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Reconsidering Aging and Financial Markets in East Asia

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Abstract

Amid the concern over detrimental effects of rapid aging in East Asia, estimations of the impacts of the region's demography on macroeconomic variables have been conducted since the early 2000s. A recent example is IMF (2017), which estimated several macroeconomic variables using panel data of demographic variables and a number of newly introduced explanatory variables, such as "financial openness" and expected "aging speed." IMF (2017), however, defines the range of ages in the "working age population" differently from those commonly used. In this chapter, we estimate macroeconomic and financial variables by using explanatory variables similar to those of IMF (2017), but with commonly used demographic definitions, and with an increased number of countries during extended periods. The results of the estimations are different from those of IMF (2017) but similar to those of previous literature. "Youth dependency ratio," "old-age dependency ratio" and "expected aging speed" have significant impacts on interest rates and stock return, the impacts of which, however, can be mitigated by increased "financial openness." Empirically revealed relationships between "aging speed" and savings as well as financial variables is a "conundrum" which is not consistent with the Life Cycle/Permanent Income hypothesis, but can be explained using "behavioral economics." The resulting shortage of savings after retirement can be rectified by introducing "Saving More Tomorrow" type pension plans which incorporate behavioral economics and are widely available in the United States. Similar plans may provide solutions against the expected shortage of savings in East Asia, including Japan.

***JEL Classification number*: E44, E70, O16**

Keywords; demography, aging, East Asia, financial market, savings, interest rates, stock return, financial openness, aging speed, behavioral economics

1. Introduction

Among East Asian countries, including ASEAN (Association of Southeast Asian Nations), 10 countries, Japan, Korea and PRC (People's Republic of China), have become, or are becoming, "aging societies," where the ratio of the elderly (65 years or older) exceeds 7% of the total population. According to the population prospects of the United Nations (2019), "the years to double the elderly ratio" from 7% to 14%, at which level the country enters the "aged society," of East Asian countries are compatible to, or less than those of Japan (24 years), except for the Philippines (35 years), and Myanmar (31 years). The elderly ratios of all East Asian countries are expected to rise (Fig. 1) and the working-age (15 to 64 years of age) population ratios are expected to decline by the year 2050.

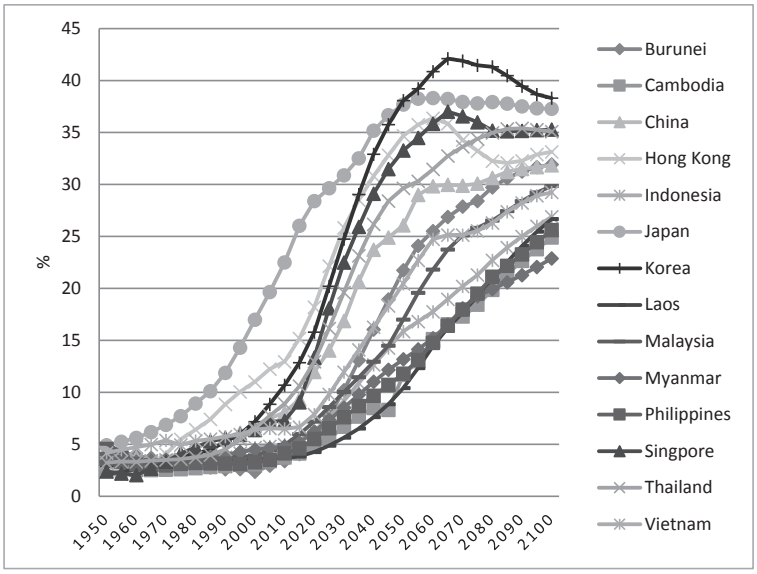

Figure 1: Elderly ratio (%; Pop. age 65 or older / Total pop.) of East Asian Economies
(Source) United Nations (2019) and calculation by author.

Amid the concern over detrimental effects of rapid aging in East Asia, estimations of the impacts of the region's demography on macroeconomic variables have been conducted since the early 2000s. A recent example is IMF (2017), which estimated several macroeconomic variables by using panel data of demographic variables, such as "working age population," and a number of newly introduced explanatory variables, such as "financial openness" and expected "aging speed." IMF (2017), however, defines "working age population" as the population aged 30 to 64, which is different from the usual definition of working age population, covering ages 15 to 64. In this chapter, we estimate macroeconomic variables by using explanatory variables similar to those of IMF (2017), but with a commonly defined working age population, i.e., ages 15 to 64, and with an increased number of countries during extended periods. The results of the estimations are different from those of IMF (2017), but similar to those of previous literature, including studies by the author. "Youth dependency ratio," "old-age dependency ratio" and "expected aging speed" have significant impacts on interest rates and stock return, the impacts of which, however, are mitigated by increased "financial openness."

