid. Overall, the results in Table 13 confirm that common institutional ownership promotes corporate green performance.

[Insert Table 13 about here]

4.6.4. Placebo test

It is possible that the positive and significant effect of common institutional ownership on corporate green performance is due to a coincidence. To address this concern, we conduct a

series of placebo tests to further validate the baseline results. First, we construct a pseudo-*Cross5Dum* variable based on the randomly assigned *Cross5Dum* to measure common institutional ownership, and we employ the pseudo-*Cross5Dum* variable to estimate the baseline models. Then, we repeat this procedure for 500 times, thereby generating 500 coefficient estimates of the pseudo-*Cross5Dum* variable. Using these estimates, we finally construct an empirical distribution of the *Cross5Dum* coefficient under the scenario that the positive relation between common institutional ownership and environmental performance is unlikely to be driven by coincidence.

The results of this analysis are reported in Table 14. To facilitate comparison, we also report the actual *Cross5Dum* coefficient estimates (from baseline). The table shows that actual *Cross5Dum* coefficient estimates lie at the extreme upper tail of the empirical distributions of pseudo-*Cross5Dum* coefficients. The results indicate that the baseline results are unlikely to be driven by coincidence.

[Insert Table 14 about here]

4.8. Dedicated institutional cross-owners

Prior literature suggests that dedicated institutional investors are more likely to engage in monitoring activities because they have larger shareholding and are committed over a long holding period (Bushee, 1998; Chen et al., 2007). Thus, dedicated institutional cross-owners may have more focus on firms' long-term growth. However, transient cross-owners may pursue short-term gains and are less likely to engage in firm monitoring. In this section, we examine the effects of dedicated cross-owners on firm green performance. We define dedicated cross-owners as those hold at least 5% shares for at least 3 consecutive quarters in a year.

We construct three variables to measure the effects of dedicated cross-owners including *Cross5Ded_Dum*¹², *Cross5Ded_Num*, and *Cross5Ded_MaxPeriod*. The detailed definitions

¹² 7.55% of our sample firm-years have at least one dedicated cross-owner.

are shown in Appendix A. Table 15 reports the regression results. As shown in Columns (1) to (3), the coefficients of all three dedicated common ownership measures are positive and significant at the 1% level, indicating that the presence of dedicated cross-owners is associated with better corporate environmental performance. The results confirm that the enhanced monitoring effect is significant in firms with dedicated institutional cross-owners.

[Insert Table 15 about here]

5. Conclusion

Using a large sample of Chinese listed firms, we examine the impact of common institutional ownership on corporate environmental performance. In line with the monitoring and coordination view of common cross-owners, we find that having an institutional cross-owner enhances corporate green performance. Further analysis suggests that institutional cross-owners play an effective monitoring role in enhancing corporate green innovation and firm productivity, which explains the positive effect of common ownership on corporate green performance. Moreover, common institutional owners can facilitate industry coordination and benefit all firms in the industry, thus leading to better industry green productivity and industry profitability.

We also explore the role of state-owned institutional cross-owners on corporate environmental engagement. State-owned institutional cross-owners enhance corporate environmental engagement in general, but subsample analysis indicates that the presence of state-owned institutional cross-owners improves environmental engagement only in non-SOEs but not in SOEs. We argue that the dynamics features of state being both the ultimate controller and institutional investors call for more future research. Future research on this will be beneficial to gain a better understanding of the global rise of state as an important investor.

In addition, we examine the influence of dedicated common institutional ownership on corporate environmental performance. We find dedicated institutional cross-owners have a

strong positive impact on the corporate green performance. The results indicate that dedicated cross-owners engage in monitoring activities and pay more attention to firms' long-term growth.

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Table 1. Descriptive statistics

This table reports the descriptive statistics of the main variables used in the study. The sample consists of firms listed on SHSE and SZSE from 2008 to 2019 (24,706 observations). Detailed definitions of variables are in Appendix A.

	(1) Mean	(2) Standard deviation	(3) Minimum	(4) P25	(5) Median	(6) P75	(7) Maximum
<i>CEP index</i>	0.145	0.241	0.000	0.000	0.000	0.133	1.000
<i>Awareness</i>	0.127	0.207	0.000	0.000	0.000	0.250	1.000
<i>Green Emission</i>	0.182	0.386	0.000	0.000	0.000	0.000	1.000
<i>Investment</i>	0.124	0.264	0.000	0.000	0.000	0.000	1.000
<i>Cross5Dum</i>	0.103	0.304	0.000	0.000	0.000	0.000	1.000
<i>Cross5Num</i>	0.074	0.218	0.000	0.000	0.000	0.000	0.896
<i>Cross5Prop</i>	0.029	0.099	0.000	0.000	0.000	0.000	0.544
<i>Firm size</i>	22.150	1.281	19.830	21.217	21.970	22.872	26.110
<i>Leverage</i>	0.434	0.204	0.055	0.271	0.430	0.590	0.876
<i>ROA</i>	0.039	0.055	-0.201	0.015	0.036	0.065	0.192
<i>Sales growth</i>	0.186	0.426	-0.528	-0.013	0.113	0.276	2.796
<i>OCF</i>	0.048	0.070	-0.158	0.008	0.046	0.089	0.245
<i>IO</i>	0.457	0.242	0.000	0.274	0.481	0.648	0.908
<i>Big4/10</i>	0.531	0.499	0.000	0.000	1.000	1.000	1.000
<i>Board size</i>	2.143	0.199	1.609	1.946	2.197	2.197	2.708
<i>Independence</i>	0.374	0.053	0.333	0.333	0.333	0.429	0.571
<i>Duality</i>	0.243	0.429	0.000	0.000	0.000	0.000	1.000
<i>SOE</i>	0.422	0.494	0.000	0.000	0.000	1.000	1.000
<i>Top1</i>	0.355	0.148	0.148	0.237	0.336	0.456	0.749
<i>Firm age</i>	2.738	0.387	1.386	2.485	2.773	2.996	3.434
<i>Tang</i>	0.225	0.167	0.002	0.094	0.192	0.322	0.719
<i>GDPG</i>	0.105	0.058	-0.250	0.077	0.100	0.123	0.323
<i>POPG</i>	0.009	0.019	-0.084	0.003	0.006	0.012	0.199

