

Untangling the Relationship Between Corporate Political Ties and Low-Carbon Innovation: The Moderating Roles of Prominence and Favorability

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NOMENCLATURE

Abbreviations and Acronyms

PT	Political ties.
LCI	Low-carbon innovation.
CP	Corporate prominence.
GF	Generalized favorability.

I. INTRODUCTION

FOR decades, climate change and its potential solutions have received tremendous attention from worldwide governments and industrial practitioners [1], [2], particularly for those countries undergoing economic transitions like China. As the world's largest carbon dioxide (CO₂) emissions emitter, accounting for roughly 28% of global carbon emissions [3], China has committed to meeting a key green transition goal toward a low-carbon economy so as to pay the price for its remarkable economic growth during the past 40 years. Notably, this transition has become a global concern after the financial crisis of 2007–2008, given the fact that China's CO₂ emissions increased dramatically as a result of leveraging infrastructure expansion as an economic stimulant. Recognizing that LCI has been playing an increasingly fundamental role in the win-win formula of decarbonization and sustainable growth [4], [5], [6], government organizations see considerable potential in LCI and therefore embrace it as an effective response to the environment and climate change challenges.

It is argued that the majority of low-carbon technologies should originate from businesses, because they are responsible for most of CO₂ emissions.¹ Nonetheless, for the following reasons, profit-driven businesses themselves typically lack the impetus to invest in LCI, especially in the absence of external incentives or support from outside stakeholders (e.g., governments). First, it necessitates rare external resources, privileged information, higher capacity for recombining the existing resource and knowledge, and higher risk tolerance for innovation failure [7], [8], [9]. Second, LCI perfectly falls into the

Abstract—The current literature has yet to reach a full consensus on the influence of corporate political ties (PT) on firm-level low-carbon innovation (LCI). At one extreme, some literature argues that PT can improve access to government-controlled material innovation resources and provide firms with privileged information on existing or forthcoming innovation policies, thus facilitating LCI. At the other end of the spectrum, others suggest that businesses with PT may be vulnerable to rent-seeking activities and suffer reduced autonomy in innovation decision-making, which appears detrimental to LCI. To reconcile the debate, this study fused and extended insights drawing upon the combination of resource dependence, rent-seeking, and legitimacy theories and reasoned that both propositions may be correct over some range. As expected, we found that PT will exert a U-shaped effect on LCI. Also, it revealed that two facets of corporate reputation, namely, corporate prominence (i.e., *being known*) and generalized favorability (i.e., *being liked*), can enhance the curvilinear relationship. By collecting and analyzing a longitudinal panel dataset of 3425 firms from 2009 to 2018 drawn from China—the largest emerging market economy and the biggest carbon dioxide emitter in the world, strong evidence was found for our theoretical arguments and empirical hypotheses. Our study contributes to the literature on the curvilinear effects of political capital, the reputational contingency of PT, and more broadly, the relationship between corporate political activities and corporate environmental performance. Finally, our findings survived a series of rigorous robustness checks.

Index Terms—Being known, corporate political strategies, corporate reputation, favorability, green patenting, low-carbon technologies, prominence.

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¹According to the Carbon Majors Database report published by the Carbon Disclosure Project, just 100 major firms have accounted for 71% of the global greenhouse gas emissions since 1998.

intersection of environmental economics and innovation economics, thereby leading to LCI showing double externalities. Specifically, on the one hand, LCI exerts a larger knowledge spillover effect on society relative to conventional innovation and therefore creates a significant positive externality [7]; on the other hand, directly emitting CO₂ is much cheaper than developing environment-friendly technologies, and the latter can substantially drain firms' critical resources and thus further discourages them from investing in LCI, revealing a severe negative externality [10].

Meanwhile, in less developed market economies featuring incomplete capital market structures and unstable institutional environments (e.g., China) [11], [12], firms are inclined to embrace informal nonmarket strategies, for example, co-opting governments through PT. PT generally indicates a close relationship with governmental authorities. According to the investigations by Faccio [13] and Zhang et al. [14], PT is a universal social phenomenon that exists not only in developed countries such as the United States, Canada, and France but also in most emerging economies. In the Asia-Pacific region encompassing China, Vietnam, and South Korea, PT is deeply rooted in the concept of *guanxi* (in the sense of relation), and an old and interesting saying highlights the importance of *guanxi*, "*it's not what you know, but whom you know that matters.*" On this basis, it is generally acknowledged that PT follows the social norm of reciprocal relationships between governments and business entities [15].

As for the relationship between PT and LCI, resource dependence theory reveals that firms cannot realistically internalize the entire cost of developing environmental innovation, meaning that they must rely on external actors to gain access to critically needed innovation resources [16], [17]. Meanwhile, it is noteworthy that their resource dependence makes firms *per se* vulnerable to environmental compliance pressures from governments—the greatest source of pressures and expectations among outside actors [18]. In support of the benefits of PT (i.e., the helping hands), innovation management scholars have suggested that compared with firms isolating themselves from politics, their PT counterparts are likely to enjoy considerable competitive advantages that can lead to superior LCI performance [14], [19], [20], including but not limited to tax breaks or relief [13], government subsidies [21], a greater ability to navigate government policies and influence regulations [16], [22], enhanced social and environmental legitimacy [23], and access to privileged information on upcoming or existing environmental policies [14].

Nevertheless, it seems too early to reach a full consensus regarding the nature of the relationship between PT and LCI. That is because political economists also see the dark side of PT (i.e., the grabbing hands) by referring to the rent-seeking theory [8], [24]. Specifically, they have identified and found that firms with close connections to governments may suffer reduced autonomy in innovation and have to deal with interference and rent-seeking activities from politicians [25], [26]. However, these seemingly controversial arguments are respectively established and examined under the linear assumption, even if these studies have hinted at the potential that the grabbing and helping

hands of PT toward LCI may coexist. Thus, it is referred that the inherent PT-LCI relationship may be too intricate to be reflected using linear logic. This, in turn, inspires us to further cast light on the nature of this correlation using nonlinear reasoning.

With PT's helping hands and grabbing hands aside, Shi et al. [27] pointed out that PT remains a controversial topic with the public in some contexts. This is because PT has the potential to lead to a business ethical dilemma [28], such as corruption and bribery that cause damage to the careers of government officials, the established reputation of firms, and the resulting reciprocal relationship. Recognizing that corporate reputation has been generally viewed as an intangible or social approval asset for businesses [29], firms that are well-known or well-liked by outside stakeholders appear to be more sensitive and thus more responsive to environmental compliance pressures exerted by government organizations [30], [31]. Furthermore, compared with their unknown peers, firms with high reputations are likely to attract more attention from the greatest source of regulatory pressures, the government. This attention then comes with higher expectations for their environmental performance. Research in various disciplines, such as management and sociology, also reveals that governments and other stakeholders generally place greater demands and higher expectations on high-reputation firms [32], [33]. Hence, high-reputation firms can be more subject to environmental compliance pressures, and we argue that this elite subset of firms are likely to strive to achieve better LCI performance so as to win the support of government organizations for higher legitimacy. In this connection, it seems worthwhile to investigate the moderating role played by corporate reputation in the assumed curvilinear PT-LCI relationship. Surprisingly, to date, this reputational contingency has received limited attention in the environmental innovation literature.

Drawing upon the combination of resource dependence theory (Pfeffer and Salancik [16]), rent-seeking theory (Appelbaum and Katz [34]), and legitimacy theory (Suchman [35]), we attempt to answer two leading *research questions*: 1) What is the influence of PT on LCI? and 2) Does corporate reputation (i.e., CP and GF) moderate this influence? By collecting a longitudinal sample of 3425 listed firms in China from 2009 to 2018, we estimate several multivariate econometric models using a fixed effect method and find strong evidence to support our research hypotheses. Specifically, our rigorous results demonstrate that 1) PT can exert a curvilinear influence on LCI; and 2) two pillars of corporate reputation, CP (i.e., *being known*) and GF (i.e., *being liked*), positively moderate this influence.

Our study adds value in three ways. First, it contributes to the burgeoning literature on the linkages between corporate political activities and corporate environmentalism by untangling the curvilinear relationship between PT and LCI. Previous studies treated governments as unitary entities and accordingly viewed the influence of PT on corporate environmental actions as uniform [8], [14], [36]. Specifically, their empirical analyses on the PT-LCI linkage are based on either the number or the existence of PT and improperly presumed that the authorized power among politicians was evenly distributed. By contrast, we take into account the administrative hierarchy of China's political system and shed light on the curvilinear impact of PT

on LCI. More broadly, although this study is based on a Chinese setting, the findings can be appropriately extrapolated to other emerging economies beyond China, such as Vietnam and North Korea. Second, by fusing and extending critical insights from prior literature, we aim to comprehensively illustrate several latent mechanisms regarding helping hands and grabbing hands through which PT can affect LCI with nonlinear reasoning. This can provide a deeper understanding of how the relationship dynamically evolves in such transition economies as China. Third, to our knowledge, in contrast with much of the current research studying external environment factors, we are the first to bring the moderating role of two core facets of corporate reputation into the discussion of the PT-LCI nexus. This fills the lacuna at the intersection of the three literature domains of corporate political management, environmental innovation management, and corporate reputation management.

II. THEORY AND HYPOTHESES

A. *Helping Hands of Corporate Political Ties to Low-Carbon Innovation*

According to the resource dependency theory, other external actors can exert various levels of influence on an organization's strategic decision-making and, therefore, its consequences [16], [37]. This is especially true when they can provide critical resources necessary for firms' survival and long-term investment, such as through LCI programs [1]. In the real world, critical resources that facilitate a firm's LCI performance are unlikely to be entirely managed internally but are often controlled and allocated by key outside stakeholders such as the government [37]. These natural resources include water, rare metals, land, and key financial resources such as government subsidies, bank loans, and tax breaks.² Thus, PT offers shortcuts to these critical resources, thereby helping firms effectively manage their resource dependence on other organizations [15]. Considering that developing LCI requires firms to be equipped with a high capacity to acquire and recombine resources and knowledge [7], it can be assumed that such firms are eager to develop ties with politicians. In the literature, an array of studies has revealed that PT can contribute to the output of LCI at the firm level. Specifically, Huang et al. [38] found that PT is associated with better LCI performance in China's listed industrial firms. Zhang et al. [14] empirically found that PT can promote LCI performance through corporate entrepreneurship strategies in China's pollution-intensive firms.

Furthermore, firms would inevitably have difficulties in maintaining their LCI investments when facing the risk of resource

loss. In this case, PT can provide resource-related protection for them through minimizing regulation enforcement. For example, Deng et al. [39] documented that PT can make firms less likely to suffer from stringent environmental regulations and the resulting punishments. Moreover, just as Leff [40] and Xin and Pearce [41] pointed out, to a large extent, PT can help firms overcome or even waive regulation requirements. Sheng et al. [42] also stressed that PT could help firms gain endorsements and favorable treatment from governments. Therefore, in addition to assisting firms in securing needed resources smoothly, PT is also instrumental in making these critical resources more sustainable.

The physical and visual resource advantages aside, politically tied firms also possess an information advantage. It has been argued that firms' strategic decision about LCI investment is significantly affected by political and economic uncertainty [27], [43]. By co-opting governments through PT, firms can establish broader and deeper social networks with political decision-makers. By doing so, such firms can be rewarded with timely access to privileged information on the existing or emerging policies related to LCI³ [27], [38], which sometimes is much more costly to obtain from other channels [44]. Furthermore, privileged information can reduce political uncertainty arising from the external environment [41], [44]. PT might enable politically tied firms to be better informed by policymakers about the circumstances under which conducting innovation activities will lead to greater success [20].

Legitimacy is defined as "a generalized perception or assumption that the actions of an entity are desirable, proper, or appropriate within some socially constructed system of norms, values, beliefs, and definitions" [35]. In this logic, as a branch of corporate legitimacy, environmental legitimacy indicates a generalized perception or assumption that a firm's environmental performance is desirable and satisfies the expectation of key stakeholders [45]. As Ashforth and Gibbs [46] suggested, organizations can enhance and/or repair their legitimacy by winning the support of key stakeholders. Furthermore, Alakent and Ozer [47] pointed out that firms can manage legitimacy by establishing and maintaining connections with other entities such as government organizations. Hence, it is plausible that firms can find PT very helpful in reaping environmental legitimacy under increasing environmental compliance pressures because PT will send other stakeholders and beholders a strong signal, albeit informally, that the focal firm is well equipped with the motivation and capability to fulfill governmental expectations for environment-friendly practices [48]. Furthermore, firms may employ PT to influence decision-makers and lobby them to discuss, adjust, or enact innovation policies and regulations to their advantage [23], [49]. This allows them to protect their

²For example, Tesla is one of the leading manufacturers of new energy vehicles worldwide, and it is barely impossible for Tesla to innovate low-carbon green energy batteries without providing vast subsidies and adequate rare earth resources from governments. Tesla has indeed benefited substantially from its close connection with governments, including the U.S. and China. In the U.S., aid came in multiple forms, such as more government contracts, tax breaks, and bank loans with lower interest rates. In China, the government also provided Tesla with a wide range of preferential treatments, including, but not limited to, loans on loose terms, low-cost land, an ideal investment agreement, and a deep supply chain of suppliers. For details, see <https://www.bloomberg.com/opinion/articles/2021-12-07/elon-musk-has-it-all-wrong-on-subsidies-tesla-benefits-from-state-backing#xj4y7vzkg>.

