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Exploring the relationship between spatial driving forces of urban expansion and socioeconomic segregation: The case of Shiraz

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ABSTRACT

As socioeconomic contexts of cities influence urban expansion and development, urban structures should be seen from both physical and socioeconomic perspectives. Therefore, this study seeks to investigate the relationship between urban socioeconomic segregation and spatial driving forces of expansion of Shiraz, a city in the south of Iran. To this end, the association of environmental, planning, neighborhood and accessibility factors with the expansion of different areas of Shiraz was investigated from 2006 to 2011. By using the geographically weighted logistic regression, the local effect of each driving force on urban growth was calculated and then, the relationship between urban growth factors and socioeconomic segregation was explored by averaging the parameters of independent variables in different socio-spatial classes of Shiraz categorized according to the occupation of the inhabitants and the state of informal settlements. Although the results obtained from spatial driving forces of urban expansion of Shiraz were mostly in accordance with the results of previous studies, the magnitude of the effects of driving forces changed across different socio-spatial classes. The results revealed that urban expansion of Shiraz was a reflection of socioeconomic segregation in a way that the poorer strata of Shiraz were seeking closer access to essential services such as schools, health centers, and major roads. However, at the same time, they were unable to live near major economic centers of the city and were pushed to rural areas. On the other hand, the affluent residents of Shiraz were more likely to reside near major urban centers and conversation areas that are far superior in terms of environmental features.

1. Introduction

Due to the uneven accumulation of job opportunities and living facilities in urban centers, the rapid growth of cities in developing countries has become one of the main issues studied by researchers (Bagheri & Tousi, 2017; Jokar Arsanjani, Helbich, & de Noronha Vaz, 2013). These studies have attempted to examine spatial driving forces of urban expansion by studying the past of cities, analyzing the current structure of them, and predicting how these cities are going to be in the future (Dong, Xu, & Zhang, 2015; Mundia & Murayama, 2010; Sarvestani, Ibrahim, & Kanaroglou, 2011; Shahraki et al., 2011).

However, it seems two related issues are associated with urban expansion analysis, and urban dynamics studies have been attempting to somewhat respond to these issues over the past years. First is the fact that analysis of driving forces of urban expansion can be done in both spatial and non-spatial ways (de la Luz Hernández-Flores et al., 2017). However, since the nature of urban expansion occurs spatially, and the relationship with its driving forces is not necessarily stationary, then it seems essential to examine driving forces of urban expansion more dynamically rather than statically (Luo & Wei, 2009; Mirbagheri & Alimohammadi, 2017; Xie & Yang, 2011). Therefore, more dynamic models and methods such as cellular automata and geographically weighted regression have been introduced into urban modeling and spatial analysis in comparison with more static models including traditional and logistic regression (Han, Hayashi, Cao, & Imura, 2009; Mirbagheri & Alimohammadi, 2017; Yin, Kong, Yang, James, & Dronova, 2018).

The other less studied issue is the impact of socioeconomic contexts of cities on their development as urban structure and dynamics should be seen from both physical and socioeconomic perspectives (Bayón & Saraví, 2013; Jiang & Yao, 2010). To address this issue, previous studies have treated some of the driving forces of urban expansion as socioeconomic factors, such as planning policies (e.g. especial planning for conservation areas, development control zone, and agricultural land)

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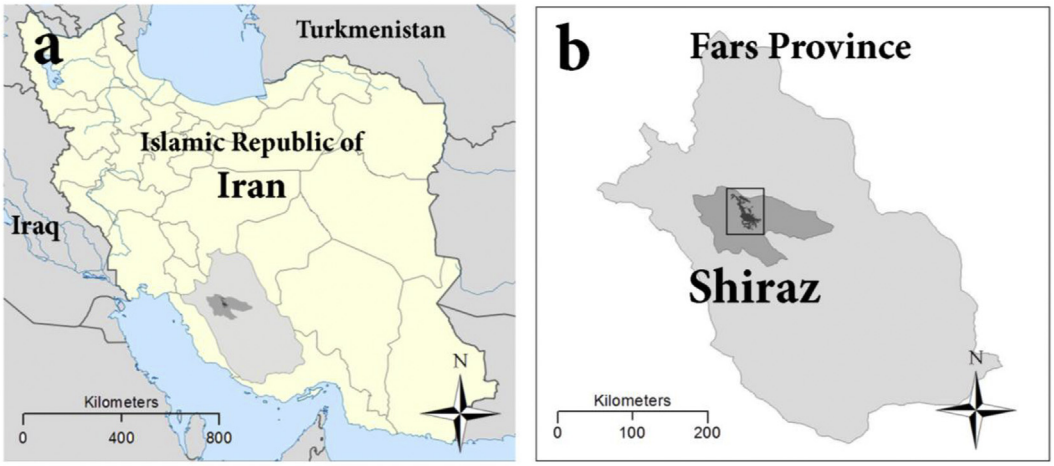

