



# Strategic interaction in municipal governments' provision of public green spaces: A dynamic spatial panel data analysis in transitional China



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## ABSTRACT

A wide range of benefits can be provided by urban green spaces to enhance urban dwellers' social, economic and environmental welfare, and secure urban ecosystem resilience. With the increasing recognition of these benefits, municipal governments might provide urban public green spaces (UPGS) in a strategic manner to upgrade local landscape amenities so as to make their cities more attractive compared with their neighbors and boost economic growth. Based on a panel dataset of China's cities at the prefecture-level and above over the period of 2002 to 2014, this study explores the strategic interaction amongst municipal governments in providing green spaces for the general public. A novel and powerful econometric tool, the dynamic spatial Durbin model with city and time-period fixed effects, is applied to test for spatial interaction effects. The results depict a confirmative picture of the strategic interactions amongst China's municipal governments. Specifically, cities tend to mimic their neighbors and provide more UPGS as a response to the increase of UPGS provision in their neighboring cities across the whole country. Economic development, average income level, urban population growth, and urban land availability exhibit strong positive direct effects on UPGS provision in a short time-span, suggesting that municipal governments' decisions regarding UPGS provision tend to be myopic. Regional variations indicate that municipal governments in the eastern and central regions are actively involved in strategic interaction in providing UPGS, while those in the western region are not. The results illustrate that UPGS provision serves as a metric for evaluating local officials' performance complementary to the overwhelmingly-believed economic-performance based political competition, which reasonably benefits urban residents' environmental welfare in transitional China. However, a general lack of far-sighted greening perspective and inter-city synergy might engender some risks regarding the long-term resilience and stability of urban ecosystems and broad social efficiency. This study sheds light on the co-evolutionary dynamics of social and bio-physical systems, and specifically provides a scientific basis for region-specific policy making to achieve socially optimal UPGS provision in China.

## 1. Introduction

Cities, where the dominant portion of the populace, and even more so in the future (Gu, Li, & Han, 2015; ; United Nations, 2015), live and work, play a key role in providing various public services to satisfy a wide range of significant demands from a growing urban population (Buhaug & Urdal, 2013; Ouyang, Wang, Tian, & Niu, 2017). These public services range from mundane ones, such as street repair, to complex ones, such as education and healthcare (Levin & Tadelis, 2010; Young, 2010), amongst which the provision of urban public green spaces (UPGS) has been an integral component (Van Herzele and Wiedemann, 2003; BenDor, Westervelt, Song, & Sexton, 2013). Being entirely and essentially the responsibility of local governments

(Chen & Hu, 2015; Choumert, 2010; You, 2016), the provision of UPGS, i.e., those publicly accessible lands that consist predominantly of unsealed, permeable, soft surfaces, such as soil, grass, shrubs, trees, and water (Coolen & Meesters, 2012; James et al., 2009; Swanwick, Dunnett, & Woolley, 2003) in various forms, such as parks, riparian strips, or street gardens (Roy et al., 2012; Chen & Hu, 2015; You, 2016), holds considerable promise of enhancing urban dwellers' economic, social, psychological, and environmental welfare, and securing urban ecosystem resilience (Baycan-Levent & Nijkamp, 2009; Deng, Song, Chen, & Rong, 2008; Iojă, Grădinaru, Onose, Vânău, & Tudor, 2014; McPhearson et al., 2016), via the generation of a full spectrum of benefits, such as climate regulation (Escobedo, Varela, Zhao, Wagner, & Zipperer, 2010; Zhang, Xie, Gao, & Yang, 2014), air pollutant

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removal (Escobedo, Kroeger, & Wagner, 2011; Jim & Chen, 2008), water purification and runoff mitigation (Yang, Zhang, Li, & Wu, 2015), noise reduction (Margaritis & Kang, 2017), amenity and recreation (Hladnik & Pirnat, 2011; Jim & Chen, 2006), stress recovery and restoration (Tyrväinen et al., 2014; Wang, Rodiek, Wu, Chen, & Li, 2016b), enhancement of social interaction and sense of place (Hur, Nasar, & Chun, 2010; Yao, Liu, Wang, Yin, & Han, 2014), environmental justice (Heynen, Perkins, & Roy, 2006; Wolch, Byrne, & Newell, 2014), and ecological resilience (Barthel, Parker, Ernstson, & Ernstson, 2015).

The ecological, social, and economic importance of public green spaces in urban fabrics has experienced a resurgence of interest amongst not only scholars, but also practitioners, from both developed and developing countries (Deng et al., 2008; Sadler, Bates, Hale, & James, 2010; Carpenter, 2014; Kabisch, Qureshi, & Haase, 2015; Li & Liu, 2016). Many municipal governments tend to provide UPGS in a strategic fashion aiming to improve their environmental amenities and make their cities more sustainable, more pleasant, and more livable (Choumert & Cormier, 2011; Hansen & Winther, 2010; Pincetl & Gearin, 2005), so as to compete with other cities (especially their neighbors) via bringing in more economic activities in terms of firms and highly skilled labor which seek to optimize their amenity utility (Baycan-Levent & Nijkamp, 2009; Choumert & Cormier, 2011; Dooling, Simon, & Yocom, 2006; Partridge, Rickman, Ali, & Olfert, 2008). Surprisingly, there has been very limited published research delving into the spatial interactions and underlying incentives regarding UPGS provision on an inter-urban basis, in particular, which have rather been neglected in transitional economies, such as China, where the urban landscape, in tandem with an unprecedented scale and rate of urbanization, has been changed fundamentally (Deng, Wang, Hong, & Qi, 2009; Yang, Huang, Zhang, & Wang, 2014). In the past several decades, most Chinese cities have densified due to infilling of free spaces and re-development of existing green spaces within developed areas, as well as expanded into agriculture land and green spaces in urban peripheries (Seto, Fragkias, Güneralp, & Reilly, 2011; Yin, Kong, & Zhang, 2011; Zhao et al., 2013). The resultant deterioration in urban residents' social and environmental welfare has become a long-standing concern and poses a great challenge to policy-making (Dong & Liang, 2014; Fu, 2008; Smyth, Mishra, & Qian, 2008).