Section 2 of this chapter reviews preceding literature up to the early 2000s. Section 3 shows the regression results of financial market variables and savings on demography, taking recent literature into "reconsideration." Section 4 deals empirically with the "conundrum" between "expected aging speed" and financial variables including savings, interest rates and stock return, which can be solved by using "behavioral economics." In the United States, retirement savings plans incorporating behavioral economics are already available. We illustrate the outcomes of introducing these plans and provide possible solutions to the ongoing "20 million yen" shortage problem[1] after retirement in Japan. Section 5 summarizes the discussions in this chapter.

[1] Financial Services Agency (2019) mentions that the shortage in retirement income has to be withdrawn from accumulated financial assets, therefore around JPY13 million in 20 years and around JPY20 million in 30 years need to be withdrawn if the income continues to be short of expenditure by JPY50 thousand every month.

2. Literature in the Early 2000s

IMF and other international organizations, as well as many researchers, have estimated the macroeconomic impacts of demographic variables since the early 2000s. Some of this literature is summarized below.

(1) Impact of Aging on Macroeconomic Variables

IMF (2004) demonstrates that GDP per capita growth rates have a positive correlation with working age (aged 15 to 64) population ratios, and a negative correlation with elderly (age 65 or older) population ratios. It also shows that savings rates, investment ratios and current account balances have positive correlations with working age population ratios and negative correlations with elderly population ratios. As such, aging in East Asian countries may cause these countries to lose the "demographic dividend" they have experienced thus far. A decline in the labor force due to retirement in the aging population may reduce potential growth rates, and decreased working age population may reduce savings, investments, capital accumulation, and in turn, reduce growth rates. The volume of reduction in savings is larger than the fall in investment volume, which leads to a deterioration in current account balances. On the fiscal side, population aging induces increases in pension, medical and elderly care expenditure, which has negative impacts on fiscal balances.

Furthermore, different coverages and social security systems may illuminate the geographical, occupational and intergenerational inequalities. On the financial front, aging in East Asia may induce "Asset Market Meltdown" and a fluctuation of demand for, and prices of, financial assets.

(2) Impact of Aging on Economic Growth

Population aging has a negative impact on economic growth. Bloom and Canning (2004) conducted panel estimates of the following modified neo-classical growth model, finding that GDP per capita growth rates (g_y) have positive correlations with labor participation ratio (p), initial working age population ratio (w_0) and its growth rates (g_w).

$$g_y = \lambda (X\beta + p + w_0 - y_0) + g_w$$

(X: other variables (e.g. policy and institutional environment, openness, education, region), β: coefficient vector, λ: convergence speed, y_0: initial income level)

Kihara (2007a, b) uses similar explanatory variables to those of Bloom and Canning (2004), but panel data for different countries in Asia and Sub-Sahara Africa over an extended period (1973 to 2004), to estimate real GDP per capita growth rates. The results are similar to Bloom and Canning (2004); working age population ratio and its growth rate have positive and significant impacts on GDP per capita growth rates.

According to the results of estimations by Kihara (2007a,b), an increase in working age population ratio from 50% to 60% causes GDP per capita to grow by 1.6%, and a 1% increase in the growth rate of working age population ratio (g_w) leads to a 1.6% hike in GDP per capita.

The United Nations has estimated the prospects of working age population ratios in East Asia and finds that the growth rates of their working age population ratios will fall and become negative in coming decades. Reflecting the fall in g_w, demographic contributions to GDP growth rates are expected to decline.

(3) Impact of Aging on Savings

Now, let us turn to the impact of aging on savings. The Life cycle/Permanent income hypothesis suggests that people save while in their middle ages, and dissave in youth and old ages. Bosworth and Chodorow-Reich (2007) estimate the impacts of aging on savings using panel data of 85

countries during the period 1960-2004 (in 5-year periods). The estimated results show that demography has significant effects on savings, and saving rates are lower when the old-age or youth dependency ratio is higher. They also indicate that demographic impacts on saving rates are particularly large in Asia. Thus, rapid aging in Asia may have larger macroeconomic impacts than in other regions. The comparison between age cohorts shows that the saving rates peak at age 40 to 50 years.

