

Analysis Of the Impact of China's Population Age Structure on Residential Commercial Housing Prices

Jiabaidi Wu *

School of Management Science and Engineering, Nanjing University of Information Science and Technology, Nanjing, China

* Corresponding Author Email: tangxing@ldy.edu.rs

Abstract. With the intensification of global aging, the impact of changes in population age structure on the real estate market is becoming increasingly significant. This article aims to explore the impact of changes in China's population age structure on the prices of residential commercial housing, to provide a scientific basis for regulating the real estate market. By analyzing data from 30 provinces and cities in China from 2013 to 2022, this article finds that as aging population intensifies and the number of children decreases, both the old-age dependency ratio and the child-age dependency ratio have a negative impact on housing prices. This means that the aging society and the economic pressure of childcare may weaken the demand for home purchases. Household Saving Rate and increase in total population positively drive house prices, while the relationship between per capita income and house prices is not significant. From a regional perspective, the aging population in the eastern region has a significant effect on suppressing housing prices, while the impact is gradually evident in the central region. The western region has a smaller impact and population growth suppresses housing price increases. The study emphasizes the impact of changes in the age structure of the Chinese population on the prices of residential properties and proposes policy recommendations such as improving old-age security and optimizing the housing supply structure to promote the steady development of the real estate market.

Keywords: Population age structure; residential commodity housing prices; population aging.

1. Introduction

As the foundation of people's livelihood, the fluctuation of housing prices not only directly affects the quality of life and consumption ability of residents, but also profoundly affects the healthy development of the real estate industry and the economic structure and social stability of the entire society. During the Fourteenth Five-Year Plan period in particular, China had emphasized high-quality development and sought to achieve more balanced and fuller development. Against this backdrop, it is particularly urgent to explore this topic. With the marketisation of the housing market in 1998, housing prices in China have risen significantly. According to statistics from the China Statistical Yearbook, the average sales price of residential housing in China has risen from RMB 1,948 per square meter in 2000 to RMB 10,375 per square meter in 2023, with an annual growth rate of approximately 9.09 %. Although this growth rate is very considerable and can stimulate economic growth and employment in the short term, in the long term, if the rise in housing prices is not effectively controlled is likely to bring a series of negative consequences. To address this issue, the Government has introduced various measures to curb the rise in property prices, including but not limited to the establishment of the policy tone of 'housing without speculation', the implementation of a prudent management system for real estate finance, and the support for the construction of a housing system that combines rental and purchase. Although these regulatory measures can smooth out fluctuations in housing prices in the short term, and the average sales price of residential properties has already fallen to a certain extent, due to the rapid growth in the previous period, housing prices are still relatively high. High housing prices have become a serious social problem. Therefore, it is necessary to explore the reasons behind housing prices to better understand the operating rules of the Chinese real estate market and formulate targeted regulatory policies to prevent risks in the real estate market.

At the same time, with the significant changes in the age structure of China's population, namely the acceleration of the aging process and the decline in the number of new births, this poses new challenges and requirements for the demand pattern of the housing market, the future development path of the real estate industry, and social governance strategies. According to data on the age structure of the population over the years published by the National Bureau of Statistics, over the 25-year period from 1998 to 2022, China's old-age dependency ratio for children and adolescents has fallen from the initial 38% to 24.8%, while the old-age dependency ratio has risen from 9.9% to 21.8%. According to data from China's seventh population census, the proportion of the population aged 0-14 years is 17.95%, which is at the level of 'severe low birth rate'. This reminds us that the problems of low birth rate and aging in China are already very prominent, and this phenomenon will inevitably have an impact on housing prices.

Given the current complex demographic changes and policy environment, this study focuses on the impact of China's population age structure on housing prices. This article mainly uses a research method that combines qualitative and quantitative analysis to deeply explore the inherent relationship between the age structure of the Chinese population and the prices of residential commercial housing. Firstly, through extensive reading and analysis of relevant literature, this article summarizes the cutting-edge developments in the current research field and clarifies the starting point and direction of the research. Subsequently, based on the specific national conditions of China, including the actual situation of regions with different levels of economic development, this article used panel data analysis method and statistical software such as STATA17.0 to analyze the dynamic impact of China's population age structure on residential commodity housing prices and the driving mechanism behind it. Finally, based on the analysis results and combined with the current situation in China, reasonable suggestions are proposed for the age structure of the population and the housing market. This study helps the government to more accurately grasp the new characteristics of housing demand and provide data support for policymaking. In addition, analyzing this article can help promote Chinese real estate enterprises to adapt to changes in market demand, adjust product structure and layout in a timely manner, promote the transformation and upgrading of the real estate industry, achieve sustainable development, and effectively address the social challenges of aging population. The research significance of this article is not limited to China, it can also provide reference experience and countermeasures for other countries or regions facing similar problems and has practical guidance significance.

