


Article

Reconstructing Social Segregation in Danwei: An Examination of High-Quality Education Resources' Impact on Housing Prices in Nanjing, China

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Abstract: This study investigates the impact of capitalizing educational resources on housing prices. As housing has gradually transitioned from a basic social right to a means of accumulating individual and familial wealth, it has emerged as a significant indicator of social stratification and has increasingly become a crucial tool for the intergenerational reproduction of social class. This paper takes Nanjing, China, as a case study and uses the geographically weighted regression model (GWR) and the hedonic pricing model (HPM) to investigate the impact of high-quality primary schools on housing prices. The results show that high-quality educational resources have become the most significant influencing factor on residential prices in Nanjing. The analysis in the mechanism section further indicates that the uneven distribution of educational resources in China is a continuation of the “danwei” system. Moreover, during the urbanization process, these high-quality educational resources are often leveraged by the government and developers, who see them as essential tools to attract investment and inflate housing prices. Therefore, the current overlap of the school district system and the marketization of housing in China not only intensifies residential segregation within the city, leading to severe residential inequality but also rebuilds social segregation within “danwei” and facilitates its reproduction.

Keywords: housing prices; school district system; social segregation; danwei; Nanjing; China



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1. Introduction

Housing equality, as a fundamental social right, has become a universal consensus among governments worldwide and policies relating to social fairness and equity should be advanced [1]. However, starting from the late 1970s, with the global penetration of neoliberal policies, housing has gradually shifted from a basic social right to an essential means of individual and familial wealth accumulation [2–4]. Relevant studies indicate that housing has not only become a significant indicator of social stratification but has also increasingly emerged as an important tool for the intergenerational reproduction of social class. For example, in China's basic education stage, due to the strict implementation of the “school district system”, which requires students to attend nearby schools, urban advantaged families can ensure their children's eligibility to attend high-quality primary and secondary schools by purchasing housing in desirable school districts, thereby obtaining local household registration in that district [5]. Furthermore, research indicates that students from high-quality primary and secondary schools have a significantly higher proportion of admissions into top-tier high schools and prestigious universities compared to their counterparts from regular primary and secondary schools. This distinction subsequently influences their professional trajectories [6,7].

In fact, the school district system that allocates students to nearby public schools during the basic education phase is not unique to China. Most countries have adopted a

similar method to address the issue of admission eligibility for public schools. However, due to the uneven distribution of high-quality educational resources, various methods, and studies targeting both developed and developing economies have consistently indicated a significant statistical correlation between housing prices and school quality [5,8–10]. Numerous studies have elucidated the process of the capitalization of educational resources from perspectives such as the accessibility of educational resources and imbalances between supply and demand, thereby revealing their spillover benefits on housing prices. For instance, research by Wen et al. [11] indicated that educational facilities have a positive impact on housing prices in Hangzhou. For every one-level improvement made in primary and junior high school quality, housing prices rise by 2.020% or 5.443%, respectively. Feng et al. [12], employing a natural experiment approach, confirmed that the differences between quantity and quality in high school educational facilities have been capitalized by Shanghai's housing prices. Residential inequality caused by the price filtering mechanism or housing affordability and the resulting residential segregation is very common [13]. However, as mentioned above, when residential segregation overlaps with high-quality educational resources, it not only intensifies social stratification but also facilitates the intergenerational transmission of this stratification.

Existing research has already provided many insights into the positive correlation between housing prices and high-quality educational resources. However, these studies often adopt singular perspectives rooted in economics or geography, largely focusing on the demand side of urban residents and positing that city dwellers are willing to pay higher housing prices to access superior educational resources. While the demand-side explanation is undeniably vital, it is equally crucial to delve into the supply side of the housing market. Such an exploration further elucidates the underlying reasons for the unequal distribution of educational resources and its capitalization, along with its subsequent impact on urban housing prices and housing inequality. Furthermore, most existing research is predicated on the context of the marketization and privatization of housing and educational resources. However, public schools are the primary providers of basic education in China, and the “Double Reduction” policy further requires de-privatization reforms in the field of basic education. Most research in the literature has overlooked this significant difference. Therefore, this paper further integrates the spatial patterns and differences in housing prices to probe the deeper societal reasons behind the coupling of the uneven distribution of educational resources and housing price disparities.

This study unfolds through a case study in Nanjing, China. It is worth noting that while this paper focuses on a Chinese context, and there might be distinct differences due to China's predominant public education system in comparison to other countries, the research remains highly relevant. In recent years, especially against the backdrop of the global spread of housing financialization, analyzing the impact mechanism of China's educational resources on housing prices could aid in understanding how governments or developers in other countries capitalize on scarce public resources. This, in turn, sheds light on their strategies to further stimulate the real estate market and the more pronounced housing inequalities that result from such strategies [14,15].

The subsequent organization of this paper is as follows: first, the theoretical analysis of this paper is introduced through a review of the literature. Then, the third section presents the case study area, data sources, and research methods. Quantitative analysis results are presented in the fifth section. In the subsequent discussion section, the paper introduces the concept of “danwei” (the work-unit system) to explore the historical reasons for an uneven distribution of educational resources. It argues for their coupling with the marketization of housing, which enables the reconstruction of social segregation associated with “danwei” within school districts. Finally, the paper concludes with policy recommendations.

2. Literature Review

Understanding the intricate relationship between the supply of public goods and real estate markets is crucial when informing urban planning and policy making [11,16]. Tiebout was among the earliest to link the supply of public goods, including urban education, healthcare, and transportation, with the real estate market [17]. In his research, urban residents select housing based on their income and preferences, and the quantity and quality of public goods around housing often serve as important criteria in this selection process. Therefore, the quantity and quality of public goods in the vicinity of housing are often reflected in housing prices [18].

