



Determinants of House Prices in Small Cities in Northwest China

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Abstract: In recent years, China's urbanization has brought about a new problem of population loss in small and medium-sized cities. The property prices in these cities often reflect the local residents' feeling of their surrounding urban spatial environment in a more intuitive way, meanwhile the explosive development of new technologies such as big data provides a new latitude for re-evaluating the suitability of cities and buildings for development. Taking Qingyang City as an example, this study attempts to reveal the objective pattern of the intrinsic correlation between residential property prices and some urban spatial environmental influencing factors in small and medium-sized cities in Northwest China through a multiple linear regression model method, and concludes that basic education resources and urban public green space are the two spatial environmental influencing factors affecting residential property prices more significantly. Based on this, this study propose a few suggestions for urban managers: firstly, we should tackle population loss by focusing on basic education; secondly, we should focus on the uneven distribution of education resources in the layout of public services; thirdly, we should pursue accessibility and small but precise public spaces; fourthly, small and medium-sized cities should build on their own endowments and continuously improve their Liveability, small and medium-sized cities should build on their own endowments, continuously improve their own public services and strive to create a comfortable urban living environment in order to meet the challenges of new-type urbanization.

1. INTRODUCTION

In recent years, with the continuous development of urbanisation in China, the resident urban population in China reached 830 million at the end of 2018, with an urbanisation rate of 59.58% of the resident population, surpassing the world average, and the level of urbanisation has been significantly improved. However, at the same time, the rapid urbanisation development in China has brought about some new urban problems, one of the most prominent of which is the "flight of peacocks to the southeast". the problem of uneven development between the east and west, the "blood sucking" of developed cities on the southeast coast to small and medium-sized cities in the west and north. The specific case of "cabbage house

prices" in Hegang, Heilongjiang is the most prominent, the average house price in March 2019 in Hegang, Heilongjiang is 1,423 RMB/m², of which there are even 753 RMB/m², far below the cost of housing construction. The fundamental reason behind this is the "population loss" of Hegang. In 2001, the resident population of Hegang was 1,112,600, but in 2017, it dropped to 1,095,000. As can be seen, property prices in small and medium-sized cities are often a barometer of the development of cities, and when they fall excessively, it reflects the residents are lacking the confidence and optimism of the development of the city. Compared to small and medium-sized cities in the northeast and southwest of China, small and medium-sized cities in the northwest are more likely to lose population due to their own lack of urban development because of their weaker natural endowments and lower levels of urbanisation. Therefore, the study of the intrinsic mechanism of the interaction between property prices and various spatial elements of the city can provide local city managers with some planning thoughts and suggestions that can help stabilise urban population and enhance urban vitality.

2. OVERVIEW OF URBANISATION DEVELOPMENT IN QINGYANG

Qingyang City is located in the eastern part of Gansu Province, known as "Longdong" in ancient times, at the intersection of the three provinces of Shaanxi, Gansu and Ningxia, on the Dongzhi Plateau, the thickest loess plateau in the world, and is a typical representative of small and medium-sized cities on the northwest Loess Plateau. As can be seen from the Qingyang City Statistical Yearbook, the total population of Qingyang City was 1,812,400 in 1980 and 2,664,800 in 2018, with the city's total resident population growing steadily, but the rate of population growth has slowed in recent years, and the urbanisation rate of Qingyang's resident population reached 38.4% in 2018, far below the national average, which on the one hand means that Qingyang's new urbanisation is lagging behind, but It also means great potential for development.