2. Literature Review

There has been a lot of research on the influencing factors of housing prices in various countries. Due to the early formation of housing markets and relatively developed economic levels in developed countries such as Europe and America, contradictions in population age structure have already emerged. Therefore, foreign scholars have conducted comprehensive research on the factors affecting housing prices and the impact of population age structure on housing prices. Fernandez -Villaverde and Krueger integrated factors such as differences in residents' income, mortality risk, and endogenous financing limitations into the classic lifecycle framework to analyze the consumption path problems of durable goods consumption and non-durable goods consumption, including housing. It was found that young people prefer to purchase durable consumer goods such as real estate that can be mortgaged [1]. Thenuwara and others. also used life cycle theory to explore the impact of an ageing population on the Australian property market. The study found that although ageing may lead to a reduction in demand for large homes and a slowdown in economic growth, which in turn affects house prices, it does not directly trigger a collapse in house prices. Factors such as wealth transmission and policy regulation can mitigate this negative effect. The article points out that house prices are affected by ageing in a complex way, and flexible policy responses are needed to stabilise the market [2]. Cho used supply and demand theory and population forecasting models, adopted panel data analysis method, and combined with South Korea's demographic data to study the Granger causality

relationship between population aging and housing prices. The article points out that in an aging society, the decrease in young homebuyers weakens housing demand and puts downward pressure on housing prices; Older people prefer to keep their properties, which reduces market supply. However, in the long run, weakened demand determines the direction of housing prices, indicating that aging will lead to weak housing prices [3]. Heo empirically analyzed data from 21 OECD countries to explore the correlation between population aging and real housing prices. Revealing the impact of heterogeneity in aging on housing prices through adjusting the old-age dependency ratio based on effective retirement age and remaining life expectancy. The study points out that an increase in the old-age dependency ratio based on remaining life expectancy is associated with a fall in house prices, while the effect of the old-age dependency ratio of the effectively retired population is not significant. A breakdown of age groups confirms that rising old-age dependency ratios are key to house price declines. This implies that the negative effect of population aging on housing prices is mainly driven by older people with shorter lifespans, rather than the inevitable decline in housing prices caused by aging itself [4]. Shinichiro and Norifumi used microeconomic theory, particularly the life-cycle hypothesis and the theory of intergenerational transfers, as well as panel data models to examine the impact of housing wealth on the consumption behaviour of older people in Japan. The study finds that older people with higher housing wealth have higher levels of consumption in retirement, suggesting that housing wealth, as a form of savings, plays a key role in supporting the quality of life and consumption of older people. In addition, the study discusses how this wealth effect evolves with the age structure of the population, which has important implications for understanding economic behaviour in an ageing society [5].

In the study of the impact of population aging and low birth rate on housing prices, Chinese scholars have inconsistent research results, and the relevant research conclusions vary greatly. Different data processing and method applications may also lead to conflicting research conclusions. Liu analyzed the mechanism of aging affecting housing prices through supply and demand structure and savings consumption theory, emphasizing the supporting role of elderly people selling properties to increase supply and intergenerational wealth transfer on demand, as well as the downward pressure of low housing purchase willingness and healthcare expenses on housing prices among the elderly population. Research has found that the phenomenon of aging at the national level has become an important factor in the fluctuation of commercial housing prices, and its impact varies in different regions: in economically developed areas, aging has a significant inhibitory effect on housing prices; The correlation between the two is not significant in economically underdeveloped regions; In developing regions, aging population actually drives up housing prices [6]. Zeng's study reveals that global population ageing has a generally negative impact on housing prices, but that foreign capital inflows can mitigate this effect to some extent, especially for Asian countries and countries in the Confucian cultural sphere. The article also explores the interaction between population mobility and housing prices, as well as the role of urbanisation in driving housing prices, providing new perspectives for understanding the complex relationship between demographics and housing prices [7]. Sheng and Ge mainly studied the impact of population aging on real estate prices in cities in Anhui Province. It was found that house prices in economically developed cities were negatively affected by ageing, while the less economically developed and developing cities showed a positive impact [8]. Chen and Lu analysed the impact of population age structure on housing demand using a probit model with micro-household survey data, suggesting that an increase in the number of teenagers and aging will dampen housing demand, whereas there is a positive relationship between the number of young adults and housing demand [9]. Shen, on the other hand, analysed the specific impact of demographic changes on housing prices since the 21st century. The study found that the juvenile dependency ratio has a driving effect on housing prices, but its influence weakened after 2010; the old-age dependency ratio has a dampening effect on housing prices, but its effect weakened with the rise of housing prices; the imbalance of gender ratio is positively correlated with housing prices, and the higher the gender ratio is, the stronger the role of housing prices is pushed up. In