For example, studies such as those by Black [19], Gibbons and Machin [20], and Figlio and Lucas [21] empirically demonstrate a significant positive correlation between school quality, determined by test scores, and housing prices within respective school districts. Research by Rosen [22] and Brasington [23] points toward a positive relationship between proximity to healthcare facilities and housing prices, indicating the value that homeowners place on this public amenity. Moreover, a vast array of research in the literature, including studies by McMillen and McDonald [24], Seo et al. [25], and Ahlfeldt [26], illustrate that the presence and quality of transport infrastructure plays a pivotal role in shaping real estate values. Reductions in commute times and enhanced accessibility to amenities significantly increase property values. Broadly speaking, these studies, from the perspective of the demand side, elucidate how urban residents, when selecting housing, prioritize the accessibility of public resources such as education and healthcare, as well as transportation convenience. They are willing to pay a premium for these amenities, thereby elevating housing prices.

The fact that the uneven supply of public goods can significantly impact housing prices has spurred wide discussions about housing affordability and the resulting social inequality. Research conducted by Chetty et al. [27] and Raco et al. [28] demonstrates that the unequal distribution of public facilities leads to socioeconomic disparity. Communities with superior amenities are unaffordable for low-income families, thereby exacerbating social stratification. The work of Quigley and Raphael [29] elucidates this relationship, particularly noting that, in densely populated cities, differences in the provision of amenities considerably impact affordability. Overall, existing research has comprehensively demonstrated the impact of the uneven distribution of public goods on housing prices and social inequality. However, this paper aims to discover some novel insights within these extensive discussions.

First, most studies are based on the underlying context of the privatization and marketization processes of public goods and housing supply after the 1980s, filled with evaluative analyses of this transition [30]. Indeed, China also initiated its reform toward privatization and marketization during this period. However, in the realm of public goods provision, although China has been continually attempting to introduce market mechanisms and allow private capital to enter these areas, this progress remains limited [31,32]. Essential public goods such as education and healthcare are still predominantly under public ownership. Taking the education sector as an example, the “Double Reduction” policy launched in 2021 not only requires existing subject training institutions to be uniformly registered as non-profit organizations, prohibiting them from going public for financing, but also calling for the “rectification and cleanup” of those previously in violation [33]. Moreover, a large number of private basic education schools are also required to undergo de-privatization [34].

Second, in contrast to the insufficient marketization of public product supply, housing supply in China is often criticized for being overly marketized [35]. The housing reform that began in 1998 marked the start of marketization in China’s housing sector. Over the past two decades, the real estate industry has not only become one of China’s pillar industries, but urban land transactions relating to it have also become a significant source of fiscal revenue for local governments [36]. Under this context, vigorously promoting the marketization of the housing supply and driving up housing prices through various

forms of gentrification has become the main means for local governments to implement urban renewal and expansion [37,38]. For example, Wu et al. [39] conducted an in-depth examination of the rapid expansion of China's real estate market since the early 2000s, emphasizing the significant surge in housing prices, particularly after 2003. They underscored the impacts of policies, financial mechanisms, and speculative activities. Moreover, urban regeneration, especially the renovation and development of old districts, has played an indispensable role in propelling the commodification of the housing market. Concurrently, gentrification has fueled the commodification of the real estate market. Zhao et al. [40] discussed how the promotion of clustering facilities in education, science, culture, health, and other sectors in new urban centers has attracted high-income residents and upscale commercial activities, laying the groundwork for rising house prices.

As previously discussed, the unequal supply of public goods has a significant impact on both the real estate market and social inequality. However, in China, on the one hand, there is insufficient marketization alongside an even de-privatization of public product supplies in the education sector; on the other hand, there is excessive marketization of housing supply. What kind of socio-spatial effects could the combination of these two factors produce? Exploration in this regard is still insufficient. To answer this question, this paper proposes to introduce the concept of the “danwei” or work unit. Despite the market reforms that began in the 1980s, “danwei” gradually distanced itself from the daily lives of urban residents in China [41]. However, the uneven spatial pattern of many public goods and supplies, including education, still follows the “danwei” system [42]. During the planned economy era, China rigidly categorized urban residents into two main groups: cadres and workers. The public services enjoyed by these two groups were exclusively provided by their respective “danwei” [43]. Tracing back, a significant proportion of high-quality primary and secondary schools in China's major cities originated as institutions serving the children of cadres, primarily established for government officials, research institutions, and similar entities. Although post-market reforms have seen these “danwei” gradually relinquishing their responsibilities to deliver public goods to their employees and their children, the spatial distribution of public goods, resulting from the divisions created by these “danwei”, remains uneven [41,42]. Moreover, in recent years, these elite educational institutions have displayed a trend toward “group schooling”, expanding their scale through the merger of other schools. Furthermore, a study indicated that Chinese real estate developers, in an effort to promote their housing properties and elevate housing prices, have intentionally incorporated high-quality educational resources. This phenomenon is also referred to as “education-led gentrification” [44]. Thus, this paper argues that the marketization of housing and the uneven distribution of educational resources likely results in a resurgence of the social-spatial segregation of the “danwei” era, albeit in a more latent manner.

3. Study Area and Data Sources

Nanjing, the capital of Jiangsu, China, is known as the capital of the Six Dynasties of ancient China. The city has 11 districts with an area of 6600 km² and a total population of 9,423,400 (Figure 1). This study focuses on the main urban area of Nanjing City, examining the relationship between the school districts of public primary schools in Nanjing and housing prices, primarily for the following reasons. Firstly, as a regional metropolis, Nanjing is not like Beijing or Shanghai—the former being China's political hub and the latter its economic core. Instead, Nanjing better represents the general characteristics of major Chinese cities. Secondly, given its status as a regional metropolis, Nanjing boasts a wealth of educational resources, which provides a solid foundation for the conduct of this research.