³For example, Longyuan Power Group Corporation Limited (<http://www.clypg.com.cn/>) is a state-owned energy enterprise that focuses on developing renewable energy in China. The firm has a strong relationship with China's governments, which enables it to stay updated with upcoming environmental policies. The Chinese government has been promoting wind power development through the "National Key Wind Power Base" plan since 2006, aiming to provide tremendous policy support for wind power projects. Interestingly, one year prior to this promotion plan, Longyuan had taken the first initiative to carry out green innovation in the field of wind power generation.

innovative products (e.g., patents) and gain higher levels of environmental legitimacy [48], [50].

Moreover, two major concerns discourage firms from innovating with low-carbon technologies in the real world. First, rivals may imitate LCI patents easily, thereby causing damage to their market competitiveness to a certain extent. Second, filing LCI patents is likely to be rejected after waiting several years, thus boosting patenting uncertainty [51]. Yet, PT can be instrumental in alleviating both concerns. For one thing, it may help mitigate the odds of unlawful patent infringement and unfair competition [20], [52]. For another, firms with PT can be better informed of the ideal circumstances or ways in which innovation activities can come with higher success rates [20]. This can allow politically connected firms to gain a greater understanding of how to engage in patenting activities that are advantageous to them, so that they can manage the risk of patent failure to some extent.

B. Grabbing Hands of Corporate Political Ties to Low-Carbon Innovation

Helping hands of PT aside, the current body of literature also suggests that political capital also has grabbing hands. For instance, Hou et al. [24] implied that PT might inflict a resource curse on corporate innovation. That is, politically tied firms may be obsessed with a desire to determine resource allocation rather than to pursue high standards of innovation [24], [53]. Meanwhile, the resources brought by PT can exert a motivation crowding out effect on firms. In a similar vein, PT may demotivate firms from pursuing innovation because the focal firms may sense that PT should ensure their survival and development despite threats resulting from inadequate innovation outcomes. In addition, Li et al. [54] documented that firms tied with political stakeholders are more willing to implement diversification and mergers and acquisition strategies, thus focusing less on innovation.

Moreover, one strand of literature has revealed the grabbing hands of PT from the politicians' standpoint. As rent setters, politicians are not entirely altruistic but partially spurred by rent-seeking [34]. Li et al. [11] emphasized that if firms can leverage their relationships with politicians, it is intuitive to reason that the politicians will expect reciprocity from those businesses. For instance, Shleifer and Vishny [55] implied that politicians would extract rents by keeping PT with firms. Prior studies found that it is nearly impossible for politicians to provide benefits without certain exchanges, and firms may be required to fulfill politicians' desires, such as giving gifts, paying bribes, and aiding them in winning political campaigns [13], [51]. For instance, Li and Zhou [56] revealed the existence of a political promotion tournament in contemporary China, meaning that to a large extent, certain indicators of local economic development, such as GDP growth and unemployment rate, have been key determinants of the political career of officials. Wang et al. [57] pointed out that this is especially the case among those positioned at lower levels. In response to the pressures of political competition, officials may take advantage of the established PT, such as instigating or forcing these firms to prettify these indicators by engaging in nonvalue-added activities. For example,

Bertrand et al. [58] reported that politically tied firms likely appeal to politicians by creating excess jobs and preventing plant closures. Dinc [59] also revealed that government officials may require political-tied banks to increase the scale of lending in emerging economies.

In addition to rent-seeking costs from politicians, agency theorists hold that politically tied managers may also be tempted to take rents from government-controlled resources as their remuneration [11], [13], [55], [60]. In other words, politically tied managers are stimulated by self-interest, and they may act in a way that contrasts with the interest of shareholders due to the separation of firm ownership and management in corporate governance [60].

In summary, it can be reasoned that PT may drive firms to cater to officials beyond the need to innovate low-carbon technologies, thereby diverting their attention away from environmental innovation activities.⁴ Additionally, the rent-seeking costs from politicians or managers may adversely affect firms' investment in low-carbon technologies. Thus, it appears that PT can potentially hinder LCI under certain circumstances.

C. Curvilinear Relationship Between Corporate Political Ties and Low-Carbon Innovation

Taken together, one can find that the PT-LCI relationship is almost impossible to infer accurately using linear logic, such as the simple positive or negative inference adopted by most previous studies. Even worse, those studies treated governments as unitary entities, inappropriately assuming that they would function and coordinate coherently [57]. This caused biases when building relevant arguments. To address this factor, we consider the role of administrative hierarchy (in the sense of the strength of PT) and shed light on untangling the relationship between PT and LCI from an evolutionary point of view.

Initially, when a firm without a track record of PT begins to seek PT (from zero to one), the rent-seeking cost can be substantial since the focal firm has to pay for expensive channels to get in touch with the targeted local officials. In transition economies, the rent-seeking market is especially competitive due largely to incomplete formal institutions, which makes the competition for informal market mechanisms (e.g., PT) even more fierce [11]. Additionally, PT is greatly exclusionary, meaning that it is less likely for firms with established political capital to share PT with newcomers unless compensated. In most cases, PT will be informally exchanged for other types of resources among firms and institutions. Later, once firms successfully develop PT with local officials, they generally find it more useful in accessing resources and relatively symmetric information than previously. Nonetheless, considering that central governments have greater access to resources and broader regulatory discretion compared with local counterparts [15], firms tied with a lower level of government will gain considerably less from PT as the strength

⁴According to an investigation conducted in China (<https://hbr.org/2010/06/the-globe-the-china-rules>), more than half of the CEOs interviewed have to spend 20% to 50% of their time on managing their relationships with government organizations, such as coping with policy issues and dealing with governmental authorities.

of their PT is at an infant stage. On the other hand, Zheng et al. [15] argued that lower level government agencies have not always prioritized sustainable development to a similar level as higher levels of governments. Furthermore, Li and Zhou [56] and Chen et al. [61] stressed that lower level administrative branch members are more obsessed with market development since economic growth (e.g., GDP) plays a key role in promoting their political careers. Also, the top-down implementation of environmental policies indicates that lower level governments can exert less environmental regulatory pressures on businesses [57]. Thus, for profit-driven firms with lower level PT, environmental compliance pressure arising from governments will be lessened because environmental innovation policies have always been redirected or readjusted to prioritize local officials' interests. As Zheng et al. [15] and Wang et al. [57] stated, this includes promoting fiscal income and local employment rather than facilitating environmental innovation. Hence, it can be reasoned that when PT is at lower levels, LCI performance is likely to see a downward trend.

With the soaring level of PT, firms will get close to officials in positions closer to central governments. This will increase access to government-controlled resources and broader regulatory authorities, both of which can benefit firms' LCI performance, as discussed earlier. In this sense, firms with higher levels of PT can benefit disproportionately in terms of resources, boldness, and the ability to innovate [50], thus leading to the marginal benefit of PT (i.e., the slope of the curve for total PT benefits) increasing rapidly. As the level of PT increases, the focal firm may find it easier to secure privileged information on existing or upcoming environmental policies. It will significantly attenuate firms' concerns about political and economic uncertainty and in turn encourage firms to make long-term investment decisions related to LCI. In addition, Wang et al. [57] argued that the government has a differing impact (e.g., regulatory pressure) on the focal firm, from the local to the central government. In contrast to lower level governments that predominantly emphasize economic growth, Li [62] highlighted that higher level governments create more influential innovation policies for firms to fulfill their ambitions, such as environmental innovation policies. As such, firms with higher level PT will perceive more environmental compliance pressures, which prompts them to innovate more low-carbon technologies to align with the broader interests of higher level officials. Also, Walsh et al. [63] evidenced that firms with higher level PT are eligible to participate in government-sponsored innovation networks, such as those in universities and research institutions. This enables them to innovate low-carbon technologies more effectively and efficiently. Collectively, it can be inferred that when PT is at a sufficiently higher level, LCI performance is likely to see an upward trend.

Acknowledging that political costs associated with PT are also at play is undeniable. Politicians in higher positions generally show a greater career concern effect [42], [64] and, therefore, may grab more rents from businesses. In turn, politically tied managers may also expect more rent from PT. Notwithstanding, the incremental increase in overall political costs will eventually level off for several reasons. First, although one of the primary interests of politicians is to advance their political careers [42], the overall level of a political career is limited. Kong et al.

[65] revealed that higher level politicians generally receive more attention from the public. Furthermore, Zheng et al. [15] pointed out that higher level politicians are always the focus of more rigorous legal investigations. In this light, higher levels of elite politicians are less likely to stake their existing political achievements on boundless rent-seeking activities that can render them illegitimate and unethical. Second, once politically tied managers seek rents beyond the extent that either political or economic stakeholders can tolerate, they will take necessary measures, such as replacing managers, to curb the adverse effects of intolerant agency costs associated with rent-seeking. Thus, overall political costs may increase but will end with diminishing margins as expected.

Consequently, a U-shaped relationship between PT and LCI emerges in light of these countervailing forces. Within certain limits, for profit-driven firms, the cost of establishing and maintaining PT will compete with the efforts and attention of developing LCI due to insufficient environmental compliance pressures and limited benefits in terms of resources and information. As the strength of PT increases beyond a sufficiently high level, focal firms face greater pressures pertaining to environmental innovation. Meanwhile, they can tap into extensive critical government-controlled resources as well as more privileged information on emerging innovation policies. In this connection, we argue that the benefits of PT to LCI (i.e., helping hands) can eventually surpass the adverse costs (i.e., grabbing hands). Several prior studies have also corroborated this argument. For instance, Huang et al. [38] found that only central politically connected CEOs (as opposed to locally tied ones) can exert a significant effect on LCI. Additionally, Li et al. [50] suggested that a focal firm's innovation performance will benefit from a stronger relationship with political stakeholders. In fact, this seems to resonate with the established view that the positive marginal value of PT is premised on sufficient benefits and external incentives, consistent with Faccio [13] and Zheng et al. [15]. Taken together, we propose that

Hypothesis 1: PT and LCI have a U-shaped curvilinear relation. Specifically, LCI performance slopes downward at first but tends to move upward as the level of PT increases.

D. Moderating Role of Corporate Reputation

Corporate reputation has been widely considered an intangible or social approval asset for firms [29]. Due to the halo or spotlight effect induced by prior reputation [66], Halebian et al. [67] argued that political and other stakeholders might deliberately partition and specifically treat a set of high-reputation firms and reward them based on the firms' capabilities and willingness to consistently meet high expectations related to certain activities. As noted, elite politicians have the incentives to prolong and promote their political careers. Accordingly, it can be assumed that officials are prone to place higher expectations and therefore tend to put greater environmental compliance pressure related to LCI outcomes on those high-reputation firms. In addition, compared with their less-renowned counterparts, these prestigious firms are also more sensitive and thus more responsive to environmental compliance pressures exerted by government organizations [30], [31]. In this connection, it appears that focal firms generally choose to transfer these pressures

into the incentives of carrying LCI activities [68] to meet and even exceed the expectations of politicians. In return, officials to whom firms are connected will provide them with more critical resources and privileged information necessary to fully develop LCI.

In addition, a large body of literature has implied that reputation is intimately related to legitimacy, and both are integral to sustainable competitive advantages (e.g., [69], [70]). Specifically, Deephouse and Carter [70] emphasized that legitimacy is necessary to develop a positive reputation, and reputation helps facilitate legitimacy. In a similar vein, it can be said that a firm's reputation is proportional to its desire for legitimacy, and firms strive to gain legitimacy by integrating the expectations of outside stakeholders (e.g., political stakeholders) into their operational strategies [70]. Based on this perspective, we argue that well-regarded firms are more eager to embrace environmental innovation in response to governments' calls for more innovation in low-carbon technologies to meet the demand for maintaining or improving their own environmental legitimacy [48]. In other words, compared with nameless firms, it is inferred that high-reputation firms with the desire to reap environmental legitimacy from political stakeholders will conform and respond to environmental compliance pressure more effectively, such as by employing environment-friendly strategies [48]. Also, for well-known or well-liked firms, it seems that more responsiveness to environmental policies can send other stakeholders and beholders a strong signal that the firms are more capable of satisfying their social and environmental expectations. As Marquis et al. [71] stated, firms with good reputations are keen to maintain their reputational resource by conducting eco-friendly practices like LCI.

In this regard, it can be reasoned that the nature of the PT-LCI relationship would be more salient under the moderation of corporate reputation. Despite diverse conceptualizations of corporate reputation, CP (i.e., *being known*) and GF (i.e., *being liked*) constitute the core of corporate reputation [66], [72]. On this basis, we next introduce prominence and favorability as two boundary conditions.

E. Moderating Role of Corporate Prominence (*Being Known*)

CP refers to the degree to which a firm's existence is known by other stakeholders and is nonvaluative, which can last for a certain period [66]. In other words, CP captures the degree to which a focal firm receives large-scale, collective, and unbiased recognition from various stakeholders [73]. Hence, politicians are more willing to maintain a closer relationship with well-known firms than with their less-famous counterparts because there is more room for exchanges of interests between both parties [13].

Moreover, CP makes firms more likely to grab media attention, and high CP indicates high visibility and accessibility of information about the firm [72]. Thus, high-profile firms are always the targets of attacks by environmentalists, and stakeholders are also eager to keep a closer eye on the actions of well-known firms [33], including their political activities and environmental practices. In this regard, it would be big news if a

well-known firm with PT were found to be irresponsible regarding environmental issues. This would hurt its relationship with political stakeholders and impair its reputation with tied government organizations [74], [75]. Therefore, given the concern of losing critical resources granted by politicians, well-known firms will be pressured to respond to the claims from political stakeholders, such as the call for developing LCI.