Table 2: Correlation matrix

This table reports the Pearson correlation matrix for the variables in the analysis. Detailed definitions of variables are in Appendix A.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)
1. <i>CEP index</i>	1.000																						
2. <i>Awareness</i>	0.671***	1.000																					
3. <i>Green Emission</i>	0.920***	0.435***	1.000																				
4. <i>Investment</i>	0.865***	0.415***	0.712***	1.000																			
5. <i>CrossSDum</i>	0.208***	0.124***	0.185***	0.203***	1.000																		
6. <i>Cross5Num</i>	0.215***	0.127***	0.190***	0.209***	0.996***	1.000																	
7. <i>Cross5Prop</i>	0.204***	0.116***	0.184***	0.200***	0.849***	0.861***	1.000																
8. <i>Firm size</i>	0.493***	0.373***	0.405***	0.463***	0.269***	0.276***	0.262***	1.000															
9. <i>Leverage</i>	0.175***	0.106***	0.145***	0.182***	0.132***	0.135***	0.143***	0.493***	1.000														
10. <i>ROA</i>	0.041***	0.012	0.042***	0.042***	-0.006	-0.007	-0.026***	-0.005	-0.360***	1.000													
11. <i>Sales growth</i>	-0.041***	-0.052***	-0.030***	-0.029***	-0.028***	-0.028***	-0.028***	0.046***	0.041***	0.203***	1.000												
12. <i>OCF</i>	0.095***	0.092***	0.076***	0.075***	0.052***	0.053***	0.036***	0.038***	-0.152***	0.372***	0.001	1.000											
13. <i>IO</i>	0.259***	0.134***	0.235***	0.259***	0.234***	0.239***	0.244***	0.429***	0.229***	0.102***	0.036***	0.121***	1.000										
14. <i>Big4/10</i>	0.085***	0.126***	0.052***	0.058***	0.064***	0.065***	0.063***	0.146***	-0.004	0.035***	-0.005	0.033***	0.031***	1.000									
15. <i>Board size</i>	0.174***	0.079***	0.163***	0.174***	0.118***	0.124***	0.116***	0.249***	0.157***	0.018**	-0.016*	0.055***	0.232***	0.002	1.000								
16. <i>Independence</i>	0.004	0.006	-0.003	0.010	-0.004	-0.004	-0.002	0.026***	-0.012	-0.023***	0.007	-0.026***	-0.065***	0.028***	-0.510***	1.000							
17. <i>Duality</i>	-0.116***	-0.066***	-0.105***	-0.112***	-0.095***	-0.096***	-0.105***	-0.174***	-0.149***	0.041***	0.024***	-0.015*	-0.210***	0.032***	-0.186***	0.113***	1.000						
18. <i>SOE</i>	0.255***	0.120***	0.245***	0.247***	0.248***	0.250***	0.259***	0.334***	0.303***	-0.102***	-0.069***	0.013*	0.425***	-0.023***	0.279***	-0.063***	-0.296***	1.000					
19. <i>Top1</i>	0.127***	0.060***	0.117***	0.130***	0.072***	0.072***	0.143***	0.220***	0.076***	0.115***	0.010	0.087***	0.525***	0.061***	0.031***	0.047***	-0.051***	0.219***	1.000				
20. <i>Firm age</i>	0.099***	0.199***	0.052***	0.039***	0.061***	0.060***	0.051***	0.166***	0.144***	-0.086***	-0.040***	-0.006	0.030***	0.034***	-0.005	-0.010	-0.076***	0.136***	-0.129***	1.000			
21. <i>Tang</i>	0.144***	0.135***	0.122***	0.109***	0.147***	0.153***	0.154***	0.083***	0.081***	-0.103***	-0.085***	0.253***	0.145***	-0.010	0.172***	-0.061***	-0.098***	0.212***	0.086***	-0.024***	1.000		
22. <i>GDPG</i>	-0.044***	-0.171***	0.001	0.013*	0.005	0.005	0.010	-0.081***	0.055***	0.032***	0.061***	-0.013*	0.067***	-0.123***	0.072***	-0.029***	-0.040***	0.093***	0.021**	-0.188***	0.039***	1.000	
23. <i>POPG</i>	0.005	-0.087***	0.024***	0.046***	0.027***	0.028***	0.044***	0.005	0.020**	0.040***	0.035***	-0.004	0.040***	-0.011	0.033***	-0.009	-0.020**	0.062***	0.048***	-0.083***	-0.028***	0.147***	1.000

Table 3. Common institutional ownership and corporate environment performance

This table reports the results of the regression as follows:

$$CEP_{i,t} = \beta_0 + \beta_1 Cross5Dum_{i,t} + \sum_k \beta_k Controls_{k,i,t} + \epsilon_{i,t}$$

$CEP_{i,t}$ refers to the *CEP index*. $Cross5Dum_{i,t}$ is the main measure of common institutional ownership. Appendix A presents the detailed variable definitions. All continuous variables are winsorized at the 1% level in each tail. Industry and year fixed effects are controlled for, and the t -statistics are reported in parentheses with standard errors clustered at the firm level. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

	OLS	Tobit	WLS	Newey West	Prais Winsten
	(1)	(2)	(3)	(4)	(5)
	<i>CEP index</i>				
<i>Cross5Dum</i>	0.049*** (4.214)	0.039** (2.182)	0.045*** (2.899)	0.049*** (5.718)	0.021*** (3.110)
<i>Firm size</i>	0.088*** (25.287)	0.151*** (26.543)	0.096*** (13.758)	0.088*** (36.383)	0.066*** (24.839)
<i>Leverage</i>	-0.079*** (-4.696)	-0.091*** (-2.730)	-0.147*** (-5.352)	-0.079*** (-6.436)	-0.035*** (-3.570)
<i>ROA</i>	0.115*** (2.876)	0.409*** (5.015)	-0.070 (-0.932)	0.115*** (3.482)	0.011 (0.618)
<i>Sales growth</i>	-0.026*** (-7.826)	-0.057*** (-8.299)	-0.014** (-2.218)	-0.026*** (-8.277)	-0.008*** (-3.883)
<i>OCF</i>	0.101*** (3.727)	0.189*** (3.461)	0.090* (1.814)	0.101*** (4.370)	0.034** (2.455)
<i>IO</i>	0.021 (1.449)	0.035 (1.227)	0.046** (2.356)	0.021** (2.021)	-0.007 (-0.704)
<i>Big 4/10</i>	0.004 (0.717)	0.004 (0.378)	-0.004 (-0.464)	0.004 (0.979)	-0.002 (-0.597)
<i>Board size</i>	0.039** (2.041)	0.075** (2.201)	-0.033 (-0.878)	0.039*** (2.843)	0.021* (1.938)
<i>Independence</i>	0.094 (1.515)	0.098 (0.894)	-0.128 (-0.972)	0.094** (2.057)	0.015 (0.464)
<i>Duality</i>	-0.004 (-0.748)	-0.017 (-1.580)	-0.005 (-0.461)	-0.004 (-0.988)	0.000 (0.129)
<i>SOE</i>	0.045*** (5.332)	0.083*** (5.506)	0.023* (1.705)	0.045*** (8.054)	0.042*** (6.766)
<i>Top1</i>	-0.017 (-0.739)	-0.047 (-1.130)	-0.055* (-1.654)	-0.017 (-1.039)	0.033** (2.063)
<i>Firm age</i>	0.020** (2.325)	0.046*** (2.673)	-0.001 (-0.049)	0.020*** (3.387)	0.009 (1.309)
<i>Tang</i>	0.025 (1.091)	0.068* (1.725)	0.096*** (2.954)	0.025 (1.511)	0.055*** (4.457)
<i>GDPG</i>	0.060 (1.537)	0.108 (1.628)	0.086 (1.442)	0.060* (1.679)	-0.001 (-0.039)
<i>POPG</i>	0.262*** (2.666)	0.730*** (3.420)	0.088 (0.741)	0.262*** (2.832)	0.147*** (2.580)
Constant	-2.016*** (-22.428)	-3.895*** (-25.648)	-1.855*** (-15.162)	-2.032*** (-32.300)	-1.487*** (-22.295)
Industry FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
Observations	24,706	24,706	24,706	24,706	24,706
Adjusted R ²	0.307		0.321	0.307	0.062
Pseudo R ²		0.317			

Table 4. Alternative CEP measures

This table reports the results of the regression as follows:

$$CEP_{i,t} = \beta_0 + \beta_1 Cross5Dum_{i,t} + \sum_k \beta_k Controls_{k,i,t} + \epsilon_{i,t}$$

$CEP_{i,t}$ represents the alternative CEP measures including *Awareness*, *Green Emission*, and *Investment*. $Cross5Dum_{i,t}$ is the measure of common institutional ownership. Appendix A presents the detailed variable definitions. All continuous variables are winsorized at the 1% level in each tail. Industry and year fixed effects are controlled for, and the t -statistics are reported in parentheses with standard errors clustered at the firm level. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

