

Urban Ecological Governance, City Parks, and Corporate Green Innovation

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Abstract:

In this study, we investigate the effect of the ecological environment near a firm's operations on its green innovation. Using manually collected data on city parks, we find that firms surrounded by more favorable ecological environments, as indicated by the presence and density of city parks within a 500-meter radius of its headquarters, exhibit higher levels of corporate green innovation. Our findings hold across various green patent measures and alternative model specifications. The effect is more pronounced for firms exposed to green spaces at the time of their initial public offering and for those led by environmentally conscious CEOs. Importantly, the relationship persists even when firms relocate, suggesting a lasting imprint of early ecological exposure on innovation behavior. Overall, our results show that the role of urban environmental governance in promoting corporate green innovation and have significant implications for urban planning. Expanding green infrastructure and optimizing its use can potentially have a long lasting impact on corporate green innovation.

Keywords: City parks, Green innovation, Imprinting, Urban ecological environmental governance

1. Introduction

Carbon emissions linked to global energy consumption have increased over the past centuries, reaching a peak of 36.8 billion tons in 2022. The concerning trend has drawn significant attention from both the general public and academic researchers.¹ In response to the increasing pressure for climate change mitigation, governments worldwide have implemented stringent standards and enforcement mechanisms to curb pollution-related behaviors. For example, the European Union (EU) enacted legislation to enhance the restoration of natural ecosystems by passing the Nature Restoration Law (Council of the European Union, 2024), which aims to mitigate the loss of biodiversity and better address climate change by restoring degraded terrestrial and marine ecosystems. In China, the government has also taken a leading role in this effort, focusing not only on regulatory measures but also actively engaging in the restoration of ecological environments and the expansion of urban green spaces. This proactive approach is evidenced by a substantial increase in per capita green space within urban areas, which expanded from 11.8 square meters in 2011 to 14.78 square meters in 2021, marking a significant increase of 25.25% (Global Times, 2023).

Prior research finds that both formal mechanisms of environmental protection enforcement, such as emission charges and carbon emission taxes, and informal institutions, including social media and stakeholder pressure, play an important role in motivating firm managers to integrate environmental considerations into green production strategies (Delmas, 2002; Sharma & Henriques, 2005; Berrone et al., 2010; Clarkson et al., 2011; He et al., 2020; Buntaine et al. 2024). These studies highlight the significant impact of external pressures on corporate environmental behavior. However, there is dearth of evidence in the literature

¹ Recent studies investigate the impact carbon emissions on various aspects of societal well-being, including public health (Greenstone et al., 2015; Greenstone & Hanna, 2014; Ebenstein et al., 2017), labor productivity (Graff-Zivin & Neidell, 2013; Chang et al., 2016; Zivin, & Neidell, 2012), and overall welfare (Ito & Zhang, 2020; Wang & Wang, 2020). As a result, an increasing amount of research has begun to focus on environmental issues and explore them within both finance and accounting disciplines (Linnenluecke, Smith, & McKnight, 2016; Marrone et al., 2020).

regarding the relationship between ecological and environmental governance, defined as the development and regulation of government-initiated ecological systems and environmental policies (Wunder et al., 2018), and corporate green strategies. Specifically, critical to this analysis is a need to understand how ecological and environmental governance affects corporate behavior and what role the government plays in shaping and implementing these ecological systems. To address this gap, we employ manually collected data on city parks in China, particularly the proximity and density of city parks surrounding firms, and explore the relationship between environmental governance and corporate green innovation.

Imprinting theory suggests that individuals and organizations acquire enduring characteristics reflecting key features of their environment during formative periods (Marquis & Tilcsik, 2013). Imprinting is a fundamental concept that explains the enduring influence of the past on the present. It refers to a process where, an entity or actor—such as an industry, organization, or individual—develops attributes that mirror the dominant features of its environment at critical developmental stages. These characteristics persist even as the environment undergoes substantial changes over time.

We posit that a firm's proximity to ecological environments, such as city parks, shapes its operation toward green innovation by improving greater environmental awareness. This hypothesis is grounded in the notion that direct and continual interaction with natural environments enhances environmental consciousness at both individual and organizational levels (Bratman et al., 2012; Hartig et al., 2014). City parks, as a core component of urban green infrastructure, are communal natural spaces benefiting city residents (Wolch et al., 2014). Regular exposure to these parks may gradually enhance individuals' and organizations' environmental awareness (Chawla, 2015), and environment conscious firms are more attuned to the sustainable focus of stakeholders and can seize market opportunities by innovating in green products or services to align their business goals with environmental responsibility

(Orlitzky et al., 2003; Eccles et al., 2014). There is also a feedback loop. Engaging in green innovation helps companies meet environmental regulations, enhance their reputation, and improve resource efficiency (Chen et al., 2006; Chang, 2011; Ramanathan et al., 2017).

Hence, the presence of a large number of parks near an organization may reflect a strong influence of the surrounding natural environment. This, in turn, could lead to greater ecological awareness and increase the likelihood of engaging in green innovation initiatives (Dibrell et al., 2011). Furthermore, a dense network of parks can raise environmental consciousness within the local community, thereby creating further pressure on firms to adopt and implement environmentally responsible strategies (Gadenne et al., 2009; Husted et al., 2016).

However, the ecological environment, as a public good, presents a challenge due to unequal costs and benefits. While the benefits of environmental governance are shared broadly across society and all firms, the costs associated with implementing green initiatives are often borne individually by companies (Ambec & Lanoie, 2008). This imbalance can discourage investment in green initiatives without regulatory incentives (Demirel & Kesidou, 2011). Furthermore, green innovation, while a strategic response to ecological issues, involves high costs and significant risk over the long term (Bhattacharya et al., 2017; Yan et al., 2021). Firms may scale back their green innovation efforts in favor of short-term financial benefits. Therefore, whether urban green spaces, such as city parks, encourage corporate green innovation remains an empirical question.

We investigate this question within the context of China for two primary reasons. First, China's rapid economic growth has brought severe environmental degradation, exacerbated by its pollution-intensive industries (He et al., 2020). Second, China's significant contribution to the global increase in green spaces—accounting for a quarter of the world's new green areas since early 2000—provides a unique opportunity to assess the impact of ecological governance on corporate green innovation. Between 2011 to 2021, there is a 25.25 percent (from 11.80 to

14.78 square meters) increase in urban green space per capita (Global Times, 2023).

Using a hand-collected and comprehensive dataset of city park information between 2007 and 2021, our baseline analysis begins with assessing the influence of the ecological environment on corporate green innovation. For our independent variable, we operationalize the ecological environment based on the proximity and density of parks within a 500-meter radius of a firm's operational area. To measure green innovation activities, we consider the number of green patent applications filed by the company in a given year. When we regress the number of green innovation on the indicator of proximity of the city park, we show a positive relationship between the quality of the ecological environment and a company's propensity to engage in green innovation. The result is also economically significant. Firms near city parks see approximately a 6.8% increase in green patent filings compared to those farther away. Our main results are robust with the use of alternative green patent measures, the three-year delay in patent counting measures, and an alternative model specification. We also find this relationship is more pronounced in non-state-owned (non-SOE) and for firms in more competitive industries.

Next, we conduct additional analyses to gain further insights. First, we find that when firms change their headquarters, signifying a shift in its ecological environment (from better to worse or vice versa), it does not lead to a corresponding change in its green innovation strategy. This finding suggests a persistence in corporate environmental strategies despite changes in their immediate ecological surroundings. Second, firms that go public in regions with better ecological environments engage in more green innovation. This result highlights the importance of the initial ecological environments in shaping corporate behavior. Third, CEOs with a pro-environmental orientation, measured by the green space per capita in their birthplace, have a positive impact on their company's green innovation capabilities, highlighting the role that CEOs and their early life experiences play in driving sustainable practices. Overall, our

findings indicate that the initial ecological environment condition individuals and organizations face has a lasting impact on corporate green behavior.

Our study makes several contributions to the literature. Prior studies investigate whether anti-pollution regulations have an impact on productivity or innovation, but results are somewhat mixed (Conrad & Wastl, 1995; Popp, 2006; Greenstone et al., 2012; Calel & Dechezleprêtre, 2016). We use a novel dataset to shed light on how environmental awareness can shape corporate green strategies. Our findings offer one plausible explanation as to why for-profit companies are adopting green innovation strategies to proactively fulfill their social responsibilities. To the best of our knowledge, this aspect is new to the literature.

