

# Impact of Economic Growth and Housing Prices on Population Ageing

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## Abstract

Whether China can avoid falling into the “ageing trap” and find the main causes of the persistent ageing problem are theoretical and practical issues that need to be explored in depth. Based on inter-provincial panel data from 2006-2019, this paper uses stepwise regression to investigate whether economic growth can influence population ageing through housing prices. The study finds that: Firstly, economic growth has a positive effect on population ageing. Secondly, economic growth exacerbates population ageing through the mediating effect of housing prices. From the results of the study, it appears that economic growth has resulted in a larger gap between the income of people of the right age and the price of housing, accompanied by a decline in mortality rates and an increase in the burden of old age under higher levels of medical care, a disincentive to have children and an increase in the problem of ageing. It is recommended that the reform of the housing system should be deepened to facilitate the release of fertility intentions and to overcome the “ageing trap”.

## Keywords

Economic Growth; Housing Prices; Ageing; Fertility.

## 1. Introduction

In recent years, China's economy has maintained its momentum of rapid growth, with GDP growth from 7.66% in 1999 to 7.86% in 2012, and then 6.75% in 2018. GDP per capita was \$800 in 2000, reaching a new level of \$1,000 in 2003. Under normal circumstances, a per capita living area reaching 30–35 m<sup>2</sup> before the per capita GDP rises to between 800–1,500 US dollars is considered a period of rapid development for the housing industry; a per capita of 8,000 US dollars is considered a period of stable development; and a per capita GDP of more than 13,000 US dollars is considered a period of recession. In May 2021, the National Bureau of statistics of the People's Republic of China (NBSPRC) released the results of the 7th National Population Census, and the issue of population ageing has once again attracted the attention of all sectors in China. According to the results of the first national census, the current situation of China's population shows three characteristics under the trend of ageing. Firstly, the growth rate of the total population has further slowed down. the total population grew by 5.38% during 2010-2020, which is lower than that of 2000-2010 (5.84%) and significantly lower than that of 1982-1990 (12.45%) and 1990-2000 (11.66%). secondly, the proportion of the working-age population has declined. The census found that the proportion of the working-age population not only fell for the first time, but also fell significantly (-5.98%); thirdly, the proportion of the elderly population increased significantly. The results of previous censuses show that the proportion of people over 65 years of age (generally regarded as the elderly population) in China has increased by no more than two percentage points per decade. The ageing of the population has led to the disappearance of the demographic dividend, a reduction in the labour force, and an increased burden on society in terms of pensions and health care. In the face of the unprecedented changes of the century, actively addressing the ageing population is a matter of national development and the well-being of people's livelihoods, an important step in

achieving high-quality economic development, maintaining national security and social stability, and an important factor affecting the competition among major powers in the 21st century. In China, 'Wu Zi entering the family' was deemed a blessing for marriage. In modern times, 'Wu Zi' refers to a house, car, wife, children and silver, indicating that-with the passage of time, the rise of Chinese prices, and the reasons behind Chinese customs-pressure on the Chinese people is increasing, the cost of "house" accounts for a higher proportion of the cost of living of the Chinese people than the other "Si Zi", so this paper cites "house" as a representative of the "Wu Zi". According to the function proposed by economist Becker (1960)[1], the cost of goods purchased + the cost of childcare = total household income indicates that the more a household spends on goods purchased, the less the household spends on childcare. Obviously the higher the price of goods, the lower the cost of childcare to the household the lower the fertility rate. Theoretically, total household income and childcare costs directly determine the number of children born, and since the financial crisis in 2008, house prices in China have risen rapidly and remain high. The gap, and the higher mortgage interest payments and long-term home purchase debt, tend to discourage people of the right age from having children. Studies have shown that the rise in house prices is an important reason for the decline in fertility rates (Malmberg, 2010)[2]. Specifically, the pressure caused by the huge gap between the rise in house prices and China's wage growth makes it difficult for expecting couples to allocate funds to child-rearing. Hu Pei (2020)[3] believes that the rapid growth of China's real estate industry in the 'Golden Decade' may have a lasting impact on the fertility behaviour of Chinese citizens, leading to a long-term decline in the fertility rate. Moreover, this reduction in fertility, coupled with the auxiliary effect of the reduction in mortality, has resulted in a rapid increase in China's ageing population.