	(1) <i>Awareness</i>	(2) <i>Green Emission</i>	(3) <i>Investment</i>
<i>Cross5Dum</i>	0.022*** (3.061)	0.171*** (2.640)	0.157*** (3.986)
<i>Firm size</i>	0.046*** (19.529)	0.507*** (18.734)	0.295*** (23.959)
<i>Leverage</i>	-0.008 (-0.689)	-0.556*** (-3.784)	-0.284*** (-5.249)
<i>ROA</i>	0.136*** (4.509)	1.131*** (2.843)	0.230* (1.792)
<i>Sales growth</i>	-0.019*** (-7.373)	-0.153*** (-4.984)	-0.081*** (-7.747)
<i>OCF</i>	0.070*** (3.520)	0.655*** (2.726)	0.285*** (3.219)
<i>IO</i>	0.016 (1.454)	0.165 (1.227)	0.064 (1.463)
<i>Big 4/10</i>	0.008** (2.243)	-0.033 (-0.783)	0.010 (0.607)
<i>Board size</i>	0.018 (1.510)	0.203 (1.481)	0.135** (2.052)
<i>Independence</i>	-0.006 (-0.144)	0.097 (0.218)	0.464** (2.226)
<i>Duality</i>	-0.010** (-2.433)	-0.050 (-0.927)	-0.005 (-0.278)
<i>SOE</i>	0.027*** (5.000)	0.352*** (5.647)	0.101*** (3.784)
<i>Top1</i>	-0.014 (-0.891)	-0.268 (-1.497)	-0.033 (-0.440)
<i>Firm age</i>	0.012** (2.164)	0.159** (2.142)	0.050* (1.687)
<i>Tang</i>	0.076*** (5.080)	-0.046 (-0.271)	-0.019 (-0.259)
<i>GDPG</i>	0.011 (0.334)	0.483 (1.502)	0.201 (1.551)
<i>POPG</i>	-0.048 (-0.732)	1.877** (2.420)	1.064*** (2.899)
Constant	-1.109*** (-19.408)	-13.293*** (-19.081)	-6.605*** (-21.251)
Industry FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Observations	24,706	24,590	24,706
Adjusted R ²	0.315		0.264
Pseudo R ²		0.236	

Table 5. Alternative measures of common ownership

This table reports the results of the regression as follows:

$$CEP_{i,t} = \beta_0 + \beta_1 Common_{i,t} + \sum_k \beta_k Controls_{k,i,t} + \epsilon_{i,t}$$

$CEP_{i,t}$ represents the *CEP index*. $Common_{i,t}$ represents alternative common institutional ownership measures, including *Cross5Num*, *Cross5Prop*, *Cross3Dum*, *Cross3Num*, and *Cross3Prop*. Appendix A presents the detailed variable definitions. All continuous variables are winsorized at the 1% level in each tail. Industry and year fixed effects are controlled for, and the t -statistics are reported in parentheses with standard errors clustered at firm level. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

	(1) <i>CEP index</i>	(2) <i>CEP index</i>	(3) <i>CEP index</i>	(4) <i>CEP index</i>	(5) <i>CEP index</i>
<i>Cross5Num</i>	0.072*** (4.455)				
<i>Cross5Prop</i>		0.156*** (4.199)			
<i>Cross3Dum</i>			0.027*** (3.509)		
<i>Cross3Num</i>				0.041*** (3.906)	
<i>Cross3Prop</i>					0.142*** (3.917)
<i>Firm size</i>	0.088*** (25.198)	0.088*** (25.242)	0.089*** (25.573)	0.089*** (25.420)	0.088*** (25.194)
<i>Leverage</i>	-0.079*** (-4.687)	-0.080*** (-4.730)	-0.080*** (-4.760)	-0.080*** (-4.745)	-0.080*** (-4.717)
<i>ROA</i>	0.116*** (2.893)	0.121*** (3.025)	0.109*** (2.723)	0.108*** (2.698)	0.119*** (2.984)
<i>Sales growth</i>	-0.026*** (-7.814)	-0.026*** (-7.857)	-0.026*** (-7.941)	-0.026*** (-7.902)	-0.026*** (-7.867)
<i>OCF</i>	0.101*** (3.733)	0.103*** (3.825)	0.100*** (3.694)	0.100*** (3.685)	0.102*** (3.789)
<i>IO</i>	0.020 (1.390)	0.023 (1.590)	0.022 (1.557)	0.021 (1.456)	0.023 (1.575)
<i>Big 4/10</i>	0.004 (0.702)	0.004 (0.712)	0.004 (0.828)	0.004 (0.813)	0.004 (0.712)
<i>Board size</i>	0.039** (2.022)	0.039** (2.040)	0.039** (2.054)	0.039** (2.034)	0.039** (2.034)
<i>Independence</i>	0.093 (1.491)	0.094 (1.517)	0.098 (1.568)	0.096 (1.540)	0.095 (1.536)
<i>Duality</i>	-0.004 (-0.747)	-0.004 (-0.670)	-0.004 (-0.768)	-0.004 (-0.768)	-0.004 (-0.670)
<i>SOE</i>	0.045*** (5.327)	0.045*** (5.306)	0.046*** (5.437)	0.045*** (5.416)	0.045*** (5.294)
<i>Top1</i>	-0.016 (-0.700)	-0.027 (-1.173)	-0.016 (-0.677)	-0.014 (-0.594)	-0.026 (-1.145)
<i>Firm age</i>	0.020** (2.333)	0.020** (2.273)	0.020** (2.336)	0.020** (2.342)	0.020** (2.263)
<i>Tang</i>	0.024 (1.075)	0.025 (1.104)	0.027 (1.181)	0.026 (1.155)	0.026 (1.137)
<i>GDPG</i>	0.060 (1.539)	0.059 (1.520)	0.060 (1.537)	0.060 (1.545)	0.059 (1.501)
<i>POPG</i>	0.259*** (2.637)	0.247** (2.516)	0.276*** (2.818)	0.275*** (2.809)	0.251** (2.553)
Constant	-2.011*** (-22.329)	-2.013*** (-22.291)	-2.035*** (-22.768)	-2.026*** (-22.631)	-2.014*** (-22.294)

Industry FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
Observations	24,706	24,706	24,706	24,706	24,706
Adjusted R ²	0.307	0.307	0.305	0.306	0.307

Table 6. State common ownership and corporate environment performance

This table reports the results of the regression as follows:

$$CEP_{i,t} = \beta_0 + \beta_1 Common_State_{i,t} + \sum_k \beta_k Controls_{k,i,t} + \epsilon_{i,t}$$

$CEP_{i,t}$ represents the *CEP index*. $Common_State_{i,t}$ represents the state common ownership measures, including *Cross5Dum_State*, *Cross5Num_State*, *Cross5Prop_State*. Appendix A presents the detailed variable definitions. All continuous variables are winsorized at the 1% level in each tail. Firm and year fixed effects are controlled for, and the t -statistics are reported in parentheses. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

	(1) <i>CEP index</i>	(2) <i>CEP index</i>	(3) <i>CEP index</i>
<i>Cross5Dum_State</i>	0.022*** (3.835)		
<i>Cross5Num_State</i>		0.037*** (5.258)	
<i>Cross5Prop_State</i>			0.061*** (3.750)
<i>Firm size</i>	0.034*** (13.890)	0.033*** (13.793)	0.034*** (13.919)
<i>Leverage</i>	-0.048*** (-4.834)	-0.048*** (-4.794)	-0.048*** (-4.817)
<i>ROA</i>	0.021 (0.899)	0.020 (0.835)	0.021 (0.889)
<i>Sales growth</i>	-0.006*** (-2.892)	-0.006*** (-2.810)	-0.006*** (-2.880)
<i>OCF</i>	0.009 (0.578)	0.010 (0.633)	0.009 (0.603)
<i>IO</i>	-0.045*** (-4.186)	-0.047*** (-4.318)	-0.044*** (-4.098)
<i>Big 4/10</i>	-0.002 (-0.876)	-0.002 (-0.910)	-0.002 (-0.854)
<i>Board size</i>	-0.010 (-1.011)	-0.011 (-1.059)	-0.011 (-1.049)
<i>Independence</i>	-0.059* (-1.943)	-0.060** (-1.983)	-0.060** (-1.985)
<i>Duality</i>	-0.003 (-0.978)	-0.003 (-0.970)	-0.003 (-0.925)
<i>SOE</i>	0.005 (0.646)	0.005 (0.743)	0.005 (0.716)
<i>Top1</i>	0.010 (0.608)	0.011 (0.680)	0.005 (0.336)
<i>Firm age</i>	0.007 (0.562)	0.007 (0.616)	0.006 (0.500)
<i>Tang</i>	0.054*** (4.445)	0.054*** (4.456)	0.055*** (4.515)
<i>GDPG</i>	0.025 (1.163)	0.025 (1.175)	0.024 (1.115)
<i>POPG</i>	-0.100* (-1.775)	-0.098* (-1.744)	-0.100* (-1.789)
Constant	-0.631*** (-10.156)	-0.627*** (-10.095)	-0.628*** (-10.116)
Firm FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Observations	24,706	24,706	24,706
Adjusted R ²	0.714	0.714	0.714