Moreover, we extend the research on how ecological values are transformed into economic values. Prior work has largely focused on the ecological environment's effects on health, production efficiency, and environmental awareness, mostly at the aggregated and macro level, with less attention given to its economic implications at the firm level (Du et al., 2009; Gadenne et al., 2009; Sinclair et al., 2012; Marjanski et al., 2021). Our study demonstrates how the tenets of ecological civilization can be converted into economic assets, providing firm-level evidence on the relationship between ecological conditions and corporate innovation.

Finally, our study contributes to the burgeoning literature on ecological environmental governance. This area of research is gaining increasing attention, with researchers increasingly interested in how to promote the governance of ecological environments (Ostrom, 2017). Despite the growing interest, there remains a notable gap in empirical evidence regarding the effectiveness of these governance mechanisms on corporate behaviours. Gadenne et al. (2009) find that legislation can enhance a firm's green awareness and encourage the adoption of environmental strategies. However, firms often have limited awareness of the potential benefits that could arise from ecological governance (Gadenne et al., 2009). We provide evidence that

government-initiated ecological systems, such as city parks, can improve corporate green innovation and sustainability practices.

The remainder of this paper is organized as follows. Section 2 presents the institutional background and develops the hypotheses. Section 3 describes the sample selection and research methodology. Section 4 presents our empirical findings. Section 5 offers concluding remarks.

2. Background and hypothesis

2.1 Development of the city parks in China

City parks, as natural recreational public spaces, play a crucial role in urban ecosystems. In response to the challenges posed by urban expansion, such as the deterioration of residential living environments and social health issues, developed countries in Europe and the United States have historically adopted the strategy of increasing urban public green spaces (Lachowycz & Jones, 2013; Sugiyama et al., 2018). This approach indicates the fundamental rationale for the development of city parks. In the Chinese context, the concept of “park” dates back to the Southern and Northern Dynasties, primarily referring to ancient imperial gardens (Li & Du, 2017). These early gardens, in function and form, were markedly different from modern urban parks. While the tradition of Chinese gardens boasts a long history, the concept of the park as a democratic space emerged in the late Qing Dynasty with foreign concessions. Huangpu Park², located in the British and American public accommodation in Shanghai, is noted as the earliest city park in this era. This marked a significant transformation of parks from private garden spaces serving the elite to open green spaces accessible to the general public.

² Later, the concession successively built Hongkou Amusement Park (now known as Lu Xun Park), Gujiazhai Park (currently Fuxing Park), and Jijifuel Park (presently Zhongshan Park).

After the establishment of the People's Republic of China, there was a concerted effort by governments at all levels to enhance the quality of life for citizens. This was achieved through the restoration and renovation of modern parks and historical gardens existing before liberation, as well as the construction of various types of new parks, thereby increasing their number and accessibility. Currently, parks have emerged as a new benchmark in China's urban construction narrative. According to the Global Times (2023), the per capita urban green area in China has seen a substantial increase, from 11.8 square meters in 2011 to 14.78 square meters in 2021, an increase of 25.25%. This trend not only reflects the growing emphasis on urban ecological balance but also indicates the transforming relationship between urban development and public welfare.

2.2 Prior literature

The natural environment is critical to shaping lifestyles and influencing psychosocial stress (Rentscher et al., 2020; Yao et al., 2021). Social-ecological theory posits that direct and repeated interactions with nature significantly enhance individuals' affinity towards the natural environment (Kellert, 2002; Wells & Lekies, 2006). This theoretical perspective is further corroborated by a substantial body of empirical research. Studies have consistently demonstrated that individuals who engage more frequently in natural activities during childhood are more likely to develop environmentalist attitudes (Bixler et al., 2002; Cheng & Monre 2012; Gifford, 2014; Jensen & Olsen 2019).

Green innovation, characterized as technological and process advancements aimed at reducing environmental pollution and conserving resources (Saunila et al., 2018). Firms adopt green innovation strategies, motivated by multiple influences such as external pressures from stakeholders and institutional mandates (Delmas, 2002; Sharma & Henriques, 2005; Berrone et al., 2010), as well as internal factors such as managerial motivations, experiences, gender, and environmental consciousness (Sharma et al., 1999; Sharma, 2000; Walker et al., 2014;

Schaltenbrand et al., 2018; Zhi, 2022). In addition, the pursuit of legitimacy (Bansal & Roth, 2000) and the influence exerted by boards of directors (de Villiers et al., 2011; Post et al., 2011; Dixon-Fowler et al., 2017) are also significant determinants in the implementation of green innovation strategies within firms.

The long cycle, substantial investment, and high risk associated with green innovation often result in insufficient motivation for companies to proactively engage in such initiatives. Therefore, establishing a well-designed institutional framework to support ecological innovation emerges as an important solution. Some empirical evidence suggests that moderate environmental regulation can compel firms to adopt green production technologies, thereby enhancing their capacity for independent innovation (Acemoglu et al., 2012; Berrone et al., 2013; Jefferson et al., 2013; Chakraborty & Chatterjee, 2017). Other studies indicate that environmental regulation may hinder green innovation by escalating compliance costs and resources that could otherwise be allocated to green innovation efforts (Palmer et al., 1995; Levinson & Taylor, 2008; Zhao & Sun, 2016, Petroni et al., 2019).

While research on green innovation has obtained considerable attention in recent years, the influence of governmental ecological environment governance on firm-level green behavior remains underexplored. Zhi (2022) employs city-level greenspace data as a proxy for CEOs' nature loving preferences, and reports an association between their preferences and firms' efforts to combat global warming. Moreover, Covington et al. (2024) show that CEOs who engage in nature-related activities like hunting and fishing may influence their companies' environmental performance negatively, suggesting that life experiences significantly impact corporate strategies. Our study focuses on the ecological environment proximate to a company's operational location, using nearby city parks as a more tangible proxy. We aim to establish a clear relationship between the ecological environment and corporate green strategies through the lens of imprinting theory and explore how these environmental interactions can be

transformed into economic value.

2.3 Hypotheses development

Imprinting theory, rooted in biological ecology, posits the existence of multiple “environmentally sensitive periods” during the developmental stages of both individuals and organizations (Pieper et al., 2015). The environmental characteristics prevalent during a specific stage exert a significant impact on individuals or organizations, leading to the acquisition of ecological traits. This imprinting exerts a lasting influence on their behavior and does not easily diminish (Marquis & Tilcsik, 2013). At the individual level, prior studies show how early career experiences have enduring effects (Tilcsik, 2014) and carry these imprints as individuals move between organizations (McEvily et al., 2012). More importantly, at the organizational level, extensive studies demonstrate that organizations carry imprints of their founding environments. These imprints encompass the economic, technological, and institutional conditions prevalent at the time of founding, as well as the influence of the founding individuals (Johnson, 2007; Marquis & Huang, 2010; Judge et al., 2015).

In the field of management, once imprinting is established, it equips decision-makers with cognitive frameworks useful for problem-solving (Zhang & Greve, 2019). The ecological environment can influence a firm’s green innovation by enhancing environmental awareness in two primary ways. First, internal managers are crucial in shaping a company’s strategic direction; their management styles significantly influence corporate policies. Different CEO characteristics, such as ability, personality, and experience, have been shown to impact business operations, investment decisions, and financing strategies (Malmendier & Tate, 2005; Steven et al., 2015; Bernile et al., 2017). Therefore, it is reasonable to assume that heightened environmental awareness among executives may improve in the firm’s environmental policies. As environmental consciousness grows, more responsible investors are likely to allocate resources towards firms’ green innovation initiatives. Therefore, the increasing environmental

awareness among the public, including consumers, suppliers, community residents, and the media, drives executives with stronger ecological consciousness to recognize the significance of green innovation. They are more inclined to develop environmentally friendly products and opt for sustainable materials. Furthermore, employees, as primary agents of firm green innovation activities, play a crucial role. The greater their commitment to environmental protection, the more enthusiasm and responsibility they demonstrate in pursuing green innovation activities.

