An education-related geodemographic classification of sub-districts in Central Beijing and its implications for access to compulsory education

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Summary

The paper explores the use of geodemographics as a means of assessing potential inequality in access to compulsory education. The article argues that applying an area classification, one of the first in China, allows consideration of multi-dimensional, socio-spatial influences which affect school choice. The ideas are illustrated through a case study of central Beijing. Variables from the 2010 Census have been used to create a sub-district classification to identify whether pupils are living in more or less advantaged locations for access to schools, given China's specific institutional environment.

KEYWORDS: geodemographic classification, education inequality, hukou, nearby enrolment, China

1. Introduction

Providing quality and equal education is a high priority of every national government, however, the goal of achieving education equality in China is facing unprecedented challenges. The uneven allocation of educational resources has received close attention in recent decades (Niu, 1992, Rong and Shi, 2001, Yang et al., 2014, Li, 2008, Qian and Smyth, 2008), and there is an increasing number of studies of education inequality in China from a geographical perspective. Due to the absence of educational data relating to small areas, most of the research has been focused on inequalities in terms of education provision between different regions or provincial units (Qian and Smyth, 2008, Xie, 2011, Wang, 2014) or between rural and urban areas (Fu and Ren, 2010, Zhang et al., 2015, Rao and Ye, 2016) rather than within urban or rural areas. Although there is some research based on urban areas (Liu and Jacob, 2013), there is a conspicuous lack of detailed studies of education inequality within urban areas and its spatial diversity. In this paper, a geodemographic classification using available data from the most recent Chinese census provides a multi-dimensional analysis framework to identify spatial variations in population types in Beijing and, in combination with survey data, allows us to better understand the inequality in access to compulsory education that exists in the city.

2. Background: Hukou system and 'nearby enrolment' policy

The hukou system was established in China as a means to control population movement; everyone is registered with a community which authorises certain rights. The local urban citizens are granted priority access to urban services and facilities, while migrants with a non-local hukou normally have limited access to the same services and facilities, including schools (Zhao and Howden-Chapman, 2010). Consequently, they are discriminated against by policies based on the hukou system, such as the 'nearby enrolment' policy for compulsory education. For example, In Beijing, primary schools are supposed to enrol children who live within or whose hukou is within their attendance zones (Zheng *et*

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al., 2015). The school enrolment system in China, which is strictly constrained by location of hukou or property, is struggling to implement 'nearby enrolment'.
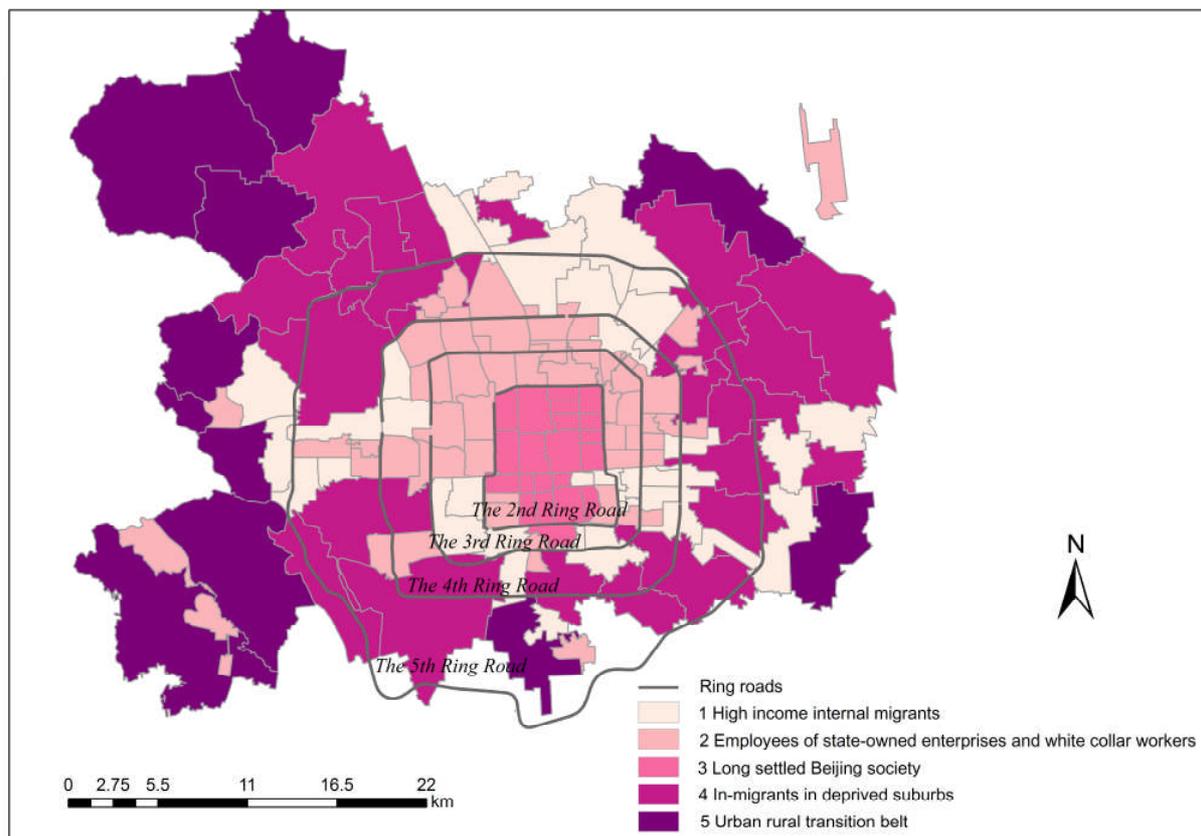
3. A geodemographic classification of central Beijing's sub-districts