Kihara (2007a,b) estimates saving rates by different countries (in Asia and Sub-Sahara Africa) and periods (1970-2004, 4-year periods), but obtains similar results as found in the literature mentioned above. The saving rates are estimated to rise when the population ratio of the "high-saving-generation" (aged 40 to 64) over "working age" (aged 15 to 64) rises. (The domestic gross saving ratio rises by 0.5% when the high-saving-population ratio increases by 1%). On the other hand, the saving rates are estimated to fall when the "old-age dependency" ratio (population of age 65 or older / working age population) rises. (The domestic gross saving ratio falls by 2% when the dependency ratio increases by 1%.) Both relationships are significant and robust.

What are the prospects for the "high-saving-generation" population in East Asia? United Nations (2019) predicts that the population ratios of the high-saving-generation in ASEAN countries will continue to increase for a while. However, in East Asia, they will peak out in Korea and Thailand in the year 2020, China in 2030, Brunei and Vietnam in 2035, Myanmar in 2060, Indonesia in 2065, Lao Republic and Cambodia in 2075, and the Philippines in 2090; all countries will experience a reduction in the population ratio of the high-saving-generation within this century. East Asian economies need to eliminate the vulnerabilities of financial markets during the affluent period of savings, in order to efficiently channel their reduced volumes of savings in aged societies toward sustained investment and growth.

(4) Impact of Aging on Financial and Capital Markets

Since the early 2000s, a substantial volume of literature on theories and empirical studies presents significant impacts of aging on financial markets due to changing saving rates and preferences for different classes of assets. IMF (2004), for example, mentions that empirical analyses show a robust relationship between the population of the high-saving-generation and asset prices (e.g., asset prices rise when baby boomers become 40 to 64 years old). They also show the possibility of lower stock prices when baby boomers become old (e.g., in the United States, baby boomers born in 1946 to 1964 may begin to retire at 65 years of age, that is, from around 2010); i.e., there is a possibility that that the "Asset Market Meltdown Hypothesis" may hold.

Besides IMF, many empirical analyses have been conducted to estimate the impacts of aging on financial asset prices and interest rates, including Davis and Li (2003) and Park and Rhee (2005). Following these studies, Bessho and Kihara (2006) estimate demographic impacts on real stock indices, stock return and real government bond yields by using panel data from 50 countries during the period 1950-2004. The results are mostly consistent with the Asset Market Meltdown Hypothesis of aging, which are, (i) an increase in the high-saving-generation ratio raises financial asset holdings and asset (stock) prices (in turn, a fall in the ratio leads to "Asset Market Meltdown"), (ii) when aging proceeds, the holdings of long-term bonds are reduced, pulling their prices down, which in turn raises government bond yields (interest rates).

What is likely to occur in the ratios of "elderly population over the population of the high-saving-generation" in East Asian economies in the future? It is certainly expected that these ratios will rapidly increase, from 22.4% in 2010 to 53.7% in 2050, even in the "Southeast Asia" region (e.g. ASEAN countries) where the elderly ratio is relatively low.

If, in East Asia, the elderly population, who sell financial assets, grows rapidly, but the

population of the high-saving-generation, who purchase the assets, stagnates or declines, then it would be highly possible that prices of financial assets fall and interest rates rise, as is envisaged by the "Asset Market Meltdown Hypothesis."

3. New Estimates of Financial Variables by Demography

As it becomes clear that East Asian economies, the current growth center of the world, will turn "gray," the interest of researchers in the economic impacts of aging has been renewed. For instance, World Bank (2016) gives a comprehensive review of aging trends and policy responses in Asia and the Pacific. In this section, the IMF (2017) analyses are reviewed, and the empirical results of new analyses which rectify the problems of IMF (2017) are demonstrated.

(1) IMF (2017) Estimates of Interest Rates and Stock Return

IMF (2017) estimates (i) 10-year-government bond interest rates, and (ii) stock return by using demographic variables including (a) "youth" dependency ratios (population of age less than 30 / population aged 30 to 64) , (b) "old" dependency ratios (population of age 65 and older / population aged 30 to 64), and (c) aging speed (the projected change in the old dependency ratio in the coming 20 years; the proxy of change in survival probability), in addition to other explanatory variables such as (d) capital openness (Chinn-Ito financial openness index, ranging from 0 (completely closed) to 1 (completely open)), and (e) world interest rates.