Fig. 1. The study area; a, Fars province in Iran; b, Shiraz County in Fars province.

and accessibility factors (e.g. access to service centers, access to main roads etc.) (Chen, Gao, Yuan, & Wei, 2016; Dong et al., 2015; Glaeser & Kohlhase, 2004; Müller, Steinmeier, & Küchler, 2010; Shefer & Antonio, 2013; Shu, Zhang, Li, Qu, & Chen, 2014; Sridharan, 2011; Su, Xiao, & Li, 2014; Wei, Li, & Yue, 2017). Also, there have been some attempts at the regional scale to account for inequality by taking into account economic variables such as GDP and municipal budget (Chen, Chang, Karacsonyi, & Zhang, 2014; Kuang, Chi, Lu, & Dou, 2014; Wei et al., 2017). However, since intra-urban inequality and segregation are more of a socioeconomic problem rather than a merely economic one, they cannot be sufficiently dealt with only economic indices.

Thus, new approaches to the urban modeling and analysis, such as agent-based modeling, have considered the effect of social behavior and individuals interactions on urban development. Hybrid systems (e.g., Cellular automata-Agent based models) have attracted a lot of attention in recent years by including both spatial and aspatial approaches in the same model and taking into account developers' preferences and spatial structure (Arsanjani, Helbich, Kainz, & Boloorani, 2013; Mustafa, Cools, Saadi, & Teller, 2017; Silva, 2011). However, agent-based modeling focuses on the economic status and preferences of citizens and the role of developers, rather than focusing on the socioeconomic context of a city.

In other words, although it is true that individual households make their choices based on lifestyle and, more importantly, income, some of their preferences are constrained by external factors including planning policy, socioeconomic segregation and social rules (Musterd & Van Gent, 2015). Therefore, not only does the growth of a city with a physical presence is affected by socioeconomic disparities, but driving forces of urban expansion could also exacerbate socio-spatial inequality and segregation (Frenkel & Israel, 2018; Mundia & Murayama, 2010; Sridharan, 2011).

So the question is what the relationship between intra-urban socioeconomic segregation and spatial driving forces of urban expansion is. Studies on urban segregation, which mostly consists of socio-economic, socio-spatial and residential segregation, have clearly shown us how socioeconomic differences can affect organization and structure of a city (Johnston, Poulsen, & Forrest, 2014; Lima, 2001; Musterd & Ostendorf, 2013). Although urban segregation has various aspects including educational, ethnical, racial and economic differences, its spatial representation is virtually dependent on the welfare state of a city where the separation of wealthy people and more impoverished people will create a heterogeneous society grouped on the basis of specific classes changing according to their socioeconomic status (de Córdova, Fernández-Maldonado, & del Pozo, 2016). In this manner, individuals with average and higher incomes can choose their housing and living space (Dong et al., 2015; Frenkel & Israel, 2018). On the other hand, in the absence of suitable options for access to urban land, low-income residents are deprived of proper housing and, in some cases, even forced to occupy urban land informally. Thus, understanding the factors that stimulate urban growth and studying their relationship with socioeconomic segregation can be a great help to improve the planning process of future development of cities.

Therefore, with the emphasis on the two issues above about analyzing the factors contributing to the expansion of a city, the present study attempts to explore spatial driving forces of urban expansion of Shiraz in its socioeconomic context. The purpose of this study is threefold: a. Determining the effect of spatial driving forces on the expansion of Shiraz, a city in a developing country, b. Explaining and describing socioeconomic differences in Shiraz using occupational groups, and c. Exploring the changes in the effect of these spatial forces on the expansion of different areas of the city which are distinguished based on occupational groups.

2. Methodology

2.1. Study area

Shiraz, as the fifth largest city in Iran, is the center of Fars province and the central urban area in southern Iran. In addition to being one of the most important tourist centers in Iran, it is also the main economic and political center in the south of the country. Therefore, over the past few decades, the city of Shiraz has witnessed a massive expansion. In fact, the population and the built-up area grew from 850000 to 6000 ha in 1986–1860000 and 15600 ha in 2016, respectively.

In the seventh Iranian national population and housing census which was held in 2011, more than 500 census tracts categorized according to socio-demographic integration formed Shiraz statistical urban area. In this study, these census tracts were used to survey the state of socioeconomic segregation in Shiraz. Also, there are 45 rural centers within the metropolitan area, some of which are largely integrated with the city, and the rest of the villages also have the urban lifestyle. Also, the population of the city in 2006 and 2011, the period used in this study, increased from 904000 to 1460000, respectively (Fig. 1).

2.2. Materials

First, a spatial database for Shiraz was created for the years 2006 and 2011 using satellite imagery and socio-economic data. The built-up area map of the city for 2006 and 2011 was extracted using Landsat 7 satellite imagery with 30 m * 30 m resolution which is available on the website of the United States Geological Survey (USGS) agency. The