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# *An Empirical Analysis of the Relationship Between Shopping Malls and Surrounding Property Prices: Evidence from Xi'an, China*

**Ao Tan**[1,a,*]

[1]*Faculty of Social Sciences, University of Southampton, Southampton, SO17 1BJ, United Kingdom*
*a. at2g20@soton.ac.uk*
**corresponding author*

***Abstract:*** Shopping malls have become integral components of urban areas in China, and their influence on the local economy and real estate markets is substantial due to the country's rapid urbanisation and economic expansion. This study examines the price premium of properties in Weiyang District, Xi'an, China that are affected by their proximity to malls. The study analyses a comprehensive dataset of 10,175 transaction prices for second-hand homes in 12 administrative zones of Weiyang District from September 2017 to June 2021 based on the hedonic price model and ordinary linear regression. The findings indicate that the value of properties in proximity to local shopping malls is notably enhanced; however, this positive effect fades as the distance from the malls increases. This study addresses a research gap in the influence of shopping centres on property prices in the Weiyang District. It offers valuable insights for local urban planners, property developers, and investors. These results have the potential to enhance the value of property and optimise urban development. The research methodology includes statistical methodologies to guarantee the accuracy of the findings and stresses the necessity of strategic urban planning to maximise the advantages of commercial amenities. To develop a more comprehensive understanding of the dynamics between commercial amenities and property values, future research might investigate the longitudinal impacts over a longer period and incorporate supplementary variables, such as socio-economic factors and real estate developments.

***Keywords:*** Hedonic Price Model, Property Price, Shopping Mall, Price Premium.

## 1. Introduction

Shopping malls are large, indoor commercial complexes that include a wide range of retail establishments, restaurants, entertainment venues, and other services, providing a complete shopping experience. Typically, these complex malls are home to a variety of businesses and play a significant role in modern urbanization.

However, nowadays, shopping malls are experiencing severe challenges. Firstly, the widespread of e-commerce has led many consumers to opt for online shopping platforms. Furthermore, customers now tend towards experiential purchasing rather than traditional conventional retail. Also, the mall situation is being worsened by the excessive competition in retail centres [1].

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To overcome the above obstacles and attract more customers, most retail malls are shifting from conventional retail to experiential retail, i.e. with attractive interior designs and diversified anchor tenants. As a result, recent malls provide consumers with a diverse range of entertainment, food, and leisure events, which are natural attractions to individuals [2]. Consequently, as Wilhelmsson and Long assumed, people would prefer to live near developed malls to get more convenient and delightful shopping experiences [3]. Therefore, it is rational to deduce that the prices of houses are positively impacted by their proximity to shopping centres.

This study aims to examine the influence of the proximity of shopping malls on home transactional prices in Weiyang District, Xi'an. Meanwhile, providing urban planners, real estate builders, and investors with valuable insights on how to optimize property values in the study area.

The subsequent sections are organized as follows. Section 2 provides a literature review on the impacts of shopping malls on property values. In Section 3, data, variables, and model specifications are described. The findings derived from the study are given and analyzed in Section 4. The conclusions are provided in Section 5.

## 2. Literature Review

The modern shopping centre was developed in the suburbs of the USA after the Second World War, driven by returning veterans, the influx into the suburbs and the baby boom. Retailers found these centres ideal, which led to widespread development in the 1970s [4]. As Rajagopal indicated, retail centres have become an essential component of urban life now, serving not only as commercial hubs but also as social and recreational spaces [5]. Moreover, they have a significant economic influence by providing job opportunities, producing tax revenue, and promoting economic growth in nearby areas.

The recent challenges faced by commercial malls are complex and interdependent [6]. These problems have resulted in the development of new patterns in shopping malls. One notable development is the shift towards experiential shopping, where malls are including more entertainment, cuisine, and lifestyle events to attract and keep shoppers [6]. Another emerging trend involves the strategic planning and placement of modern shopping malls near mixed-use buildings. This ensures an effortless link between residential, commercial, and recreational spaces [7]. These multifunctional spaces provide an innate appeal to individuals [3]. Therefore, living near these centres provides easy access to a variety of leisure, social and cultural experiences, which enhances the overall life quality. In conclusion, malls would theoretically have a price premium on the property in the surrounding area [3]. Also, homeowners who own houses near malls can expect higher property values, which meets their investment goals.

