Habitat International xxx (xxxx) xxx–xxx

Contents lists available at ScienceDirect

Habitat International

journal homepage: www.elsevier.com/locate/habitatint

The effects of locational factors on the housing prices of residential communities: The case of Ningbo, China

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ARTICLE INFO

Keywords:
Residential communities
Housing prices
Locational factors
Geographic field model
Geographically weighted regression
Spatially non-stationary

ABSTRACT

Residential communities are the basic living units in Chinese cities. Housing prices are closely associated with the community location and surrounding support facilities. When selecting satisfactory residential accommodation, potential real estate purchasers prioritize the community location in a city at the macro-level and then consider other micro-factors (i.e., the floor, orientation, structure, etc.). This paper attempts to explore the relationship between housing prices and locational factors at the community level. We collect the current market prices of 545 residential communities built in the last decade in Ningbo, the second largest city in Zhejiang Province. Then, thirteen locational factors of five dimensions are identified to research their influences on housing prices. In the process of selecting certain locational variables, both extant features and additional features (i.e., planned ones) are considered. The geographic field model is introduced to quantify the external effects of locational factors, due to its advantages of producing more accurate results than that of traditional distance-based measure methods. Then, regression analysis is performed based on the average housing prices of residential communities and explanatory variables by the ordinary least squares model and the geographically weighted regression. The regression coefficients demonstrate that the externalities of parks, lakes, department stores, banks, secondary schools and rail transit have significant but spatially non-stationary effects on housing prices. The results provide references for local real estate planning departments and potential real estate purchasers.

1. Introduction

The residential community is the basic unit of urban living areas in China. Each community is a closed area (normally enclosed by walls or fences) and consists of its internal apartment buildings, roads, green space and auxiliary facilities. Each apartment building contains multiple floors and each floor contains several apartments. This kind of living mode is different from that of western countries and formed due to the context of China's real estate development (Mou, He, & Zhou, 2017; Wen, Bu, & Qin, 2014; Yang, Wu, Shen, & Dang, 2017). In the period of planned economy, due to the national strategy of giving priority to the industrial development, many Danwei Compounds were formed, involving both production space and living space. The apartments in these compounds are distributed to employees as welfare. In 1998, the government initiated a thorough housing mechanism reform toward being market-oriented. From then on, the mainstream form of housing supply concerned two stakeholders (real estate developers and independent purchasers). That is, apartments in residential communities became commercial merchandizes for sale (Chai, Chen, & Zhang, 2007; Hui & Wang, 2014; Shih, Li, & Qin, 2014). To meet the needs of residents' safety and reduce the overheads of developers, residential communities follow the Danwei Compounds' mode (with entrance guard). As a result, the relatively independent residential community become the current basic components of the urban living areas in China. Due to the development of market economy, the deepening of urbanization and the emergence of urban centers and various subcenters, the disparities of housing prices in different communities become increasingly striking within each city. In this sense, it is worth researching the spatial variation and its underlying driving forces in depth.

When selecting a satisfactory residence, homebuyers prioritize the macro-factors (esp. the community location) and then consider the micro-factors (e.g., the floor, orientation, structure, etc.). The reason is that the community location does not only closely concern safety,

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https://doi.org/10.1016/j.habitatint.2018.09.004
Received 23 November 2017; Received in revised form 25 August 2018; Accepted 10 September 2018

convenience and comfort but also the housing price. Notably, the average prices of intra-urban residential communities vary significantly in space. This could be exemplified by particular cases: (1) Housing prices are different in certain communities in different locations, even developed by the same real estate developer; (2) Housing prices of old communities in good locations are normally higher than those (even newly-built communities) in inferior locations. (3)The difference in price among apartments with diverse structure and floor within a community is relatively small. Given the location's seemingly obvious impact on the housing prices, we need to define the term “location” and explore its mechanism. Not only refers to the spatial position, “location” also includes the surrounding facilities and environmental amenities that have considerable external benefits for residential communities (Jiao & Liu, 2010). These facilities and amenities can meet the needs of residents in their daily lives and may have implicit economic value on housing price.

Although many studies have involved the spatial distribution and determinants of housing price, researches focusing on locational factors at community level are still insufficiently. Moreover, some locational facilities (e.g., transport systems, educational facilities, medical facilities and commercial facilities, etc.) increasingly influence the real estate market and are the determining factors considered by potential real estate purchasers. Therefore, it is very necessary to quantitatively detect the influence mechanism of locational factors on housing prices at the community level. Based on geospatial data, this paper seeks to explore the influence of locational factors on housing prices in residential communities with a case study in Ningbo. The specific research questions are as follows: (1) What locational factors influence the average housing prices of residential communities and what is the influential degree of each locational factor? (2) What is the spatial variation in terms of influential degrees? The results of this study are believed to contribute to decision-makings of potential real-estate purchasers and local real estate planning departments.

The reminder of this paper is arranged as follows. Section 2 reviews the various influence factors of housing price, the models for relationship exploration and methods of variable quantification. Section 3 presents the study area, the research procedures, the models specification, and the variable collection and processing. Section 4 compares the results obtained through two regression models and analyses the spatially varying relationships between three typical explanatory variables and housing prices. Finally, this study is concluded in Section 5.