The data used by IMF are panel observations consisting of 42 countries (interest rate estimates) and 14 countries (stock return estimates) annually during the period 1985-2013. The country fixed effects model is used to perform the estimations.

The empirical results of IMF (2017) are as follows;

(i) Both interest rates and stock return rise as the youth dependency ratio rises.
(ii) As the old dependency ratio rises, interest rates fall. However, the impact on stock return is undetermined (the estimate is not statistically significant).
(iii) Increase in aging speed causes interest rates to fall, but stock return to rise.
(iv) On the other hand, the estimated coefficients of interactive terms between demographic variables and "capital openness" have inverse signs to the estimated coefficients of the respective demographic variables, with similar magnitudes. This means that an increase in capital openness mitigates the demographic impacts on financial markets.

Furthermore, F tests cannot reject the null hypothesis that the estimated coefficients of demographic variables are equal (with the opposite sign) to those of the interactive terms between the respective demographic variables and capital openness. Therefore, the new explanatory variable "demographic variables × (1 – capital openness)" can be introduced to perform the estimate. The estimated coefficients of the new interactive terms in the regression of long-term (10-year) real interest rates, for instance, indicates that an increase in youth dependency ratio, a decrease in old dependency ratio and a decrease in aging speed are expected to raise long-term interest rates in the countries with a less open capital market. On the other hand, the impacts of those demographic variables could be nullified by completely opening their capital markets (i.e., capital openness = 1).

(2) New Estimates of Interest Rates, Stock Return and Savings Rates

In this chapter, we regress (i) real government bond interest rates, (ii) real lending interest rates, and (iii) real stock return (the rate of increase in stock prices) on similar explanatory variables to IMF (2017), including youth dependency ratio, old age dependency ratio, aging speed, Chinn-Ito financial openness index and world interest rates, by using panel data of these variables.

However, (i) "working age population" is defined to be those aged 15 to 64, which is commonly used, but different from IMF (2017). (ii) We also use both GDP deflator and CPI (Consumers Price Index) to make the "nominal" variables "real" ones, to check the robustness of the estimated results. (iii) As the "world interest rates," we use the SDR interest rates (before cut-off)[2] which represents the weighted average of the interest rates of major currencies.

Data on interest rates and stock prices used to perform the estimations are panel observations retrieved from IMF/IFS (International Financial Statistics), which consists of all countries retrievable (79-92 countries for interest rate estimates, 75 countries for stock return estimates) during the period 1970-2015, covering the transition period from the "fixed" to the "flexible" exchange rate system. The number of countries is larger and the data period longer than those of IMF (2017).

The regression method consists of panel estimates of the cross-country fixed effects model, as conducted by IMF (2017). However, we regress not only by annual data but also by compiling the data in 5-year averages.

The estimated results are, in some respects, different from those of IMF (2017), but largely consistent with the preceding literature such as Bessho and Kihara (2006). In particular, they indicate that an increase in the old age dependency ratio causes interest rates to rise and stock return (the rate of increase in stock price indices) to fall.

(3) Panel Regression of Real Interest Rates (Fixed Effects Model) (79-92 Countries during the Years 1970-92)

As Table 1 indicates, the regression results in this chapter are different from those of IMF (2017), and this is due partly to the definition of "working age." The estimated coefficient of the interactive term between "youth dependency ratio" and (1 – financial openness) is significantly negative in financially closed economies, whereas IMF (2017) estimates the coefficient to be significantly positive.

The estimated coefficient of the interactive term between "old age dependency ratio" and (1 – financial openness) is significantly positive in financially closed economies. This means that an increase in the old age dependency ratio in financially closed economies is expected to induce withdrawals of financial assets, reduce demand for financial assets, and then reduce the bond prices and raise the interest rates or yields. IMF (2017), however, estimates the coefficient to be significantly negative.

The estimated coefficient of the interactive term between "aging speed" and (1 – financial openness) is, as seen in IMF (2017), significantly negative, which means that the prospect of increase in aging speed in financially closed economies brings bond prices up and interest rates down. IMF (2017) explains this to be a result of increased lifetime savings and increased demand for financial assets. However, as is seen in the empirical results below, when aging speed rises, the savings ratio, in fact, significantly falls. The IMF (2017) explanation is, therefore, not consistent with this empirical outcome.

