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How does real estate income affect retirement age?: Lessons from national survey of tax and benefit*

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Abstract

In Western countries, where retirement funds primarily consist of pensions, research on retirement decision making revolves around pension-related considerations. Conversely, in Korea, where a whopping 77.5% of assets are tied to real estate, little attention has been devoted to exploring the connection between real estate holdings and retirement. This study employs panel models, utilizing data from the 2016-2021 National Survey of Tax and Benefit, to analyze the impact of real estate income on the expected retirement age. The empirical findings reveal that individuals with real estate income tend to postpone their retirement by an average of 2.25 years. Moreover, as both the amount of income derived from real estate and proportion of real estate income in total income increase, the incentives to continue working beyond the traditional retirement age strengthen notably. Given that this study is the first to establish a connection between real estate income and retirement, it is imperative to delve deeper into this topic and uncover further implications through subsequent research endeavors.

key words: real estate income, retirement, panel analysis, population aging, pension

Ⅰ. Introduction

Retirement is a critical research area spanning across various domains, encompassing individuals, businesses, and nations, and its significance cannot be overstated, particularly given the global challenge of population aging (Vogel et al., 2017). Within the context of Western countries, which have seen a plethora of studies investigating retirement determinants, pensions consistently emerge as a pivotal factor influencing retirement timing. Numerous studies, ranging from Feldstein's seminal work in 1974 emphasizing public pensions as the primary determinant of retirement to more

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recent research like Riedel et al.'s (2015) findings highlighting company pensions (retirement pensions), converge on the idea that pensions play a central role in retirement decisions. The influence of pensions on retirement can be elucidated through theories such as the life cycle hypothesis (Ando and Modigliani, 1963; Fisher, 1930; Modigliani and Ando, 1957; Modigliani and Brumberg, 1954) and the permanent income hypothesis (Friedman, 1957). As individuals accumulate surplus income throughout their high-income years and adulthood, the decision to retire often hinges on the attainment of sufficient financial resources for retirement. Pensions function as a mechanism for transferring income from one's younger, working years to their later years in retirement. Particularly noteworthy is the role of life annuities in providing income throughout one's lifetime (permanent income), which can influence the decision to retire and discontinue working.

In contrast to Western societies, where retirement decisions are often influenced by factors such as a flexible labor market, corporate culture, ease of job transition, re-employment opportunities, and individual preferences, the landscape of retirement decision-making in Korean society is characterized by rigidity and compulsion. For instance, the timing of retirement in Korea hinges largely on whether a guaranteed retirement age exists and at what age that guarantee is set, as outlined by Park (2003). In the context of the national pension system, which serves as a cornerstone of the country's social safety net, the subscriber base stands at a modest 22.33 million (as of May 2022). Additionally, over half of the pension recipients receive monthly payments of less than 400,000 won, with merely 8.4% enjoying pensions exceeding 1 million won[1]. Regarding private pensions, the retirement pension —deemed as carrying substantial economic and social significance—was only introduced in December 2005. By the end of 2021, the reserve fund for these pensions had surged to 295.6 trillion won, yet the proportion of recipients remains limited, with only 4% of eligible individuals receiving pension payments, as reported by the Financial Supervisory Service (2022).

In Korea, making a voluntary retirement decision that takes into account the expected pension amount can be a challenging endeavor. Therefore, this study undertakes empirical analysis to ascertain the impact of real estate income on retirement age. The rationale behind focusing on real estate income lies in the unique landscape of Korea, where household wealth is primarily comprised of real estate assets rather than pension holdings. As reported by Statistics Korea (2021),

1) Detailed statistics can be accessed on the National Pension Research Institute's website (https://institute.nps.or.kr/jsppage/etc/data/data02_02.jsp).

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as of March 2021, real assets constituted a substantial 77.5% of household wealth, amounting to 502.53 million won, with real estate accounting for a dominant 95.6% share of these real assets. However, the primary aim of Koreans in real estate ownership or investment lies in profit generation through arbitrage, rather than seeking substantial cash flow (Kim, 2021). Given the paramount importance of cash flow in retirement decision-making, this study chooses to emphasize real estate income as the primary explanatory variable, rather than focusing solely on real estate assets[2].

As mentioned earlier, in the context of Korean society, retirement age is predominantly determined involuntarily. Therefore, we analyzed the relationship between real estate income and the expected retirement age rather than the actual retirement age. The theoretical prediction of how real estate income influences the expected retirement age is intricate. For instance, if Koreans perceive real estate income as a cash flow similar to an annuity that continues until death, they may tend to retire relatively early, aligning with the permanent income hypothesis. Conversely, if individuals believe that real estate income is not perpetual, their retirement tendencies may differ. Moreover, the desire to maximize utility or happiness from real estate income could lead economic agents to extend their working years. Notably, the presence of real estate income prior to retirement may elevate overall consumption levels. Furthermore, the desired post-retirement consumption level might be higher, potentially incentivizing individuals to sustain their work activities to meet these elevated consumption goals, as indicated by Li et al. (1996). Hence, it is imperative to conduct an empirical analysis to ascertain the tangible impact of real estate income on retirement age.