Furthermore, we argue that the more attention a prominent firm receives, the more likely it is to expose its environmental performance to public critique. This will result in more environmental compliance pressure on it to conduct LCI to meet or surpass government expectations. Otherwise, failure would cause damage to a well-known firm's institutional legitimacy due to its inability to achieve the aspirations of government organizations regarding low-carbon technologies. Taken together, we conjecture that

Hypothesis 2 (a): CP (i.e., being known by stakeholders) intensifies the U-shaped relationship between PT and LCI such that the same level of PT corresponds to better LCI performance under higher levels of CP than in lower levels.

F. Moderating Role of Generalized Favorability (*Being Liked*)

GF means that stakeholders hold positive perceptions and judgments of the firm based on its prior actions [66], [72]. A favorable reputation will result in a magnified halo effect for firms [66], and it can also strengthen the certification effect of PT and the signaling effect of corporate environmental practices. Specifically, stakeholders such as customers and investors are likely to view a well-liked and politically tied firm more positively and are therefore more readily impressed by its social and environmental performance. Thus, it can be argued that external audiences, including political stakeholders and economic stakeholders, may place greater value on and thus set higher expectations for the future output of low-carbon technologies developed by well-liked firms. Additionally, Dangelico and Pujari [76] and Pfarrer et al. [77] revealed that GF is associated with stakeholders' (especially investors') positive reactions to technology breakthroughs [76], [77]. In this light, a more favorable reputation will allow firms to charge premium prices on low-carbon products. Besides, it has been documented that firms with a good track record of GF also gain human resource advantages. These advantages include attracting and retaining outstanding employees [78], including LCI experts.

Nonetheless, although the well-liked image can help firms win premium prices and human resource advantages, it also makes them more subject to environmental compliance pressures and expectations from outside stakeholders. Thus, we argue that the concern of failing to address such pressure and expectations can make those politically tied firms with high GF more likely to adopt environmental practices, such as conducting environment-friendly innovation. We, therefore, propose that

Hypothesis 2 (b): GF (i.e., being liked by stakeholders) intensifies the U-shaped relationship between PT and LCI such that the same level of PT corresponds to better LCI performance under higher levels of GF than in lower levels.

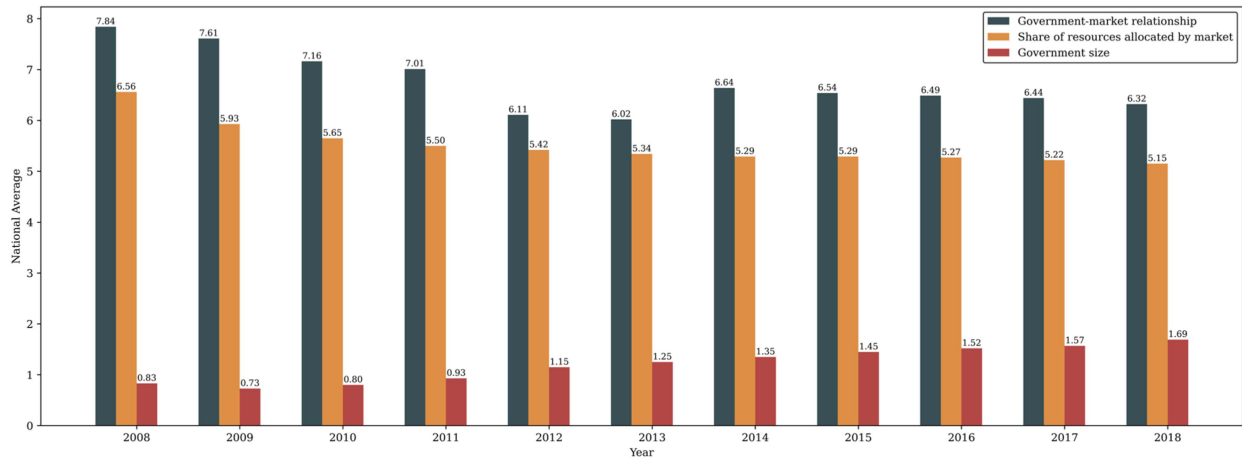


Fig. 1. Relationship between the government and the market has become tenser in China from 2008 to 2018.⁷

III. METHODOLOGY

A. Research Setting: China

China is studied as an appropriate and representative research setting. Three main factors make China an ideal context for experimenting with our theoretical arguments and research hypotheses.

First and foremost, despite its reform and opening-up policies since 1978, China's political governance ecosystem still features high centralization, incompletely developed institutions, and a relatively underdeveloped market [11], [12]. This makes Chinese firms rely heavily on government actions [15]. There is one proverb demonstrating China's political ecosystem: officials one rank superior crush the inferiors (Chinese *pinyin*: *guan da yi ji ya si ren*) [79], suggesting that officials in central governments (versus decentralized or local governments) typically have greater access to governmental-controlled resources and privileged information as well as having more regulatory discretion [15]. In addition, China faces great carbon emissions challenges in the aftermath of its economic prosperity, and the ruling party in China (i.e., CPC) has been emphasizing its commitment to low-carbon targets. Hence, it is argued that the PT-LCI relationship studied in the context of China can serve as a quintessential example and provide valuable implications for other settings.

Second, it is easier to detect and capture the effects of PT on firm-level low-carbon patenting in China. Regarding absolute expenditures, China has become the world's second-largest spender on R&D.⁵ As a result, there has been a considerable increase in the quantity of low-carbon patents filed by and granted to Chinese firms and other organizations over the past decades [5]. More importantly, corporate political activities are prevalent in China's *guanxi* society [11]. On the other hand, the underlying reason for Chinese firms' obsession with PT could be largely due to the disharmony between the government

and the market. It can be seen from Fig. 1 that the share of resources allocated by the market has trended downward, whereas government size has been growing, resulting in greater interdependence between China's government organizations and firms since 2008. Besides, it appears that in recent years China's ruling party (i.e., CPC) has been gradually shifting the criteria for promoting local officials from GDP-oriented output to environmental performance.⁶ This, in turn, incentivizes those political elites (e.g., mayors) who are eager to prolong and promote their political careers to shift or exert environmental innovation pressure on firms [80]. Accordingly, we believe it should be more feasible and easier to observe and estimate the dynamic influence of PT on LCI in China relative to other regions.

Finally, as noted earlier, PT remains controversial and may incur a business ethical dilemma in certain contexts [27], [28]. This is especially the case in China, where PT may lead to corruption and bribery, which is against the goals of massive Chinese anti-corruption campaigns [65]. Hence, it is relatively uncommon for managers in China to publicize their ties with the government, particularly those companies that enjoy a great reputation in society. In light of the fact that a good corporate reputation represents a firm's high societal acceptability [29], well-known or well-liked firms operating in China are more sensitive to the institutional pressure imposed by their political stakeholders. Accordingly, these firms are assumed to be more responsive to that pressure due to the demand for political legitimacy.

B. Sample and Data

Our initial sample consists of all China's A-share listed firms, and the time period is between 2009 and 2018. Next, we delete firms labeled as "ST (Special Treatment)" as it indicates that

⁵According to OECD's assessment of gross domestic spending on R&D (<https://data.oecd.org/rd/gross-domestic-spending-on-r-d.htm>), China's absolute R&D expenditure was 468 billion US dollars in 2018, following the United States which invested 582 billion.

⁶For example, since 2013, the former Ministry of Environmental Protection of China has carried out an air quality ranking for 74 cities and publicized the list of the top 10 cities with the best air quality and the last 10 cities with the poorest air quality every month.

⁷Fig. 1 is based on the Index of Marketization for China's provinces, which is released by the National Economic Research Institute in China. Note that the indicator of "government size" is attained by subtracting raw data from five so as to make it directly comparable with others.

the firm suffered financial losses for at least two consecutive years and thereby is on the brink of being delisted from the stock market. The firms are excluded because financial firms differ relative to nonfinancial firms in their capital structures [81]. The final sample comprises 24 323 firm-year observations, including 3425 listed firms. Online Appendix Table S1 (see Supplementary material) describes the sample distribution across industries and years.

Firm-level financial data are collected from the China Stock Market and Accounting Research database, a well-known scientific database used to study Chinese issues cited in the literature [82]. We download firms' annual financial reports from the official websites of the Shenzhen Stock Exchange and Shanghai Stock Exchange in China. Then, we create a Python script to collect the disclosed personal information for CEOs and Chairmen including their working experience and political backgrounds. Finally, in order to ensure the accuracy of research data, we manually identify their PT with either local or central governments. This way of building firms' PT is consistent with an array of studies (e.g., [83]), given that the information disclosed by both stock exchanges is the most accurate and transparent for Chinese listed firms.

In line with Zhu et al. [5], detailed patent information, encompassing patent types and International Patent Classification (IPC) code, was at first collected from the State Intellectual Property Office. Since each patent has a unique IPC code that allows for the identification of the patent's technical characteristics, we successfully filter LCI with reference to low-carbon IPC codes that are well-developed by World Intellectual Property Office. All continuous variables are winsorized at the 1st and 99th percentiles to eliminate the effect of outliers.

C. Variables and Measures

1) *Dependent Variables*: Following a large body of related studies [1], [5], [38], [84], [85], two measures were used, that is, the number of low-carbon patent applications (App) and LCI patent authorizations (Auth), to gauge LCI performance at the firm level. We take the natural logarithm of each measure plus one to mitigate the overdispersion of patent data.

2) *Independent Variables*: Although much of the current innovation literature used a binary index to proxy for PT [8], [83], [86], this measurement is hard to precisely gauge the level of PT since it omits the administrative hierarchy of China's political ranking system. Also, the binary index cannot capture the variance of the strength of PT from local governments to the central government [79]. With reference to some related research [15], [79], [87], [88], we use a hierarchical measurement method to capture the variant level of PT as per China's political system. Detailly, PT equals zero if neither CEOs nor Chairmen serve as an official in governments (Channel 1) and two legislative bodies (Channel 2), that is, the National People's Congress (NPC) and the National People's Political Consultative Conference (NPPCC). Otherwise, PT is granted a score of 1, 2, 3, 4, respectively, when the CEOs or Chairmen previously or currently hold a position in the following:

1) the district and county level governments or legislative bodies;

- 2) municipal government or legislative bodies;
- 3) provincial government or legislative bodies;
- 4) central government or legislative bodies.

As shown in Fig. 2, the rationale behind this hierarchical measurement is that government officials in higher level positions are generally more powerful and influential than their lower level peers in China [79].

For ease of interpretation, as shown in Table I, several real examples are provided to demonstrate how to determine the index of PT.⁸ It also reveals that our approach attempts to take into account all possible situations in which the CEOs and Chairmen are tied to politics through the government (i.e., Channel 1) and NPC/NPPCC (i.e., Channel 2). To put it simply, it allows us to comprehensively document their concurrently multiple affiliations or connections with different levels of government organizations through Channel 1 and 2.

3) *Moderating Variables*:

a) *Generalized favorability (GF; being liked)*: As suggested by Deephouse [29], a method based on the comprehensive analysis of the media coverage is used to evaluate the GF of the focal firm, as illustrated in (1). In line with Zhang and Ouyang [89], we collect media coverage data from the CNRD database (<https://www.cnrds.com/Home/>), which retrieves more than 600 important newspapers and assesses the sentiment (positive, neutral, and negative) for each news article. Then, news that mentions the focal firm in their titles or the content for each fiscal year is screened out to compute GF according to the following:

$$\text{Generalized favorability (GF)} = \begin{cases} \frac{P^2 - PN}{V^2} & \text{if } P > N \\ \frac{PN - N^2}{V^2} & \text{if } N > P \\ 0 & \text{if } P = N \end{cases} \quad (1)$$

where P denotes the number of positive news articles, N denotes the number of negative news articles, and V is the total number of news articles including those featured by neutral sentiment. The score ranges from -1 to 1 , where -1 means the lowest favorability and 1 means the highest favorability for a firm.

b) *Corporate prominence (CP; being known)*: Guba (<http://guba.eastmoney.com/>) is the most influential and active stock forum in China, where stakeholders (such as analysts and investors) can discuss and share firm-specific information in each specified subforum. In line with Wei and Ouyang [72] and Zhang and Ouyang [89], CP is measured by taking the natural logarithm of the total number of posts focused on the focal firm in a given fiscal year. This approach helps capture the exposure degree of a firm to stakeholders as well as the public.

4) *Control Variables*: This study controls for several board-level and firm-level variables that may confound our estimations. We control for the size of a listed firm (*FirmSize*) and measure it by taking the natural logarithm of total assets. Firm age (*FirmAge*) is measured by calculating the number of years since the firm was established, and similarly, this study takes the natural

⁸Our sample covers state-owned firms (SOEs) and privately owned firms (non-SOEs), so this begs the question: whether our method of constructing PT is valid for SOEs? We, therefore, have introduced several tests to mitigate this concern. See Online Appendix A12 for details.