Academics worldwide have used quantitative methods to study how retail malls affect nearby property prices. Zhang et al. used empirical difference-in-difference in the Netherlands [8]. They found that property prices near renovated shopping centres rose 1.43% following rebuilding. A spatial hedonic model by Yu et al. estimated how much Tennessee households value living near a shopping mall [9]. Knoxville's largest mall, Turkey Creek Shopping Centre, benefits house prices of $0.91-0.96 million within 3-20 minutes via driving.

Research in China also applied similar methods and reached comparable conclusions. Zhang et al. used 2011–2015 housing price data to divide Hangzhou, China, into nine blocks and use hedonic pricing and the price gradient technique [10]. A retail center in the neighborhood boosts home values in nearby blocks, according to the study. The positive effect decreased by 0.109% as residences moved farther from shopping centers. Wen and Tao examined Hangzhou's housing statistics in 2003, 2008, and 2011 [11]. The researchers examined six administrative districts using classic hedonic pricing and spatial models. The authors found that adding a kilometre to three retail centres decreases house prices by 4.055%, 1.120%, and 0.790%.

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However, despite Xi'an's importance as a northwest Chinese urban core, shopping complexes' effects on property values have been overlooked. This study examines how shopping centre proximity affects Weiyang District home values. It also fills the research gap with empirical proof in Weiyang District. This research's findings could also inform governmental and private-sector decision-making. Policymakers may use the results to plan and grow cities. Property developers and investors can use the information to improve target selection and investment strategies [12].

## 3. Methodology

### 3.1. Study Area

Xi'an, the administrative centre of Shaanxi province, provides a geographic background for this research. Xi'an has grown significantly in recent decades as the heart of the Silk Road Economic Belt in the 21st century [13]. This study focuses on Weiyang District, a major part of Xi'an. According to the Xi'an Bureau of Statistics, Weiyang District encompasses 263 square kilometres with a population of 980,000 in northeastern Xi'an. Due to population expansion and business relocation, its housing market has grown significantly. Weiyang District's economic and housing importance in Xi'an justifies its selection as the research area.

### 3.2. Data Selection

The dataset includes 10,175 Weiyang District historical cross-sectional second-hand transactions from September 2017 to June 2021, provided by a local real estate agency in Xi'an, Lianjia.com, and Jiatianxia.com. Figure 1 shows the Weiyang District Government's administrative boundaries and the research area separated into 12 regions to help readers understand.

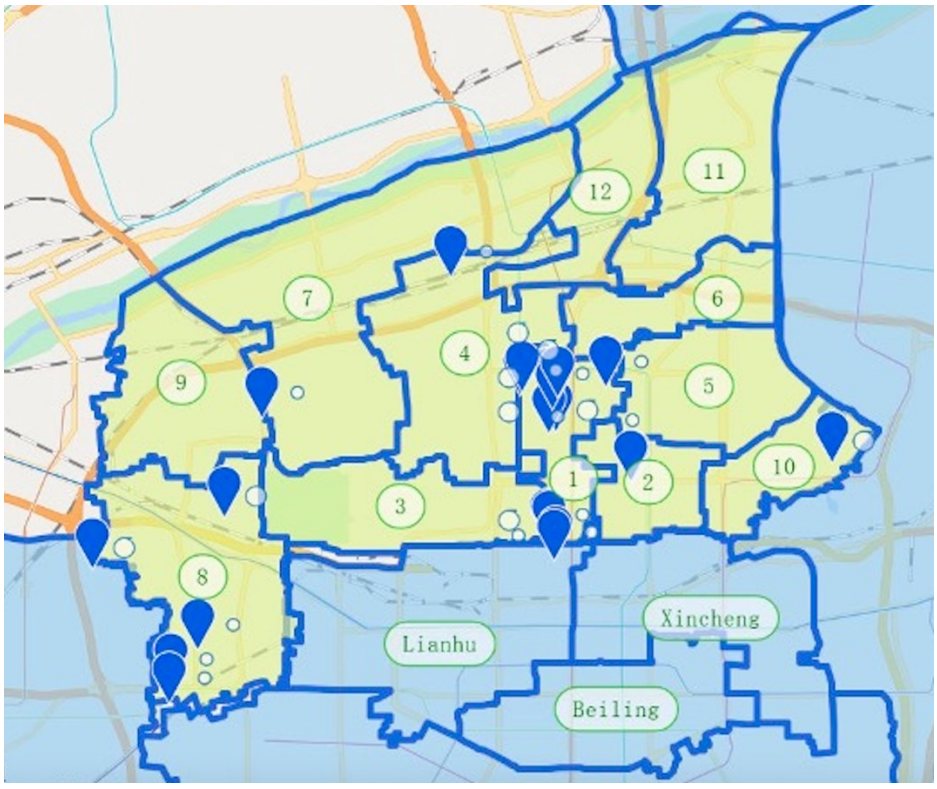


Figure 1: Zone 1 to Zone 12 and all the shopping malls in Weiyang District.

