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Article

Ageing, Credit and House Prices: Comparison between OECD and Non-OECD Countries

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Abstract

Since Takáts (2012), which shows that ageing has a negative impact on house prices, numerous papers have been published that either support or do not support this conclusion. We examine the relationship between population ageing and house prices by focusing on the role of credit availability using cross-country unbalanced panel data for the period 1981-2020 for 59 countries. We find that, unlikely to Takáts (2012), the negative effect of ageing on house prices is not confirmed when credit availability is not taken into account, but also could be offset by an increase in the availability of credit. These results suggest that the impact of population ageing may have different effects on house prices depending on the availability of credit in the market. These results suggest that the demographic headwind by population ageing has not realized yet.

Keywords

Population ageing, Financial development, House prices

Introduction

In the past decades, the world has witnessed the unprecedented population ageing and focused on what effects it would have on our economies. One possibility of impacts that population ageing may cause is the effect on the asset price, especially, house prices. The first paper to consider demographics in the study of house prices was Mankiw and Weil (1989), which predicted a 47% decline over the period of 1987 ~ 2007 in real price. Such a collapse in real house prices, so-called 'demographic headwind', however, 'didn't occur' in the United States. Nevertheless, after

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their study, a lot of papers that agreed and disagreed with them were published, and concerns about the possibility of the negative impact of ageing on asset prices has been spread despite of its truth or not.

The mechanism of the negative effect of ageing on house prices is based on life-cycle hypothesis. Younger people in their working period save part of their income for their future consumption when they get old and retired, and their saving is assumed to be invested to assets, that is, houses. When they get retired, they would sell their assets for consumption, and this might lead to house prices decline.

Takáts (2012), for the first time, empirically showed the negative impact of ageing on house prices with international data in the literature, finding that one percent higher old age dependency ratio corresponds to around 2/3% lower real house prices. But, he said that it does not necessarily imply absolute declines in real house prices because other factors, such as economic growth, could well offset the negative effect of ageing. Now, more than a decade after Takáts (2012), demographic headwind by population ageing 'didn't occur'. Nevertheless, after his study, a lot of papers that supported and not supported him were published, and the debate is still on going (Poterba, 2014; Sun et al., 2024).

While numerous papers have used different samples and time periods, we use data from as many countries as possible and as long a time period as possible to show that an expansion in credit availability also can mitigate potential demographic headwind. We find that, unlikely to Takáts (2012), the negative effect of ageing on house prices is not confirmed when credit availability is not taken into account, but also could be offset by an increase in the availability of credit. These results suggest that the demographic headwind by population ageing has not realized yet.

This paper consists of the followings. The section 2 introduces literatures about the relation between ageing and house prices. The third section explains data used in our analysis and our empirical methods. The section 4 shows empirical results and the final section concludes.

Literature

1. Population and House Prices

The relation between population structure and house prices is one of the most interesting issues after Mankiw and Weil (1989), which caused a lot of debates about the relation. They predicted collapse in US house prices about 20 years later, but it didn't happen. Pitkin and Myers (1994) presented estimation results of house demand by age using cross-sectional data with 4 different time period. The house demand curve by age has a reverse-U shape with the top of 35~39 or 40~44 on the same time period with Mankiw and Weil (1989), but on the different time period, the older people[1] have the more house demand unlike Mankiw and Weil (1989). That is, the same cohort needs more house even if they get older.

Nevertheless, Mankiw and Weil (1989) brought up a fear of decrease of house prices by population ageing. Usually, the speed of population structure change was very slow so that it was known as difficult to capture the relation between population structure and economic variables such as house prices, GDP which change relatively faster. A recent study, Takáts (2012), for the first time, presents the estimation result about the effect of population ageing on the house prices using international panel data. Although other studies which examine the relation between house prices and macro-economic variables already exist in the literature, there were no papers to directly focus on the relation between house prices and population ageing before Takáts (2012).

After Takáts (2012), some follow-up studies were taken. For instance, Saita et al. (2016) examines the relation between population ageing and house prices using Japan and US regional panel data with the same methodology with Takáts (2012), and show the similar result. They confirm that the negative effect of population ageing on house prices are empirically provable in not only international panel data but also regional panel data.[2]

The negative impact of demographic ageing on house prices is also confirmed by another study using a sample of 13 developed countries over the period 1950-2012 (Jäger and Schmidt, 2017) as well as by studies using regional panel data (Breidenbach et al., 2024; Hillera & Lerbs, 2016; Park et al., 2017; Zheng, 2017).[3]

2. Population and House Prices when Credit is Considered

It is difficult to find literature which examines the role of credit availability in relation between population ageing and house prices. Some studies have considered the impact of ageing on house prices in combination with macroprudential or credit constraints but they used only in a limited number of countries in their empirical studies(Cheung, 2024; Coleman, 2014; Lee & Jung, 2020). Nishimura and Takáts (2012), covering 22 countries, considered savings demand together, and found that a decline in savings demand as baby boomers retire could contribute to real estate price stability, which highlighted the importance of monetary stability.

The mechanism of the negative effect of ageing on house prices is based on life-cycle hypothesis, and we pay attention to the fact that there is no consideration of the role of 'credit' in that hypothesis. In order to introduce credit in the hypothesis, we can consider four scenarios as follows. The point in our scenarios is what role the credit plays in relation between ageing and house prices, and to find it out is the matter of empirical estimation.