While empirical studies in the context of UPGS provision and local governments' strategic behaviors have been confined to the Western democratic world (e.g., Choumert & Cormier, 2011), the rapid and relentless transformation of urban landscapes in transitional nations calls for a new synthesis of fresh ideas and deserves more rigorous attempts to discern some essential implications of future social changes for urban systems (Luck, Smallbone, & O'Brien, 2009; McPhearson et al., 2016).

The present study attempts to fill this knowledge gap and provide a basis for a more accurate understanding of the social/economic processes and ecological/environmental outcomes of urbanization (Collins et al., 2011; Sadler et al., 2010), as well as the co-evolutionary dynamics of social and bio-physical systems (Karvonen & Yocom, 2011; McPhearson et al., 2016), by examining the strategic interactions across Chinese municipal governments in the variations of UPGS provision over time and space. A panel dataset on 258 cities at the prefecture level and above over the period 2002–2014 (the longest longitudinal period that full UPGS data is available) is compiled, via dynamic spatial Durbin models with fixed effects by implementing the bias-corrected Quasi-Maximum Likelihood estimation procedure (Lee & Yu, 2010; Yu, de Jong, & Lee, 2008), to test the existence of both endogenous interaction (associated with yardstick competition) and exogenous interaction (associated with local collaboration), in both short-term and long-term scales (LeSage & Pace, 2010; LeSage & Sheng, 2014). The remainder of this paper is structured as follows. Section 2 contains a brief review of the literature related to mechanisms of strategic interaction amongst governments. Section 3 provides a description of the dynamic spatial Durbin model and the dataset. In Section 4, the analytical results and discussions are presented. Finally, Section 5 summarizes the

conclusion and highlights the implications of this study.

## 2. Mechanisms of strategic interactions in UPGS provision

Under the decentralized governance system in both developed and transitional economies which mandates local governments to provide the requisite public services within in their areas of jurisdiction (Dillinger, 1994; Kurian, Ardakanian, Veiga, & Meyer, 2016), it is impossible to imagine that local governments made decisions separately (López, Martínez-Ortiz, & Cegarra-Navarro, 2017). Spatial interactions (how a city responds to the choices and decisions of other cities) might be arising from the interdependence amongst cities due to, mimicking, externality spillovers, competition, or inter-city collaborative networks.

While theoretical literature and empirical studies pertaining to local governments' provision of public services from both developed and transitional economies suggest spatial interactions may lead local governments to strategically respond to the change in their neighbors as free-riders or to adopt mimetic behavior due to yardstick competition (Besley & Case, 1995; Bulow, Geanakoplos, & Klemperer, 1985; Lundberg, 2006), depending on what public goods/service is at stake (Choumert & Cormier, 2011), burgeoning evidence from China, as yet inconclusive (Oppen, Nee, & Brehm, 2015), reveals that local governments tend to 'race to the top' for the provision of public goods related to the promotion of local officials' economic performance (e.g., urban transportation infrastructure), but 'race to the bottom' for public services related to their environmental performance (e.g., air pollutant control), driven by an economic-performance based political competition embedded in its hierarchical system (Caldeira, 2012; Deng, Zheng, Huang, & Li, 2012; Huang & Du, 2016; Liu, Zhang, & Li, 2012; Yu, Zhou, & Zhu, 2016). For example, it was found that Chinese cities appeared to free-ride and cut its own spending as a response to the rise in environmental protection spending by their neighbors (Deng et al., 2012). Another recent study revealed strong spatial effects for city-level investment and mimicking behaviors amongst Chinese cities which are driven by strategic interactions amongst political rivals in tournament competition (Yu et al., 2016).

The last decades have seen a huge increase in research on strategic interactions with regard to public service provision. However, interactions and interdependences over urban green infrastructure issues have hitherto received scant attention (Choumert & Cormier, 2011; Claude, Figuières, & Tidball, 2012). Being virtually a public environmental goods with distinctive social and economic importance, but generally low priority in the political agenda at both national and local levels, whether and how local governments respond strategically to other cities' provision of UPGS has not yet been addressed explicitly in the extant literature.

Two mechanisms can explain the potential strategic interactions amongst local governments in UPGS provision. First, urban green infrastructure provided by a local government may not be bounded by the jurisdiction that supplies it. Residents can use parks and other public green spaces provided in surrounding cities. Thus UPGS is subject to spatial spillovers across the boundaries of cities (Claude et al., 2012). Correspondingly, a municipal government might strategically reduce its UPGS provision when its geographically close neighbors provide sufficient UPGS and its residents can act as free-riders. Second, yardstick competition may exist and induce potential spatial interactions in UPGS provision amongst Chinese cities. Due to the performance criteria formulated by the central government, a local government can take into account its competitors' performance as a yardstick and mimic their greening policy. When deciding on the best policy and the level of UPGS provision, a Chinese city might seek to compete with its neighboring cities by providing UPGS in a more-than-competitor fashion so as to earn significant competitive advantage in performance evaluation and domestic political arena.

Traditionally, empirical models have treated cities as isolated entities and assumed urban green space provision to be determined only by

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