The neighbourhood classification has been designed solely using data at the sub-district level from China's latest decennial census in 2010. Based on related literature (Talen, 2001, Harris et al., 2007, Williams and Wang, 2014) and after initial correlation analysis, 33 census variables have been selected to construct the geodemographic classification and each variable has a direct or indirect influence on education (Table 1). For example, a pupil's hukou status is a crucial influence on his or her accessibility to schools and, consequently, on the education quality he or she receives.

Table 1 Selected census variables and their influence on education

| Domain	Number of variables	Example	Influence on education
Demographic structure	5	Persons with hukou within this sub-district (%)	Culture difference; family burden and education requirement
Household composition	2	Child dependency ratio	Family burden and education requirement
Housing characteristics	15	Households in cheap rent housing (%)	Dwelling enrolment and family socio-economic status
Socio-economic traits	9	Persons aged over 6 with lower qualification (%)	Parents' occupation and occupation based social class grading

After running the k-means clustering and obtaining the results, the clusters were labelled and given descriptions, as shown in Figure 1, based on the principal and distinctive variables. The geodemographic clusters display a pattern of concentric rings, although some parts of these rings are discrete.

The principle features of each cluster were summarized and displayed by the radial plots below. The highest and lowest values of variables are immediately distinguishable and reflect the principal features of the cluster in terms of its demographic structure, household composition, housing and socio-economic features. The distinct characteristics and education related descriptions of each cluster have been described by the following pen portraits. Due to the word limit, only two clusters have been briefly introduced below.
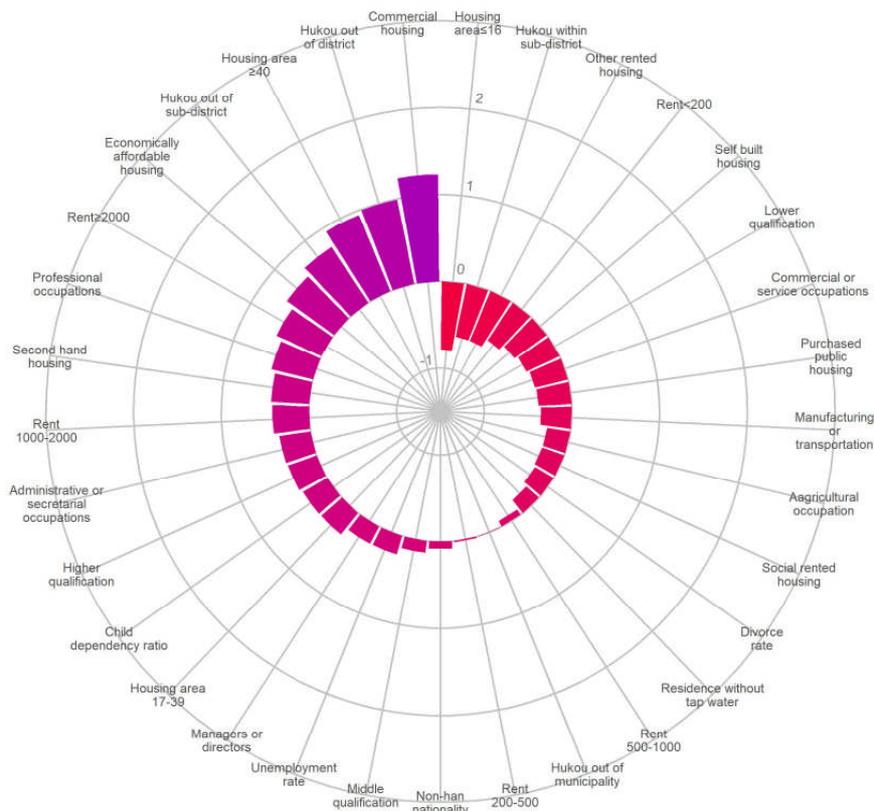

