Green Innovation Spillover

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Abstract

As green innovation gains traction and its benefits become evident to firms and society, scholarly attention has shifted from potential future returns to the actual implementation of green innovation practices. While corporate green development has attracted growing interest, how executive mobility contributes to the diffusion of green innovation across firms remains under-investigated. Drawing on behavioral consistency and upper echelons theories, this study investigates whether, and to what extent, executive migration facilitates the spillover of green knowledge and practices. Using comprehensive data combining green patents and executive migration records, we document a positive relation between the green innovation performance of origin and destination firms linked by migrating executives. These spillovers remain robust after multiple checks and addressing endogeneity concerns. The effect is contingent on executive power, salary level, job migration attributes, and various province-, firm-, and executive-level characteristics. Overall, this study highlights the role of executive mobility in driving green innovation spillovers across different contexts.

Key words: Green innovation; spillover effects; executive transition; environmental identity

1. Introduction

Environmental degradation remains one of the most pressing global challenges. As countries progress in development, many adopt green innovation as a key strategy for ecological preservation (Guo et al., 2021). Green innovation, referred to as sustainable, ecological, or environmental innovation, supports both financial performance (Vasileiou et al., 2022; Cheng et al., 2025) and long-term development goals (Chen et al., 2023). Environmental ethics position green innovation as a strategic corporate resource that promotes sustainability, strengthens competitive advantage, and helps firms manage short-term risks while securing long-term benefits (e.g., Khanra et al., 2021; Quan et al., 2021).

With the growing focus on environmental sustainability, firms increasingly recruit executives with green-related experience to strengthen internal initiatives, qualify for government subsidies, and signal alignment with sustainable development goals (Chen et al., 2024). While corporate green development has attracted research interest, limited attention has been given to how executive mobility contributes to the diffusion of green innovation across firms. From a behavioral perspective, environmental identity encourages individuals to act in line with pro-environmental values (Truelove et al., 2014). As both strategic leaders and social actors, executives tend to maintain these values in decision-making, especially as sustainability becomes more central to organizational and societal expectations. Their movement between firms not only brings fresh perspectives but also forms inter-organizational links and facilitates resource allocation in green innovation expertise.[1] Drawing on behavioral consistency theory (Epstein, 1979) and upper echelons theory (Hambrick & Mason, 1984; Hambrick, 2007), this study investigates whether, and to what extent, executive migration facilitates the spillover of green knowledge and practices across firms.

China is an ideal setting for our study for several reasons. First, it was among the earliest major economies to establish a national green standards framework and has actively promoted green growth policies (Yu et al., 2021; Green Book of China Green Capital Market, 2023). Second, China leads global green innovation, ranking at the top for both patent applications and grants in green technology. The IP5 countries (the world's five largest patent offices—China, U.S., Europe, Japan, and South Korea) hold 87.8% of green patent grants, while China alone accounts for 43.6% of all IP5 green patent grants. Given China's rapid progress, examining its green innovation offers valuable insights and a benchmark for other countries. Statistically,

To examine whether green innovation spillovers occur through executive job migration, we compile a firm-level panel of 10,441 firm-year observations

[1] One prominent example is Patricia Poppe, who served as the CEO of CMS Energy before becoming the CEO of PG&E in 2021. During her tenure at CMS Energy, Poppe made significant strides in supporting the development of renewable energy and implementing a strong safety culture. After joining PG&E, she brought her commitment to green innovation to the new firm. Currently, Poppe's goal for PG&E is to strengthen trust in the company by improving safety and leveraging technology, while leading it on the path toward clean energy.

from 2008–2020, on Chinese listed companies, by merging annual green patents with executive job migration records and firm characteristics. Baseline regressions controlling for various fixed effects consistently show that green innovation at origin firms positively predicts green innovation at destination firms, providing robust evidence of spillovers through executive mobility.

Our analysis further reveals that the transfer of prior strategies by migrating executives is not automatic but contingent on a constellation of temporal, individual, organizational, and regional factors. Temporally, spillovers emerge with a one-year lag, remain significant for three years, and dissipate by the fourth year, highlighting a "golden window of opportunity" for recipient firms. At the individual level, spillovers are stronger when executives move without pay increases, consistent with evidence that high-powered incentives can crowd out long-term sustainability-oriented behavior (Li et al., 2021; Hong et al., 2015). Similarly, executives promoted to more powerful positions—or maintaining comparable authority—facilitate spillovers, whereas demoted executives show no significant effect, underscoring the role of discretion in strategic decision-making (Finkelstein, 1992). Career continuity also matters: executives who transition directly without career gaps maintain momentum in knowledge transfer, while interruptions weaken the effect, echoing concerns that non-compete restrictions disrupt knowledge flows (Conti, 2013; Marx, 2022). At the organizational level, stronger corporate governance amplifies spillovers, suggesting that effective boards and concentrated ownership enhance absorptive capacity and the integration of external practices (Amore & Bennedsen, 2016; Baldenius et al., 2014). At the regional level, firms in provinces with higher pollution, more frequent environmental emergencies, or weaker innovation capacity exhibit stronger spillovers, indicating that environmental pressures and local innovation gaps heighten receptiveness to external knowledge (Ma & He, 2023; Berrone et al., 2013).

Finally, to ensure that these findings are not artifacts of model specification, we conduct several robustness tests. First, we apply propensity score matching (PSM) to address potential selection bias and two-stage least squares (2SLS) to mitigate concerns about unobserved heterogeneity. Second, we carry out a placebo test that randomly reassigns executives to firms to verify causality. Finally, we re-estimate the models using alternative measures for green innovation including adjusted citations, the ratio of green to total patents, and an alternative sample period to account for patent quality, innovation intensity, and temporal distortions. Across all specifications, the spillover effect remains consistent, reinforcing the robustness and credibility of our conclusions.

Our contributions to the literature are two folds. First, we bring human capital into the center of the green innovation determinants by introducing executive job migration as a novel and dynamic spillover channel. Whereas prior studies have emphasized managerial demographics and traits (Quan et al., 2021; He & Jiang, 2019), digital transformation (Tang et al., 2023; Ning et al., 2023), financial relationships (Sheng et al., 2023), supply-chain linkages (Huang et al., 2025), investor influence (Zhao et al., 2022), or policy and institutional environments (Krieger & Zipperer, 2022; Berrone et al., 2013; Jiang et al., 2023; Ren et al., 2024), we demonstrate that executives through their accumulated knowledge, values, and strategic orientation, constitute an agency-driven mechanism for transmitting sustainability practices across firms. This enriches ongoing conversations about how green knowledge diffuses, offering insights not only for China but also for global contexts where cross-border talent flows are intensifying.

Second, we provide evidence of how such spillovers occur by uncovering their contingent nature. Our analyses show that the strength and persistence of spillovers hinge on a constellation of temporal, individual, organizational, and regional factors. By documenting these heterogeneous effects, we contribute a more nuanced and behaviorally grounded understanding of inter-firm knowledge transfer, complementing upper echelons (Hambrick & Mason, 1984; Hambrick, 2007) and behavioral consistency theories (Epstein, 1979) with new evidence from sustainability-oriented innovation. Our results provide important actionable insights for various stakeholders, which we discuss in detail in Section 8.

2. Theoretical Framework

2.1 Green Innovation and Knowledge Spillovers

Green innovation, which involves the development of environmentally friendly products, processes, and organizational practices, is widely recognized as a crucial pathway for achieving sustainable growth perspectives (Berrone et al., 2013; Xie et al., 2019). Compared with conventional innovation, it provides both economic (Hao et al., 2022; Vasileiou et al., 2022) and environmental benefits (Dai et al., 2025) by improving firms' resource efficiency, reducing emissions, and strengthening legitimacy in increasingly sustainability-conscious markets (Zhao et al., 2022). At the same time, green innovation is often costly and uncertain (Ahuja & Morris Lampert, 2001; Martínez-Ros & Kunapatarawong, 2019), requiring significant upfront investment and long payback periods, which can discourage firms from committing to such activities on their own (Rennings, 2000; Huang et al., 2025).

A central mechanism enabling the diffusion of green innovation is knowledge spillovers, whereby firms benefit from external knowledge without fully internalizing the costs of its generation (Jaffe et al., 1993; Sheng et al., 2023). Spillovers are particularly important for sustainability-oriented innovation, where the collective benefits extend beyond individual firms. Prior research highlights several spillover channels: financing relationships (Sheng et al., 2023), supply-chain dependencies (Huang et al., 2025), and investor influence

(Zhao et al., 2022). These studies underscore how external actors shape firms' green innovation through financial resources, governance pressures, and inter-firm ties.

However, less is known about the role of human capital mobility as a channel of spillover. Executives, in particular, embody both tacit knowledge and strategic orientation. When they move between firms, they can actively transfer not only technical expertise but also organizational routines and innovation logics. Unlike passive diffusion through financial or supply-chain ties, executive migration represents an agency-driven mechanism that has the potential to directly influence whether and how destination firms pursue green innovation and sustainability-oriented practices.

Existing research on knowledge diffusion emphasizes that the mobility of individuals plays a critical role in transferring tacit knowledge across organizational boundaries (Almeida & Kogut, 1999; Song et al., 2003). In the context of green innovation, this mobility may be particularly important because sustainability-related knowledge is often complex, path-dependent, and embedded in organizational routines (Rennings, 2000; Xie et al., 2019). Migrating executives can thus accelerate the diffusion of green practices by bringing with them both technological expertise and a mindset that prioritizes environmental goals.

2.2 Theoretical Perspectives

We rely on several complementary theoretical perspectives providing insights into why and how executive job migration may generate green innovation spillovers. First, upper echelon theory argues that organizational outcomes are partially a reflection of the values, experiences, and cognitive bases of top managers (Hambrick & Mason, 1984). When executives move between firms, they bring with them not only technical knowledge but also strategic orientations shaped by their prior organizational contexts. Executives from green-innovative firms are thus more likely to imprint sustainability-oriented values and practices on their new organizations, influencing green innovation outcomes at the destination firm.

Moreover, behavioral consistency theory emphasizes that individuals strive for coherence between past experiences and future actions (Epstein, 1979). Executives who have previously led or participated in green innovation initiatives may seek to replicate these behaviors in new settings, ensuring consistency with their established professional identity. This tendency provides a behavioral foundation for the persistence of green innovation logics across organizational boundaries.

Relatedly, social identity theory further highlights that individuals' behaviors are shaped by identification with prior groups and contexts (Turner, 1975). Migrating executives may maintain identification with the norms and values of their former organizations, especially if those firms emphasized sustainability. Such identity carryover can strengthen their motivation to advocate for and implement green innovation practices in destination firms, even under different structural conditions.

