UNPACKING THE INFLUENCE OF MAJOR CITIES ON CORPORATE ENVIRONMENTAL PERFORMANCE IN CHINA: A PERSPECTIVE OF SPATIAL KNOWLEDGE SPILLOVER

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Abstract. As one of the most concerned topics in environmental and ecological research, the environmental performance of firms is extensively studied while little notices the relationship between firms' geo-location and major cities. Focusing on the spatial agglomerations of corporate environmental performance (CEP) surrounding major cities in China, we examine the research question of "How could major cities affect firms' environmental performances". We propose that major cities affect CEP through knowledge spillover, while the strength of influences depends on firms' spatial proximity to the central area of major cities. Besides, we argue that CEP knowledge spillover principally consists of knowledge transfer and knowledge conversion, the two modes via which CEP knowledge spills over. Based on a sample of 193 Chinese firms, we find that Firms in spatial proximity to major cities centers could obtain more knowledge transfer and conversion on CEP, and thereby improving their environmental performance. Finally, we discuss the research findings, limitations, and future research directions.

Keywords: *spatial proximity, major cities, corporate environmental performance, knowledge spillover, knowledge transfer, knowledge conversion*

Introduction

With the rapid development of China's economy, environmental and ecological issues constantly snowball and draw attention. As one of the most influential economic entities, firms significantly affect the environment and ecology while their environmental performance gradually turns into a crucial concern in theory and practice. In recent years, while overall corporate environmental performance (CEP) has improved in many countries, the distributions show obvious spatial imbalances, such as the prominent CEP agglomeration around major cities. For example, in the United States, firms closer to New York and Chicago are significantly more active in environmental performance, while those in other locations are relatively mediocre (Husted et al., 2016). Extant wisdom shows that major cities could significantly impact corporate environmental performance in both form and content while the impact is tightly related to firms' spatial closeness to major cities (Marquis and Tilcsik, 2016). However, how do firms' spatial proximities to major cities affect their environmental performances? Extant literature lacks a unified and detailed explanation (Marquis and Battilana, 2009; Husted et al., 2012). Thus, correctly clarifying the influence of major cities on CEP and identifying the potential factors that explains the effect of geo-location on firms' environmental performance have become the primary concern.

In extant literature, most scholars have studied the mechanisms between firms' spatial proximity to major cities and CEP from the institutional perspective. Based on the neo-institutional theory, researchers suggest that institution is the key reason that a firm's geo-location affects its environmental performance (DeBoer et al., 2017). Similar to industry-related organizational fields (DiMaggio and Powell, 1983), space-related stakeholders could form geographic fields. To obtain legitimization positions in local fields, companies conduct and adjust environmental strategies to meet the legitimacy demands of local stakeholders (Marquis et al., 2007; Hoi et al., 2018). Since the legitimacy requirements in geographic fields are often different, firms' environmental performance vary by locations (Attig and Brockman, 2017; Marquis et al., 2013). In the meantime, related literature suggests that geo-location could influence a firm's organizational practices through efficiency mechanisms, not only in innovation but also in many other organizational practices, including internationalization (Lejpras, 2015), competitive strategy choice (Liarde and Forgues, 2008), legislation resistance behaviors (Simons et al., 2016), stock backdating (Audia and Yao, 2017), and so forth. In such cases, some scholars focus on the efficiency perspective and seek for other theoretical explanations that could bridge proximity to major cities and CEP.

Despite the prevalence of institutional perspective, a few scholars argue that local resources also matter in the influence of geo-location on firms' environmental performances. They propose that firms' geo-locations determine the local resources that are necessary for organizational practices, such as local labor, news media, and information (Sorenson and Baum, 2003). Among those local resources, knowledge resource is of particular importance to corporate environmental performance. Through knowledge spillover, CEP knowledge could significantly promote firms' environment-friendly actions. For instance, Nyuur argues that knowledge spillover from FDI could increase domestic firms' uptake of environment-protection activities (Nyuur et al., 2016). Ning and Wang propose that environmental knowledge spillover could improve local firms' environmental performances (Ning and Wang, 2018). Although a few scholars have noticed the influence of knowledge spillover on CEP, the corresponding research is quite limited, leaving critical issues unanswered. Specifically, how proximity to major cities influence corporate environmental performance through knowledge spillover.