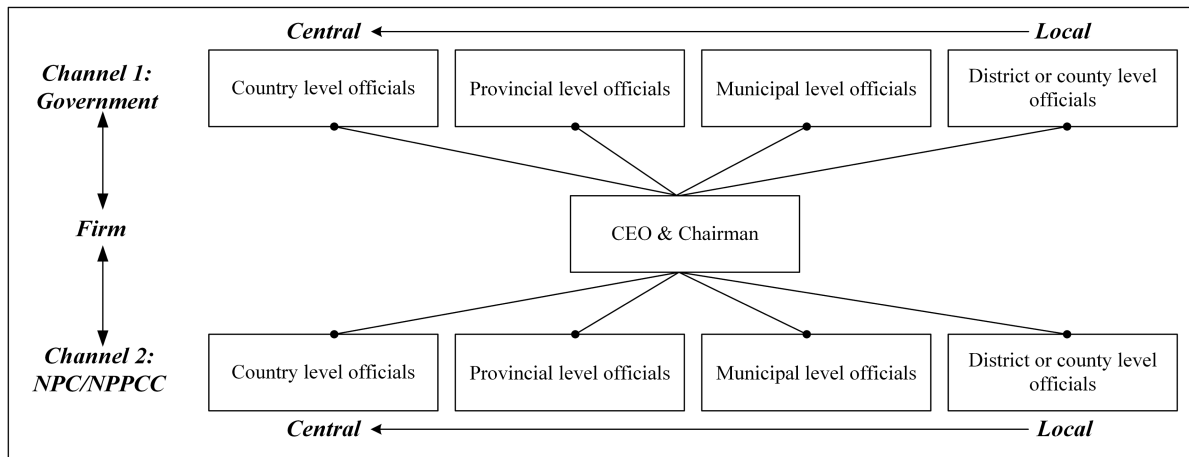


Fig. 2. Illustration of two main channels for firms to seek political ties in China.

TABLE I
ILLUSTRATIVE EXAMPLES OF PT CONSTRUCTION IN THIS STUDY

Firm#	Year#	CEO		Chairman		PT Combined score
		Channel 1	Channel 2	Channel 1	Channel 2	
		Government	NPC&NPPCC	Government	NPC&NPPCC	
Firm 1#	2010	0	0	0	0	0
Firm 2#	2018	1	0	1	0	2
Firm 3#	2016	3	0	1	0	4
Firm 4#	2011	1	1	2	2	6
Firm 5#	2015	3	2	2	1	8
Firm 6#	2013	1	1	4	4	10
Firm 7#	2016	4	4	3	3	14
Firm 8#	2018	4	4	4	4	16

logarithm of this variable. Return on Equity (*ROE*) is key to measuring firms' profitability. Besides, firm leverage (*FirmLev*) indicates firms' financial risks, and this study measures *FirmLev* through the proportion of a firm's year-end asset liability. Firm growth (*Growth*) is calculated by computing the annual growth rate of a firm's operating income. CEO duality occurs when the CEO simultaneously serves as the president of the firm and the chairman of the board. This study treats CEO duality (*Dual*) as a dummy, and specifically, it is coded as one if the CEO plays a dual role in the firm and zero otherwise. The ownership structure (*SOE*) of firms is controlled and measured as a dummy variable that equals 1 if the firm is in charge of the government and 0 otherwise. The stakeholder who holds the most shares (*Top1*) is more likely to influence corporate strategic decisions on LCI. This study measures it by computing the shareholding proportion of major stakeholders. In addition, Board size (*BSize*) is measured by the total number of board of directors, and board independence (*BIndep*) is determined by calculating the ratio of independent directors on the board. R&D intensity (*R&D*) is computed by taking the natural logarithm of total R&D expenditure. Finally, we control for Industry FE and Year FE.

D. Econometric Models

Two econometric models are established to test the hypotheses, as outlined in (2) and (3). Equation (2) is the baseline model

used to examine the curvilinear effect of PT on LCI, and (3) is utilized to examine the moderating effect of two pillars of corporate reputation (i.e., GF and CP) on the main relationship between PT and LCI.

Given that our established panel dataset is characterized by time series and cross-sectional features, we estimate these multivariate econometric models using the panel data method.⁹ Furthermore, the result of the Hausman specification test ($p < .01$) suggests that fixed effects panel models are more suitable for our empirical analysis rather than random effects models [20]. This is because the former is more useful in mitigating potential concerns of unobserved heterogeneity and endogeneity [90]. Considering that firms' adoption of low-carbon technologies is sensitive to unobserved industry-specific factors that vary over time [1], [85], [91], both industry-fixed effect (Industry FE) and year-fixed effect (Year FE) are added to (2) and (3). Following Chen et al. [79], the heteroskedasticity-robust standard error is

⁹As for panel datasets, the panel data method is superior to other estimation methods, including the ordinary least square regressions, as the former is helpful in addressing unobserved heterogeneity and endogeneity, such as omitted variable bias [90]. Nonetheless, it is undeniable to acknowledge that the panel data method is not a panacea for addressing all sources of endogeneity bias, such as sample selection bias and reverse causality. This is also the primary reason why we would like to conduct a series of robustness checks in Section V so as to further ensure the reliability and validity of our estimations.

clustered at the firm level to further deal with panel heteroskedasticity and potential contemporaneous error correlation

$$\begin{aligned} \text{App}_{i,t} \text{ or } \text{Auth}_{i,t} = & \alpha + \beta_1 \text{PT}_{i,t-1} + \beta_2 \text{PT}_{i,t-1}^2 \\ & + \sum_{j=1}^n \gamma_j \text{CVs}_{j,i,t-1} + \text{Fixed Effects} \\ & + \varepsilon_{i,t} \end{aligned} \quad (2)$$

$$\begin{aligned} \text{App}_{i,t} \text{ or } \text{Auth}_{i,t} = & \alpha + \beta_1 \text{PT}_{i,t-1} + \beta_2 \text{PT}_{i,t-1}^2 + \beta_3 \text{CR}_{i,t-1} \\ & + \beta_4 \text{PT}_{i,t-1} \times \text{CR}_{i,t-1} + \beta_5 \text{PT}_{i,t-1}^2 \\ & \times \text{CR}_{i,t-1} + \sum_{j=1}^n \gamma_j \text{CVs}_{j,i,t-1} \\ & + \text{Fixed Effects} + \varepsilon_{i,t} \end{aligned} \quad (3)$$

where i denotes the firm and t refers to the observed time point, PT denotes the level of corporate political ties, App and Auth denote low-carbon patent applications and low-carbon patent authorizations, respectively, Fixed effects include industry fixed effect (Industry FE) and year fixed effect (Year FE), CR refers to corporate reputation, which is divided into two facets: GF and CP, $\varepsilon_{i,t}$ is the random error term, and CVs subsume all control variables as stated above. In light of the endogenous issues potentially caused by reverse causality, all independent variables and CVs are lagged for 1 year.

As robustness checks, we also apply the negative binomial regression model and two-stage residual inclusion model (see Online Appendix A4 and A7, Supplementary material) to re-estimate our empirical analysis, and these results appear similar. Notably, the inclusion of Industry FE and Year FE instead of firm fixed effects (Firm FE) is because a certain portion of observations of PT is time-invariant. In this case, if the firm fixed effects are included in the econometric models, it will be inefficient to estimate the coefficients for the time-invariant variables [92], [93], [94]. Nonetheless, we still conduct another robustness test (see Online Appendix A8, Supplementary material) to check whether the inclusion of Firm FE will change the results. The corresponding results remain largely unchanged.

IV. RESULTS

A. Descriptive Statistics

Online Appendix Table S2 reports descriptive statistics and correlations and demonstrates several stylized facts. First, the distribution of PT is relatively unbalanced within our sample, with a mean of 2.486 and a standard deviation of 3.853. The mean of the PT dummy indicates that approximately 36% of firm-year samples have PT, implying that roughly at least one-third of the CEOs or Chairmen of Chinese listed firms are involved in political activities. This is consistent with the investigation by Faccio [13], showing that PT is more popular in countries with an underdeveloped market economy and interventionist governments. Second, the negative statistical correlation between the PT dummy and LCI (i.e., App and Auth) provide the basic evidence to corroborate our earlier argument that

LCI will reveal a considerable downward trend when firms without PT begin to seek their first records of PT (from zero to one) ($\beta = -.016, p < .05; \beta = -.007, p < .10$). Third, although the linear correlation between PT and LCI (i.e., App and Auth) is positive and significant in statistics ($\beta = .022, p < .01; \beta = .024, p < .01$), this result of bivariate correlation should be interpreted with caution, as they do not consider the quadratic term of PT as well as other important features of politically tied firms, such as size and age. Similarly, though the quadratic term of PT seems significantly and positively correlated with LCI ($\beta = .047, p < .01; \beta = .046, p < .01$), it must be interpreted with caution as well. We also demonstrate LCI distribution across industries and ownership structure (see Online Appendix Table S3, Supplementary material), and it is revealed that firm-level LCI is unevenly distributed across industries and between non-state-owned enterprises (non-SOEs) and SOEs.

Online Appendix Table S4 illustrates the statistical distribution of the PT index across years and industries. First, it appears that the index of PT ranges from 0 to 16, except for a value of one. To some degree, the absence is due to the combination of two channels through which China's listed firms seek PT. To eliminate potential measurement errors induced by the combination, we perform a robustness check (see Online Appendix A2, Supplementary material for details). In addition, it also indicates that political capital is unevenly distributed across industries and that, on average, the CEOs and Chairmen of firms listed in the mining, transportation, and education sectors tend to have higher-level PT. In addition, Online Appendix Table S6 indicates that, on average, the listed firms without PT and with top levels of PT tend to apply for or be granted more low-carbon patents than those with relatively low levels of PT. This provides preliminary and direct statistical evidence for the U-shaped relationship between PT and LCI.

B. Regression Results

Table II presents fixed effect regression results. Therein, Models 1 and 2 include the linear and quadratic terms of PT as the predictors. Models 3 and 4 report the regression result involving the interaction of CP with PT and its quadratic term. Likewise, the result of the interaction of GF with PT and its quadratic term is reported in Models 5 and 6.

As shown in Models 1 and 2, we find a U-shaped relationship between PT and LCI given the coefficients of the linear term ($\beta = -.016, p < .05; \beta = -.008, p < .10$) and the quadratic term ($\beta = .002, p < .01; \beta = .001, p < .05$). Thus, *Hypothesis 1 is supported*. The profit orientation of firms and great political costs initially leads to the decline of LCI, while mounting environmental compliance pressures and scaling benefits (manifesting in information and resource advantages) result in the rise of LCI at higher levels of PT. The turning point of the curvilinear relationship is situated at the PT value close to 4. It means that LCI performance will decline for firms whose combined PT scores are less than four. By contrast, firms with a combined PT score of more than four enjoy more critical government-controlled resources and also more rapidly respond and conform to the

TABLE II
FIXED EFFECT PANEL REGRESSION FOR LOW-CARBON INNOVATION

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	App	Auth	App	Auth	App	Auth	App	Auth
PT	-0.0159** (0.0073)	-0.0077* (0.0041)	-0.0159** (0.0072)	-0.0075* (0.0040)	-0.0173** (0.0074)	-0.0081** (0.0041)	-0.0173** (0.0073)	-0.0080** (0.0041)
PT ²	0.0021*** (0.0007)	0.0010** (0.0004)	0.0021*** (0.0007)	0.0010** (0.0004)	0.0021*** (0.0008)	0.0010** (0.0004)	0.0021*** (0.0007)	0.0010** (0.0004)
Corporate prominence (CP)			0.0291** (0.0128)	0.0227*** (0.0076)			0.0326** (0.0128)	0.0240*** (0.0076)
PT×CP			-0.0196** (0.0080)	-0.0098** (0.0048)			-0.0198** (0.0080)	-0.0100** (0.0048)
PT ² ×CP			0.0020** (0.0008)	0.0011** (0.0005)			0.0020** (0.0008)	0.0011** (0.0005)
Generalized favorability (GF)					0.0160 (0.0435)	0.0115 (0.0267)	0.0245 (0.0436)	0.0183 (0.0267)
PT×GF					-0.0782* (0.0424)	-0.0635** (0.0249)	-0.0825* (0.0423)	-0.0669*** (0.0248)
PT ² ×GF					0.0261*** (0.0099)	0.0183*** (0.0058)	0.0272*** (0.0099)	0.0191*** (0.0057)
ROE	0.5506*** (0.1047)	0.0981 (0.0600)	0.5648*** (0.1029)	0.1091* (0.0585)	0.5437*** (0.1046)	0.0954 (0.0599)	0.5588*** (0.1027)	0.1064* (0.0585)
FirmSize	0.1417*** (0.0179)	0.0892*** (0.0119)	0.1330*** (0.0168)	0.0824*** (0.0109)	0.1404*** (0.0179)	0.0884*** (0.0119)	0.1308*** (0.0168)	0.0812*** (0.0109)
FirmLev	0.0398 (0.0621)	-0.0314 (0.0370)	0.0449 (0.0613)	-0.0273 (0.0364)	0.0448 (0.0621)	-0.0289 (0.0371)	0.0508 (0.0613)	-0.0243 (0.0364)
Growth	-0.0335*** (0.0107)	-0.0255*** (0.0063)	-0.0326*** (0.0106)	-0.0248*** (0.0062)	-0.0335*** (0.0107)	-0.0253*** (0.0063)	-0.0325*** (0.0106)	-0.0246*** (0.0062)
Dual	0.0069 (0.0227)	0.0088 (0.0139)	0.0101 (0.0227)	0.0110 (0.0139)	0.0093 (0.0227)	0.0102 (0.0139)	0.0127 (0.0227)	0.0124 (0.0139)
SOE	0.0278 (0.0282)	-0.0059 (0.0170)	0.0254 (0.0280)	-0.0079 (0.0170)	0.0246 (0.0282)	-0.0071 (0.0170)	0.0216 (0.0280)	-0.0094 (0.0170)
FirmAge	-0.0581* (0.0332)	-0.0091 (0.0184)	-0.0625* (0.0333)	-0.0127 (0.0184)	-0.0563* (0.0332)	-0.0085 (0.0183)	-0.0610* (0.0333)	-0.0122 (0.0183)
Top1	-0.1475* (0.0886)	-0.0238 (0.0580)	-0.1246 (0.0883)	-0.0065 (0.0586)	-0.1422 (0.0884)	-0.0217 (0.0579)	-0.1167 (0.0881)	-0.0033 (0.0586)
BSize	0.0196* (0.0103)	0.0149** (0.0070)	0.0198* (0.0102)	0.0151** (0.0070)	0.0187* (0.0103)	0.0145** (0.0070)	0.0188* (0.0102)	0.0146** (0.0070)
BIndep	0.3080 (0.2012)	0.2299* (0.1190)	0.2908 (0.1995)	0.2178* (0.1175)	0.3080 (0.2009)	0.2293* (0.1189)	0.2899 (0.1991)	0.2171* (0.1174)
R&D	0.0110*** (0.0018)	0.0055*** (0.0011)	0.0113*** (0.0018)	0.0057*** (0.0011)	0.0108*** (0.0018)	0.0054*** (0.0011)	0.0111*** (0.0017)	0.0056*** (0.0011)
_cons	-3.0978*** (0.4144)	-2.0749*** (0.2903)	-3.1568*** (0.4236)	-2.1187*** (0.2979)	-3.0804*** (0.4134)	-2.0589*** (0.2901)	-3.1493*** (0.4229)	-2.1073*** (0.2980)
Industry & Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R ²	0.161	0.115	0.163	0.118	0.162	0.116	0.164	0.119
Obs.	20 680	20 680	20 680	20 680	20 680	20 680	20 680	20 680

Note: Robust standard errors clustered at the firm level are in parentheses. App stands for low-carbon patent applications, and Auth stands for low-carbon patent authorizations. * $p < .10$, ** $p < .05$, *** $p < .01$. The regression coefficients reported in this table are unstandardized.

environmental compliance pressures, resulting in an increasing LCI performance.

