Do institutional contingencies matter for green investment?—An institution based view of Chinese listed companies

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ABSTRACT

Current research in the field of environmental management has placed significant emphasis on understanding the reasons behind varying organizational responses to environmental responsibilities. Governance scholars emphasize the central role of institutional factors in shaping environmental responsibilities, primarily due to the substantial influence exerted by regulatory institutions. Drawing on institutional theory, we investigate how sub-national institutional factors impact a firm's green investment intensity and explore their moderating influence on the relationship between green investment and a firm's financial performance. Using a database of Chinese listed companies from 2012 to 2019, this study employs fixed effect model as a baseline regression. Our analysis demonstrates that sub-national institutions, such as state-owned enterprises (SOEs), regional development, and cross-listing, have significant and positive impact on corporate green investment. Our study further provide an evidence that green investment significantly improve firms' financial performance. Moreover, the positive effect of green investment on financial performance is stronger in SOEs and in firms of developed regions as compared to their counterparts, and weaker in cross listed firms than those of non-cross listed peers. Our study suggest that subnational institutions play an imperative role in improving environmental quality and financial performance by promoting corporate green investment. To make sure that our findings remain robust to endogeneity, we applied generalized method of moments (GMM) and propensity score matching (PSM) method. Our findings further provide implications for emerging economies with similar shareholding patterns and unbalanced regional development.

1. Introduction

Green investment is becoming increasingly important in today's highly competitive economic world. The World Business Council for Sustainable Development saw social and environmental investment as a critical component of long-term economic growth and societal well-being [1]. Implementing green practices is not only a matter of regulatory compliance but is also essential for a company to establish its legitimacy [2], enhance its corporate image and to derive financial benefits from such initiatives [3]. Despite the fact

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that every company's principal motivation remains financial performance [4,5], stakeholders' expectation for companies to engage in environmentally responsible ways have become an increasing concern [6,7]. Environmental protection, in conjunction with economic growth, is increasingly acknowledged as a pivotal element of sustainable development for economies worldwide. Consequently, environmentalists are growing more concerned about the deteriorating patterns in global carbon emissions and the levels of investment directed toward environmental protection. These concerns are particularly pronounced in developing economies, since their approach to environmental sustainability holds significant implications for the broader discourse on balancing economic progress with ecological responsibility [8]. In this context, understanding the dynamics of China's environmental protection practices is vital for assessing its commitment to a sustainable and environmentally responsible future.

Given its rapid industrialization and urbanization, extensive development, high energy consumption, and high pollution emissions, China has become the largest energy consumer in the world [9]. Objectively speaking, the excessive consumption of resources resulting from China's rapid growth stage has become increasingly severe, leading to environmental deterioration [10]. According to the report on air quality issued by the Ministry of Environmental Protection, only 25 % of the cities at the prefecture level had air quality that met criteria [11]. Actually, firms are the main producers of environmental pollution and the main consumers of resources, with approximately 80 % of the country's air pollutants originating from these firms [10]. According to report of the U.S. Energy Information Administration (EIA), in 2018, China's energy consumption reached 3719 million metric tons of oil equivalent (Mtoe), representing 24.6 % of the world's total consumption. As of now, China stands as the top contributor to worldwide carbon emissions, accounting for 29.1 % of the total global carbon dioxide emissions [12]. Although China has taken great advances toward renewable energy transition, Chinese firms have yet to significantly increase their pollution reduction investments [13], since it is one of the most important ways to reduce carbon emissions in emerging economies [8]. In this regard, the United Nations' Sustainable Development Goals (SDG) program has also underlined the importance of green investment [14]. For example, SDG12 intends to increase investments in climate finance, which is said to be effective in preventing environmental hazards. Furthermore, green investments can take the shape of investment in sustainable energy development (SDG7), and such investments can be expected to promote the quality of the environment in both advanced and emerging markets [15].

From an environmental responsibility perspective, the existing body of literature has extensively investigated various factors that influence firms' environmentally friendly practices. However, there is a noticeable dearth of empirical studies that quantitatively analyze the relationship between institutional factors and the development of green finance. Prior research has asserted that diverse perceptions of environmental behavior can emerge within different regional institutional contexts [16–18] often linked to formal pressures [19], legal frameworks, government regulations, and specific political systems pertaining to corporate environmental responsibility [20]. Moreover, there can be substantial variations in the adoption of eco-friendly practices among different industries operating within specific regional institutional environments [21,22]. Surprisingly, institutional factors have received relatively less attention in corporate governance studies. Previous research has predominantly examined the influence of institutional forces on corporate financial outcomes [17,23–26] while providing limited focus on their impact on non-financial objectives, particularly green investment. These studies believe that government laws, regulations and national culture have a substantial impact on policies and organizational outcomes. Against this premise, this paper raises an important question: How do regional-level institutions influence firms' green investment behavior?

The mechanism of institutional settings that may influence corporate green investment is "institutional monitoring", which is noted as the most influential monitoring mechanism [17,23]. Given the significant influence of monitoring approaches, regional level institutional contingencies have become a fascinating subject to explore, as it varies in the largest emerging economies [27]. Notably, China's diverse subnational regions exhibit considerable variations in culture, industrial progress, identities, as well as the implementation and enforcement of central government policies [28,29]. This diversity allows for a comprehensive examination of the primary features of sub-national institutional contingencies, which encompass ownership patterns (e.g., state-owned enterprises), regional disparities, and the listing patterns of enterprises on stock exchanges (e.g., cross-listing). In particular, the unique institutional diversity within China offers a valuable opportunity to probe the effects of these variations on green investments and their ultimate outcomes. This investigation may provide deeper insights into the intricate interplay between institutional configurations, corporate choices, and the drive for environmental sustainability.

To test this assumption, our study utilizes a dataset comprising 5347 firm-year observations of listed firms in China over the period from 2012 to 2019. Our findings offer several contributions to the current body of literature. First, previous studies in the field of environmental sustainability have predominantly concentrated on the influence of institutional factors on comprehensive Corporate Social Responsibility (CSR) and environmental performance [13,16–18,30]. Although the environmental protection investment belongs to the category of corporate social responsibility, there is a dearth of literature on institutional contingencies and environmental investment that merely related to pollution reduction. Our study fills this gap by exploring that regional-level institutional factors exert a positive influence on corporate green investments. Our findings suggest that sub-national institutional factors play a pivotal role in governing and promoting strategic choices, such as green financing, in emerging markets. Secondly, we explore the relationship between green investment and firms' financial performance. Our study affirms that the environmental initiatives such as green investment are not solely driven by stakeholder expectations but also enhance a company's financial standing by improving the company's reputation in the eyes of government and the society. Finally, this study contributes to the literature by representing the green investment impact on corporate financial objectives under sub-national institutions. Our study claim that green investment positively affect a firm's economic performance, hence this link is stronger for SOEs and firms located in developed regions. Besides, our findings conclude that the relationship between green investment and financial performance is weaker in cross-listed firms as compared to their counterparts. This difference in the strength of the relationship can be attributed to the additional scrutiny and pressure placed on SOEs, firms in developed regions, and cross-listed firms by dominant stakeholders. These entities are not only legally obliged to pursue

environmental policies but also focus on enhancing their financial standing, which may explain the varying degrees of influence. Non-cross-listed companies, on the other hand are not bound by the same rules. Thus they do green practices to meet financial objectives and they are more concerned with cost–benefit assessment than with institutional pressures.

2. Literature and hypotheses development

According to institutional theory, organizations operate within the constraints of institutional settings, making them susceptible to various institutional limitations that significantly impact their corporate decisions and policies [31]. These limitations manifest in the form of regulatory pressures stemming from a country's legal system, established norms, and regulations [32,33]. Companies are under pressure to act in conformity with a society's common views, values, and standards [34]. Moreover, the norms, traditions, and cognitive perceptions of various social actors play a pivotal role in shaping corporate behavior within specific contexts [35]. Companies that follow legislation, societal conventions, and moral standards have a better chance of surviving and prospering [36]. Ali, Zhang [17] suggest that institutions, including legal systems and social norms, establish a framework within which businesses are subject to effective oversight from both formal and informal institutions, including state-level officials, international community and other relevant stakeholders. Companies that recognize the significance of these frameworks and incorporate them into their internal strategies can navigate the competitive landscape more effectively. By adhering to legal and societal expectations, companies can build trust, foster positive public perception, and ultimately enhance their prospects for long-term viability and prosperity. According to Haque and Ntim [37], the alignment of internal practices with institutional factors is a key element in establishing and maintaining legitimacy in the eyes of stakeholders, which can, in turn, foster sustainable growth and enhance competitiveness [33,38].