Second, the increasing environmental awareness among community residents places pressure on local companies to adopt green strategies. According to stakeholder theory (Freeman, 1984), firms are expected to address the interests and concerns of various stakeholders in order to maintain legitimacy and ensure long-term success. In particular, growing environmental expectations from community members have become a key driver shaping firms' strategic decisions. For instance, consumers with a preference for local consumption are more inclined to purchase products from local firms. Those with increased environmental consciousness are likelier to opt for eco-friendly products and may assign a higher value to companies that demonstrate environmental responsibility. Additionally, a notable trend accompanying China's rapid economic development is industrial agglomeration (Lu & Tao, 2009). As competitors enhance their focus on environmental protection, companies may be motivated to engage in green innovation. This is not only to maintain market competitive but also to access government resources more effectively by providing green innovative products.

Conversely, green innovation represents a type of innovation that demands substantial long-term resources, characterized by high costs and significant risks. Firms focused on profit maximization lack sufficient motivation to implement green innovation. Especially when firms often lack the motivation to pursue such innovation, particularly under resource constraints.

Faced with limited resources, these firms may gravitate towards investments with quicker returns and more stable profits. Consequently, even with heightened environmental awareness, companies might not prioritize green innovation if it conflicts with shareholder value and short-term profit objectives (Di-Giuli & Kostovetsky, 2014; Manchiraju & Rajgopal, 2017; Chen et al., 2018). Therefore, while green development clearly reflects a firm's commitment to corporate social responsibility, the pursuit of economic interests often takes precedence in profit-driven firms. In light of the foregoing discussion, we propose the following hypothesis for empirical testing:

H1: There is a positive relationship between the quality of environmental governance near a firm's operational location and the extent of its engagement in green innovation activities.

3. Methods

3.1 Data and sample

Our study sample comprises companies listed on the China A-Shares index from 2007 to 2021. We hand-collected city park information from various sources, including the Baidu Map³ and municipal-level government departments. For example, we obtain city park information for Beijing from the Beijing Municipal Forestry and Parks Bureau, and for Shanghai from the Shanghai Landscaping & City Appearance Administrative Bureau. Data on firms' green innovation and city-level greenbelts are from the CNRDS database.⁴ Other variables such as firms' operating location, CEOs' names, and financial information are from the CSMAR

³ As one of the leading mapping services in China, Baidu Map provides detailed geographic data, including the longitude and latitude as well as attributes of city parks.

⁴ The China Research Data Services Database (CNRDS) is a platform that facilitates collaboration among researchers and institutions, and promotes the sharing and utilization of scientific research data across various fields in China. Many studies focusing on the Chinese market have utilized the CNRDS database.

database. In general, CEO's birthplaces are manually collected from their publicly available biographies. The birthplace of the CEO at the time the firm goes public is inferred from the disclosed ID⁵ information in the IPO prospectus. Our final dataset comprises 11,085 firm-year observations⁶.

In Table 1, we present the distribution of city parks and firms for the top 20 cities. A total of 25,617 city parks are identified. Our sample includes 5,170 listed firms for the sample period. We investigate 32 first-tier cities, provincial capitals, and municipalities in China, encompassing 2,801 listed companies during the sample period. This represents 54.18% of all listed companies. We focus on these 32 cities for their significant economic development, high urbanization rates, and their status as key political, economic, and cultural hubs in China. In addition, all 32 cities have substantial population densities. For instance, Xining, the provincial capital of Qinghai, accounts for 41.66% of the province's total population. Analyzing the relationship between government ecological governance and corporate green innovation in these urban centers provides valuable insights and could serve as a benchmark for other regions, offering a model for sustainable urban and economic development strategies.

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3.2 Dependent variables

We utilize green innovation data to construct our measures of corporate green innovation performance. Green innovation is widely recognized as the most comprehensive data available on this aspect of corporate performance and widely used in innovation research (Hsu, Tian, & Xu, 2014; Quan et al., 2021). The green innovation dataset comprises two numerical indicators to evaluate a firm's green innovation capability: the number of green invention patents and

⁵ The Chinese citizen identification number comprises 18 digits. To ensure privacy, the IPO prospectus discloses only the first six digits and the last four digits of the CEO's ID number. The third and fourth digits specifically indicate the city of birth, which we utilize to identify the CEO's birthplace.

⁶ We exclude firms within the financial services sector.

green utility model patents. We measure corporate green innovation performance by summing these two indicators. Thus, for each year, we aggregate the number of green invention patents and green utility model patents for each firm as our green innovation capability measure (i.e., *GPATENT*). Additionally, we apply the natural logarithm to the total number of green patent applications to assess a firm's green innovation performance, with larger values indicating higher capabilities. We choose the number of green patent applications over the number of granted patents as a measure of a firm's green innovation capability, considering that patent authorization is often subject to time lags and uncertainties (Gao et al., 2020). In line with previous studies (Aghion et al., 2013; Gao et al., 2020), we excluded firms that had never applied for a single patent throughout our entire sample period.

3.3 Independent variables

Regarding our independent variable, we measure the number of city parks near a firm's operating location. To do so, we manually collect information on city parks, including their completion year, occupied area, longitude, and latitude. We then calculate the distance between each city park and the operational location of every firm. A 6-minute walking distance (approximately 500m) is widely recognized as beneficial for an individual's mental and physical health (Du et al., 2009) and is commonly used in clinical practice and research (Sinclair et al., 2012; Marjanski et al., 2021). While access to these parks may vary depending on employees' working hours and proximity to the workplace, their presence near firms is expected to enhance the overall ecological environment, potentially influencing green innovation behaviors. Therefore, to assess the impact of city parks on a firm's green innovation behavior, we selected two indicators: the presence of city parks (*PARK_DUM*) and the number of city parks (*PARK_NUM*) within a 500m radius of a firm's operational location. *PARK_DUM* is a binary variable, with "1" indicating the presence of a city park and "0" otherwise. *PARK_NUM* is treated as a continuous variable, calculated as the natural logarithm of one plus

the number of city parks within the specified radius of a firm.

3.4 Control variables

Our selection of control variables is in line with prior literature on corporate innovation performance (Gao et al., 2020; Quan et al., 2021). We control for factors such as firm size, corporate financial performance, managerial shareholding, and corporate ownership, each of which could influence a firm's engagement in corporate green innovation. Firm size (*SIZE*) is measured as the natural logarithm of the book value of total assets; Leverage (*LEV*) is measured as the ratio of total liabilities to total assets; Firm growth (*GROWTH*) is measured as the difference of operating income from the previous period to the current period, divided by the operating income of the previous period; Firm performance (*ROA*) is measured as net profit over total assets; Cash flow (*CFO*) is measured as a company's net cash flow from operating activities divided by total assets.

To control for a firm's market capability, we include the Market power (*MARKET*), measured as the natural logarithm of sales revenue divided by operating costs; We also controlled for the potential impact of executive shareholding on corporate green innovation performance by including the ratio of executive stock ownership to total share capital (*MSHARE*); To control for a firm's ownership structure, we included Corporate ownership (*SOE*) captured as a dummy variable equal to "1" if the firm was a state-owned firm during the fiscal year and "0" otherwise.

4. Results

In Table 2 (Panel A), we report descriptive statistics for the variables used in our study. The sample mean of *GPATENT* is 0.608, which means, on average, firms have approximately 0.608 green patents. The sample mean of *PARK_DUM* and *PARK_NUM* are 0.335 and 0.314,

respectively. This indicates that 33.5% of companies have a city park within a 500m radius, and, on average, firms have approximately 0.314 of city parks within a 500m radius. For instance, we identify 1,450 city parks in Beijing, including urban parks, pocket parks, communal parks, and others, through the use of Baidu AI and manual collection methods. Additionally, there are 455 listed firms located in Beijing, implying that approximately 153 listed firms in Beijing have a city park within a 500m radius.