Figure 2 Radial plot for cluster 1: High income internal migrants

High income internal migrants (cluster 1): The areas in this cluster have a high percentage of spacious and owner occupied commercial housing (private housing) (Figure 2). This means their economic status is comparatively high. There is a high proportion of residents with their hukou outside a district but within the municipality, who changed their residence and moved to an outer zone with spacious housing and a more pleasant living environment. However, the schools with a good reputation historically are mainly located in the inner areas of central Beijing; there are only a few high-quality schools located in the newly developed outer areas. As the place of hukou registration of these inhabitants tends to be in inner Beijing, their children still have the opportunity to enrol in a better school in an inner area. As their economic status is high, it can be speculated that some of the children living in these areas would commute quite a long distance to enrol in a better school rather than enrol in a nearby school, resulting an increase in the traffic burden and more congestion.

Employees of state-owned enterprises and white collar workers (cluster 2): More people in this group own purchased public housing indicates that quite a lot of people in these areas are working in state-owned enterprises that are the legacy of the danwei (work unit) system which is now defunct. As each danwei usually had its own schools for employees' children, the education provision in these residential areas was normally sufficient (Chen *et al.*, 2015) and children's commuting distances are not very long.

Long settled Beijing society (cluster 3): Areas in this cluster are found inside the second ring road (Figure 1), where the high quality education resources are historically located (Bi and Zhang, 2016). In addition, the proportion of pupils with their hukou within the sub-district in this cluster is high, so the commute distance of children is likely to be relatively short.
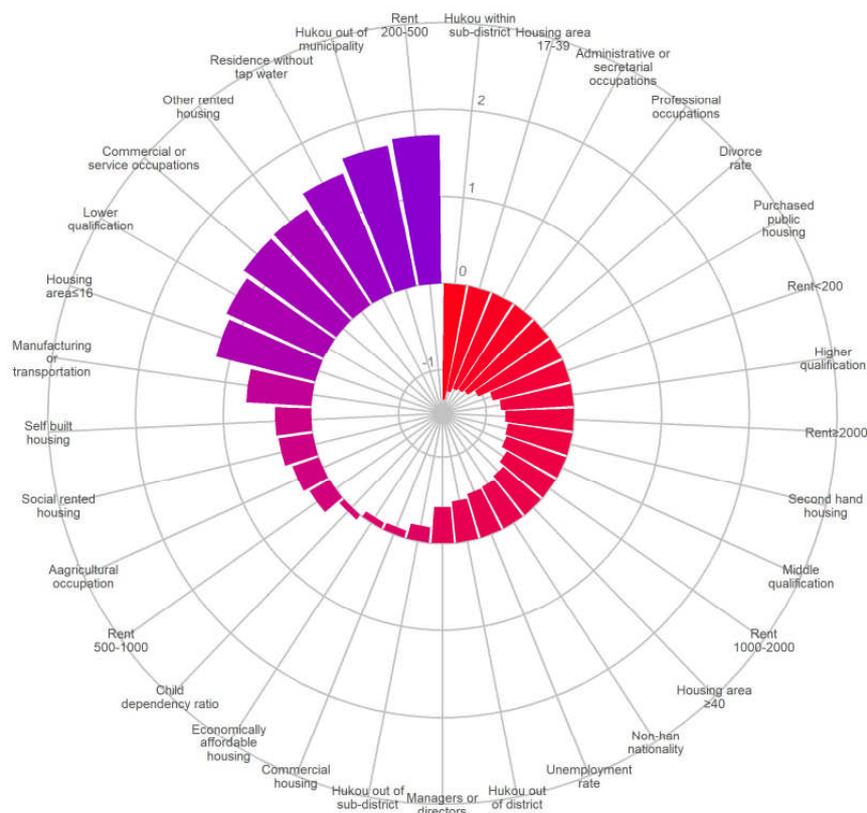
Figure 3 Radial plot for cluster 4: In-migrants in deprived suburb**s**