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To start with, household transaction data selection is considered from two perspectives. First, many Weiyang District structures were developed after 2016, resulting in a lack of housing transaction data before 2017. Also, local regulations prevent access to transaction pricing data after June 2021. Thus, this study evaluated data from September 2017 to June 2021. Second, the local agency statistics show that newly built residential buildings in Weiyang District in 2017-2021 have mostly been developed in 131 municipalities in Zones 3–5, leaving Zones 1 and 2 vacant. In contrast, second-hand housing sales are evenly distributed throughout 357 communities from Zone 1 to Zone 12. Thus, using second-hand sale data ensures a more accurate representation of housing expenses in the study area [10].

In the second place, all 24 Weiyang District shopping mall information was obtained from fangtianxia.com. Figure 1 shows where these malls are located with blue markers. Supermarkets, city plazas, regional retail parks, shopping centres, city malls, outlet malls, regional malls, and theme parks were all included in this study.

### 3.3. Variable Definition

As shown in Table 1, properties' structural, neighbourhood, and location characteristics were included as independent variables for hedonic pricing analysis. In general, structural characteristics evaluate physical characteristics. Neighbourhood characteristics show local quality and identity. Geography and accessibility are location characteristics [3].

The distance to a shopping mall is calculated using the Euclidean distance, which measures the straight-line distance between two coordinates. The formula is as stated: $distance = \sqrt{(q1 - p1)^2 + (q2 - p2)^2}$, where $q1$ and $q2$ are retail mall coordinates and $p1$ and $p2$ are dwelling coordinates [3].

Table 1: Variable description for dwelling characteristics.

| Characterization classification | Characterization variable | Quantitative basis |
|---|---|---|
| Structure characteristics | size | Residential building's area in square metres. |
| | room | Number of rooms in the house. |
| | floorno | The floor/level of the home, with the ground floor being considered the first floor, is partitioned into four levels: The different levels of a building are categorised as follows: basement (grade 1), lower floors (grade 2), high-rise (grade 3), and middle level (grade 4). |
| | tfloor | The total number of floors in the building, excluding the ground floor. |
| | bage | Duration: A building erected in 2021 is one year old. |
| | orientation | The house's orientation is categorised into four levels: West orientation (grade 1), East orientation (grade 2), North orientation (grade 3), and South orientation (grade 4). |
| | decoration | The level of adornment in the residence is classified into three tiers: vacant (grade 1), minimally adorned (grade 2), and exquisitely adorned (grade 3). |
| | structure | The building housing the house is divided into four levels: a single-storey house (grade 1), a tower building (grade 2), a combined slab and tower building (grade 3), and a building constructed with slabs (grade 4). |

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Table 1: (continued)

| | | |
|---|---|---|
| Location Characteristics | dshop | The Euclidean distance from the community to a shopping centre: estimates the shortest distance in kilometres to the nearest shopping mall among all the included shopping malls. |
| | dcbd2 | The Euclidean distance from the community to Saigao New Block (the CBD of Weiyang District, Xi'an City) (km). |
| | subway | The proximity of the underground acts as a binary variable: subterranean stations located within one kilometre of the settlement are assigned a score of 1, while those outside this range are assigned a score of 0. |
| Neighbourhood characteristics | shop3km | The number of shopping centres located within a three-kilometre radius of the flat: a binary indicator that takes the value of 1 if the flat is located within a one-kilometre radius of a shopping mall, and 0 otherwise. |
| | bshop1km | Bshop1km is a binary variable that equals 1 if the residence is within a radius of one kilometre from a shopping mall, otherwise, it is 0. |
| | bshop800m | The variable Bshop800m is a binary indicator that takes the value of 1 if the flat is located within a distance of 800 metres from a shopping mall, and 0 otherwise. |
| | bshop500m | The variable Bshop500m is a binary indicator that takes the value of 1 if the distance between the flat and the shopping centre is less than 500 metres and 0 otherwise. |