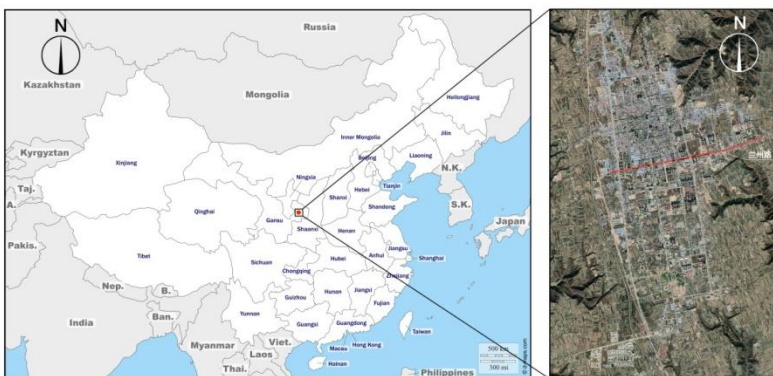


Figure 1. This is a location map and satellite plan of Qingyang

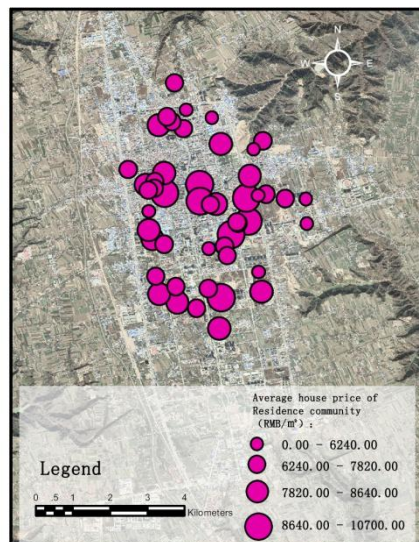
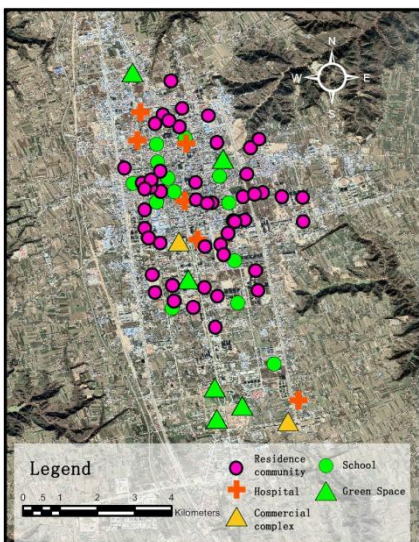
In terms of urban development and construction, a lot of urban construction has been carried out in the urban area of Qingyang in the last 10 years (2010-2020). On the basis of the old urban area in the north, according to the new master plan blueprint, combined with the topography of Dongzhi Plateau, a belt-like urban pattern with a long north-south and short east-west urban area has been formed: with Lanzhou Road from west to east as the

boundary (as shown in Figure 1), the old urban area on the north side and the new urban area on the south side of the road, a large number of high-rise residential areas have been built, which have largely improved the living conditions of the people of Qingyang. The large number of high-rise residential communities built in the last decade has not only attracted local residents in the main urban area to make improved home purchases, but also attracted residents and farmers from the surrounding counties to buy houses in the city, and during the decade, house prices in the main urban area of Qingyang have risen all the way, with the average price of RMB7,645/m² ranking Qingyang at 118th out of the total 322 mainland cities evaluated, according to data released by China House Price Quotation Network in July 2019. 118th, at the forefront of small and medium-sized cities in northwest China.

3. ACQUISITION AND ANALYSIS OF WEB DATA ON HOUSE PRICES AND RELATED SPATIAL ENVIRONMENTAL FACTORS IN QINGYANG CITY

Firstly, this study crawled through the second-hand house trading websites such as 58 Tongcheng and Anjuke to get the house prices of each residential district in Qingyang, and calculated the average house price per square metre of each district, and obtained the latitude and longitude coordinates of each residential district, and then obtained the location points of public primary schools, middle schools, high schools, hospitals, parks and commercial complexes in Qingyang according to Baidu POI points, all of which are the most important residential properties that residents care about. These are the elements of the external spatial environment that residents care most about when buying and living in their homes. After obtaining these POI points, the ArcGIS platform was used to draw a spatial layout map reflecting the high and low prices of each community in Qingyang and the spatial relationship between the community and each public service spatial environment factor (Figure 2 and Figure 3). The selection of POI points did not include private schools and private hospitals, considering that in small and medium-sized cities, the level of professional services of private hospitals and schools is relatively low compared to that of public hospitals and schools, and cannot be used as an effective spatial factor that mainly affects the house prices of the neighbourhoods.