In-migrants in deprived suburbs (cluster 4): Compared to other clusters, there is a large group of in-migrants who do not have a Beijing hukou, living in low rent accommodation, without the necessary facilities and with low qualifications (Figure 3). Their residential environment is unpleasant, crowded and lacking basic facilities. A high proportion of people in this cluster type are employed in commercial and service occupations and have primary or middle school education. The children of migrant families usually cannot enrol in nearby schools because they lack a Beijing hukou and do not own property in Beijing. They will be allocated to less popular schools within the range of the district of residence. As the areas of these outer districts are very large, pupils normally have to commute a longer distance to low-performance schools. Therefore, these areas will potentially be the most educationally disadvantaged areas in the city.

Urban-rural transition belt (cluster 5): Areas in this cluster tend to locate in rural and suburban conjoint areas (Figure 1). The unbalanced education provision between rural and urban areas potentially leads to education disadvantage for residents in these areas.

4. Conclusions

This research provides the first geodemographic classification relating to a public-sector service in China. It is also the first time that a compulsory education-specific area classification has been used to assess potential inequalities in access to schools. This study offers a valuable data exploration approach that yields new ideas and insights about potential inequalities in education, providing a useful point of reference for areas where educational research is limited by the availability of data for small areas. In terms of substantive findings, potential inequalities in access to schools due to the nearby enrolment policy for different types of area are revealed in central Beijing. This is associated with housing type, parental occupation, qualifications and, in particular, registration status which has mediated the influence of market sorting and maintained the advantage of local households over migrants with similar or even higher incomes (Fang et al., 2015). This area classification provides some crucial education-related implications and is constructive in clarifying the main issues of education development within each type of area revealed by the cluster analysis and in formulating the corresponding 'action' measures.

5. Acknowledgements

6. Biography

Professor **John Stillwell** is Professor of Migration and Regional Development in the School of Geography at the University of Leeds. He was Director of Census Support at the ESRC-funded UK Data Service from 2012-2017 and has recently edited the 2011 Census Handbook. He has longstanding research interests in population studies and internal migration in particular. He is co-editor of the international journal Applied Spatial Analysis and Policy (ASAP).

Dr **Luke Burns** is a Lecture in Quantitative Human Geography in the Centre for Spatial Analysis and Policy in the School of Geography at the University of Leeds. Having worked in both industry and academia, Luke has developed firm expertise in several areas of quantitative geography including the advanced application of geographical information systems to socio-economic problems and the construction and application of geodemographic classification systems.

Professor **Alison Heppenstall** holds a Chair in Geocomputation. Her interests are in the application of artificial intelligent solutions for geographical problems, with applied research experience in the development and linkage of novel methodologies for a variety of socio-economic applications including education planning/management, retail analysis and crime. A particular focus of her work is in individual based modelling, in particular the development and application of agent-based modelling and microsimulation to geographical systems.

Dr **Paul Norman** is a population and health geographer with expertise in time-series analysis of both area and individual-level data derived from census, survey and administrative records. His work includes the harmonisation of small area sociodemographic, morbidity and mortality data to enable time-series analysis of demographic, deprivation and health change; the development of population estimation and projection methods that incorporate multiple data sources about population subgroups and demographic processes; and the use of area typologies to understand variations in health and other outcomes.

Ms. **Lili Xiang** is currently studying (third year) for a Ph.D. at the School of Geography, University of Leeds. Her interests are in spatial analysis and education inequality.

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