Models 3 and 4 present that the coefficient of interaction between CP and the quadric term of PT is significantly positive ($\beta = .002$, $p < .05$; $\beta = .001$, $p < .05$), indicating a steepening of the curve [95]. Following Dawson [96], we depict how low, medium, and high degrees of CP moderate the PT-LCI relationship, as shown in Fig. 3(a) and (b). It appears that firms with higher level CP experience a steeper U-shaped effect between PT and LCI, indicating that CP (i.e., being known by stakeholders) positively moderates the PT-LCI relationship. Thus, *Hypothesis 2(a) is supported*. Furthermore, Models 5 and 6

provide valid evidence to support *Hypothesis 2(b)*. The coefficient of the interaction between GF and the quadric term of PT is significant with a positive sign ($\beta = .026$, $p < .01$; $\beta = .018$, $p < .01$). Likewise, it means that the U-shaped relationship is intensified when firms enjoy higher level GF, suggesting that GF (i.e., being liked by stakeholders) positively moderates the PT-LCI relationship. Fig. 3(c) and (d) show how the degree of GF influences the main effect, and it turns out that well-liked firms will see a steepening of the curve. Finally, Models 7 and 8 provide consistent evidence to support our hypotheses.

We note that the LCI performance for firms with the highest level of PT is greater in magnitude than for those with the lowest

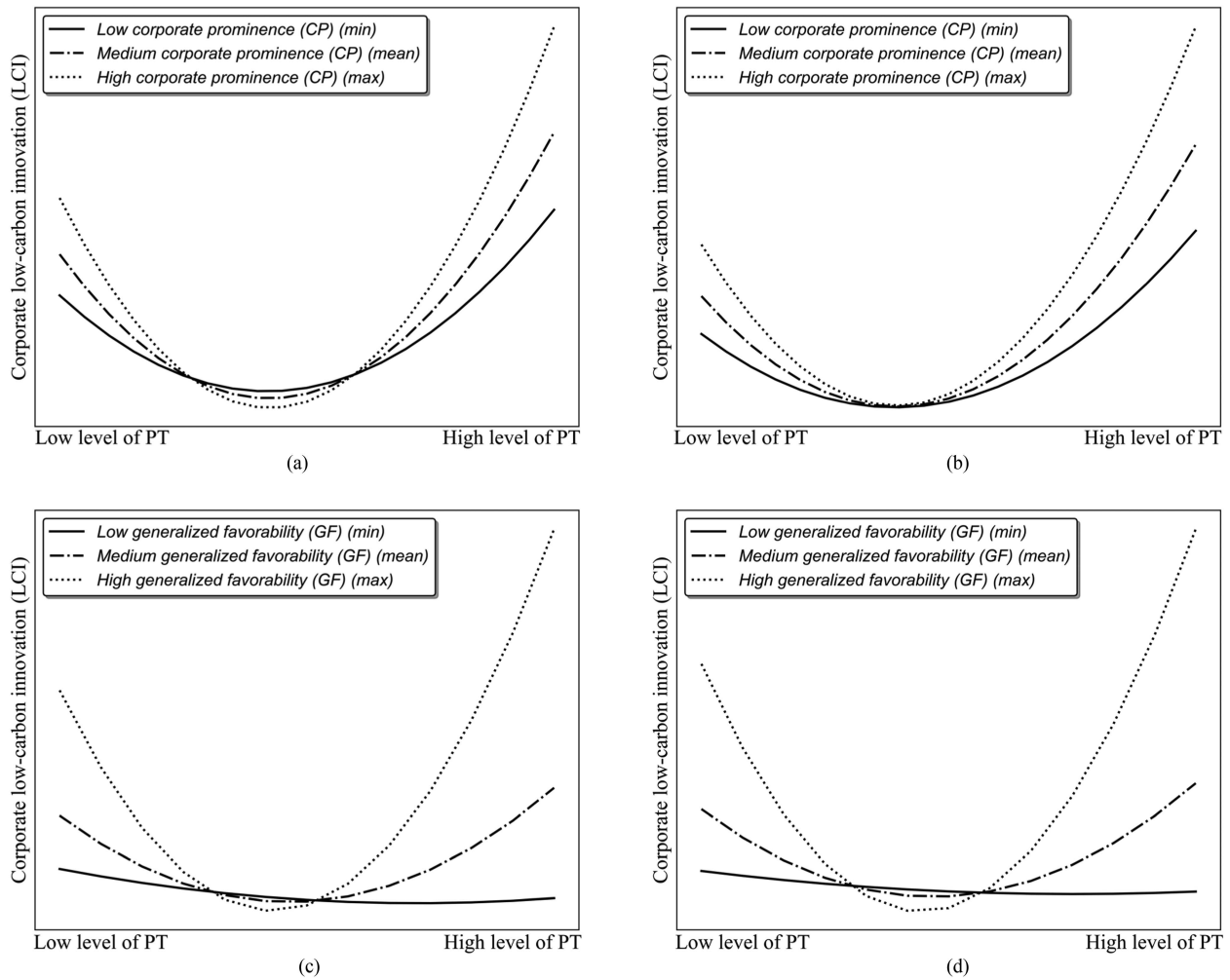


Fig. 3. Moderating effect of corporate prominence (a), (b) and generalized favorability (c), (d). Note: App stands for low-carbon patent applications, and Auth stands for low-carbon patent authorizations.

level of PT. That is, when it comes to LCI patents applied or granted, firms with an overall PT score of 16 outperform those with a combined PT score of 0. Interestingly, there is another noteworthy difference between the moderating effect of CP and GF. Fig. 3(a) and (b) suggest that a U-shaped PT–LCI relationship exists at all levels of CP, while Fig. 3(c) and (d) reveal that, to a large extent, an increase in the level of PT is negatively associated with LCI at a low GF level. Specifically, the PT–LCI relationship has not shown an apparent U-shaped curve for firms with an unfavorable image in the eyes of the public, and this U-shaped relationship becomes more significant when the focal firm enjoys a more favorable public image. This suggests that PT may not benefit LCI for firms with poor favorability even at a sufficiently high level.

V. ROBUSTNESS CHECKS

As shown in Online Appendix A1–A11, we performed a variety of robustness checks, such as rechecking the U-shaped relationship, altering estimation methods, correcting for sample selection bias, and so on. Overall, these results provided

consistent support for our theoretical arguments and empirical hypotheses.

VI. FURTHER ANALYSIS

A. Direct Evidence of the Helping Hands of Political Ties

As discussed earlier, PT might manifest its helping hands in resource and information advantages. Here we provide direct evidence to corroborate this argument. As shown in Online Appendix Table S26, the level of PT is negatively associated with information asymmetry and positively associated with government subsidy, which means that higher level PT enables firms to acquire more symmetry information and secure more government-controlled resources.

B. Does Ownership Structure Matter?

There are two main kinds of Chinese listed firms in terms of ownership structure: SOEs and privately controlled firms (non-SOEs). One big difference between them is that the CEOs

or Chairmen of some SOEs are directly appointed by governments. Hence, a certain portion of SOEs is thought to be born with a certain level of PT. Owing to the built-in nature of PT, SOEs may have fewer concerns about risk-taking [97] and thus have a higher risk tolerance for LCI programs [7], [14]. In fact, China's governments are willing to give higher priority to some SOEs than non-SOEs whilst distributing rare resources, and most of China's SOEs have to take the initiative in environmental innovation.

Therefore, it is worthwhile to investigate whether the previously evidenced U-shaped PT-LCI relationship is conditional on the ownership structure. To this end, we split the entire sample into two subgroups. We find that regardless of the ownership structure, the U-shaped relationship between PT and LCI was largely supported (see Online Appendix Table S27, Supplementary material). This indicates that compared with non-SOE counterparts, the coefficient of the quadric term of PT seems greater for SOEs. For ease of interpretation, we depict the comparison between SOEs and non-SOEs regarding the U-shaped PT-LCI association, as shown in Online Appendix Fig. S2, Supplementary material. It appears that SOEs generate a steeper U-shaped curve than non-SOEs. To accurately reach this conclusion, we conduct Fisher's Permutation test to check the difference between the coefficients on the quadric term of PT of two subgroups. The results reveal significant differences in statistics (see Online Appendix Table S27, Supplementary material). Thus, it can be concluded that the U-shaped relationship between PT and LCI is more pronounced for SOEs than for non-SOEs. It may be attributed to the fact that senior managers of SOEs are semi-regulators to a large extent, and it will be cheaper and easier for them to gain comparative advantages in acquiring government-controlled resources and privileged information related to LCI compared with their non-SOEs counterparts. This is in consonance with an array of studies (e.g., [14], [79], [98]).

Besides, the built-in nature of PT can lead to higher conformity to environmental compliance pressures, thereby prompting politically tied managers in SOEs to endeavor to develop LCI [14]. In this connection, it seems intuitive that SOEs would have better LCI performance and thus generate a steeper U-shaped curve. Also, for the same reason, it would be expected that the turning point should emerge at a lower level PT for SOEs than for non-SOEs, as shown in Online Appendix Fig. S2, Supplementary material. This provides additional evidence in support of the validity of our PT measurement scale, because the majority of SOEs should have had PT when they were established and thus the left-hand side of the U-shaped curve should be shorter for SOEs than for non-SOEs.

C. The Interaction of Corporate Prominence and Generalized Favorability

Rindova et al. [73] pointed out that CP and GF are two interrelated but distinct dimensions that conceptualize corporate reputation. Lange et al. [66] highlighted the need to explore the interaction of the dimensions of corporate reputation. Taking inspiration from both studies, we further investigate the interactive effect of CP and GF on the U-shaped PT-LCI relationship. To

this end, we partition the entire sample into several subsamples according to the average value of CP and GF. We find that the positive moderating effect of CP is more pronounced when firms enjoy higher levels of GF (versus lower levels of GF), while the positive moderating effect of GF is more salient when firms have lower levels of CP (versus higher levels of CP) (see Online Appendix Tables S28 and S29, Supplementary material). Hence, there appears to be an asymmetric effect between the roles of CP and GF in interactively moderating the PT-LCI relationship. That is, higher level GF can resonate better with CP, while higher level CP is less concerned with GF. Part of the reason may be that higher level GF is always associated with a higher likelihood of a firm being mentioned (i.e., CP) in positive contexts [73], while the opposite is not necessarily the case.

D. Heterogeneity in Environmental Regulatory Stringency

Firms are confronted with heterogeneous levels of environmental regulation, which has the potential to inflict significant differences in their environmental innovation behavior. As such, with reference to Fredriksson and Millimet [99] and Cao and You [100], we employ the pollution abatement and control expenditures per China Yuan of manufacturing output by the region where the firm is headquartered to proxy for the extent to which a listed firm is exposed to regional environmental regulatory stringency, which *Envir_Reg* denotes.

Afterward, we construct the dummy for firms with high exposure to regional environmental regulatory stringency, i.e., 1 for firms whose headquarters exceed the within-region median value of *Envir_Reg* and 0 otherwise. Likewise, we also construct the dummy for those firms with low exposure to regional environmental regulatory stringency. Next, we multiply both dummy variables with the linear and quadratic terms of PT to build interaction terms. As shown in Online Appendix Table S30, the regression results indicate that the U-shaped effect of PT on LCI for firms exposed to high regional environmental regulatory stringency is more statistically significant than for their counterparts. This result is not surprising, and the underlying reason can be that the environmental compliance pressure on conducting LCI is underperceived for firms located in those regions with low levels of environmental regulatory stringency. Accordingly, they may not feel the urgent need to prioritize LCI to comply with environmental policies and gain legitimacy from higher level government authorities.