Finally, green identification theory suggests that individuals who internalize pro-environmental values are more likely to champion environmentally friendly practices (Truelove et al., 2014). Executives with strong green identification not only carry technical expertise but also act as change agents who promote the diffusion of sustainability-oriented routines, especially when organizational or regional contexts reinforce environmental pressures.

Together, these theories suggest that executive migration is not merely a transfer of human capital but a process through which cognitive orientations, behavioral patterns, and identity-based commitments to green practices are transmitted across firms. This perspective complements prior research that highlights external factors such as financiers (Sheng et al., 2023), suppliers (Huang et al., 2025), and investors (Zhao et al., 2022) as important drivers of green innovation. By focusing on the mobility of executives, we emphasize the agency-driven spillover of tacit knowledge and sustainability values, offering a distinct yet complementary mechanism for understanding the diffusion of green innovation.

2.3 Hypothesis Development

Drawing on the discussion above, we argue that migrating executives carry valuable information, experience, knowledge, and preferences from their previous roles, acting as channels for inter-organizational learning (Kraatz & Moore, 2002). Their personal resources and strategies often remain consistent between origin and destination firms. We propose our first hypothesis that there is a positive relation between the green innovation performance of origin and destination firms under executive job migration, aiming to verify the presence of green innovation spillovers. Figure 4 illustrates the proposed conceptual model for green innovation spillovers.

H1: Executive job migration leads to green innovation spillovers across firms.

[Insert Figure 4 here]

2.4 Contingencies of Green Innovation Spillovers

While executive job migration can facilitate the transfer of green knowledge and practices across firms, theory and prior evidence suggest that such spillovers are not uniform but contingent on a range of temporal, individual, organizational, and regional conditions. Knowledge diffusion is shaped by both the characteristics of the transmitting agent and the absorptive context of the receiving firm (Cohen & Levinthal, 1990). Accordingly, the extent to which migrating executives can reproduce prior innovation strategies depends on alignment between their authority, incentives, and experience, and the receptiveness of the destination firm and its environment.

From a temporal perspective, spillovers are unlikely to be immediate. New executives often require time to adapt, build influence, and implement initiatives in their new organizations. Yet, knowledge transfer also depreciates if not enacted within a reasonable timeframe, implying that spillovers may follow a concentrated but limited trajectory (Rennings, 2000). At the individual level, executives' discretion and motivation play a pivotal role. Theories of behavioral consistency suggest that executives seek coherence with their established identities (Epstein, 1979), but their ability to act on such preferences is conditioned by whether they hold sufficient power (Finkelstein, 1992) and whether incentives align with long-term innovation rather than short-term performance (Hong et al., 2015). Career continuity and industry-specific expertise may further preserve the tacitness and contextual relevance of green knowledge, reinforcing its transferability (Melander, 2017).

Organizational attributes also moderate spillover dynamics. Research on corporate governance indicates that boards and ownership structures shape the discretion of top managers (Baldenius et al., 2014; Amore & Bennedsen, 2016). Firms with stronger governance and clearer strategic alignment may therefore provide more fertile ground for external knowledge to take root. Similarly, absorptive capacity, reflected in firms' prior innovation experience and resource commitments, enhances the likelihood that external practices are assimilated and leveraged (Cohen & Levinthal, 1990).

Finally, regional contexts introduce further heterogeneity. Firms embedded in provinces facing acute environmental pressures, such as high pollution or frequent environmental emergencies, may be especially receptive to externally sourced green innovation as a means of compliance and legitimacy (Berrone et al., 2013; Ma & He, 2023). In contrast, firms in peripheral or less innovative regions may depend more heavily on imported expertise to overcome local capability gaps. These perspectives motivate the subsequent analysis, where we explore how these temporal, individual, organizational, and regional contingencies condition the diffusion of green knowledge across firms.

3. Data and Methodology

3.1 Data

We obtain firm-level green innovation data from the CnOpenData[2], a widely used platform that provides Chinese patent and intellectual property information from official sources such as the China National Intellectual Property Administration (CNIPA) (Dai et al., 2024; Wang et al., 2022; Zhao et al., 2022). The database covers patent filings across industries from 1999 to 2021 and is regularly updated with approvals, rejections, and legal status changes. Green patents are classified according to International Patent Classification (IPC) codes established by CNIPA and aligned with World Intellectual

[2] More information on CnOpenData is at: www.cnopendata.com/en.

Property Organization (WIPO) standards. We aggregate the total number of green invention[3] patent applications annually at the firm level.

Our sample covers all publicly listed Chinese firms and their top management teams, excluding financial firms, non–A-share firms, and Special Treatment (ST) firms that face delisting risks due to financial instability or regulatory concerns. We obtain all other variables, including executive employment history and firm-level variables, from the China Stock Market and Accounting Research (CSMAR) database. After merging all variables, we identify 32,440 executive migrations from 2008 to 2020, involving 3,837 destination firms and 3,946 origin firms, together account for 152,108 green patents. To ensure representativeness, when multiple executives join the same destination firm in a given year, we retain only one randomly selected executive. The final sample includes 10,441 executive job migration to 3,837 destination firms from 3,194 origin firms, covering 494,012 green patents. As an alternative, in later robustness checks, we also average all migrations within a firm-year and examine the relationship between the average green innovation of all origin firms and the green innovation of the destination firms.

3.2 Methodology

[3] Invention patents refer to new technical solutions for products, methods and improvements. There are three categories of patent according to the CNIPA: Invention, Utility Model and Appearance Design. Compared to Utility Model and Appearance Design, Invention patents require more advanced technological support. In addition, green innovation brings significant positive economic effects, mainly from green invention patents rather than green utility patents (Ma et al., 2023). Thus, following Quan et al. (2021), we use green invention patent as a proxy of green innovation performance of firms.

We use the following model to examine the spillover effect on green innovation brought by the migrating executives:

$$GI\_Destination_{i,t+1} = \alpha_i + \beta_1 GI\_Origin_{i,t-1} + \beta_2 FirmControls_{i,t+1} + \beta_3 ExecutiveControls_{i,t+1} + YearFE + Firm\ FE + \varepsilon_{i,t+1} \quad (1)$$

where $GI\_Destination_{i,t+1}$ represents the green innovation performance of the destination firm i in year $t+1$, the year after executive migration; $GI\_Origin_{i,t-1}$ captures the green innovation performance of the origin firm for the migrated executive in year $t-1$, the year prior to the executive migration. $GI\_Destination_{i,t+1}$ and $GI\_Origin_{i,t-1}$ are measured by the natural logarithm of one plus the number of green patents. We allow a one-year lag between $GI\_Origin_{i,t-1}$ and $GI\_Destination_{i,t+1}$ to better establish causality.

Following prior studies, the control variables include a range of firm-level and executive-level variables that may influence green innovation (e.g., Quan et al., 2021; Tian et al., 2023). At the firm level, we control for firm size (*FirmSize*), firm age (*FirmAge*), sales growth (*Growth*), firm financial performance (*ROA*), firm leverage (*Leverage*), and percentage of institutional shareholders (*InstitutionalOwn*). At the executive level, we control for executive age (*Age*), and gender (*Gender*). The detailed variable definitions are in Appendix 1. Additionally, we winsorize all continuous variables at 1%

level and include firm and year fixed effects in our regressions to control for unobserved factors and reduce endogeneity concerns.

3.3 Summary Statistics

We report the summary statistics[4] of the main sample in Panel A of Table 1. The mean value of *GI_Origin* is 0.596, which corresponds to an average of 0.815 green patents per origin firm annually. Similarly, the mean value of *GI_Destination* is 0.769 (or 1.158 green patents per destination firm annually). This pattern is consistent with a positive spillover effect of executive migration on firm green innovation. In terms of executive characteristics, the majority of executives in the sample are male (83.9%), with an average age of 52 years.

Panel B of Table 1 reports the Pearson correlation matrix of main variables. The correlation between *GI_Origin* and *GI_Destination* is significantly positive at the 1% level, which preliminarily supports our main hypothesis of green innovation spillovers through executive migrations. Moreover, the other correlations between *GI_Destination* and the control variables are largely consistent with the expectations.

[Insert Table 1 here]

4. Main Results

4.1 Baseline Results

[4] To reduce skewness and improve interpretability, we use the logarithmic transformations and report the logarithmic value of *GI_Destination*, *GI_Origin*, *FirmSize*, *FirmAge*, and *ExecutiveAge* in the regression models.

We report our baseline results using model (1) in the first column of Table 2. As indicated by the statistically significant coefficient of *GI_Origin*, we find the number of green patents of the origin firm positively predict the number of green patents of the destination firm at the 1% significance level. In terms of economic significance, a 1% increase (decrease) in *GI_Origin* (the log-transformed number of green patents of the origin firm) is associated with a 0.065% increase (decrease) in *GI_Destination* (the log-transformed number of green patents of the destination firm). More substantively, a one standard deviation increase in GI_Origin corresponds to an increase of about 0.185 green patents per destination firm per year, representing roughly a 16% improvement relative to the mean. Moreover, columns (2) and (3) replicate the same analysis, while alternatively control for year and industry fixed effect, and year and province fixed effects, we find the results hold after accounting for unobserved factors from the industry and province levels.

The results of the control variables are largely consistent with previous literature. Firm size positively predicts innovation, because larger firms can amortize the fixed cost per innovation over more units of output, absorb the risk of project failure, and more likely to have any required expertise in-house (Knott & Vieregger, 2020). Younger firms undertake more riskier innovation activities (Coad et al., 2016). Regarding financial performance measured by ROA (Tan et al., 2022; Zhang et al., 2023), more profitable firms may have greater capacity to allocate resources toward environmental R&D. We also find a negative relationship between institutional ownership and green innovation, supporting the argument that institutional investors may discourage long-term sustainability investments when their incentives are not aligned with green objectives (Velte, 2023). In addition, older executives are more likely to support green innovation (He et al., 2024), possibly due to stronger ethical standards and a heightened sense of social responsibility (Daboub et al., 1995).

[Insert Table 2 here]

4.2 Temporal Analysis

We further conduct a temporal analysis by estimating the effect of *GI_Origin* on *GI_Destination* from the year of migration (t) through five subsequent years (t + 1 to t + 5). The results are reported in Table 3. Our analysis shows that green innovation spillovers unfold gradually and are time-bound. In column (1), the positive but only marginally significant relationship between GI_Origin_t and $GI\_Destination_t$ indicates a weak immediate effect, consistent with the learning and adaptation period required for a migrating executive. Columns (2)–(4) reveal that the effect strengthens and peaks within the first year after the executive's arrival, persisting through the third year. By contrast, columns (5) and (6) show the effect fading to insignificance in the fourth and fifth years. These results imply that spillovers are neither instantaneous nor permanent but exert a concentrated, economically meaningful influence over roughly three years—the "golden window" for recipient firms to capitalize on imported green knowledge.