The existing literature has consistently highlighted the significance of institutional differences in shaping strategic decisions. According to Gandhi, Thanki [39] and Mangla, Luthra [40], the implementation of environmental strategies can be attributed to a range of institutional factors, including cultural norms, state policies, and regional variations, which can differ significantly from one country to another. In developing countries, institutional norms may differ from those in developed countries such as, government regulations related to environmental matters and public expectations regarding environmental safety can vary significantly from one country to another [41]. With this understanding, the Chinese context offers a rich landscape of variations in demonstrating effects of sub-national institutions [23]. For instance, Chinese listed firms exhibit diverse ownership structures, which not only influence their institutional environment but also impact the effectiveness of corporate governance mechanisms and the extent of shareholder protection [42]. Additionally, China comprises numerous subnational regions that vary in terms of cultural identities, customs, economic development, and the implementation and enforcement of central government regulations [29,43]. In this regard, Alkebsee, Tian [44] argue that internal governance mechanisms and the legal environment vary across Chinese regions, with monitoring quality being higher in more developed regions compared to less developed ones. These variations provide a unique opportunity to investigate how differences in both formal and informal institutional contexts affect corporate green investment behavior and its financial outcomes.

2.1. State owned enterprises and green investment

The institutional pressure exerted on every public company is not uniform. The organizational environment for companies varies with different ownership forms. In emerging markets like China, where the state supervises economic growth and intervenes in economic activity, state ownership is determined as a leading institutional driver [18,45]. State ownership determines the level to which a company is directly controlled by the government and the degree to which the government interferes with its economic activities [46]. Zhang, Zhou [47] argue that the government plays a crucial role in mitigating the uncertain risks associated with green activities, as the absence of sufficient policy support can pose challenges for businesses in achieving long-term growth. China, as a transitioning economy, exhibits a unique blend of public and private ownership, characterized by a regulatory framework typical of an emerging market [2]. In this context, the Chinese government actively encourages firms to pursue environmental legitimacy [48], and it acts as a steward of state-owned enterprises to advance its social and economic objectives [49]. These entities are likely to undertake the state level policies and duties, such as ecological stewardship and sustainable growth [45]. The progress of state enterprises is monitored closely by state agencies. The state assists state owned enterprises financially [50,51], stimulating them to engage in society's well-being [52], providing subsidies [53], and incentivizing them to indulge in green activities [13,54,55].

From an institutional perspective, regulatory pressure plays a pivotal role in guiding companies to align their actions with societal interests, consequently fostering improvements in a firm's environmental efforts. Specifically, state-owned companies face higher regulatory pressure, and they are expected to adhere to ethical accountability while playing influential roles in society by serving a wide range of community stakeholders [56]. In such a case, establishing a strong connection with the government becomes a significant strategy for firms aiming to establish legitimacy [4]. Notably, major Chinese state-owned companies heavily rely on government support to access opportunities related to new product development, including securing approvals for patents and acquiring the necessary financial and other resources for environmental protection initiatives [47]. This reliance on government support enables state-owned enterprises to align with societal expectations, reinforcing their environmental legitimacy, and contributing to a more sustainable and responsible future. Besides, previous studies claim that SOEs' aims are not just focusing profit-generating, however their objective is also meeting demand of society [13,57]. According to Liu, Li [18], a state firm has remained in the best position of implementing state guidelines on the ground, since government has the incentives to utilize the SOEs in order to achieve environmental objectives, and thus make contribution in society. Similarly, Hsu, Liang [55] find a positive link between government ownership and environmental participation by analyzing companies from all over the world. They emphasize the importance of this link in emerging economies, but they fail to show the specific link in advanced economies. They claim that government helps emerging

economies deal with the challenge of enforcing regulations.

On the other hand, non-state-holding companies typically operate as entities within a free-market economy, guided by the principles of rational decision-making [58]. Prior research has demonstrated that these non-state firms exhibit a lesser degree of reliance on external sources of financing, such as government support. Consequently, they tend to be more adaptable and flexible when it comes to making investment decisions [59]. Moreover, the autonomy enjoyed by private owners within these non-state companies allows them to utilize business resources for their personal benefit, rather than for the betterment of society [60,61]. This inclination of non-state companies toward personal benefit translates into a reduced emphasis on environmental protection initiatives [48,62].

In conclusion, SOEs are subject to a number of administrative regulations and mechanisms aimed at improving environmental monitoring and promoting green initiatives. SOEs are required to carry out state mandates through which the government fulfils societal objectives like environmental protection. SOEs therefore should be held to a higher standard than non-SOEs when it comes to fulfilling the country's green development strategy through green investment, which lead us to the following prediction:

Hypothesis (H1). SOEs are more likely to invest in green practices.

2.2. Regional development and green investment

Institutional environments differ depending on where a company is located [63]. In terms of foreign capital, per capita GDP and other indicators, China's central and western areas are considerably less developed than the country's eastern coastal regions [64]. In addition to imbalanced economic growth, different areas of China have varied informal and formal policy mechanisms such as protecting property rights, enforcing contracts and monitoring etc. [29]. Chinese regions generally "retain their own identities, including their cultures, traditions, and sometimes languages. Because of their well-established legal systems, visibility and media exposure, environmental actions are more prominent among enterprises especially in the developed regions [13].

We predict that advanced legal development positively influence green investment. As institutional development progresses, environmental regulation will be more strongly implemented, and administrative procedures become more transparent [65]. In this case, developed region puts enterprises under more regulatory conformity with state's requirement for sustainability practices. The development of market intermediaries, business groups, and communities is also fostered by legislative advancement, which permits them to supervise enterprises' environmentally friendly practices [45]. Moreover, it's noteworthy that top management in advanced regions often faces more stringent scrutiny, which places additional pressure on them to conduct business in a socially responsible manner [58]. This scrutiny arises from the heightened expectations and demands of both the local community and regulatory authorities in these well-developed regions. In this context, Liu, Xi [30] and Marquis and Qian [43] present compelling evidence that organizations situated in developed regions are subject to closer scrutiny compared to their counterparts in less developed areas.

Taken together, a company's geographical position is essential for sustainable actions in China, since enterprises in developed areas experienced higher environmental attention due to information asymmetries and policy-makers' responses to stakeholders' complaints [66]. From the perspective of creditors and investors, a developed region typically offers more robust legal protection, whereas less developed areas contend with comparatively lax legal enforcement, higher risks of expropriation, increased commercial intrusions, and less effective local government oversight [67]. Consequently, the level of sustainable investments, environmental technology and treatment efficiency are weaker and constrained by insufficient total input factors and low-scale efficiency [68]. Environmental governance differences in China's eastern, central, and western regions have been steadily widening, deepening inequalities, and consolidating environmental disparities among these areas [69]. Zhu, Zhu [70] conducted a comparative study on the ecological efficiency of these regions from 2006 to 2015, revealing that the western region lags significantly behind the eastern region in terms of environmental efficiency and carbon emissions. The varying priorities and decisions of local governments across regions further underscore the multifaceted nature of China's regional development policies [71], as they grapple with both social welfare and economic development considerations. Overall, this implies that, due to the government-led management model and the strong influence of administrative power in developed regions, companies would face additional institutional pressure for ensuring environmental safety, driven by both resource allocation dynamics and public expectations regarding ecological matters, which leads us to the following prediction:

Hypothesis (H2). Firms in developed region are more likely to invest in green practices.