2. Literature review

The housing price is inextricably linked with urban economic development and citizens' quality of life. How to measure the effect of various factors on housing prices has aroused a widespread interest among scholars. The numerous empirical researches have been conducted in different cities of western countries and China. From the economic perspective, these articles mainly choose the potential factors influencing housing prices from four dimensions, including the structure, neighborhood, location and landscape. Most of these publications have confirmed that the selected factors have the significantly value-added effect on the housing prices (Bo & Janssen, 2001; Dai, Bai, & Xu, 2016; Dubé, Thériault, & Rosiers, 2013; Wen, Xiao, & Zhang, 2017a). For example, Debrezion, Pels, and Rietveld (2006) illustrated the positive effect of railway accessibility on house prices based on sales data from three metropolitan areas in the Netherlands. Wen, Zhang, and Zhang (2014) identified that educational facilities have a positive capitalization effect on housing price in Hangzhou, China, based on the spatial econometric model. Whereas, a few studies revealed the insignificant or negative effects of the potential factors on housing prices (Baranzini & Schaerer, 2011; Jim & Chen, 2010). The research conducted by Efthymiou and Antoniou (2013) found the influences of an electric urban railway (ISAP), a national railway station, an airport and a shipping port on housing prices were negative because of the generated noise. Recently, many scholars turn to evaluate the values of environmental amenities, such as urban green spaces, water bodies, forest and parks, etc., which has been capitalized into housing price through the housing market (Bolitzer & Netusil, 2000; Bond, Seiler, & Seiler, 2002; Jim & Chen, 2009; Tyrväinen & Miettinen, 2000; Wen, Xiao, & Zhang, 2017b; Wu, Ye, Du, & Luo, 2017). Jiao and Liu (2010) studied the effect of the Yangtze River and East Lake on housing prices in Wuhan, China. Sharma (2013) estimated a hedonic price equation for residential lands in some mountain counties of Colorado. The results suggested that land price per acre in a town is positively influenced by the town's proximity to ski resort and is negatively influenced by its proximity to forest. Wen, Bu, et al. (2014) found that the West Lake had a significant positive external effect on housing prices and this effect exhibited the directional and distance heterogeneities in Hangzhou, China. In addition, most studies on the driving forces of housing prices have selected existing features as explanatory variables. However, certain features under the planning stage can significantly influence housing prices, especially public transit facilities in large cities. This paper takes planned rail transit stations into account when detecting the relationship between rail transit system and housing price.

There are various models and methods to explore the relationship between potential factors and housing price. Among them, the commonly-used one is the hedonic pricing method (HPM). This model is firstly proposed in the field of economics (Bartik & Smith, 1987; Gatto & De Leo, 2000), and can be used to estimate the marginal implicit prices of any factor influencing potential purchasers from the economic perspective. The fundamental assumption is that a homebuyer does not only pay for the dwelling itself but also for other associated factors (e.g., locational qualities and environmental amenities). This method is the multiple linear regression analysis in essence. Because of its simplicity and effectiveness, HPM has been widely used in real estate research (Cebula, 2009; Jim & Chen, 2009; Sander & Polasky, 2009). However, HPM is not inclusive of the spatial dependence (or spatial autocorrelation). To explain the driving forces of housing prices is susceptible to biases based on the results of HPM. Some improved model (e.g., the spatial lag model, the spatial error model, the spatial Durbin model, etc.) to correct spatial dependence are applied to explain the housing price (Hu, Geertman, & Hooimeijer, 2014; Hui, Zhong, & Yu, 2012). Due to the complexity of spatial objects and interactions among them, spatial heterogeneity is another characteristic of geographical phenomenon. However, the regression coefficient estimated by the abovementioned models are spatially and temporally accordant. Geographically weighted regression (GWR) is a multiple regression model that can be used to accurately evaluate how the relationships between dependent variables and explanatory variables vary spatially. This method was proposed by Brunsdon et al., in 1996 (Brunsdon, Fotheringham, & Charlton, 1996). Because of the advantages of GWR, it has been widely utilized in many fields (esp. the geoscience field) in recent years (Gao, Li, Zhao, & Cai, 2012; Lee & Schuett, 2014; Tu & Xia, 2008; Wang, Zhang, & Li, 2013). Additionally, some scholars have applied GWR to housing prices studies (Harris, Dong, & Zhang, 2013; Lu, Charlton, Harris, & Fotheringham, 2014; Nilsson, 2014). This paper focuses on the spatial heterogeneity of the influence degree of various factors, via the GWR method.

The quantification of independent variables is pivotal as the basis of model implementation. In terms of locational variables, the typically distance-based measures (i.e., the Euclidean distance, path distance, time cost, etc.) are adopted in many studies (Hu, Yang, Li, Zhang, & Xu, 2016; Kong, Yin, & Nakagoshi, 2007; Troy & Grove, 2008). These methods imply that the factors' external influence decreases gradually with the distance increasing between the study object and the various factors. The distance-based methods can demonstrate a continuous quantification for the external effect of factors but ignore their limited influence range. To make up for this deficiency, some researches utilize the “existence” of factors within a certain distance as a dummy variable to quantify the accessibility. For example, Hui, Chau, Pun, and Law