To address the gap mentioned, this study integrates stakeholder theory and knowledge spillover theory to study the mediating role of knowledge spillover between firms' spatial proximity to major cities and environmental performance. We initially analyze the dimension of CEP knowledge spillovers and identify two modes - knowledge transfer and knowledge conversion- via which CEP knowledge spills over. Then we construct the theoretical model that consists of the "spatial proximity-knowledge transfer-CEP" path and the "spatial proximity-knowledge conversion-CEP" path. We hypothesize that knowledge transfer and knowledge conversion are the two potential mediating roles between proximity to major cities and CEP. Furthermore, we empirically test the research hypotheses. Finally, we discuss research findings, limitations, and future research directions.

Materials and methods

Study area

The study area includes multiple major cities from different regions in China mainland, including eastern coastal regions and western inland regions. *Figure 1* shows the location

of the study area, the gray area represents the administrative boundary of China mainland, the blue labeled area represents the cities that our sample firms located in.

Those cities typically inhabit more population and other stakeholders, which derives the influence in social, economic, cultural, and political aspects, on the national or regional scale. For instance, Beijing (21.54 million), Shanghai (24.24 million), Guangzhou (14.9 million), and Shenzhen (13.03 million) are the top four cities in China, while Nanjing (8.44 million), Hangzhou (9.81 million), Xining (2.37 million), Hefei (8.09 million), and Zhengzhou (10.13 million) are provincial capital (population in the brackets).

Figure 1. Location of study area

Theories and hypotheses

CEP knowledge spillover: knowledge transfer and conversion

As an essential concept in economic geography, knowledge spillover is controversial in its definition (Stanko and Olleros, 2013; Yang and Steensma, 2014; Qiu et al., 2017). Relevant literature extensively diverges on various facets in the process that knowledge spills over. For instance, the intentionality of knowledge providers (Fallah and Ibrahim, 2004), the content of knowledge (Lejpras, 2015; Simons et al., 2016; Wang and Wu, 2016), and whether receivers adjust the knowledge they gained (Eapen, 2012; Battke et al., 2016). Despite the above disputes, we follow Ko and Liu that define knowledge spillover as ‘the process that firms receive information, technique, and experience from knowledge providers, and improve the action efficiencies’ (Ko and Liu, 2015).

In early research, knowledge spillover mostly is correlated to the efficiencies of production or innovation (Krugman, 1991; Glaeser et al., 1992; Fukugawa, 2017). However, with the extension of application extent, this concept has been gradually employed in other fields. Knowledge attribute embeds not only in innovation which is knowledge-intensive but also in many other organizational practices, such as

international expansion (Lejpras, 2015), entrepreneurship (Dahl and Sorenson, 2012), and stock backdating (Audia and Yao, 2017), etc. Similarly, CEP practices also require different types and extent of knowledge, which could make CEP practices more cost-efficient, encouraging firms to further engage in CEP (McWilliams and Siegel, 2001). For instance, managers who received ethic knowledge training are more likely to integrate ethics codes into corporate's strategic decisions, because they know how to fulfill environmental performance efficiently and thus be encouraged to do more (Stevens et al., 2005). Similarly, FDI could promote the environmental performance of local firms, since foreign companies could provide local firms CEP knowledge (Nyuur et al., 2016).

How can firms obtain CEP knowledge? Besides the endogenous growth from learning by doing (Arrow, 1962), firms could acquire CEP knowledge from the external as well. While CEP knowledge spillover differs from other knowledge spillovers in terms of knowledge content, they are fundamentally similar in other aspects. Therefore, based on the two modes of knowledge spillover and context-specific trait of CEP (Williams, 2007; Aguinis and Glavas, 2012), we define CEP knowledge spillover as 'the process that firms receive information, technique, and experience that are related to CEP, and thereby improve CEP efficiencies.' Furthermore, we propose that CEP knowledge spillover happens via two modes: knowledge transfer and knowledge conversion.

In CEP knowledge spillover, knowledge receivers acquire knowledge from different providers, such as local or industrial peers, NGOs, academic institutes and even governments (Miles, 2015). In some cases, receivers would find the acquired knowledge fits the CEP practices and can be applied without modification. Based on Fallah's definition of knowledge transfer (Fallah and Ibrahim, 2004), we define this dimension as CEP knowledge transfer. Meanwhile, not all the CEP knowledge spills over via this mode because the external CEP knowledge is often not completely applicable. Since firms' environmental performance is context-specific organizational actions and policies, successful applications of CEP knowledge are often bounded within specific contexts, such as national context (Matten and Moon, 2008; Kim et al., 2013), industrial context (Wanderley et al., 2008; Cordeiro and Tewari, 2015), and organizational context (Aguinis and Glavas, 2012). In this case, the external CEP knowledge should be conversed according to receivers' external environment and internal conditions, which is termed as knowledge conversion.