2.3. Cross listing and green investment

Institutional pressure on cross-listed companies is also significant, and it has an impact on a company's strategic direction [72]. Cross-listing, as defined by Shi, Sun [29], involves Chinese firms being listed on both domestic and foreign stock exchanges, often issuing H-shares in the process. Cross-listing in countries with robust legal frameworks enables firms operating in weaker investor protection and enforcement environments to make credible commitments to elevated standards of corporate governance. This includes commitments to avoid expropriation of outside investors and self-interesting practices [73]. Since stringent security laws and enforcement make it harder and more costly for controlling shareholders or managers to obtain private benefits, those laws could effectively protect minority investors to exercise their rights and limit their expropriation by controlling shareholders [74]. This evidence is also echoed by Jannasari, Rizki [75], who demonstrates that companies engaged in cross-listings are subject to more extensive foreign investor scrutiny and are constrained by more stringent legal environments. This pressure motivates management to proactively disseminate company information in line with principles of transparency, thereby enhancing the company's international reputation. Specifically, this dual listing exposes enterprises to a diverse array of societal expectations and regulatory frameworks,

which, in turn, accelerates their commitments to social investments [16,76]. Furthermore, cross-listing expands a company's pool of stakeholders and introduces non-financial incentives, fostering reflective thinking and learning processes that can enhance environmental awareness and proactivity [21].

Cross-listing provides businesses with access to information from various institutional settings, including their domestic market and different cross-listing locations. The diversity in corporate mechanisms for internal control and societal goals [77,78] means that, in addition to meeting internationally established requirements, corporations must address local demands and preferences regarding social and environmental initiatives that differ from those in their home country. Lu and Wang [73] also claim that cross-listed firms, navigating the complex institutional frameworks, are encouraged to proactively engage with environmental concerns to align with evolving societal and regulatory demands. This flexibility allows them to adapt and respond effectively to diverse expectations across their markets.

From the opportunity side, international enterprises typically want to improve their profile and recognition, enlarge their investment portfolio, and improve their competitiveness [16,79]. In such scenario, a company's commitment to engage in social activities can be a beneficial strategy for enterprises to manage challenges from multiple stakeholders including investors, customers and policymakers [75,80]. Better socially responsible status demonstrates the company's adherence to institutionalized standards of ethical manner, with favorable consequences for humanity, society's environment, and socially accepted interest expressed by investors and stakeholders. Overall, cross-listed firms are expected to invest in green practices in order to gain legitimacy in international stock markets leading to following hypothesis:

Hypothesis (H3). Cross-listing is positively associated with the green investment of a firm.

2.4. Green investment and financial performance

External forces and internal motivations drive corporate entities to embrace environmental responsibilities, recognizing that environmental stewardship represents a long-term investment for these entities [81]. When a firm excels in its environmental safety practices, it can unlock various advantages, including enhanced credibility, wealth maximization, and value creation [82]. It may also help to improve the brand's reputation, entice customers and employees and eventually improve the company's financial position. Consequently, companies have a vested interest in adopting effective environmental policies, as proactive environmental initiatives offer strategic benefits like cost reduction, improved product and service quality, enhanced corporate reputation, and access to new markets [83]. The configuration of environmental sustainability with corporate strategy is a sound business decision. By recognizing the value of environmental responsibility, companies can create a win-win scenario, improving their own performance and contributing to broader social and environmental goals [84]. Moreover, in a world where environmental concerns are increasingly prominent, companies that lead the way in sustainability stand to gain a competitive edge in the market and secure their positions as responsible corporate citizens. Studies, such as Shabbir and Wisdom [85] and Lee [86] highlight the significance of environmental and social activities in building strong relationships with stakeholders. They establish that this connection underscores the broader trend where enterprises increasingly recognize the benefits of integrating environmental and social responsibility into their core strategies, resulting in both positive financial outcomes and enhanced relationships with their various stakeholders.

Prior research suggests that environmental efforts have an important influence in a variety of domains, thus enterprises must react to stakeholders' increasing concerns [87]. Companies increase their financial performance by growing popularity, operating efficiency, and capturing new prospects by encouraging sustainable investments [88]. Green investments helps to facilitate sustainable future and alleviate environmental concerns, lead to shifts in consumer psychology, with more individuals opting for organic over traditional products [87]. When a company demonstrates its commitment to environmental stewardship, it can earn the trust and loyalty of customers, employees, and investors [89]. This trust translates into customer retention, as well as attracting new customers who seek socially and environmentally responsible brands. Moreover, green investments help businesses prepare for future regulatory changes. As environmental regulations become increasingly stringent, companies that have already implemented sustainable practices are better positioned to comply with these requirements. They are less likely to face fines or operational disruptions due to non-compliance, further protecting their financial stability [90]. Thus businesses and other concerned parties would seek investment opportunities in firms making environmental investment [91]. Based on the above discussion, it can be expected that firms will pay much more attention to the environmental investment in order to gain financial benefits, which leads to the following hypothesis:

Hypothesis (H4). Green investment improves corporate financial performance.

2.5. Chinese institutional environment and performance outcome of green investment

Subnational institutional characteristics can moderate the link between green investment and firm performance. First, China's economic and social progress is dependent on SOEs [17]. The government takes a primary interest in environmental practices, and because of the special connection between SOEs and the government, SOEs should take on greater environmental obligations and enhance their environmental investment. When there are incidences of environmental pollution, state-owned firms are usually obliged to pay larger compensation [18].

Non-SOEs are comparatively market based corporations; they often determine whether to publish environment related information or not. Due to resource and environmental constraints, the general public and the government devote increasing attention to environmental issues in SOEs as compared to non-SOEs [2]. According to Jin and Xu [92], state enterprises face more substantial pressure from both the government and the public in comparison to non-state owned enterprises. This heightened pressure increases the

likelihood of SOEs adopting proactive environmental strategies, which in turn, significantly influencing a company's environmental practices. In addition, prior research claims that the government aids state enterprises for their societal contributions [93], which may come in the form of subsidies, tax incentives, or preferential financing terms, enabling SOEs to get better economic outcomes [30]. Montabon, Sroufe [94] also support this view by highlighting that environmental performance can lead to good financial performance when the enterprises implement proactive environmental management. Therefore we expect that the positive incentives to undertake sustainability objectives are becoming highly significant for SOEs than non-SOEs leading to the following hypothesis:

Hypothesis (H5a). The positive impact of green investment on financial performance is stronger in SOEs than in non-SOEs.

The government enforces distinct environmental protection policies for companies based on their respective regions. In developed regions, the government places a stronger emphasis on regulating corporate environmental protection practices over economic development. In contrast, for companies situated in less developed regions, the government's primary role is to drive local economic growth and address societal welfare concerns [92]. Consequently, businesses in these areas often lack environmental awareness, contributing to adverse environmental conditions and increased pollution levels. On the other hand, companies in developed regions usually enjoy faster growth and stronger capabilities of technological innovation. They often invest more in environmental protection, respond to government environmental policies, and reduce the waste of resources [30]. In less developed regions, companies may not be able to quickly acquire advanced production technologies, because firms' social engagement in those areas is strongly reliant on slack resources [78]. In addition, managers of companies in less developed regions may lack the understanding of environmental issues and need to pay a large amount of money for environmental protection, which affects the financial performance of these companies [95]. More importantly, CEOs in advanced regions confront more effective inspection that may exert additional pressure on top management to behave in socially beneficial manner [58]. They contend that senior management invests in welfare programs for getting benefits in sense of reputation enhancement and greater incentives with improvement of economic performance. Based on these arguments, we make the following prediction:

Hypothesis (H5b). The positive impact of green investment on financial performance is stronger in firms of developed regions than from firms in less developed regions.

Normative drivers play a crucial role in urging organizations to fulfill social expectations and obligations, which are integral to their survival and prosperity [96]. The institutional theory is often employed as a theoretical framework for comprehending why organizations, both in developed and developing countries, adopt environmental management practices. This choice is guided by the understanding that institutional pressures concerning environmental safety from external entities can differ across international markets [41,97]. To establish legitimacy in international stock markets, cross-listed companies may adhere to socially formed values, beliefs, and standards [98]. These companies are more responsive to legal and regulatory requirements, as well as shareholder protection [99], and are therefore more likely to perform effectively in terms of social and environmental concerns. Non-cross-listed companies, on the other hand, are not bound by the same regulations. However, they engage in green practices in order to meet financial objectives, and they are more concerned with cost–benefit analyses than with normative pressures [100]. We therefore assume that the positive incentive to make environmental investment is more significant for non-cross-listed than cross listen firms, which leads to the following hypothesis.

Hypothesis (H5c). The positive impact of green investment on financial performance is weaker in cross-listed firms than in domestic firms.