### 3.4. Modelling

Hedonic pricing is a statistical model that links property values ($Y$) to property characteristics ($X$). The equation is $Y = \beta X + \alpha$ [14]. However, different hedonic models exist, including linear, linear-log, log-linear and double-log models [15]. After testing these four forms, the study chooses the log-log relation since it explains the same variables best. The basic model (OLS) used in this research is $lnP = \alpha_0 + \alpha_1 lnS + \beta_i N_i + \gamma_j lnL_j + \varepsilon_i$, where $\alpha_0, \alpha_1, \beta_i \; and \; \gamma_j$ are the coefficients. $S$ means the structural characteristics, $N_i$ represents neighbourhood characteristics, $L_j$ is location the characteristics, and $\varepsilon_i$ is the random error term.

## 4. Empirical Results

### 4.1. Descriptive Statistics

Table 2 summarizes the characteristics of the properties in the study area (Second-hand housing transaction data collection period: September 2017 - June 2021, N=10175). The average transaction price is 132,085 RMB, with the high standard deviation indicating a wide range. The buildings generally have 25 storeys, indicating that they are mostly mid-rise to high-rise buildings. Most properties are relatively new, being built within the last decade. About 15.3% of properties are located near subway stations, indicating that some of them are well connected to public transport. The distance to the CBD varies, with properties ranging from very close to the city centre to suburban locations.

Key features indicate the proximity and density of shopping amenities in the region. Most residences are close to a shopping mall. Yet, the distance to a mall and the number of malls within 3 km vary widely, showing large differences in shopping proximity and density. More specifically, the

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density of malls is low (less than one mall) within a 500m, 800m and 1km radius, suggesting that while some dwellings are close to retail areas, others are further away.

Table 2: Descriptive statistics of second-hand housing transaction data.

| Variable | Abbreviation | Mean | Std. Dev. | Min |
|---|---|---|---|---|
| Total price | tprice | 132.085 | 53.841 | 14 |
| Total number of rooms | room | 3.934 | 1.138 | 1 |
| A | size | 207.683 | 316.332 | 21.65 |
| Total floors of the building | tfloors | 24.791 | 9.547 | 1 |
| Age of building | bage | 9.9 | 4.294 | 1 |
| Orientation of house | orientation | 3.211 | 1.113 | 1 |
| House decoration degree | decoration | 2.464 | .665 | 1 |
| Floor/ level of the house | floorno | 3.106 | .799 | 1 |
| Structure of building | structure | 3.102 | .654 | 1 |
| Subway nearby | subway | .153 | .36 | 0 |
| Distance from community to CBD (km) | cbd2 | 3.945 | 3.032 | .162 |
| Distance from community to mall (km) | dshop | 1.648 | 1.068 | .036 |
| MallsNo around community within 3km | shop3km | 7.009 | 4.683 | 0 |
| MallsNo around community within 500m | shop500m | .260 | .834 | 0 |
| MallsNo around community within 800m | shop800m | .641 | 1.568 | 0 |
| MallsNo around community within 1km | shop1km | .894 | 1.928 | 0 |

Furthermore, the correlation matrix (Table 3) shows correlations between the distance to a shopping mall and the CBD and the malls number of shopping centres within 3 km. The strong negative correlation between the distance to a mall and the number of malls within 3 km ( -0.619) shows that houses closer to a large shopping centre have fewer malls within 3km. This pattern is indicative of urban planning strategies. Besides, a relatively positive correlation between distance to a mall and distance to the CBD (0.513) shows that houses further away from the CBD are closer to suburban malls and serve as local commercial centres. These links show the distribution and planning of commercial facilities in different locations.

Table 3: Correlation matrix of key variables.

| Variables | tprice | room | size | tfloors | bage | subway | cbd2 | dshop | shop3km |
|---|---|---|---|---|---|---|---|---|---|
| tprice | 1.000 | | | | | | | | |
| room | 0.688 | 1.000 | | | | | | | |
| size | 0.196 | 0.208 | 1.000 | | | | | | |
| tfloors | 0.114 | -0.089 | -0.006 | 1.000 | | | | | |
| bage | -0.350 | -0.089 | -0.060 | -0.628 | 1.000 | | | | |
| subway | 0.008 | -0.000 | -0.003 | 0.004 | -0.001 | 1.000 | | | |
| cbd2 | 0.044 | 0.145 | 0.034 | 0.016 | -0.269 | 0.003 | 1.000 | | |
| dshop | -0.025 | 0.105 | 0.001 | 0.003 | -0.138 | -0.002 | 0.513 | 1.000 | |
| shop3km | -0.029 | -0.121 | -0.016 | -0.001 | 0.239 | -0.002 | -0.723 | -0.619 | 1.000 |