[Insert Table 3 here]

4.3 Endogeneity Tests

4.3.1 PSM

To reduce potential concerns around endogeneity due to selection bias, we employ the Propensity Score Matching (PSM) method based on entropy balancing. We construct a dummy variable, *HaveGreenPatents_Origin*, which equals 1 if the origin firm holds any green patents and 0 otherwise.

Panel A of Table 4 reports the balancing results. After entropy balancing, the treatment and control groups achieve close alignment across all covariates, with differences in means, variances, and skewness substantially reduced. This indicates that the matched sample satisfies the balancing requirements, thereby ensuring comparability between firms whose executives migrate from green-innovative versus non–green-innovative origins. The improved balance across firm size, firm age, profitability (ROA), leverage, ownership, and executive characteristics strengthens the reliability of subsequent regression analysis.

Panel B presents the OLS regression results on the matched sample. The coefficient on *HaveGreenPatents_Origin* is 0.047, statistically significant at the 1% level. This finding indicates that destination firms are significantly more likely to engage in green innovation when they recruit executives from origin firms with green patents. The results on control variables are also largely consistent. The PSM results corroborate our baseline findings while mitigating concerns that the observed spillover effect is an artifact of sample selection, after adjusting for observable firm and executive characteristics.

[Insert Table 4 here]

4.3.2 2SLS

To further address potential bias from unobservable factors, we employ a two-stage least squares (2SLS) method. Following Huang et al. (2025), we use provincial green innovation performance, defined as the average number of green innovations among firms in the province where the focal firm is located, as the instrumental variable. It is worth noting that executives may migrate within the same province. To mitigate potential overlap between provincial green innovation performance and the green innovation performance of the destination firm, we exclude observations in which executives move within the same region.

The instrument strength tests validate our identification strategy. The Cragg–Donald Wald F statistic is 131.846 and the Kleibergen–Paap rk Wald F statistic is 37.226, both exceeding the critical value for 10% maximal bias suggested by Stock and Yogo (2005), thereby indicating that the instrumental variable passes the weak-identification test. Table 5 reports the results of the two-stage least squares (2SLS) regression. In the first stage, provincial green innovation performance (*GI_Industry_Average*) is strongly and positively associated with *GI_Origin*, with a coefficient of 0.490 and significance at the 1% level, confirming instrument relevance. In the second stage, the results show that the fitted value for *GI_Origin* is positively related to *GI_Destination*, with a coefficient of 0.468 and significance at the 5% level, supporting our baseline findings.

[Insert Table 5 here]

4.3.2 Placebo test

To further mitigate concerns about endogeneity and establish causal inference, we conduct a placebo test. Specifically, we randomly reassign executives to destination firms 1,000 times, thereby creating placebo datasets in which firm pairs are not connected through actual executive migration.

The results, reported in Figure 5, show that the distribution of coefficients across these placebo samples is tightly centered around zero. None of the estimated placebo coefficients approaches the magnitude of our baseline estimate (0.065), and the t-value distribution indicates no systematic statistical significance. Panel A illustrates the coefficient and p-value distribution, while Panel B shows the kernel density of the t-statistics, both of which confirm the absence of spurious effects.

The results provide strong validation that the observed spillover effect is not an artifact of random matching or unobserved confounding factors. Instead, they underscore that the positive relationship between origin and destination firms' green innovation is uniquely attributable to executive migration, rather than to chance correlations or sample construction.

[Insert Figure 5 here]

5. Heterogeneity Analyses

In this section, we expand our analysis to investigate whether our baseline findings differ when executives move between jobs with different payoffs and reasonings.

5.1 Executive Compensation

We examine whether the green innovation spillover effect persists for executives who move to better-paid jobs. There are several reasons why executive compensation is relevant. First, when executives are incentivized by personal monetary gains (e.g., higher salary, allowances, or stock options), which are typically tied to the firm's immediate financial performance, they may be less likely to bring their prior knowledge and experience to the new firm. In particular, for costly and highly uncertain innovation projects, these migrated executives are more likely to adopt a short-term perspective, as they are concerned that research failures could lower firm financial performance (Li et al., 2021). In this case, the spillover effect may diminish.

Second, executive compensation may correlate with firms' socially responsible activities (Hong et al.,2015; Mahoney et al., 2006). Cai et al. (2011)

find that when a firm engages in more socially responsible activities, the CEO's compensation may be constrained due to the firm's overall resource allocation and external pressures.

Third, it is possible that more green-innovative executives leave their original firms to join destination firms in order to leverage their expertise in green innovation and extend its impact across different firms. The opposite may also hold. In this case, a pay rise may not be necessary to induce a job switch, while the spillover effect is likely to remain strong. These are consistent with the self-determination theory (van Schie et al., 2018; Walther et al., 2016) and identity theory (Withers et al., 2012) which posit that executives are motivated not only by external rewards (such as salary and financial compensation) but also by intrinsic factors, including personal growth, autonomy, purpose, and alignment with values.

To test the conjectures, we divide our sample along four dimensions: (1) executives who receive a total salary compensation package (the sum of salary, allowance and stock options) increase after job migration and those who do not; (2) executives who receive an allowance increase after job migration and those who do not; and (3) executives who receive a higher value of stock options after a job change and those who do not; (4) executives who receive both a higher total salary and a higher stock option after a job change and those who do not. We then replicate our main analysis and present the results in Table 6, Panel A.

[Insert Table 6 here]

We find that the contagion effect in green innovation is more pronounced when executives do not receive a pay raise. The results are consistent regardless of whether executive compensation is measured by salary, allowances, or stock option value. These findings imply that for firms seeking to enhance their green innovation performance through executive hiring, offering a pay raise may not be the most effective way to recruit talent. Alternatively, when firms attract new external executives, they need to be mindful of the potential impact on the firm's green innovation. The design of compensation packages could be an important driver of firm innovation and socially responsible performance (Li & Yang, 2023).

5.2 Executive Power

Executive power plays a positive role in promoting environmental innovation (Zhang et al., 2022). Powerful CEOs are likely to take more risks (Lewellyn & Muller-Kahle, 2012), pursue more exploratory innovations (Sariol et al., 2017), and promote green innovation (Zhao & Qu, 2024). Intuitively, executive power positively correlates with an executive's influence on strategic decisions, such as green innovation. Executives with greater power are better positioned to incorporate their prior knowledge, experience, and values into their new roles, leading to similar green innovation performance between the original firm and the subsequent firm.

To test the conjecture, we employ two proxies to capture executive power at the destination firm. A promotion in corporate position may represent heightened executive power, allowing the migrating executive more discretionary authority in green innovation decisions. Following Finkelstein (1992)'s framework for executive power (details are in Appendix 2), we classify job changes as upward (promotion), downward (demotion), or lateral (power-neutral) based on changes in formal authority and decision-making power.

Similar to the previous section, we then replicate our main analysis in subsamples representing different degree of executive power. Our results are presented in Panel B of Table 6. We find evidence that the contagion effect in green innovation is stronger when the migrating executives receive a position promotion or stay in the same position, as indicated by the statistically significant coefficients of *GI_Origin* in Columns (1) and (2), while the coefficient is insignificant in Column (3) for the subsample of demoted after switching firms.

5.3 Industry Switch, Relocation and Career Gap

We further consider several common factors that may influence an executive's decision to migrate between firms. First, executives may move across firms to gain experience or pursue their leadership beliefs in different industries (Farah et al., 2020). The literature also suggests that firms strategically hire executives with diverse backgrounds to bring fresh perspectives to firm operations (Zahra et al., 2009). However, the fast-evolving technologies and knowledge in green innovation may not be easily transferable across different industries. To explore this, we examine whether the green innovation correlation induced by executive job migration persists when the origin and destination firms belong to the same or different industries. We classify firm industries following the method of National Bureau of Statistics of China. The results are presented in the first two columns of Table 6 Panel C. Consistent with the notion that green innovation related resources and focuses could be highly contextual (Melander, 2017), we find the spillover effect only remain when executives move to a new firm that belongs to the same industry.

Second, executives may exhibit location preferences when switching jobs (Choudhury, 2022; Noe & Barber, 1993). Some may relocate when taking on new roles. However, resources critical to green innovation—such as information channels, social ties, and regulatory environments—may not be easily transferable when physical barriers are present (Cao et al., 2017; Ali et al., 2022). In such cases, we may observe a weak relationship between an executive's former and current employers' green innovation performance.

Our analysis based on location changes is presented in Columns (3) and (4) of Table 6, Panel C. Since top executives are typically based at their firms' headquarters, we use the headquarters location to determine whether executives change provinces when they switch firms. We find that a correlation between the prior and current employers' green innovation performance is more pronounced when executives remain in the same city after switching jobs. In contrast, although the coefficient in column (4) remains positive and statistically significant, the magnitude is notably smaller, implying that geographic distance may weaken but does not fully impede the spillover.

Third, in fast-paced research and development, executives who possess highly sensitive and private information are often restricted to work for similar firms for a certain period after leaving their job. This is commonly referred to as a non-compete agreement or non-compete clause (Conti, 2014; Marx, 2022). These agreements are intended to protect the employer's confidential information, trade secrets, client relationships, and overall business interests. Moreover, executives may choose to step away from their leadership roles for a period to pursue other personal or life interests. Under these circumstances, we predict that an interruption in career may result in a weak spillover effect in green innovation.

We identify executives who switch from one employer to another directly, and those who do not, and present the results in Columns (5) and (6) of Table 4 Panel C. We find stronger green innovation contagion when an executive directly migrates from the previous firm into the new role, maintaining greater consistency and momentum in green innovation performance.

5.4 Destination Province Attributes

Prior study emphasizes the connections of ambient environmental factors and green innovation. In particular, ambient air pollution in the vicinity of corporate headquarters has been found to positively predict subsequent green innovation (Ma & He, 2023). This suggests that firms located in regions facing more severe air pollution tend to exhibit greater receptiveness to external green innovation inputs. To further examine how regional environmental contexts influence the green innovation spillover effect, we divide the sample based on the environmental conditions of the destination firm's province.