The structure of this study is as follows: Chapter 2 provides a comprehensive review of prior research directly or indirectly linked to the subject matter. Chapter 3 elucidates the analysis model and data employed. Chapter 4 delves into the analysis outcomes, and Chapter 5 offers the concluding remarks.

II. Lierature Review

1. Domestic Research

The realm of retirement research is vast and encompasses numerous studies; while it's impossible to provide an exhaustive list, the majority of these studies tend to focus on analyzing the factors influencing actual retirement age. Notably, as the most recent domestic study, Kim et al. (2021) unveiled the significance of

2) Considering the high correlation between real estate income and real estate assets, as highlighted by Kim (2021), it is noteworthy that even if one were to substitute real estate assets for real estate income in the analysis, the resulting findings remain largely consistent.

factors such as physical and biological aging, employment stability, and gender in the retirement decision-making process. Common themes emerge from domestic research regarding the determinants of retirement. For instance, deteriorating health status tends to correlate with earlier retirement (Kim et al., 2015), retirement timing often hinges on job security (Park, 2003), and men typically retire later than women (Kim et al., 2015). Furthermore, due to the distinctive dynamics of family relationships in Korea, it's argued that parents tend to delay retirement when they have dependent children (Kim et al., 2015; Kim et al., 2021).

Conversely, there are conflicting findings regarding income levels. Individuals with lower incomes often prolong their working years to make ends meet, while even higher-income individuals with specialized skills or expertise may delay retirement due to the high opportunity cost associated with leaving the workforce (Kim et al., 2015). An outlier in Korean retirement research is Son (2010), who focused on real estate as a determinant of retirement. This study indicated that individuals with greater real estate holdings tend to have higher post-retirement satisfaction, but it did not establish a clear link between real estate assets and retirement age. The absence of a significant relationship between real estate assets and retirement age in Son's study (2010) may be attributed to the fact that, as previously discussed, retirement timing in Korea is predominantly influenced by involuntary factors rather than voluntary decision-making. Furthermore, Son's study (2010) has limitations due to its reliance on cross-sectional analysis rather than panel analysis. This limitation arises from the use of only the first-year data from the Korean Longitudinal Study of Aging (KLoSA), making it impossible to ascertain whether retirement decisions were influenced by real estate assets or if real estate assets were acquired or disposed of after retirement.

Korea has been experiencing a diversification in the distribution of retirement ages, a departure from the past. This shift is primarily driven by the prolonged life expectancy and improved physical health among the population. As life expectancy increases and overall physical status improves in Korea, the retirement landscape is becoming increasingly diverse. Gradual retirement, partial retirement, and post-retirement re-employment have become more prevalent, as noted by Cho (2014). Indeed, according to Statistics Korea (2022), a survey conducted among individuals aged 55 to 64 revealed that while the average age at which they retired from their primary occupation was 49.3, a remarkable 69.9% continued working after their initial retirement. Even individuals in their 70s and 80s display a strong desire to postpone retirement. In Korea, which grapples with one of the world's highest rates of elderly poverty, many elderly citizens are compelled to continue working for their

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livelihoods rather than pursuing work as a preference.

2. Research in Other Countries

Studies conducted in various other countries similarly identify involuntary factors like age, health, and economic crises as significant determinants of retirement (Anderson et al., 1986; Disney and Tanner, 1999; Loughran et al., 2001). However, in these countries, individual autonomous preferences often play a more pivotal role in retirement decision-making compared to Korea. Notably, many studies pertaining to retirement decisions in these countries have placed a strong emphasis on analyzing the impact of pension systems on retirement choices. Beginning with Feldstein's groundbreaking study (1974), a consistent pattern emerges in subsequent research: as public pension accumulations increase, the likelihood of early retirement also rises. Given the profound influence of pensions on retirement, there is research suggesting that when governments raise the pension eligibility age to stabilize pension finances, it tends to lead to a delay in the retirement age (Gustman and Steinmeier, 2005). Historically, in the United States and Europe, the retirement age often coincided with the pension eligibility age. However, in recent times, governments have increased the pension eligibility age significantly, reaching into the late 60s and even 70s, in efforts to bolster fiscal stability. Consequently, this has decoupled the retirement age from the pension eligibility age, empowering individuals to make voluntary decisions about when to retire before reaching the pension eligibility age (Pilipiec et al., 2021).

Li et al. (1996) uncovered a nuanced aspect of retirement planning: a non-linear relationship between actual cash flows and subjective assessments of the adequacy of old-age resources. Interestingly, even when individuals experienced relatively modest cash (income) flows, they often perceived their retirement income as sufficient. Conversely, those with more substantial cash flows sometimes felt their retirement income remained inadequate. As a result, the timing of retirement might be influenced more by subjective judgments about the adequacy of cash flows rather than the objective cash flow amounts themselves (Li et al., 1996). Furthermore, it’s worth noting that the utility derived from work itself, independent of objective or subjective assessments of income, assets, or pensions, could lead individuals to lean toward postponing their retirement (Pilipiec et al., 2021).