VII. DISCUSSION

One of the most significant findings to emerge from our study is that, for the first time in the literature, we find a nonlinear and U-shaped relation between PT and LCI at the firm level. Specifically, on one hand, there is a performance-diminishing effect at a low level of PT due to the great political costs, the profit-driven and risk-averse nature of businesses, and the low priority given by lower tiered officials to environmental issues; on the other hand, as the level of PT increases, the conformity to government environmental goals as the exchange of environmental legitimacy and the concomitant access to resource and information advantages provided by higher level PT can

overwhelmingly lead to a performance-enhancing effect. It is also revealed that the U-shaped relationship is not symmetrical, meaning that those firms with the highest PT score exhibit significantly better LCI performance compared to those firms with the lowest PT level. In general, this finding is consistent with the view held by many scholars that the value of PT to firms varies with the level or strength of PT [79]. Interestingly, this finding is in contrast to Wu [101], who found that there is an inverted U-shaped relation between PT and conventional innovation. It may be due to these unmatched characteristics that significantly distinguish environmental innovation from conventional innovation, such as the double externality.

The other important finding is that the U-shaped relationship is contingent on two pillars of corporate reputation. Specifically, the U-shaped relationship can be intensified by both GF and CP. Notably, Fig. 3 reveals that the U-shaped curve is likely to be insignificant at a low GF level. Part of the reason likely stem from the career and reputation concerns of political parties [75]. In this situation, PT might become a hot potato for firms without a favorable public perception. Moreover, our further analyses indicate the following:

- 1) PT is useful in mitigating firm-level information asymmetry and helping firms gain more government subsidies, providing direct evidence to corroborate the helping hands of PT.
- 2) The U-shaped curve is steeper for SOEs than for their non-SOEs counterparts, and the curve for SOEs reaches the turning point ahead of that for non-SOEs.
- 3) The positive moderating effect of CP is more pronounced when firms enjoy high favorability, while that of GF is less pronounced when firms enjoy high prominence.
- 4) The U-shaped effect of PT on LCI for firms exposed to high regional environmental regulatory stringency is generally more statistically significant than for their counterparts.

Mounting studies centered on PT in transition economies have revealed that the grabbing hand and the helping hand of connections to politics may coexist when determining various aspects of corporate performance [79], [102]. These studies dovetail nicely with our findings because the U-shaped curve implies that when the level of PT reaches a certain threshold, LCI performance will see a shift from hindrance to facilitation. It is one thing to underline that low levels of PT can impose a burden on conducting LCI due to political intervention and rent-seeking costs, yet it is another to unveil that higher level PT is advantageous to LCI as such ties can serve as a solid pipeline through which privileged information and critical resources could flow in [27]. Furthermore, in general, the turning point of this U-shaped curve is situated at the PT value close to 4, suggesting that firm-level LCI performance will not increase until the combined PT score for CEOs and Chairmen connected to the government bodies (i.e., governments and NPC/NPPCC) is more than four.

In addition, our results suggest that corporate reputation significantly and positively moderates the influence of PT on LCI. Owing to the halo or spotlight effect arising from a good track record of reputation [66], governments are inclined to place higher expectations on well-liked and well-known firms

regarding eco-friendly initiatives, and these expectations naturally come with increased environmental compliance pressures. Furthermore, high-profile firms are likely to receive more attention from the public [32]. If they do not effectively respond to calls from governments for environment-friendly practices, the resulting problem will be aggravated. In this connection, high-reputation firms tend to show greater responsiveness and conformity to environmental policies regarding LCI to meet the demand for social and environmental legitimacy.

A U-shaped relationship between PT and LCI is at the core of our results. So, why do firms with sufficiently higher level PT (i.e., the right-hand side of the U-shaped curve) tend to have more environmentally friendly patents? First, China is widely recognized as an emerging giant of the world and will play a significant role in mitigating climate change problems in the 21st century [103]. In this context, China's top-level elite politicians have shown more and more concerns about environmental issues over the past decades, which is spreading in a top-down manner within China's highly centralized political system [57]. Higher level politicians generally give higher priority to implementing environmental policies than lower tiered ones because the latter is more in pursuit of economic indicators (e.g., GDP) [56]. In turn, those firms tied to upper level government organizations ordinarily perceive more significant pressure to comply with environmental policies at a higher level. Increasing investment in low-carbon technology, such as applying for more eco-friendly patents, can be a useful strategy to mitigate this pressure and simultaneously gain political legitimacy to sustain their routine operation. Moreover, in China, where intellectual property protection is not as robust as in Western countries, PT is crucial in deterring imitation and unfair competition [29], [52]. Since patents enable firms to safeguard and profit from their innovative activities, higher level connections with politics will likely reinforce firms' incentives to engage in patenting activities.

In addition, the current body of literature suggests that firms can benefit from investing in LCI. Applying for and being granted more low-carbon patents conveys a positive signal to political and economic stakeholders about the green reputation and green quality of firms' products and services [104], which is advantageous to their operation target. Investing in low-carbon technologies helps save materials and energy and thus is likely to improve resource utilization efficiency for firms in the long term [105]. In recent years, there has been a growing awareness and demand from the public and investors for environmentally friendly solutions, making them more willing to accept the new products or services launched as a result of LCI. Hence, it is suggested that investing in low-carbon technology enables firms to become more creative and acquire more bargaining power in the market. Governments worldwide, including China, are implementing policies to support low-carbon investments and technologies. These include incentives such as tax credits, subsidies, and carbon pricing mechanisms. Firms with more patents in low-carbon field are likely to take advantage of these incentives. Collectively, it is argued that superior performance in low-carbon technology (e.g., more low-carbon patents applied

or granted) can allow firms to reap more regardless of financial or operational benefits.

VIII. THEORETICAL CONTRIBUTIONS

This study has several contributions to the literature. First, to our best knowledge, we are the first to develop a relatively complete picture of the influence of PT on LCI from an evolutionary perspective. Previous findings on the same or related theme are mixed and deeply polarized, that is, either positive (e.g., [14], [38]) or negative (e.g., [8], [24]), thereby generating a lingering debate that is hard to reconcile using linear reasoning. Instead, by utilizing nonlinear inference on the PT–LCI relationship, we contribute to reconciling this long-standing debate rooted in the literature on corporate political strategy and corporate environmentalism. Also, we depart from those previous studies that treated governments as unitary entities and assumed the effect of PT on firm environmental behavior to be monolithic. Instead, we show that the extent to which LCI benefits from PT can vary with the strength of PT. Through the inclusion of the administrative hierarchy of government organizations, our study advances the current understanding of the nexus between PT and LCI.

Second, our study contributes to the growing literature on firm nonmarket strategies such as PT. In line with recent calls for more efforts in examining the value of nonmarket strategies [27], our primary finding that sufficiently high levels of PT can improve LCI lends support to the view that PT continues to be valuable in emerging economies. By fusing and extending insights from the literature, we illustrate detailed mechanisms through which PT may either hurt or benefit LCI performance. This provides a broader understanding of the role of firm nonmarket strategies in corporate environmental performance in the largest emerging economy - China.

Third, through the lenses of two pillars of corporate reputation (i.e., GF and CP), we further elucidate how and under which conditions corporate political activities would influence corporate environmental innovation. By doing so, our study contributes to the intersection of literature on corporate political strategies, environmental innovation management, and corporate reputation management. Unlike studies focusing on external environmental factors such as environmental dynamism (e.g., [14]) and environmental regulation (e.g., [8]), our study may be the first to investigate the interactive effects of corporate reputation and PT on LCI. Our findings suggest that the recognition of the public and outside stakeholders can determine the extent to which firms can benefit from PT in terms of LCI performance. Although a large body of literature to date has regarded corporate reputation as an intangible asset or social approval asset and has explored how corporate reputation predicts investors' reaction to a firm crisis or surprising events (e.g., [72], [77]), less is known with respect to its contingent role in the relationship between political capital and corporate environmental performance (e.g., LCI).

IX. MANAGERIAL IMPLICATIONS

Our findings have several important managerial implications for both firm managers and policymakers. First, in response to the increasing environmental compliance pressures exerted by governments to prompt environmental innovation, those

managers who run firms in transition economies with incomplete formal institutions and centralized political system (e.g., China) must determine the appropriate level of government organizations with which their firms should connect. Part of the reason is that being tied with governments below a certain level will put firms at a disadvantage in terms of approaching government-controlled resources and privileged information that is integral to innovating low-carbon technologies. Second, given that the effect of PT on LCI can be enhanced by the quality of corporate reputation, it is thus suggested that businesses aiming to improve environmental performance should endeavor to increase their prominence (i.e., *being well-known*) or earn the public's favor (i.e., *being well-liked*). In so doing, they can better leverage political capital to fuel environmental innovation performance. Third, notwithstanding the merits of political capital to eco-innovation, firms without political connections are equally important to government organizations that strive to effectively manage CO₂ emissions. In this regard, policymakers are advised to implement low-carbon policies by simultaneously taking into consideration how to effectively improve formal institutional environments so that even businesses with no political relationships would benefit from fairer chances in terms of innovating low-carbon technologies.

X. CONCLUSION, LIMITATIONS, AND FUTURE RESEARCH

In conclusion, this study elucidates the multifaceted effect of PT on LCI in terms of helping hands and grabbing hands and suggests it to be neither purely negative nor positive but U-shaped, which challenges the oversimplified linear prediction assumed by the extant literature. Our findings reveal that an overall score of PT below four is counterproductive to LCI performance, while it can see a rapidly upward trend once PT attains the inflection point. Besides, this curvilinear relationship is found to be intensified by two facets of corporate reputation, that is, GF and CP.

Our study has several limitations that may open new avenues for future research. First, we have not closed the book on the forms of government-firm ties. Some informal ones such as family ties or social ties (e.g., alumni ties) with elite politicians are also advisable for future studies to consider.

Second, it is undeniable to acknowledge the limitation of using patent data because not all efforts devoted to the area of LCI can be measured through patenting activities. To address this issue, future studies should explore other tools to capture firm-level LCI performance more accurately.

Third, the established PT might be influenced when firm relocation happens. Although we have conducted another robustness check (see Online Appendix A10, Supplementary material) to try to rule out this potential, it is noteworthy that this type of check does not differentiate the underlying reasons why firms choose to relocate their operation addresses. Future research can employ surveys or other nuanced methods to accurately identify those cases associated with the issue of PT. Alternatively, future studies with more obtainable data on firm branch expansion are encouraged to examine its linkage with PT movement.¹⁰

¹⁰The authors thank one of the reviewers for providing this valuable thought.

In addition, our way of constructing the index of PT pays closer attention to capturing variation in the strength of PT, while PT may not always be sustained but possibly terminated due to political uncertainty. Despite our efforts to mitigate this concern (see Online Appendix A11, Supplementary material), it is suggested that more transparent information and fine-grained data will be more supportive of operationalizing PT, enabling future research to identify and analyze all relevant cases of political uncertainty that happen to officials who are tied to the focal firm.

Finally, future research may find it interesting and worthwhile to explore how the distance between firms and governments generates more serendipitous value other than low-carbon technologies [105].