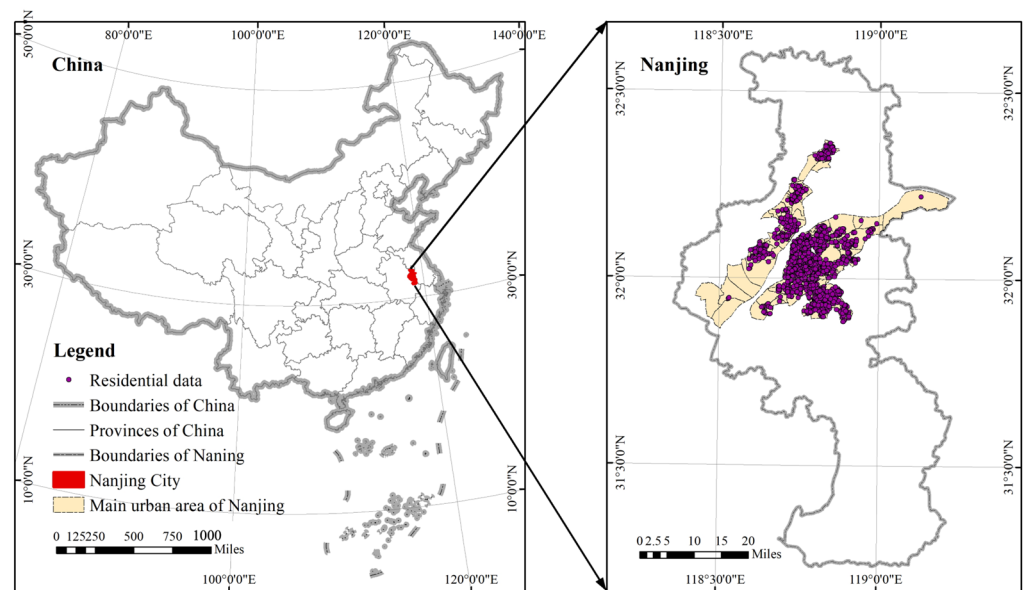


Figure 1. Location of study area.

According to the data provided by the Nanjing Education Bureau in 2018, 143 public primary schools were selected in downtown Nanjing. The distribution of the primary schools and their school districts can be obtained from the website of the Education Bureau of Nanjing City (<http://edu.nanjing.gov.cn/> (accessed on 2 February 2023)). Education quality varied by school. Although there is no official ranking for compulsory schools in Nanjing, people usually consider the admission rate of Nanjing Foreign Language School (the best middle school in Nanjing) as the criteria to evaluate the quality of schools. Accordingly, public primary schools in Nanjing are classified into four grades based on their acceptance rates: general (admission rate < 0.5%), moderate (0.5–2%), high (2–10%), and top (>10%). The relevant dataset was obtained from publicly available data sources [45]. The dataset encompasses data from 2018, detailing the enrollment rate (which, in the context of this paper, refers to the proportion of students who secured admission into Nanjing Foreign Language School) and school district locations of public primary schools in Nanjing’s main urban district. While the data are from 2018, the school district boundaries within Nanjing’s primary urban district have remained unchanged in subsequent years. Furthermore, based on our research findings, post-2018, in compliance with the directives of the Nanjing Education Bureau, individual primary schools stopped publishing their enrollment rates. As a result, parents typically continue to reference 2018 enrollment data as a primary criterion for school selection.

The research scope of this dataset covers the main urban area of Nanjing with a total area of 868.3 km², consisting of Xuanwu district, Gulou district, Qinhuai district, Jianye district, Yuhuatai district (northeastern part), Jiangning district (northern part) and Qixia district (western part). It should be clarified that this dataset encompasses the main urban district of Nanjing and excludes the broader surrounding counties. On one hand, this is because elite schools in Nanjing predominantly reside within the central urban district. On the other hand, in recent years, administrative boundary adjustments and school district realignments in the counties around Nanjing’s main urban district have been recurrent, which poses challenges for consistent research. Furthermore, housing prices in the counties surrounding Nanjing are typically below the average housing prices within Nanjing itself.

Residential data are provided by the Chinese Housing Market Platform (<https://www.creprice.cn> (accessed on 2 February 2023)), including information relating to the address, build year, housing types, average selling price, average rent, floor area ratio, and school districts. All data are updated to 2020. By geocoding the address, the point data for each residential community can be created with the help of ArcGIS Pro 3.0. To reduce the time

for data processing, I selected circular regions centered at Xinjiekou (the central business district of Nanjing) with a radius of 30 km as the study area. The reason for this is that the shortest linear distance from the urban core (Xinjiekou) to the municipal boundary is about 30 km. Additionally, the transportation system is mainly concentrated in this area. Finally, 4997 residential communities are covered in this study area. By removing the record with missing data, finally, there were 1638 records for residential communities with completed information. It is worth noting that, given how a single school's district encompasses multiple residential communities, these 1638 housing community data entries cover all primary schools within the study area. Moreover, the dataset of Points of Interest (POIs), extracted from amap.com (accessed on 31 August 2023), includes various factors that have the potential to drive differences in housing prices. These factors include but are not limited to, transportation, infrastructure, and amenities within the 1 km buffer zone around each community. This paper also collected information on the distances from each residential area to Nanjing's central business district (Xinjiekou) measured in kilometers. These data were applied to investigate the impact of distance on housing prices.