Some studies have focused on individuals' anticipated or desired retirement age rather than their actual retirement age. In this regard, Montalto et al. (2000) discovered that as individuals age, a preference for delaying retirement tends to emerge. Intriguingly, they also observed that individuals with higher current income levels are more inclined to postpone their retirement.

A prevalent trend observed in both Eastern and Western societies in recent years is the inclination to postpone retirement. In Western countries, this tendency is amplified by the availability of better health conditions that enable individuals to continue working well into their advanced years (Hess, 2017; Wheaton and Crimmins, 2012).

3. Contributions of This Study

In Western countries, the timing of retirement is primarily influenced by the sufficiency of pension income, as highlighted by Montalto et al. (2000). Conversely, in Korea, where real estate assets are predominant rather than pensions, this study conducts an empirical analysis of retirement decision-making with a focus on real estate income. Additionally, taking into account the distinctive feature of the Korean context, where retirement timelines are often determined involuntarily, this research examines individuals' expected or preferred retirement age rather than their actual retirement age.

Ⅲ. Empirical Model and Data

1. Analysis Approach

〈Eq. 1〉 can be employed to assess the influence of real estate income on the retirement age.

$$RetireAge_{it} = \alpha RealEstate_{it} + X_{it}^{'}\beta + u_{it}$$

〈Eq. 1〉

$$i = 1, 2, \ldots, N,\ t = 2016, \ldots, 2021.$$

In 〈Eq. 1〉, $RetireAge_{it}$ represents the anticipated retirement age of individual i at time t as self-assessed by the individual. $RealEstate_{it}$ corresponds to the real estate income of individuals. The vector X_{it} encompasses explanatory variables that may impact an individual's expected retirement age, excluding real estate income. α denotes the regression coefficient, and β signifies the vector of regression coefficients. The primary objective of this study is to estimate the value of α. If α is greater than zero (α>0), it indicates that retirement age tends to be postponed with an increase in real estate income. Conversely, if α is less than zero (α<0), it suggests that an increase in real estate income is associated with an earlier retirement age. Finally, u_{it} represents the error term in the equation.

However, within the framework of 〈Eq. 1〉, there is the potential for a correlation to exist between the primary explanatory variables and the error term. To address this challenge, one potential solution is to employ a fixed-effects model (Cameron and Trivedi, 2005; Greene, 2003). The fixed-effects model mitigates the potential correlation which gives rise to endogeneity issues, through a subtraction process, as illustrated in 〈Eq. 2〉 below.

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$$RetireAge_{it} - \overline{RetireAge_i} = \alpha(RealEstate_{it} - \overline{RealEstate_i}) + (X_{it} - \overline{X_i})'\beta + (u_{it} - \overline{u_i})$$

where $\overline{RetireAge_i} = \sum_{t=1}^{T} RetireAge_{it}$, $\overline{RealEstate_i} = \sum_{t=1}^{T} RealEstate_{it}$, $\overline{X_i} = \sum_{t=1}^{T} X_{it}$, and $\overline{u_i} = \sum_{t=1}^{T} u_{it}$ 〈Eq. 2〉

To determine the most suitable modeling approach, whether fixed or random effects, when there is no discernible correlation between the primary explanatory variables and the error term, a random effects model is often preferred (Cameron and Trivedi, 2005; Greene, 2003). The appropriateness of the chosen model can be confirmed through the Hausman test (Hausman, 1978). In all the analyses conducted within this study, the Hausman test consistently affirmed the suitability of the fixed effects model. However, this study opted to present the analysis results for both models. The rationale behind this decision lies in 〈Eq. 2〉, where all time-invariant variables, such as gender, are eliminated from the fixed effects model. Particularly, a random effects model becomes indispensable when analyzing the impact of variables that are not entirely time-invariant but exhibit relatively low volatility over time, such as residence and education level.

In 〈Eq. 1〉, apart from the endogeneity concern, issues related to causality or reverse causality may also arise. For instance, choices pertaining to asset allocation and savings behavior can differ based on an individual's intended retirement age (Lusardi, 2006). To address this complex interplay, we conducted an empirical analysis using panel data, tracking each individual's trajectory and observing how their expected retirement age evolves when their real estate income undergoes changes. Additionally, we analyzed both unbalanced and balanced panels to ensure the robustness of our findings. Furthermore, while the initial analysis encompassed all household members, subsequent investigations focused specifically on the household head and their spouse. Finally, to validate the robustness of our empirical analysis, we conducted additional assessments. This involved replacing the primary explanatory variable in 〈Eq. 1〉, real estate income, with a dummy variable indicating the presence or absence of real estate income, as well as the ratio of real estate income to total household income.

2. Analysis Data

For our empirical analysis, we utilized data spanning from 2016 to 2021, sourced from the National Survey of Tax and Benefits (NaSTaB). The NaSTaB offers comprehensive real estate income and personal information for each member within households, making it a rich resource for our research[3].