Spatial proximity, major cities and corporate environmental performance

Recent studies have discovered the influence of major cities on CEP. Drawing on the neo-institutional theory, scholars argue that major cities could form geo-institutional communities, which exert institutional pressures on firms and drive them to engage in CEP (Ning and Wang, 2018). The primary logic is, the three pillars of institutional pressures-regulatory pressure, normative pressure, and cognitive pressure originates from the different type of stakeholders, which intensively resident in major cities. In the meantime, compared with the peripheral areas, the central areas of major cities inhabit much more stakeholders, including residents, universities, local communities, and NGOs, and so forth.

Besides residents, the other stakeholders also tend to locate concentrated in the central areas of major cities (Taylor, 2005). While the major cities' influence on CEP majorly results from those stakeholders, the influence would be stronger in those areas

populated with more stakeholders. Therefore, compared with the peripheral areas, the central areas of major cities are more likely to function as the influences sources and affect firms' environmental performances. Meanwhile, the influences from stakeholders in major cities centers could transmit across geographic distance via face-to-face interactions (Sorper and Venables, 2004), which means the remote firms could also be affected by major cities centers and engage in CEP. However, the influence would decay with distance due to the economic and time cost of interactions, which means firms close to the major cities centers would be influenced more and thereby engage in CEP more. The following hypotheses are therefore proposed:

Hypothesis 1: Firms in spatial proximity to major cities centers engage in CEP more than their more remote counterparts.

Proximity to major cities centers and knowledge spillover

According to Boschma (2005), geographic proximity is “the spatial or physical distance between economic actors”. In this study, spatial proximity to major cities centers refers to “the spatial distance between the focal firm and the central area of the nearest major city”. Urban economists argue that knowledge spillover happens more intensively in major cities, no matter inter- or intra- industries (Jacobs, 1969; Carlino et al., 2007). In the meantime, we argue that knowledge spillover happens more intensively in the central areas of major cities than the peripheral areas, which would be further explained in the following.

In economic geography, knowledge is an important resource that could boost firms' efficiencies, which is arduous to transport (Krugman, 1991). Stakeholders in the major cities centers could be viewed as CEP knowledge reserve, from which firms could acquire CEP knowledge by interacting (Porter and Kramer, 2011). Through direct or indirect, pro-active or passive interactions, companies can obtain CEP knowledge from nearby non-peer stakeholders (Miles et al., 2006). *Figure 2* is created by utilizing diagramming software Visio 2016, as the figure shows, local peers are also an important source to obtain CEP knowledge via inter-firm knowledge spillover (Appleyard, 1996). Comparing to those remote peers, nearby firms are more convenient to contact, while the CEP knowledge from them is regarded as more legitimate and proper (Haveman, 1993). For those knowledge receivers, CEP knowledge would be beneficial to the CEP practices by bettering the cost-efficiencies. Therefore, because of knowledge spillovers from local stakeholders, a firms' geo-location could influence its accessible CEP knowledge and thereby the cost-efficiency of CEP practices.

Figure 2. *The model of major cities centers' influence on knowledge spillover*

Although CEP knowledge flows from major cities centers toward nearby firms, its spatial-bounded trait limits the long-distance transmission (Boschma, 2005), which means effective knowledge spillover only happen within a limited geographic extent. Although IT technologies could help explicit knowledge flows beyond geographic limits, face-to-face interaction is still an important channel for knowledge spillovers, especially tacit knowledge (Storper, 2004). Besides, the interpretation and absorption of explicit knowledge might still need implicit knowledge (Howells, 2002). Hence, the spillover of codified CEP knowledge could also be spatial-bounded. In this case, the spatial closeness between knowledge receiver and provider would be a must for effective CEP knowledge spillover, no matter knowledge transfer or knowledge conversion. The following hypotheses are therefore proposed:

Hypothesis 2a: Firms in spatial proximity to major cities centers obtain more knowledge transfer on CEP than their more remote counterparts.