4. Variable Description and Methods

4.1. Variable Description

This paper selected the admission rate as an indicator to measure the educational quality of school districts in different residential communities (Table 1). The quality of the residential community itself is assessed through the floor area ratio, green space area, and the building area of the residential community [46]. For developers, the residential floor area ratio determines the proportion of land cost in total house pricing. A higher floor area ratio indicates the greater area available for developers to sell, subsequently leading to increased profits. On the part of homebuyers, a lower floor area ratio suggests a lower building density and fewer floors, coupled with higher greenery rates and greater distances between buildings, which contributes to a better living environment. Conversely, a higher floor area ratio comes with an increase in the population density within a unit land area, leading to issues such as traffic congestion and inadequate infrastructure, resulting in a decreased level of residential comfort.

Table 1. Variable description, quantization, and expected sign.

Classification	Variable	Variable Definition	Expected Sign
Dependent variable	Housing prices	Housing price is measured as the mean selling price per square meter of housing units within the same residential community (CNY).	
Independent variable	Admission rate	To gauge the quality of educational resources in school districts based on the admission rate of Nanjing Foreign Language School, as mentioned above, we categorized them into four tiers. The top-tier school districts, where schools have an admission rate exceeding 10%, were assigned a value of 4, while ordinary school districts, with an admission rate of less than 0.5%, were assigned a value of 1.	+
	Floor area ratio	The floor area ratio denotes the ratio of the total floor area of buildings in a certain location to the size of the land of that location, serving as a measure of residential density. A higher floor area ratio indicates increased residential density, often implying a lower quality of living.	—

Table 1. Cont.

Classification	Variable	Variable Definition	Expected Sign
Independent variable	Building area of residential community	The building area of residential communities can be utilized to gauge the scale of the community. A larger building area generally denotes a larger community or a high-rise structure. Given the gradual shift toward larger and taller residential complexes in major cities in China, a more expansive building area usually indicates a newer development within the community (m ²).	+
	Green space	Green space is measured using the greenery rate of a residential community; a higher greenery rate indicates a larger amount of public space in the residential area, which often translates to a higher quality of living and is generally inversely related to the floor area ratio.	+
	Distance to Xijiekou	The straight-line distance to Xijiekou can also be used; a longer distance indicates further proximity from the city center (km).	–
	POI density	The POI density serves to quantify the concentration of facilities, such as scientific, educational, cultural, health, and transportation amenities, within the 1 km buffer zone surrounding a residential community. A higher density generally indicates a higher level of convenience in daily living.	+

Generally speaking, in communities with a good living environment, the floor area ratio should not exceed 4.5 for high-rise residences (12–18 floors) and should not surpass 2 for multi-story residences (7–11 floors), with the greenery rate not falling below 30% [47]. Moreover, the building area of a residential community serves as an indicator to gauge the scale of the community. Concurrently, owing to the recent trend where residential communities in China’s major cities are increasingly evolving toward a larger scale and higher structures, a more extensive building area typically signifies a more recent development in the community.

The density of POIs surrounding residential communities typically reflects the concentration of various commercial and industrial service facilities in this area [11]. This commonly indicates the level of convenience for the work and daily life of residents in a community, thereby serving as a basis for understanding the impact of POIs on property prices. It should be noted that the housing prices referred to in this article denote the price per square meter of living space, not the total price of the house. Utilizing the price per square meter to gauge housing quality is a prevalent method amongst urban residents in China, and most studies employ this metric as a critical indicator to distinguish residential differentiation [48]. This approach helps to circumvent the influence of the housing area on pricing.

4.2. Spatial Autocorrelation Analysis Model

The spatial autocorrelation analysis aims to quantify the degree of similarity or dissimilarity in data and identify spatial patterns. Before constructing the regression model, it is important to measure the spatial autocorrelation of housing prices in the study area, which can reduce the overestimation of public service values due to spatial effects. If the variable has a significant spatial correlation, the geographically weighted regression model (GWR) can capture the spatial heterogeneity caused by spatial autocorrelation more effectively. Moran’s Index is the most commonly used method for examining global spatial autocorrelation. On the one hand, Moran’s Index can reflect not only positive correlations but also

negative ones: a capability that many other indices lack. On the other hand, Moran's Index offers numerous advantages when testing for spatial autocorrelation in the error terms of regression models. Furthermore, there is a wealth of research associated with it, facilitating comparative analyses. Moran's Index can be calculated using the following equation:

$$I = \frac{n \sum_{i=1}^n \sum_{j=1}^n w_{ij} (x_i - \bar{x})(x_j - \bar{x})}{\sum_{i=1}^n \sum_{j=1}^n w_{ij} (x_i - \bar{x})^2} \quad (1)$$

where n is the total number of features, \bar{x} is the mean housing price, x_i and x_j represent the housing price in the i th and j th space unit, and w_{ij} is the spatial weight matrix. Moran's Index can be measured using the Spatial Autocorrelation (Global Moran's I) tool in ArcGIS Pro 3.0.

4.3. Hedonic Prices Model

The hedonic housing prices model typically uses regression analysis to estimate the relationship between housing prices and their attributes. The traditional hedonic prices model sets attributes as explanatory variables and housing prices as the dependent variable. This method is commonly used to evaluate the implicit prices of variables in relation to the building characteristics, community characteristics, and location characteristics of the house. The hedonic prices model is a typical linear regression with housing prices, serving as the fixed dependent variable. This model can be constructed using the OLS tool in ArcGIS Pro.

4.4. Geographically Weighted Regression

Differing from OLS, geographically weighted regression (GWR) is a local regression method that captures the spatial non-stationarity of the housing price distribution. Thus, GWR was employed here to discern and quantify the spatial heterogeneity of educational capitalization and to further uncover the distributional features and the effect educational facilities have on housing prices. This model is shown as follows:

$$y_i = \beta_0(u_i, v_i) + \sum_{k=1}^k \beta_k(u_i, v_i) x_{ik} + \varepsilon_i \quad (2)$$

where y_i is the housing price for the i th sample point, (u_i, v_i) is the geographic location coordinate of the i th sample point, β_0 is a constant term, $\beta_k(u_i, v_i)$ is the k th regression parameter of the i th sample point, and ε_i is the random error term. This model can be constructed using the GWR tool in ArcGIS Pro (Figure 2).