As shown in Panel D, column (1), firms located in provinces with poorer air quality, measured by an Air Quality Index (AQI) above the national annual median, exhibit stronger green innovation spillovers. This finding suggests that greater environmental pressure enhances firms' responsiveness to external sources of green innovation. Similarly, in Column (3), we find that green innovation spillovers are more pronounced for destination firms located in provinces with more frequent environmental emergencies. Furthermore, innovative firms in peripheral regions offset the limited availability of local knowledge spillovers by engaging in collaborations across broader geographic scales. Thus, it is plausible that executives who change firms across regions serve as conduits for transferring advanced green innovation knowledge and practices to less innovative areas, promoting the cross-regional transfer of green innovation capabilities. As shown in Column (5) and (6), green innovation spillovers are stronger for destination firms located in less innovative provinces. This indicates that firms in lagging regions may benefit more from external innovation resources.

5.5 Corporate Governance

While executives influence corporate strategic decisions, their impact may depend on board composition (Westphal & Fredrickson, 2001; Karaevli & Zajac, 2013). Corporate governance can significantly shape the extent to which executives are able to pursue their strategic agendas (Baldenius et al., 2014; Hermalin & Weisbach, 1998), including those related to green innovation. Since boards are more likely to hire new executives who share similar goals and values in terms of corporate outlook (Elsaid et al., 2011; Fisman et al., 2014), we predict that the transmission effect in green innovation is stronger when corporate governance is robust. This is because supportive and powerful boards are more likely to back the green innovation initiatives of the new executive.

To measure corporate governance, we employ three proxies: board size (*BoardSize*), the proportion of independent directors (*IndDirectorRatio*), and ownership concentration measured as the shareholding of the largest shareholders (*OwnershipCon*). We split the sample by median values of the proxies and replicate our main analysis. The results are presented in Table 6, Panel E. We observe consistent evidence that the transmission of green innovation only remains significant under strong corporate governance, as demonstrated convincingly across the three proxies.

5.6 Executive Characteristics

To explore the role of executive characteristics in shaping green innovation spillovers, we conduct subgroup analyses based on various background attributes. The results, reported in Panel F of Table 6, reveal several notable patterns, suggesting that executive background characteristics critically influence the extent to which green innovation can diffuse between firms. Diverse, practical, and globally informed leadership may be particularly important in facilitating knowledge transfer in the context of sustainability-oriented innovation.

First, we observe weaker or insignificant spillover effect in firms led by executives with financial or academic backgrounds. This supports the argument that such executives are more susceptible to short-term pressures from stakeholders (Liu et al., 2020) or undermine corporate social responsibility performance (Dhar et al., 2021), which could dampen their responsiveness to external innovation signals.

In contrast, executives with overseas experience, are associated with stronger spillover effect, indicating that broader exposure and versatility enhance a firm's capacity to absorb and implement external green innovation. These findings are consistent with prior studies suggesting that internationally experienced executives tend to facilitate promote firms' green innovation output (Chen et al., 2023) and promote its diffusion (Quan et al., 2021). Executives with non-academic backgrounds also exhibit a consistent pattern of green innovation spillovers. This may be attributed to the fact that resources and expertise associated with academically oriented executives are often context-specific, thus exhibiting lower transferability across firms or to practice-driven innovation environments.

Moreover, following Custódio et al. (2013), we classify executives as either functional generalists or functional specialists based on the breadth of their functional experience. Our analysis reveals that executives with generalist backgrounds are associated with stronger green innovation spillover effect, as their openness to novel ideas and ability to integrate diverse knowledge better equip them to facilitate knowledge diffusion and innovation (Custódio et al., 2019) across organizational boundaries (Custódio et al., 2013; Xu et al., 2021)

6. Robustness Checks

To verify the robustness of our findings, we conduct several additional tests as presented in Table 7.

First, given the observed decline in green patent applications in 2021 likely due to the COVID-19 outbreak, we exclude this year from the sample to rule out potential distortions. The result in Column (1) remains consistent, suggesting that green innovation spillovers are persistent over time.

Next, we re-estimate the model using the number of green patent applications from origin firms measured in the same year as the executive job migration, rather than in the previous year, the results shown in Column (2) remains robust.

Moreover, we employ alternative green innovation measures based on innovation outputs, rather than inputs as in the main results. Following prior studies (Yu et al., 2021; Lanjouw & Schankerman, 2004), we use the average number of green patent claims (Marco et al., 2019) and the average time-adjusted citations (Jaffe & Trajtenberg, 2002; Lerner & Seru,2021), which help overcome the common truncation problem in patent data, to gauge the breadth and quality of innovation, respectively. Both measures yield results that are aligned with our baseline findings, as shown in Columns (3) and (4), reinforcing the presence of spillovers not only in quantity but also in quality.

Additionally, we test the sensitivity of our findings to how executive job migration is measured. While our main analysis measures the impact of one executive per firm-year, we further account for scenarios where multiple executives join a firm by averaging origin firm innovation levels of all incoming executives. The result in Column (5) confirms that green innovation spillovers remain the same.

Finally, we use the green patent ratio, defined as the proportion of green patents relative to total patents, as an alternative proxy for origin firm innovation. The results in Column (6) suggest a consistent and positive coefficient, providing additional support for the green innovation spillovers through executive job migration and increasing emphasis on green innovation by enterprises.

[Insert Table 7 here]

7. Discussion

This study provides robust evidence that executive job migration is an important channel for the diffusion of green innovation across firms. By compiling a comprehensive panel of Chinese listed firms and integrating patent and executive mobility data, we demonstrate that the green innovation performance of origin firms significantly predicts that of destination firms, confirming the presence of spillover effects through managerial mobility. These findings underscore the role of executives (human capital) as carriers of tacit knowledge (Anand et al., 2002; Almeida & Kogut, 1999; Song et al., 2003) and strategic orientation in shaping organizational innovation outcomes.

Our analyses further reveal that these spillovers follow a clear temporal pattern. They do not emerge immediately but become evident with a one-year lag, remain significant for three years, and dissipate thereafter. This pattern reflects both the time required for executives to integrate into new organizations and the eventual erosion of transferable knowledge, suggesting a "golden window" for recipient firms to capitalize on imported expertise.

Beyond timing, spillover intensity varies systematically with individual, organizational, and regional contingencies. Executives exert greater influence when they retain or gain authority, migrate within the same industry, or bring broader exposure such as overseas (Quan et al., 2021) or generalist (Xu et al., 2021) experience. In contrast, demotion or narrowly specialized backgrounds diminish their impact. At the organizational level, firms with stronger governance structures exhibit greater absorptive capacity (Amore & Bennedsen, 2016; Baldenius et al., 2014), enabling them to translate imported knowledge into effective innovation practices. At the regional level, firms located in provinces facing higher environmental pressure or weaker innovation bases demonstrate heightened receptiveness to external green expertise. Taken together, these findings indicate that the transfer of sustainability-oriented practices through executive mobility is highly context dependent.

To ensure the robustness of these results, we conduct several additional analyses. Using propensity score matching (PSM) with entropy balancing, we show that differences between treatment and control groups are substantially reduced, and the positive effect of executive migration remains significant. Employing a 2SLS approach to mitigate concerns about unobserved heterogeneity similarly confirms the baseline findings. A placebo test in which executives are randomly reassigned to firms produces coefficients centered around zero and never approaching the observed estimates, validating that the observed spillovers are not due to spurious correlations.

Moreover, using output-based proxies, such as green patent claims (Marco et al., 2019) and time-adjusted citations (Jaffe & Trajtenberg, 2002), also corroborates the baseline, showing that spillovers occur in both the quantity and quality of green innovation. When multiple executives migrate to the same firm in a given year, averaging the green innovation performance of their origin firms produces results consistent with the baseline. Similarly, substituting the level of green patents with the ratio of green to total patents yields a stable and robust association. Furthermore, we re-estimate the model with different sample periods. Across all specifications, the spillover effect persists, reinforcing confidence in the credibility and generalizability of our conclusions.

To summarize, this study demonstrates that the diffusion of green innovation through executive mobility is neither automatic nor uniform. By combining rigorous baseline tests with extensive robustness checks, we provide strong evidence that executive job migration constitutes a distinctive and credible mechanism for the spread of green innovation.

8. Implications

This study offers several implications for theory, managerial practice, and policy. From a theoretical perspective, our findings provide new evidence for the literature on green innovation spillovers. Much of the prior research has examined spillovers via structural channels such as investor influence (Zhao, 2022), supplier relationships (Huang, 2025), or financial proximity (Sheng, 2023). Other focus on industry linkages (Seo, 2021; Li & Wang, 2022) and regional proximity (Cao et al., 2024). By showing that spillovers also occur through executive migration, we highlight a human-capital-based inter-firm knowledge transfer mechanism (Kraatz & Moore, 2002) that is active and agency-driven, rather than passive. This contributes to closing an important gap in the green innovation literature, where the role of individuals, particularly senior managers, has been underexplored. Our results also reinforce the importance of behavioral perspectives. The persistence of executives' green orientation across organizational boundaries supports theories of behavioral consistency and social identity, while the moderating roles of discretion, incentives, and governance show that values and identities are expressed only under enabling conditions. In this way, our evidence extends upper echelon theory (Hambrick & Mason, 1984) by illustrating that executives' prior experience shapes destination firms' outcomes through both cognitive frames and structural opportunities.

In terms of practical implications, the findings underscore that green innovation represents a distinctive balance between profitability and prosocial responsibility. Unlike conventional R&D, which is often driven purely by competitive motives and involves substantial uncertainty and long payback horizons (Bayona et al., 2001), green innovation is more strongly anchored in ethical and altruistic considerations (Zhang & Gong, 2024). It requires firms to pursue technological advancement not solely for financial return but also for the broader social good of environmental protection (Khanra et al., 2021; Vasileiou et al.,2022). In this sense, green innovation moderates the excessive risk-taking often associated with frontier R&D by embedding projects within a framework of corporate responsibility and legitimacy. The risks borne by firms are not only financial but reputational (Chen et al., 2023). Failure to engage in sustainability initiatives may undermine stakeholder trust and social license to operate. Conversely, successful green innovation delivers dual rewards by enhancing long-term competitiveness while advancing environmental and social well-being (Khanra et al., 2021). Firms should therefore treat green projects not as isolated technological bets but as strategic commitments that align profitability with ethical responsibility, ensuring that economic gains are achieved alongside environmental stewardship.

For boards and senior decision-makers, the study has clear implications for executive hiring and support. Firms aiming to strengthen their green innovation portfolios should prioritize hiring executives from green-innovative origin firms, particularly those with local experience and industry continuity. Boards should also create conditions to best absorb and implement imported green practices. For example, by granting executives sufficient authority to influence strategic agendas, aligning compensation packages with long-term sustainability goals rather than short-term earnings, enforcing strong corporate governance, and providing early-stage support within the "golden three-year window" identified in this study.