Table 7. Pure state common ownership versus pure private common ownership

This table reports the results of the regression as follows:

$$CEP_{i,t} = \beta_0 + \beta_1 \text{Pure} - \text{Common}_{i,t} + \sum_k \beta_k \text{Controls}_{k,i,t} + \epsilon_{i,t}$$

$CEP_{i,t}$ represents the *CEP index*. $\text{Pure} - \text{Common}_{i,t}$ represents *Pure Cross5Dum_State* and *Pure Cross5Dum_Private*. Appendix A presents the detailed variable definitions. All continuous variables are winsorized at the 1% level in each tail. Firm and year fixed effects are controlled for, and the *t*-statistics are reported in parentheses. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

	SOEs	Non-SOEs
	(1)	(2)
	<i>CEP index</i>	<i>CEP index</i>
<i>Pure Cross5Dum_State</i>	0.007 (0.959)	0.028** (2.265)
<i>Pure Cross5Dum_Private</i>	0.019 (1.506)	0.024*** (2.732)
<i>Firm size</i>	0.049*** (10.363)	0.030*** (10.769)
<i>Leverage</i>	-0.054*** (-2.759)	-0.052*** (-4.821)
<i>ROA</i>	-0.026 (-0.558)	0.024 (0.997)
<i>Sales growth</i>	-0.009** (-2.131)	-0.004 (-1.484)
<i>OCF</i>	0.068** (2.408)	-0.013 (-0.731)
<i>IO</i>	-0.053** (-2.358)	-0.041*** (-3.592)
<i>Big 4/10</i>	-0.003 (-0.661)	0.000 (0.087)
<i>Board size</i>	-0.011 (-0.639)	-0.013 (-1.113)
<i>Independence</i>	-0.079 (-1.560)	-0.023 (-0.627)
<i>Duality</i>	-0.006 (-0.843)	-0.005 (-1.423)
<i>Top1</i>	-0.066** (-2.205)	0.048** (2.548)
<i>Firm age</i>	0.085*** (3.386)	-0.000 (-0.027)
<i>Tang</i>	0.046** (2.217)	0.043*** (2.898)
<i>GDPG</i>	0.100*** (2.711)	-0.031 (-1.225)
<i>POPG</i>	-0.088 (-1.097)	-0.010 (-0.117)
Constant	-1.081*** (-7.985)	-0.587*** (-7.318)
Firm FE	Yes	Yes
Year FE	Yes	Yes
Observations	10,422	14,284
Adjusted R ²	0.716	0.686

Table 8. Mechanism test: Promoting corporate green innovation

This table reports the results of the impact of common institutional ownership on CEP via increasing corporate green innovation. First stage reports the results of the impact of common institutional ownership (*Cross5Dum*) on firm green innovation (*Green innovation*). Second stage is the results of the impact of predicted value of green innovation (*Green innovation*) on corporate environmental performance (*CEP index*, *Awareness*, *Green Emission*, and *Investment*). Control variables are the same as in Table 3. All continuous variables are winsorized at the 1% level in each tail. Appendix A presents the detailed variable definitions. Industry and year fixed effects are controlled for, and the t-statistics are reported in parentheses with standard errors clustered at firm level. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

	First stage		Second stage			
	<i>Green innovation</i>		<i>CEP index</i>	<i>Awareness</i>	<i>Green Emission</i>	<i>Investment</i>
			(1)	(2)	(3)	(4)
<i>Cross5Dum</i>	0.105** (2.338)	<i>Predicted-Green innovation</i>	0.381*** (4.214)	0.173*** (3.061)	1.337*** (2.640)	0.408*** (3.986)
<i>Firm size</i>	0.390*** (23.451)	<i>Firm size</i>	-0.067* (-1.779)	-0.024 (-1.028)	-0.038 (-0.180)	-0.068 (-1.604)
<i>Leverage</i>	0.053 (0.693)	<i>Leverage</i>	-0.093*** (-5.511)	-0.015 (-1.205)	-0.606*** (-4.119)	-0.110*** (-6.020)
<i>ROA</i>	0.235 (1.359)	<i>ROA</i>	0.037 (0.841)	0.100*** (3.164)	0.857** (2.097)	-0.007 (-0.148)
<i>Sales growth</i>	-0.028* (-1.808)	<i>Sales growth</i>	-0.014*** (-3.114)	-0.014*** (-4.261)	-0.111*** (-3.158)	-0.014*** (-2.962)
<i>OCF</i>	0.051 (0.469)	<i>OCF</i>	0.064** (2.265)	0.054*** (2.594)	0.528** (2.143)	0.056* (1.796)
<i>IO</i>	0.027 (0.435)	<i>IO</i>	0.012 (0.797)	0.012 (1.062)	0.133 (0.979)	0.012 (0.774)
<i>Big 4/10</i>	0.029 (1.363)	<i>Big 4/10</i>	-0.008 (-1.302)	0.003 (0.771)	-0.074* (-1.666)	-0.009 (-1.386)
<i>Board size</i>	0.035 (0.408)	<i>Board size</i>	0.025 (1.267)	0.012 (0.968)	0.153 (1.104)	0.030 (1.313)
<i>Independence</i>	0.125 (0.472)	<i>Independence</i>	0.030 (0.467)	-0.035 (-0.831)	-0.127 (-0.279)	0.086 (1.183)
<i>Duality</i>	-0.010 (-0.394)	<i>Duality</i>	-0.003 (-0.516)	-0.009** (-2.286)	-0.045 (-0.843)	-0.000 (-0.042)
<i>SOE</i>	0.061* (1.845)	<i>SOE</i>	0.021** (2.025)	0.016** (2.333)	0.269*** (3.744)	0.008 (0.741)
<i>Top1</i>	-0.190* (-1.906)	<i>Top1</i>	0.051* (1.796)	0.017 (0.914)	-0.028 (-0.133)	0.062** (1.972)
<i>Firm age</i>	-0.079* (-1.959)	<i>Firm age</i>	0.054*** (4.501)	0.027*** (3.557)	0.276*** (3.187)	0.052*** (3.918)
<i>Tang</i>	-0.501*** (-5.491)	<i>Tang</i>	0.220*** (4.311)	0.165*** (5.076)	0.638** (2.057)	0.202*** (3.541)
<i>GDPG</i>	0.041 (0.263)	<i>GDPG</i>	0.039 (0.994)	0.002 (0.050)	0.410 (1.269)	0.045 (1.021)
<i>POPG</i>	0.797** (2.008)	<i>POPG</i>	-0.057 (-0.459)	-0.192** (-2.325)	0.759 (0.862)	0.013 (0.092)
Constant	-7.911*** (-19.092)	Constant	1.151 (1.491)	0.329 (0.687)	-2.187 (-0.502)	1.189 (1.359)
Industry FE	Yes		Yes	Yes	Yes	Yes
Year FE	Yes		Yes	Yes	Yes	Yes
Observations	24,706		24,706	24,706	24,706	24,706
Adjusted R ²	0.359		0.307	0.315		0.264
Pseudo R ²					0.236	

