# The Influence of Population Aging on House Price

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**Abstract:** Population aging is a common problem of the world. Population aging has a significant impact on the real estate market. China steps into an aging society in 2000, with a rapid aging rate. China's housing market reform is still short. The long-term influence of aging on house price has not yet fully manifested. This paper uses 833 samples from 1970-2018 in 17 OECD countries such as Japan, USA and UK to empirically test the influence of aging on house price. The result shows that aging has a significant negative impact on house price. The negative effect increase with the deepening of aging. Therefore, people should focus on the negative effect of aging and make active prevention.

## Introduction

In the past 65 years, great changes have taken place in the age structure of China's population. China's population aged over 64 reached 88.21 million in 2000, accounting for 7% of the population in China, according to the Statistics Bureau. It indicates that China steps into an aging society. Chinese aging process is showing an accelerated rise. As of the end of 2018, Chinese population aged above 64 was 166.58 million. The rapid population aging poses a potential threat to the stable development of the real estate market. Base on life cycle theory, the housing demand of the elderly will decline. Aging will cause the housing price to fall. However, Chinese scholars are still controversial about the effect of aging on house price. Some scholars believe that the aging, through intergenerational transfer, will actually push up house price.

Since 1978, with the reform process of China's economic system, land system and housing system, China's housing market has experienced historical changes from scratch and rapid development. After the government determined the direction of monetization, marketization, and commercialization of urban housing in 1998, China's new housing system was gradually established, and the real estate market began to flourish. The increasing adulthood of the "baby boom" has led to an increase in demand for home purchases, and China's house price have continued to rise to a high level. Because Chinese housing market reform is relatively short, it is impossible to accurately observe the long-term influence of aging on house price. However, it can be seen that China is gradually converging with OECD countries in terms of demographic changes, real estate market, and economic and social development. The real estate market in OECD countries has a long history, a high degree of marketization, a relatively complete cycle, and relatively mature market development. Therefore, we can provide China with experience by investigating the influence of aging population on house price in OECD countries.

The next part reviews the literature on the influence of population aging on house price, and further proposes the contribution of this paper. The third part introduces model design, data sources and descriptive statistics of variables. The fourth part empirically examines the relationship between population aging and house price, and focuses on examining the staged characteristics of the impact of population aging on house price. Finally, the fifth part draws conclusions and summarizes the experience from OECD countries.

## Literature Review

Mankiw and Weil (1991)[1] first used the US census data from 1970 and 1980 to study the influence of population structure on house price. It was found that the "baby boom" has become the main force to promote the rise of house prices 20 years later. With the "baby boom" people got older, the decline in housing demand led to a decline in house price. Jones (1996) [2]used the housing market data of USA and Canada to investigate the living mode of the elderly, and found that the elderly, especially the elderly living alone, are more inclined to change from the owner of housing to the renter of housing, while some of the elderly who have reduced the housing area also have greater options to sell housing. Chen et al. (2012)[3] researched on the real estate markets in Scotland and England found that aging had a negative effect on house prices. Takáts (2012)[4] based on 40 years of house price data in 22 countries found that aging significantly reduced house prices. However, some scholars pointed out that the influence of aging population on house price is not significant. Engelhardt and Poterba (1991)[5] used Canadian data and found that although the relationship between aging and house price is negative in most cases, it is usually not significant. Guest and Swift (2010)[6] used Australian data and found that aging inhibited rising house price, but had little effect.

Chinese scholars have also explored the influence of aging population on house price. Xu Jianwei et al. (2012)[7] based on OECD countries data to confirm that the old-age dependency ratio has a negative impact on house price. Chen Binkai et al. (2012)[8] used Chinese census data and found that age is highly correlated with housing demand. Chen Guojin et al. (2013)[9] used China's provincial data from 1999 to 2011 and found that an increase in the old-age dependency ratio would drive up house price. Zou Jin et al. (2015)[10] used data from Chinese provinces from 1998 to 2013 and found that the short-term impact of aging on house prices is negative, and the long-term impact on house prices is positive. The above studies have not reached a consistent conclusion about the effect of aging on house price, and none of these studies have found that the effect of aging on house price has staged differences.

**Model Design and Data Sources**

This section studies the influence of the old-age dependency ratio on house price based on OECD country panel data. This paper focuses on the change of the influence of the proportion of the elderly population on the housing price over time. The specific model settings are as follows:

$$HP_{it} = \alpha_0 + \alpha_1 Odep_{it} + \alpha_2 Ydep_{it} + X_{it}\gamma + \varepsilon_{it} \quad (1)$$

Among them, HP means house price. Odep elderly dependency ratio (the proportion of the population over 64 years old to the working age population) and Ydep child dependency ratio (the proportion of the population under 15 years old to the working age population). X represents a series of national characteristics, including population, urbanization rate, real GDP, stock market value / GDP, domestic consumption expenditure, central government expenditure, land, etc.