First, let's consider a scenario that there is no credit. In this case, the number of the younger decreases, and the number of the older increases as population ages. According to the life-cycle hypothesis, the decrease of younger people who purchase houses leads to decrease of house demand and the increases of older people who sell their houses leads to provide more houses in the market. Both of the two get house prices lower. Therefore, population ageing without credit could lower house prices. The figure 2-(a) describes this case. In the case of figure 2-(b), which describes 2nd scenario, only younger people can access to credit with a little constraint, and even if the number of the younger decreases as population ages, they use credit to increase their house demand. It could shift demand curve toward right, increasing house prices. In the case of figure 2-(c), which describes 3rd scenario, only younger people can access to credit without constraint, that is, they can access to credit as much as they want, and then house prices would increase more than the case of figure 2-(b). It could shift demand curve toward right, increasing house prices much more. Lastly, in the case of figure 2-(d), which describes 4th scenario, not only younger people but also older people can access to credit. The older can finance their own retirement living expenses through mortgages or reverse mortgage loan without disposal of their house assets which they saved for retirement. Therefore, the effect of credit extension on 'house demand' may vary according to cohorts in a different way.

In modern economies with advanced financial markets, investors invest on assets, such as houses, with not only their own wealth but also loans. In economies with less liquidity constraints, investors can purchase present assets with future income, that is, loan. Therefore, in countries with advanced financial markets, the less liquidity constraints (the more credit extension), the more power to purchase houses. Moreover, relaxing of liquidity constraints is not only to increase the purchasing power of houses but also to decrease retirees' need of selling their houses for consumption. For younger people (mostly potential house purchasers) who are in their working

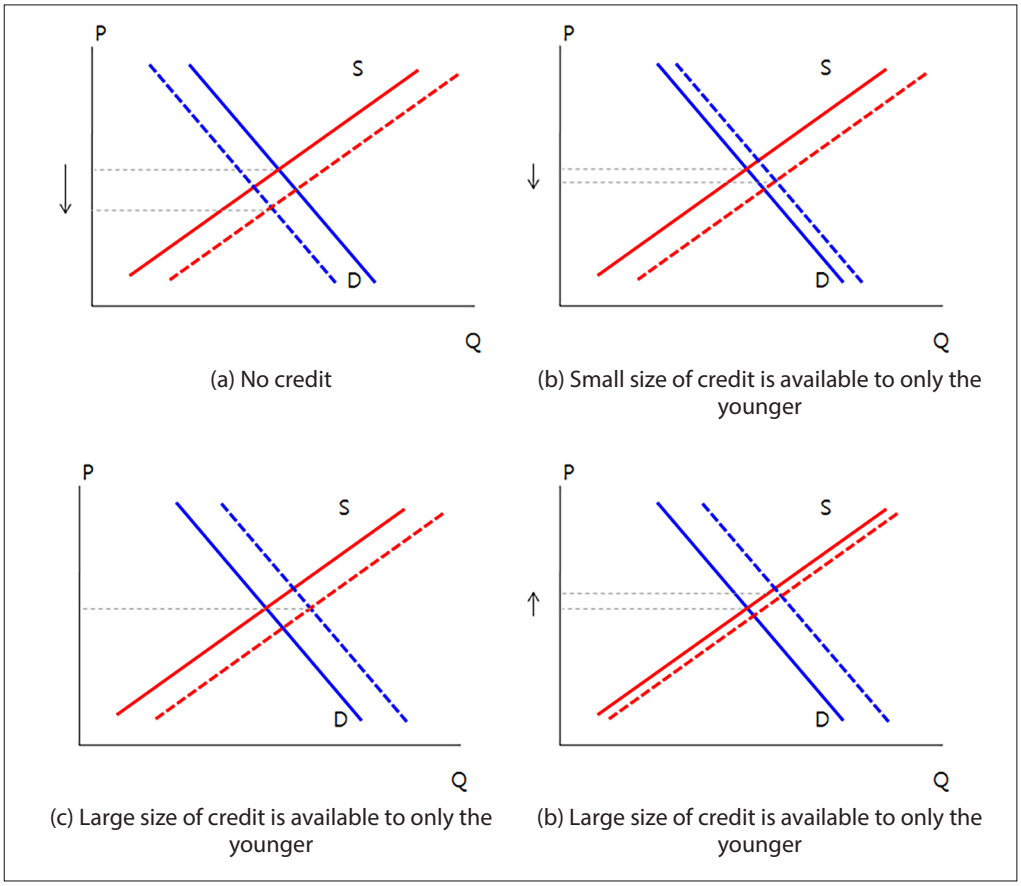

Figure 1. The effect of credit on house prices

life, it may increase their purchasing power and lead to an increase of house prices. For the older people (mostly potential house sellers) at their retirement ages, it may decrease their motive to dispose of their houses and lead to an increase of house prices. Although credit extension leads to the same effect on house prices in the market, it has different impacts on demands of younger (potential demanders) and older people (potential suppliers).