In Table 2 (Panel B), we show univariate tests based on the presence of city parks within a 500m radius of a firm's operating location and the number of such parks. The result indicates that the average green innovation level for firms with city parks nearby is 0.680. In contrast, the average for firms without city parks nearby is 0.572. This mean difference is statistically significant at the 1% level. Similarly, when firms are categorized into high and low groups based on the number of nearby city parks, those with a greater number of parks in proximity to their operating locations demonstrate significantly higher green innovation capabilities compared to those in the low-park group. These univariate test results preliminarily suggest that a city's environmental governance has a significant impact on corporate green innovation activities.

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4.1 Baseline analysis

Hypothesis 1 posits that the presence of city parks in the vicinity of firms will enhance their green innovation performance. To test this hypothesis, we regress *GPATENT* on *PARK_DUM* and *PARK_NUM*, respectively, with industry, year, and city fixed effects in the first two models. Models (3) and (4) then include our full set of control variables as discussed in the previous section. The standard errors are adjusted for heteroskedasticity and clustering by city.

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In Table 3, we report the results of this estimation using a series of nested models. As shown in column (3), the coefficient of *PARK_DUM* is 0.066, which is positively significant at the 1% level (t-value=3.355), providing support for Hypothesis 1. The economic impact of having a city park nearby is also substantial: a firm located near a city park experiences an increase in the number of green patents by approximately 6.8% ($=e^{0.066}-1$) compared to firms that are not located near city parks. In Column (4), the coefficient of *PARK_NUM* in our sample is 0.049, which is positively significant at the 5% level (t-value=2.385), indicating that a 10% increase in the number of city parks nearby is associated with a 0.49% increase in the number of green patents.

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To ensure the robustness of our results, we expand our analysis of corporate green innovation by measuring it through two distinct dimensions: green invention patents and green utility model patents.⁷ This approach allows us to re-estimate the influence of city parks on the complex nature of corporate green innovation capabilities. The two alternative green innovation measures, green invention patents (*INVENTION*) and green utility model patents (*UTILITY*), are regressed against our variables of interest, with fixed effects and our full set of control variables.⁸ The results are reported in Table 4.

In Columns 1 and 2, when the dependent variable is green invention patents (*INVENTION*), the coefficients of *PARK_DUM* and *PARK_NUM* are both positive and significant. In Columns 3 and 4, when the dependent variable is green utility model patents

⁷ As documented in the CNRDS database, green patents are classified into two categories: green invention patents and green utility model patents. Green invention patents are granted for novel, innovative, and commercially viable inventions across various technological fields. On the other hand, green utility model patents focus on new technical solutions involving a product's shape, structure, or their combination, making them more applicable for incremental improvements or modifications to existing products. Overall, green invention patents typically demand a higher level of commitment and technical expertise, indicating more stringent grant criteria and a higher degree of innovation (Quan et al., 2021; Tian & Xu, 2022).

⁸ See the Appendix for variable definitions.

(*UTILITY*), *PARK_DUM* continues to be significant, while *PARK_NUM* is now marginally insignificant (p-value = 0.106). Overall, the results are slightly stronger for green invention patents than for green utility model patents. More importantly, these findings further confirm that the ecological system surrounding a firm can positively impact firm-level green innovation.

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Additionally, we acknowledge the inherent time lag in green patent applications, reflecting the time required for firms to initiate and implement green innovation activities. To account for this, we utilize green patent data adjusted for a three-year lag period, as shown in Table 5 Panel A. Consistent with our previous analysis, the coefficient for *PARK_DUM* is positive and significant at the 1% level, with a value of 0.055 (see column (3)). Similarly, the coefficient for *PARK_NUM* is positive and significant at the 5% level, with a value of 0.043 (see column (4)). This indicates that, ceteris paribus, a firm located near a city park experiences an average increase of 5.65% ($=e^{0.055}-1$) in *GAPENT*. Moreover, a 10% increase in the number of city parks around firms is associated with a 0.43% increase in green patents.

In recent years, some researchers have argued that the log transformation has several limitations when applied to count data like patents (Chen & Roth, 2024). Specifically, they argue that log-transformed models assume normally distributed errors, which is often not appropriate for count data that are typically skewed and over-dispersed. To address this issue, we follow Cohn et al. (2022) and employ a negative binomial regression, which is well-suited for over-dispersed count data and can produce more efficient estimates. The results of our negative binomial regression analysis are presented in Table 5 Panel B. The statistical significance and magnitude of the coefficients in our models indicate that our results are robust and provide strong evidence that city parks positively impact firm-level green innovation.

In conclusion, across all these analyses, the positive coefficients for *PARK_DUM* and *PARK_NUM* consistently support the causal link between city parks and enhanced corporate

green innovation. These findings indicate that ecological governance contributes to fostering green innovation within the corporate sector. These green spaces not only provide aesthetic and recreational benefits but also create a supportive atmosphere that encourages firms to invest in and develop green technologies. This empirical evidence highlights the potential of targeted government policies aimed at improving urban ecological infrastructure as a means to drive sustainable corporate practices and innovation. By strategically establishing city parks, policymakers can significantly impact the green innovation trajectory of firms, promoting a broader transition towards environmentally friendly industrial practices.

4.2 Mechanism Analysis: The Role of Imprinting Theory

To further substantiate the mechanism underlying our findings, we conduct a set of additional analyses. The imprinting theory suggests that conditions present during the early stages of an individual or organization's development can exert a long-lasting impact on future behavior (Marquis & Tilcsik, 2013; Pieper et al., 2015). If that's the case, we expect that a firm's green behavior continues to persist even when its operating location changes.

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To test this prediction, we identify firms that changed their operating location once during this period. We exclude firms that changed their operating location multiple times to avoid potential confounding factors. We then code whether these firms moved to greener locations, as indicated by the presence of city parks nearby, or to less greener locations. We employ a difference-in-difference approach, assigning a "*TREAT*" value of "1" to firms that changed their operating location once within the sample period and "0" to firms that did not change their location at all. The results, presented in Table 6, show no significant findings regarding corporate green innovation capabilities, thereby providing support for the imprinting theory.

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Second, our analysis involves categorizing the firms into two distinct groups based on the proximity of city parks at the time of their initial public offering (IPO). The motivation for this test is to understand the long-term impact of initial environmental conditions on corporate green innovation. By examining firms at the time of their IPO, we can isolate the effect of early exposure to green spaces on their subsequent innovation performance. This approach allows us to test the imprinting theory, which suggests that conditions during the early stages of an organization's development can have a lasting influence on its future behavior (Marquis & Tilcsik, 2013). The empirical results, as delineated in Table 7, show that firms situated near city parks during their IPO exhibit enhanced green innovation capabilities relative to their counterparts located further from such parks. Specifically, the coefficient for $PARK_DUM \times PARK_IPO$ is 0.222 which is statistically significant at the 1% level (see column (3)). This suggests that the presence of city parks near the firms at the time of their IPO can lead to an expected 22.3%⁹ increase in green patents compared to those without a city park nearby. Furthermore, the coefficient of $PARK_NUM \times PARK_IPO$ is 0.165 which is statistically significant at the 1% level. This indicates that the number of city parks near the firms at the time of their IPO also positively impacts green innovation, indicating that a 10% increase the number of city parks surrounding the firm when it goes to public can increase green patents by 1.86%¹⁰.

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Third, we examine the influence of CEOs' environmental consciousness, operationalized through the greenbelt level of their birthplaces, on corporate green innovation strategies. The motivation for this test is to understand the long-term impact of personal environmental exposure on corporate leadership decisions (McEvily et al., 2012; Tilcsik, 2014; Li et al., 2021).

⁹ The total effect of the presence of city parks near the firms at the time of their IPO is calculated as $0.222 - 0.021 + 0.0003 = 0.2013$. Therefore, the percentage increase can be calculated as $e^{0.2013} - 1 = 22.3\%$.

¹⁰ The total effect of the number of city parks near the firm at the time of their IPO is calculated as $0.165 - 0.039 + 0.060 = 0.186$.