After determining the coordinate locations of residential districts and corresponding spatial environmental factors, the walking distance between each residential district and its nearest spatial environmental factor was then



obtained according to Gaode Map, and the table of house prices and spatial distances of districts in Qingyang City was collated (Table 1). Due to the old and new variability brought about by the unique urban development process in Qingyang, the neighbourhoods in the old urban area and the new urban area were categorised and their respective averages were calculated to obtain Table 2.

Figure 2. Spatial relationship between the spatial environmental factors of each district and each public service package in Qingyang

Figure 3. Spatial layout of the high and low house prices in each neighbourhood in Qingyang

Table 1. Table of house prices and spatial distances in Qingyang District

| Name of residence community | Average House Price(RMB/ m ²) | Primary School Distance (m) | Junior High School Distance (m) | High School Distance (m) | Hospital Distance (m) | Green Space Distance (m) | Commercial Complex (m) |
|---|---|-----------------------------|---------------------------------|--------------------------|-----------------------|--------------------------|------------------------|
| Haoxing Mingyuan | 10700 | 525 | 817 | 822 | 1900 | 1700 | 1700 |
| Yujingchen city | 9070 | 983 | 420 | 440 | 2100 | 1400 | 2100 |
| Jinxiu city | 6700 | 915 | 2100 | 1100 | 950 | 1400 | 3500 |
| Donghu Anju | 8200 | 1500 | 1200 | 867 | 864 | 1200 | 3100 |
| Hengmei Huayuan | 8000 | 1200 | 2200 | 912 | 1700 | 702 | 1400 |
| Bihui Gaodi | 5400 | 866 | 1900 | 3000 | 2900 | 1600 | 3800 |
| Yongping | 5300 | 1900 | 1600 | 1600 | 2100 | 3400 | 1800 |
| Haoxin Jiayuan | 9000 | 860 | 1250 | 525 | 1800 | 2400 | 1500 |
| Dongshu Yiping | 9100 | 616 | 706 | 706 | 1500 | 812 | 1500 |
| Huayu mingcheng | 6600 | 1200 | 732 | 732 | 1200 | 516 | 1200 |
| Dangzhuang | 5100 | 909 | 2100 | 3900 | 2600 | 3800 | 2700 |
| Xinqin Juyuan | 7200 | 1100 | 2300 | 2200 | 3200 | 1800 | 4000 |
| Yangguang Mindu | 8640 | 456 | 1100 | 1100 | 994 | 941 | 2800 |
| Nanyuan 1st | 8330 | 805 | 570 | 560 | 1500 | 1900 | 1560 |
| Qingmao | 9300 | 923 | 860 | 938 | 1400 | 2000 | 1500 |
| Zhongyuan | 7200 | 588 | 1100 | 1300 | 2600 | 2000 | 2300 |
| North Gate | 4790 | 1200 | 2300 | 1000 | 1000 | 1700 | 3700 |
| Ziyu Runyuan | 6700 | 1200 | 1100 | 1100 | 2800 | 2200 | 2700 |
| Huijing Jiayuan | 7500 | 1600 | 1300 | 958 | 1400 | 2100 | 2600 |
| Shengding Jiayuan | 8000 | 379 | 427 | 1200 | 1300 | 2000 | 2200 |
| Fujing Jiayuan | 5300 | 1900 | 1700 | 1700 | 3400 | 2800 | 3300 |
| Hunyuan lidu | 7750 | 850 | 857 | 579 | 622 | 2100 | 3100 |
| City Centre | 8560 | 803 | 2200 | 2300 | 1100 | 272 | 1000 |
| Beiyuan Mingcheng | 6920 | 1600 | 1600 | 1900 | 1700 | 1200 | 4600 |
| Xinye Jiayuan | 8300 | 1100 | 944 | 1200 | 2400 | 1700 | 2100 |
| Tianhe Jiayuan | 6240 | 1600 | 2200 | 1400 | 1400 | 2100 | 4100 |
| Jiaxyuan | 7420 | 360 | 1600 | 904 | 840 | 1500 | 3400 |
| Yijing Jiayuan | 5770 | 1600 | 985 | 960 | 2400 | 1800 | 2300 |
| Hengxin Jinxiu | 8620 | 240 | 1600 | 1200 | 728 | 1800 | 3700 |
| Huayu Mincheng | 7360 | 1500 | 567 | 604 | 1200 | 590 | 1300 |
| Residence Community of Power Supply Company | 7450 | 1400 | 899 | 2000 | 2000 | 2700 | 2900 |
| Residence Community of Administration | 7820 | 721 | 819 | 1400 | 1900 | 2600 | 2100 |
| Wenquan District | 6840 | 832 | 615 | 1100 | 1200 | 1900 | 1200 |
| Changxinyuan 3rd | 6880 | 1200 | 1100 | 1500 | 2200 | 2200 | 2000 |