We try to set up a simple theoretical model to explain the effect of ageing on house prices in the case of presence of credit. Specially, our model provides an evidence that the effect of ageing on house prices can be captured by the interaction term of credit and ageing variables in our reduced form model estimation. The following two equations are equations of supply and demand of houses respectively. We assume that there are two kinds of households in the economy, the younger (Y_y) and the older (Y_o), and also the younger demand houses and the older supply. Superscripts explicitly mean demanders (D) and suppliers (S), and subscripts do younger (y) and older (o).

$$Q^D = \alpha^D + X^D\beta^D + \left(1 + \gamma_y^D\gamma\right)Y_y^D + \delta^D P^D \qquad (1)$$

$$Q^S = \alpha^S + X^S\beta^S + \left(1+\gamma_o^S\gamma\right)Y_o^S + \delta^S P^S \quad (2)$$
$$\gamma_y^S > 0,\ \gamma_o^S < 0,\ \delta^D < 0,\ \delta^S > 0$$

Q^D and Q^S represent demand and supply of houses, and $X^D$and X^S do regressors in the demand and supply equations, respectively. Demanders (younger people) are assumed to demand a single house. γ stands for the amount of credit that individual agents can access. γ_y^D is the size of demand increased by credit demanders use, $\gamma_y^D > 0$. The amount of credit, γ, can be provided to older people, and γ_o^S is the size of supply decreased by supply $\gamma_o^S < 0$. Older people that have houses don't need to sell their houses because they can finance money for their retirement living expenses.

In reality, even younger people could be suppliers and older people be demanders. Therefore, our assumption, $\gamma_y^D > 0$, $\gamma_o^S < 0$ are valid only in our restricted situation. Nevertheless, our simple two-period model provides how the interaction term reflects the effect of ageing on house prices. δ^D and δ^S are the price elasticity of demand and supply respectively if both sides are taken of the logarithm, and $\delta^D < 0$, $\delta^S > 0$. In equilibrium, which is $Q^S = Q^D = Q^*$, we can draw a reduced form model as following.

$$P^* = \frac{1}{\delta^S - \delta^D}\left[(\alpha^D - \alpha^S) + (X^D\beta^D - X^S\beta^S) + Y_y^D(1 - Ageing) + Y_y^D\gamma\left(\gamma_y^D - \gamma_o^S Ageing\right)\right] \quad (3)$$

$$\frac{\partial P^*}{\partial Ageing} = -\frac{1}{\delta^S - \delta^D}\left(Y_y^D + Y_y^D\gamma_o^S\gamma\right) \quad (4)$$

$$\frac{\partial P^*}{\partial \gamma} = \frac{Y_y^D}{\delta^S - \delta^D}\left(\gamma_y^D - \gamma_o^S \mathrm{Ageing}\right) \quad (5)$$

The denominator is $\delta^S - \delta^D > 0$ due to and $\delta^S > 0$, $\delta^D < 0$, which doesn't affect signs of other variables. As shown in equation (4), the negative effect of ageing on house prices ($-\frac{Y_y^D}{\delta^S - \delta^D}$) is offset by the increase of house prices due to decreased asset disposal ($-\frac{Y_y^D}{\delta^S - \delta^D}\gamma_o^S\gamma$). Also as shown in equation (5), the impact of credit extension on house prices is further accelerated by the positive effect of demand as well as the ageing effect ($-\frac{Y_y^D}{\delta^S - \delta^D}\gamma_o^S Ageing$). Equation (5) specifically represents how credit extension accelerates house prices. Credit extension leads to not only the increase of house demand of the younger people ($\frac{Y_y^D}{\delta^S - \delta^D}Y_y^D$) but also the decrease of house asset disposal of the older people ($-\frac{\gamma_o^S}{\delta^S - \delta^D}Ageing\,Y_y^D = -\frac{\gamma_o^S}{\delta^S - \delta^D}Y_o^S$).

Data and Methodology

1. Data

We expand Takáts (2012)'s data, covered 22 OECD countries, to 59 countries including the 34 OECD countries, which is provided by the Bank for International Settlements (BIS). BIS provides a variety of house prices series for each country. But the series of each country are not consistent, for example, in terms of type of property, area covered, property vintage, priced unit, compilation method and seasonal adjustment. Therefore, we select a house prices indicator for each country based on the following criteria:

(a) vintage: Since ageing is an indicator of the entire population of a country, an appropriate house prices indicator should cover existing houses or all houses rather than new houses. Typically, newly constructed houses a year represent only a small fraction of the entire houses. (b) covered area: Select an indicator that covers the entire region of a country, if possible. (c) time span: Since ageing is a long-term phenomenon, house prices indicators also require a long-term time series. However, some countries have very short time series indicators that cover the entire country. In this case, we select a long time series that covers the capital or major cities instead. (d) type: If there are multiple indicators that cover the entire country with a long time span, select an indicator that covers the most common type of house in the country. More details of our data are presented in the Appendix.

For each country, GDP per capita, total population, old age dependency ratio (65 and above to working age population), old age ratio (65 and above, % of total population) are obtained from World Bank. Consumer price index (CPI) and financial development index (FD) as a proxy variable of credit are obtained from International Monetary Fund (IMF).

It is common to use credit (% of GDP) as a variable of liquidity constraints, but there is a problem with too many missing data. Therefore, this study uses the IMF's financial development index as a proxy variable for credit, assuming that there is a close relationship between financial development and credit. That is, FD means liquidity constraints. Financial development indices are compiled by measuring the level of development in various aspects, such as depth, access, and efficiency of financial institutions and financial markets.[4]

2. Methodology

Our empirical model follows the benchmark model of Takáts (2012) and adds private credit as well as its cross-term with ageing in order to consider liquidity restriction. According to economic theories, income, population and credit are predicted to have positive effects on house prices. ageing could have a negative effect as Takáts (2012) estimation. On consideration of life-cycle hypothesis, credit may increase the purchasing power for the younger, and also decrease the motive of disposal of house assets for the older.