Hypothesis 2b: Firms in spatial proximity to major cities centers obtain more knowledge conversion on CEP than their more remote counterparts.

Knowledge spillover and corporate environmental performance

Despite the disputes of available conceptualizations, we avoid confusion by following Aguinis and Trumpp (Aguinis and Glavas, 2012; Trumpp et al., 2015), and define CEP as “context-specific organizational actions and policies that take into account stakeholders’ expectations in environmental performance”. In the past decades, due to the limited role of knowledge in CEP practices, studies about knowledge spillovers and CEP were carried out independently, and few scholars noticed the connections. With the evolution of CEP in theory and practice, the importance of knowledge on firms’ environmental performance gradually draws attention.

As a significant channel that knowledge spills over, training programs can deepen the financial supervisors’ understanding of ethical regulations, who thereafter consider more environment-friendly action in decision-making. Stevens finds that financial executives who received relevant training are more inclined to integrate ethic codes into strategic activities because they know how to do so effectively (Stevens et al., 2005). The dialogue between firms and stakeholders contribute to the flow of tacit knowledge and help firms make better decisions about CEP (Miles et al., 2006). When other conditions remain unchanged, obtaining knowledge makes CEP practices more cost-efficient, and firms that receive CEP knowledge will be more environment-friendly (Stevens et al., 2005). For instance, FDI could promote local firms in host countries to engage in CEP more. In most developing countries, because of more knowledge and experience in CEP foreign companies function as important CEP knowledge sources for domestic companies (Nyuur et al., 2016). During communication with foreign peers, local domestic firms could acquire CEP knowledge as well as technological knowledge.

Knowledge spillover enables firms to acquire knowledge, increasing cost-efficiency in the same practice. Similarly, CEP knowledge can guide firms to know how to effectively perform CEP, encouraging firms to further engage in CEP activities (McWilliams and Siegel, 2001). Driven by different motives such as organizational interest, institutional pressure or managerial preference, firms would increase the CEP engagements to a certain extent. However, the influences of these drivers are usually limited. Similar to the other organizational practice such as internationalization, the

decreasing marginal profits restrict firms to participate in CEP unconditionally but stay at a certain cost-benefit equilibrium point (Kim et al., 2015). For firms that gain operational efficiency from CEP knowledge spillover, the CEP capabilities are further enhanced, enabling those firms to reduce the cost or improve the revenue when performing environment-friendly actions. Those firms could break the initial equilibrium point and further participate in CEP until reaching the new equilibrium point. In this process, no matter knowledge transfer or knowledge conversion, CEP knowledge spillover always follow the “knowledge-efficiency-action” path, providing firms with CEP knowledge to enhance the CEP efficiencies, and further promotes firms to engage in CEP activities. The following hypotheses are therefore proposed:

Hypothesis 3a: Obtaining knowledge transfer on CEP promotes firms’ CEP engagements.

Hypothesis 3b: Obtaining knowledge conversion on CEP promotes firms’ CEP engagements.

The mediating role of knowledge spillover

The recent study shows that proximity to major cities should promote firms to engage in CEP more (Husted et al., 2012, 2016). The arguments overwhelmingly derive from the belief that various stakeholders in major cities centers could exert institutional pressures on nearby firms, driving them to improve environmental performance and obtain legitimacy in local communities (Marquis and Tilcsik, 2016; Marquis et al., 2007; Attig and Brockman, 2017). Meanwhile, some scholars argue that the influence of major cities centers on firms’ practices is usually comprehensive, including not only legitimacy mechanism of institutional pressures but also efficiency mechanism of knowledge spillover (Jacobs, 1969; Carlino, 2001). On this basis, we argue that legitimacy mechanism maybe not the unique channel that links major cities to CEP. One alternative is that proximity to major cities may influence CEP through the efficiency mechanism that typically derives from knowledge spillover.

Based on knowledge spillover theory, we argue that firms close to major cities could benefit from local knowledge reserve via knowledge spillover, which enhances the efficiency of environmental actions and encourages firms to engage in CEP more (Lejpras, 2015; Audia and Yao, 2017). During the process of CEP knowledge spillover, firms could obtain CEP knowledge through knowledge transfer or knowledge conversion from the local knowledge reserve embedded in major cities. Knowledge transfer offers firms proper CEP knowledge that could be applied directly, and knowledge conversion offers firms partially proper CEP knowledge that is applicable after adaptation. Because of knowledge transfer and knowledge conversion, firms close to major cities could access CEP knowledge spillover more, and thus more actively engage in CEP. Furthermore, whether knowledge transfer and knowledge conversion mediate the relationship between proximity to major cities and CEP warrants an empirical test. The following hypotheses are therefore proposed:

Hypothesis 4a: Firms in spatial proximity to major cities centers obtain more knowledge transfer on CEP than their more remote counterparts, and thereby engage in CEP more.