Table 9. Mechanism test: Increasing firm productivity

This table presents the impact of common institutional ownership on CEP via increasing firm productivity. First stage reports the results of the impact of common institutional ownership (*Cross5Dum*) on firm total factor productivity (*TFP*). Second stage is the results of the impact of predicted value of total factor productivity (*TFP*) on firm environmental performance (*CEP index*, *Awareness*, *Green Emission*, and *Investment*). Control variables are the same as in Table 3. All continuous variables are winsorized at the 1% level in each tail. Appendix A presents the detailed variable definitions. Industry and year fixed effects are controlled for, and the t-statistics are reported in parentheses with standard errors clustered at firm level. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

	First stage		Second stage			
	<i>TFP</i>		<i>CEP index</i>	<i>Awareness</i>	<i>Green Emission</i>	<i>Investment</i>
		<i>Predicted-TFP</i>	(1)	(2)	(3)	(4)
<i>Cross5Dum</i>	0.103*** (3.604)		0.460*** (4.129)	0.213*** (3.004)	1.481** (2.336)	0.503*** (3.985)
<i>Firm size</i>	0.636*** (73.278)	<i>Firm size</i>	-0.204*** (-2.838)	-0.089* (-1.951)	-0.428 (-1.044)	-0.221*** (-2.727)
<i>Leverage</i>	0.891*** (15.458)	<i>Leverage</i>	-0.492*** (-4.945)	-0.198*** (-3.090)	-1.915*** (-3.328)	-0.547*** (-4.828)
<i>ROA</i>	2.191*** (16.489)	<i>ROA</i>	-0.900*** (-3.649)	-0.332** (-2.112)	-2.230 (-1.555)	-1.033*** (-3.681)
<i>Sales growth</i>	0.116*** (10.672)	<i>Sales growth</i>	-0.079*** (-6.026)	-0.045*** (-5.221)	-0.320*** (-4.076)	-0.086*** (-5.764)
<i>OCF</i>	1.111*** (13.388)	<i>OCF</i>	-0.415*** (-3.250)	-0.163** (-1.989)	-1.046 (-1.379)	-0.468*** (-3.236)
<i>IO</i>	0.063* (1.682)	<i>IO</i>	-0.008 (-0.506)	0.002 (0.157)	0.077 (0.532)	-0.010 (-0.558)
<i>Big 4/10</i>	0.005 (0.366)	<i>Big 4/10</i>	-0.000 (-0.049)	0.007* (1.861)	-0.056 (-1.283)	-0.001 (-0.141)
<i>Board size</i>	-0.011 (-0.231)	<i>Board size</i>	0.040** (2.084)	0.014 (1.165)	0.207 (1.483)	0.047** (2.132)
<i>Independence</i>	-0.144 (-0.901)	<i>Independence</i>	0.167*** (2.617)	0.010 (0.238)	0.439 (0.953)	0.237*** (3.352)
<i>Duality</i>	-0.026* (-1.851)	<i>Duality</i>	0.007 (1.187)	-0.005 (-1.042)	-0.006 (-0.102)	0.010 (1.552)
<i>SOE</i>	0.056** (2.561)	<i>SOE</i>	0.021* (1.891)	0.015** (2.103)	0.282*** (3.736)	0.007 (0.601)
<i>Top1</i>	0.170*** (2.791)	<i>Top1</i>	-0.098*** (-3.353)	-0.052*** (-2.711)	-0.571*** (-2.807)	-0.097*** (-2.987)
<i>Firm age</i>	0.001 (0.035)	<i>Firm age</i>	0.021** (2.430)	0.012** (2.270)	0.178** (2.372)	0.017* (1.743)
<i>Tang</i>	-1.184*** (-17.140)	<i>Tang</i>	0.566*** (4.244)	0.329*** (3.843)	1.698** (2.195)	0.584*** (3.872)
<i>GDPG</i>	-0.047 (-0.456)	<i>GDPG</i>	0.076* (1.910)	0.014 (0.404)	0.529 (1.585)	0.089** (2.004)
<i>POPG</i>	0.844*** (2.776)	<i>POPG</i>	-0.057 (-0.403)	-0.226** (-2.362)	1.105 (1.107)	0.024 (0.146)
Constant	-5.282*** (-23.776)	Constant	0.404 (0.663)	0.031 (0.081)	-5.672 (-1.610)	0.444 (0.642)
Industry FE	Yes		Yes	Yes	Yes	Yes
Year FE	Yes		Yes	Yes	Yes	Yes
Observations	23,625		23,625	23,625	23,511	23,625
Adjusted R ²	0.793		0.311	0.314		0.270
Pseudo R ²					0.239	

Table 10. Promoting industry coordination

This table reports the results of the regression as follows:

$$Ind_benefit_{i,t} = \beta_0 + \beta_1 Cross5 - ratio_{i,t} + \sum_k \beta_k Controls_{k,i,t} + \epsilon_{i,t}$$

Ind_benefit_{i,t} refers to three measures of the industry coordination effects of common ownership - *Ind-GTFP*, *Ind-ROIC*, and *Ind-ROLC*. *Controls_{k,i,t}* includes *SOE-ratio*, *HHI*, *Ind-Size*, and *Ind-Lev*. All continuous variables are winsorized at the 1% level in each tail. Appendix A presents the detailed variable definitions. Industry and year fixed effects are controlled for, and the t-statistics are reported in parentheses. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

	(1)	(2)	(3)
	<i>Ind-GTFP</i>	<i>Ind-ROIC</i>	<i>Ind-ROLC</i>
<i>Cross5-ratio</i>	0.587** (2.337)	0.135*** (3.851)	0.103*** (3.129)
<i>SOE-ratio</i>	-0.285*** (-3.254)	0.013 (0.784)	0.010 (0.664)
<i>HHI</i>	0.099 (0.650)	0.048*** (2.758)	0.019 (1.144)
<i>Ind-Size</i>	-0.001 (-0.040)	0.004 (1.091)	0.004 (1.253)
<i>Ind-Lev</i>	0.241 (1.403)	-0.107*** (-4.671)	-0.125*** (-5.833)
Constant	0.709* (1.710)	-0.012 (-0.125)	-0.004 (-0.052)
Industry FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Observations	514	514	514
Adjusted R ²	0.885	0.605	0.674

Table 11. Robustness: Firm fixed effects

This table reports the results of the regression as follows:

$$CEP_{i,t} = \beta_0 + \beta_1 Cross5Dum_{i,t} + \sum_k \beta_k Controls_{k,i,t} + \epsilon_{i,t}$$

where $CEP_{i,t}$ represents the CEP measures of listed firm, including *CEP index*, *Awareness*, *Green Emission*, and *Investment*. $Cross5Dum_{i,t}$ is the measure of common institutional ownership. Appendix A presents the detailed variable definitions. All continuous variables are winsorized at the 1% level in each tail. Firm and year fixed effects are controlled for, and the t -statistics are reported in parentheses. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