addition, the gender imbalance and the juvenile dependency ratio have no interaction effect on house prices, but they can weaken the inhibitory effect of the old-age dependency ratio on house prices [10].

Overall, the academic community has not reached a unified conclusion on the relationship between changes in population age structure and housing prices. Without considering differences in economic development strength, housing prices, and aging levels, conclusions may differ based on data from multiple countries or regions, making it difficult to provide effective recommendations for macroeconomic regulation and reform. Therefore, considering the regional differences in China's economic development, this article first conducted regression analysis on the entire sample, and then divided the sample into three major regions: central, western, and eastern. The impact of aging on housing prices in each region was discussed, aiming to provide theoretical basis and targeted strategic recommendations for government departments in regulating real estate prices.

3. Empirical Analyses

3.1. Data Sources and Selection

3.1.1 Variable selection

In this paper, based on previous research and experience, the selected indicators include residential house prices, child-age dependency ratio, old-age dependency ratio, per capita income, total population, and household saving rate.

Among them, the explained variables are residential housing prices; The core explanatory variable is the population age structure related indicator, and the aging population is represented by the old-age dependency ratio, which is the proportion of the elderly population aged 65 and above to the labor force aged 15-64. The phenomenon of declining birth rates is represented by the child-age dependency ratio, which refers to the proportion of children aged 0-14 to the labor force aged 15-64; The main control variables are per capita income, total population, and household saving rate, and the variable descriptions as shown in Table 1.

Table 1. Variables Description

Variable	Variable Name	Variable Symbol	Variable Description
Explained variable	Residential commercial property prices	Y	Average sales price of residential commercial property
Core explanatory variables	Child-age dependency ratio	CR	Population of children aged 0-14/ labor force aged 15-64
	Old-age dependency ratio	OR	Population aged 65 and above/ labor force aged 15-64
Control variables	per capita income	PCGDP	GDP per capita
	Total population	POP	Size of population
	Household saving rate	SP	Total household sector savings/ household sector disposable income

3.1.2 Data sources and descriptive statistics

In view of the availability of data, this paper uses the panel data of 30 provinces, municipalities and autonomous regions in China from 2013 to 2022 as the research sample, excluding Hong Kong, Macao, Taiwan and Tibet. Tibet was not included in the study because of the significant difference between the average selling price of commercial residential housing and population related indicators and the lack of data integrity. In this article, the average sales price data of residential commercial housing in various provinces and cities, as well as the data related to population age structure variables, are all taken from the National Bureau of Statistics to ensure the accuracy and reliability of the research.

To reduce the problem of heteroscedasticity, this article logarithmically processed the data of three variables: residential commodity housing price Y , per capita income PCGDP, and total population POP. Before conducting multiple regression analysis, descriptive statistics were performed on the variables, and the statistical results are shown in Table 2.