By assessing the greenbelt level of CEOs' birthplaces, we aim to determine whether early-life exposure to greener environments influences their commitment to green innovation in their professional roles. This approach allows us to explore the potential imprinting effect of early environmental experiences on CEOs' decision-making and their firms' innovation strategies. Specifically, we categorize the firms into two distinct groups based on the CEO's environmental awareness, measured by the green space per capita in their birthplace. As shown in Table 10, the coefficient of $PARK_DUM \times AWARE_HIGH$ is 0.170, which is statistically significant at the 1% level (see column (3)). This suggests that for firms with a city park nearby, those operated by CEOs with high environmental awareness can expect an increase in green patents by approximately 6.61%¹¹ compared to those led by CEOs with low environmental awareness. In addition, the coefficient of $PARK_NUM \times AWARE_HIGH$ is 0.146, which is statistically significant at the 5% level. This indicates that for firms with a 10% increase in city park nearby, those operated by CEOs with high environmental awareness can expect an increase in green patents by approximately 0.18%¹² compared to those lead by CEOs with low environmental awareness. These findings suggest that CEOs with exposure to greener environments in their early life demonstrate a higher commitment to green innovation initiatives. In summary, the robustness of our results is affirmed across various analytical tests, indicating the significant role of environmental factors in shaping corporate green innovation trajectories.

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4.3 Cross-sectional and further analysis

Competitive markets are typically more responsive to investor preferences and market trends. As public awareness and demand for environmentally friendly practices grow, firms in

¹¹ The total effect of firms operated by CEOs with high environmental awareness is calculated as $0.170 - 0.044 - 0.062 = 0.064$. Therefore, the percentage increase can be calculated as $e^{0.064} - 1 = 6.61\%$.

¹² The total effect of firms operated by CEOs with high environmental awareness is calculated as $0.146 - 0.078 - 0.050 = 0.018$.

competitive industries may be more inclined to invest in green innovation to meet these market demands. Moreover, competitive pressure often drives firms to seek operational efficiencies and cost reductions (Kong et al., 2022). Green innovation can lead to more efficient use of resources, energy savings, and waste reduction, which not only benefits the environment but also improves the bottom line. The Herfindahl-Hirschman Index (HHI) is a commonly used measure of market competitiveness. A lower HHI indicates a more competitive market, while a higher HHI suggests a more concentrated market. We calculate the average HHI for each industry during the sample period and categorize the industries based on their level of competition, using the median as a benchmark. In this context, a value of 1 for the *HHI_HIGH* variable indicates intense competition within the industry. In Table 9 (see the first two columns), we observe that firms in competitive industries are more likely to engage in green innovation practices. In column (1), the coefficient of *PARK_DUM* $\times$ *HHI_HIGH* is 0.125, which is statistically significant at the 5% level. This suggests that for firms with a city park nearby, those operating in highly competitive industries can expect an increase of approximately 14.22%¹³ in their green patents compared to those in industries with low competition. In column (2), the coefficient of *PARK_NUM* $\times$ *HHI_HIGH* is 0.168, which is also statistically significant at the 5% level. This indicates that for firms with a 10% increase in city parks nearby, those operating in highly competitive industries face an increase in green patents of approximately 1.02%¹⁴ compared to those in industries with low competition.

In addition, the ownership structure can significantly influence corporate green innovation. State-owned enterprises (SOEs) often operate within bureaucratic systems, which can slow down decision-making processes and innovation initiatives (Fan et al., 2007; Wang, 2014). The need to adhere to government procedures and policies can limit their agility and

¹³ The total effect of firms operating in highly competitive industries is calculated as $0.125 - 0.046 + 0.054 = 0.133$. Therefore, the percentage increase can be calculated as $e^{0.133} - 1 = 14.22\%$

¹⁴ The total effect of firms operating in highly competitive industries is calculated as $0.168 - 0.103 + 0.037 = 0.102$.

responsiveness to market changes and emerging green technologies. Moreover, state-owned firms may have different priorities compared to private firms. Their objectives might be more aligned with government policies and social goals rather than profit maximization, which can divert focus and resources away from green innovation. Furthermore, in competitive markets, firms are driven to innovate to maintain or improve their market position. Without this pressure, SOEs might lack the incentive to invest in green innovation. Therefore, we divide our firms into two groups based on their ownership structure and find that SOEs indeed have lower green innovation performance compared to private firms (Table 9, see the last two columns). Likewise, private firms are more inclined to commit themselves to green innovation compared to state-owned enterprises.

5. Discussion

Our study provides new evidence on the relationship between urban ecological governance and firm-level green innovation, indicating how proximate natural environments influence corporate innovation outputs. The findings indicate several key insights that contribute to research on environmental governance, corporate sustainability, and imprinting theory.

5.1 Ecological imprinting as a source of green innovation

Informed by imprinting theory, we argue that exposure to ecological environments can create enduring cognitive, normative, and behavioral orientations that persist even when external conditions change. Several empirical patterns strongly support this view. First, the positive relationship between nearby parks and green patents is robust across patent types, model specifications, and lagged measures. Second, the impact persists even after firms relocate, which suggests that early ecological exposure leaves a lasting imprint on organizational decision. Third, firms located near parks at the time of their IPO show

significantly stronger long-term green innovation, highlighting the idea that formative organizational periods are critical windows during which ecological features shape strategic directions.

Together, these findings extend imprinting theory by identifying urban ecological quality as a previously understudied structural feature capable of influencing firm innovation behavior. While prior work focuses on founding environments or CEO early-life shocks, our study demonstrates that natural environmental features, i.e., green spaces, also constitute strategic imprints, influencing innovation persistence and long-term organizational orientation toward sustainability.

5.2 Environmental awareness and social-ecological contexts

The results also highlight environmental awareness as a key behavioral mechanism linking ecological governance and corporate innovation. We find that CEOs socialized in greener hometowns enhance the relationship between park proximity and green patents. This finding is consistent with social-ecological theories showing that repeated nature contact fosters environmental attitudes at the individual level. It also suggests that managerial ecological consciousness interacts with local environmental conditions in ways that shape how firms interpret environmental opportunities and constraints.

In addition, the presence of parks may generate community-level expectations and pressure for environmental responsibility, consistent with stakeholder theory. In neighborhoods where ecological amenities are highly valued, residents, consumers, and local media may impose greater scrutiny on corporate environmental behaviors, improving green innovation incentives.

5.3 Market Competition and Ownership Structure

There is substantial heterogeneity in how firms respond to ecological environments. We find that non-SOEs and firms in highly competitive industries exhibit stronger responses to

ecological environments. Market competition raises the strategic value of innovation, making firms more responsive to ecological signals. Green innovation provides firms with a pathway to differentiation and legitimacy in competitive markets. In such environments, even slight ecological advantages can translate into meaningful competitive gains because firms must continuously seek ways to meet stakeholder expectations and distinguish themselves from rivals. State-owned enterprises, constrained by bureaucratic priorities and limited innovation incentives, are less responsive to ecological environments despite being situated in similar urban conditions. Such attenuated responsiveness arises because SOEs typically privilege administrative mandates and policy compliance over competitive differentiation, which limits the degree to which ecological conditions are interpreted as strategic opportunities for innovation. These results suggest that ecological governance operates most effectively when organizational incentives are aligned with innovation goals. While proximity to parks can enhance firms' green innovation overall, the performance gains are considerably stronger for firms whose strategic incentives and competitive positioning enable them to translate ecological advantages into innovation outputs.

6. Implications

This study generates several important implications for theory, managerial practice, and public policy. Theoretically, it expands our understanding of how macro-level ecological environments influence micro-level organizational decisions. Management research has traditionally examined how institutional pressures, regulatory enforcement, and stakeholder expectations influence environmental strategies. Our findings show that the physical ecological conditions surrounding firms constitute an additional and previously underexplored dimension of influence. By demonstrating that city parks, which arise from government ecological governance, can generate lasting imprints on firms' innovation outcomes, this study expands

imprinting theory to incorporate ecological attributes of urban environments. It also connects insights from environmental psychology to strategic management by illustrating how sustained exposure to natural environments can translate into innovation behavior within firms.

From a managerial perspective, our findings indicate that the ecological quality of a firm's surroundings is more than merely an amenity; it constitutes a strategic asset that supports creativity, environmental orientation, and long-term innovative capacity. Decisions about where to locate headquarters or innovation centers may therefore benefit from considering not only economic and logistical factors but also ecological surroundings. Firms seeking to improve their green innovation capabilities may create work environments that replicate the benefits of natural ecological settings. This approach strengthens internal green values and encourages greater employee commitment to sustainability. These findings further suggest that managers with early-life ecological exposure may be particularly effective in promoting sustainability strategies, indicating that ecological consciousness can play a meaningful role in shaping leadership effectiveness in green innovation.