Hypothesis 4b: Firms in spatial proximity to major cities centers obtain more knowledge conversion on CEP than their more remote counterparts, and thereby engage in CEP more.

Research design

Sample and procedures

In this research, we collect data primarily through a questionnaire survey. A total of 474 questionnaires are distributed with 278 returned, which means a 58.65% response rate. After discarding questionnaires that contain missing information, 193 questionnaires are usable. To ensure the diversity and reliability of our sample, in our survey three principles are followed.

First, we manage to ensure the diversity of firms' regions and industries. This study examines the connection between major cities and corporate environmental performance from a spatial proximity perspective, hence the dispersion of geography and industry is particularly important. Considering the actual influence radius of major cities centers, in this study we only distribute questionnaires to those firms located in the administrative areas of major cities. The research samples include major cities in the eastern coastal areas such as Beijing, Shanghai, Nanjing, Hangzhou, Guangzhou, Shenzhen, and those in the inland provinces such as Xining, Hefei, and Zhengzhou. In terms of industry distribution, the research samples' industry includes manufacturing (51.30%), financial (8.80%), real estate (12.95%) and others (26.94%).

Second, we manage to ensure the diversity of firms' age and size. Extant literature suggests that a firm's age, size, and ownership could significantly affect its environmental performance [238, 261]. Therefore, we pay particular attention to those corporate characteristics in sample selection. Based on the survey results, the research sample of this study has good representativeness in terms of age, scale, and ownership, including 22.80% for less than eight years, 45.60% for 8 to 15 years, and 31.6% for 15 years or more. In terms of firm size, 100 or less accounted for 31.61%, 101 to 500 people accounted for 26.94%, 501 to 1000 people accounted for 10.88%, and more than 1,000 people accounted for 30.57%.

Third, to ensure the reliability of data acquired, we invite senior executives and key management personnel to fill out the questionnaire to obtain comprehensive and accurate survey results. We distribute questionnaires through channels including social networks, economic development zone management committees, and college MBA centers to ensure the participation of senior managers or CEP-related managers.

Measures

Except for the "proximity to major cities" variable, all other variables were measured by multi-item scales with a five-point Likert scale (1 = strongly disagree, 5 = strongly agree).

Spatial proximity to major cities. We utilize the instrumental variable "driving distance" to measure "spatial proximity to major cities". The calculation involves two coordinate points, including the coordinates of the target enterprise and the coordinates of the center point of the nearest major city. Following DeBoer, this study utilizes Google Map software to calculate the driving distance between target firm and the central point of the major city, the driving distance could reflect the accessibility and convenience of communication between socio-economic entities (Husted et al., 2016; DeBoer et al., 2017). Based on the operational definition from Mahafzaa (Mahafza et al., 2017), we adopt the logarithm of the driving distance between the firm's location and the city center point as the measurement of proximity to major cities. Also, in case

that the target firm's distance to the central point is less than 1 km, we increase all the measured distance by 1 km before taking the logarithm (Broekel and Boschma, 2011).

Knowledge transfer. Knowledge transfer is measured by adopting a four-item scale developed by modifying the relevant scale and theoretical arguments (Ko and Liu, 2015; Tho and Trang, 2015). Sample items include: "Our company obtains entirely suitable CEP knowledge from local peers, governments, NGOs or academic institutions", and "Our company improves the efficiency of CEP practices by directly applying acquired CEP knowledge". The Cronbach's α is 0.899.

Knowledge conversion. Knowledge conversion is measured by adopting a four-item scale developed by modifying the relevant scale and theoretical arguments (Williams, 2007; Islam et al., 2017). Sample items include: "Our company obtains entirely suitable CEP knowledge from local peers, governments, NGOs or academic institutions", and "Our company improves the efficiency of CEP practices by adjusting or improving acquired CEP knowledge". The Cronbach's α is 0.926.