	(1)	(2)	(3)	(4)
	<i>CEP index</i>	<i>Awareness</i>	<i>Green Emission</i>	<i>Investment</i>
<i>Cross5Dum</i>	0.025*** (5.258)	0.031*** (5.884)	0.287* (1.908)	0.012* (1.910)
<i>Firm size</i>	0.033*** (13.793)	0.012*** (4.383)	0.945*** (9.915)	0.042*** (13.742)
<i>Leverage</i>	-0.048*** (-4.794)	-0.030*** (-2.769)	-1.667*** (-4.474)	-0.031** (-2.493)
<i>ROA</i>	0.020 (0.835)	0.043* (1.680)	0.311 (0.344)	0.009 (0.324)
<i>Sales growth</i>	-0.006*** (-2.810)	-0.006** (-2.314)	0.054 (0.653)	-0.010*** (-3.713)
<i>OCF</i>	0.010 (0.633)	-0.004 (-0.250)	0.418 (0.730)	0.017 (0.846)
<i>IO</i>	-0.047*** (-4.318)	-0.043*** (-3.649)	-0.943** (-2.313)	-0.019 (-1.395)
<i>Big 4/10</i>	-0.002 (-0.910)	-0.001 (-0.308)	0.000 (0.002)	-0.003 (-1.005)
<i>Board size</i>	-0.011 (-1.059)	-0.021* (-1.918)	-0.001 (-0.003)	-0.001 (-0.096)
<i>Independence</i>	-0.060** (-1.983)	-0.050 (-1.512)	-1.746* (-1.796)	-0.042 (-1.102)
<i>Duality</i>	-0.003 (-0.970)	-0.002 (-0.672)	0.002 (0.013)	-0.007* (-1.781)
<i>SOE</i>	0.005 (0.743)	0.005 (0.570)	0.388 (1.399)	-0.009 (-0.996)
<i>Top1</i>	0.011 (0.680)	0.050*** (2.824)	-0.691 (-1.183)	0.011 (0.533)
<i>Firm age</i>	0.007 (0.616)	0.054*** (4.069)	0.256 (0.592)	-0.027* (-1.796)
<i>Tang</i>	0.054*** (4.456)	0.078*** (5.888)	0.605 (1.390)	0.031** (2.052)
<i>GDPG</i>	0.025 (1.175)	-0.013 (-0.548)	0.137 (0.196)	0.054** (1.998)
<i>POPG</i>	-0.098* (-1.744)	-0.203*** (-3.322)	2.187 (1.310)	-0.133* (-1.901)
Constant	-0.627*** (-10.095)	-0.335*** (-4.948)		-0.721*** (-9.303)
Year FE	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes
Observations	24,706	24,706	7,388	24,706
Adjusted R ²	0.714	0.538		0.631
LR chi2			634.78	

Table 12. PSM test

This table reports the regression results using a propensity score matching (PSM) procedure. Panel A shows the determinants of common institutional ownership (*Cross5Dum*). Panel B presents the regression results using the matched sample. Panel C reports the comparison of the mean value of determinants of *Cross5Dum* in the matched sample. Variable definitions are provided in Appendix A. All the continuous variables are winsorized at the 1% and 99% levels. The reported t-statistics are based on robust standard errors clustered at the firm level. ***, **, and * denote statistical significance at the 1%, 5%, and 10% levels, respectively.

Panel A		Panel B			
	<i>Cross5Dum</i>	<i>CEP index</i>	<i>Awareness</i>	<i>Green Emission</i>	<i>Investment</i>
		(1)	(2)	(3)	(4)
<i>Cross5Dum</i>		0.042*** (3.158)	0.021** (2.491)	0.210*** (2.749)	0.041*** (2.734)
<i>Firm size</i>	0.191*** (6.240)	0.098*** (14.018)	0.047*** (10.857)	0.455*** (9.988)	0.118*** (14.054)
<i>Leverage</i>	0.027 (0.152)	-0.064 (-1.423)	0.021 (0.766)	-0.427 (-1.518)	-0.091* (-1.788)
<i>ROA</i>	-0.004 (-0.008)	0.082 (0.733)	0.074 (0.879)	0.371 (0.496)	0.104 (0.809)
<i>Sales growth</i>	-0.169*** (-4.834)	-0.028*** (-2.708)	-0.026*** (-3.779)	-0.078 (-1.306)	-0.032*** (-2.705)
<i>OCF</i>	0.011 (0.037)	0.102 (1.370)	0.128** (2.391)	0.388 (0.780)	0.090 (1.048)
<i>IO</i>	1.663*** (9.217)	0.078* (1.819)	0.065** (2.401)	0.599** (2.162)	0.030 (0.606)
<i>Big 4/10</i>	0.139*** (2.737)	0.023* (1.714)	0.017** (2.004)	0.087 (1.146)	0.024 (1.625)
<i>Board size</i>	-0.067 (-0.409)	0.033 (0.860)	0.003 (0.114)	0.223 (1.008)	0.035 (0.712)
<i>Independence</i>	0.539 (0.989)	0.031 (0.221)	-0.052 (-0.589)	-0.120 (-0.150)	0.112 (0.679)
<i>Duality</i>	-0.012 (-0.197)	0.014 (0.967)	-0.015 (-1.477)	0.104 (1.102)	0.023 (1.422)
<i>SOE</i>	0.454*** (6.301)	0.064*** (3.751)	0.024** (2.031)	0.440*** (4.100)	0.061*** (3.200)
<i>Top1</i>	-1.368*** (-5.823)	-0.068 (-1.270)	-0.038 (-1.065)	-0.508 (-1.631)	-0.061 (-0.988)
<i>Firm age</i>	0.098 (0.997)	0.008 (0.320)	0.006 (0.472)	0.082 (0.546)	-0.005 (-0.165)
<i>Tang</i>	0.392** (1.988)	-0.025 (-0.514)	0.035 (1.130)	-0.218 (-0.800)	-0.032 (-0.594)
<i>GDPG</i>	-0.086 (-0.243)	0.047 (0.509)	0.029 (0.348)	0.246 (0.447)	0.027 (0.266)
<i>POPG</i>	1.423 (1.594)	0.102 (0.487)	-0.180 (-1.322)	1.288 (1.004)	0.199 (0.723)
Constant	-6.842*** (-8.887)	-1.122*** (-10.508)	- (-11.140)	-2.569*** (-12.334)	-1.122*** (-10.508)
Industry FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
Observations	22,749	4,206	4,206	4,197	4,206
Adjusted R ²	0.235	0.310	0.363		0.268
Pseudo R ²				0.214	

Panel C	Firms with common ownership	Firms without common ownership	Diff. in means (t-stat)	Standardized Bias (%)
<i>Firm size</i>	22.818	22.851	-0.033 (-0.76)	-2.3
<i>Leverage</i>	0.495	0.497	-0.002 (-0.37)	-1.1
<i>ROA</i>	0.039	0.039	0.000 (0.52)	1.6
<i>Sales growth</i>	0.161	0.147	0.014 (1.14)	3.5
<i>OCF</i>	0.056	0.053	0.003 (1.04)	3.2
<i>IO</i>	0.589	0.585	0.004 (0.78)	2.4
<i>Big 4/10</i>	0.581	0.571	0.010 (0.69)	2.1
<i>Board size</i>	2.191	2.198	-0.007 (-1.13)	-3.5
<i>Independence</i>	0.372	0.373	-0.001 (-0.40)	-1.2
<i>Duality</i>	0.143	0.158	-0.015 (-1.34)	-4.1
<i>SOE</i>	0.739	0.728	0.012 (0.87)	2.7
<i>Top1</i>	0.380	0.375	0.005 (1.04)	3.2
<i>Firm age</i>	2.806	2.803	0.003 (0.30)	0.9
<i>Tang</i>	0.263	0.268	-0.005 (-0.82)	-2.5
<i>GDPG</i>	0.106	0.104	0.002 (1.13)	3.5
<i>POPG</i>	0.010	0.011	-0.001 (-0.62)	-1.9

Table 13. Instrumental variable estimation

This table presents the impact of local common institutional ownership on corporate environmental performance using instrumental variable estimation. We use *HSR* and *Airport_Dis* as the instrumental variables of common institutional ownership. In the first-stage analysis, we regress *HSR* and *Airport_Dis* on common institutional ownership measures (*Cross5Dum*, *Cross5Num*, *Cross5Prop*) with other independent variables as same as in Table 3. In the second-stage analysis, we use the fitted values generated from the first-stage estimation as the instrument variable for common institutional ownership and rerun the baseline regression. Appendix A presents the detailed variable definitions. Industry and year fixed effects are controlled for, and the t-statistics are reported in parentheses. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively. We also perform the weak-identification test and over-identification tests.

