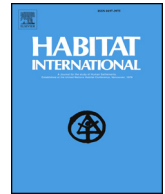




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Education quality, accessibility, and housing price: Does spatial heterogeneity exist in education capitalization?

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ABSTRACT

Evaluating the capitalization effect of educational facilities via the real estate market has elicited considerable research attention. Although the spatial attribute of housing data is generally considered when constructing a hedonic price model, only a few studies investigated the spatial heterogeneity of educational capitalization in depth. To fill this gap, this study uses the housing data of 516 communities in Hangzhou, as well as constructs the hedonic price, spatial econometric and geographically weighted models to quantitatively evaluate the capitalization effect of educational facilities and explore whether space plays an important role in the capitalization of education. Results confirm that, from the perspective of educational quality or accessibility, kindergarten, primary school, junior high school, senior high school, and university significantly affect housing prices. Specifically, the quality of primary school and junior high school as well as the accessibility of university profoundly influence housing prices. The geographically weighted regression model (GWR) further reveals the existence of spatial heterogeneity in educational capitalization. Different types of educational facilities show significant spatial differences in the scope of influence and capitalization rate, thereby implying that homebuyers have different preferences for educational resources in different areas of the city. Comparisons of the three models affirm that the spatial econometric model can better handle problems caused by the spatial dependence of housing price, whereas the GWR has unique advantages in dealing with spatial heterogeneity and can obtain results that are substantially detailed.

1. Introduction

Chinese parents have attached significant importance to the education of the next generation and hope to enhance their social status via good education. In October 1992, the 14th National Congress of the Communist Party of China first proposed that “education must be given a strategic priority”, thereby showing that the development of education is highly valued by the Chinese government and that the importance of educational resources is self-evident. However, compared with that in western countries, quantitative research on the value of educational resources in China is relatively limited.

As an important part of urban public goods, education resources cannot be traded in the market akin to a common commodity. Therefore, the value of educational resources is a type of non-market value and is difficult to measure directly. To quantify this value and help the government decide the structure of education supply and the direction of education policy reform, some scholars used housing transaction data to estimate the implicit prices of educational resources.

Tiebout (1956) corroborated that people will choose their residential location on the basis of the quality of surrounding public service and that their preferences for public goods, such as educational facilities, can be revealed via housing purchase behavior. To a certain extent, the quality of public services determines the difference in housing prices. In other words, the value of urban public goods has been capitalized into the housing price. High-quality public resources can bring new demand, which homebuyers are willing to pay a certain premium for.

However, housing products have special attributes, such as heterogeneity and non-mobility, thereby making the housing pricing mechanism complex. The hedonic price method is commonly used to study the effect of microscopic factors on housing price and reveals that almost all types of public goods are capitalized into the housing price at different degrees. For example, urban landscapes, such as green spaces (Kong, Yin, & Nakagoshi, 2007; Mansfield, Pattanayak, & Mcdow, 2005), parks (Bolitzer & Netusil, 2000; Troy & Grove, 2008), lakes (Mahan & Adams, 1996), and rivers (Wen, Xiao, & Zhang, 2017b), increase the housing price via availability, visibility, or accessibility. The

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convenience of rail transit will result in significant added value to the nearby houses (Hess & Almeida, 2007; Mcmillen & McDonald, 2004). Furthermore, high-quality educational resources will lead to different levels of housing price increase (Black, 1999; Oates, 1969; Zheng, Hu, & Wang, 2016).

On the other hand, as a typical spatial data, housing price presents the spatial dependence and spatial heterogeneity, which have attracted the attention of increasing number of scholars recently (Anselin, 1988; Dubin, 1998). Spatial dependence means that the price of a house is determined not only by its own characteristics, but also the prices of nearby houses because they usually share similar building, neighborhood, and location characteristics. The OLS estimates used in most existing literature usually neglected the effect of spatial dependence and would be biased and insufficient (Dubin, 2003). Previous study proved that the housing prices in Hangzhou, China show obvious spatial effect (Wen, Jin, & Zhang, 2017) and it is necessary to take this effect into consideration. The spatial econometric model can help us address this problem and provide more practical and unbiased results (Hui & Liang, 2016). In addition, spatial heterogeneity reflects the fact that the relationship between educational variables and housing prices may be nonstationary over space. The existence of this kind of spatial nature is mainly due to the difference in the supply factors (Jayantha & Lam, 2015). In the context of the “nearby enrollment” policy of compulsory education in China, enrollment in primary and secondary schools is strictly in accordance with the school district where the child’s registered residence is located. Many parents are, hence, willing to pay high housing prices for good schools, thereby leading to a soaring price of “school district housing” at present. Even the non-compulsory education, such as kindergarten, senior high school, and university could improve adjacent housing prices through accessibility (Hahn, Kim, & Kim, 2012; Vandegrift, Lockshiss, & Lahr, 2009; Wen, Zhang, & Zhang, 2014). In China, the supply of public goods such as educational facilities, landscapes and hospitals is relatively inadequate compared with people’s increasing demand and is also uneven over space. Consequently, the implicit prices of educational facilities and other public goods may be spatially heterogeneous. Also, people’s preferences for public goods may be different geographically, which should be reflected in the coefficients of housing characteristics in hedonic price model (Theriault, Rosiers, Villeneuve, & Kestens, 2003).