For policymakers and urban planners, the results indicate the value of ecological investments as an indirect yet powerful tool for promoting sustainable corporate behavior. City parks and green infrastructure are typically defended on the basis of public health or aesthetic benefits. Our findings show that they can also generate positive economic externalities by encouraging corporate green innovation and fostering environmentally conscious local business ecosystems. By improving ecological quality across key development areas, local governments can cultivate environments that foster long-term sustainable innovation. The persistence of ecological imprinting also suggests that policy efforts targeting early-stage firms or regions experiencing rapid entrepreneurial activity may have particularly enduring effects.

At a broader societal level, the findings highlight that ecological governance can generate value well beyond its environmental and recreational benefits. By influencing the direction of

corporate innovation, green infrastructure contributes to the development of greener industries, more sustainable products, and more environmentally responsible economic systems. These insights support the idea that ecological civilization is not only a cultural or environmental aspiration but also a force that can drive meaningful economic transformation. Urban ecological governance, therefore, plays a dual role in enhancing public welfare and supporting long-term sustainable industrial development.

5. Conclusion

This study investigates the relationship between urban ecological environments, specifically the presence and density of city parks, and corporate green innovation. We find that firms surrounded by better ecological environments, as indicated by the presence of city parks within a 500-meter radius of their headquarters, exhibit higher levels of green innovation. This relationship is particularly pronounced in non-state-owned enterprises and firms operating in more competitive industries, indicating the significant influence of market dynamics on environmental strategies. The persistent nature of this relationship, even after firms relocate, highlights the enduring impact of initial ecological environments on corporate behavior.

Our study contributes to the literature in several ways. First, we provide empirical evidence on the influence of urban ecological environments on firm-level green innovation, a relatively underexplored area. We shed light on how environmental awareness, fostered by proximity to green spaces, can drive corporate green strategies. We extend the understanding of how ecological values are transformed into economic values. While prior research has focused on the ecological environment's effects at a macro level, our study provides firm-level insights into how these values can be converted into economic assets. Our findings suggest that urban green spaces can enhance corporate green innovation, offering a practical implication for urban planners and policymakers.

By demonstrating the influence of urban green infrastructure on corporate green innovation, this study emphasizes the importance of integrating ecological considerations into urban planning. Expanding green infrastructure and optimizing its use can substantially enhance corporate green innovation, contributing to broader environmental and economic sustainability goals. Overall, our findings highlight the critical role of urban environmental governance in fostering a sustainable corporate culture. By promoting green spaces and enhancing the ecological quality of urban environments, policymakers can incentivize firms to adopt green innovation strategies, ultimately contributing to the broader objective of sustainable development.

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Appendix A Variable Definitions

Variable	Definition
Dependent variable	
<i>GPATENT</i>	The natural logarithm of one plus the total number of green patent applications.
<i>INVENTION</i>	The natural logarithm of one plus the number of green invention patents.
<i>UTILITY</i>	The natural logarithm of one plus the number of green utility model patents.
Variable of Interest	
<i>PARK_DUM</i>	A binary variable where “1” indicates the presence of a city park within a 500-meter radius of a firm’s operational location, and “0” otherwise.
<i>PARK_NUM</i>	The natural logarithm of one plus the number of city parks within a 500-meter radius of a firm’s operational location.
Control variable	
<i>SIZE</i>	The natural logarithm of the book value of total assets.
<i>LEV</i>	The ratio of total liabilities to total assets.
<i>ROA</i>	The ratio of net profit to total assets.
<i>GROWTH</i>	The difference of operating income from the previous period to the current period, divided by the operating income of the previous period.
<i>CFO</i>	The ratio of net cash flow from operating activities to total assets.
<i>MARKET</i>	The natural logarithm of sales revenue divided by operating costs.
<i>MSHARE</i>	The ratio of executive stock ownership to total share capital.
<i>SOE</i>	A binary variable that equals one if a firm is a state-owned enterprise, and zero otherwise.
Other variable	
<i>PARK_IPO</i>	A binary variable that equals one if a firm has a city park nearby when it goes public, and zero otherwise.
<i>AWARE_HIGH</i>	A binary variable that equals one if the CEO’s green awareness is higher than the median value, and zero otherwise.
<i>HHI_HIGH</i>	A binary variable that equals one if a firm is located in an industry with an HHI value below the median, and zero otherwise.

Table 1: Distribution of city parks and firms

Top 20 park cities			Top 20 firm cities		
City	Freq.	%	City	Freq.	%
Beijing	1450	5.66%	Beijing	455	8.80%
Shenzhen	1126	4.40%	Shanghai	431	8.34%
Shanghai	729	2.85%	Shenzhen	401	7.76%
Chongqing	644	2.51%	Hangzhou	205	3.97%
Guangzhou	618	2.41%	Guangzhou	144	2.79%
Hangzhou	612	2.39%	Suzhou	144	2.79%
Suzhou	525	2.05%	Chengdu	116	2.24%
Chengdu	399	1.56%	Nanjing	114	2.21%
Tianjin	361	1.41%	Ningbo	92	1.78%
Nanjing	340	1.33%	Changsha	84	1.62%
Zhengzhou	334	1.30%	Wuxi	82	1.59%
Shijiazhuang	271	1.06%	Wuhan	78	1.51%
Jinhua	264	1.03%	Chongqing	70	1.35%
Xi'an	241	0.94%	Hefei	68	1.32%
Jiaxing	239	0.93%	Tianjin	67	1.30%
Fuzhou	237	0.93%	Xiamen	66	1.28%
Changsha	228	0.89%	Shaoxing	64	1.24%
Jinan	220	0.86%	Changzhou	61	1.18%
Hefei	218	0.85%	Qingdao	57	1.10%
Quanzhou	213	0.83%	Xi'an	54	1.04%
# of top 20 cities	9,269	36.18%	# of top 20 cities	2,853	55.18%
# of total park cities	25,617	100.00%	# of total firm cities	5,170	100.00%
# of unique park cities	6		# of unique firm cities	127	

Note: This table presents the top 20 cities in China with the most city parks and listed firms. We identified 25,617 city parks across China and 5,170 publicly listed firms during the sample period. Cities with bolded names appear in both rankings.

Table 2: Summary statistics**Panel A: Descriptive Statistics**

Variables	Mean	SD	10 th	25 th	Median	75 th	90 th
<i>GPATENT</i>	0.608	0.935	0.000	0.000	0.000	1.099	2.079
<i>PARK_DUM</i>	0.335	0.472	0.000	0.000	0.000	1.000	1.000
<i>PARK_NUM</i>	0.314	0.480	0.000	0.000	0.000	0.693	1.099
<i>SIZE</i>	22.240	1.437	20.580	21.193	22.006	23.083	24.252
<i>LEV</i>	0.440	0.217	0.146	0.268	0.436	0.600	0.729
<i>ROA</i>	0.060	0.070	0.006	0.030	0.056	0.092	0.136
<i>GROWTH</i>	0.194	0.446	-0.161	-0.005	0.126	0.290	0.525
<i>CFO</i>	0.043	0.070	-0.039	0.005	0.043	0.084	0.127
<i>MARKET</i>	0.385	0.316	0.101	0.172	0.303	0.495	0.763
<i>MSHARE</i>	0.103	0.173	0.000	0.000	0.0001	0.160	0.395
<i>SOE</i>	0.450	0.498	0.000	0.000	0.000	1.000	1.000

Panel B: Univariate test

	<i>PARK_YES</i>	<i>PARK_NO</i>	t-statistic	<i>PARK_HIGH</i>	<i>PARK_LOW</i>	t-statistic
<i>GPATENT</i>	0.680	0.572	5.610***	0.680	0.597	3.117***

Note: Panel A provides descriptive statistics for the variables utilized in the baseline regressions of this study, including 11,805 firm-year observations from 2007 to 2021. Definitions of all variables can be found in Section 3.4. Continuous variables are winsorized at the 1% and 99% levels to mitigate the impact of outliers. Panel B compares the average green patent measures for firms. The t-statistics and p-values are derived from difference in means tests.