〈Table 1〉 displays the variables employed in the empirical analysis conducted and provides their respective definitions. In line with our earlier

〈Table 1〉 Names and definitions of variables

Categories	Variable name	Definition
Dependent variable	Retirement age	Retirement age (unit: years)
Main explanatory variables	Has R.E. income	1 if there is real estate income, 0 otherwise
	Log (R.E. income)	Logarithm of real estate income (unit: 10,000 won)
	Log (R.E. income ratio)	Logarithm of the ratio of real estate income to household income (unit: %)
Income	Log (income)	Logarithm of household income (unit: 10,000 won)
Age	30s	1 if you are in your 30s, 0 otherwise.
	40s	1 if you are in your 40s, 0 otherwise.
	50s	1 if you are in your 50s, 0 otherwise.
	60s	1 if you are in your 60s, 0 otherwise.
Working status	Wage worker	1 if employee, 0 otherwise.
	Self-employed	1 if self-employed, 0 otherwise
Marital status	Single	1 if never married, 0 otherwise
	Spouse	1 if married and has a spouse, 0 otherwise
	Non-spouse	1 if married but no spouse, 0 otherwise.
Health status	Health	1 if your health is very bad, 2 if it is bad, 3 if it is average, 4 if it is good, and 5 if it is very good.
Education	No_high school	1 if not graduate from high school, 0 otherwise
	High school	1 if graduated from high school, 0 otherwise
	College	1 if graduated from college, 0 otherwise
Gender	Male	1 if male, 0 if female
	Female	1 if female, 0 if male
Region	Seoul	1 if live in Seoul, 0 otherwise
	Busan	1 if live in Busan, 0 otherwise
	Daegu	1 if live in Daegu, 0 otherwise
	Incheon	1 if live in Incheon, 0 otherwise
	Gwangju	1 if live in Gwangju, 0 otherwise
	Daejeon	1 if live in Daejeon, 0 otherwise
	Ulsan	1 if live in Ulsan, 0 otherwise
	Gyeonggi	1 if live in Gyeonggi, 0 otherwise
	Gangwon	1 if live in Gangwon, 0 otherwise
	Chungbuk	1 if live in Chungbuk, 0 otherwise
	Chungnam	1 if live in Chungnam, 0 otherwise
	Jeonbuk	1 if live in Jeonbuk, 0 otherwise
	Jeonnam	1 if live in Jeonnam, 0 otherwise
	Gyeongbuk	1 if live in Gyeongbuk, 0 otherwise
	Gyeongnam	1 if live in Gyeongnam, 0 otherwise
	Jeju	1 if live in Jeju, 0 otherwise
	Sejong	1 if live in Sejong, 0 otherwise

3) More detailed information about the NaSTaB dataset can be accessed on the official website (ttps://www.kipf.re.kr/panel/index.do).

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discussion, the primary explanatory variables used in 〈Eq. 1〉 or 〈Eq. 2〉 encompassed the presence or absence of real estate income, real estate income itself, and the ratio of real estate income to household income. As the dependent variable, we opted to use expected retirement age, which can also be interpreted as the preferred retirement age.

The set of other control variables encompassed age, work type, marital status, health status, education level, gender, and residence. Given the prominence of real estate income as the primary variable and the tendency in Korea for individuals to enter the labor market relatively late in life, our analysis focused exclusively on individuals aged 30 to 64. Furthermore, considering that the key variable of interest is expected retirement age, we excluded individuals who had already retired or were not part of the workforce during the analysis period spanning from 2016 to 2021. Among the control variables, age, work type, marital status, and health status are variables that could be integrated into the fixed effect model. Meanwhile, gender, region, and education level were treated as time-invariant variables. Although education level and region are not strictly time-invariant from a theoretical standpoint, they were included solely in the random effects model. This decision was based on the fact that our analysis encompassed individuals aged 30 or older, and there were relatively few instances of residential region changes during the analysis period. For each categorical variable, we established a reference group comprising individuals in their 60s, self-employed, single, with less than a high school education, females, and residents of Seoul.

In the unbalanced panel analysis involving household members, we utilized a dataset comprising 31,357 samples. For the unbalanced panel analysis focused on household heads and their spouses, we worked with 29,007 samples. In the balanced panel analysis involving household members, we utilized a sample size of 16,070 (with 3,214 samples in each year), while for the balanced panel analysis focused on household heads and spouses, we worked with 15,130 samples (with 3,026 samples in each year).

Ⅳ. Empirical Results

1. Summary Statistics

〈Table 2〉 provides descriptive statistics for the variables utilized in the empirical analysis. We conducted a *t*-test to assess the mean differences between groups with and without real estate income.