	First stage			Second stage		
	<i>Cross5Dum</i>	<i>Cross5Num</i>	<i>Cross5Prop</i>	<i>CEP index</i> (1)	<i>CEP index</i> (2)	<i>CEP index</i> (3)
<i>HSR</i>	0.021*** (4.482)	0.015*** (4.441)	0.008*** (5.479)			
<i>Airport-Dis</i>	-0.024*** (-7.990)	-0.018*** (-8.292)	-0.010*** (-9.905)			
<i>Cross5Dum</i>				0.367*** (4.750)		
<i>Cross5Num</i>					0.500*** (4.770)	
<i>Cross5Prop</i>						0.909*** (4.910)
<i>Firm size</i>	0.043*** (21.453)	0.031*** (22.126)	0.013*** (19.887)	0.074*** (19.963)	0.074*** (19.967)	0.078*** (26.974)
<i>Leverage</i>	-0.028** (-2.292)	-0.021** (-2.371)	-0.005 (-1.281)	-0.068*** (-6.874)	-0.068*** (-6.905)	-0.074*** (-7.887)
<i>ROA</i>	-0.013 (-0.317)	-0.018 (-0.613)	-0.044*** (-3.328)	0.119*** (3.704)	0.123*** (3.853)	0.155*** (4.809)
<i>Sales growth</i>	-0.018*** (-4.092)	-0.013*** (-4.058)	-0.005*** (-3.556)	-0.020*** (-5.345)	-0.020*** (-5.465)	-0.022*** (-6.298)
<i>OCF</i>	-0.010 (-0.355)	-0.010 (-0.455)	-0.018* (-1.909)	0.102*** (4.404)	0.103*** (4.473)	0.115*** (5.086)
<i>IO</i>	0.161*** (15.901)	0.120*** (16.659)	0.038*** (11.530)	-0.029** (-2.022)	-0.031** (-2.084)	-0.005 (-0.488)
<i>Big 4/10</i>	0.020*** (5.282)	0.014*** (5.345)	0.006*** (4.958)	-0.003 (-0.950)	-0.003 (-0.927)	-0.001 (-0.481)
<i>Board size</i>	0.004 (0.369)	0.008 (1.016)	0.002 (0.473)	0.039*** (4.381)	0.037*** (4.114)	0.039*** (4.526)
<i>Independence</i>	0.131*** (3.291)	0.110*** (3.882)	0.042*** (3.259)	0.055* (1.667)	0.048 (1.438)	0.064** (2.057)
<i>Duality</i>	-0.002 (-0.530)	-0.002 (-0.546)	-0.004** (-2.523)	-0.004 (-1.137)	-0.004 (-1.144)	-0.002 (-0.444)
<i>SOE</i>	0.065*** (14.289)	0.045*** (13.679)	0.021*** (14.048)	0.024*** (3.974)	0.026*** (4.463)	0.029*** (5.670)
<i>Top1</i>	-0.145*** (-9.840)	-0.111*** (-10.527)	0.018*** (3.721)	0.026* (1.662)	0.028* (1.778)	-0.044*** (-3.643)
<i>Firm age</i>	0.006 (1.163)	0.003 (0.829)	0.004** (2.442)	0.017*** (3.920)	0.018*** (4.126)	0.016*** (3.614)
<i>Tang</i>	0.094*** (6.608)	0.070*** (6.858)	0.029*** (6.283)	-0.001 (-0.047)	-0.001 (-0.075)	0.007 (0.632)
<i>GDPG</i>	0.007 (0.180)	0.006 (0.190)	0.009 (0.667)	0.066** (2.042)	0.066** (2.054)	0.060* (1.941)
<i>POPG</i>	0.113	0.103	0.108***	0.162*	0.153*	0.105

Constant	(1.021) -0.908*** (-16.657)	(1.292) -0.682*** (-17.495)	(2.986) -0.300*** (-16.831)	(1.804) -1.706*** (-19.104)	(1.699) -1.698*** (-18.778)	(1.160) -1.766*** (-23.358)
Industry FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	24,695	24,695	24,695	24,695	24,695	24,695
Wald F statistic	52.387	55.008	79.872			
Sargan statistic (p-value)				0.5139	0.4631	0.4843

Table 14. Placebo test

This table presents the results of placebo tests. *Cross5Dum* is the dummy variable that equals 1 if the focal firm and at least one industry peer are commonly held by at least one common owner ($\geq 5\%$ of shares outstanding) in at least one quarter of the year, and 0 otherwise. We contrast a pseudo-*Cross5Dum* variable based on the randomly assigned *Cross5Dum* to measure common institutional ownership. We repeat the procedure 500 times, thereby generating 500 coefficient estimates of the pseudo-*Cross5Dum* variable. These estimates are used to construct an empirical distribution of the *Cross5Dum* coefficient under the scenario that the relation between common institutional ownership and corporate environmental performance (*CEP index*) is of a spurious nature. For comparison, we also report the actual estimate of *Cross5Dum* coefficient, replicated from Column (1) of Table 3.

	(1) <i>CEP index</i>
Mean β for pseudo- <i>Cross5Dum</i>	-0.0001
Min β for pseudo- <i>Cross5Dum</i>	-0.0113
1% percentile β for pseudo- <i>Cross5Dum</i>	-0.0086
5% percentile β for pseudo- <i>Cross5Dum</i>	-0.0061
25% percentile β for pseudo- <i>Cross5Dum</i>	-0.0030
Median β for pseudo- <i>Cross5Dum</i>	-0.0002
75% percentile β for pseudo- <i>Cross5Dum</i>	0.0025
95% percentile β for pseudo- <i>Cross5Dum</i>	0.0061
99% percentile β for pseudo- <i>Cross5Dum</i>	0.0101
Max β for pseudo- <i>Cross5Dum</i>	0.0117
Coefficient of actual <i>Cross5Dum</i> in column (1) of Table 2	0.0488

Table 15. Dedicated common ownership

This table reports the results of the effects of dedicated common ownership on corporate environmental performance. Appendix A presents the detailed variable definitions. All continuous variables are winsorized at the 1% level in each tail. Industry and year fixed effects are controlled for, and the *t*-statistics are reported in parentheses with standard errors clustered at the firm level. *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.

	(1)	(2)	(3)
	<i>CEP index</i>	<i>CEP index</i>	<i>CEP index</i>
<i>Cross5Ded_Dum</i>	0.061*** (4.703)		
<i>Cross5Ded_Num</i>		0.088*** (5.079)	
<i>Cross5Ded_MaxPeriod</i>			0.039*** (4.657)
<i>Firm size</i>	0.088*** (25.349)	0.088*** (25.229)	0.088*** (25.351)
<i>Leverage</i>	-0.079*** (-4.694)	-0.079*** (-4.693)	-0.079*** (-4.698)
<i>ROA</i>	0.116*** (2.899)	0.117*** (2.920)	0.116*** (2.895)
<i>Sales growth</i>	-0.025*** (-7.765)	-0.025*** (-7.757)	-0.025*** (-7.773)
<i>OCF</i>	0.100*** (3.717)	0.101*** (3.734)	0.100*** (3.720)
<i>IO</i>	0.021 (1.449)	0.020 (1.372)	0.021 (1.455)
<i>Big 4/10</i>	0.004 (0.728)	0.004 (0.708)	0.004 (0.731)
<i>Board size</i>	0.039** (2.014)	0.038** (1.965)	0.039** (2.014)
<i>Independence</i>	0.093 (1.504)	0.091 (1.464)	0.094 (1.505)
<i>Duality</i>	-0.004 (-0.709)	-0.004 (-0.712)	-0.004 (-0.707)
<i>SOE</i>	0.045*** (5.330)	0.045*** (5.346)	0.045*** (5.328)
<i>Top1</i>	-0.017 (-0.748)	-0.016 (-0.687)	-0.017 (-0.753)
<i>Firm age</i>	0.020** (2.309)	0.020** (2.320)	0.020** (2.305)
<i>Tang</i>	0.024 (1.056)	0.023 (1.017)	0.024 (1.052)
<i>GDPG</i>	0.062 (1.586)	0.062 (1.592)	0.062 (1.590)
<i>POPG</i>	0.259*** (2.635)	0.257*** (2.608)	0.259*** (2.634)
Constant	-2.012*** (-22.392)	-2.004*** (-22.235)	-2.012*** (-22.394)
Industry FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Observations	24,706	24,706	24,706
Adjusted R ²	0.307	0.308	0.307