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REFERENCES

- [1] L. Xia, S. Gao, J. Wei, and Q. Ding, "Government subsidy and corporate green innovation - does board governance play a role?," *Energy Policy*, vol. 161, Feb. 2022, Art. no. 112720, doi: [10.1016/j.enpol.2021.112720](#).
- [2] B. Downar, J. Ernstberger, S. Reichelstein, S. Schwenen, and A. Zaklan, "The impact of carbon disclosure mandates on emissions and financial operating performance," *Rev. Accounting Stud.*, vol. 26, no. 3, pp. 1137–1175, Sep. 2021, doi: [10.1007/s11442-021-09611-x](#).
- [3] D. Normile, "Can China, the world's biggest coal consumer, become carbon neutral by 2060?" *Science*, Sep. 2020, doi: [10.1126/science.abf0377](#).
- [4] C. Wilson, "Disruptive low-carbon innovations," *Energy Res. Soc. Sci.*, vol. 37, pp. 216–223, Mar. 2018, doi: [10.1016/j.erss.2017.10.053](#).
- [5] J. Zhu, Y. Fan, X. Deng, and L. Xue, "Low-carbon innovation induced by emissions trading in China," *Nature Commun.*, vol. 10, no. 1, Dec. 2019, Art. no. 4088, doi: [10.1038/s41467-019-12213-6](#).
- [6] L. Xia, J. Wei, S. Gao, and B. Ma, "Promoting corporate sustainability through sustainable resource management: A hybrid decision-making approach incorporating social media data," *Environ. Impact Assessment Rev.*, vol. 85, Nov. 2020, Art. no. 106459, doi: [10.1016/j.eiar.2020.106459](#).
- [7] N. Barbieri, A. Marzucchi, and U. Rizzo, "Knowledge sources and impacts on subsequent inventions: Do green technologies differ from non-green ones?," *Res. Policy*, vol. 49, no. 2, Mar. 2020, Art. no. 103901, doi: [10.1016/j.respol.2019.103901](#).
- [8] L. Desheng, C. Jiakui, and Z. Ning, "Political connections and green technology innovations under an environmental regulation," *J. Cleaner Prod.*, vol. 298, May 2021, Art. no. 126778, doi: [10.1016/j.jclepro.2021.126778](#).
- [9] A. B. Jaffe, R. G. Newell, and R. N. Stavins, "Technological change and the environment," in *Handbook of Environmental Economics*, vol. 1. Amsterdam, The Netherlands: Elsevier, 2003, pp. 461–516, doi: [10.1016/S1574-0099\(03\)01016-7](#).
- [10] K. Bi, P. Huang, and X. Wang, "Innovation performance and influencing factors of low-carbon technological innovation under the global value chain: A case of Chinese manufacturing industry," *Technological Forecasting Social Change*, vol. 111, pp. 275–284, Oct. 2016, doi: [10.1016/j.techfore.2016.07.024](#).
- [11] S. Li, H. Wu, and X. Jiang, "Rent-seeking and firm value: Chinese evidence," *Bus. Politics*, vol. 20, no. 2, pp. 239–272, Jun. 2018, doi: [10.1017/bap.2017.25](#).
- [12] V. Nee, "Organizational dynamics of market transition: Hybrid forms, property rights, and mixed economy in China," *Administ. Sci. Quart.*, vol. 37, no. 1, pp. 1–27, Mar. 1992, doi: [10.2307/2393531](#).
- [13] M. Faccio, "Politically connected firms," *Amer. Econ. Rev.*, vol. 96, no. 1, pp. 369–386, 2006.
- [14] C. Zhang, B. Zhou, and X. Tian, "Political connections and green innovation: The role of a corporate entrepreneurship strategy in state-owned enterprises," *J. Bus. Res.*, vol. 146, pp. 375–384, Jul. 2022, doi: [10.1016/j.jbusres.2022.03.084](#).
- [15] W. Zheng, K. Singh, and W. Mitchell, "Buffering and enabling: The impact of interlocking political ties on firm survival and sales growth," *Strategic Manage. J.*, vol. 36, no. 11, pp. 1615–1636, Nov. 2015, doi: [10.1002/smj.2301](#).
- [16] J. Pfeffer and G. Salancik, *The External Control of Organizations: A Resource Dependence Perspective*. New York, NY, USA: Harper & Row, 1978.
- [17] J. Horbach, "Determinants of environmental innovation—New evidence from German panel data sources," *Res. Policy*, vol. 37, no. 1, pp. 163–173, Feb. 2008, doi: [10.1016/j.respol.2007.08.006](#).
- [18] I. Henriques and P. Sadosky, "The determinants of an environmentally responsive firm: An empirical approach," *J. Environ. Econ. Manage.*, vol. 30, no. 3, pp. 381–395, May 1996, doi: [10.1006/jeem.1996.0026](#).
- [19] M. Zhang, Y. Qi, Z. Wang, X. Zhao, and K. S. Pawar, "Effects of business and political ties on product innovation performance: Evidence from China and India," *Technovation*, vol. 80–81, pp. 30–39, Feb. 2019, doi: [10.1016/j.technovation.2018.12.002](#).
- [20] N. L. Díaz-Díaz, F. J. López-Iturriaga, and D. J. Santana-Martín, "The role of political ties and political uncertainty in corporate innovation," *Long Range Plan.*, vol. 55, no. 1, Feb. 2022, Art. no. 102111, doi: [10.1016/j.lrp.2021.102111](#).
- [21] L. Cheng, "Estimating the value of political connections in China: Evidence from sudden deaths of politically connected independent directors," *J. Comp. Econ.*, vol. 46, no. 2, pp. 495–514, Jun. 2018, doi: [10.1016/j.jce.2017.10.001](#).
- [22] R. H. Lester, A. Hillman, A. Zardkoohi, and A. A. Cannella, "Former government officials as outside directors: The role of human and social capital," *Acad. Manage. J.*, vol. 51, no. 5, pp. 999–1013, Oct. 2008, doi: [10.5465/amj.2008.34789675](#).
- [23] A. J. Hillman, A. Zardkoohi, and L. Bierman, "Corporate political strategies and firm performance: Indications of firm-specific benefits from personal service in the U.S. government," *Strategic Manage. J.*, vol. 20, no. 1, pp. 67–81, Jan. 1999, doi: [10.1002/\(SICI\)1097-0266\(199901\)20:1<67::AID-SMJ22>3.0.CO;2-T](#).
- [24] Q. Hou, M. Hu, and Y. Yuan, "Corporate innovation and political connections in Chinese listed firms," *Pac.-Basin Finance J.*, vol. 46, pp. 158–176, Dec. 2017, doi: [10.1016/j.pacfin.2017.09.004](#).
- [25] M. Bertrand, F. Kramarz, A. Schoar, and D. Thesmar, "The cost of political connections," *Rev. Finance*, vol. 22, no. 3, pp. 849–876, May 2018, doi: [10.1093/rof/rfy008](#).
- [26] J. Fan, T. Wong, and T. Zhang, "Politically connected CEOs, corporate governance, and Post-IPO performance of China's newly partially privatized firms," *J. Financial Econ.*, vol. 84, no. 2, pp. 330–357, May 2007, doi: [10.1016/j.jfineco.2006.03.008](#).
- [27] W. (Stone) Shi, L. Markóczy, and C. V. Stan, "The continuing importance of political ties in China," *Acad. Manage. Perspectives*, vol. 28, no. 1, pp. 57–75, Feb. 2014, doi: [10.5465/amp.2011.0153](#).
- [28] C. Su and J. E. Littlefield, "Entering Guanxi: A business ethical dilemma in mainland China?," *J. Bus. Ethics*, vol. 33, no. 3, pp. 199–210, 2001, doi: [10.1023/A:1017570803846](#).
- [29] D. L. Deephouse, "Media reputation as a strategic resource: An integration of mass communication and resource-based theories," *J. Manage.*, vol. 26, no. 6, pp. 1091–1112, Dec. 2000, doi: [10.1177/014920630002600602](#).
- [30] M. Morales-Raya, I. Martín-Tapia, and N. Ortiz-de-Mandojana, "To be or to seem: The role of environmental practices in corporate environmental reputation," *Org. Environ.*, vol. 32, no. 3, pp. 309–330, Sep. 2019, doi: [10.1177/1086026617753154](#).
- [31] M. A. Delmas and M. W. Toffel, "Organizational responses to environmental demands: Opening the black box," *Strategic Manage. J.*, vol. 29, no. 10, pp. 1027–1055, Oct. 2008, doi: [10.1002/smj.701](#).
- [32] Y. Mishina, B. J. Dykes, E. S. Block, and T. G. Pollock, "Why 'good' firms do bad things: The effects of high aspirations, high expectations, and prominence on the incidence of corporate illegality," *Acad. Manage. J.*, vol. 53, no. 4, pp. 701–722, Aug. 2010, doi: [10.5465/amj.2010.52814578](#).
- [33] M. E. Brooks, S. Highhouse, S. S. Russell, and D. C. Mohr, "Familiarity, ambivalence, and firm reputation: Is corporate fame a double-edged sword?," *J. Appl. Psychol.*, vol. 88, no. 5, pp. 904–914, 2003, doi: [10.1037/0021-9010.88.5.904](#).
- [34] E. Appelbaum and E. Katz, "Seeking rents by setting rents: The political economy of rent seeking," *Econ. J.*, vol. 97, no. 387, Sep. 1987, Art. no. 685, doi: [10.2307/2232930](#).
- [35] M. C. Suchman, "Managing legitimacy: Strategic and institutional approaches," *Acad. Manage. Rev.*, vol. 20, no. 3, Jul. 1995, Art. no. 571, doi: [10.2307/258788](#).

- [36] J. Zhang, X. Li, H.-G. Fung, and P. Qiao, "Do political connections promote innovation in environmentally polluting enterprises?," *China World Econ.*, vol. 27, no. 3, pp. 76–101, 2019, doi: [10.1111/cwe.12281](#).
- [37] J. Frooman, "Stakeholder influence strategies," *Acad. Manage. Rev.*, vol. 24, no. 2, Apr. 1999, Art. no. 191, doi: [10.2307/259074](#).
- [38] M. Huang, M. Li, and Z. Liao, "Do politically connected CEOs promote Chinese listed industrial firms' green innovation? The mediating role of external governance environments," *J. Cleaner Prod.*, vol. 278, Jan. 2021, Art. no. 123634, doi: [10.1016/j.jclepro.2020.123634](#).
- [39] Y. Deng, Y. Wu, and H. Xu, "Political connections and firm pollution behaviour: An empirical study," *Environ. Resource Econ.*, vol. 75, no. 4, pp. 867–898, Apr. 2020, doi: [10.1007/s10640-020-00410-7](#).
- [40] N. H. Leff, "Economic development through bureaucratic corruption," *Amer. Behav. Sci.*, vol. 8, no. 3, pp. 8–14, Nov. 1964, doi: [10.1177/000276426400800303](#).
- [41] K. K. Xin and J. L. Pearce, "Guanxi: Connections as substitutes for formal institutional support," *Acad. Manage. J.*, vol. 39, no. 6, pp. 1641–1658, Dec. 1996, doi: [10.2307/257072](#).
- [42] S. Sheng, K. Z. Zhou, and J. J. Li, "The effects of business and political ties on firm performance: Evidence from China," *J. Marketing*, vol. 75, no. 1, pp. 1–15, 2011.
- [43] D. Luo, K. C. Chen, and L. Wu, "Political uncertainty and firm risk in China," *Rev. Dev. Finance*, vol. 7, no. 2, pp. 85–94, Dec. 2017, doi: [10.1016/j.rdf.2017.06.001](#).
- [44] A. J. Hillman, "Politicians on the board of directors: Do connections affect the bottom line?," *J. Manage.*, vol. 31, no. 3, pp. 464–481, Jun. 2005, doi: [10.1177/0149206304272187](#).
- [45] P. Bansal and J. L. Clelland, "Talking trash: Legitimacy, impression management, and unsystematic risk in the context of the natural environment," *Acad. Manage. J.*, vol. 47, no. 1, pp. 93–103, Feb. 2004, doi: [10.2307/20159562](#).
- [46] B. E. Ashforth and B. W. Gibbs, "The double-edge of organizational legitimation," *Org. Sci.*, vol. 1, no. 2, pp. 177–194, May 1990, doi: [10.1287/orsc.1.2.177](#).
- [47] E. Alakent and M. Ozer, "Can companies buy legitimacy? Using corporate political strategies to offset negative corporate social responsibility records," *J. Strategy Manage.*, vol. 7, no. 4, pp. 318–336, Nov. 2014, doi: [10.1108/JSMA-04-2013-0028](#).
- [48] T. Wang, T. Zhang, and Z. Shou, "The double-edged sword effect of political ties on performance in emerging markets: The mediation of innovation capability and legitimacy," *Asia Pac. J. Manage.*, vol. 38, no. 3, pp. 1003–1030, Sep. 2021, doi: [10.1007/s10490-019-09686-w](#).
- [49] A. Musacchio, S. G. Lazzarini, and R. V. Aguilera, "New varieties of state capitalism: Strategic and governance implications," *Acad. Manage. Perspectives*, vol. 29, no. 1, pp. 115–131, Feb. 2015, doi: [10.5465/amp.2013.0094](#).
- [50] J. Li, J. Xia, and E. J. Zajac, "On the duality of political and economic stakeholder influence on firm innovation performance: Theory and evidence from Chinese firms," *Strategic Manage. J.*, vol. 39, no. 1, pp. 193–216, Jan. 2018, doi: [10.1002/smj.2697](#).
- [51] F. Lu, Z. Zhu, L. Zhu, and H. Gao, "Political tie hot potato: The contingent effect of China's anti-corruption policy on cash and innovation," *Res. Policy*, vol. 51, no. 4, May 2022, Art. no. 104476, doi: [10.1016/j.respol.2022.104476](#).
- [52] M. Zhao, "Conducting R&D in countries with weak intellectual property rights protection," *Manage. Sci.*, vol. 52, no. 8, pp. 1185–1199, Aug. 2006, doi: [10.1287/mnsc.1060.0516](#).
- [53] S. Chen, Z. Sun, S. Tang, and D. Wu, "Government intervention and investment efficiency: Evidence from China," *J. Corporate Finance*, vol. 17, no. 2, pp. 259–271, Apr. 2011, doi: [10.1016/j.jcorpfin.2010.08.004](#).
- [54] W. Li, A. He, H. Lan, and D. Yiu, "Political connections and corporate diversification in emerging economies: Evidence from China," *Asia Pac. J. Manage.*, vol. 29, no. 3, pp. 799–818, Sep. 2012, doi: [10.1007/s10490-011-9265-5](#).
- [55] A. Shleifer and R. W. Vishny, "Politicians and firms," *Quart. J. Econ.*, vol. 109, no. 4, pp. 995–1025, Nov. 1994, doi: [10.2307/2118354](#).
- [56] H. Li and L.-A. Zhou, "Political turnover and economic performance: The incentive role of personnel control in China," *J. Public Econ.*, vol. 89, no. 9/10, pp. 1743–1762, Sep. 2005, doi: [10.1016/j.jpubeco.2004.06.009](#).
- [57] R. Wang, F. Wijnen, and P. P. M. A. R. Heugens, "Government's green grip: Multifaceted state influence on corporate environmental actions in China," *Strategic Manage. J.*, vol. 39, no. 2, pp. 403–428, Feb. 2018, doi: [10.1002/smj.2714](#).
- [58] M. Bertrand, F. Kramarz, A. Schoar, and D. Thesmar, "Politicians, firms and the political business cycle: Evidence from France," Univ. Chicago, Chicago, IL, USA, *Working Paper*, 2007.
- [59] I. Dinc, "Politicians and banks: Political influences on government-owned banks in emerging markets," *J. Financial Econ.*, vol. 77, no. 2, pp. 453–479, Aug. 2005, doi: [10.1016/j.jfineco.2004.06.011](#).
- [60] C. Jensen and H. Meckling, "Theory of the firm: Managerial behavior, agency costs and ownership structure," *J. Financial Econ.*, vol. 3, no. 4, 1976, Art. no. 56.
- [61] W. Chen, Y. Zhu, Z. He, and Y. Yang, "The effect of local government debt on green innovation: Evidence from Chinese listed companies," *Pac.-Basin Finance J.*, vol. 73, Jun. 2022, Art. no. 101760, doi: [10.1016/j.pacfin.2022.101760](#).
- [62] J. Li, Ed., "China's economic dynamics: A Beijing consensus in the making?," in *Routledge Studies on the Chinese Economy*, vol. 53. Evanston, IL, USA: Routledge, 2014.
- [63] G. Walsh, V.-W. Mitchell, P. R. Jackson, and S. E. Beatty, "Examining the antecedents and consequences of corporate reputation: A customer perspective," *Brit. J. Manage.*, vol. 20, no. 2, pp. 187–203, Jun. 2009, doi: [10.1111/j.1467-8551.2007.00557.x](#).
- [64] D. Masciandaro and M. Quintyn, "Helping hand or grabbing hand?," *North Am. J. Econ. Finance*, vol. 19, no. 2, pp. 153–173, Aug. 2008, doi: [10.1016/j.najef.2008.02.002](#).
- [65] D. Kong, Y. Tao, and Y. Wang, "China's anti-corruption campaign and firm productivity: Evidence from a quasi-natural experiment," *China Econ. Rev.*, vol. 63, Oct. 2020, Art. no. 101535, doi: [10.1016/j.chieco.2020.101535](#).
- [66] D. Lange, P. M. Lee, and Y. Dai, "Organizational reputation: A review," *J. Manage.*, vol. 37, no. 1, pp. 153–184, Jan. 2011, doi: [10.1177/0149206310390963](#).
- [67] J. J. Halebian, M. D. Pfarrer, and J. T. Kiley, "High-reputation firms and their differential acquisition behaviors," *Strategic Manage. J.*, vol. 38, no. 11, pp. 2237–2254, Nov. 2017, doi: [10.1002/smj.2645](#).
- [68] P. Zhou, F. M. Song, and X. Huang, "Environmental regulations and firms' green innovations: Transforming pressure into incentives," *Int. Rev. Financial Anal.*, vol. 86, Mar. 2023, Art. no. 102504, doi: [10.1016/j.irfa.2023.102504](#).
- [69] G. Miotto, C. Del-Castillo-Feito, and A. Blanco-González, "Reputation and legitimacy: Key factors for Higher Education Institutions' sustained competitive advantage," *J. Bus. Res.*, vol. 112, pp. 342–353, May 2020, doi: [10.1016/j.jbusres.2019.11.076](#).
- [70] D. L. Deephouse and S. M. Carter, "An examination of differences between organizational legitimacy and organizational reputation," *J. Manage. Stud.*, vol. 42, no. 2, pp. 329–360, Mar. 2005, doi: [10.1111/j.1467-6486.2005.00499.x](#).
- [71] C. Marquis, J. Zhang, and Y. Zhou, "Regulatory uncertainty and corporate responses to environmental protection in China," *California Manage. Rev.*, vol. 54, no. 1, pp. 39–63, Oct. 2011, doi: [10.1525/cmr.2011.54.1.39](#).
- [72] J. Wei, Z. Ouyang, and H. Chen, "Well known or well liked? The effects of corporate reputation on firm value at the onset of a corporate crisis," *Strategic Manage. J.*, vol. 38, no. 10, pp. 2103–2120, 2017.
- [73] V. P. Rindova, I. O. Williamson, A. P. Petkova, and J. M. Sever, "Being good or being known: An empirical examination of the dimensions, antecedents, and consequences of organizational reputation," *Acad. Manage. J.*, vol. 48, no. 6, pp. 1033–1049, Dec. 2005, doi: [10.5465/amj.2005.19573108](#).
- [74] H. Lin, S. Zeng, L. Wang, H. Zou, and H. Ma, "How does environmental irresponsibility impair corporate reputation? A multi-method investigation: How does environmental irresponsibility impair corporate reputation?," *Corporate Social Responsibility Environ. Manage.*, vol. 23, no. 6, pp. 413–423, Nov. 2016, doi: [10.1002/csr.1387](#).
- [75] A. Marland and B. DeCillia, "Reputation and brand management by political parties: Party vetting of election candidates in Canada," *J. Non-profit Public Sector Marketing*, vol. 32, no. 4, pp. 342–363, Aug. 2020, doi: [10.1080/10495142.2020.1798857](#).
- [76] R. M. Dangelico and D. Pujari, "Mainstreaming green product innovation: Why and how companies integrate environmental sustainability," *J. Bus. Ethics*, vol. 95, no. 3, pp. 471–486, Sep. 2010, doi: [10.1007/s10551-010-0434-0](#).
- [77] M. D. Pfarrer, T. G. Pollock, and V. P. Rindova, "A tale of two assets: The effects of firm reputation and celebrity on earnings surprises and investors' reactions," *Acad. Manage. J.*, vol. 53, no. 5, pp. 1131–1152, Oct. 2010, doi: [10.5465/amj.2010.54533222](#).
- [78] G. J. Stigler, "Information in the labor market," *J. Political Economy*, vol. 70, no. 5, pp. 94–105, Oct. 1962, doi: [10.1086/258727](#).