Table 2. Descriptive statistics of variables

VarName	Obs.	Mean	SD.	Min.	Median	Max.
lny	300	8.918	0.533	8.197	8.799	10.774
or	300	16.285	4.358	8.800	15.400	28.800
cr	300	23.174	6.174	11.700	23.650	36.400
sp	300	0.288	0.055	0.106	0.288	0.449
lnpcgdp	300	10.946	0.432	10.003	10.898	12.155
lnpop	300	8.213	0.741	6.347	8.283	9.448

3.2. Model Building

To test the impact of the age structure of China's population on the price of the average sales price price of residential commercial housing and based on the explained variables, explanatory variables and control variables set above, the following model is established:

$$\ln Y_{it} = \alpha_0 + \alpha_1 OR_{it} + \alpha_3 SP_{it} + \alpha_4 \ln PCGDP_{it} + \alpha_5 \ln POP_{it} + \varepsilon_t \quad (1)$$

$$\ln Y_{it} = \alpha_0 + \alpha_2 CR_{it} + \alpha_3 SP_{it} + \alpha_4 \ln PCGDP_{it} + \alpha_5 \ln POP_{it} + \varepsilon_t \quad (2)$$

In the above model, i represents the province, t represents time, α_0 is the intercept term, α_i is the regression coefficient, the explained variable $\ln Y_{it}$ is the natural logarithm of the price of residential commercial housing, α_1 and α_2 represent the impact of the child-age dependency ratio and the old-age dependency ratio on the price of residential housing, respectively; α_3 expressing the impact of residents' savings rate; α_4 indicate the impact of per capita income; α_5 denotes the impact of the number of population, and ε_t is the random error term.

3.3. Benchmark Regression Results

Since both F-test and Hausman test show the rejection of the original hypothesis. So fixed effects can be identified as the optimal model.

In the benchmark regression analyses in Table 3, the paper meticulously examines the models in columns (1) to (3), progressively incorporating different core explanatory variables to comprehensively analyse the impact of the old-age dependency ratio and the child-age dependency ratio on the price of residential commodity housing. According to Table 3, the old-age dependency ratio is significantly and negatively correlated with the price of residential commercial housing at the 1% significance level, which suggests that as the elderly population increases, social wealth distribution gradually tilts towards the elderly, leading to a weakening of the purchasing power of the younger generation and thus exerting downward pressure on housing prices. At the same time, the child-age dependency ratio also shows a negative but not significant impact on house prices. This is because although at the macro level, as the fertility rate declines, the child-age dependency ratio decreases, leading to a reduction in the number of potential future home-buying subjects, which naturally weakens the purchasing power of and demand for the property market. Although theoretically, a decrease in demand will lead to a decline in housing prices, this impact may be in reality offset by other factors or masked by other factors, resulting in an insignificant impact. Furthermore, household saving rates have a significant positive impact on house prices, suggesting that even in the context of ageing and declining birth rates, the increased savings capacity of households can compensate for the reduced demand for homeownership, thus stabilising house prices. In addition, there is a negative but not significant correlation between per capita income and housing prices, which may be the result of a combination of factors such as government regulation, economic expectations, and investment preferences. Finally, the result that an increase in total population has a

significant positive push on house prices is in line with the general public perception and implies that even if the child-age dependency ratio declines, the overall population growth still maintains or even pushes up house prices, which counteracts the negative effect of the child-age dependency ratio and makes the final effect of the child-age dependency ratio insignificant. In addition to the control variables mentioned in this article, the real estate market is also influenced by various factors such as monetary policy, fiscal policy, land supply, and construction costs. The changes in these factors will also to some extent offset the potential impact of the decrease in child-age dependency ratio on housing prices, resulting in insignificant correlation. The fact that both the old-age dependency ratio and the child-age dependency ratio show a negative impact on house prices further emphasises that both the pressures of an ageing society and the financial constraints faced by young households due to child-rearing are likely to be important constraints on house price growth in the current research framework.

Table 3. Benchmark regression results

	(1) lny	(2) lny	(3) lny
or	-0.006***		-0.007***
	(-2.788)		(-3.015)
sp	0.630***	0.646***	0.649***
	(3.515)	(3.548)	(3.616)
lnpcgdp	-0.067	-0.133	-0.081
	(-0.622)	(-1.234)	(-0.757)
lnpop	0.593***	0.491**	0.685***
	(2.802)	(2.292)	(3.105)
cr		-0.004	-0.006
		(-0.879)	(-1.443)
_cons	4.399**	5.907***	3.944**
	(2.483)	(3.475)	(2.196)
N	300	300	300
R ²	0.913	0.910	0.913
Year	YES	YES	YES
Province	YES	YES	YES
F	206.445	200.464	192.655

t statistics in parentheses

* p < 0.1, ** p < 0.05, *** p < 0.01

3.4. Heterogeneity Analysis

Considering the heterogeneity of geographical locations, this article divides the 30 provinces and cities in China into three major regions: East, Central, and West, as shown in Table 4.