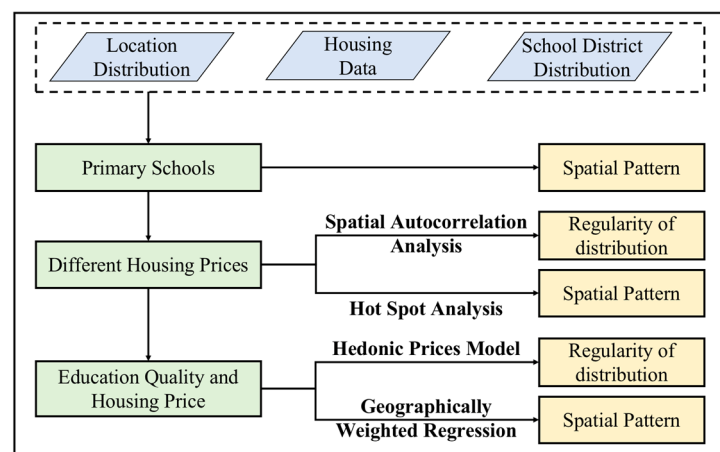


Figure 2. Schematic research framework.

4.5. Error and Uncertainty

By checking the admission rate of Nanjing Foreign Language School in the dataset, I found that only 260 (18%) public primary schools had an acceptance rate larger than zero. This could lead to the error of multicollinearity due to data redundancy since the software might consider the value of zero as a binary variable.

5. Result

5.1. Spatial Pattern of Primary Schools and Housing Prices

The choropleth map shows the clustering of top-level schools in the main urban area. Figure 3 shows that high-quality primary schools were mainly concentrated in the Gulou district and Xuanwu district.

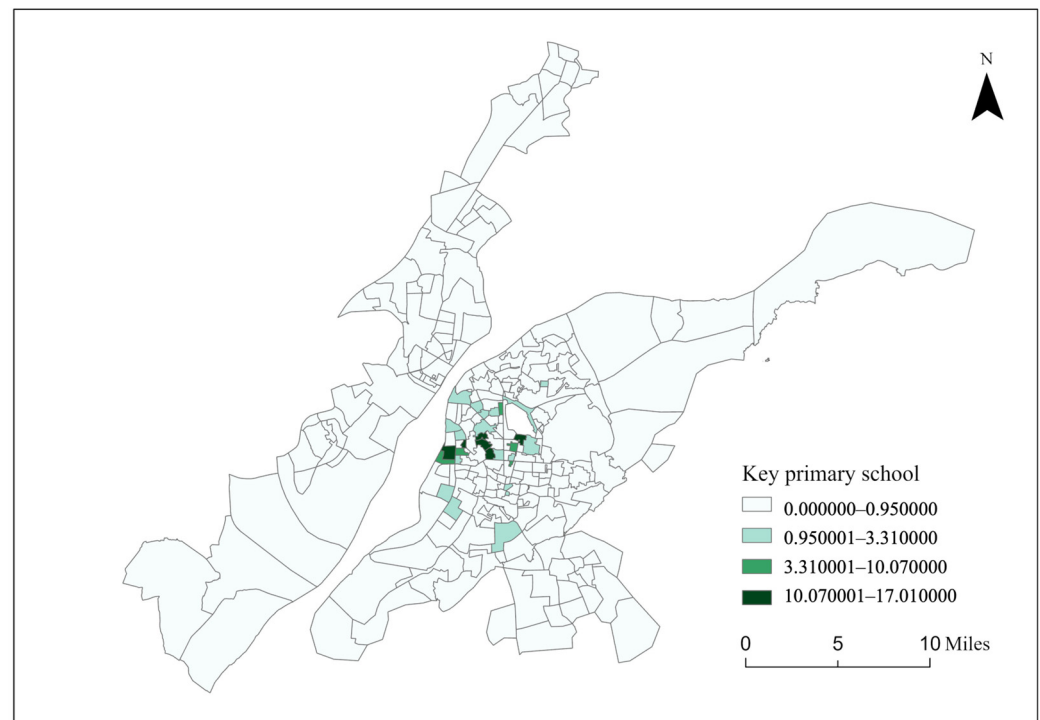


Figure 3. Spatial pattern of key primary schools.

Figure 4 highlights the clustering of housing prices in the main urban area, showing that high housing price areas are mainly concentrated in the Gulou, Jianye, Qinhuai, and Xuanwu districts.

From Figures 3 and 4, it is evident that areas with high-quality primary schools significantly overlap with regions with high property prices. This overlapping is primarily concentrated in the Gulou and Xuanwu districts of Nanjing, both of which are hubs for premium educational resources. However, regions with elevated property values also encompass the Jianye and Qinhuai districts. This can be attributed to Jianye housing, the key developmental zone of Hexi New City, while Qinhuai has stood at the forefront of urban renewal in Nanjing in recent years. The development of new urban areas and the revitalization of older cities have, to some extent, contributed to the surge in property prices. Concurrently, Nanjing's prestigious primary schools have begun extending their reach into these two districts through collaborative schooling and the establishment of branch campuses, which have also indirectly inflated housing prices.