The main hypotheses are concisely outlined in Fig. 1. Specifically, our contention is that institutional factors will have an impact on
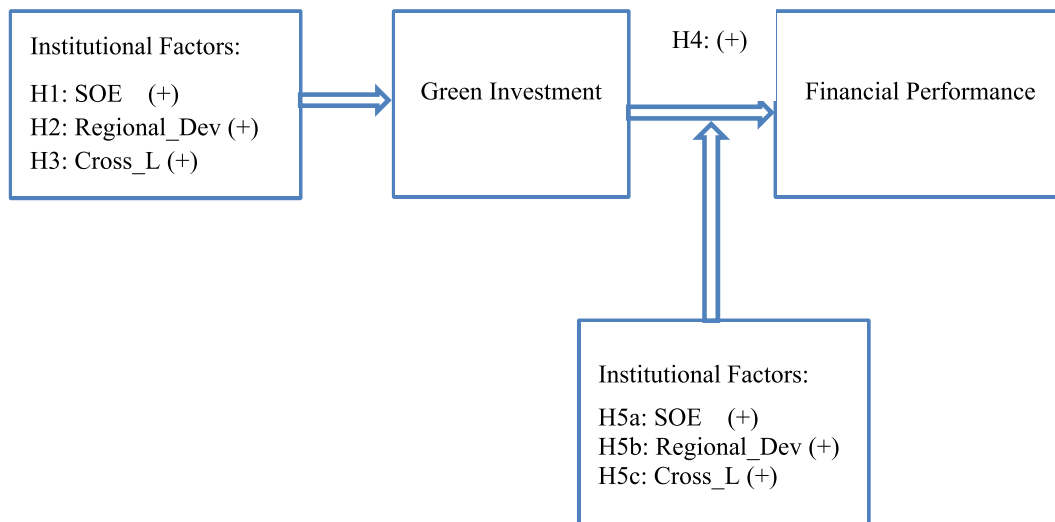

Fig. 1. The institution-based view of green investment.

both the factors leading to green investment and the financial outcomes associated with it.

3. Methodology

3.1. Sample

This research uses Chinese companies trading in Shanghai and Shenzhen stock exchanges over the period 2012–2019. Because most publicly traded firms announced green investment in 2012, we selected 2012 as the beginning point for our data sample. To obtain data on the study's variables, we employed different data sources. We collected data on the study's variables from various sources. Green investment data came from annual CSR and sustainability reports, while independent and control variables were obtained from the China Stock Market and Accounting Research (CSMAR) database, which is considered a reliable data source in China [2,60]. We excluded companies that did not disclose environmental expenditures in their financial statements, companies with missing information, and special treatment companies. Finally, we combined firm-year observations with complete information on all the explanatory variables used in the analysis. This process yielded a useable sample of 5347 observations, which we employed to examine the connection between sub-national institutional contingencies and green investment performance.

3.2. Measures

3.2.1. Dependent variable

This research uses green investment (GI) as a dependent variable. Green investment is measured in Yuan units (particularly in millions), and particularly refer to corporate investments in environmental protection to alleviate environmental pollution. Green investment data is carefully gathered from each company's "Sustainable Development" and "CSR" reports. In addition, we use return on assets ratio (ROA) to express the corporate financial performance measured as dividing the net profit on total assets [49,101].

3.2.2. Independent variables

The independent variables are subnational institutional factors. Consistent with prior research [16,17,27,63,79], this study measures institutional contingencies as state owned enterprises (SOE), regional development (Regional_Dev) and cross listing (Cross_L). Specifically, SOEs refer to those enterprises where state is a controlling shareholder and we assign 1 for enterprises where state is the controlling owner, and 0 otherwise. Regional development (Regional_Dev) is measured based on developed and less developed regions of China. This study assigns 1 if a company head office is in developed region and 0 otherwise. Similarly, we assign 1 for cross listed companies (Cross_L) if their shares are also listed in Hong Kong stock exchange known as H-share, and 0 otherwise.

3.2.3. Control variables

Our study consider several corporate level characteristics to control their effects. For instance, different governance factors has taken into consideration such as board size (B_Size) that is measures as number of directors working on corporate boards. Studies have established that larger boards are powerful and conducive to better participation and supposed to be efficient at supervising corporate management, therefore, resulting in effective decision making [58]. Independent and foreign members on board usually do more respect of institutional and regulatory policies [102], thus we control the effect of number of independent directors (Ind_D) and number of foreign directors (Foreign_D) on green investment. Previous studies also claimed that duality of CEOs status also matter for social and environmental outcomes due to decisional power [17]. Thus we consider CEO duality (Duality), which is expressed by dummy approach that equals 1 if CEO also holds chairman position and 0 otherwise.

Regarding other firms' factors, this research includes firms age (Age) because younger entities are expected to spend in social goals [43] thus we measure Age as the number of year a company is listed on stock exchange. Moreover, because larger corporations receive additional media coverage than smaller corporations [60] and such companies have greater resources, we thus control for firm size (Size) that is measured by taking natural log of total assets; and firms' growth (Growth) that indicates changes in total assets over a

Table 1
Descriptive statistics.

Variable	N	Mean	Std. Dev.	Min	Max
GI	5347	26.387	66.346	0	509.75
SOE	5347	.606	.489	0	1
Regional_Dev	5347	.692	.462	0	1
Cross_L	5347	.142	.349	0	1
B_Size	5347	11.153	3.187	4	26
Ind_D	5347	4.207	1.422	2	13
Foreign_D	5347	.234	.688	0	8
Duality	5347	.186	.389	0	1
ROA	5347	.039	.066	−1.081	.669
Age	5347	17.6	5.475	1	39
Size	5347	23.389	1.77	18.491	30.952
Growth	5347	.165	.731	−.972	47.927
Lev	5347	.515	.218	.008	2.302

Table 2

VIF and Pearson correlation tests.

Variables	VIF	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
(1) GI		1.000												
(2) SOE	1.91	0.085[a]	1.000											
		(0.000)												
(3) Regional-D	1.05	0.060[a]	−0.102[a]	1.000										
		(0.000)	(0.000)											
(4) Cross_L	2.16	0.068[a]	0.176[a]	0.117[a]	1.000									
		(0.000)	(0.000)	(0.000)										
(5) B_Size	1.22	0.029[a]	0.196[a]	−0.036[a]	0.210[a]	1.000								
		(0.031)	(0.000)	(0.007)	(0.000)									
(6) Ind_D	1.05	0.018	0.116[a]	−0.037[a]	0.167[a]	0.805[a]	1.000							
		(0.177)	(0.000)	(0.006)	(0.000)	(0.000)								
(7) Foreign_D	1.04	−0.011	−0.097[a]	0.118[a]	0.135[a]	0.157*	0.146*	1.000						
		(0.433)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)							
(8) Duality	1.15	−0.039[a]	−0.260[a]	0.072[a]	−0.067[a]	−0.112*	−0.057*	0.071*	1.000					
		(0.004)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)						
(9) ROA	1.31	0.005[a]	−0.033[a]	0.011	−0.024	−0.054[a]	−0.042[a]	0.001	0.044[a]	1.000				
		(0.032)	(0.015)	(0.409)	(0.095)	(0.000)	(0.002)	(0.957)	(0.001)					
(10) Age	1.06	−0.001	0.075[a]	0.023	0.082[a]	0.104[a]	0.028[a]	0.019	−0.053[a]	−0.036[a]	1.000			
		(0.920)	(0.000)	(0.092)	(0.000)	(0.000)	(0.036)	(0.163)	(0.000)	(0.008)				
(11) Size	1.93	0.154[a]	0.227[a]	0.101[a]	0.445[a]	0.381[a]	0.319[a]	0.200[a]	−0.102[a]	−0.056[a]	0.155[a]	1.000		
		(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000			
(12) Growth	1.02	−0.014	−0.052[a]	−0.008	−0.020	0.009	0.011	0.018	0.018	0.028[a]	−0.003	0.038[a]	1.000	
		(0.287)	(0.000)	(0.577)	(0.155)	(0.520)	(0.419)	(0.179)	(0.187)	(0.041)	(0.836)	(0.005)		
(13) Lev	2.04	0.067[a]	0.183[a]	−0.011	0.188[a]	0.250[a]	0.195[a]	0.072[a]	−0.091[a]	−0.233[a]	0.165[a]	0.603[a]	0.024	1.000
		(0.000)	(0.000)	(0.406)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.080)	

[a] denotes significance at the 0.05 level.

year. Finally, leverage ratio is added (Lev), because it is expected that with high amount of leverages, companies can be unlikely to make investment in environmental practices [103].