Table 3: The effect of city parks on corporate green innovation

Variables	(1)	(2)	(3)	(4)
	Dependent variable = <i>GPATENT</i>			
<i>PARK_DUM</i>	0.100*** (4.935)		0.066*** (3.355)	
<i>PARK_NUM</i>		0.082*** (3.915)		0.049** (2.385)
<i>SIZE</i>			0.195*** (21.497)	0.195*** (21.503)
<i>LEV</i>			-0.010 (-0.203)	-0.005 (-0.105)
<i>ROA</i>			0.937*** (6.994)	0.944*** (7.049)
<i>GROWTH</i>			-0.045** (-2.466)	-0.045** (-2.484)
<i>CFO</i>			-0.045 (-0.367)	-0.046 (-0.367)
<i>MARKET</i>			-0.008 (-0.255)	-0.011 (-0.330)
<i>MSHARE</i>			0.158*** (2.786)	0.162*** (2.847)
<i>SOE</i>			-0.035 (-1.578)	-0.033 (-1.512)
<i>CONS</i>	0.551*** (6.602)	0.565*** (6.764)	-3.529*** (-17.883)	-3.524*** (-17.839)
Industry_FE	YES	YES	YES	YES
Year_FE	YES	YES	YES	YES
City_FE	YES	YES	YES	YES
Observations	11,085	11,085	11,085	11,085
Adjusted R ²	0.140	0.139	0.197	0.197

Notes: This table presents the results of panel OLS regression analyses examining the relationship between urban ecological environments and corporate green innovation, as specified by Equation (1). The dataset includes of firm-year observations from 2007 to 2021. The first two columns are fixed effects models, while the remaining two columns incorporate control variables. Tested coefficients are highlighted in bold. Standard errors are adjusted for heteroskedasticity and clustering at city-level.

***, ** and * indicate significance at the 1%, 5% and 10% levels, respectively.

Table 4: Classification of corporate green innovation (green invention patents vs. green utility model patents)

Variables	(1) Dependent variable = <i>INVENTION</i>	(2) Dependent variable = <i>INVENTION</i>	(3) Dependent variable = <i>UTILITY</i>	(4) Dependent variable = <i>UTILITY</i>
<i>PARK_DUM</i>	0.052*** (3.109)		0.034** (2.455)	
<i>PARK_NUM</i>		0.040** (2.329)		0.023¹⁵ (1.615)
<i>SIZE</i>	0.171*** (22.227)	0.171*** (22.232)	0.101*** (15.671)	0.101*** (15.677)
<i>LEV</i>	-0.026 (-0.639)	-0.023 (-0.553)	0.021 (0.604)	0.024 (0.685)
<i>ROA</i>	0.685*** (6.227)	0.690*** (6.280)	0.580*** (6.142)	0.584*** (6.180)
<i>GROWTH</i>	-0.028* (-1.818)	-0.028* (-1.833)	-0.029** (-2.426)	-0.030** (-2.440)
<i>CFO</i>	-0.063 (-0.617)	-0.063 (-0.618)	0.009 (0.106)	0.009 (0.106)
<i>MARKET</i>	0.037 (1.334)	0.035 (1.269)	-0.085*** (-4.467)	-0.086*** (-4.540)
<i>MSHARE</i>	0.106** (2.237)	0.108** (2.294)	0.114*** (2.808)	0.116*** (2.853)
<i>SOE</i>	0.010 (0.510)	0.011 (0.565)	-0.058*** (-3.813)	-0.057*** (-3.756)
<i>CONS</i>	-3.284*** (-19.577)	-3.280*** (-19.537)	-1.730*** (-12.198)	-1.727*** (-12.171)
Industry_FE	YES	YES	YES	YES
Year_FE	YES	YES	YES	YES
City_FE	YES	YES	YES	YES
Observations	11,085	11,085	11,085	11,085
Adjusted R ²	0.184	0.183	0.178	0.177

Notes: This table presents the results of panel OLS regression analyses examining the relationship between urban ecological environments and corporate green innovation, using two alternative green patent measures. The dataset includes of firm-year observations from 2007 to 2021. The first two columns use green invention patents (*INVENTION*) as the dependent variable, while the remaining two columns use green utility model patents (*UTILITY*) as the dependent variable. Tested coefficients are highlighted in bold. Standard errors are adjusted for heteroskedasticity and clustering at city-level.

***, ** and * indicate significance at the 1%, 5% and 10% levels, respectively.

¹⁵ The p-value is 0.106.

Table 5 Panel A: Robust test utilizing green patent data adjusted for three-year lags

Variables	(1)	(2)	(3)	(4)
	Dependent variable = <i>GPATENT</i>			
<i>PARK_DUM</i>	0.082*** (4.203)		0.055*** (2.865)	
<i>PARK_NUM</i>		0.069*** (3.460)		0.043** (2.137)
<i>SIZE</i>			0.151*** (16.896)	0.151*** (16.923)
<i>LEV</i>			-0.057 (-1.164)	-0.053 (-1.097)
<i>ROA</i>			0.506*** (3.988)	0.512*** (4.030)
<i>GROWTH</i>			-0.030* (-1.763)	-0.030* (-1.775)
<i>CFO</i>			0.003 (0.025)	0.003 (0.024)
<i>MARKET</i>			0.059* (1.840)	0.057* (1.781)
<i>MSHARE</i>			0.105* (1.851)	0.108* (1.906)
<i>SOE</i>			-0.040* (-1.926)	-0.039* (-1.872)
<i>CONS</i>	0.675*** (8.222)	0.686*** (8.362)	-2.469*** (-12.791)	-2.467*** (-12.777)
Industry_FE	YES	YES	YES	YES
Year_FE	YES	YES	YES	YES
City_FE	YES	YES	YES	YES
Observations	11,790	11,790	11,790	11,790
Adjusted R ²	0.103	0.102	0.137	0.136

Notes: This table presents the results of panel OLS regression analyses examining the relationship between urban ecological environments and corporate green innovation, utilizing green patent data adjusted for three-year lags. The dataset includes of firm-year observations from 2007 to 2021. The first two columns are fixed effects models, while the remaining two columns incorporate control variables. Tested coefficients are highlighted in bold. Standard errors are adjusted for heteroskedasticity and clustering at city-level.

***, ** and * indicate significance at the 1%, 5% and 10% levels, respectively.

Table 5 Panel B: Robust test utilizing negative binomial regression

Variables	(1)	(2)	(3)	(4)
	Dependent variable = <i>GPATENT</i>			
<i>PARK_DUM</i>	0.275*** (4.893)		0.165*** (3.030)	
<i>PARK_NUM</i>		0.251*** (4.329)		0.138** (2.426)
<i>SIZE</i>			0.477*** (19.511)	0.477*** (19.480)
<i>LEV</i>			0.012 (0.077)	0.019 (0.123)
<i>ROA</i>			2.641*** (5.107)	2.643*** (5.092)
<i>GROWTH</i>			-0.018 (-0.316)	-0.021 (-0.372)
<i>CFO</i>			-0.684* (-1.837)	-0.692* (-1.864)
<i>MARKET</i>			-0.224* (-1.836)	-0.226* (-1.848)
<i>MSHARE</i>			0.571*** (3.385)	0.576*** (3.418)
<i>SOE</i>			-0.049 (-0.766)	-0.045 (-0.705)
<i>CONS</i>	-0.155 (-0.692)	-0.112 (-0.503)	-10.366*** (-20.474)	-10.350*** (-20.397)
Industry_FE	YES	YES	YES	YES
Year_FE	YES	YES	YES	YES
City_FE	YES	YES	YES	YES
Observations	11,085	11,085	11,085	11,085
Nagelkerke R ²	0.134	0.134	0.193	0.193

Notes: This table presents the results of panel OLS regression analyses examining the relationship between urban ecological environments and corporate green innovation, utilizing negative binomial regression. The dataset includes of firm-year observations from 2007 to 2021. The first two columns are fixed effects models, while the remaining two columns incorporate control variables. Tested coefficients are highlighted in bold. Standard errors are adjusted for heteroskedasticity and clustering at city-level.