It is noteworthy that the increase in financial openness mitigates the demographic impacts on interest rates. As financial openness becomes closer to one on the 0-1 scale, the "coefficient × (1 – financial openness)" approaches closer to zero.

The real interest rates of government bonds are considered to link with the interest rates of

[2] The SDR interest rate at the beginning of the year (January 2) is allocated to the rate of the respective year. SDR interest rates are weighted averages of the interest rates, which consist of the German Mark, French Franc, Japanese Yen, British Pound, and US dollar during the period 1969-99, of Euro, Japanese Yen, British Pound, US dollar during 2000-2016, and of Chinese yuan, Euro, Japanese Yen, British Pound, US dollar after 2017, retrieved from IMF HP.

major currencies, i.e., "world interest rates," through interest arbitrage transactions. Therefore, "world interest rates" are included in the controlled variables in the interest rate panel regression. "Real SDR interest rates," retrievable from the IMF database and deflated by price indices, are used as the proxy of "world interest rates." Even after controlling for "world interest rates," the estimated coefficients of the interactive terms between demographic variables and financial openness have the same signs and significance, as those in Table 1 show.

Table 1: Panel regression of real interest rates（Fixed effect model）（1970-2015, 79-92 countries）

Explained variables / Explanatory variables	Annual model (1970－2015)			5-yr. average model (1970-2015)		
	GB Int. rates (GD)	GB Int. rates (CPI)	Lending Int. rates (CPI)	GB Int. rates (GD)	GB Int. rates (CPI)	Lending Int. rates (CPI)
Constant	3.768*** (7.70)	4.155*** (7.77)	10.903*** (12.25)	5.780*** (6.73)	8.048*** (5.79)	10.495*** (5.18)
Youth dependency ratio × (1 - financial openness)	**-0.102*** (-3.77)**	**-0.125*** (-4.34)**	**-0.210*** (-5.74)**	**-0.223*** (-4.94)**	**-0.314*** (-4.34)**	**-0.188** (-2.33)**
Old age dependency ratio × (1 – financial openness)	**0.161* (1.80)**	**0.248** (2.50)**	**0.616*** (2.73)**	**0.404*** (2.61)**	**0.711*** (2.80)**	**0.622 (1.25)**
Aging speed × (1 – financial openness)	**-0.310** (-2.08)**	**-0.555*** (-3.49)**	**-1.005*** (-2.96)**	**-0.547** (-2.27)**	**-1.575*** (-4.15)**	**-0.999 (-1.49)**
Adjusted R^2	0.281	0.284	0.221	0.233	0.175	0.137
Country/Observation	79/1867	79/1841	92/2264	79/463	79/459	92/550

（Note）"GD" indicates deflated by GDP deflator, "CPI" indicates deflated by Consumer Price Index. Figures in parentheses are t values. *,** and *** indicate significance at the 10%, 5% and 1% significance level, respectively.
（Source）Estimation by author.

The estimated coefficient of real SDR interest rate in the regression of real "government bond" interest rates is significantly positive, as expected, which means that SDR interest rates have a positive correlation with the government bond interest rates of each country. The coefficient of SDR interest rate in the regression of real "lending" interest rates is, however, estimated as significant but negative. International transactions of securities may make the interest rates of government bonds arbitrage with world interest rates, whereas monetary policies adopted by each country may cause the impact of world interest rates on lending rates to be counter-cyclical.

Table 2: Panel regression of real interest rates（including SDR real interest rates as a controlled variable）（1970-2015, 79-92 countries）

Explained variables / Explanatory variables	Annual model (1970-2015)			5-yr. average model (1970-2015)		
	GB Int. rates (GD)	GB Int. rates (CPI)	Lending Int. rates (CPI)	GB Int. rates (GD)	GB Int. rates (CPI)	Lending Int. rates (CPI)
Constant	5.329*** (23.74)	5.594*** (23.33)	11.358*** (14.32)	5.232*** (7.14)	5.378*** (6.61)	10.013*** (10.40)
Youth dependency ratio × (1 - financial openness)	-0.098*** (-7.92)	-0.108*** (-8.37)	-0.249*** (-7.43)	-0.126*** (-3.21)	-0.091** (-2.13)	-0.186*** (-4.74)
Old age dependency ratio × (1 – financial openness)	0.366*** (8.96)	0.396*** (8.93)	0.723*** (3.34)	0.395*** (3.00)	0.449*** (3.04)	0.328 (1.32)
Aging speed × (1 – financial openness)	-0.326*** (-4.78)	-0.369*** (-5.18)	-1.125*** (-3.63)	-0.424** (-2.06)	-0.527** (-2.35)	-0.692** (-2.11)
SDR real interest rates	**0.835*** (82.28)**	**0.861*** (83.84)**	**-0.017*** (-28.38)**	**0.540*** (12.09)**	**0.836*** (27.19)**	**-0.044*** (-41.29)**
Adjusted R^2	0.850	0.857	0.439	0.444	0.721	0.823
Country/Observation	79/1867	79/1841	92/2171	79/463	79/459	92/530

