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A geospatial analysis of multi-scalar regional inequality in China and in metropolitan regions

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ABSTRACT

This paper provides a geospatial analysis of regional inequality across provinces, prefectures and counties in China from 1997 to 2010 under a comparative spatiotemporal conceptual framework. Despite significant spatial agglomeration at all spatial scales, the extent of agglomeration shows an obviously downward trend from 2003 to 2006. Substantially stronger agglomeration of economic development is demonstrated at county scales. Local indicators of spatial autocorrelation (LISA) are employed to visualize the local spatial characteristics of economic growth. Four snapshots (in the years 1997, 2001, 2005, and 2010) of LISA indicate a dramatic north-shifting of hot spots of economic growth in response to the northward movement of foreign investors and spatial agglomeration besides institutional forces in China. Furthermore, local spatial agglomeration demonstrates a heterogeneous process: hot spots of economic development along the coast, cold spots in western China and no significant spatial clusters in central China. As the major carries of scale economies, metropolitan regions see decreasing internal agglomeration during this period with the exception of the Yangtze River Delta area, which shows a strong spatial spillover into its neighbourhood. Finally, LISA Markov and geovisualization methods are employed to predict the long-run properties of spatial distribution in multi-scalar China. The results show that downward co-movements of a county with its neighbours are more frequently encountered, perhaps resulting in the continuous concentration of poor areas in the long run.

1. Introduction

The widening regional inequality has always been a major concern for the Chinese government despite an intensive economic growth phase that has been in place since the opening and reform policy in 1978. Coastal regions are developing more rapidly with an average annual gross domestic product (GDP) growth rate exceeding 9.40%,[1] while the remaining inland regions have relatively slower GDP growth rates averaging between 6% and 7% from 1978 to 2013. In response to this unbalanced economic growth pattern, the Great Western Development Strategy was proposed in 1999; initiatives were also put forward in 2004 to improve central China and revive northeastern China. Significant progress has been made in narrowing coastal-inland inequality across four subregions through special funds, preferential bank loans and tax exemptions (Lemoine, Poncet, & Ünal, 2015; Wei, 2002). However, more intensifying inequalities are mainly demonstrated across prefectures and counties in China (He, Bayrak, & Lin, 2017; Liao & Wei, 2012). Although some studies have investigated the county-level inequality, most of them mainly focus on an individual coastal province such as Guangdong (Liao & Wei, 2012, 2015), Jiangsu (Ou & Zhao, 2007; Wei & Fan, 2000), Zhejiang (Wei & Ye, 2004; Ye & Wei, 2005) and Greater Beijing (Yu & Wei, 2008; Yu, 2006). No formal consensus has been reached to date and a geospatial analysis on the county-level inequality in China is lacking.

According to National main functional area planning published in 2010 by the state council, regional development should be differentiated according to spatial heterogeneity in resources and environmental carrying capacity. Furthermore, as proposed by the 13th five-year plan, urban agglomerations as the major growth engine should be accelerated to develop and be spatially distributed as "two horizontal and three vertical" shape to promote

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[1] This is based on the author's own calculation. The deflated GDP is utilized to eliminate the influence of price-level changes.

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coordinated development of large and medium-sized cities as well as small towns. Significant progress has recently been made in the coordinated development of the Beijing-Tianjin-Hebei region and in building the Yangtze River Economic Belt. According to the urban experience of the West, metropolitan development reveals a convergent pattern on the background of globalization (Knox, 1996; Lin, 2000; Vogel et al., 2010). However, as indicated by Lin (2001) and Vogel et al. (2010), the Chinese experience of urbanization reveals a distinct pattern that differs from the prevailing globalization discourse in correspondence with empirical evidence from the West. However, a comparative analysis of seven national metropolitan regions as a whole, and especially at the county level, has rarely been conducted.

A spatial view is crucial for regional inequality analysis, particularly in the case of the county-level China (Isard, 1956; Krugman, 1991; Wei, 2015; Zhang & Deng, 2016). On the one hand, according to the "National territorial planning framework (2016–2030)" approved by Premier Li, the initiative of "enhancing county-level economies" proposed in 2002 transfers urban functions and promotes rural development. However, the ways in which regional inequality is spatially formulated at the micro scale and connected spatially at different spatial scales remains unknown. On the other hand, new-type urbanization[2] requires the coordinated development of urban agglomerations to realize regionalization and optimize spatial patterns of regional development in China. Hence, a spatially explicit view of development dynamics in the county-level China and also China's metropolitan regions requires further research. Hence, this paper is devoted to examining global and local spatial structures as well as the spatial distributional dynamics of multi-scalar regional inequality in China especially in seven national metropolitan regions from 1997 to 2010 using spatial autocorrelation techniques, local indicators of spatial association (LISA) Markov and geovisualization tools.