Table 4. Distribution of Provinces and Cities in China

Eastern region	Central region	Western region
Beijing	Inner Mongolia Autonomous Region	Shanxi Province
Tianjin	Liaoning	Chongqing
Hebei Province	Jilin Province	Sichuan Province
Shanghai	Heilongjiang Province	Guizhou Province
Jiangsu Province	Anhui Province	Yunnan Province
Zhejiang Province	Jiangxi Province	Shaanxi Province
Fujian Province	Henan Province	Gansu Province
Shandong Province	Hubei Province	Qinghai Province
Guangdong Province	Hunan Province	Ningxia Hui Autonomous Region
Guangxi Zhuang Autonomous Region		Xinjiang Uygur Autonomous Region
Hainan Province		

From the heterogeneity analysis results in Table 5, what can be seen is that the old-age dependency ratio and the child-age dependency ratio have a significant inhibitory effect on housing prices in the eastern region. This may be due to the higher level of economic development in the eastern region, resulting in a relatively high proportion of elderly population, which in turn increases housing supply (elderly people may tend to sell or rent out excess properties) or reduces housing demand (young families reduce their willingness to buy houses due to parenting pressure), thereby lowering housing prices. And due to the developed economy in the eastern region, the quality of education is often higher, and there is a high demand for school district housing. However, as the number of children decreases, this demand decreases, reducing the pursuit of high-priced properties. In addition, the construction of the social security system in the eastern region is relatively complete. The government has responded to the challenges brought by the declining birth rate by providing housing subsidies and encouraging families with multiple children. This may not immediately increase housing prices in the short term but may lead to a wait-and-see attitude among the public due to policy uncertainty, thereby suppressing the rise in housing price. The household saving rate has a significant and positive impact on house prices, indicating that the stronger saving and investment capacity of residents in the eastern region directly contributes to the activity of the property market. The negative correlation between per capita income and house prices at the 1% significance level may be due to the fact that after a certain stage of economic development in the eastern region, the marginal impetus of economic growth on house prices is weakened, and, at the same time, the demand for housing from the high-income group is more diversified, and no longer relies purely on the growth of the total economy. What's more, as the main destination for population inflows, the eastern region has a significant population agglomeration effect, increasing the rigid demand for housing and promoting housing prices, although the impact is not significant.

The central region is in the process of rapid urbanisation and the economy is gradually rising. During this process, although the transformation of population age structure has not fully demonstrated its comprehensive impact on housing prices, the increase in the dependency ratio between children and the elderly has shown a negative correlation trend with housing prices, especially the old-age dependency ratio, which has reached a statistical significance level of 10% and has a significant inhibitory effect on housing prices. Secondly, although the household saving rate positively drives housing prices, its effect is not as good as in the eastern region, which is related to the potential release of economic development and the speed of residents' wealth accumulation in the central region. The growth of population has the most significant promoting effect on housing prices among various variables, indicating an increase in population concentration in the central region. The housing demand brought about by urbanization is becoming an important factor driving up housing prices. In addition, although the per capita income in the central region has increased, there is still a gap compared to the eastern region, which has a significant inhibitory effect on the prices of residential commercial housing at the 10% significance level.

In the western region, which benefits from urbanisation and population policy adjustments, both the child-age dependency ratio and the old-age dependency ratio are negatively but insignificantly related to house prices. It is worth noting that the effect of population growth on housing prices in the western region is different from that in the eastern and central regions, manifested as a suppressive effect. This is because the population growth in the western region may be accompanied by a greater output of labor, resulting in the actual housing demand not increasing correspondingly with the population growth, and even decreasing the local housing demand due to some family members going out to work. The household saving rate is a more significant driver of house prices in the western region, probably because as economic conditions improve, western residents are beginning to have more money to spend on property investment. However, due to the fact that the western region may rely more on natural resources and heavy industry, the investment return cycle in these areas is longer, and the direct driving effect on housing prices is not as significant as in the service and high-tech intensive eastern and central regions. Therefore, per capita income actually suppresses the rise of housing prices.

In summary, the impact of various variables on the price of residential commercial housing is significantly heterogeneous in different regions, influenced by various factors.