The average expected retirement age across the entire dataset was 65.95 years. However, individuals with real estate income had a slightly higher expected retirement age of 66.84 years compared to those without real estate income (65.91). Out of the total sample of 31,357 individuals, only 1,329

〈Table 2〉 Descriptive statistics

Variables	Full samples		Samples without real estate income		Samples with real estate income	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Retirement age	65.95***	5.80	65.91	5.80	66.84	5.68
Has R.E. income	0.04***	0.20	0.00	0.00	1.00	0.00
Log (R.E. income)	0.29***	1.37	0.00	0.00	6.73	1.04
R.E. income	64.14***	683.30	0.00	0.00	1,513.40	2,971.37
Log (R.E. income ratio)	0.10***	0.52	0.00	0.00	2.36	1.06
R.E. income ratio	0.72***	4.90	0.00	0.00	17.05	16.98
Log (income)	8.53***	1.26	8.52	1.25	8.80	1.26
Income	6,956***	5,680	6,853	5,597	9,287	6,918
Age	48.14***	9.14	47.96	9.16	52.20	7.62
30s	0.21***	0.41	0.22	0.41	0.07	0.25
40s	0.32***	0.47	0.32	0.47	0.28	0.45
50s	0.35***	0.48	0.34	0.47	0.46	0.50
60s	0.12***	0.33	0.12	0.32	0.20	0.40
Wage worker	0.70***	0.46	0.71	0.45	0.59	0.49
Self-employed	0.30***	0.46	0.29	0.45	0.41	0.49
Single	0.11***	0.31	0.11	0.31	0.04	0.20
Spouse	0.81***	0.39	0.80	0.40	0.88	0.32
Non-spouse	0.09	0.28	0.09	0.28	0.08	0.27
Health	3.85***	0.71	3.86	0.71	3.80	0.72
No high school	0.08*	0.26	0.08	0.26	0.09	0.28
High school	0.38***	0.48	0.38	0.49	0.33	0.47
College	0.55***	0.50	0.55	0.50	0.58	0.49
Male	0.57***	0.50	0.57	0.50	0.61	0.48
Female	0.43***	0.50	0.43	0.50	0.39	0.48
Seoul	0.13**	0.33	0.12	0.33	0.15	0.35
Busan	0.08*	0.26	0.08	0.26	0.06	0.24
Daegu	0.06***	0.24	0.06	0.24	0.08	0.28
Incheon	0.05	0.22	0.05	0.22	0.06	0.23
Gwangju	0.04***	0.19	0.04	0.19	0.06	0.24
Daejeon	0.05***	0.22	0.05	0.22	0.01	0.11
Ulsan	0.03	0.17	0.03	0.17	0.03	0.18
Gyeonggi	0.19	0.39	0.19	0.39	0.19	0.39
Gangwon	0.03	0.18	0.03	0.18	0.03	0.18
Chungbuk	0.04***	0.19	0.04	0.20	0.01	0.11
Chungnam	0.10	0.30	0.10	0.30	0.10	0.30
Jeonbuk	0.04	0.20	0.04	0.20	0.03	0.18
Jeonnam	0.04**	0.20	0.04	0.20	0.05	0.22
Gyeongbuk	0.05***	0.21	0.05	0.21	0.07	0.26
Gyeongnam	0.07***	0.25	0.07	0.25	0.05	0.21
Jeju	0.00	0.03	0.00	0.03	0.00	0.04
Sejong	0.01	0.09	0.01	0.09	0.01	0.08
Number of samples	31,357		30,028		1,329	

Note: *, **, *** indicate statistical significance evaluated at 90%, 95%, and 99% confidence levels respectively as a result of a *t*-test on the mean difference between two groups.

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(4.23%) reported having real estate income. When considering only the household head, this percentage increases to 4.80%. For those with real estate income, their annual earnings from real estate averaged 15.13 million won, equivalent to a monthly average of 1.26 million won. Real estate income constituted 17.05% of their total income.

People with real estate income had an average annual household income of 92.87 million won, which was 1.36 times higher than the 68.53 million won annual income of those without real estate income. Notably, the income disparity between these two groups amounted to 24.34 million won, exceeding the difference in real estate income (15.13 million won). This observation underscores the strong correlation between real estate income and household income, suggesting a virtuous cycle where a high household income serves as an investment to generate real estate income, subsequently increasing household income further (Kim, 2021).

The average age of individuals with real estate income was 52.2 years, notably higher than the average age of those without real estate income, which stood at 47.96 years. Interestingly, among individuals with real estate income, wage workers comprised 59%, whereas among those without real estate income, the percentage of wage workers was notably higher at 71%. Conversely, the proportion of self-employed individuals among those with real estate income was 41%, significantly exceeding the 29% among those without real estate income.

Among individuals with real estate income, 88% were married, a higher percentage compared to those without real estate income, where 80% were married. Subjective health status, assessed on a scale of 1 to 5, was slightly lower for individuals with real estate income (3.80) than for those without real estate income (3.86). While it's common for education levels to decline with age, individuals with real estate income exhibited a higher level of education despite being older than those without real estate income.

2. Effect of Having Real Estate Income on Retirement Age

〈Table 3〉 displays the results of the analysis concerning the variation in expected retirement age based on the presence or absence of real estate income. Model 1 and Model 2 represent the outcomes obtained from the random effect model and fixed effect model, respectively. The fixed effect model reveals that individuals who initially lacked real estate income extended their expected retirement age by 2.25 years following the acquisition of real estate income.