| | | | | | | | |
|------------------|------|------|------|------|------|------|------|
| Shijicheng | 7700 | 1200 | 2900 | 2900 | 1500 | 364 | 1400 |
| Shiji Xincun | 7800 | 479 | 1400 | 3600 | 2200 | 1000 | 2100 |
| Wanggou Quanyou | 5100 | 2200 | 1300 | 3000 | 2000 | 1100 | 2200 |
| Kejiao XIncun | 7300 | 1200 | 1200 | 3100 | 1900 | 807 | 1800 |
| Shizhi Jiguan | 7800 | 923 | 923 | 3300 | 1900 | 358 | 1800 |
| Nanzhuang | 8400 | 795 | 795 | 4000 | 2700 | 1200 | 2700 |
| Sanlimiao | 5200 | 1300 | 1500 | 2100 | 488 | 1400 | 515 |
| Gongyuan | 9000 | 1100 | 686 | 2300 | 2100 | 910 | 1900 |
| Fenghuang Dajing | 8400 | 2300 | 722 | 2300 | 2800 | 1800 | 2900 |
| Qinghuayuan 2nd | 8500 | 160 | 160 | 3200 | 2200 | 680 | 2100 |
| Jinjiang Mindu | 7600 | 2000 | 1500 | 2400 | 976 | 541 | 976 |
| Lijing Jiayuan | 8400 | 1400 | 1900 | 2000 | 2700 | 1500 | 2600 |
| Haoting Chuntian | 7350 | 1400 | 1600 | 2300 | 1000 | 430 | 1200 |
| Jinpeng Jiayuan | 7600 | 1600 | 2000 | 2100 | 1000 | 375 | 769 |
| Jindu Xiyuan | 8920 | 1200 | 813 | 867 | 952 | 273 | 1000 |

Table2. Table of house prices and spatial distances compared in the north and south of Qingyang

| Two District of residence community | Average house price(RMB/m ²) | Primary school distance (m) | Junior High School Distance (m) | High School Distance (m) | Hospital Distance (m) | Green Space Distance (m) | Commercial Complex (m) |
|-------------------------------------|--|-----------------------------|---------------------------------|--------------------------|-----------------------|--------------------------|------------------------|
| Northern Old Town District | 7414 | 1042 | 1287 | 1286 | 1732 | 1789 | 2493 |
| Southern New Town District | 7671 | 1284 | 1293 | 2631 | 1761 | 849 | 1731 |

As can be seen from Table 1 and Table 2, the overall house price in the southern new town district is RMB257/m² higher than that in the old town, this is because the residential projects in the southern new town neighbourhood were built later and relatively newer, and the design vocabulary and supporting facilities of the built neighbourhoods are better than those in the northern old town. Most of the neighbourhoods in the northern old city were built in the first decade of the 21st century (2000-2010), and most of them are multi-storey houses with no lifts, no properties and no underground parkings, and the green space rate does not meet the current planning requirements, which is probably one of the main reasons why the overall house prices in the old city are lower. But at the same time, we can see that the house prices in the old city are not pulled apart by the house prices in the new city, and even the highest second-hand house prices in the whole city of Qingyang, "Haixin Mingyuan", is located in the old city in the north, with one square meter house price of 10,700 RMB, although this district was built more than 10 years ago, with multi-storey houses without lifts. Table 1 shows that the walking distance to the surrounding public schools is very close, less than 1,000 metres, and the walking distance to the nearest park and public hospital is no more than 2 kilometres, which is probably the main reason why the prices are among the highest in the city. Table 2 also shows that the walking distance to public schools is generally lower in the northern old city than in the southern new city, explaining why the prices in the northern old city are not separated from those in the southern new city. In contrast to the excellent public education resources in the northern old city, it can be seen that the spatial environment of the southern new city is equally advantageous, with the southern new city