Under the condition of high liquidity constraints (that is, low credit), ageing would cause fall of house prices because the purchasing power of the younger would not increase and the number of potential house buyers decrease, while more older people should have difficulties to finance money for their retirement living expenses. House demand curve would shift left but house supply curve would shift right. But, in the opposite situation (that is, high credit), ageing might make house prices increase or at least not decrease because the younger could finance their purchase of houses easily and the older could finance money for their retirement living expenses without disposal of their house assets. As a result, the magnitude of the effect of ageing on house prices would be determined by both of the magnitudes of right-shift of demand curve and right-

shift of supply curve.

Thus, the negative effect of ageing on house prices would be offset with the level of credit measure by $Credit_{i,t}$. For this reason, we allow the interaction term $Credit_{i,t} \times Ageing_{i,t}$ to be included in the specification.

$$\Delta \ln P_{i,t} = \alpha + \beta_1 \Delta\, lnGDPP_{i,t} + \beta_2 \Delta\, lnPOP_{i,t} + \beta_3 \Delta\, lnAgeing_{i,t} + \beta_4 \Delta\, lnCredit_{i,t} + \beta_5 \Delta\, lnAgeing_{i,t} \times \Delta\, lnCredit_{i,t} + \epsilon_{i,t} \quad (6)$$

In the above specification, the ageing effect is captured by $(\beta_3 + \beta_5 \Delta\, lnCredit_{i,t})$.

$$\frac{\partial\ \Delta\, lnP_{i,t}}{\partial\ \Delta\, lnAgeing_{i,t}} = \beta_3 + \beta_5 \Delta\, lnCredit \quad (7)$$

If β_5 is positive in sign, we can say that the negative effect of ageing is offset by relaxing of liquidity constraints.

Empirical Results

Our estimation results compose four parts. We employ the Pooled LS methodology to estimate all parts, and the estimation is presented stepwise to check the multicollinearity and robustness of the estimation results. The first part is the baseline model, and the second to fourth parts expand on it. Specifically, the first part is a baseline model that uses income and population as basic variables as in Takáts (2012), and additionally examines ageing (the old age dependency rate and the old age ratio) and financial development index which is used as a proxy for credit variable. The second part examines the impact of each type of financial development index (which consists of two variables, financial institution index and financial market index) on house prices based on the baseline model. The third part examines the interaction between credit and ageing. The last part examines the impact of credit and ageing on income level using OECD dummy variables (OECD = 1, non-OECD = 0).

1. Baseline Model

Table 1 presents the estimation results for the baseline model. Model (1) ~ (6) are cases for all the countries and the entire period in the sample, but the number of samples is 1,321 because the data has an unbalanced panel structure. Model (1) considers only income (GDP per capita) and population as basic variables, while Model (2) and (3) include ageing variables (DEP and OAG) in Model (1), and Model (4) includes credit variable (FD) in Model (1). In addition, Model (5) and (6) employ both ageing and credit variables.

The results of the estimation are robust regardless of the choice of ageing and credit variables, and the autocorrelation problem is also minimal when considering the DW statistics. The effects of variables such as GDP, population and credit variables on house prices seem to be in accord with literature. However, the estimation results for the ageing variable show different results from Takáts (2012). Specifically, Model (1) ~ (6) show Income (GDPP), population (POP) and credit variables (FD, FD1 and FD2) are a statistically significant positive effect on house prices. The ageing variables (DEP and OAG) showed a negative sign, as in Takáts (2012), but the results

Table 1. Baseline results on house prices

Variables		M (1)	M (2)	M (3)	M (4)	M (5)	M (6)
Constant		-0.002 (0.004)	-0.001 (0.004)	-0.002 (0.004)	-0.003 (0.004)	-0.003 (0.004)	-0.003 (0.004)
Δ *lnGDPP*		1.087*** (0.079)	1.088*** (0.079)	1.089*** (0.079)	1.063*** (0.079)	1.063*** (0.080)	1.064*** (0.080)
Δ *ln POP*		0.567* (0.303)	0.545* (0.313)	0.551* (0.310)	0.590* (0.302)	0.585* (0.313)	0.583* (0.309)
Δ *ln Ageing*	Δ *ln DEP*	-	-0.028 (0.098)		-	-0.006 (0.098)	-
	Δ *ln OAG*	-	-	-0.026 (0.102)	-		-0.010 (0.102)
Δ *ln Credit*	Δ *ln FD*	-	-	-	0.109*** (0.041)	0.109*** (0.041)	0.109*** (0.041)
Number of observations		1,321	1,321	1,321	1,321	1,321	1,321
Number of groups		59	59	59	59	59	59
R^2		0.125	0.125	0.125	0.130	0.130	0.130
D-W		1.694	1.694	1.694	1.703	1.703	1.704

Notes: ***, **, and * denote significance at 1%, 5%, and 10% levels, respectively. Figures in parentheses of each variable indicate standard errors.