**Table 1.** Variables description

| Variable | Observations | Mean | Standard Deviation | Min | Max |
|---|---|---|---|---|---|
| Hprice | 833 | 72.46 | 30.00 | 22.54 | 165.9 |
| Ydep | 833 | 0.306 | 0.0653 | 0.202 | 0.531 |
| Odep | 833 | 0.219 | 0.0505 | 0.0996 | 0.462 |
| Pop | 833 | 44.34 | 64.95 | 2.811 | 327.2 |
| Urbanr | 833 | 77.98 | 8.951 | 51.28 | 98.00 |
| Gdp | 833 | 164.9 | 272.9 | 3.769 | 1786 |
| Stockr | 833 | 66.68 | 49.59 | 2.676 | 291.2 |
| Consume | 833 | 98.55 | 180.0 | 2.503 | 1239 |
| Govexpe | 833 | 32.07 | 46.53 | 1.064 | 251.0 |
| Land | 833 | 178.6 | 326.5 | 3.028 | 916.2 |

The explained variable in the model is the housing price. The data comes from the actual housing price index published by OECD. The key explanatory variables and other control variables come from the World Development Indicators of the World Bank. In order to ensure that the sample size is as complete as possible, selecting 833 samples from 1970-2018 in 17 OECD countries such as Britain, Japan, and USA. Variable descriptive statistics are shown in Table 1.

**Empirical Analysis**

For developed countries, the effect of aging on housing price is negative. The negative relationship will increase over time, that is, there is a stage difference in the negative impact. The process of aging is not a process of increasing at a constant speed, but a process of acceleration. In the early stage of aging, the housing demand of the elderly group begin to decline, but the reduction in housing area required a series of transaction costs, which would lead to the lag of actual housing conversion actions, and the aging population ratio is not very large at this time. The impact of the market is not obvious. In the middle of aging, the medical expenditure of the elderly population has increased sharply. To pay for the growing health care expenditure, more and more elderly people have begun to reallocate family assets, increase liquid assets and reduce housing assets accordingly. The negative effect of chemical on the housing market is beginning to show. In the late ageing period, a large number of elderly people have passed away one after another, leaving a large number of real estate to enter the market. There is an oversupply situation in the housing market, and house price are under tremendous downward pressure. In order to identify the non-linear relationship between the aging and house price, the time is divided into two periods before and after regression analysis.

**Table 2.** Influence of old-age dependency ratio on house price

| | (1)<br>1970-1994 | (2)<br>1995-2018 |
|---|---|---|
| Odep | -80.27 | -415.0*** |
| | (122.8) | (82.11) |
| Ydep | -217.2*** | -404.6*** |
| | (45.50) | (51.68) |
| Pop | 0.480 | 0.312 |
| | (0.286) | (0.201) |
| Urbanr | -0.830** | -0.0469 |
| | (0.307) | (0.273) |
| Gdp | 0.705*** | 0.00399 |
| | (0.215) | (0.172) |
| Stockr | -0.0800 | -0.0770 |
| | (0.130) | (0.0454) |
| Consume | -0.530 | -0.137 |
| | (0.341) | (0.198) |
| Govexpe | -2.284*** | 0.340 |
| | (0.729) | (0.356) |
| Land | -0.00409 | -0.0322*** |
| | (0.0126) | (0.00805) |
| Fixed effect of year | Yes | Yes |
| Observations | 425 | 408 |
| $R^2$ | 0.753 | 0.722 |

Notes: *** p<0.01, ** p<0.05, * p<0.1.

As shown in column (1) of Table 2, between 1970 and 1994, the influence of the increase of the old-age dependency ratio on the house price is not significant. Specifically, for every 1% increase in

the old-age dependency ratio, the housing price index is only reduced by 0.8027 units, and the coefficient is not significant. Between 1995 and 2018, there was a significantly negative correlation between the old-age dependency ratio and the house price. As shown in column (2) of Table 2, for every 1% increase in the old-age dependency ratio, the housing price index decreases by 4.15 units, and the absolute value and significance of the coefficient increases significantly.

## Conclusion

According to the experience of OECD countries, the process of aging is not advancing nonlinearly, but is advancing wave after wave. As the population's fertility peak enters old age, the problem of aging will erupt. The aging of the population has the characteristics that it is not easy to detect in the early stage, and once it enters, it will accelerate its progress. At present, most OECD member countries have entered an accelerated stage of aging. Aging has a significant negative impact on the housing market and the entire country's economic development, technological innovation, labor supply, etc. The impact of the aging on house price has a staged characteristic. In the early stages of aging, the negative impact of rising old-age dependency ratio on house price is not obvious, which may cause residents to ignore the impact of aging population on house price. However, in the middle and later stages of aging, the negative impact of rising old-age dependency ratio on house prices will appear. That is, with the increase in the proportion of the elderly population, the demand for housing in the entire society has declined, the real estate market has increased supply and insufficient demand, and house price are facing downward pressure. When residents find out about this situation, they will sell their properties and cause house price to fall. Chinese aging problem has been exposed, and the aging rate is even faster than that of OECD countries such as USA, France, Germany and Japan. The problem of population aging seriously threatens the stable development of Chinese real estate market. The residents should face this problem and make active prevention.

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