However, most existing studies were conducted on the basis of the assumption that the coefficients of the characteristic variables are consistent in the whole space and used the traditional hedonic price model to obtain the global average capitalization rate of educational resources. This assumption may lead to a conclusion that the effects of characteristic variables are uniform in the whole space, which is obviously not true in reality. Consequently, the traditional hedonic price model which neglects the effect of spatial heterogeneity is far from adequate to shed light on the real world phenomenon and may be misleading to some extent. Scholars as early as Straszheim (1974) and Goodman (1978) recognized the importance of submarkets and coefficient heterogeneity, and estimated models with these feature in mind. Nonetheless, it is difficult to divide submarkets objectively because the law of housing market usually cannot be fully understood. The GWR can perfectly solve this problem by obtaining different coefficients for each sample point without data partition, thus is extremely useful when we are interested in the spatial heterogeneous capitalization rates.

Unfortunately, inconsiderable attention has been paid to spatial heterogeneity in the capitalization effect of educational facilities by scholars. Whether space plays an important role in the capitalization of education is a question worth of in-depth study. To fill this gap, this paper initially looks at this problem not only from a global perspective, but also a local perspective. We conducted some basic researches in Hangzhou and found that the value of educational facilities have been capitalized into housing prices to some extent (Wen, Xiao, & Zhang, 2017a; Wen et al., 2014). The current study focuses on the heterogeneous behavior of educational capitalization and is considered as a

complement to the previous ones. Several econometric models are constructed in this study to explore the heterogeneous capitalization effect of educational facilities, including the traditional hedonic price model, spatial lag model, spatial error model, and geographically weighted regression model (GWR). By comparing the results of these models, some unique and interesting conclusions are obtained and the important role of space in educational capitalization is proved. In addition, a large number of educational variables are taken into consideration from two aspects of educational quality and accessibility. Existing literature usually focused on the effects of one or two kinds of educational facilities (mainly primary and secondary schools) on housing price (Chiodo, Hernández-Murillo, & Owyang, 2010; Hansen, 2014; Zheng et al., 2016), while our study includes the whole educational stages, such as the kindergarten, primary school, junior high school, senior high school, and university. The robust and complete results could provide the government, homebuyers, and developers with profound insight. We attempt to answer the following three questions. (1) Globally, do educational facilities affect housing price significantly? (2) If an external effect is present, then what are the average capitalization rates of different types of educational resources? (3) Locally, does spatial heterogeneity exist in the capitalization effect of educational facilities?

Equal access to education is the goal of the whole society. The quantitative results of this study have important theoretical as well as practical significance and can help the government further consider the rationality and optimization of the current allocation of educational resources. The rest of this paper is constructed as follows. The second part summarizes the empirical studies on the effect of educational resources on housing price from the two dimensions of educational quality and accessibility. The third part introduces data sources, definitions of variables, and model specifications. The fourth and fifth parts present the empirical results and conclusion, respectively.

2. Literature review

2.1. Educational quality and housing price

As one of the important factors that cause the difference in housing price, educational facilities have elicited scholarly interest. Specifically, many studies focused on the effect of educational quality on housing price. Oates (1969) first provided empirical evidence that public goods, such as educational facilities, are capitalized into housing price and that homebuyers are willing to pay a high premium for good schools. The idea of Oates was used by other scholars, and the housing data were widely used to measure the value of educational facilities. For example, Black (1999) verified that the assessment of school reform requires a quantitative estimate of parents’ judgment of school value and that housing price can be used to infer this value. Similar to Oates (1969), Black demonstrated that parents are willing to pay 2.5% added housing price for a 5% increase in their children’s test scores. Some parents, especially those with advanced education, are willing to pay some extra money to buy a house adjacent to a good primary school long before their children reach school age (Hansen, 2014). Machin (2011) reviewed a large body of literature on estimates of parents’ judgment of school value and their willingness to pay. He summarized that a significant positive relationship occurs between school quality and housing price. The improvement of school quality will result in varying degrees of housing price increase (Bae & Chung, 2013; La, 2015; Zheng et al., 2016). Unlike most studies that measured the average capitalization rate of educational resources, Chiodo et al. (2010) validated that the relationship between the quality of public primary and secondary schools and housing prices is nonlinear. Furthermore, the linear assumption of test scores would underestimate the premium offered by high-quality schools and overestimate that offered by general schools.

For the investigation of the relationship between educational quality and housing price, a characteristic variable should be set first to

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