Corporate environmental performance. Corporate environmental performance is measured by a 4-item scale developed by modifying extant scales to fit our research context and purpose (Turker, 2009; Moneva and Ortas, 2010). Sample items include: "Our company participates in activities which aim to protect and improve the quality of the natural environment", "Our company implements special programs to minimize its negative impact on the natural environment", "Our company conducts environmental training of employees", and "Our company supports environmental NGOs working in problematic areas". The Cronbach's α is 0.876.

Control variables. Due to the potential effects of firm demographics (e.g., firm size, age, region, and industry) on corporate environmental performance (Brik et al., 2011; Wu et al., 2015), we control for firm size, firm age, firm industrial type, and firm region type. We collect the data of control variables through a questionnaire survey, firm size (employee number, 1 = less than 100, 2 = 101 – 500, 3 = 501 – 1000, 4 = more than 1000), firm age (establishment years, 1 = 1 – 7, 2 = 8 – 15, 3 = more than 15), and firm industry (1 = manufacture, 2 = finance, 3 = real estate, 0 = others) are represented by category variables, while a dummy variable represents firm region (1 = coastal cities, 0 = non-coastal cities).

Methods and models

To examine hypothesis 1 and 2, this study utilizes the following regression model 1 (Eq. 1), model 2 (Eq. 2), and model 3 (Eq. 3). Symbol i represents each firm, CEP represents the dependent variable corporate environmental performance, $Distance$ represents the independent variable spatial proximity to major cities centers, $Transfer$ represents the mediator knowledge transfer, and $Conversion$ represents the mediator knowledge conversion. $Controls$ represents the control variables, including firm size, firm age, firm region, and firm industry. ε represents random error terms. β represents parameters to be estimated.

$$CEP_i = \beta_0 + \beta_1 Distance_i + \beta_2 Controls_i + \varepsilon_i, \quad (Eq.1)$$

$$Transfer_i = \beta'_0 + \beta'_1 Distance_i + \beta'_2 Controls_i + \varepsilon_i, \quad (Eq.2)$$

$$Conversion_i = \beta''_0 + \beta''_1 Distance_i + \beta''_2 Controls_i + \varepsilon_i, \quad (Eq.3)$$

To examine hypothesis 3 about the relationship between knowledge spillover (knowledge transfer and conversion) and CEP, we construct model 4 (Eq. 4) and model 5 (Eq. 5), meanwhile, we integrate the above models and construct the regressions model 6 (Eq. 6) and model 7 (Eq. 7) to further examine the mediating effects of knowledge transfer and knowledge conversion.

$$CEP_i = \beta_0''' + \beta_1''' Transfer_i + \beta_2''' Controls_i + \varepsilon_i, \quad (Eq.4)$$

$$CEP_i = \beta_0'''' + \beta_1'''' Conversion_i + \beta_2'''' Controls_i + \varepsilon_i, \quad (Eq.5)$$

$$CEP_i = \beta_0''''' + \beta_1''''' Transfer_i + \beta_2''''' Distance_i + \beta_3''''' Controls_i + \varepsilon_i, \quad (Eq.6)$$

$$CEP_i = \beta_0'''''' + \beta_1'''''' Conversion_i + \beta_2'''''' Distance_i + \beta_3'''''' Controls_i + \varepsilon_i, \quad (Eq.7)$$

Results

Descriptive statistics

Table 1 presents the means, standard deviations, and correlations of all critical variables. As shown in the table, proximity to the major city significantly correlates with knowledge transfer ($r = -.469$, $p < .01$), knowledge conversion ($r = -.606$, $p < .01$) and CEP ($r = -.700$, $p < .01$). Besides, both knowledge transfer ($r = .428$, $p < .01$) and knowledge conversion ($r = .544$, $p < .01$) are positively associated with CEP. The above results provide primary support to our hypotheses.