neighbourhoods generally being closer to parks (849m) and to commercial and recreational centres (1731m), which is in line with the spatial relationship diagram shown in Figure 2, the development and construction of the southern district in Qingyang over the past decade has taken into account some street-level green spaces for use by the surrounding neighbourhoods. The city government is more scientific and certain about the creation of public space for urban green spaces after Qingyang was selected as the second batch of pilot cities for the construction of sponge cities in 2016, while the old city in the north did not have a corresponding number of urban squares and centralised green spaces for residents' use because it was built earlier.

4. MULTIPLE LINEAR REGRESSION ANALYSIS

According to the data obtained from Table 1, combined with the analysis of the preliminary research, the preliminary hypothesis is that the house price in small and medium-sized cities is related to each spatial environmental influence factor around the residential community, which includes educational resources, medical resources, landscape resources and commercial resources, etc. According to the research, these factors are summarised as the 6 kinds of walking distance. The six spatial environmental impact factors were used as the independent variables in the regression model, and the data obtained from the network were brought into the formula and analysed using Stata software(Figure 4).

| Source | SS | df | MS | Number of obs | = | 49 |
|----------|------------|----|------------|---------------|---|--------|
| Model | 36680076.5 | 6 | 6113346.08 | F(6, 42) | = | 5.77 |
| Residual | 44511829.7 | 42 | 1059805.47 | Prob > F | = | 0.0002 |
| | | | | R-squared | = | 0.4518 |
| | | | | Adj R-squared | = | 0.3735 |
| Total | 81191906.1 | 48 | 1691498.04 | Root MSE | = | 1029.5 |

| Average House Price (RMB/m ²) | Coef. | Std. Err. | t | P> t | [95% Conf. Interval] | |
|---|-----------|-----------|-------|-------|----------------------|-----------|
| Primary School Distance | -.9729454 | .3148057 | -3.09 | 0.004 | -1.608249 | -.3376418 |
| Junior High School Distance | -.5039378 | .2771369 | -1.82 | 0.076 | -1.063223 | .0553472 |
| High School Distance | -.3624846 | .1861926 | -1.95 | 0.058 | -.7382365 | .0132674 |
| Hospital Distance | .3439027 | .264189 | 1.30 | 0.200 | -.1892523 | .8770576 |
| Green Space Distance | -.6239889 | .2194548 | -2.84 | 0.007 | -1.066867 | -.1811113 |
| Commercial Complex Distance | -.1343384 | .1789311 | -0.75 | 0.457 | -.495436 | .2267592 |
| _cons | 10484.93 | 604.7273 | 17.34 | 0.000 | 9264.543 | 11705.32 |

Figure 4. Analysis of multiple linear regressions calculated using stata software

The results of the regression analysis in Figure 4 show that, with the exception of "distance to public hospital", the other five independent variables do correlate with the dependent variable, i.e. the closer the neighbourhood is to the supporting spatial factor, the higher the house price, implying that residents are relatively more satisfied with their living in the neighbourhood. However, by looking at the p-values, we can see that the p-

values for the two independent variables "distance to public hospitals" and "distance to commercial complexes" are both greater than 0.1, meaning that the effect of these two independent variables on the dependent variable is not as significant as the other four. In contrast, the more significant spatial influences on neighbourhood house prices are "distance to public primary school" and "distance to parkland", with p-values of 0.004 and 0.007 respectively.