- [79] C. Chen, Y. Li, D. Luo, and T. Zhang, "Helping hands or grabbing hands? An analysis of political connections and firm value," *J. Bank. Finance*, vol. 80, pp. 71–89, Jul. 2017, doi: [10.1016/j.jbankfin.2017.03.015](https://doi.org/10.1016/j.jbankfin.2017.03.015).
- [80] S. Zheng, M. E. Kahn, W. Sun, and D. Luo, "Incentives for China's urban mayors to mitigate pollution externalities: The role of the central government and public environmentalism," *Regional Sci. Urban Econ.*, vol. 47, pp. 61–71, Jul. 2014, doi: [10.1016/j.regsciurbeco.2013.09.003](https://doi.org/10.1016/j.regsciurbeco.2013.09.003).
- [81] H. Ding, Y. Hu, K. A. Kim, and M. Xie, "Relationship-based debt financing of Chinese private sector firms: The role of social connections to banks versus political connections," *J. Corporate Finance*, vol. 78, Feb. 2023, Art. no. 102335, doi: [10.1016/j.jcorpfin.2022.102335](https://doi.org/10.1016/j.jcorpfin.2022.102335).
- [82] L. Xia, Z. Li, J. Wei, and S. Gao, "Doing well by doing good: Unpacking the black box of corporate social responsibility," *Asia Pac. J. Manage.*, 2023, doi: [10.1007/s10490-023-09878-5](https://doi.org/10.1007/s10490-023-09878-5).
- [83] X. Yu, Y. Yao, H. Zheng, and L. Zhang, "The role of political connection on overinvestment of Chinese energy firms," *Energy Econ.*, vol. 85, Jan. 2020, Art. no. 104516, doi: [10.1016/j.eneco.2019.104516](https://doi.org/10.1016/j.eneco.2019.104516).
- [84] W. Chen, "Digital economy development, corporate social responsibility and low-carbon innovation," *Corporate Social Responsibility Environ. Manage.*, vol. 30, pp. 1664–1679, Jan. 2023, doi: [10.1002/csr.2443](https://doi.org/10.1002/csr.2443).
- [85] L. Xia, S. Gao, Q. Shao, J. Wei, and Z. Li, "Board interlock networks and corporate low-carbon innovation in China: Does position matter?," *IEEE Trans. Eng. Manage.*, to be published, doi: [10.1109/TEM.2023.3276999](https://doi.org/10.1109/TEM.2023.3276999).
- [86] S. Liu, J. Du, W. Zhang, X. Tian, and G. Kou, "Innovation quantity or quality? The role of political connections," *Emerg. Markets Rev.*, vol. 48, Sep. 2021, Art. no. 100819, doi: [10.1016/j.ememar.2021.100819](https://doi.org/10.1016/j.ememar.2021.100819).
- [87] Y. Xiang, M. Jia, and Z. Zhang, "Hiding in the crowd: Government dependence on firms, management costs of political legitimacy, and modest imitation," *J. Bus. Ethics*, vol. 176, no. 4, pp. 629–646, Apr. 2022, doi: [10.1007/s10551-020-04709-9](https://doi.org/10.1007/s10551-020-04709-9).
- [88] Z. Su, Z. Xiao, and L. Yu, "Do political connections enhance or impede corporate innovation?," *Int. Rev. Econ. Finance*, vol. 63, pp. 94–110, Sep. 2019, doi: [10.1016/j.iref.2018.08.012](https://doi.org/10.1016/j.iref.2018.08.012).
- [89] Y. Zhang and Z. Ouyang, "Doing well by doing good: How corporate environmental responsibility influences corporate financial performance," *Corporate Social Responsibility Environ. Manage.*, vol. 28, no. 1, pp. 54–63, 2021, doi: [10.1002/csr.2031](https://doi.org/10.1002/csr.2031).
- [90] W. H. Greene, *Econometric Analysis*, 5th ed. Englewood Cliffs, NJ, USA: Prentice-Hall, 2003.
- [91] S. Gao, R. Qiao, M. K. Lim, C. Li, Y. Qu, and L. Xia, "Integrating corporate website information into qualitative assessment for benchmarking green supply chain management practices for the chemical industry," *J. Cleaner Prod.*, vol. 311, Aug. 2021, Art. no. 127590, doi: [10.1016/j.jclepro.2021.127590](https://doi.org/10.1016/j.jclepro.2021.127590).
- [92] B. H. Baltagi, "Econometric analysis of panel data, sixth edition," in *Springer Texts in Business and Economics*. Cham, Berlin: Springer, 2021, doi: [10.1007/978-3-030-53953-5](https://doi.org/10.1007/978-3-030-53953-5).
- [93] C. Hsiao, *Analysis of Panel Data*, 3rd ed. Cambridge, U.K.: Cambridge Univ. Press, 2014, doi: [10.1017/CBO9781139839327](https://doi.org/10.1017/CBO9781139839327).
- [94] J. M. Wooldridge, *Econometric Analysis of Cross Section and Panel Data*, 2nd ed. Cambridge, MA, USA: MIT Press, 2010.
- [95] R. F. J. Haans, C. Pieters, and Z.-L. He, "Thinking about U: Theorizing and testing U- and inverted U-shaped relationships in strategy research: Theorizing and testing U-shaped relationships," *Strategic Manage. J.*, vol. 37, no. 7, pp. 1177–1195, Jul. 2016, doi: [10.1002/smj.2399](https://doi.org/10.1002/smj.2399).
- [96] J. F. Dawson, "Moderation in management research: What, why, when, and how," *J. Bus. Psychol.*, vol. 29, no. 1, pp. 1–19, Mar. 2014, doi: [10.1007/s10869-013-9308-7](https://doi.org/10.1007/s10869-013-9308-7).
- [97] N. Boubakri, J.-C. Cosset, and W. Saffar, "The role of state and foreign owners in corporate risk-taking: Evidence from privatization," *J. Financial Econ.*, vol. 108, no. 3, pp. 641–658, Jun. 2013, doi: [10.1016/j.jfineco.2012.12.007](https://doi.org/10.1016/j.jfineco.2012.12.007).
- [98] N. Boubakri, J.-C. Cosset, and W. Saffar, "Political connections of newly privatized firms," *J. Corporate Finance*, vol. 14, no. 5, pp. 654–673, Dec. 2008, doi: [10.1016/j.jcorpfin.2008.08.003](https://doi.org/10.1016/j.jcorpfin.2008.08.003).
- [99] P. G. Fredriksson and D. L. Millimet, "Strategic interaction and the determination of environmental policy across U.S. States," *J. Urban Econ.*, vol. 51, pp. 101–122, 2002, doi: [10.1006/juec.2001.2239](https://doi.org/10.1006/juec.2001.2239).
- [100] Y. Cao and J. You, "The contribution of environmental regulation to technological innovation and quality competitiveness: An empirical study based on Chinese manufacturing enterprises," *Chin. Manage. Stud.*, vol. 11, no. 1, pp. 51–71, Apr. 2017, doi: [10.1108/CMS-12-2016-0252](https://doi.org/10.1108/CMS-12-2016-0252).
- [101] J. Wu, "Asymmetric roles of business ties and political ties in product innovation," *J. Bus. Res.*, vol. 64, no. 11, pp. 1151–1156, Nov. 2011, doi: [10.1016/j.jbusres.2011.06.014](https://doi.org/10.1016/j.jbusres.2011.06.014).
- [102] Y.-L. Cheung, P. R. Rau, and A. Stouraitis, "Helping hand or grabbing hand? Central vs. local government shareholders in Chinese listed firms," *Rev. Finance*, vol. 14, no. 4, pp. 669–694, Oct. 2010, doi: [10.1093/rof/rfp024](https://doi.org/10.1093/rof/rfp024).
- [103] K. S. Bawa et al., "China, India, and the environment," *Science*, vol. 327, no. 5972, pp. 1457–1459, Mar. 2010, doi: [10.1126/science.1185164](https://doi.org/10.1126/science.1185164).
- [104] M. Shahzad, Y. Qu, A. U. Zafar, S. U. Rehman, and T. Islam, "Exploring the influence of knowledge management process on corporate sustainable performance through green innovation," *J. Knowl. Manage.*, vol. 24, no. 9, pp. 2079–2106, Nov. 2020, doi: [10.1108/JKM-11-2019-0624](https://doi.org/10.1108/JKM-11-2019-0624).
- [105] M. Balzano, "Serendipity in management studies: A literature review and future research directions," *Manage. Decis.*, vol. 60, no. 13, pp. 130–152, Dec. 2022, doi: [10.1108/MD-02-2022-0245](https://doi.org/10.1108/MD-02-2022-0245).



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