This paper examines whether economic growth can exacerbate population ageing through the rise in house prices from the perspective of economic growth. The contribution of this paper lies in the following: 1. The impact of economic growth on the demographic structure from a micro perspective has rarely been studied in the previous literature, and this paper takes advantage of this gap to study the influencing factors that lead to the current demographic problems in China, expanding the perspective of population ageing research and providing advice for the rational development of the country's economy. 2. The "house", which is integrated into the "Wu Zi", acts as a mediating variable, bringing to light the disadvantages of China's economic development and the increase in property prices, which have led to a decline in the desire to have children and an increase in ageing. 3. Using Chinese economic and demographic data, this paper demonstrates the deep-rooted influence of traditional Chinese customs and culture on the ideology of modern Chinese people, which in turn influences the economic decisions of the general public.

## 2. Literature Review and Research Hypothesis

It is generally accepted that the causes of population ageing are declining fertility and mortality rates. The Malthusian (1978)[4] law of growth states that when an economy reaches equilibrium there is an equilibrium wage rate and that rising household incomes, which stimulate fertility, will reduce the capital-labour ratio, which in turn will reduce fertility back to its equilibrium level. However, as industrialization progressed, fertility rates in Western countries declined and remained low even as economic incomes soared. The "baby boom" in Europe and the United States, for example, began to wane in the 1960s and a new wave of low fertility began in the late 1960s and has continued to the present day, with countries such as Germany, Austria, Italy and Spain currently having very low total fertility rates (TFRs below 1.3) for many years. Moreover, by the 1980s, fertility rates in many developing and newly industrialized countries had fallen below replacement level, with a trend towards convergence

with that of Europe and the United States. The demographic transition theory suggests that with modernization, such as industrialization and urbanization, the population will also complete the modernization process from 'high births, high deaths and low growth' to 'low births, low deaths and low growth', with the final total fertility rate remaining at or near replacement level (Davis, 1945)[5]. There are now studies that explain the reasons for the reduction in mortality, with Brenner(2005)[6] showing that the dramatic decline in mortality in the United States in the 20th century was due to rapid economic development, and Birchenall(2007)[7] demonstrating that this conclusion applies to most other countries. It is thus found that economic growth affects population ageing to a certain extent through the decline in fertility and mortality rates. Between 2010 and 2020, China's GDP grows by a cumulative 147%, and with this comes a rapid rise in house prices, with economic growth influencing the rise in house prices to some extent. From an international perspective (Colyns, 2002)[8] believe that in the United States, per capital GDP is the main factor affecting real estate prices. In Asia, Leung(2003)[9], through an empirical study, found that the main reason for the rise of house prices in Singapore, South Korea, Japan, and Hong Kong is the sustained economic growth and prosperity in these places. Overall, Geert (2000)[10] studied the correlations of real estate prices in the world (taking 60 countries and regions as samples) and found that the economic growth of the world and countries has a great impact on the changes in house prices. Englund(1997)[11] examined the real estate prices of 15 OECD countries and found that GDP growth has a positive effect on house prices, while the rise of interest rates has a negative effect. Some scholars have even analyzed in depth the current situation and future trends of carbon reduction in buildings in the real estate sector (Sun, 2022)[12]. With the increasing economic and social development of China, the construction industry in China produces a disproportionately high share of total emissions of carbon dioxide, the average provincial carbon intensity of commercial building operations kept rising by 2.88% per year from 2000 to 2016 (Lia, 2022)[13], the urgent need for high intensity carbon emitting buildings to be converted to low carbon green building models as a means of maintaining a healthy building sector. However, residential buildings of green construction are priced at an average premium of 2.1%-5.4% in the sales market due to the higher costs required (Kahn, 2014)[14], and thus boosting the development of green and low-carbon buildings can lead to higher residential prices. Rising house prices affect the fertility rate to a certain extent. Specifically, an increase in child-rearing costs leads to a decline in the willingness to conceive and reduced fertility behaviour, resulting in a decline in fertility rates (Malmberg, 2012)[15]. Detting(2014)[16] found that in the short term, an increase in house prices leads to a decline in the fertility rate of people without housing. Vignoli(2013)[17] concluded that Italian families who feel secure about their housing are more likely to have their first child sooner than those who do not. Clark and Ferrer (2019)[18] use the Canadian Survey of Labour Income and Dynamics (SLID) to find that lagged house prices have a positive effect on the marginal and complete fertility rates of homeowners aged 18 to 45. In summary, previous scholarship has found that economic growth can reduce regional fertility or mortality rates and that house prices can lead to lower fertility rates. However, previous research has focused on the relationship between the economy, house prices and fertility or mortality, which is rather one-sided and does not provide an in-depth picture of the impact of economic growth on ageing. In this study, the causes of ageing are divided into two aspects, namely fertility and mortality, and the channels through which economic growth affects the demographic structure are explored in these two aspects. Therefore, this study proposes:

H1: Economic growth exacerbates population ageing and housing prices play a mediating role in the impact of economic growth on population ageing.

### 3. Model Construction, Index Selection, and Data Sources

#### 3.1. Model Construction

This study relies on the data of 31 provinces and cities in China from 2006 to 2019 to identify empirically the impact of economic growth on population ageing through the housing price channel. A general statistical model was designed to compare and analyse the impact of economic growth on population ageing. The model is as follows:

$$old_{it} = \alpha_0 + \alpha_1 pergd p_{it} + \alpha_2 control_{it} + \varepsilon_{it}$$

As shown in the formula,  $i$  and  $t$  represent provinces or cities and year, respectively.  $old$  denotes population ageing;  $pergd p_{it}$  refers to the economic growth index of provinces and cities; and  $control_{it}$  represents the control variables that affect population ageing in each province and city.

Based on the mediating effect of housing prices, this study designs an mediating effect model to explore how economic growth affects population ageing through housing prices. Specifically, we first regress economic growth on the housing price index, and then simultaneously regress economic growth and housing prices on population ageing. The model is as follows:

Intermediary utility model:

$$pri_{it} = \partial_0 + \partial_1 pergd p_{it} + \partial_2 control_{it} + \tau_{it}$$

$$old_{it} = \beta_0 + \beta_1 pri_{it} + \beta_2 control_{it} + \ell_{it} \quad old_{it} = \rho_0 + \rho_1 pergd p_{it} + \rho_2 pri_{it} + \rho_3 control_{it} + \zeta_{it}$$

As shown in the formula,  $pri$  represents housing prices. Coefficient  $\partial_1$  denotes the impact of economic growth on housing prices. If  $\partial_1 > 0$ , this means that economic growth has caused housing prices to rise, thereby limiting childcare expenditures. A coefficient  $\beta$  indicating the effect of housing prices on population ageing, where  $\beta_1 > 0$  indicates that housing prices are causing an increase in population ageing. Coefficient  $\rho_3$  represents the mediating effect of housing prices, if  $\rho_3 > 0$ , this means that economic growth has led to rising housing prices. Simultaneously, rising housing prices also exert tremendous economic pressure on expecting couples, leading to a decline in fertility rates and adversely affecting population ageing.

#### 3.2. Indicator Selection and Data Sources

##### 3.2.1. Indicator Selection

1) Explained variable: Population ageing

The elderly population coefficient is an indicator commonly used internationally to determine the level of population ageing, and is calculated as the elderly population coefficient = elderly population/total population, i.e. the proportion of the elderly population in the total population. A country or region is considered to be an ageing society if the proportion of the population aged 65 and over in the total population is greater than 7%, i.e. the elderly population coefficient is greater than 7%. This study uses the ratio of the elderly population aged 65 and older to the total population. Data from CHINA STATISTICAL YEARBOOK.

2) Explanatory variable: Economic growth

Economic growth is marked by the increasing productive capacity of society. Economic growth refers to the increase in the production of material goods or services, the growth of technology and wealth, and the growth of production or output in a country or region. This study quotes

the per capital GDP data of each province and city as indicators to measure the economic growth of each province. Data from China Stock Market & Accounting Research Database (CSMAR).