This paper is organized as follows. The next section briefly presents the literature review and is followed by the data and methodology section. Global and local spatial patterns are then analysed to characterize spatial agglomeration and spatial diffusion in multi-scalar China. A cluster and outlier analysis is further utilized to uncover spatial inequality across counties in seven national urban agglomerations. Furthermore, LISA Markov and geovisualization tools are employed to capture the dynamics of spatial structure and predict the long-term distribution of spatial inequality across provinces, prefectures, and counties in China. Finally, this paper concludes with major findings and policy implications.

2. Literature review

Regions and regional thinking has played a crucial part in the development of geographic thought for more than a century (Soja, 2009). Regional science embraces all social sciences around a spatial dimension although at the beginning geospatial approaches were relatively neglected. By 1990s, since the heyday of regional science was over, a mixture of neo-Marxist, postmodern, Neoliberalism and feminist theories spurred a resurgence of interest in regions and regionalism, especially in the integration of macro- and micro-geographical analysis (Baert, 2017; Soja, 2009). More recently, with the advent of new regionalism, an integrative meso-geographical perspective is emphasized that the global and the local, the macro and micro, exogeneous and endogenous development processes should be investigated at multiple regional scales. From an evolutionary view of regional theories, the spatial perspective is determined and the multi-scalar geographical analysis is intensively encouraged.

The spatial view applies to all levels of analysis from the microscale to macroscale and to a variety of geographic phenomena although geographers are more concerned with the meso-scale (Dicken & Lloyd, 1972). This view of different spatial scales introduces a significant concept, namely, the environment. Each spatial unit is regarded as an open environment, and it continuously interacts with its external environment. This functioning between each open system and its external system demonstrates distinct characteristics at different geographical scales. The multi-scalar viewpoint has been demonstrated effectively in many empirical analyses, such as racial segregation (Reardon et al., 2008), ecosystem management (Cheng & Daniels, 2003), and metropolitan governance (Blatter, 2006; Ye, 2014). This view also applies to the discipline of regional economics, which has been investigated by Wei (2002; 2015). Furthermore, Herrmann-Pillath, Kirchert, and Pan (2002), He, Bayrak, and Lin (2017) investigated the impact of different spatial scales on the assessment of regional disparities in China and recommended a finer spatial scale, for example the county-level for policy purposes. Some scholars have studied the spatiotemporal trend as well as determinants of county-level inequalities taking Guangdong (Liao & Wei, 2015; Liao & Wei, 2012), Jiangsu (Ou & Zhao, 2007; Wei & Fan, 2000), Zhejiang (Wei & Ye, 2004; Ye & Wei, 2005) and Greater Beijing (Yu & Wei, 2008; Yu, 2006) as examples. However, how spatial inequality performs across counties in the whole China especially in metropolitan regions and how spatial inequality is connected at different geographical scales requires further studies.

The relationships between regional inequality and its geospatial dimensions have been examined by a number of studies (Liao & Wei, 2015; Rey & Le Gallo, 2009; Wei, 2015). These studies investigate spatial distributional dynamics of regional inequalities which conclude that regional inequality is sensitive to multiple geographical scales as well as geographical clustering and agglomeration. Li and Wei (2010), Yu and Wei (2003), Liao and Wei (2012) conclude that space does matter in shaping uneven regional development in China. Spatial dependence, scale and hierarchy are all significant for better understanding the complexity of China's regional inequality. Rey and Sastré Gutiérrez (2015) suggest that the role of spatial context does influence the distributional dynamics of regional inequality through comparing the case of Mexico and the United States. Wei (2015) find that mechanisms of regional inequality in China are mainly demonstrated in terms of first nature (physical geography) and second nature (agglomeration).

Of primary interest to geographers and economists are the spatial dependence and spatial heterogeneity present in cross-sectional data or panel data from the spatial econometric perspective (Rey & Le Gallo, 2009; Rey & Montouri, 1999). Spatial dependence has been the central theme of geography and is mainly caused by a variety of spatial spillover effects (Anselin & Florax, 1995; Anselin, 2013). From a methodological view, the explicit treatment of spatial dependence has been a focus of linear regression models with cross-sectional settings. More efforts are still required to consider dependence in space-time frameworks. Spatial heterogeneity has been demonstrated in terms of many phenomena in regional science, which has led to structural instability over space and heteroskedasticity (Cornwall & Parent, 2017; Goodchild, 2004).

[2] New-type urbanization was proposed in 2014. Compared to the traditional urbanization process, new-type urbanization (Chen, Liu, & Lu, 2016) aims to avoid stimulating economic development at the cost of agriculture, ecology and the environment. The equal provision of infrastructure and public service in urban and rural areas is promised in the "New Urbanization Plan (2014–2020)" so as to realize common prosperity.