Table 5. Results of heterogeneity analysis

	Eastern region	Central region	Western region
or	-0.013** (-2.296)	-0.005* (-1.853)	-0.005 (-1.478)
cr	-0.042*** (-4.281)	-0.008 (-1.255)	-0.008 (-1.303)
sp	1.037** (2.533)	0.360* (1.814)	0.606* (1.813)
lnpcgdp	-0.862*** (-2.691)	-0.251* (-1.841)	-0.043 (-0.245)
lnpop	0.151 (0.293)	1.376*** (4.004)	-0.471 (-0.860)
_cons	17.941*** (3.761)	-0.436 (-0.188)	12.659*** (2.645)
N	110	90	100
R ²	0.925	0.965	0.924
F	75.216	133.405	65.671

t statistics in parentheses

* p < 0.1, ** p < 0.05, *** p < 0.01

4. Conclusions and Suggestions

4.1. Conclusions

This article provides a theoretical analysis of the impact of changes in the age structure of the Chinese population on the prices of residential properties and conducts empirical tests. The conclusion shows that:

The aging and declining birth rates in China are gradually intensifying. Overall, population aging has a significant negative impact on the prices of residential properties. Although the declining birth rate has also suppressed the rise in housing prices, its impact is not significant in the short term; The impact of population aging on the prices of residential commercial housing shows significant regional differences, with more developed regions experiencing a more significant impact on housing prices due to aging. Moreover, due to differences in the level of economic development and supportive policies, the impact of household saving rates, per capita income, total population and other factors on the price of residential commercial property also shows more pronounced geographical variability.

4.2. Policy Suggestions

Based on the above analysis, this article proposes the following suggestions:

The government should accelerate the improvement of the elderly care security system. Due to the imperfect pension security system, many elderly people are facing high pension expenses. Overemphasizing pension consumption will lead to a serious contraction of housing demand, but focusing on housing consumption is not in line with reality and may also cause overheating of housing demand. Therefore, in the face of the ageing trend, the Government should increase public expenditure on pension protection and accelerate the development of a sound pension protection system, so as to cope with the problem of ageing with ease, and thus maintain the healthy and sustainable development of China's property market.

The Government should guide the structural adjustment of housing supply and accelerate the efficiency of the recirculation of the elderly housing market. As the recirculation of the stock of

housing for the ageing population will significantly increase market supply, the idea of regulatory policy can start from the perspective of the time, willingness and efficiency of the stock of housing to enter the market, to give appropriate play to the role of structural redistribution of the stock of housing to make up for the gap between supply and demand, to stabilise the real estate market price, and to prevent premature and excessive input into the market from triggering a waste of resources and a market imbalance. At the same time, in response to the situation where some empty nest elderly people have houses and fewer children, in order to solve the problem of elderly support, the government can learn from foreign housing and elderly care mechanisms, improve the financial transaction mechanism for elderly care, allow the elderly to mortgage or rent their houses, and regularly receive a fixed pension or enjoy elderly care services, and combine elderly care issues with housing issues to solve them.

The government should implement a relaxed population policy to promote a soft landing in housing prices. On the one hand, it is necessary to guide population mobility reasonably to achieve balanced development. Due to the large urban siphon effect in developed regions, there is a serious loss of labor force in underdeveloped and developing regions, resulting in different impacts of aging on housing prices in different regions. Therefore, policy regulation should guide young and middle-aged people to migrate reasonably between regions and guide the rational return of housing prices. On the other hand, timely adjustment of the birth policy can help optimize the age structure of China's population, increase the proportion of young and middle-aged labor force, prevent aging from continuing to deepen, and thus suppress the further impact of deep aging on China's housing prices.

The government needs to avoid a one size fits all approach to regulating housing prices. Empirical research reveals that there is significant regional heterogeneity in the impact of aging trends on housing prices in different regions, and factors such as housing loan interest rates and investment in commercial housing development also have different effects on housing prices depending on the region. Therefore, measures to regulate housing prices should follow the laws of regional economic development and be tailored to local conditions. For example, in developed regions, the government should attach importance to the role of regulating housing loan interest rates and housing prices, while accelerating the reform of the re circulation of existing housing for the elderly population, and promoting the stable return of housing prices; In underdeveloped regions, as the impact of aging on housing prices is not yet significant, the government can accelerate the improvement of the elderly care security system, implement rational talent introduction strategies, and avoid the impact of future aging population on housing prices.

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