### 3) Intermediary variable: Housing price

China's house price to income ratio increased by 0.2 to 28.4 in 2019 compared to FY18. Most developed economies are lower than China, such as Japan at 13.3, Germany at 9.4 and the US at 3.7, and developing economies are also generally lower than China, such as Vietnam at 21.9, Brazil at 16.5 and Russia at 11.3. Housing can be used both as a consumer expenditure for households and as a fixed asset investment, accounting for a significant proportion of both households budgeted income and consumption. The sales prices of commercial properties in the CHINA STATISTICAL YEARBOOK are divided by use into residential, office and commercial business premises, taking into account the household's need for a house to live in. Commercial housing prices are expressed by the average price of commercial and residential housing in 31 provinces, cities, and regions in China. Data from CHINA STATISTICAL YEARBOOK.

### 4) Control variables

According to Professor Qiao Xiaochun and Professor Liang Jianzhang of the Institute of Population Studies of Peking University, the two major causes of population ageing are low fertility and low mortality rates. Based on this, the control variables selected for this study focus on such factors and mainly select the following as control variables.

### 5) Control variables related to low fertility rates

A. Regional average household income (sal): According to the concept of the Easterlin relative cohort size hypothesis or relative income hypothesis, developed by the renowned American demographic economist Richard A. Easterlin, fertility is not solely a feedback on individual wealth, but it is more closely linked to people's usual economic status. He argues that the standard of living experienced in late childhood is the basis for assessing people's standard of living in adulthood. People are likely to delay marriage or at least the raising of children if they anticipate that they will not have a standard of living that they were accustomed to as children. Conversely, people are likely to marry earlier and have more children if they can easily reach a standard of living in later childhood with their adult income. The increase in the number of young people as a proportion of the total population leads to lower average wages for young people, which leads to a trade-off between family size and material wealth, and this trade-off is a turning point in fertility changes, resulting in a decline in the total fertility rate and a change in fertility and family size as a result. Considering the income effect of fertility decision-making, income level is deemed to affect the family's fertility preference. Thus, family annual income is added as a control variable, and the regional average annual family income is selected as the measurement. Data from National Bureau of statistics of the People's Republic of China (NBSPRC).

B. Urbanization rate (urb): According to the World Bank's public data on crude birth rate, GDP per capital and urbanization rate for 1984-2019, birth rates in China, Vietnam, Japan, South Korea and Malaysia all show a trend of a sharp decline, then a slow decline, then a sharp decline as the urbanization rate increases. According to the NBSPRC, China's urbanization rate has reached 71.09% in 2021. Although rapid urbanization promotes economic and social development, it also constantly changes people's lifestyles, fertility concepts, and fertility behaviors. Advanced fertility concepts have spread throughout China with the flow of population, prompting the fertility rate in various regions to decline successively. With the gradual advancement of urbanization, an increasing number of rural people have moved to the city, the improvement in living standards and the increase in educational attainment have subtly changed people's mindset and the concept of eugenics has gradually replaced the idea of having more children. Therefore, the urbanization rate is regarded as an important control variable.

C. Government expenditure on education (edu): On the one hand, an increase in education expenditure improves parents' education level and makes it easier for them to accept updated fertility concepts, particularly when women's education levels increase, the loss of wages due to childbirth and the negative impact on career progression, so that more educated women will face a higher opportunity cost of becoming mothers (Matín-García T, 2008)[19]. On the other hand, advances the level of education to the extent that people are willing to support the government's call for family planning. The improvement of people's education level has been an important factor affecting the change in fertility rate in recent years (Lutz W, 2011)[20]. The new family economics theory, which uses an economic model of fertility, holds that an increase in education level will make people pay more attention to the development of a child, which will then have a certain limiting effect on the number of children (Becker G S, 1960)[1]. Therefore, this study selects the annual government education expenditure of each province to measure this variable. Data from CSMAR.