The analysis revealed that as income levels rise, individuals tend to extend their expected retirement age. Interestingly, there is an association between increasing age and a higher expected retirement age. In other words, when individuals were younger, they expressed a desire to retire early, but as they grew older, they became more inclined to

〈Table 3〉 Retirement age based on real estate income

Variables	Model 1: Random effect model		Model 2: Fixed effect model	
	Coef.	Std. Err.	Coef.	Std. Err.
Has R.E. income	1.77**	0.89	2.25**	0.98
Log (income)	2.49	2.32	8.80***	2.83
30s	-4.80***	0.14	-3.98***	0.32
40s	-4.07***	0.12	-3.13***	0.25
50s	-2.67***	0.11	-1.82***	0.19
Wage worker	-1.56***	0.08	-0.56***	0.16
Spouse	-0.26**	0.13	0.45	0.46
Non-spouse	0.58***	0.18	0.80	0.56
Health	0.20***	0.04	0.28***	0.06
High school	-1.32***	0.16	Non-controlled	
College	-2.26***	0.16		
Male	2.35***	0.08		
Busan	0.60***	0.17		
Daegu	-0.67***	0.18		
Incheon	-0.74***	0.19		
Gwangju	-0.13	0.22		
Daejeon	1.52***	0.20		
Ulsan	-0.73***	0.25		
Gyeonggi	-0.10	0.13		
Gangwon	-0.51**	0.22		
Chungbuk	0.75***	0.22		
Chungnam	-0.20*	0.12		
Jeonbuk	0.19	0.21		
Jeonnam	0.83***	0.21		
Gyeongbuk	0.54***	0.20		
Gyeongnam	0.02	0.18		
Jeju	-0.28	1.21		
Sejong	0.46	0.37		
_cons	70.34***	0.32	66.55***	0.56

Note: 1. Prob〉F=0.000 for both with $R^2 = 0.24$ and Model 2 with $R^2 = 0.15$.
2. Number of observations: 31,357 (Model 1-Model 2).
3. *, **, *** mean significant at 90%, 95%, and 99% confidence levels, respectively.
4. As a result of the Hausman test, Model 2 is more suitable than Model 1 (p〈0.01).

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work longer.

Marital status and the presence of a spouse were not found to have a significant impact on retirement age. However, there was a notable correlation between individuals intending to work longer and an improvement in their health status. The estimated coefficient indicates that for each unit of improvement in health status, assessed on a scale of 1 to 5, the desired retirement age increases by 0.28 years. These findings align with a study by Swedas et al. (2017), which emphasized that health plays a pivotal role in income-earning activities, with poorer health being associated with earlier retirement.

The results from the random effect model indicate that individuals who are male and possess a higher level of education are inclined to retire later. In comparison to residents of Seoul, individuals residing in Busan, Daejeon, Cheongbuk, Jeonnam, and Gyeongbuk exhibit a tendency to retire at a later age. Conversely, those living in Daegu, Incheon, Ulsan, and Gangwon demonstrate a preference for earlier retirement. However, there was no discernible difference in the expected retirement age of residents in Gwangju, Gyeonggi, Chungnam, Jeonbuk, Gyeongnam, Jeju, and Sejong, when compared to residents in Seoul.

3. Effect of Increase in Real Estate Income on Retirement Age

<Table 4> displays the results of the analysis investigating the variation in expected retirement age as real estate income increases. The analysis revealed that as real estate income increased, the expected retirement age also increased. According to the estimated coefficient from the fixed effect model, the expected retirement age increased by 0.072 years for every 1% increase in real estate income. Therefore, if real estate income increases by 10%, the expected retirement age can be interpreted as increasing by 0.72 years[4]. Furthermore, if real estate income doubles (increases by 100%), the expected retirement age can be interpreted as increasing by 7.2 years. Since the estimated coefficients of other variables align with those in 〈Table 3〉 in terms of sign, magnitude, and statistical significance, a detailed interpretation is not provided.

4. Effect of the Proportion of Real Estate Income in Houshold Income on Retirement Age

〈Table 5〉 displays the results of an analysis examining how the expected retirement age changes with variations in the proportion of real

4) In this linear-log model (where the dependent variable is linear, and real estate income is a logarithmic value), a 1% increase in the explanatory variable corresponds to an increase or decrease in the dependent variable by 'estimated coefficient/100'.

〈Table 4〉 Retirement age due to changes in real estate income

Variables	Model 1: Random effect model		Model 2: Fixed effect model	
	Coef.	Std. Err.	Coef.	Std. Err.
Log (R.E. income)	4.06*	2.35	7.21**	3.33
Log (income)	2.52	2.32	8.77***	2.83
30s	-4.80***	0.14	-3.98***	0.32
40s	-4.07***	0.12	-3.13***	0.25
50s	-2.67***	0.11	-1.82***	0.19
Wage worker	-1.56***	0.08	-0.56***	0.16
Spouse	-0.26**	0.13	0.45	0.46
Non-spouse	0.58***	0.18	0.80	0.56
Health	0.20***	0.04	0.28***	0.06
Education	Controlled		Non-Controlled	
Gender				
Region				

Note: 1. Prob〉F=0.000 for both with $R^2=0.21$ and Model 2 with $R^2=0.14$.
2. Number of observations: 31,357 (Model 1-Model 2).
3. *, **, *** mean significant at 90%, 95%, and 99% confidence levels, respectively.
4. As a result of the Hausman test, Model 2 is more suitable than Model 1 (p〈0.01).

estate income in household income. In the fixed effect model, the estimated coefficient indicates that the expected retirement age increases by 0.22 years for every 1% increase in the proportion of real estate income. In practical terms, if real estate income accounts for 10% of household income, the expected retirement age would increase by 2.2 years. It's worth noting that the estimated coefficients for other variables exhibit consistency with those found in 〈Table 3〉 and 〈Table 4〉 in terms of direction, magnitude, and statistical significance. Therefore, a detailed interpretation is not provided here.