Table 2. Results on house prices: Types of Credit Variable

Variables		M (5)	M (5-1)	M (5-2)	M (6)	M (6-1)	M (6-2)
Constant		-0.003 (0.004)	-0.003 (0.004)	-0.002 (0.004)	-0.003 (0.004)	-0.003 (0.004)	-0.003 (0.004)
Δ *ln GDPP*		1.063*** (0.080)	1.058*** (0.080)	1.082*** (0.079)	1.064*** (0.080)	1.059*** (0.080)	1.082*** (0.080)
Δ *ln POP*		0.585* (0.313)	0.558* (0.312)	0.563* (0.313)	0.583* (0.309)	0.553* (0.309)	0.567* (0.310)
Δ *ln Ageing*	Δ *lnDEP*	-0.006 (0.098)	0.007 (0.099)	-0.019 (0.098)	-	-	-
	Δ *ln OAG*	-	-	-	-0.010 (0.102)	0.001 (0.102)	-0.019 (0.102)
Δ *ln Credit*	Δ *ln FD*	0.109*** (0.041)	-	-	0.109*** (0.041)	-	-
	Δ *ln FD1*	-	0.171*** (0.055)	-	-	0.171*** (0.055)	-
	Δ *ln FD2*			0.026 (0.016)	-	-	0.026 (0.016)
Number of observations		1,321	1,321	1,321	1,321	1,321	1,321
Number of groups		59	59	59	59	59	59
R^2		0.130	0.132	0.127	0.130	0.132	0.127
DW		1.703	1.704	1.699	1.704	1.704	1.699

Notes: ***, **, and * denote significance at 1%, 5%, and 10% levels, respectively. Figures in parentheses of each variable indicate standard errors.

were not statistically significant.[5] These results imply that the influence of ageing on house prices fluctuations over the past 40 years has been clearly evident, while the influence of ageing has not yet been confirmed. In other words, it shows that if the financial sector can continue to develop even as ageing becomes more severe, there is a possibility that house prices will continue to rise.

2. House prices and Types of Credit Variable

Table 2 shows the estimation results for the impact of each type of financial development index (financial institution index and financial market index) on house prices. In <Table 2>, model (5) and (6) are presented for comparison with the results in <Table 1>, and Model (5-1), (5-2), (6-1) and (6-2) consider sub-types of financial development as credit variables in model (5) and (6), respectively.

The estimation results are very similar to those in Table 1, and show robust results regardless of variable selection. The development of financial institutions has a statistically significant effect on house prices, while the development of financial markets has an unclear effect. It is very interesting that the results show different results depending on the sector of financial development. These results show that the development of financial institutions rather than the development of financial markets drove the rise in house prices in the 59 countries analyzed during the sample period.

Table 3. Results on house prices: Ageing and Credit

Variables		M (5-3)	M (5-4)	M (5-5)	M (6-3)	M (6-4)	M (6-5)
Constant		-0.002 (0.004)	-0.003 (0.004)	-0.002 (0.004)	-0.003 (0.004)	-0.003 (0.004)	-0.002 (0.004)
Δ *ln GDPP*		1.068*** (0.080)	1.046*** (0.080)	1.092*** (0.079)	1.069*** (0.080)	1.046*** (0.080)	1.092*** (0.079)
Δ *ln POP*		0.579* (0.312)	0.657** (0.320)	0.507* (0.313)	0.586* (0.309)	0.675** (0.319)	0.515* (0.308)
Δ *ln Ageing*	Δ *ln DEP*	-0.039 (0.099)	-0.046 (0.106)	-0.039 (0.099)			
	Δ *ln OAG*	-	-	-	-0.044 (0.103)	-0.063 (0.111)	-0.030 (0.012)
Δ *ln Credit*	Δ *ln FD*	0.063 (0.045)	-	-	0.060 (0.045)	-	-
	Δ *ln FD1*	-	0.145** (0.059)	-	-	0.137** (0.060)	-
	Δ *ln FD2*	-	-	-0.002 (0.019)	-	-	-0.002 (0.019)
Δ *ln Ageing** Δ *ln Credit*		2.805** (1.124)	2.449 (1.786)	1.683*** (0.647)	2.890** (1.155)	2.820 (1.873)	1.759*** (0.675)
Number of observations		1,321	1,321	1,321	1,321	1,321	1,321
Number of groups		59	59	59	59	59	59
R^2		0.134	0.133	0.132	0.134	0.133	0.132
DW		1.707	1.711	1.700	1.707	1.712	1.700

Notes: ***, **, and * denote significance at 1%, 5%, and 10% levels, respectively. Figures in parentheses of each variable indicate standard errors.

Table 4. Results on house prices: Ageing and Credit (OECD)