The policy implications are equally significant. Regions that have historically relied on polluting industries, such as heavy manufacturing or coal-based energy, can use executive mobility as a catalyst for upgrading their innovation base. Similarly, less innovative regions may benefit disproportionately from imported managerial expertise. Policymakers can therefore design targeted incentives, such as relocation subsidies, executive exchange programs, or preferential tax treatment, to draw sustainability-oriented human capital into regions that need it most.

More broadly, although our empirical evidence comes from China, the findings offer pioneering lessons for other countries. In economies undergoing green transitions, (cross-border) talent mobility can become an important vehicle for transferring sustainability and innovation practices globally.

9. Limitations and Future Research

Last but not least, this research is subject to certain limitations that provide opportunities for further inquiry. First, while our analysis captures the outcomes of executive job migration, it does not account for institutional or contractual frictions that may shape mobility. In many countries, non-compete agreements or post-employment restrictions limit the ease with which executives can transfer between firms (Blake, 1960; Azevedo et al., 2018). Although such arrangements are less common in China, they are prevalent in other markets, and their effects on the diffusion of sustainability-oriented knowledge remain largely unexplored. Future research could assess how these legal and institutional frictions alter both the likelihood of executive migration and the strength of spillover effects.

Second, the present study examines green innovation spillovers in aggregate, rather than distinguishing among different categories of green technologies. As more fine-grained patent data become available, future work could examine whether certain domains—such as renewable energy, energy efficiency, pollution abatement, or circular economy technologies—are more easily transmitted across firms via executive mobility.

Third, while our study focuses on within-country spillovers, cross-border executive mobility represents an especially promising avenue for future research. In an increasingly globalized labor market, executives often migrate across national boundaries (Collings, 2014), potentially carrying not only technical expertise but also institutional logics and cultural orientations toward sustainability. Examining cross-border spillovers would illuminate how differences in national policy regimes, regulatory environments, and institutional infrastructures shape the transfer and assimilation of green innovation practices.

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Figure 1. The definition of green innovation

Figure 1 introduces the basic components of green innovation and its future influence.

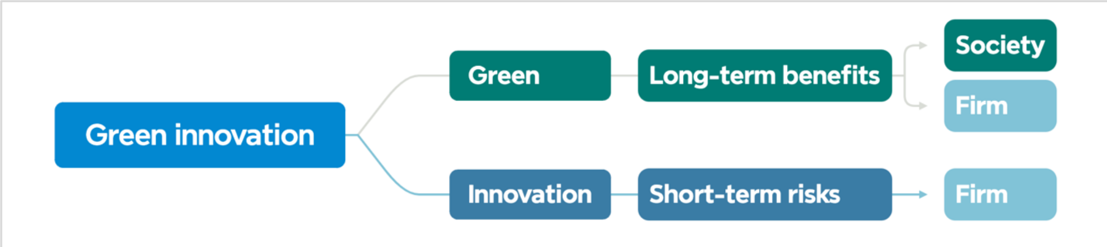
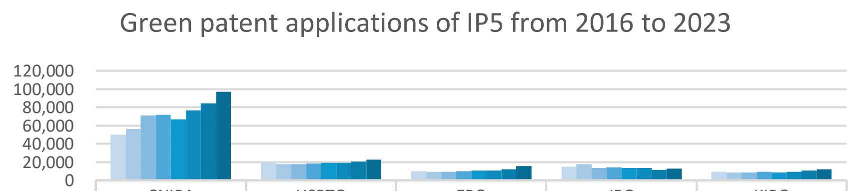


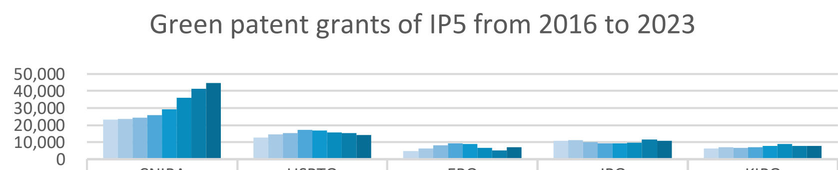
Figure 2. Application and authorization of green patents for IP5

Figure 2 lists the number of green patent applications and grants for all institutions across the IP5 from 2016 to 2023. The term "IP5" refers to the world's five largest intellectual property offices, which include the China National Intellectual Property Administration (CNIPA), the United States Patent and Trademark Office (USPTO), the European Patent Office (EPO), the Japan Patent Office (JPO), and the Korean Intellectual Property Office (KIPO).

Source(s): *Report on Statistical Analysis of Green and Low-Carbon Patents (2024)*



	CNIPA China	USPTO United States	EPO Europe	JPO Japan	KIPO Korea
2016	49,609	18,992	9,675	14,863	9,451
2017	56,323	18,075	9,169	17,436	8,545
2018	70,691	18,070	9,672	13,671	8,299
2019	71,490	18,651	10,053	14,005	9,078
2020	66,780	19,124	10,550	13,207	8,562
2021	76,900	18,816	10,633	13,235	9,082
2022	84,616	20,874	12,061	11,725	10,790
2023	96,854	22,337	15,394	12,917	11,954



	CNIPA China	USPTO United States	EPO Europe	JPO Japan	KIPO Korea
2016	23,353	12,780	4,901	10,914	6,110
2017	23,735	14,663	6,220	11,132	7,011
2018	24,239	15,272	8,347	10,001	6,499
2019	25,871	17,377	9,184	9,270	7,105
2020	29,145	16,725	8,814	9,411	7,764
2021	36,159	15,694	6,835	9,676	8,863
2022	41,322	15,361	5,287	11,588	7,815
2023	44,637	14,265	7,175	10,757	7,946

Figure 3. Application and authorization of green patents for Chinese listed firms
Figure 3 shows the green patent applications from 1999 to 2021 and green patent grants from 2000 to 2021 for all Chinese listed firms in our sample.

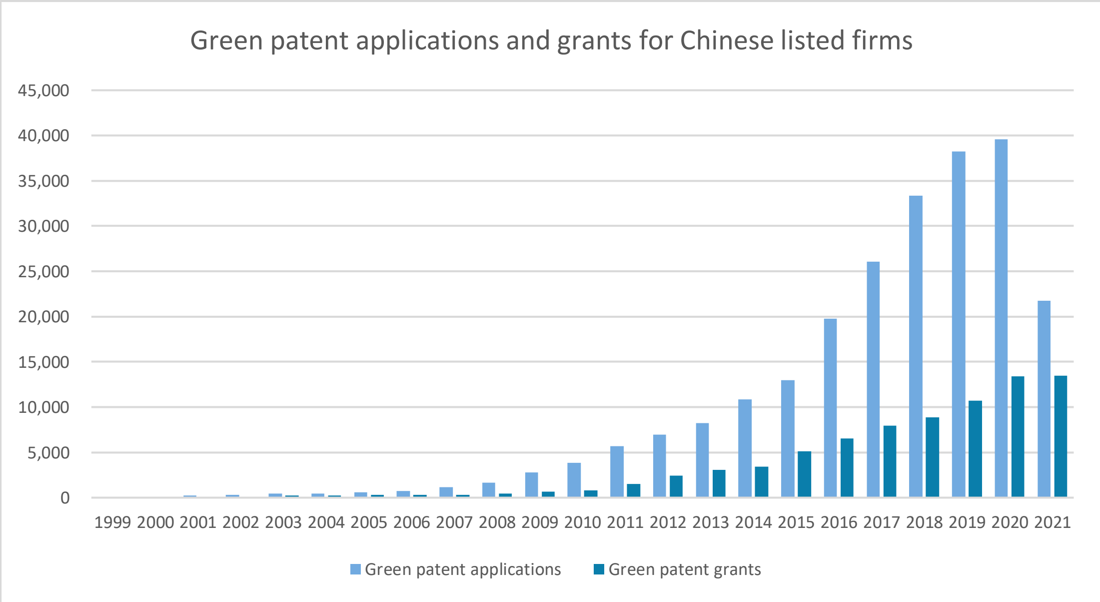


Figure 4. Conceptual Model for green innovation spillover

Figure 4 presents the conceptual model for green innovation spillover caused by executive job migration.

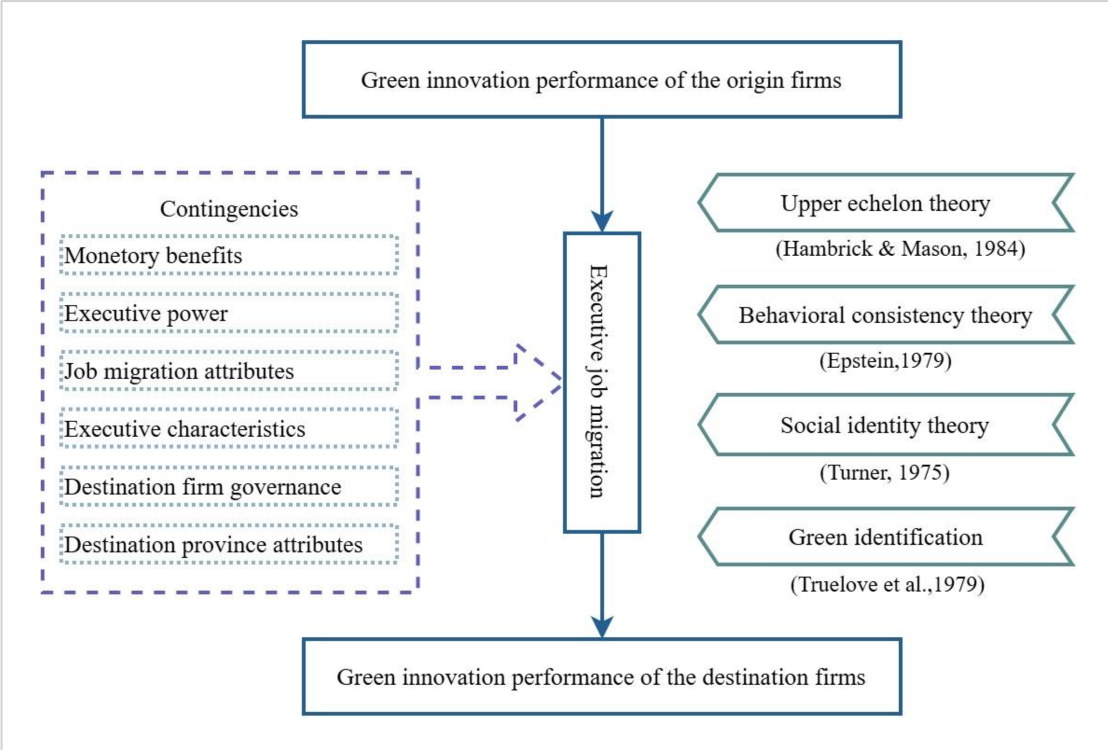


Figure 5. Placebo test

Figure 5 shows the results of the placebo test. The pairs of firms are randomly matched for 1000 times.