6) Control variables related to low mortality rates

A. Regional medical level (bed): According to data from the Ministry of Health, China's total health expenditure from 2010 to 2019 showed a contact upward trend, and the growth rate all remained above 10%. 2019 national total health expenditure is expected to reach 6,519.59 billion yuan, and the number of medical and health institutions nationwide reached 1,023,000. 2020 China's medical institutions have a total of 9.11 million beds, an increase of 3.4% year-on-year. With the improvements in medical treatment, the average life expectancy of Chinese people has been effectively extended between 1949 and 2020, the average life expectancy of the population rises by 42 years. The number of hospital beds in various provinces and cities is selected to measure regional medical levels. Data from NBSPRC.

B. Social medical insurance (insur): Medical insurance enables sick people to obtain the necessary assistance, reduce the burden of medical expenses, and prevent them from 'getting into poverty due to illness'. Social health insurance has been effective in alleviating the "difficult and expensive" situation of the Chinese people, and the subsidies and reimbursement policies for major diseases have increased the average life expectancy of the population and contributed to the ageing of the population. This study selects the insured proportion in provinces and cities to measure the level of medical insurance. Data from CSMAR.

3.3. Data Source

Table 1. Variable definition

Variable name		Variable symbol	Variable description
Explained variable	Degree of population ageing	old	Ratio of the elderly population aged 65 and older to the total population
Explanatory variable	Economic growth	pergdp	Per capital GDP data of provinces and cities
Mediating variable	Housing price	pri	Average price of commercial and residential housing in 31 provinces and cities in China
Control variable	Regional average household income	sal	Average annual household income by region
	urbanization rate	urb	Proportion of the real population of each province and city in the total population
	Government expenditure on education	edu	Annual government education expenditure for each province
	Regional medical level	bed	Number of hospital beds in provinces and cities
	Social medical insurance	insur	The proportion of insured citizens in provinces and cities



Considering data availability, this study selects data from 31 provinces and cities in China from 2006 to 2019 as the research sample. The data are mainly from the CHINA STATISTICAL YEARBOOK, NBSPRC and some data are from the CSMAR. All data are annual data.

## 4. Empirical Analysis

### 4.1. Descriptive Statistics

The descriptive statistics of the variables selected in this study are shown in Table 2.

**Table 2.** Descriptive analysis

Variable	Average value	Standard deviation	Minimum	Maximum
old	0.098	0.022	0.048	0.164
pergdp	2.192	0.124	1.857	2.518
pri	3.692	0.256	3.200	4.585
sal	0.135	0.214	-0.329	0.707
urb	0.044	0.169	-0.513	0.385
edu	0.206	0.391	-1.116	1.077
bed	-0.677	1.819	-4.998	0.784
insur	0.021	0.136	-0.513	0.385

### 4.2. Benchmark Regression Results

This study uses step-by-step regression to test for mediating effect (Table 3). According to the regression results it can be found that 1. The results show that the impact coefficient of economic growth on population ageing is significantly positive, meaning that economic growth has aggravated China's population ageing. Economic growth in the narrow sense of GDP growth brings with it rising levels of education and health care. The higher the level of education of the population, the higher the opportunity cost of childbirth, i.e. the higher the shadow price of having children, thus discouraging the willingness to have children, and the complementary effect of rising medical care, the lower mortality rate and the increased burden of old age. The ageing of the population is bound to increase as a result of the combination of "ageing". 2. Housing prices are significantly and positively related to population aging. As urbanization accelerates in China, the price of the 'house' in the 'Wu Zi' culture continues to rise. For low-income families without homes, rising regional house prices increase the opportunity cost of having children, exposing them to a higher shadow price of childbearing and dampening demand for children. Moreover, the large gap between house prices and incomes has led to the use of commercial loans to finance residential mortgages, and the interest on these loans, combined with the principal payments required to purchase a home, has also led to a squeeze on family finance for fertility, which in turn has led to a dampening of demand for fertility and an increase in ageing. 3. The regression results show that both economic growth and housing prices are significantly positively correlated at the 1% level, indicating that housing prices play a partially mediating effect in the process of economic growth affecting population aging. 4. The coefficient of the effect of economic growth on housing prices is significantly positive, i.e. economic growth promotes higher housing prices. Economic growth brings income effects, inflation due to money supply and price increases. Real estate has both consumer goods attributes (demand for housing, both immediate and improved) and financial attributes (investment and speculative demand, and can be leveraged), and thus house prices depend not only on supply and demand (population and resident income, land supply), but are also closely related to money supply. Experience from the operation of the global real estate market shows

that in the absence of contention, plague, natural disasters, economic and financial crises and other shocks, house prices rise in the long term in line with economic development.