## 4.2. Multicollinearity Results (VIF)

The study utilizes the variance inflation factor (VIF) as shown in Table 4 to identify the presence of multicollinearity in the regression analysis. As a result, the study reveals the existence of moderate to

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strong multicollinearity in the distance to the nearest shopping mall and CBD, the number of malls within an 800-meter and one-kilometre radius. The existence of multicollinearity is expected because of the mutual connection between these variables. For example, properties in proximity to a certain shopping mall may also be near other commercial amenities, resulting in a convergence with other location-related factors. On the other hand, the variable subway exhibits no substantial multicollinearity, which suggests that underground access is separate from other factors in the area.

Table 4: Variance inflation factor.

| Variable | VIF | 1/VIF |
|---|---|---|
| lndshop | 4.905 | .204 |
| lncbd2 | 4.494 | .223 |
| bshop800m | 4.126 | .242 |
| bshop1km | 3.629 | .276 |
| shop3km | 3.514 | .285 |
| bshop500m | 2.63 | .38 |
| lntfloors | 1.902 | .526 |
| lnbage | 1.85 | .541 |
| lnstructure | 1.398 | .715 |
| lnroom | 1.254 | .797 |
| lnorientation | 1.154 | .866 |
| lnsize | 1.138 | .879 |
| lndecoration | 1.032 | .969 |
| lnfloorno | 1.002 | .998 |
| subway | 1.001 | .999 |
| Mean VIF | 2.335 | . |

## 4.3. Regression Analysis

The regression results shown in Table 5 provide important insights into the impact of shopping malls on property prices in Weiyang District, Xi'an, China. Three models, specified in column (1) to (3) respectively, were used to analyse this relationship, each containing different variables relating to the proximity and number of shopping malls.

Table 5: Regression results.

| Variables | (1) | (2) | (3) |
|---|---|---|---|
| lnroom | 0.766*** | 0.764*** | 0.765*** |
| | (113.44) | (113.22) | (113.23) |
| lnsize | 0.0309*** | 0.0308*** | 0.0310*** |
| | (11.21) | (11.18) | (11.26) |
| lntfloors | 0.124*** | 0.118*** | 0.118*** |
| | (23.33) | (22.23) | (22.14) |
| lnbage | -0.191*** | -0.199*** | -0.198*** |
| | (-30.31) | (-31.88) | (-31.08) |
| lnorientation | 0.0421*** | 0.0417*** | 0.0423*** |
| | (8.57) | (8.47) | (8.60) |
| lndecoration | 0.0800*** | 0.0788*** | 0.0775*** |
| | (12.16) | (11.99) | (11.75) |

DOI: 10.54254/2754-1169/94/2024OX0141

Table 5: (continued)

| | | | |
|---|---|---|---|
| lnfloorno | 0.00440 | 0.00482 | 0.00556 |
| | (0.56) | (0.61) | (0.70) |
| lnstructure | 0.164*** | 0.161*** | 0.164*** |
| | (14.45) | (14.14) | (14.42) |
| subway | 0.0124* | 0.0123* | 0.0120* |
| | (2.04) | (2.04) | (1.99) |
| lncbd2 | -0.0487*** | -0.0413*** | -0.0684*** |
| | (-11.28) | (-8.07) | (-17.63) |
| lndshop | -0.0239*** | | |
| | (-5.63) | | |
| shop3km | | 0.00478*** | |
| | | (5.98) | |
| bshop500m | | | -0.0393*** |
| | | | (-3.86) |
| bshop800m | | | 0.0553*** |
| | | | (5.01) |
| bshop1km | | | -0.0334*** |
| | | | (-3.74) |
| Constant | 3.449*** | 3.443*** | 3.500*** |
| | (89.43) | (89.06) | (89.20) |
| Adjusted $R^2$ | 0.685 | 0.686 | 0.685 |

Note: t-statistics in parentheses; * p < 0.05, ** p < 0.01, *** p < 0.001.