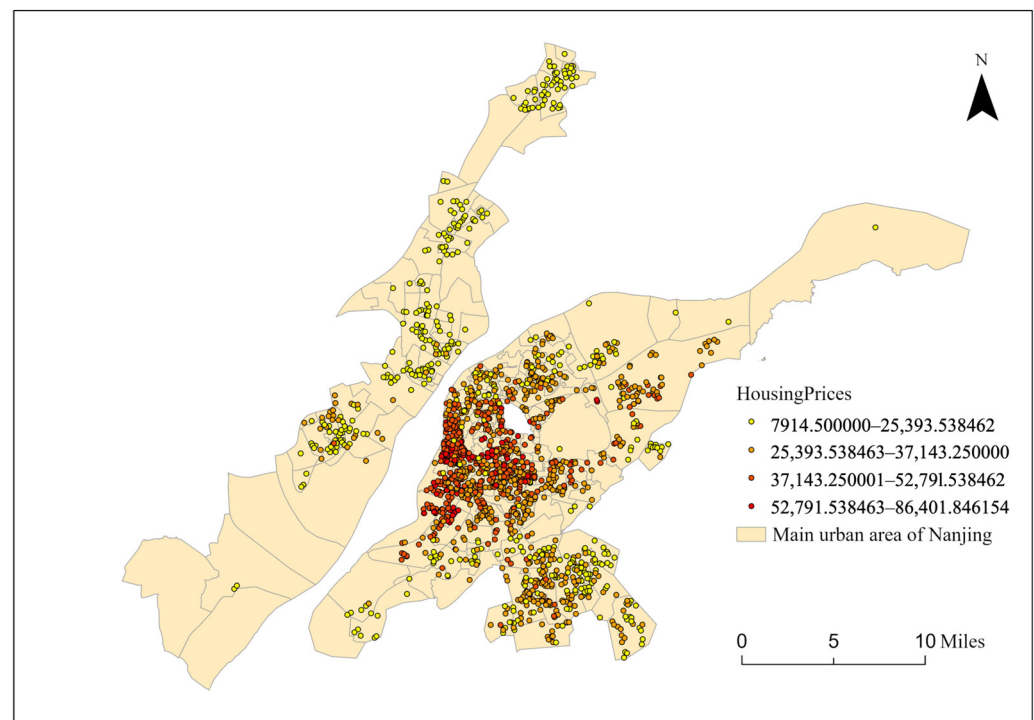


Figure 4. Spatial pattern of housing prices.

5.2. Spatial Autocorrelation Analysis

Moran's Index for housing prices is 0.297460 (Table 2). The positive Global Moran's Index indicates positive spatial autocorrelation, which means that residential communities with high housing prices are likely to cluster together, the same as cheap ones. The Z-score is 25.338294, and the p-value is 0.000000. This indicates that the data are statistically significant, and a random pattern is unlikely. Moran's Index further substantiates the aforementioned analysis. Although the Jianye and Qinhuai districts experienced a surge in property prices due to new urban development and old city renewal to some extent, there has also been a pronounced spatial correlation between high-quality schools and elevated housing prices.

Table 2. Results of Global Moran's I index analysis.

Statistical Indicators	Value
Moran's I	0.297460
Expected Index	−0.000611
Variance	0.000138
Z-score	25.338294
p-value	0.000000

5.3. Hedonic Prices Model

The result of the hedonic prices model shows that admission rates have had the greatest positive effect on housing prices. The adjusted R^2 is 0.535648, which indicates that almost 54% of the variance in housing prices can be explained using this model. The value of VIF for each variable is approximately equal to one, which means there is no multicollinearity among the independent variables. Among all the characteristic variables, the admission rate of Nanjing Foreign Language School has had the most significant effect on housing prices. A one percent increase in the admission rate leads to a rise in housing prices of CNY 2258.447 (Table 3).

Table 3. Results of hedonic prices model.

Variable	Coefficient	Std Error	t-Statistic	VIF
Intercept	32,531.7624	1128.27703	28.833134	
Admission rate	2258.44708	94.913682	23.794747	1.048997
Floor area ratio	−371.92243	147.909565	−2.514526	1.205783
Building area of residential community	0.001477	0.001203	1.227772	1.080423
Green space	182.464582	23.921567	7.627618	1.131632
Distance to Xinjiekou	−0.895349	0.034651	−25.83921	1.363253
POI density	1.050335	0.367236	2.860108	1.399053

In comparison, the impact of community green space and the floor area ratio on housing prices is considerably less. Specifically, for each additional unit, housing prices exhibit a marginal increase of CNY 182.465 and a decrease of CNY 371.922, respectively. The influence of residential community building areas on the unit price of houses is less significant. This could be attributed to the fact that in the past decade in Nanjing, the average building area of residential communities has surpassed 60,000 square meters, predominantly featuring high-rise buildings and large-scale communities. When purchasing homes, residents tend to give more consideration to the greenery level and floor area ratio within residential complexes rather than the size of the community itself.

Moreover, in fact, housing within premier school districts in Nanjing's inner city, even when constructed in the 1970s, has architecture and environments that have aged significantly and might even be unsuitable for habitation. However, their property values remain substantially higher than newer and better-quality housing in neighboring school districts. As a result, it can be inferred that when urban residents select housing for their families, the quality of the school district associated with a residence takes precedence. Families, within their means, prioritize the reputation of the school district over living quality.

The influence of the distance to the central business district and POI density on housing prices is even smaller. Due to rapid urbanization, the surrounding amenities of the residential area and the coverage of the transportation system do not exhibit significant variations. Convenient public transportation has also reduced buyers' demand to live in the city center.