**Table 3.** Benchmark regression results of economic growth on population ageing

Explained variable(old)	Explained variable(old)			Mediator(pri)
pergdp	0.172*** (4.49)	-	0.177*** (4.65)	0.475*** (4.61)
pri	-	0.022** (2.15)	0.025*** (2.46)	-
sal	0.057*** (3.92)	0.078*** (5.42)	0.036** (2.20)	0.452*** (11.26)
urb	0.015 (0.80)	0.067*** (4.27)	0.019 (1.05)	0.078 (1.22)
edu	-0.073*** (-10.54)	-0.066*** (-9.70)	-0.075*** (-10.82)	0.016 (1.01)
bed	-0.001*** (-4.30)	-0.001*** (-4.10)	-0.001*** (-4.05)	-0.003 (-1.17)
insur	0.011 (0.77)	0.018 (1.20)	0.007 (0.47)	0.662*** (8.76)
Cons	-0.274*** (-3.34)	0.015 (0.39)	-0.374*** (-4.11)	2.567*** (11.64)
Individual	Yes			
Time	Yes			

Note: \*\*, \*\*\*, and \* denote significance at the 1%, 5%, and 10% levels, respectively.

## 5. Conclusion and Recommendations

### 5.1. Conclusion

In the context of China’s special ‘Wu Zi’ culture, this study selects the ‘house’ component of the ‘Wu Zi’ culture as the means through which the impact of economic growth on China’s population ageing can be examined. The main conclusions are as follows.

Economic growth has a positive impact on population ageing, and economic growth exacerbates population ageing through the mediating effect of housing prices. In terms of the current social situation, economic growth affects population ageing mainly through the reduction of fertility and mortality rates. Economic growth increases the level of healthcare, decreases mortality rates and increases the financial burden on families in old age, which in turn discourages fertility. In the longer term, the increased cost of green technology systems or measures required for low carbon buildings and the premium on the sale of commercial properties will further dampen fertility intentions and exacerbate the ageing of the population.

### 5.2. Recommendations

1) As property prices rise, the 'just-needed' population, mainly young people, face greater pressure for housing in cities, resulting in a delay in the age of childbearing and even a disincentive to have children. the Chinese government should strengthen price controls and the provision of livelihood measures, for instance, by controlling the speculative demand for housing; increasing the supply of small and medium-sized housing; and providing affordable,



public, and low-cost rental housing, and property rights for affordable housing. For families who have children but have not yet purchased a home, it is important to facilitate their application for public rental housing and ensure that such families can apply for public rental housing as far as possible. This will go a long way to stabilize young people's expectations of having children and ensure that they have a home to live in afterwards, thus increasing their willingness to have children. For childless and homeless families, financial support by way of lowering the down payment ratio will reduce the difficulty of home ownership; secondly, mortgage concessions will be granted to reduce the pressure of monthly mortgage payments; thirdly, home purchase subsidies will be provided to reduce the cost of home ownership; and fourthly, mortgage add-on deductions will reduce personal income tax. The reduced difficulty in purchasing a home will help boost the willingness to have children, which in turn will increase the fertility rate. In the future, housing policies should focus on meeting the rigid housing needs of more young families without a home, thereby reducing the crowding-out effect of the housing burden on young families' fertility decisions, effectively facilitating the release of fertility intentions among people of childbearing age, and helping the migrant population to move from "living in a house" to "living in peace", thereby creating good housing conditions for having children.

2) Raising the level of pension insurance and improving the social security system. Increase the publicity of urban and rural pension insurance to strengthen the awareness of residents to participate in pension insurance, and at the same time vigorously promote knowledge about urban and rural pension insurance through mass media channels, so as to increase the enthusiasm of the elderly population to participate in insurance, thereby reducing the burden of pensions on the fertile population and releasing the willingness to have children.