Variables		M (5-3)	M (5-4)	M (5-5)	M (6-3)	M (6-4)	M (6-5)
Constant		0.013* (0.007)	0.012* (0.007)	0.013* (0.007)	0.014** (0.007)	0.014** (0.006)	0.014** (0.006)
Δ *ln GDPP*		1.327*** (0.130)	1.317*** (0.129)	1.335*** (0.130)	1.359*** (0.130)	1.349*** (0.130)	1.366*** (0.131)
Δ *ln POP*		0.317 (0.486)	0.303 (0.483)	0.315 (0.487)	0.404 (0.476)	0.385 (0.473)	0.401 (0.478)
Δ *ln Ageing*	Δ *ln DEP*	-1.077*** (0.276)	-1.055*** (0.271)	-1.024*** (0.272)	-	-	-
	Δ *ln OAG*	-	-	-	--1.321*** (0.304)	-1.297*** (0.297)	-1.234*** (0.299)
Δ *ln Credit*	Δ *ln FD*	0.030 (0.066)	-	-	-0.008 (0.071)	-	-
	Δ *ln FD1*	-	0.107 (0.079)	-	-	0.041 (0.086)	-
	Δ *ln FD2*	-	-	-0.017 (0.031)	-	-	-0.033 (0.034)
Δ *ln Ageing** Δ *ln Credit*		5.884 (3.807)	10.431** (4.744)	1.720 (1.658)	9.774** (4.556)	16.741*** (5.669)	3.109 (2.058)
Number of observations		961	961	961	961	961	961
Number of groups		34	34	34	34	34	34
R^2		0.246	0.252	0.243	0.249	0.257	0.245
DW		1.926	1.945	1.908	1.939	1.961	1.917

Notes: ***, **, and * denote significance at 1%, 5%, and 10% levels, respectively. Figures in parentheses of each variable indicate standard errors.

3. Ageing and Credit on House Prices

Table 3 shows the results including the interaction terms between the ageing variables and the credit variables in Table 2. Therefore, model (5-3), (5-4), (5-5), (6-3), (6-4) and (6-5) present the analysis results when the interaction term is included in the analysis model, respectively.

The results of the analysis are as follows: First, even if the interaction term is taken into account, the impact of ageing on house prices is unclear, as in the previous analysis results. Second, the impact of the financial sector is significant only in the development of financial institutions. Third, all the interaction terms are positive, so it can be said that the negative effect of ageing on house prices is offset by the relaxation of liquidity constraints. However, it can be confirmed that the impact is limited only to the development of the financial market. Based on these results, we can interpret that the negative impact of ageing, which various literatures have worried about, has not been realized or its evidence has not been confirmed. This is because the impact of credit expansion due to the development of the financial sector on the fluctuation of house prices was relatively greater than the impact of ageing.

4. Ageing and Credit on House Prices in OECD

Meanwhile, the impact of ageing on house prices may depend on income level. So, we perform the same analysis as above for OECD countries only. The model in Table 4 is identical to the

Table 5. Results on house prices: Ageing and Credit (Non-OECD)

Variables		M (5-3)	M (5-4)	M (5-5)	M (6-3)	M (6-4)	M (6-5)
Constant		-0.027*** (0.007)	-0.027*** (0.007)	-0.028*** (0.007)	-0.028*** (0.007)	-0.028*** (0.007)	-0.028*** (0.007)
Δ *ln GDPP*		1.707*** (0.161)	1.699*** (0.164)	1.711*** (0.161)	1.707*** (0.162)	1.697*** (0.164)	1.711*** (0.161)
Δ *ln POP*		1.227*** (0.368)	1.211*** (0.397)	1.152*** (0.368)	1.237*** (0.364)	1.207*** (0.397)	1.157*** (0.364)
Δ *ln Ageing*	Δ *ln DEP*	0.022 (0.101)	0.038 (0.111)	0.045 (0.101)	-	-	-
	Δ *ln OAG*	-	-	-	0.036 (0.102)	0.057 (0.112)	0.059 (0.102)
Δ *ln Credit*	Δ *ln FD*	-0.065 (0.096)	-	-	-0.070 (0.097)	-	-
	Δ *ln FD1*	-	-0.008 (0.104)	-	-	-0.005 (0.105)	-
	Δ *ln FD2*	-	-	-0.027 (0.035)	-	-	-0.025 (0.035)
Δ *ln Ageing** Δ *ln Credit*		2.736** (1.126)	0.173 (1.839)	1.586** (0.646)	2.781** (1.148)	0.067 (1.900)	1.594** (0.652)
Number of observations		360	360	360	360	360	360
Number of groups		25	25	25	25	25	25
R^2		0.426	0.415	0.426	0.426	0.415	0.426
DW		1.394	1.407	1.386	1.393	1.407	1.387

Notes: ***, **, and * denote significance at 1%, 5%, and 10% levels, respectively. Figures in parentheses of each variable indicate standard errors.

model in Table 3, except that the sample is limited to OECD countries, which reduces the number of observations to 961.

The results of the analysis are as follows: First, unlike the previous analysis, we find a clear negative effect of ageing on house prices; Second, however, we also find a positive effect of the financial sector, suggesting that the negative effect of ageing on house prices may be offset by the easing of liquidity constraints. However, third, the impact of the financial sector is only significant with the development of financial institutions. Based on these results, it can be interpreted that the negative effects of ageing, which have been feared in the literature, have not realized in OECD countries or have not been confirmed. This is due to the relatively greater impact of credit expansion due to the development of the financial sector rather than the impact of ageing on house price changes.

Finally, we find that these effects do not depend on the choice of the ageing variable.

5. Ageing and Credit on House Prices in non-OECD

We perform the same analyses as above, only for non-OECD countries with relatively low-income. The model in Table 5 is the same as that in Table 3 or Table 4, with the sample size reduced to 360.

We do not find a negative impact of ageing in the case only for the non-OECD countries. This does not depend on the choice of the ageing variable and we still do not find a negative effect of ageing when we include an interaction term between ageing and credit.