3.3. Descriptive statistics and correlations

Table 1 portrays statistics for all the variables used in this study. Specifically, the mean value of green investment (GI) indicates that on average, the annual investment of Chinese listed companies in environmental protection is about twenty six millions (RMB). Regarding the explanatory variables, the summary statistics highlights that on average, 60% companies are controlled by state owners. In addition, Table 1 provides evidence that 69% Chinese companies are located in developed regions of China. As to cross listed companies, the statistics indicates that 14% firms among the sample are those who are also listed in Hong Kong stock exchange that issue H-shares.

To detect potential multicollinearity issue among variables, we estimate variance inflation factor (VIF) test for which the results are reported in Table 2. The maximum value of VIF is obtained for cross listing (2.16) and the mean VIF is 1.41. Taken together, all the variables' VIF values are below the standard value (>5), which provide evidence of a low variance inflation factor [49]. Table 2 also presents Pearson correlation among the study's variables. The coefficients of all the estimated variables are lower than 0.60 that propose that all the variables are sufficiently independent from each other [104]. Additionally, the correlation results indicate that subnational institutional factors such as "SOE, regional development and cross listing" are positively and significantly associated with green investment, providing the initial evidence that institutional contingencies can lead to better environmental outcomes.

3.4. Statistical model

Current research in corporate finance, especially within the field of governance framework has raised questions about the unobserved heterogeneity [2,60,79]. To deal with unobserved heterogeneity, fixed-effect analysis has usually been applied. This pattern led us to choose fixed-effect estimates as our main model because we think that although green investment preferences may differ from firm to firm, they remain constant during study period. The unidentified time-unvarying heterogeneity may have an impact on both the decisions related to institutional factors and green investment. Moreover, a fixed-effects model permits the removal of such unobserved heterogeneity without identifying its source [79]. In contrast, pooled ordinary least squares (OLS) estimations don't account for unobserved heterogeneity in the same way. They treat all observations as if they are drawn from the same population, which can lead to biased estimates if unobserved heterogeneity is present. So, using a fixed-effects model is a more rigorous statistical approach that better controls for the unique characteristics of individual firms and their impact on dependent variable. Thus we preferred to utilize fixed effect model to quantify the impact of sub-national institutional contingencies (SNIC) on green investment and the green investment impact on financial performance (FP). Our study also analyze the moderating role of institutional contingencies in the green investment-financial performance nexus.

To study the linkages between institutional characteristics, green investment and financial performance, equations (1) and (2) highlight empirical models.

$$GI_{it} = \alpha + \beta_1 SNIC_{it} + \sum_{i=1}^{n} \beta_n F\_Control_{it} + \varepsilon_{it} \tag{1}$$

$$ROA_{it} = \alpha + \beta_1 GI_{it} + \sum_{i=1}^{n} \beta_n F\_Control_{it} + \varepsilon_{it} \tag{2}$$

Where GI is dependent variable indicating green investment in equation (1); SNIC indicates subnational institutional contingencies that expresses SOEs, regional development and cross listing. In equation (2), ROA is dependent variable reflecting corporate financial performance that is regressed with GI. F_Control represents all the control variables used in this study.

We further employ the split-sample approach to assess the moderation roles of SNIC on the link between green investment and firm performance.

4. Results and discussion

Before explaining the findings of the study's hypotheses, we first report the results of all the control variables in Model 1 to isolate their effects on green investment. Except for a few control variables like board size, growth, and leverage, every other control variable has an influential impact on green investment. Specifically, the governance variable like independent (Ind_D) and foreign directors (Foreign_D) positively influence corporate green investment. The presence of the mentioned directors on board do more care about their reputation, thus respect the stakeholder's demands. Besides, the CEO's dual job role (Duality) decreases the companies' likelihood to invest in environmental practices, because dual status makes them more powerful that may affect corporate non-financial activities [102]. We also find negative effect of firm's age (Age) on green investment, suggesting that elder firms restrict their investments in non-financial matters. Finally, the positive coefficient of the company's size (Size) suggest that it increases firms' intensity toward environmental investment because larger companies usually secure sufficient financial resources and such companies are more visible to the stakeholders.

Next we explain the findings about the proposed hypotheses, which are as follows:

4.1. Subnational institutional contingencies and green investment

Table 3 summarizes the results of the estimating models. The results of the hypothesis (H1), which assumes that state owned enterprises (SOEs) are more obligated to engage in environmental protection are presented in the Model 2. In favor of H1, we find positive and significant coefficient (β = 4.117, p < 0.05) for SOEs, confirming that state enterprises tend to make more green investment. The above outcome is due to the fact that the state-owned firm has a unique status; it is responsible for not only economic growth but also for enforcing appropriate environmental protection laws, policies, and guidelines [13,57]. The government is expected to encourage state-owned enterprises (SOEs) to increase their investments in environmental stewardship because these enterprises heavily depend on government support for their environmental protection initiatives [47]. Being dependent on government assistance enables state-owned enterprises to conform to social norms, reinforcing their environmental legitimacy and contributing to a more sustainable and responsible future. Our findings also align with the perspective presented by Liu, Li [18], which suggest that state-owned enterprises are well-positioned to implement government guidelines effectively. The government has a strong incentive to leverage SOEs to achieve environmental objectives, making them significant contributors to society.

Model 3 shows the findings of our second hypothesis (H2), which predicts that regional development (Regional_Dev) will have a positive impact on company green investment capacity. In line with this proposition, this study finds positive and significant coefficient (β = 8.231, p < 0.01) for Regional_Dev in Model 3, showing that companies located in developed regions are more associated with environmental practices such as green investment. The underline reason for this relationship can be the different regulatory environment for companies they face in different regions; their feedbacks to environmental obligation will be different. Along this, companies in areas of higher levels of economic development may see noticeable reactions from institutional forces that may compel them to meet environmental obligations [58]. In developed regions, local governments impose more stringent regulations on companies to ensure compliance with state-mandated sustainability practices. This closer monitoring, as emphasized by Liu, Xi [30] and Marquis and Qian [43] significantly impacts the social and environmental behavior of organizations situated in developed regions when compared to their counterparts in less developed areas.

Model 4 document findings regarding the third hypothesis (H3) of this study. The coefficient value of Cross_L in Model 4 is positive and significant (β = 7.129, p < 0.05), which affirms that there is positive relationship between firm's cross listing and its green investment. This outcome can be explained with this fact that cross-listing is often accompanied by greater surveillance and corporate governance standards. Alternatively, cross-listing encourages foreign companies to "bind" themselves to greater stakeholder protection and governance norms [73]. As a result, cross-listing should attract international enterprises to improve their green performance through effective governance by adhering to international regulatory requirements, increased reputation among investors and

Table 3
Subnational institutional contingencies and green investment (Fixed effects).

GI		Subnational institutional contingencies		
	Model 1	Model 2	Model 3	Model 4
SOE	–	4.117**	–	–
		(2.090)		
Regional_Dev	–	–	8.231***	–
			(4.095)	
Cross_L	–	–	–	7.129**
				(2.509)
B_Size	−0.115	−0.211	−0.126	−0.640
	(−0.235)	(−0.418)	(−0.253)	(−1.219)
Ind_D	0.973*	0.866*	1.150	1.273*
	(1.822)	(1.807)	(1.073)	(1.738)
Foreign_D	3.341**	2.758**	2.440*	1.148*
	(2.537)	(2.057)	(1.823)	(1.839)
Duality	−3.882*	−3.130*	−3.388	−3.989*
	(−1.676)	(−1.706)	(−1.435)	(−1.690)
Age	−0.327*	−0.395**	−0.348*	−0.402**
	(−1.777)	(−2.099)	(−1.858)	(−2.067)
Size	9.717***	7.227***	8.603***	7.897***
	(13.216)	(8.005)	(10.184)	(9.619)
Growth	−0.725	−0.832	−0.837	−0.372
	(−0.610)	(−0.689)	(−0.699)	(−0.306)
Lev	−2.815	−2.047	−5.439	−10.893*
	(−0.518)	(−0.321)	(−0.947)	(−1.929)
Constant	−18.757***	−17.742***	−17.384***	−16.803***
	(−11.561)	(−8.809)	(−9.551)	(−7.762)
Observations	5347	5347	5347	5347
R-squared	0.81	0.088	0.089	0.072
Year & Industry Dummies	Yes	Yes	Yes	Yes

This table portrays findings of fixed effect model regarding the baseline relationship between sub-institutional contingencies (SOEs, regional development and cross listing) and green investment. T-statistics are highlighted in parentheses. ***, **, * denotes significance level at 1, 5 and 10 %, respectively.

stakeholders, and enhanced competitive edge to offset the cost of foreignness. Previous research has also suggested that cross listing exposes companies to a wide range of societal expectations and regulatory frameworks, subsequently driving them to increase their commitment to social investments [16,76]. Additionally, cross-listing broadens a company's stakeholder base and introduces non-financial motivations, promoting reflective thinking and learning processes that can enhance environmental awareness and proactive initiatives [21]. Because of these possible benefits of improved environmental performance, cross-listed firms are more inclined than their domestic counterparts to make larger green investments.