3) On the one hand, the urban basic old-age security system should be improved and the commercial old-age insurance developed, to ensure the minimum living standard of the elderly. On the other hand, while continuing to advocate the traditional family pension model in rural areas, a new rural pension insurance system should be explored in a way that 'combines family and social pensions, with family pensions as the mainstay, and social support as a supplement'. The level of population ageing in economically underdeveloped areas is relatively low compared with economically developed areas, and the medical conditions are relatively poor. Therefore, it is necessary to improve the medical system for the elderly, improve the level of regional medical security, and seek medical service methods suitable for economically underdeveloped regions.

## References

- [1] BECKER G. 1960. An economic analysis of fertility [A] Demographic and Economic Change in Developed Countries [C]. New York: Columbia University Press. 209-240.
- [2] Malmberg B. 2010. Low fertility and the housing market: evidence from Swedish regional data. *European Journal of Population / Revue Européenne de Démographie*. 26(2): 229-244.
- [3] Pei H. 2020. Housing prices and birth delay: Evidence from CGSS microdata[J]. *Journal of Finance and Economics*. 4: 80-81.
- [4] Malthus T. 1798. *An Essay on the Principle of Population as It Affect the Future Improvements of Society, with Remarks on the Speculations of Mr. Godwin, M. Condorcet, and other Writers* [D]. London: J. Johnson.
- [5] K. Davis, 1945, *The World Demographic Transition*[J]. *The Annals of the American Academy of Political & Social Science*, Vol. 237, No.1, pp. 1-11.
- [6] Brenner M H. 2005. Commentary: Economic Growth is the Basis of Mortality Rate Decline in the 20th Century-Experience of the United States 1901-2000 [J]. *International Journal of Epidemiology*, 34 (6).

- [7] Birchenall J. 2007. Economic Development and the Escape from High Mortality [J]. *World Development*, 35(4).
- [8] Collyns. 2002. Leading Senhadji Booms, Real Estate Bubbles and Asian Crisis. IMF Working Paper.
- [9] Leung, K Yui. 2003. Economic growth and increasing house prices[J]. *Pacific Economic Review*. 8(2): 183-190.
- [10] Geert R. 2000. Global Real Estate Markets Cycles and Fundamentals. NBER Working Paper 7566.
- [11] Englund, Y M Ioannides. 1997. House price dynamics: An international empirical perspective[J]. *Journal of Housing Economics*. 6(2): 119-136.
- [12] Zhaohui Sun, Zhili Ma, et al. 2022. Carbon Peak and Carbon Neutrality in the Building Sector: A Bibliometric Review[J]. *Buildings*, 12, 128.
- [13] KaiLia, Minda Ma, et al. 2022. Carbon reduction in commercial building operations: A provincial retrospection in China[J]. *Applied Energy*.
- [14] Kahn M E and Kok N. 2014. The capitalization of Green Labels in the California Housing Market[J]. *Regional Science and Urban Economics*, Vol.47, No.1.
- [15] Malmberg B. 2012. "Fertility cycles, age structure and housing demand". *Scottish Journal of Political Economy*. 59(5): 467-482.
- [16] Dettling, Kearney. 2014. House prices and birth rates: The impact of the real estate market on the decision to have a baby[J]. *Journal of Public Economics*. 110: 82-100.
- [17] Vignoli, Rinesi, E Mussino. 2013. A home to plan the first child? Fertility intentions and housing conditions in Italy[J]. *Population, Space and Place*. 19(1): 60-71.
- [18] CLARK J, FERRER A M. 2019. The effect of house prices on fertility: Evidence from Canada [R]. Kiel: Kiel Institute for the World Economy (Ifw).
- [19] Matín-García T. A Reassessment of the Role of Women's Education in Existing Fertility Research [J]. *Genus*, 2008, (64): 131-157.
- [20] Lutz W, Samir K. Global human capital: Integrating education and population. *Science*. 2011, 333(6042): 587-592.