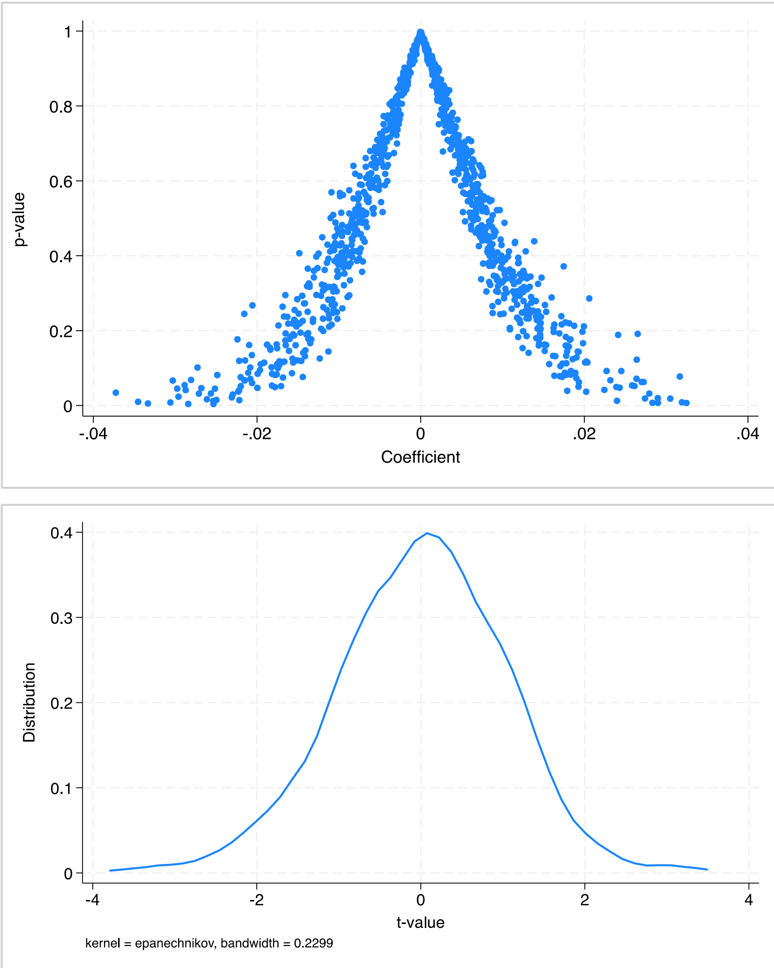


Table 1. Summary statistics

Table 1 reports summary statistics (Panel A) and the Pearson correlation matrix (Panel B). *GI_Destination* and *GI_Origin* are measured as the natural logarithm of one plus the number of green patents. Control variables are included at both firm and executive levels, with *FirmSize, FirmAge, and ExecutiveAge* expressed in logarithmic form. Variable definitions are provided in Appendix 1. Significance levels are denoted as ****p*<0.01, ***p*<0.05, **p*<0.1.

Panel A: Descriptive statistics

Variable		N	Mean	Median	SD	Min	Max
Green innovation Variables	*GI_Destination*	10,441	0.769	0	1.173	0	7.795
	GI_Origin	10,441	0.596	0	1.068	0	7.421
Firm Characteristics	*FirmSize*	10,441	9.728	9.616	0.692	7.254	13.405
	FirmAge	10,441	2.916	2.944	0.345	0.693	3.951
	Growth	10,441	0.414	0.109	6.438	-1.309	367.532
	ROA	10,441	0.034	0.036	0.314	-6.776	22.005
	Leverage	10,441	0.462	0.442	0.414	0.012	27.920
	SOE	10,441	0.410	0	0.492	0	1
	InstitutionalOwn	10,441	0.470	0.489	0.246	0	0.989
Executive Characteristics	*ExecutiveAge*	10,441	3.955	3.951	0.156	3.258	4.419
	Gender	10,441	0.839	1	0.368	0	1

Panel B: Correlation Matrix

Variables		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
(1)	GI_Destination	1										
(2)	GI_Origin	0.137***	1									
(3)	FirmSize	0.428***	0.121***	1								
(4)	FirmAge	0.033***	0.051***	0.186***	1							
(5)	ROA	0.002	-0.008	-0.024**	-0.028***	1						
(6)	Growth	-0.008	-0.004	-0.012	0.018*	0.025**	1					
(7)	Leverage	0.064***	0.002	0.210***	0.116***	-0.166***	0.013	1				
(8)	SOE	0.124***	0.048***	0.384***	0.148***	-0.019**	-0.018*	0.148***	1			
(9)	InstitutionalOwn	0.160***	0.041***	0.476***	0.054***	0.034***	0.016*	0.104***	0.440***	1		
(10)	ExecutiveAge	0.072***	0.062***	0.109***	0.053***	-0.022**	0.011	0.022**	0.068***	0.054***	1	
(11)	Gender	0.020**	0.009	0.031***	-0.019*	0.003	0.013	0.021**	0.045***	0.041***	0.050***	1

Table 2. Baseline Results

This table reports the baseline results testing the green innovation spillover as executives move from origin firms to destination firms. *GI_Destination* is measured as the natural logarithm of one plus the number of destination firms' green patents in year *t*+1, the year following the executive migration. *GI_Origin* is measured as the natural logarithm of one plus the number of origin firms' green patents in year *t*-1, the year prior to the executive migration. We include a range of firm-level and executive-level control variables and employ different fixed effects models in Columns (1) to (3). Robust standard errors clustered by firm and year. *t* statistics are in parentheses. Variable definitions are provided in Appendix 1. Significance levels are denoted as ***p<0.01, **p<0.05, *p<0.1.

	(1)		(2)		(3)	
Variables	*GI_Destination*		*GI_Destination*		*GI_Destination*	
GI_Origin	0.065***	(3.435)	0.082***	(5.755)	0.049***	(5.446)
FirmSize	0.793***	(7.466)	0.770***	(12.747)	1.002***	(9.203)
FirmAge	-0.217**	(-2.674)	-0.224***	(-3.510)	-0.08	(-1.464)
ROA	0.463*	(1.882)	0.296*	(1.814)	0.282	(1.299)
Growth	-0.009	(-0.264)	-0.027	(-1.066)	-0.033	(-1.748)
Leverage	-0.284	(-1.617)	-0.191**	(-2.365)	-0.137	(-1.747)
SOE	-0.032	(-0.406)	0.006	(0.110)	0.072	(1.733)
InstitutionalOwn	-0.245**	(-2.243)	-0.218**	(-2.712)	-0.014	(-0.180)
ExecutiveAge	0.209**	(2.655)	0.201***	(3.437)	0.125**	(2.340)
Gender	0.038	(0.959)	0.029	(0.798)	0.022	(0.682)
Constant	-6.974***	(-8.556)	-6.759***	(-12.065)	-9.253***	(-8.937)
Fixed effects	Firm & Year		Province & Year		Industry & Year	
Observations	10,441		10,441		10,441	
Adjusted R-squared	0.225		0.218		0.388	

Table 3. Temporal Analysis

This table reports results for the temporal analysis for green innovation spillover over a six-year window. *GI_Destination* and *GI_Origin* are measured as the natural logarithm of one plus the number of green patents. Robust standard errors clustered by firm and year. *t* statistics are in parentheses. Variable definitions are provided in Appendix 1. Significance levels are denoted as ****p*<0.01, ***p*<0.05, **p*<0.1.

Variables	(1) *GI_Destination (t)*		(2) *GI_Destination (t+1)*		(3) *GI_Destination (t+2)*		(4) *GI_Destination (t+3)*		(5) *GI_Destination (t+4)*		(6) *GI_Destination (t+5)*	
GI_Origin (t-1)	0.057*	(1.870)	0.065***	(3.435)	0.059**	(2.327)	0.054**	(2.893)	-0.016	(-0.373)	-0.014	(-0.283)
All controls	Yes		Yes		Yes		Yes		Yes		Yes	
Fixed effects	Firm & Year		Firm & Year		Firm & Year		Firm & Year		Firm & Year		Firm & Year	
Observations	9,229		10,441		11,099		9,154		6,560		4,989	
Adjusted R-squared	0.218		0.225		0.176		0.201		0.202		0.167	

Table 4. The PSM Method

This table reports the results of the PSM method. Panel A reports the balancing results for the entropy balancing PSM. Panel B reports the results for OLS regressions on the matched sample. *GI_Destination* is measured as the natural logarithm of one plus the number of green patents. *HaveGreenPatents_Origin* equals to 1 if the origin firm holds any green patents and 0 otherwise. Robust standard errors clustered by firm and year. *t* statistics are in parentheses. Variable definitions are provided in Appendix 1. Significance levels are denoted as ***p<0.01, **p<0.05, *p<0.1.

Panel A: Entropy Balancing Results

	Mean			Variance			Skewness		
	Treatment	Control		Treatment	Control		Treatment	Control	
		pre	post		pre	post		pre	post
FirmSize	9.8020	9.6890	9.8020	0.5388	0.4432	0.5388	1.2540	0.9917	1.1700
FirmAge	2.9410	2.9020	2.9410	0.1070	0.1251	0.1070	-0.7870	-1.1120	-0.9120
ROA	0.2490	0.4992	0.2490	3.2960	61.1100	3.2970	27.2400	37.1400	30.4000
Growth	0.0302	0.0356	0.0302	0.0276	0.1356	0.0276	12.7700	37.5500	28.1400
Leverage	0.4555	0.4654	0.4555	0.0671	0.2250	0.0671	3.9970	33.4500	16.5100
SOE	0.4317	0.3987	0.4317	0.2454	0.2398	0.2454	0.2756	0.4139	0.2756
InstitutionalOwn	0.4771	0.4659	0.4771	0.0618	0.0596	0.0618	-0.1802	-0.1448	-0.1730
ExecutiveAge	3.9660	3.9470	3.9660	0.0236	0.0240	0.0236	-0.2453	-0.1532	-0.1763
Gender	0.8399	0.8365	0.8398	0.1345	0.1368	0.1345	-1.8530	-1.8200	-1.8530

Panel B: OLS Regression Results

	(1)	
Variables	*GI_Destination*	
HaveGIOrigin	0.047***	(3.200)
FirmSize	0.240***	(18.690)
FirmAge	-0.113***	(-6.131)
ROA	-0.002	(-1.000)
Growth	0.042	(1.079)
Leverage	-0.048	(-1.717)
SOE	0.001	(0.038)
InstitutionalOwn	-0.140***	(-6.443)
ExecutiveAge	0.038	(0.938)
Gender	0.013	(0.898)
Constant	-1.663***	(-10.974)
Fixed effects	Firm & Year	
Observations	10,441	
Adjusted R-squared	0.137	

Table 5. The 2SLS Regression

This table reports the results of the 2SLS regression. Provincial green innovation performance is used as the instrumental variable for *GI_Origin*. *GI_Destination* and *GI_Origin* are measured as the natural logarithm of one plus the number of green patents. Robust standard errors clustered by firm and year. *t* statistics are in parentheses. Variable definitions are provided in Appendix 1. Significance levels are denoted as. ***p<0.01, **p<0.05, *p<0.1.