5. DISCUSSION AND SUGGESTION

Through the above analysis, it can be seen that Qingyang City has made some achievements in urban development in the last decade. But if we continue to deepen the development of new urbanisation, then in terms of optimising the urban spatial environment and improving the quality of living and living of residents, we need city managers to do better. Cities need to provide quality urban spaces that are guided by people-centred values everywhere. where the city is able to provide quality urban space under the guidance of people-oriented values everywhere. The ultimate goal of urban development is always to increase the happiness and sense of access to life of the residents, to shape the city's soul. Based on the above research and field studies, and with the expectation of the development of small and medium-sized cities in Northwest China, this study offers some discussions and suggestions for small and medium-sized cities in Northwest China for their further new urban development.

(a) Although small and medium-sized cities are not as attractive as other regional cities in many aspects of urban development such as employment, industry, culture, etc., small and medium-sized cities in the northwest should always hold on to the point of "improving basic education" to promote urban development. When there is a public primary school and public high school within 1km of a neighbourhood, the prices of second-hand properties in that neighbourhood are often among the highest in the city, meaning that people are more willing to live in such a neighbourhood and have a greater sense of access to life in such a neighbourhood. A good public school can therefore quickly make the neighbourhood around it more 'liveable', bringing vitality to the city.

(b) A major problem in the development and construction of new districts in small and medium-sized cities is that educational resources in the new districts are not guaranteed for a short period of time. City managers need to solve this problem in a timely manner to ensure that the development of new districts in the city tends to be benign and convenient for the residents of the new districts. City managers should strive to make all public schools in the city "prestigious", balance educational resources, so that educational resources are equitably distributed to every neighbourhood in the city, and spatially solve the problem of uneven distribution of quality educational resources.

(c) In addition to basic municipal measures and the transformation of neighbourhood hardware, urban managers and planners should also pay attention to the creation of urban public spaces. According to this analysis and research, the housing prices in the residential areas of small and medium-sized cities in the northwest are increasingly affected by the natural ecological environment around them, and it can be seen that the people are no longer only concerned about the structure of the house and property management, but whether there are concentrated green areas and squares

around the community for leisure and exercise is also an important reference for everyone. At the same time, we should form a consensus that such centralised green spaces and squares should not be large and comprehensive, but small, numerous and precise, enhancing accessibility. The street parks or squares should be close to the communities. With the development of China's new urbanisation and the increasing material standards of the people, the pursuit of good ecology by the residents of small and medium-sized cities in the northwest is believed to be the main theme of the next phase of urban development.

(d) Small and medium-sized cities in the northwest like Qingyang do not have the scale of industry to provide a large number of jobs like the coastal cities in the southeast, do not have sufficient population to provide a richer cultural and recreational life (drama, art exhibitions, etc.), and cannot have a good ecological landscape and humid climate like some of the southern cities themselves, so the only way is to plough deeper in providing good public service support for local residents and strive to create a truly The only way to gain new development in the new round of urban competition in the new urbanisation is to provide good public service support for local residents and strive to create a truly comfortable living environment.

(e) With the advent of the digital information age, many disciplines are facing a paradigm shift, especially the discipline of urban and rural planning, where new types of data such as open data on the Internet and big data will provide new data support for the next phase of human urban spatial planning. City managers should take a positive attitude towards new data and establish their own big data centres as early as possible, combining with traditional data (e.g. statistical yearbooks) to do a good job of basic analysis and research for urban development planning and to reveal the hidden logic and laws behind the complex urban issues.

(f) The issue of house prices in a residential area of a city is in fact a very complex issue involving many disciplines and fields. This study focused on the external spatial environmental factors of the neighbourhood, and although some correlations and objective laws of various spatial environmental factors were found through the study, a more accurate analytical model needs to be constructed to fully explain the house prices in small and medium-sized cities in the northwest, and more relevant independent variables (e.g. the level of property services, the merits of house design, how well the internal landscape of the neighbourhood is supported, the local per capita disposable income, etc.), and conduct interdisciplinary research to explore them. At the same time, the level of property prices in a city does not determine whether the city is liveable or not, but can only be used as a reference. This study is about how small and medium-sized cities in the northwest can cope with population loss and enhance their liveability in the context of new urbanisation, and cannot be used as an excuse for the high property prices in cities that are out of line with reality.

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