Model 1 includes the logarithm of the nearest shopping centre and other residential variables. The coefficient for distance to a shopping centre means that the property price decreases by 3,154.83 RMB for every 1 increase in distance to the nearest shopping centre. The decline in property prices with increasing distance illustrates that convenience is a key determinant of property value. Several reasons support this claim. For example, properties near retail areas are attractive due to their diversity of amenities and services. Shopping centres include restaurants, entertainment, and other amenities that improve the lifestyle and raise property values. This result suggests that urban planners should consider integrating shopping centres into residential areas to increase property values. Also, investors should select properties near shopping areas to enhance their investment potential.

Model 2 shifts the focus to the number of shopping malls within a 3-kilometre radius rather than proximity to the nearest shopping centre. The coefficient for the variable the number of malls within 3km means each additional shopping centre within this radius increases property prices by 631.37 RMB. This model highlights the positive cumulative effect of multiple malls on property values. Multiple shopping centres increase property prices due to their convenience, appeal to varied demographics, economic impact, shopping experience, infrastructure, and community. This result suggests that developers should aim to create clusters of malls to maximise the positive impact on surrounding properties. Also, investors should consider mixed-use projects that combine residential, commercial and retail space. Such projects create a self-sustaining community that increases property values and attracts long-term tenants. In summary, clustering shopping centres not only improves the shopping experience but also contributes to increased footfall, benefiting both retailers and residents.

Model 3 introduces binary variables reflecting proximity to shopping malls within 500 metres, 800 metres and one kilometre. The variable malls within 500 metres indicates that proximity to a shopping

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centre within 500 metres lowers property prices by 5,187.94 RMB, which is likely due to negative externalities such as noise and traffic congestion. This suggests that policy makers should take measures to mitigate these negative effects, such as better traffic management and noise reduction strategies. Conversely, the coefficient of the variable for the number of malls within 800 metres means that properties within this radius experience an increase in value of 7,305.30 RMB. This indicates that a balanced distance to shopping centres can increase property value, suggesting that urban developers should aim for a moderate distance between residential areas and shopping centres. The variable for malls within one kilometre has negative coefficient of -0.0334, which correlates with a decrease in property values of 4,411.64 RMB, suggesting that careful land use planning is needed to balance the benefits of proximity with the potential disadvantages. The mixed effects at different distances highlight the complexity of urban living, where benefits such as accessibility need to be weighed against potential disruption.

In addition to proximity to shopping centres, various housing attributes such as the number of rooms, size of the house, number of total floors, age of the building, orientation, quality of amenities, building structure, proximity to the metro and distance to the CBD also have a notable impact on housing prices across all models. These findings indicate that the various characteristics of the property also play a crucial role in influencing house values.

The results of this study provide important insights for urban planners as they suggest that strategically located shopping centres can increase property values. However, care must be taken to mitigate negative externalities in densely populated urban areas. For property developers, these findings can be used to optimise the location of projects and ensure that new residential areas are close enough to shopping facilities to maximise property values. Simultaneously, the results suggest investors to consider properties that are strategically located near shopping centres as these tend to have higher appreciation rates. Investing in residential properties within an 800-metre radius of shopping malls can be particularly lucrative due to the observed increase in property values. In addition, properties in areas where there are multiple shopping centres within a 3-kilometre radius can offer significant returns due to the positive impact on property values.

In summary, proximity to shopping malls has a significant and variable impact on property prices, with the relationship varying according to distance and specific valuation methods. These results provide a solid basis for future urban development strategies and underline the importance of balanced planning to optimise property values.

## 5. Conclusion

This empirical study of housing price premiums in the Weiyang district of Xi'an shows that the proximity and density of shopping malls relatively significantly affect surrounding housing prices. The results of this study are of great importance for urban planners, property developers and policymakers and fill a research gap on the influence of shopping malls on house prices in the Weiyang District of Xi'an. Better integration of malls with residential areas and careful determination of the optimal proximity of such facilities can drive up property prices and improve the overall quality of life in the city.

However, there are some limitations to this study. Data collection is prohibited beyond June 2021 due to political restrictions. In addition, this study did not assess the external effects of universities. Future research could consider extending the data collection period beyond June 2021 to understand recent trends and the impact of the pandemic on property values and urban development. Overcoming policy restrictions by working with local authorities to gain access to more comprehensive and up-to-date data will be crucial. Secondly, assessing the externalities of universities and higher education institutions, such as their impact on local housing markets, economic activity and social dynamics, will help policymakers integrate educational institutions into urban development plans.

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In summary, the proximity and availability of shopping amenities, in addition to the physical characteristics of the property and its transport links, have a significant impact on property value. Considering the limitations of the study and expanding the scope of the research will improve the understanding and planning of urban development.

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