	(1) First stage *GI_Origin*		(2) Second stage *GI_Destination*	
GI_Province_Average	0.490***	(6.101)		
GI_Origin			0.468**	(2.208)
FirmSize	-0.025	(-1.153)	0.817***	(14.133)
FirmAge	0.052	(1.379)	-0.235***	(-4.737)
ROA	-0.275*	(-1.836)	0.490*	(1.928)
Growth	0.019	(0.844)	-0.065	(-1.283)
Leverage	-0.019	(-0.366)	-0.274*	(-1.958)
SOE	0.018	(0.664)	-0.025	(-0.541)
InstitutionalOwn	0.05	(1.163)	-0.280***	(-3.191)
ExecutiveAge	0.092	(1.081)	0.386**	(2.684)
Gender	0.031	(0.886)	0.022	(0.359)
Constant	0.003	(0.008)		
Fixed effects	Firm & Year		Firm & Year	
Observations	4,562		4,562	
Adjusted R-squared	0.722		0.117	
Cragg-Donald Wald F statistic	131.846			
Kleibergen-Paap rk Wald F statistic	37.226			

Table 6. Heterogeneity Analyses by Migration Attributes

This table reports the sub-sample analysis results based on several internal and external attributes of executive job migration. Panel A reports the results on whether executives switch jobs for monetary benefits, measured by total salary, allowance and stock options. Panel B examines whether the executive is promoted and gains additional authority in the destination firms. Panel C shows results based on whether executives remain within the same industry or province after job migration, and address the influence of a career gap. Panel D to Panel F reports sub-sample analyses based on the environmental and green innovation attributes of destination province, corporate governance of destination firms and executive characteristics, respectively. *GI_Destination* and *GI_Origin* are measured as the natural logarithm of one plus the number of green patents. Robust standard errors clustered by firm and year. *t* statistics are in parentheses. Variable definitions are provided in Appendix 1. Significance levels are denoted as ***p<0.01, **p<0.05, *p<0.1.

Panel A: Executive Compensation

	(1)		(2)		(3)		(4)	
	Total salary increases		No total salary increases		Allowance increases		No allowance increases	
Variables	*GI_Destination*		*GI_Destination*		*GI_Destination*		*GI_Destination*	
GI_Origin	0.056	(1.014)	0.064*	(1.794)	0.052	(0.959)	0.078**	(2.355)
Constant	-7.190***	(-8.451)	-6.284***	(-6.739)	-7.611***	(-8.992)	-6.330***	(-8.597)
All controls	Yes		Yes		Yes		Yes	
Fixed effects	Firm & Year		Firm & Year		Firm & Year		Firm & Year	
Observations	4,768		5,673		4,175		6,266	
Adjusted R-squared	0.251		0.214		0.249		0.225	

	(5)		(6)		(7)		(8)	
	Stock increases		No stock increase		Increase in either total salary or stock option		Neither increase in total salary nor stock option	
Variables	*GI_Destination*		*GI_Destination*		*GI_Destination*		*GI_Destination*	
GI_Origin	0.113	(0.781)	0.069***	(3.762)	0.078	(1.626)	0.088***	(5.339)
Constant	-4.419	(-1.176)	-6.878***	(-6.652)	-6.564***	(-7.345)	-6.704***	(-10.374)
All controls	Yes		Yes		Yes		Yes	
Fixed effects	Firm & Year		Firm & Year		Firm & Year		Firm & Year	
Observations	1,343		9,098		5,421		5,020	
Adjusted R-squared	0.336		0.211		0.231		0.209	

Panel B: Executive Power

Variables	(1) Promotion *GI_Destination*		(2) Lateral move *GI_Destination*		(3) Demotion *GI_Destination*	
GI_Origin	0.255**	(2.389)	0.064**	(2.656)	-0.079	(-0.495)
Constant	-8.194***	(-3.230)	-7.111***	(-16.213)	-6.707	(-1.745)
All controls	Yes		Yes		Yes	
Fixed effects	Firm & Year		Firm & Year		Firm & Year	
Observations	1,081		8,721		637	
Adjusted R-squared	0.169		0.210		0.502	

Panel C: Industry switch, Relocation and Career Gap

Variables	(1) Same industry *GI_Destination*		(2) Different industry *GI_Destination*		(3) Same province *GI_Destination*		(4) Different province *GI_Destination*		(5) Direct job migration *GI_Destination*		(6) No direct job migration *GI_Destination*	
GI_Origin	0.091**	(2.716)	0.012	(0.322)	0.116**	(2.570)	0.067**	(2.340)	0.065**	(2.934)	0.111	(1.365)
Constant	-9.272***	(-16.224)	-6.298***	(-12.079)	-6.180***	(-8.668)	-7.266***	(-11.001)	-6.361***	(-10.712)	-7.461***	(-11.241)
All controls	Yes		Yes		Yes		Yes		Yes		Yes	
Fixed effects	Firm & Year		Firm & Year		Firm & Year		Firm & Year		Firm & Year		Firm & Year	
Observations	3,634		4,819		3,903		4,476		6,218		2,230	
Adjusted R-squared	0.348		0.195		0.259		0.268		0.235		0.283	

Panel D: Destination Province Attributes

	(1) AQI of destination province > median		(2) AQI of destination province < median		(3) Destination province with environmental emergencies > Median		(4) Destination province with environmental emergencies < Median		(5) Green innovation level of destination province > Median		(6) Green innovation level of destination province < Median	
Variables	*GI_Destination*		*GI_Destination*		*GI_Destination*		*GI_Destination*		*GI_Destination*		*GI_Destination*	
GI_Origin	0.116**	(2.516)	0.012	(0.197)	0.132**	(1.912)	0.081	(1.582)	0.024	(0.358)	0.103**	(2.601)
Constant	-9.375***	(-8.146)	-6.527***	(-6.680)	-5.429***	(-6.404)	-7.549***	(-7.500)	-7.818***	(-10.281)	-5.666***	(-4.688)
All controls	Yes		Yes		Yes		Yes		Yes		Yes	
Fixed effects	Firm & Year		Firm & Year		Firm & Year		Firm & Year		Firm & Year		Firm & Year	
Observations	3,734		4,076		3,348		3,945		3,395		3,304	
Adjusted R-squared	0.254		0.221		0.248		0.244		0.296		0.173	

Panel E: Corporate Governance

	(1) Board Size > median		(2) Board Size < median		(3) Independent director ratio > median		(4) Independent director ratio < median		(5) Ownership concentration > median		(6) Ownership concentration < median	
Variables	*GI_Destination*		*GI_Destination*		*GI_Destination*		*GI_Destination*		*GI_Destination*		*GI_Destination*	
GI_Origin	0.097***	(3.751)	0.031	(0.552)	0.068**	(2.336)	0.034	(0.607)	0.098**	(2.286)	0.048	(1.349)
Constant	-6.887***	(-5.869)	-6.981***	(-5.502)	-8.369***	(-8.222)	-6.215***	(-3.977)	-7.553***	(-6.645)	-5.092***	(-4.107)
All controls	Yes		Yes		Yes		Yes		Yes		Yes	
Fixed effects	Firm & Year		Firm & Year		Firm & Year		Firm & Year		Firm & Year		Firm & Year	
Observations	6,505		3,878		7,782		2,601		5,440		4,943	
Adjusted R-squared	0.224		0.232		0.249		0.151		0.259		0.207	

Panel F: Executive Characteristics

Variables	(1) Financial Background GI_Destination		(2) Without financial background GI_Destination		(3) Technical background GI_Destination		(4) Without technical background GI_Destination	
GI_Origin	0.082	(0.967)	0.088***	(3.122)	0.07	(0.678)	0.075**	(2.726)
Constant	-4.875*	(-1.971)	-7.870***	(-27.411)	-7.665*	(-1.836)	-6.363***	(-16.884)
All controls	Yes		Yes		Yes		Yes	
Fixed effects	Firm & Year		Firm & Year		Firm & Year		Firm & Year	
Observations	2,405		8,036		1,425		9,016	
Adjusted R-squared	0.14		0.264		0.306		0.208	

Variables	(5) Overseas background GI_Destination		(6) Without overseas background GI_Destination		(7) Academic background GI_Destination		(8) Without academic background GI_Destination	
GI_Origin	0.334*	(2.078)	0.066*	(2.149)	0.064	(1.357)	0.062**	(2.323)
Constant	-10.679**	(-2.768)	-6.600***	(-11.955)	-7.818***	(-10.281)	-5.666***	(-4.688)
All controls	Yes		Yes		Yes		Yes	
Fixed effects	Firm & Year		Firm & Year		Firm & Year		Firm & Year	
Observations	1,367		9,018		5,275		5,103	
Adjusted R-squared	0.338		0.226		0.171		0.285	

Variables	(9) Functional specialist GI_Destination		(10) Functional generalist GI_Destination	
GI_Origin	0.058	(0.941)	0.111***	(3.316)
Constant	-5.999***	(-6.372)	-6.733***	(-7.485)
All controls	Yes		Yes	
Fixed effects	Firm & Year		Firm & Year	
Observations	2,943		6,210	
Adjusted R-squared	0.225		0.228	

Table 7. Robustness Checks

This table reports the robustness checks for green innovation spillover. *GI_Destination* and *GI_Origin* are measured as the natural logarithm of one plus the number of green patents. Column (1) regression excludes year 2021. Column (2) regression re-times the origin firm's green-innovation measure to the year t. Column (3) and (4) regressions use output-based proxies (green patent claims; time-adjusted citations) to capture the spillover of green innovation breadth and quality. *Claims_Destination* is the natural logarithm of one plus the average claims of destination firms' green patents. *Claims_Origin* is the natural logarithm of one plus the average claims of origin firms' green patents. *Adj_Citations_Destination* is the natural logarithm of one plus the average citations of destination firms' green patents. *Adj_Citations_Origin* is the natural logarithm of one plus the average citations of origin firms' green patents. Column (5) regression averages origin firm green innovation across multiple incoming executives per firm-year. *Average_Origin* is the average green patents of all incoming executives' origin firms. Column (6) regression applies the ratio of green patents. *GreenRatio_Destination* is the ratio of green patents over total patents of the destination firms. *GreenRatio_Origin* is the ratio of green patents over total patents of the origin firms. Robust standard errors clustered by firm and year. *t* statistics are in parentheses. Variable definitions are provided in Appendix 1. Significance levels are denoted as ***p<0.01, **p<0.05, *p<0.1.