4.2. Green investment, financial performance and subnational institutional contingencies

Table 4 exhibits findings about the fourth (H4) and fifth (H5) hypotheses in which we aims to explore the effect of green investment on financial performance. In particular, Model 1 displays that there is positive relationship between corporate green investment and its financial performance ($\beta = 0.003$, $p < 0.05$) that is significant at 5 % level. The finding suggests that firms who invest in the environmental protection have much better financial performance, providing support to Hypothesis 4. Investing in environmental protection implies that the corporate entity has taken on and attained its environmental policies, demonstrated a positive image of social welfare consciousness to the community, and thus received policy support from regulatory bodies. Investors would prefer to offer more low-cost and long-term funding to firms due to the lower information asymmetry, and the public usually pay for goods and services because of their positive societal image. Prior evidences suggest that companies may exhibit higher motivation to implement effective environmental policies, given that proactive environmental initiatives bring about strategic advantages such as cost reduction, enhanced product and service quality, an improved corporate reputation, wealth maximization, and value creation [82,83]. Acknowledging the importance of environmental responsibility, companies can establish a mutually beneficial situation, enhancing their own performance while simultaneously contributing to broader social and environmental objectives [84]. Furthermore, the financial benefits of effectively performing environmental and social duties have to outweighed the firm's green investment as the cost of breaking environmental regulations and rules is becoming higher.

Next, we propose that the financial outcome of green investment can be different in different corporate institutional environment. Against this premise, we explore the GI-ROA link in SOEs and non-SOEs. The Model 2 highlights findings of subsample of SOEs in which the coefficients of GI is positive and significant ($\beta = 0.002$, $p < 0.05$). While Model 3 reports insignificant result for GI in non-SOEs ($\beta = 0.001$, $p > 0.10$). These findings conclude that the positive relationship between green investment and financial performance is stronger in SOEs than in non-SOEs, supporting Hypothesis (5a). Compared with non-SOEs, SOEs have a stronger intensity to satisfy green objectives because of increased stakeholders' attention towards SOEs and more governmental involvement in their strategic decisions [93]. Besides, SOEs address additional environmental commitments as they may expect to receive more government assistance in financial distress and market recognition [13]. They understand that environmental stewardship is not only an ethical obligation but also a strategic decision that can positively impact their financial outcomes.

Table 5 displays findings about the moderating role of regional development (Hypothesis 5b) and cross listing (Hypothesis 5c) in

Table 4
Green investment and financial performance (Fixed effects).

ROA	Full Sample	SOEs	Non-SOEs
	Model 1	Model 2	Model 3
GI	0.003**	0.002**	0.001
	(2.425)	(2.461)	(1.059)
B_Size	−0.001**	−0.001**	−0.001
	(-2.412)	(-2.289)	(-1.640)
Ind_D	0.001	0.002**	0.000
	(1.071)	(2.079)	(0.026)
Foreign_D	0.001	0.001	0.000
	(0.834)	(0.867)	(0.247)
Duality	0.004**	0.007***	−0.001
	(1.990)	(2.685)	(-0.432)
Age	0.000	0.000	0.000*
	(1.412)	(0.107)	(1.674)
Size	0.014***	0.011***	0.019***
	(20.990)	(15.515)	(15.041)
Growth	0.009***	0.026***	0.006***
	(8.342)	(11.166)	(4.130)
Lev	−0.155***	−0.132***	−0.186***
	(-32.216)	(-25.555)	(-20.750)
Constant	0.032***	0.030*	0.025*
	(3.621)	(1.706)	(1.781)
Observations	5347	3254	2093
R-squared	0.290	0.335	0.298
Year and Industry Dummies	Yes	Yes	Yes

This table reports findings of fixed effect model about the relationship between green investment and financial performance. T-statistics are highlighted in parentheses. ***, **, * denotes significance level at 1, 5 and 10 %, respectively.

the relationship of GI and ROA. The coefficients value of GI in Model 4 (β = 0.005, p < 0.01) and Model 5 (β = 0.002, p < 0.05) corresponds to its effect on financial performance in developed and less developed regions, significant at 1 % and 5 % level respectively. Both models show positive relationship between GI and ROA, but there is significant differences between both coefficients. These findings confirm our Hypothesis (5b) and suggest that the impact of green investment on ROA is more significant in firms of developed region. The aforementioned findings suggest that the eastern region's trend of green investment has resulted in a strong positive feedback effect, in contrast to the less developed regions. Environmental protection regulations and laws are implemented and supervised by local governments in developed regions, who also offer subsidies for environmental protection and tax incentives to firms that are environmentally responsible. However, given the government's insufficient economic resources in less developed regions [92], similar compensations for firms that bear greater environmental duties are not possible. So that the environmental compensation received will be less than the cost, lowering the financial performance of the company located in less developed region.

The Model 6 and 7 in Table 5 report findings for cross listed and non-cross listed firms. The coefficients value of GI in both models are positive (β = 0.001, p < 0.05; β = 0.007, p < 0.01). However, the positive outcomes for cross listed and non-cross listed firms in Model 6 and 7 are significant at 5 % and 1 % significance level respectively. The significant differences in both outcomes conclude that the positive impact of green investment on financial performance is stronger for non-cross listed firm as compared to its counterparts. The reason for these results is that cross-listed firms are under pressure for environmental issues due to sophisticated supervisory systems and severe rules. To establish legitimacy in international markets, cross-listed companies usually comply with internationally accepted social values, beliefs, and standards [80,98]. These companies are legally bound to perform effectively in terms of social and environmental concerns. Whereas domestic firms are free of institutional pressure and are not bound by as such stringent regulations. Thus they engage in green initiatives for their own interest. In a nutshell, non-cross listed firms are more concerned with cost–benefit analyses rather than with institutional pressures.

4.3. Endogeneity tests using GMM and PSM

Our main evidences on institutional contingencies, green investment and financial performance can be misled due to possible endogeneity issue. In order to handle different forms of endogeneity like reverse causality, we applied dynamic panel data analysis, specifically the Generalized Method of Moments (GMM). The primary rationale for using GMM is to relax the strict exogeneity requirement, which is not the case when using OLS and fixed-effect regressions. Several recent studies including Nguyen, Locke [105] and Sheikh [106], have highlighted additional types of endogeneity, such as dynamic endogeneity, which occurs when the current values of independent variables are influenced by their past performance. In our scenario, it is conceivable that the firm's current listing and ownership pattern, like firms' cross-listing in international stock exchanges and increasing state ownership, etc.—is due to its prior performance. Wintoki, Linck [107] claim that GMM tackles the dynamic endogeneity by permitting the present governance pattern to be influenced by its prior performance. GMM analysis has the advantage of being robust method because it incorporates

Table 5
The role of regional development and cross listing in GI-ROA link (Fixed effects).