Table 1. Means, standard deviations, and correlations

Variable	1	2	3	4	5	6	7	8
1. Distance	1							
2. Transfer	-.469**	1						
3. Conversion	-.606**	.419**	1					
4. CEP	-.700**	.428**	.544**	1				
5. Firm size	-.485**	.195**	.243**	.365**	1			
6. Firm age	-.533**	.347**	.385**	.437**	.250**	1		
7. Industry	-.032	.018	.019	.026	-.128	.104	1	
8. Region	-.041	.109	.059	.056	-.027	-.004	-.022	1
Mean	3.642	2.763	3.505	2.404	2.088	1.078	.777	.780
S.D.	.819	.913	.725	1.222	.734	.935	.417	.415

N = 193; **p < .01; *p < .05 (two-tailed)

Confirmatory factor analyses

We first examined a four-factor model, in which distance, knowledge transfer, knowledge conversion, and corporate environmental performance are included. Following suggestions by Hair (Wu et al., 2015; Hair et al., 2006), we utilize the overall model's Chi-square, the comparative fit index (CFI), the Tucker-Lewis Index (TLI), and the root mean square error of approximation (RMSEA) to assess the model fit. A cutoff value closes to or above .90 for CFI and TLI, and a cutoff value below .08 for RMSEA

indicate a relatively acceptable fit between the proposed model and the observed data. Our theoretical model consists of two mediating structures, including SP→KT→CEP path and SP→KC→CEP path, and the results suggest that our model fits the data well ($\chi^2 / df = 1.468 < 3$; RMSEA = 0.049 < 0.08; CFI = 0.978 > 0.9; TLI = 0.983 > 0.9). Besides, all the factor loadings were significant, providing evidence for convergent validity.

Hypotheses testing

In the above, we raise hypotheses to predict that knowledge transfer mediates the relationship between spatial proximity to major cities centers (measured by instrumental variable distance) and corporate environmental performance. We conduct hierarchical multiple regression analysis to test those hypotheses by entering the control variables, the independent variable (distance), and mediator variable (knowledge transfer) on separate steps.

The results in *Table 2* show that (1) distance is negatively related to knowledge transfer ($\beta = -0.409$, $p < 0.01$, model 2), which supports H2a; (2) distance is negatively related to corporate environmental performance ($\beta = -0.632$, $p < 0.01$, model 4), which supports H1; (3) knowledge transfer is positively related to CEP ($\beta = 0.281$, $p < 0.01$, model 5), which supports H3a; and (4) the relationship between distance and corporate environmental performance remains significant ($\beta = -0.584$, $p < 0.01$, model 6) when knowledge transfer presents ($\beta = 0.119$, $p < 0.05$, model 6), which indicates the partial mediation of knowledge transfer and supports H4a.

Table 2. Regression analysis on the mediation of knowledge transfer

	Transfer		Corporate environmental performance			
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Control variables						
Firm size	.118	-.038	.279**	.037	.246**	.042
Firm age	.318**	.141 ⁺	.365**	.091	.276**	.074
Firm industry	.002	-.013	.026	.002	.025	.004
Firm region	.113	.091	.065	.031	.033	.020
Independent var.						
Distance		-.409**		-.632**		-.584**
Mediators						
Transfer					.281**	.119*
R ²	.146	.243	.266	.498	.333	.508
ΔR^2	.146	.097	.266	.232	.067	.011
F	8.017	11.982**	17.000	37.056**	18.665**	32.051**
ΔF	8.017	23.930**	17.000	86.393**	18.863**	4.027*

β , standardized regression weight; + $p < .1$, * $p < .05$, ** $p < .01$

Table 3 shows the results of hierarchical multiple regression analysis on the mediation of knowledge conversion. The results show that (1) distance is negatively related to knowledge conversion ($\beta = -0.590$, $p < 0.01$, model 2), which supports H2b; (2) distance is negatively related to corporate environmental performance ($\beta = -0.632$, $p < 0.01$, model 4), which supports H1; (3) knowledge conversion is positively related

to CEP ($\beta = 0.401$, $p < 0.01$, model 5), which supports H3b; and (4) the relationship between distance and CEP remains significant ($\beta = -0.524$, $p < 0.01$, model 6) when knowledge conversion presents ($\beta = 0.184$, $p < 0.01$, model 6), which supports the mediation of knowledge conversion and H4b.