5. Robustness Checks

1) Using samples limited to the household head and spouse

〈Table 3〉 to 〈Table 5〉 provided analyses that included all household members, including the household head. However, as the primary decision-makers within households are typically the household head and spouse, we conducted a separate analysis focusing exclusively on these individuals. The results of this refined analysis only from the fixed effect model are presented in 〈Table 6〉, with Model 1, Model 2, and Model 3 corresponding to

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〈Table 5〉 Retirement age due to changes in the proportion of real estate income

Variables	Model 1: Random effect model		Model 2: Fixed effect model	
	Coef.	Std. Err.	Coef.	Std. Err.
Log (R.E. income ratio)	15.07**	7.19	21.54**	8.85
Log (income)	2.62	2.32	8.67***	2.83
30s	-4.79***	0.14	-3.98***	0.32
40s	-4.07***	0.12	-3.13***	0.25
50s	-2.66***	0.11	-1.82***	0.19
Wage worker	-1.56***	0.08	-0.56***	0.16
Spouse	-0.26**	0.13	0.45	0.46
Non-spouse	0.58***	0.18	0.80	0.56
Health	0.20***	0.04	0.28***	0.06
Education	Controlled		Non-Controlled	
Gender				
Region				

Note: 1. Prob〉F=0.000 for both Model 1 with $R^2=0.22$ and Model 2 with $R^2=0.14$.
2. Number of observations: 31,357 (Model 1-Model 2).
3. *, **, *** mean significant at 90%, 95%, and 99% confidence levels, respectively.
4. As a result of the Hausman test, Model 2 is more suitable than Model 1 (p〈0.01).

〈Table 6〉 Analysis results limited to the head of the household and spouse

Model	Variables	Coef.	Std. Err.
1	Has R.E. income	4.81**	2.24
2	Log (R.E. income)	7.69**	3.37
3	Log (R.E. income ratio)	24.64***	8.97

Note: 1. Prob〉F=0.000 for all models with $R^2=0.13\sim0.14$.
2. Number of observations: 29,007 (Model 1~Model 3).
3. **, *** mean significant at 95%, and 99% confidence levels, respectively.
4. Hausman test indicates that a fixed effect model is more suitable than random effect model (ρ〈0.01).
5. The control variables for each model are the same as 〈Table 3〉 to 〈Table 5〉.

Model 2 in 〈Table 3〉, Model 2 in 〈Table 4〉, and Models 2 in 〈Table 5〉, respectively.

Notably, the estimated coefficients generally increased in magnitude, but the sign and statistical significance of these coefficients remained largely consistent. In essence, this more focused analysis

confirmed that the presence and increase of real estate income were associated with a desire for a later retirement age, mirroring the findings of the broader analysis encompassing all household members.

2) Using balance panel data

While 〈Table 3〉 to 〈Table 6〉 presented the results of analyzing unbalanced panel data, 〈Table 7〉 provides the outcomes of analyzing balanced panel data. The subjects of analysis in Models 1 to 3 of 〈Table 7〉 are consistent with those in 〈Table 3〉 to 〈Table 5〉, encompassing all household members. Furthermore, Models 4 to 6 in 〈Table 7〉 focus exclusively on the household head and spouse, mirroring the approach in 〈Table 6〉. Notably, when conducting the analysis with balanced panel data, we observed changes primarily in the magnitude of the estimated coefficients. However, the direction of these coefficients, as well as their statistical significance, remained largely consistent. Therefore, whether using balanced or unbalanced panel data, the results consistently indicate that the presence and increase of real estate income are associated with a desire for a later retirement age.

3) Controlling assets and liabilities variables

〈Table 8〉 presents the analysis results, incorporating assets and liabilities as control variables. This choice is grounded in the rationale that retirement decisions may hinge not only on

〈Table 7〉 Balanced panel data analysis

Model	Variables	Coef.	Std. Err.
Samples: All household members			
1	Has R.E. income	1.98**	0.91
2	Log (R.E. income)	3.11**	1.29
3	Log (R.E. income ratio)	9.55**	4.51
Samples: Household head and spouse			
4	Has R.E. income	1.72**	0.64
5	Log (R.E. income)	2.72**	1.34
6	Log (R.E. income ratio)	9.74**	3.82

Note: 1. Prob〉F=0.000 for all models with $R^2 = 0.12 \sim 0.14$.
2. Number of observations: 16,070 (Model 1-Model 3) and 15,130 (Model 4-Model 6).
3. ** mean significant at 95% confidence levels, respectively.
4. Hausman test indicates that a fixed effect model is more suitable than random effect model (ρ〈0.01).
5. The control variables for each model are the same as 〈Table 3〉 to 〈Table 5〉.