Conclusion

We focus on the role of credit and study the relation between population ageing and house prices that has been paid much attention to after Takáts (2012) using international data to provide empirical evidence about the relation. Takáts (2012) concludes that "ageing is likely to affect future asset prices substantially negatively, though asset price declines, let alone a meltdown, are unlikely." Now, more than a decade after Takáts (2012), demographic headwind by population ageing 'didn't occur'. Nevertheless, after his study, a lot of papers that supported and not supported him were published, and the debate is still on going (Poterba, 2014; Sun et al. 2024).

We conducted various analyses focusing on the role of credit as a possible explanation for the absence of negative effects of ageing using cross-country unbalanced panel data for the period 1981-2020 for 59 countries. We find that GDP, population and credit variables have a significant positive effect on house prices, while the effect of the ageing variable is negative but not statistically significant. These results are robust to the choice of ageing and credit variables. This is a different result from Takáts (2012), which suggests that the impact of ageing has not yet been identified.

The development of financial institutions has a statistically significant positive effect on house prices, while the development of financial markets has an unclear effect. This shows that the development of financial institutions, rather than the development of financial markets, has driven house prices growth. The effect of ageing on house prices is unclear even when the interaction terms are taken into account, and the effect of the financial sector is only significant for the development of financial institutions. All the interaction terms in various specifications are positive, suggesting that the potential negative effect of ageing, if any, on house prices is offset by the easing of liquidity constraints.

These findings are clearer in OECD countries, which have higher levels of ageing but also more developed financial institutions. Analyses using only OECD countries confirm the negative impact of ageing, but also confirm the positive effect of the development of financial institutions, which explains why the house prices collapse didn't happen unlike that many studies have predicted. Based on these results, it can be interpreted that the negative effects of ageing that have been feared in the literature have not realized or not been confirmed. This might be because the impact of credit expansion due to the development of the financial sector on house prices movements has been relatively stronger than the potential negative impact of ageing.

We find that, unlikely to Takáts (2012), the negative effect of ageing on house prices is not confirmed when credit availability is not taken into account, but also could be offset by an increase in the availability of credit. These results suggest that the demographic headwind by population ageing has not realized yet.

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Conflicting interests

The author(s) declare that there is no conflict of interest (If there are conflicts of interest, list them in detail, specifying the nature of the conflict and the involved parties).

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Notes

1. We define "older people" as 65 years of age or older.
2. The methodology adopted in both studies is the same as the methodology of this study. In other words, log difference panel regressions are adopted as the basic model.
3. Park et al. (2017) is for 6 metropolitan cities and 7 provinces in South Korea from 1990 to 2014, Zheng (2017) is for 31 provinces, cities, and autonomous regions in China for 2004 to 2014, Breidenbach (2017) is for over 10,000 municipalities in Germany in 2008, and Hillera and Lerbs (2016) is for 87 cities in Germany from 1995 to 2014.
4. Though the ideal measure of liquidity restriction for house demand could be the aggregate amount of mortgage loan or the ratio of those who have mortgage in all the homeowners, it is very hard to obtain in international level with significant comparability.
5. Our finding that the ageing headwind is not statistically significant may be due to the heterogeneity of the periods analyzed. To account for this, we conduct separate analyses for OECD (the time span of the samples is relatively long) and non-OECD countries (the time span of the samples is relatively short) and present the results in the main text.

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Appendix

Appendix 1. House Prices Series used in the analysis

NO	Countries	Code	From	To	Covered area	Real estate type	Real estate vintage
1	Australia	Q:AU:4:3:0:2:6:0	1986	2023	Big cities	Single-family houses - detached	All
2	Austria	Q:AT:2:1:0:0:1:0	1986	2023	Capital city/biggest city/ financial center	All types of dwellings	All
3	Belgium	Q:BE:0:1:1:0:0:0	1973	2023	Whole country	All types of dwellings	Existing
4	Brazil	M:BR:9:1:0:0:0:0	2001	2023	Urban areas	All types of dwellings	All
5	Bulgaria	Q:BG:0:1:0:1:1:0	2005	2023	Whole country	All types of dwellings	All
6	Canada	M:CA:0:2:2:1:6:0	1981	2023	Whole country	Single-family houses	New
7	Chile	Q:CL:0:0:0:0:6:0	2002	2023	Whole country	All properties	All
8	China	M:CN:2:8:1:1:1:0	2011	2023	Capital city/biggest city/ financial center	Flats	Existing
9	Colombia	Q:CO:4:0:1:0:6:0	1988	2023	Big cities	All properties	Existing
10	Croatia	Q:HR:0:1:0:1:6:0	2002	2023	Whole country	All types of dwellings	All
11	Cyprus	Q:CY:0:1:0:0:6:0	2002	2023	Whole country	All types of dwellings	All
12	Czechia	Q:CZ:0:1:0:1:6:0	2008	2023	Whole country	All types of dwellings	All
13	Denmark	Q:DK:0:2:0:1:6:0	1971	2023	Whole country	Single-family houses	All
14	Estonia	Q:EE:0:1:0:1:1:0	2005	2023	Whole country	All types of dwellings	All
15	Finland	Q:FI:0:L:1:1:1:0	1985	2016	Whole country	Land for residential	Existing
16	France	Q:FR:0:1:1:1:6:0	1996	2023	Whole country	All types of dwellings	Existing
17	Germany	A:DE:0:1:0:0:6:0	1975	2017	Whole country	All types of dwellings	All
18	Greece	Q:GR:1:1:0:0:1:0	1994	2018	Whole country excluding capital city	All types of dwellings	All
19	Hong Kong SAR	Q:HK:0:1:0:1:1:0	1979	2023	Whole country	All types of dwellings	All
20	Hungary	Q:HU:0:1:0:0:6:0	1990	2023	Whole country	All types of dwellings	All
21	Iceland	M:IS:3:1:0:1:1:0	1999	2023	Capital/biggest city/ financial center and suburbs	All types of dwellings	All