Appendix A: Variable Definition

<i>CEP index</i>	Corporate environmental performance index, which is the average value of the three sub-measures that include environmental awareness, green emission, and environmental investment.
<i>Awareness</i>	Environmental awareness index. <i>Awareness</i> is calculated as (environmental awareness score of a firm – the minimum awareness score of the year)/(the maximum awareness score of the year – the minimum awareness score of the year). The awareness score is the aggregation of eight dummy variables, including (i) whether the firm releases environmental protection concept, environmental guideline, environmental management organizational structure, recycling economy development model, green development in the annual report; (ii) whether the firm releases the achievement of environmental targets in the past year and the future environmental targets; (iii) whether the firm formulates relevant environmental management system, regulations, obligations; (iv) whether the firm conducts environmental education and training; (v) whether the firm engages in environmental protection public welfare activities; (vi) whether the firm constructs emergency response mechanism for major environment-related emergencies; (vii) whether the firm receives awards in environmental protection; and (viii) whether the firm implements the “Three Simultaneity” system.
<i>Green Emission</i>	Green emission index, an indicator variable equals one if the firm adopts policies, measures, or techniques to reduce wastewater, gas, sludge, and greenhouse gas discharge, and zero otherwise.
<i>Investment</i>	Environmental investment index. <i>Investment</i> is calculated as (environmental investment score of a firm – the minimum investment score of the year)/(the maximum investment score of the year – the minimum investment score of the year). The investment score is the aggregation of three dummy variables, including (i) whether the firm exploits or adopts innovation products, equipment, or techniques which are beneficial to environment; (ii) whether the firm adopts renewable energy or policies and measures of circular economy; (iii) whether the firm adopts policies, measures, or techniques to save energy and resources.
<i>Cross5Dum</i>	A dummy variable equals one if the firm has at least one institutional cross-owner (at least 5% of shares outstanding) in any of the four quarters of a fiscal year, and zero otherwise.
<i>Cross5Num</i>	The natural logarithm of one plus the average number of institutional cross-owners (at least 5% of shares outstanding) in a firm across the four quarters of a fiscal year.
<i>Cross5Prop</i>	The proportion of shareholding hold by all institutional cross-owners (at least 5% of shares outstanding) in the focal firm, averaged over the four quarters in a year.
<i>Cross3Dum</i>	A dummy variable equals one if the firm has at least one institutional cross-owner (at least 3% of shares outstanding) in any of the four quarters of a fiscal year, and zero otherwise.
<i>Cross3Num</i>	The natural logarithm of one plus the average number of institutional cross-owners (at least 3% of shares outstanding) in a firm across the four quarters of a fiscal year.

<i>Cross3Prop</i>	The proportion of shareholding hold by all institutional cross-owners (at least 3% of shares outstanding) in the focal firm, averaged over the four quarters in a year.
<i>Cross5Dum_State</i>	A dummy variable that equals one if the focal firm has at least one state institutional cross-owner (at least 5% of shares outstanding) in any of the four quarters of a fiscal year, and zero otherwise.
<i>Cross5Num_State</i>	The natural logarithm of one plus the average number of state institutional cross-owners (at least 5% of shares outstanding) in a firm across the four quarters of a year.
<i>Cross5Prop_State</i>	The proportion of shareholding hold by all state institutional cross-owners (at least 5% of shares outstanding) in the focal firm, averaged over the four quarters in a year.
<i>Pure Cross5Dum_State</i>	A dummy variable that equals one if the focal firm only has state institutional cross-owner(s) (at least 5% of shares outstanding), and 0 otherwise.
<i>Pure Cross5Dum_Private</i>	A dummy variable that equals one if the focal firm only has private institutional cross-owner(s) (at least 5% of shares outstanding), and 0 otherwise.
<i>Cross5Ded_Dum</i>	A dummy variable equals one if the firm has at least one dedicated institutional cross-owner (at least 5% of shares outstanding) in any of the four quarters of a fiscal year, and zero otherwise.
<i>Cross5Ded_Num</i>	The average value of the natural logarithm of one plus the number of dedicated cross-owners (at least 5% of shares outstanding) in a firm across the four quarters of a fiscal year.
<i>Cross5Ded_MaxPeriod</i>	The natural logarithm of one plus the number of the maximum holding period (measured by quarter) of dedicated cross-owners in a year.
<i>Firm size</i>	The natural logarithm of total assets.
<i>Leverage</i>	The book value of total debt divided by the book value of total assets.
<i>ROA</i>	Net income divided by total assets.
<i>Sales growth</i>	Growth in sales income.
<i>OCF</i>	The ratio of net cash flows from operating activities to total assets.
<i>IO</i>	The percentage of shares held by institutional investors.
<i>Big4/10</i>	An indicator variable that equals one if the firm hires international Big4 auditor or national Big10 auditor.
<i>Board size</i>	The natural logarithm of the total number of directors on the board.
<i>Independence</i>	The proportion of independent directors to total number of directors on the board.
<i>Duality</i>	A dummy variable that equals one if the chief executive officer (CEO) and board chair positions are held by the same person, and zero otherwise
<i>SOE</i>	A dummy variable that equals one if the ultimate controller is a SOE or government agency, and zero otherwise.
<i>Top1</i>	Percentage of shares owned by the largest shareholder.

<i>Firm age</i>	The natural logarithm of one plus the number of years since a firm's establishment.
<i>Tangible</i>	Tangible assets over total assets.
<i>GDPG</i>	The annual provincial GDP growth rate.
<i>POPG</i>	The annual provincial population growth rate.
<i>Green innovation</i>	The natural logarithm of one plus the number of patents applied that are "green."
<i>TFP</i>	Total factor productivity of a firm, constructed following Levinsohn and Petrin (2003).
<i>HSR</i>	A dummy that equals one if a firm is in a city that has high-speed railway (HSR), and zero otherwise.
<i>Airport_Dis</i>	The natural logarithm of the average distance between a firm's registered address and the nearest two international airports.
<i>Cross5-ratio_i</i>	The ratio of listed firms held by common owners of all listed firms in each industry and year.
<i>SOE-ratio</i>	The ratio of listed firms that are ultimately controlled by SOEs or government agencies of all listed firms in each industry and year.
<i>HHI</i>	Herfindahl–Hirschman Index.
<i>Ind-Size</i>	The natural logarithm of total assets of an industry.
<i>Ind-Lev</i>	The book value of total debt of an industry divided by the book value of total assets of the industry.
<i>Ind-GTFP</i>	Green total factor productivity of an industry.
<i>Ind-ROIC</i>	Return on invested capital of an industry, which measured as: (Net profit + Financial expenses) / (Total assets - Total current liabilities + Notes payable + Short-term borrowings + Non-current liabilities due within one year).
<i>Ind-ROLC</i>	Return on long term invested capital of an industry, which measured as: (Total profit + financial expenses) / (Total average balance of non-current liabilities + Total average balance of owner's equity).