Table 3. Regression analysis on the mediation of knowledge conversion

	Conversion		Corporate environmental performance			
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Control variables						
Firm size	.159*	-.067	.279**	.037	.215**	.049
Firm age	.345**	.089	.365**	.091	.226**	.074
Firm industry	.005	-.017	.026	.002	.024	.005
Firm region	.062	.033	.065	.031	.039	-.025
Independent var.						
Distance		-.590**		-.632**		-.524**
Mediators						
Conversion					.401**	.184**
R ²	.175	.377	.266	.498	.399	.519
ΔR^2	.175	.202	.266	.232	.133	.021
F	9.984	22.640**	17.000	37.056**	41.330**	33.422**
ΔF	9.984	60.603**	17.000	86.393**	24.783**	8.160**

β , standardized regression weight; + $p < .1$, * $p < .05$, ** $p < .01$

Discussion

As interest in the topic of geo-location and CEP steadily grows (Marquis and Tilcsik, 2016; Attig and Brockman, 2017), the lack of understanding of the influence mechanism of major cities on CEP emerges. Drawn on knowledge spillover theory and stakeholder theory, we seek to unravel the hidden path that links major cities and CEP. Based on empirical tests, the evidence from China supports our proposals, which we would further discuss in the following.

First, we find a strong correlation between proximity to major cities and CEP practices in China ($\beta = -0.743$, $p < .01$), which is consistent with extant research findings that based on U.S. samples (Husted et al., 2016). As a significant geographical element that could shape firms' environmental performances, major cities inhabitant varieties of stakeholders, including firms, residents, NGO, and governments (Marquis et al., 2007). In the meantime, this influence decays with distance, which means nearer firms are affected more. Answering Husted's call (Husted et al., 2016), our study finds that this particular relationship holds across different national contexts, not only in developed economies like the U.S. but also in emerging economies like China.

Second, in the relationship of proximity to major cities and CEP in China, knowledge transfer and knowledge conversion function as essential mediators. As independent channels via which firms acquire CEP knowledge, both of them are negatively correlated with proximity to major cities ($\beta = -0.396$, $p < 0.01$; $\beta = -0.576$, $p < 0.01$), which means firms that are more proximal could acquire more CEP knowledge. Despite the different ways of obtaining knowledge, both knowledge transfer and conversion significantly affect corporate environmental performance ($\beta = 0.303$, $p < 0.01$;

$\beta = 0.360$, $p < 0.01$). Besides, both knowledge transfer ($\beta = -0.107$, $p < 0.01$) and conversion ($\beta = -0.077$, $p < 0.1$) remain significant when present simultaneously with independent variable in affecting CEP, indicating their mediating effects.

Third, based on the mediating role of knowledge transfer and knowledge conversion, via which CEP knowledge spills over, we also argue that knowledge spillover mediates the relationship between proximity to major cities and CEP. Besides the prevalent legitimacy mechanism based on institutional pressure (Marquis and Tilcsik, 2016; Marquis et al., 2013), major cities also promote firms to engage in CEP by offering relevant knowledge and efficiency mechanism. For nearby firms, major cities play as the sources of both institutional pressures and knowledge spillovers, and firms could absorb CEP knowledge while bearing pressures. It is noticeable that CEP knowledge providers include local peers and non-peer stakeholders, such as local governments, NGOs or academic institutions.

Conclusion

As the forms that firms participate in environmental actions being more diversified, the related capability gradually plays more significant roles when firms perform environment-friendly actions. Despite its importance in boosting firms' ability, the influence of knowledge on CEP is still not adequately recognized. Therefore, in the research about the impact of major cities on CEP, few scholars examine the connections from the knowledge perspective, leaving this critical path undiscovered. Based on stakeholder theory and knowledge spillover theory, this study conducts a theoretical and empirical analysis of the mediating role of knowledge spillovers between firms' proximity to major cities and CEP engagements. The research not only enriches the front-end research of corporate environmental performance, but also further expands the application scope of knowledge spillover theory.

As with any study, our study is not without limitations. There are boundaries to our theorizing and limitations to our approach, which future research could address. In this study, we introduce and build connections between knowledge spillover and CEP; meanwhile, we notice that there are some puzzles left unsolved. For example, the impact of FDI knowledge spillovers on CEP, the effect of implicit and explicit knowledge spillovers on CEP, and whether absorptive capacity moderates the relationships. Those questions worth further studies to fully discover the links between knowledge spillover and CEP.

Besides, future research could extend the logic chain and test the influence of knowledge-driven CEP engagements on financial performance. So far, our findings support that knowledge spillover could facilitate firms' CEP engagements, but we still know little about the financial outcomes of those CEP engagements. Will the knowledge-driven CEP practices benefit corporates' financial performance? Future research may incorporate financial performance into the analytical framework, follow the "S-C-P" paradigm and construct "space-behavior-performance" framework, and thereby strengthen its instructive value on CEP practices.

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