ROA	Regional_Dev = 1	Regional_Dev = 0	Cross_L = 1	Cross_L = 0
	Model 4	Model 5	Model 6	Model 7
GI	0.005***	0.002**	0.001**	0.007***
	(3.031)	(2.210)	(2.447)	(2.781)
B_Size	−0.001**	−0.001	−0.001*	−0.001*
	(-2.296)	(-1.028)	(-1.865)	(-1.939)
Ind_D	0.002*	0.002	0.002	0.002
	(1.911)	(1.455)	(1.579)	(1.606)
Foreign_D	0.004***	−0.001	0.037	0.075***
	(2.910)	(-0.169)	(1.507)	(4.422)
Duality	0.001	0.002	0.002	0.002
	(0.327)	(0.408)	(0.552)	(0.753)
Age	0.000**	−0.000	−0.000	−0.000*
	(2.556)	(-0.265)	(-0.614)	(-1.797)
Size	0.000***	0.000***	0.008***	0.006***
	(2.746)	(6.446)	(6.990)	(6.563)
Growth	0.033***	0.004***	0.036***	0.016***
	(12.531)	(3.618)	(5.521)	(5.960)
Lev	−0.120***	−0.160***	−0.175***	−0.123***
	(-25.922)	(-19.538)	(-16.643)	(-19.190)
Constant	0.106***	0.160***	0.094***	0.128***
	(20.027)	(17.757)	(13.204)	(12.763)
Observations	3702	1645	978	4144
R-squared	0.199	0.293	0.424	0.253
Year & Industry Dummies	Yes	Yes	Yes	Yes

Note: Table 5 reports result of fixed effect model for sub-sample of firms located in developed and less developed regions, cross listed and non-cross listed, which shows their moderating effect on GI-ROA relationship. T-statistics are documented in parentheses. ***, **, * denotes significance level at 1, 5 and 10 %, respectively.

internal instruments from the panel itself, such as lag values of the variables. GMM estimation was employed by the recent studies of Nguyen, Locke [105] and Barros, Bergmann [108] in which they suggest that it is the most suitable and reliable approach for governance studies.

Table 6 shows the regression results of the GMM model for the relationship between institutional factors, green investment and financial performance. Model 1 of Table 6 reports that the coefficient of SOE is positive and significant ($\beta = 0.113$, $p < 0.01$), which confirmed our baseline results. In addition, the value of AR(1) is significant ($p = 0.000$) indicating that there is no autocorrelation in the first difference, while the value of AR(2) is insignificant ($p = 0.310$), confirming that the error terms in the level regressions were not significantly correlated. Moreover, the Sargan test's p-value in Table 5 is statistically significant ($p = 0.000$), whereas the Hansen test's P-value is insignificant ($p = 0.836$).

Model 2presents positive and significant results about regional development and green investment ($\beta = 0.069$, $p < 0.10$). The AR(1) results ($p = 0.000$) confirms that there is no autocorrelation issue in the first difference, while AR(2) is insignificant ($p = 0.170$), that depicts that the error terms were not correlated. In addition, the Sargan test's p-value for Model 2 is significant ($p = 0.000$), but the Hansen test's p-value is not significant ($p = 0.375$).

Model 3 of Table 6 also confirms our main evidence regarding cross listing and green investment with significant results ($\beta = 0.088$, $p < 0.01$). The results of AR(1) tackles the autocorrelation issue by providing favorable results ($p = 0.000$), and value of AR(2) claims that there is no issue in the error terms ($p = 0.270$). Also, the Sargan test's p-value is significant ($p = 0.000$) and the p-value of Hansen test is insignificant ($p = 0.180$).

Finally, the Model 4 presents the GMM findings regarding the relationship between green investment and financial performance. The results of Model 4 are positive and significant ($\beta = 0.32$, $p < 0.05$) supporting one of our main evidence about GI and ROA. As to AR (1), the result is significant ($p = 0.000$), confirming no issue of autocorrelation. However, the AR(2) also confirms that there is no issue in the error term ($p = 0.143$). Moreover, the Sargan test's p-value is significant ($p = 0.000$) and the p-value of Hansen test is

Table 6
Endogeneity test using GMM.

GI	Subnational institutional contingencies			
	Model 1	Model 2	Model 3	Model 4 (ROA)
SOE	0.113***		–	–
	(3.390)			
Regional_Dev	–	0.069*		–
		(1.730)		
Cross_L	–	–	0.088***	–
			(2.813)	
GI				0.32**
				(2.213)
B_Size	−0.010	−0.003	−0.002	−0.440
	(-1.310)	(-0.36)	(-0.314)	(-0.019)
Ind_D	−0.005	−0.005	−0.150	1.203
	(-0.371)	(-0.31)	(-0.073)	(1.038)
Foreign_D	0.009	0.015	0.140	1.143*
	(0.400)	(0.690)	(0.823)	(1.739)
Duality	−0.095**	−0.061	−1.388*	−1.009*
	(-2.531)	(-1.593)	(-1.735)	(-1.700)
Age	−0.006	−0.002	−0.142	−0.102
	(-1.590)	(-0.654)	(-1.108)	(-0.037)
Size	0.007	−0.015	−0.032	0.497
	(0.460)	(-0.723)	(-1.641)	(1.619)
Growth	−0.025	−0.006	0.014	−0.302
	(-1.010)	(-0.192)	(0.799)	(-0.701)
Lev	0.312	0.235	0.370**	−1.293*
	(-0.241)	(1.071)	(2.327)	(-1.889)
L_GI	0.281***	0.693***	0.645***	–
	(12.132)	(31.243)	(34.684)	
L_ROA	–	–	–	1.380***
				(4.392)
Constant	−1.757**	0.702	1.008***	−1.803***
	(-2.561)	(1.461)	(2.693)	(-3.032)
AR(1): z-value	−7.600	−7.733	−6.821	−5.110
p-value	0.000	0.000	0.000	0.000
AR(2): z-value	1.260	1.361	1.125	1.460
p-value	0.310	0.170	0.270	0.143
Sargen Test: Chi^2 value	336.681	3697.91	3423.68	3014
p-value	0.000	0.000	0.000	0.000
Hansen Test: Chi^2 value	45.242	189.41	192.02	166.210
p-value	0.836	0.375	0.180	0.246

This table portrays findings of GMM model regarding the relationship between institutional factors, green investment, and ROA. T-statistics are highlighted in parentheses. ***, **, * denotes significance level at 1, 5 and 10 %, respectively.

insignificant (p = 0.246). Overall, our baseline findings were consistent and robust, which meant that an endogeneity problem was not likely to exist.

Secondly, it is also possible that our main conclusions may be biased due to self-selection problems. Under this assumption, the characteristics of a more environmentally conscious firm (which invest more in environmental protection) and a less environmentally conscious firm can be differ that can lead to different conclusions for firms to be concerned about green investment. In such a case, one may argue that companies invest in environmental protection activities because of the different characteristics of companies rather than subnational institutional factors. Also, companies may perform better due to corporate level attributes regardless of green investment. In order to tackle this issue, we used dummies for GI and ROA, assigning 1 if a company's green investment and ROA is above the industry median, and 0 otherwise, and matched the companies using a propensity score matching (PSM) method based on companies characteristics considered in this study.

Table 7 portrays results for the effect of subnational institutional contingencies on GI by using PSM technique. Consistent with the initial evidence, we find that institutional factors (i.e., SOEs, regional development and cross listing) positively and significantly influence corporate green investment. These findings are similar with the previous findings reported in Table 3, thus validated the proposed hypotheses on the role of institutional factors in green investment.

Similarly, in Table 8 we find that green investment significantly promotes financial performance, and this relationship is stronger for SOEs, developed region and non-cross listed companies as consistent with Tables 4 and 5 Overall, the PSM results are similar with our baseline findings, which concludes that our main outcomes are not driven by the corporate level factors.

5. Discussion and implications

The logic for this study is found in the institutional theory. In line with institutional theory, our study implies that institutional factors play an imperative role in green investment. Institutional theory claims that firms are influenced by external pressures for adherence, compliance, and limiting organizational behaviors. Firms should consider socially approved principles while developing their green initiatives, and they must recognize and manage several sorts of institutional logic that bring concurrent demands [109]. The theory further suggest that firms in different institutional setting have different societal goals as a result of various formal factors such as corporate ethical practices, legal restrictions, and values [110]. Consistent with this notion, institutional forces appear to be more prominent for SOEs, developed regions' firms and cross listed firms, since they operate in a distinct and more severe regulatory environment. More specifically, our findings indicate that SOEs, regional development and cross listing are significant institutional drivers, which sensitize the corporate investments in environmental protection. This institutional perspective employed in this research concludes that green investment is purely a reflection of and sensitive to the consequences of informal and formal institutions

Table 7
Endogeneity test using Propensity score matching (PSM).