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〈Table 8〉 Analysis results controlling asset and liabilities

Model 1			Model 2			Model 3		
Variable	Coef.	Std. Err.	Variable	Coef.	Std. Err.	Variable	Coef.	Std. Err.
Has R.E. income	2.09**	1.01	Log(R.E. income)	7.12**	3.03	Log(R.E. income ratio)	20.01**	8.96
Log (income)	8.20***	2.86	Log (income)	8.18***	2.91	Log (income)	8.05***	2.98
Log (asset)	1.04**	0.48	Log (asset)	1.47**	0.62	Log (asset)	1.36**	0.59
Log (debt)	-0.18	0.26	Log (debt)	-0.19	0.30	Log (debt)	-0.14	0.49
30s	-3.92***	0.33	30s	-3.92***	0.33	30s	-3.93***	0.33
40s	-3.12***	0.25	40s	-3.12***	0.25	40s	-3.13***	0.25
50s	-1.81***	0.19	50s	-1.81***	0.19	50s	-1.81***	0.19
Wage worker	-0.57***	0.16	Wage worker	-0.57***	0.16	Wage worker	-0.56***	0.16
Spouse	1.39**	0.69	Spouse	1.40**	0.69	Spouse	1.40**	0.69
Non-spouse	1.68**	0.75	Non-spouse	1.68**	0.75	Non-spouse	1.68**	0.75
Health	0.29***	0.06	Health	0.29***	0.06	Health	0.29***	0.06
_cons	65.30***	0.77	_cons	65.30***	0.77	_cons	65.31***	0.77

Note: 1. Prob〉F=0.00 for all models with $R^2 = 0.17 \sim 0.18$.
2. Number of observations: 31,357 (Model 1-Model 3).
3. **, *** mean significant at 95%, and 99% confidence levels, respectively.
4. Hausman test indicates that a fixed effect model is more suitable than random effect model (ρ〈0.01).

income but also on one's financial assets and debts. The subjects analyzed in Models 1 to 3 of 〈Table 8〉 align with those in Model 2 of 〈Table 3〉, 〈Table 4〉, and 〈Table 5〉, respectively.

Upon analysis, it was observed that, while the estimated coefficient related to real estate income decreased overall, there was no alteration in the sign or statistical significance of the estimated coefficient. Notably, individuals with greater assets tend to retire later, whereas debt exhibits no significant impact on retirement age.

Ⅴ. Conclusion and Implications

Retirement constitutes a significant area of research, encompassing individual, corporate, and national levels, with numerous studies dedicated to this topic. Western countries primarily focus on linking retirement to pensions, given the pivotal role pensions play in retirement income. In contrast, Korea stands out with real assets constituting a substantial 77.5% of household assets, amounting to KRW 502.53 million, and

real estate alone accounting for 95.6% of these real assets(Statistics Korea, 2022). Remarkably, there is a dearth of studies exploring the nexus between real estate and retirement in the Korean context. This study addresses this gap by considering real estate income, recognizing Korea's unique concentration of wealth in real estate assets, in contrast to Western countries where pensions dominate household assets. Furthermore, given Korea's distinct characteristics, where retirement often tends to be more involuntary compared to the West, we opted to use expected retirement age as the dependent variable instead of actual retirement age.

The analysis yielded intriguing results. Individuals without real estate income experienced a delay in their retirement age by approximately 2.25 years upon acquiring real estate income. Furthermore, the willingness to work longer was positively associated with increased real estate income and a higher proportion of real estate income within the total income. These findings diverge from earlier research (Feldstein, 1974), which indicated that individuals tend to retire early when they possess pension income for use in their retirement.

However, this study does not delve into the intricate motivations behind why Koreans tend to prolong retirement upon the acquisition or increase of real estate income. For instance, individuals might choose to hasten their retirement if they can secure adequate cash flow through real estate investments, a trend observed in Western studies exploring the relationship between pensions and retirement. Essentially, individuals often feel compelled to extend their working years until they accumulate enough retirement resources, such as pensions. Conversely, a common tendency emerges to retire earlier when an adequate pension corpus is in place. Hence, the tendency among Koreans to postpone retirement upon generating real estate income could be attributed to a shortfall in such income to sustain an extended retirement. Alternatively, it might be influenced by the belief that real estate income, unlike a pension, is perceived as less permanent, leading to varied preferences in retirement decisions.

Given that this study marks the initial exploration of the link between real estate income and retirement, it calls for further in-depth analysis and implications through subsequent research endeavors. For example, individuals might cycle through retiring from their primary occupation, taking on a new job, and subsequently retiring once more. Essentially, when evaluating the influence of real estate income on retirement age, it is crucial to differentiate between the first and second retirements. Regrettably, NaSTaB does not furnish such specific information.

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