Appendix 1. House Prices Series used in the analysis (continue)

NO	Countries	Code	From	To	Covered area	Real estate type	Real estate vintage
22	India	Q:IN:3:1:0:0:6:0	2010	2023	Capital/biggest city/ financial center and suburbs	All types of dwellings	All
23	Indonesia	Q:ID:4:1:2:0:0:0	2002	2023	Big cities	All types of dwellings	New
24	Ireland	M:IE:0:1:0:1:0:0	2005	2023	Whole country	All types of dwellings	All
25	Israel	M:IL:0:1:0:1:6:0	1994	2023	Whole country	All types of dwellings	All
26	Italy	Q:IT:0:1:0:0:6:0	1990	2023	Whole country	All types of dwellings	All
27	Japan	M:JP:3:2:0:3:6:0	1984	2023	Capital/biggest city/ financial center and suburbs	Single-family houses	All
28	Korea	M:KR:0:1:1:2:6:0	1986	2023	Whole country	All types of dwellings	Existing
29	Latvia	Q:LV:0:1:0:1:6:0	2006	2023	Whole country	All types of dwellings	All
30	Lithuania	Q:LT:0:1:0:0:1:0	1998	2023	Whole country	All types of dwellings	All
31	Luxembourg	A:LU:0:1:0:1:0:0	1974	2015	Whole country	All types of dwellings	All
32	Malaysia	Q:MY:0:1:0:0:0:0	2009	2023	Whole country	All types of dwellings	All
33	Malta	Q:MT:0:1:0:0:0:0	2000	2023	Whole country	All types of dwellings	All
34	Mexico	Q:MX:0:1:0:2:6:0	2005	2023	Whole country	All types of dwellings	All
35	Morocco	Q:MA:0:1:1:0:6:0	2005	2023	Whole country	All types of dwellings	Existing
36	Netherlands	M:NL:0:1:1:1:0:0	1976	2023	Whole country	All types of dwellings	Existing
37	New Zealand	Q:NZ:0:1:0:3:6:0	1979	2023	Whole country	All types of dwellings	All
38	North Macedonia	Q:MK:2:8:0:0:1:0	2000	2023	Capital city/biggest city/ financial center	Flats	All
39	Norway	A:NO:0:1:0:0:0:0	1819	2023	Whole country	All types of dwellings	All
40	Peru	Q:PE:2:8:0:0:6:0	2007	2023	Capital city/biggest city/ financial center	Flats	All
41	Philippines	Q:PH:2:8:0:2:1:0	2008	2023	Capital city/biggest city/ financial center	Flats	All
42	Poland	A:PL:0:2:0:1:1:0	2003	2022	Whole country	Single-family houses	All

Appendix 1. House Prices Series used in the analysis (continue)

NO	Countries	Code	From	To	Covered area	Real estate type	Real estate vintage
43	Portugal	M:PT:0:1:0:2:1:0	1988	2023	Whole country	All types of dwellings	All
44	Romania	Q:RO:0:1:0:1:6:0	2009	2023	Whole country	All types of dwellings	All
45	Russia	Q:RU:9:1:1:1:1:0	2001	2023	Urban areas	All types of dwellings	Existing
46	Saudi Arabia	Q:SA:0:0:0:1:6:0	2014	2023	Whole country	All properties	All
47	Serbia	Q:RS:6:8:0:3:6:0	2017	2023	Big & medium cities	Flats	All
48	Singapore	Q:SG:0:1:0:3:1:0	1998	2023	Whole country	All types of dwellings	All
49	Slovakia	Q:SK:3:1:0:2:1:0	2005	2023	Capital/biggest city/ financial center and suburbs	All types of dwellings	All
50	Slovenia	Q:SI:0:1:0:1:6:0	2007	2023	Whole country	All types of dwellings	All
51	South Africa	M:ZA:0:1:0:2:6:1	2000	2023	Whole country	All types of dwellings	All
52	Spain	Q:ES:0:1:0:3:1:0	1995	2023	Whole country	All types of dwellings	All
53	Sweden	Q:SE:0:2:0:1:0:0	1986	2023	Whole country	Single-family houses	All
54	Switzerland	Q:CH:0:2:0:2:0:0	1970	2023	Whole country	Single-family houses	All
55	Thailand	M:TH:0:3:0:0:6:0	2008	2023	Whole country	Single-family houses - detached	All
56	Türkiye	M:TR:0:1:0:0:6:0	2010	2023	Whole country	All types of dwellings	All
57	United Arab Emirates	M:AE:4:1:0:2:1:0	2003	2023	Big cities	All types of dwellings	All
58	United Kingdom	M:GB:2:1:0:1:0:0	1995	2023	Capital city/biggest city/ financial center	All types of dwellings	All
59	United States	Q:US:0:2:2:1:0:0	1963	2023	Whole country	Single-family houses	New