	(1)		(2)		(3)	
	Drop the obs of year 2021		Green patents of origin firms at time t		Green patent claims	
Variables	*GI_Destination*		*GI_Destination(t+1)*		*Claims_Destination*	
GI_Origin	0.069**	(2.819)				
GI_Origin (t)			0.039**	(2.283)		
Claims_Origin					0.042**	(2.370)
Constant	-7.084***	(-11.103)	-6.663***	(-7.467)	-5.052***	(-15.449)
All controls	Yes		Yes		Yes	
Fixed effects	Firm & Year		Firm & Year		Firm & Year	
Observations	8,923		10,441		10,441	
Adjusted R-squared	0.235		0.220		0.152	

	(4)		(5)		(6)	
	Adjusted green patent citations		Multiple incoming executives		Green ratio	
Variables	*Adj_Citations_Destination*		*GI_Destination*		*GreenRatio_Destination*	
Adj_Citations_Origin	0.051**	(3.016)				
Average_Origin			0.101***	(3.332)		
GreenRatio_Origin					0.037**	(2.398)
Constant	-23.834***	(-13.853)	-7.157***	(-14.167)	0.014	(0.279)
All controls	Yes		Yes		Yes	
Fixed effects	Firm & Year		Firm & Year		Firm & Year	
Observations	10,441		10,441		10,441	

Adjusted R-squared	0.101	0.234	0.046

Appendix 1. Variable Definitions

Panel A. Variable Definitions

Variables		Definition
Green innovation variables		
GI_Destination	Total Green Patents	Measured as the natural logarithm of one plus the number of Destination firms' green patents.
GI_Origin	Total Green Patents	Measured as the natural logarithm of one plus the number of origin firms' green patents.
Firm Variables		
FirmSize	Firm Size	Measured as the natural logarithm of total assets.
FirmAge	Firm Age	Measured as the natural logarithm of firms' age.
Growth	Sales Growth	Measured as the percentage change of sales from the last year.
ROA	Firm Performance	Measured as net income divided by total assets.
Leverage	Firm Leverage	Measured as total liabilities divided by total assets.
SOE	State-owned enterprise	State-owned enterprise = 1; otherwise = 0.
InstitutionalOwn	Institutional Ownership	Measured as the shareholding of institutional investors.
Executive-level Variables		
Age	Executive Age	Measured as the natural logarithm of an executive's age in years.
Gender	Executive Gender	Gender of executives: male = 1, female = 0.

Appendix 2. Executive power ranking

Following Finkelstein (1992), we define a promotion as an upward move in the executive power hierarchy group, indicating greater authority or decision-making responsibility. A demotion is a downward move to a lower power group. When an executive's power group remains unchanged, the move is treated as a lateral transfer, signifying no material change in responsibilities or formal authority.

Function	Position	Power Hierarchy Group
Planning	Chief Executive Officer (CEO)	1
	Chairman	1
	Acting Chairman	1
	Vice Chairman	1
	Independent Director	1
	Director	1
	Other Directors	1
Organizing	General Manager	2
	Acting General Manager	2
	Executive General Manager	2
	Executive Vice General Manager	2
	Deputy General Manager / Vice General Manager	2
	Assistant General Manager	2
Commanding	Chief Financial Officer (CFO)	3
	Financial Officer / Person in Charge of Finance	3
	Chief Accountant	3
	Financial General Manager	3
	Board Secretary	3
	Other Senior Executives	3
Coordinating	Chairman of the Supervisory Board	4
	Vice Chairman of the Supervisory Board	4
	Independent Supervisor	4
	Supervisor	4
	Other Supervisors	4
	Employee Supervisor	4
Controlling	Consultant	5
	Party and Masses Work Cadre	5
	Honorary Chairman	5
	Honorary Chairman of the Supervisory Board	5

Appendix 3. Selected articles on green innovation

Panel A. Green innovation as the explanatory variable

Article	Year	Outcome variables	Main findings
Green innovation and firms' financial and environmental performance: The roles of pollution prevention versus control	Cheng et al. (2025) Journal of Accounting and Economics	Financial and environmental performance	Green patents are used to distinguish between pollution prevention and pollution control innovations. Pollution prevention innovation improves firms' future financial and environmental performance, while pollution control innovation shows no significant effect on either outcome.
Does it pay to patent green innovations? Stock market reactions to family and nonfamily firms' green patents	Chirico et al. (2025) Journal of Business Ethics	Stock market reactions	There are differences in the types of green patents that obtain the maximum market value between family businesses and non-family businesses. For example, when green patents demonstrate the aggressiveness and novelty of innovation, non-family businesses can obtain the maximum market value returns.
Green innovation and the stock market value of heavily polluting firms: The role of environmental compliance costs and technological collaboration.	Tian et al. (2023) Business Strategy and the Environment	Tobin's Q	Green innovation measured by green patent stocks may have a positive impact on the stock market value of heavily polluting firms. The increase in the green innovation over assets index will increase Tobin's Q at the enterprise level.
Green innovation and financial performance: A study on Italian firms	Vasileiou et al. (2022) Research Policy	Environmental benefits	This paper examines the relationship between environmental innovation and financial performance, moderated through four innovation domains, product, process, organizational and marketing innovation.
Does green innovation increase enterprise value?	Hao et al. (2021)	Tobin's Q	Enterprises with a higher share of green patent applications show higher Tobin's Q. Green innovation

	Business Strategy and the Environment		also has a positive lagged effect lasting two to six years, but this effect is concentrated in young, non–state-owned firms and is stronger in heavily polluting and non–high-tech industries.
Towards green growth: How does green innovation affect employment?	Kunapatarawong & Martínez-Ros (2016) Research Policy	Employment	Green innovation is positively associated with employment, particularly in polluting ("dirty") industries. Voluntary green innovation generates stronger employment gains compared to compliance-driven innovation.
The influence of green innovation performance on corporate advantage in Taiwan	Chen et al. (2006) Journal of Business Ethics	Corporate competitive advantage	The performances of the green product innovation and green process innovation were positively correlated to the corporate competitive advantage.

Panel B. Green innovation as the outcome variable

Article	Year	Explanatory variables	Main findings
Participate in My Green: How and When Supplier Concentration Affects Firm Green Innovation	Huang et al. (2025) Journal of Product Innovation Management	Supplier concentration	Supplier concentration, reflecting firms' dependence on key suppliers, reduces green innovation, with a stronger impact on substantive than symbolic innovation. The negative effect is more pronounced in highly competitive industries and for firms with poorer media reputations.
How Officials' Political Incentives Influence Corporate Green Innovation	Ren et al. (2024) Journal of Business Ethics	Local officials' political incentives	Enterprises in provinces where the officials has not retired have higher green innovation performance than those in provinces where the officials has retired. This impact is stronger for enterprises in provinces with higher expectations for official promotion, local state-owned enterprises (SOEs), and politically affiliated enterprises.

Is proximity better? The geographical proximity of financial resources and green innovation	Sheng & Ding (2023) Journal of Product Innovation Management	Geographical proximity of financial centers (Shanghai, Beijing, and Shenzhen)	The geographical proximity of financial resources shapes firms' green innovation activities. Green innovation exhibits an inverted U-shaped relationship with distance from financial centers. Internal ownership strengthens the influence of this effect , while external environmental regulation weakens this effect.
Relationship between enterprise digitalization and green innovation: A mediated moderation model	Ning et al. (2023) Journal of Innovation & Knowledge	Digitalization	Digitalization of enterprises can have a positive impact on green innovation, and absorptive capacity plays a mediating role in it. In addition, we also found that green credit strengthens the positive relationship between absorptive capacity and green innovation.
Effect of digital transformation on enterprises' green innovation: Empirical evidence from listed companies in China	Tang et al. (2023) Energy Economics	Digitalization	Digital transformation could promote enterprises' green innovation. Technological innovation effect and learning-by-doing mechanism effectively promotes green innovation. Cooperation networks and reduced financial constraints promote green innovation.
How Political Ties and Green Innovation Co-evolve in China: Alignment with Institutional Development and Environmental Pollution	Jiang et al. (2023) Journal of Business Ethics	Political Ties	Political ties generally promote green innovation. In terms of the political ties and green innovation co-evolve , political ties and green innovation mutually reinforce each other in less developed or heavily polluted regions; however, green innovation discourages the formation of political ties in regions with high levels of institutional development or less pollution.
	Zhao et al. (2022)	Institutional investors	When assessing the role of institutional investors in corporate green innovation, both shareholding and

The effects of institutional investors on firms' green innovation	Journal of Product Innovation Management		portfolio characteristics should be considered. For instance, professional investors with stronger independence and higher portfolio concentration promote green innovation, while transient investors do not.
Does green public procurement trigger environmental innovation?	Krieger & Zipperer (2022) Research Policy	Green public procurement	Green public procurement with environmental public procurement awards significantly stimulates product-related green innovation in SMEs, while its effect is weaker for large firms and process innovations.
CEO Foreign Experience and Green Innovation: Evidence from China	Quan et al. (2021) Journal of Business Ethics	CEO overseas background	CEO foreign experience is positively related to green innovation quantity, quality and internationalization. Enhanced environmental ethics and general competency are two potential mechanisms through which CEO foreign experience affects corporate green innovation.
Corporate governance and green innovation	Amore & Bennedsen (2016) Journal of Environmental Economics and Management	Corporate governance	Exploiting changes in U.S. antitakeover legislation, evidence shows that poorly governed firms produce fewer green patents relative to their total innovations. The negative effect is stronger for firms with lower institutional ownership, fewer existing green patents, tighter financial constraints, lower pollution abatement costs, and in less energy-intensive sectors.
Necessity as the mother of 'green' inventions: Institutional pressures and environmental innovations	Berrone et al. (2013) Strategic Management Journal	Institutional pressures	An analysis of environment-related patents from 326 U.S. listed firms in polluting industries shows that institutional pressures stimulate environmental innovation, with stronger effects in firms that pollute more relative to their industry peers.