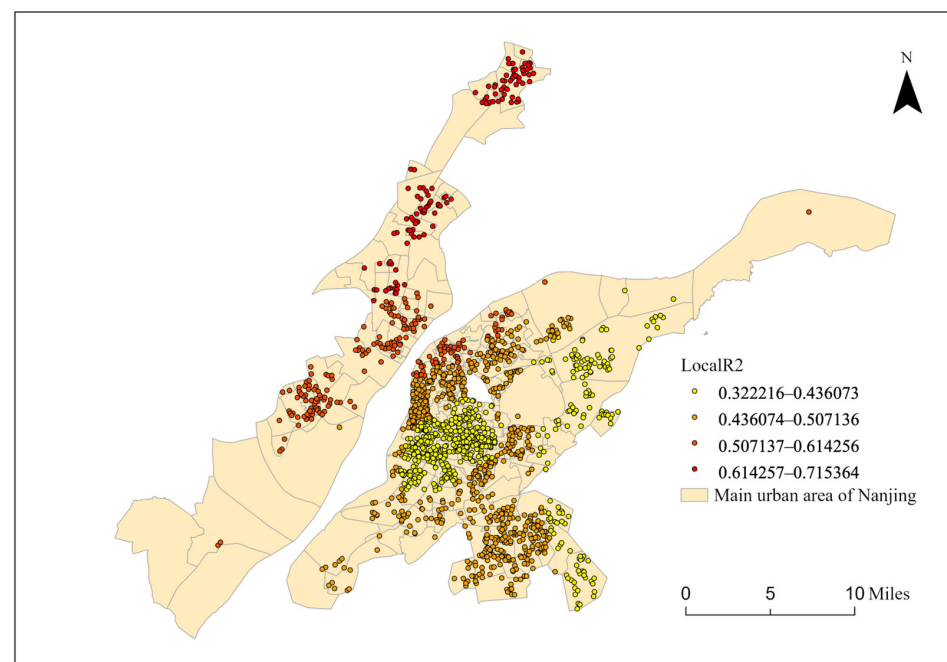
5.4. Geographically Weighted Regression (GWR)

The GWR model, with its strength in capturing spatial heterogeneity and local variations, exhibits a significantly enhanced model fit compared to the hedonic prices model. It explains 58.0292% of the total variance in housing prices, which is a 4.46% improvement from the hedonic prices model. Therefore, GWR provides a more nuanced understanding of the influence of educational factors on housing prices across different geographical locations. Moreover, the GWR model outcomes further validate the significant impact of the admission rate of Nanjing Foreign Language School on housing prices: a trend similar to the hedonic prices model. However, a key distinction lies in GWR's ability to provide localized insights. It reveals how a one percent increase in the admission rate influences housing prices differently across various spatial locations, reflecting an average rise of CNY 2179 (Table 4). This information could be invaluable in identifying specific areas where the influence of education on housing prices is more pronounced.

Table 4. Results of geographically weighted regression.

Variable	Minimum	Maximum	Mean	Standard Deviation
Admission rate	2030.522695	2750.093888	2179.499594	134.763785
Floor area ratio	−1960.273441	−36.47181	−388.322439	166.271963
Building area of residential community	−0.00123	0.0013342	0.005477	0.003591
Green space	73.980219	229.239176	195.015252	25.692198
Distance to Xinjiekou	−2.012419	−0.535973	−1.33553	0.332387
POI density	−1.424806	3.72791	−0.0401	1.041125

The map of locally adjusted R-squared shows that the highest local R-squared values are present in downtown areas, such as Pukou and Luhe districts, which means buyers' preferences are adequately explained using the GWR model in these regions (as shown in Figure 5). Since this region merely has no top-level public primary school, disparities in school quality are not significant. However, if high-quality educational resources were introduced into this region, the capitalization of education might become extremely high, given the limited access to high-level educational resources. By contrast, in the city center, in areas such as Gulou, Jianye, and Qinhuai, the concentration of high-quality educational resources not only alleviates the supply-demand contradiction of premium educational resources but also, due to their proximity to the city center, the impact of distance to Xinjiekou and the density of POIs becomes less prominent. Furthermore, within the GWR model, the influence of POI density on housing prices has even transitioned from positive to negative. This could be due to the fact that a higher density might imply traffic congestion or that an overly high density of commercial facilities could disrupt the residential environment, thereby affecting the choices of potential buyers adversely. Concurrently, this also showcases the disparity between the GWR model and the hedonic model, with the former being more adept at capturing the specific impacts of geographical locations on housing prices.

**Figure 5.** Spatial distribution of GWR performance.

In conclusion, the GWR model, through its inherent adaptability to local variations and its flexibility in identifying spatial patterns, offers a more realistic and nuanced under-

standing of the impact of educational resources on housing prices. This localized approach allows us to explore the profound capitalization effect of educational resources more accurately, thus providing researchers and policymakers with critical insights that the hedonic prices model might overlook.

6. Discussion: Rebirthing Social Segregation in Danwei through School District Division

6.1. Continuity and Historical Legacy of the Danwei in the Field of Education

Quantitative analysis shows that high-quality educational resources in Nanjing are primarily distributed in the Gulou and Xuanwu districts: a pattern that is essentially a continuation of the city's historical social spatial differentiation. Before 1949, Nanjing's Gulou and Xuanwu districts were the concentrated areas of the central government, Jiangsu provincial government and Nanjing municipal government, as well as a significant number of higher education institutions. After 1949, even though Nanjing was no longer China's capital, the provincial government, city government, and universities remained clustered in this area. During the planned economy era, China's social organization revolved around "danwei", or work units, wherein the unit was responsible for housing, medical care, and even the education and employment of their employees' children [43,49]. Consequently, some of the best primary schools in Nanjing, including Langya Road Primary School, Lasa Road Primary School, and Lixue Primary School, were formerly "cadre children's schools" which provided educational services to the children of government officials and intellectuals working in nearby universities [50]. In fact, not only are primary schools concentrated in these two regions, but they also house the finest educational resources at all stages, from kindergarten to university. As a result, the residents of Nanjing generally believe that living in these areas can provide immense convenience, facilitating a journey from birth to employment. This is also a spatial consequence of the social stratification among three major social classes—officials, workers, and farmers—during the era of China's planned economy [51].