GI	Subnational institutional contingencies		
	Model 1	Model 2	Model 3
SOE	0.337**	–	–
	(6.112)		
Regional_Dev	–	0.107**	–
		(2.170)	
Cross_L	–	–	0.187**
			(2.291)
B_Size	−0.010	−0.020	−0.011
	(-0.090)	(-0.015)	(-1.240)
Ind_D	0.001	0.007	0.102
	(0.762)	(0.341)	(0.836)
Foreign_D	0.110***	0.088***	0.099**
	(3.343)	(2.738)	(2.207)
Duality	−0.174***	−0.234***	−0.152*
	(-2.730)	(-3.660)	(-1.732)
Age	0.008	0.001	0.000
	(0.662)	(0.352)	(0.534)
Size	0.820***	0.147***	0.191***
	(6.009)	(7.589)	(5.811)
Growth	0.005	0.030	0.006
	(0.902)	(1.302)	(0.630)
Lev	0.023	0.11	−0.186
	(0.099)	(0.146)	(-0.340)
Constant	−6.112***	−5.042***	−2.935***
	(-9.561)	(-10.721)	(-6.601)
Observations	5347	5347	5347
R-squared	0.128	0.120	0.105
Industry & Year Dummies	Yes	Yes	Yes

This table portrays findings about the relationship between institutional factors and green investment by applying Propensity Score Matching (PSM) technique. T-statistics are highlighted in parentheses. ***, **, * denotes significance level at 1, 5 and 10 %, respectively.

Table 8
Green investment and corporate financial performance (Using PSM).

ROA	Full Sample	SOE = 1	SOE = 0	Regional_Dev = 1	Regional_Dev = 0	Cross_L = 1	Cross_L = 0
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
GI	0.009***	0.009***	0.008	0.007**	0.000*	0.001*	0.012***
	(3.353)	(2.932)	(1.289)	(1.992)	(1.671)	(1.711)	(3.311)
B_Size	−0.031***	−0.031**	−0.028	−0.011**	−0.038**	−0.043	−0.034*
	(-3.012)	(-2.279)	(-1.630)	(-2.003)	(-2.028)	(-1.432)	(-2.829)
Ind_D	0.226	0.041**	0.013	0.035	0.018	0.137**	0.016
	(1.511)	(1.931)	(0.037)	(1.129)	(0.375)	(2.419)	(0.662)
Foreign_D	0.103***	0.148***	0.211*	0.119***	0.224***	0.055	0.160***
	(5.433)	(3.250)	(1.711)	(3.842)	(3.211)	(1.077)	(4.664)
Duality	−0.029	−0.007*	−0.121*	−0.140	−0.009	−0.893*	−0.062
	(-0.590)	(1.695)	(-1.844)	(-0.047)	(-0.118)	(-1.752)	(-1.173)
Age	0.000	0.001	0.006	0.022	0.010	−0.010	−0.003
	(1.012)	(0.387)	(1.101)	(1.224)	(0.719)	(-0.451)	(-0.987)
Size	1.110***	0.991***	0.554***	0.963***	0.111***	0.719***	0.006***
	(11.410)	(8.115)	(6.721)	(7.226)	(5.479)	(7.052)	(8.003)
Growth	0.009***	0.766***	0.049***	0.607***	0.772***	0.886***	0.716***
	(8.342)	(9.096)	(7.192)	(7.223)	(7.223)	(4.921)	(10.620)
Lev	−0.915***	−0.199***	−2.561***	−2.714***	−3.815***	−4.805***	−2.273***
	(-12.006)	(-11.720)	(-14.590)	(-16.332)	(-15.006)	(-9.913)	(-16.774)
Constant	1.652***	2.203***	1.335*	1.336***	1.460***	4.694***	2.368***
	(8.391)	(3.061)	(5.521)	(5.537)	(3.477)	(7.490)	(9.981)
Observations	5347	3254	2093	3702	1645	978	4144
R-squared	0.154	0.168	0.128	0.136	0.200	0.279	0.165
Industry & Year Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes

This table portrays findings for GI and ROA relationship using PSM. T-statistics are highlighted in parentheses. ***, **, * denotes significance level at 1, 5 and 10 %, respectively.

in which companies are founded and developed.

Our results have also some significant practical implications for environmental management in emerging economies like China. For example, managers should comprehend the advantages SOEs, regional development and cross listing for green investment. Managers must be more conscious of the institutional pressures on environmental protection associated with the aforementioned institutional contingencies. Managers should take advantage of the subnational institutions to obtain crucial resources and policy assistance for green investment, such as environmental subsidies, R&D funding, bank borrowings, lower-cost capital, and the updated policy information on ecological sustainability.

Secondly, managers should understand the importance of green investment in financial performance, especially how it is influenced by corporate institutional environments. In this case, our findings imply that the benefits of green investment are more salient for financial performance in SOEs and companies located in developed regions. Managers in such companies should strictly follow environmental protection laws, devote special attention to societal demands for environmental protection, and fully leverage the comparative advantages linked with subnational institutions to boost green investment. In contrast, managers at firms with a less stringent legal environment, such as non-cross listed peers, should be careful of the cost-benefit perspective carried in non-cross listing, since it may harm green investment.

6. Conclusions

Based on the prior research, actors vary across institutional environments, and we must acknowledge their socially entrenched character, patterns, motives, and power relationships to properly recognize how institutions impact individual and corporate level decisions. Against this backdrop, we investigate at how subnational institutional contingencies influence the corporate green investment capacity and its outcomes. Using panel data of Chinese listed firms from 2012 to 2019, our results show that subnational institutions (state owned enterprises, regional development and firms' cross listing on international stock exchange) have positive effect on green investment. This is because of media attention, government interference, advanced supervisory systems, strict rules, and legal requirements associated with these formal institutions that sensitize the firms' environmental policies.

Secondly, we explore the impact of green investment on firms' financial performance. By investigating its relationship, our study find that green investment improves financial performance because green practices may build corporate image and trust of environmentally sensitive stakeholders. In other words, environmental protection investments of firms may deliver positive signal to society and government, increase a company's operating capacity and competitiveness, and thus significantly boost financial performance.

Finally, our study provide evidence on the role of subnational institutions in the green investment and financial performance relationship. We find that the positive relationship between green investment and financial performance is more evident in SOEs and in firms of developed regions because local and central governments provide financial assistance and subsidies to them for their green practices. In addition, we find that the role of non-cross-listed peers is more obvious in the link between green investment and financial

performance compared to cross listed counterparts because domestic firms usually free from institutional forces and they engage in environmental practices based on cost-benefit analysis.

Overall, our study presents a novel conceptual framework based on sub-national institutions and stakeholders' perspectives, which fills the gap by evaluating drivers of environmentally responsible practices under institutional heterogeneity. However, our empirical evidence may provide guidance to China's regulatory bodies and other emerging markets with similar shareholding patterns and uneven regional development.

Despite of making contributions to the literature, this research has also some limitations. For instance, the results have certain limitations in terms of generalizability, since this study just relies on China's institutional context, which is an emerging and transitioning economy that varies in many ways from advanced economies. Future research can examine the same propositions in other emerging and advanced nations to improve the findings' universal applicability. Furthermore, all the institutional contingencies are considered from a single country's context. This research could be expanded in the future to include multinational such as cross-countries contexts to provide more insights about the institutional variations and their outcomes' comparison. Finally, this research study has used model to investigate only the direct effect of institutional factors on green investment. Future studies may establish more complicated framework by exploring that this relationship may be aroused through mediated factors, such as societal expectations or regulatory pressure and policies etc.

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CRediT authorship contribution statement

Farman Ullah Khan: Formal analysis, Data curation, Conceptualization. **Junrui Zhang:** Methodology, Investigation, Funding acquisition, Formal analysis. **Imran Saeed:** Validation, Supervision, Software, Resources, Project administration. **Sajid Ullah:** Writing – review & editing, Visualization, Validation.

Declaration of competing interest

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests:Imran Saeed reports was provided by The University of Agriculture Peshawar. Imran Saeed reports a relationship with The University of Agriculture Peshawar that includes: employment. Imran Saeed has patent pending to No Licensee. All authors declare no conflict of interest If there are other authors, they declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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