***, ** and * indicate significance at the 1%, 5% and 10% levels, respectively.

Table 6: The changes of firms' operating locations

	(1)	(2)	(3)	(4)	(5)	(6)
Variables	Dependent variable = <i>GPATENT</i>					
	<i>Address Changed (in general)</i>		<i>Address Changed (better)</i>		<i>Address Changed (worse)</i>	
<i>TREAT</i> × <i>POST</i>	0.051 (1.129)	0.045 (0.989)	0.033 (0.562)	0.016 (0.264)	0.083 (1.222)	0.106 (1.538)
<i>SIZE</i>		0.063** (1.978)		0.065 (1.280)		0.065 (1.605)
<i>LEV</i>		0.117 (0.977)		0.212 (1.351)		0.099 (0.526)
<i>ROA</i>		-0.014 (-0.057)		-0.057 (-0.163)		-0.136 (-0.387)
<i>GROWTH</i>		-0.022 (-1.134)		-0.025 (-0.744)		-0.004 (-0.173)
<i>CFO</i>		-0.015 (-0.071)		0.028 (0.099)		-0.299 (-0.949)
<i>MARKET</i>		-0.023 (-0.327)		0.272** (2.474)		-0.247** (-2.469)
<i>MSHARE</i>		0.346** (2.007)		-0.003 (-0.011)		0.935*** (3.399)
<i>SOE</i>		0.214** (2.539)		0.439*** (4.153)		0.013 (0.099)
<i>CONS</i>	-0.288* (-1.708)	-2.049** (-2.544)	-0.101 (-0.643)	-2.277** (-1.973)	-0.307** (-2.573)	-1.573* (-1.848)
Firm_FE	YES	YES	YES	YES	YES	YES
Year_FE	YES	YES	YES	YES	YES	YES
City_FE	YES	YES	YES	YES	YES	YES
Observations	2,335	2,335	1,475	1,475	860	860
Adjusted R ²	0.505	0.506	0.517	0.519	0.466	0.473

Notes: This table presents the results of the influence that relocation has on corporate green innovation using the Difference in Differences approach. The term *TREAT* × *POST* refers to firms that experienced a location change during the period after the change. The dataset includes of firm-year observations from 2007 to 2021. Column (1) to (6) report the results for firms when they change their location in general, when they move to locations with better urban ecological environments, and when they move to locations with worse urban ecological environments, respectively. Tested coefficients are highlighted in bold. Standard errors are adjusted for heteroskedasticity and clustering at city-level.

***, ** and * indicate significance at the 1%, 5% and 10% levels, respectively.

Table 7: City parks nearby at the time of IPO

Variables	(1)	(2)	(3)	(4)
	Dependent variable = <i>GPATENT</i>			
<i>PARK_DUM</i> × <i>PARK_IPO</i>	0.138** (2.297)		0.222*** (3.751)	
<i>PARK_NUM</i> × <i>PARK_IPO</i>		0.087* (1.748)		0.165*** (3.380)
<i>PARK_DUM</i>	0.044* (1.877)		-0.021 (-0.933)	
<i>PARK_NUM</i>		0.027 (1.130)		-0.039* (-1.687)
<i>PARK_IPO</i>	0.012 (0.228)	0.067 (1.521)	0.0003 (0.005)	0.060 (1.404)
<i>CONS</i>	0.563*** (6.775)	0.575*** (6.888)	-3.552*** (-18.012)	-3.548*** (-17.969)
Controls	NO	NO	YES	YES
Industry_FE	YES	YES	YES	YES
Year_FE	YES	YES	YES	YES
City_FE	YES	YES	YES	YES
Observations	11,085	11,085	11,085	11,085
Adjusted R ²	0.142	0.141	0.201	0.201

Notes: This table presents the results of panel OLS regression analyses examining the mediating effect of having parks nearby at the time of IPO on the relationship between urban ecological environments and corporate green innovation. *PARK_IPO* equals one if a firm has a city park nearby when it goes public, and zero otherwise. The dataset includes of firm-year observations from 2007 to 2021. The first two columns are fixed effects models, while the remaining two columns incorporate control variables. Tested coefficients are highlighted in bold. Standard errors are adjusted for heteroskedasticity and clustering at city-level.

***, ** and * indicate significance at the 1%, 5% and 10% levels, respectively.

Table 8: The effect of CEO's green awareness on corporate green innovation

Variables	(1)	(2)	(3)	(4)
	Dependent variable = <i>GPATENT</i>			
<i>PARK_DUM</i> × <i>AWARE_HIGH</i>	0.211*** (3.186)		0.170*** (2.627)	
<i>PARK_NUM</i> × <i>AWARE_HIGH</i>		0.189*** (2.897)		0.146** (2.292)
<i>PARK_DUM</i>	-0.041 (-0.893)		-0.044 (-0.958)	
<i>PARK_NUM</i>		-0.075 (-1.550)		-0.078* (-1.649)
<i>AWARE_HIGH</i>	-0.086** (-2.160)	-0.073* (-1.855)	-0.062 (-1.613)	-0.050 (-1.294)
<i>CONS</i>	0.568*** (3.229)	0.563*** (3.196)	-3.319*** (-8.257)	-3.344*** (-8.296)
Controls	NO	NO	YES	YES
Industry_FE	YES	YES	YES	YES
Year_FE	YES	YES	YES	YES
City_FE	YES	YES	YES	YES
Observations	3,647	3,647	3,647	3,647
Adjusted R ²	0.183	0.182	0.228	0.228

Notes: This table presents the results of panel OLS regression analyses examining the mediating effect of having CEOs with high green awareness on the relationship between urban ecological environments and corporate green innovation. Green awareness of a CEO is measured by the average per capita green space of their birthplace during the sample period. *AWARE_HIGH* equals one if the CEO's green awareness is higher than the median value, and zero otherwise. The dataset includes of firm-year observations from 2007 to 2021. The first two columns are fixed effects models, while the remaining two columns incorporate control variables. Tested coefficients are highlighted in bold. Standard errors are adjusted for heteroskedasticity and clustering at city-level.

***, ** and * indicate significance at the 1%, 5% and 10% levels, respectively.

Table 9: Cross-section analysis of market competitiveness and corporate ownership structure

Variables	(1)	(2)	(3)	(4)
	Dependent variable = <i>GPATENT</i>			
<i>PARK_DUM</i> × <i>HHI_HIGH</i>	0.125** (2.122)			
<i>PARK_NUM</i> × <i>HHI_HIGH</i>		0.168** (2.568)		
<i>PARK_DUM</i> × <i>SOE</i>			-0.125*** (-3.420)	
<i>PARK_NUM</i> × <i>SOE</i>				-0.110*** (-3.038)
<i>PARK_DUM</i>	-0.046 (-0.823)		0.124*** (4.793)	
<i>PARK_NUM</i>		-0.103 (-1.632)		0.096*** (3.686)
<i>HHI_HIGH</i>	0.054 (0.457)	0.037 (0.313)		
<i>SOE</i>	-0.034 (-1.544)	-0.032 (-1.439)	0.005 (0.216)	-0.001 (-0.022)
<i>CONS</i>	-3.484*** (-17.611)	-3.474*** (-17.524)	-3.575*** (-18.047)	-3.566*** (-17.982)
Controls	YES	YES	YES	YES
Industry_FE	YES	YES	YES	YES
Year_FE	YES	YES	YES	YES
City_FE	YES	YES	YES	YES
Observations	11,085	11,085	11,085	11,085
Adjusted R ²	0.198	0.197	0.198	0.197

Notes: This table presents the results of cross-sectional analyses examining the differences between firms operating in high versus low competitive industries (see columns (1) and (2)) and the differences between private firms and state-owned firms (see columns (3) and (4)). Industry competitiveness is measured by the average Herfindahl-Hirschman Index (HHI) during the sample period, where a lower value indicates higher industry competitiveness. *HHI_HIGH* equals one if the firm is located in an industry with an HHI value below the median, and zero otherwise. The dataset includes of firm-year observations from 2007 to 2021. Tested coefficients are highlighted in bold. Standard errors are adjusted for heteroskedasticity and clustering at city-level.

***, ** and * indicate significance at the 1%, 5% and 10% levels, respectively.