Even though these former "cadre children's schools" have opened their doors to all citizens of Nanjing after market-oriented reforms, access to these top-tier schools is still primarily dictated by the strict implementation of a school district system. This system essentially allows admission into these schools through the purchase of housing within these designated districts. Consequently, despite educational resources being public goods, they can be capitalized by the housing market, leading to a significant appreciation effect on surrounding properties. The market screening mechanism thus excludes the majority of ordinary urban residents from these public goods, resulting in severe social inequality. In fact, this inequality tends to accumulate as educational years increase. For example, students from Langya Road Primary School, Lasa Road Primary School, and Lixue Primary School consistently rank among the top three in terms of admissions into Nanjing Foreign Language School. Furthermore, in 2018, 96% of students from Nanjing Foreign Language School were admitted to the first tier of universities (admission to the first tier usually implies being admitted to the top 100 universities in China), while the same year's proportion of first tier university admissions across Jiangsu province was merely 25%.

6.2. Revival of the Danwei and Its Spatial Penetration

As mentioned above, after China's market-oriented reforms, public goods such as housing, medical care, and education, which were previously the responsibility of the "danwei", were predominantly supplied by the market, and it appeared that the "danwei" system was consequently disintegrated. However, former employees of the government and universities still enjoy certain competitive advantages. For example, housing within high-quality school districts, which was largely a welfare allocation by the government and universities during the planned economy era, has been privatized at extremely low costs due to market reform [52,53]. In other words, even after market reforms, government and university employees can still ensure that their children have access to high-quality

educational resources through the school district system. Furthermore, with the continuous increase in housing prices, not only are low-income families excluded from these high-quality school districts, but these former “danwei” households also benefit from a substantial appreciation in their property value. In fact, after the children of these former “danwei” employees enter high-quality primary schools, these families generally sell their properties at high prices, and those who move in are affluent urban families. Research indicates that these incoming families still consist of employees from government entities, universities, and state-owned enterprises, which are units in China that have relatively higher incomes, better benefits, and stability [54,55]. The advantage of an excellent education can be accumulated, giving children from elevated economic and social backgrounds a greater chance of achieving desirable careers and better social status [7,56].

In addition, these high-quality primary schools have continued to expand in the era of the market economy through collaborative education and the establishment of branch schools. In the process of Nanjing’s urbanization, many district governments have also provided financial or land support to attract these excellent educational resources for regional development. For example, since 2002, Jianye District in Nanjing has introduced a series of renowned school resources, establishing schools like the Xincheng Middle School, which is affiliated with Nanjing Normal University, the Hexi Branch of Jinling High School, Zhonghua Middle School, the Hexi Branch of Nanjing Foreign Language School, and Zhiyuan Foreign Language Primary School. Moreover, it continues to absorb new renowned school resources through “group schooling”, gradually achieving full coverage from primary to high school, which has greatly driven an increase in housing prices. This has made Jianye District, where Nanjing’s Hexi New Town is located, a new gathering place for affluent families in Nanjing. Therefore, in other words, although the “danwei” system was dismantled institutionally, it has also been reborn through the school district system.

7. Conclusions

This article has examined the effect of educational capitalization on housing prices in Nanjing based on 1441 pieces of housing data. The main conclusions are as follows:

- (1) The results of the hedonic price and spatial econometric models verify the significant positive effect of school quality on housing prices. The enhanced adjusted R-squared value of the GWR model highlights the spatial heterogeneity of educational capitalization and further supports the idea that there are notable variations in the distribution and quality of elementary educational resources.
- (2) The locked-in urban pattern determines the distribution characteristics of residents and the allocation of public resources. The high concentration of quality educational resources is both a continuation of the history of “danwei” and the result of the long-term accumulation of urban spatial differentiation patterns.
- (3) The close link between the admission rate of top junior high and housing premiums is the most intuitive feature of capitalization’s effect on education. The remarkable housing premium induced by the rising quality of school districts increases the inaccessibility of high-quality education and further exacerbates social solidification. At the same time, the spatial differentiation of the “danwei” society is also reconstituted within the school district system.

The effects of capitalization resulting from the uneven distribution of high-quality educational resources in China have led to a premium on housing in desirable school districts, thereby creating significant inequalities within China’s urban landscape. This inequality not only exacerbates residential segregation within the city, re-establishing housing as a symbol of class differentiation, but also allows urban advantaged families to promote class reproduction through housing. Addressing disparities in school quality is a crucial approach to mitigating these societal challenges. As previously mentioned, allocating public education resources based on proximity to schools is a predominant model globally. While many international studies critique the social inequalities stemming from this model, these disparities do not seem as pronounced as in China. Perhaps

China can draw insights from experiences abroad. For instance, Japan's teacher rotation system has significantly balanced the distribution of educational resources. Encouragingly, pilot programs of this approach have already been initiated in several Chinese cities. Observing the case of Nanjing, housing prices in school districts have begun to decrease over recent years.

In conclusion, it is imperative to highlight that this study is primarily grounded in the case of Nanjing, China, emphasizing the implications of education—a public good—on urban housing prices and residential inequality. Our research resonates with the somewhat contentious perspective proposed by Saunders in 1984, which posits that the ownership of public goods like housing, transportation, education, and healthcare delineates a class divide between those who possess and those who do not [57]. Currently, against the backdrop of the financialization of housing, real estate is emerging once again as a pivotal determinant of class stratification [3]. However, housing is more than just a living space; the accessibility and potential ownership of various public goods inherent to it also influence its pricing. Focusing solely on education as a public good undoubtedly has its limitations, underscoring the necessity for more comprehensive research in subsequent studies.

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