（Note）"GD" indicates deflated by GDP deflator, "CPI" indicates deflated by Consumer Price Index. Figures in parentheses are t values. *,** and *** indicate significance at the 10%, 5% and 1% significance level, respectively.
（Source）Estimation by author.

(4) Panel Regression of Real Stock Return (Fixed Effects Model) (75 Countries, 1970-2015)

The estimated results of "real stock return" also differ from those of IMF (2017), as demonstrated in Table 3. Annual fluctuations of stock prices are observed to be so large that demographic impacts on stock return could not be significantly estimated.

However, the estimated results of the "5-year average model," which uses data averaged over 5 years, amply demonstrate that both "youth dependency ratio" and "aging speed" have significantly positive impacts, whereas the "old age dependency ratio" has a significantly negative impact, on "stock return" in financially closed economies. Their impacts on real stock return have opposite signs to those on real interest rates, but they are consistent with the "Life cycle/Permanent income" hypothesis of savings. According to this hypothesis, the hike in "old age dependency ratio" may increase sales of such financial assets as stocks and bonds (i.e., dissaving) and reduce demand for financial assets, thereby inducing a fall in stock return. The reason why a hike in "aging speed" raises the stock return could be explained by the notion that an increase in possibility of survival would require more life-time savings and raise demand for financial assets. Empirical evidence, however, contradicts the "Life cycle/Permanent income" hypothesis of savings; an increase in aging speed significantly reduces the savings rates.

Increasing "financial openness" mitigates the demographic impacts on stock return, as is estimated in the regression of real interest rates.

Table 3: Panel regression of real stock return（fixed effects model）(1970-2015, 75 countries)

Explained variables / Explanatory variables	Annual model (1970-2015)		5-yr. average model (1970-2015)	
	Real stock return（GD）	Real stock return（CPI）	Real stock return (GD)	Real stock return（CPI）
Constant	118.606 (0.83)	108.488 (0.88)	-2.474 (-0.54)	0.546 (0.16)
Youth dependency ratio × (1 - financial openness)	-4.202 (-0.50)	-4.202 (-0.58)	**0.632**** **(2.23)**	**0.370*** **(1.79)**
Old age dependency ratio × (1 – financial openness)	18.471 (0.54)	17.979 (0.59)	**-2.369**** **(-2.20)**	**-1.668**** **(-2.06)**
Aging speed × (1 – financial openness)	-27.591 (-0.47)	-26.151 (-0.51)	**4.603**** **(2.34)**	**3.326**** **(2.33)**
Adjusted R^2	0.032	0.029	0.144	0.129
Country/Observation	75/2208	75/2155	75/399	75/392

（Note）"GD" indicates deflated by GDP deflator, "CPI" indicates deflated by Consumer Price Index. Figures in parentheses are t values. *,** and *** indicate significance at the 10%, 5% and 1% significance level, respectively.
（Source）Estimation by author.

(5) Demographic Impacts on "Savings Ratio"

How could the newly introduced "aging speed" and "financial openness" variables, as well as the explanatory variables used in previous literature, have impacts on the "savings ratio" in the panel regression?

We regress the "gross savings ratio" (% of GDP) on the high-savings generation ratio (population aged 40 to 64 / population aged 15 to 64), old age dependency ratio, aging speed, GDP per capita growth rate (current and with a one-period lag), (natural logarithm of) GNI per capita, and financial openness, by using the panel data and fixed effects model. As in previous literature, including Kihara (2007a,b), most estimated results indicate that an increase in the "high savings

generation ratio" significantly raises savings ratio, whereas an increase in "old dependency ratio" significantly reduces savings.

The coefficients of "aging speed," however, are estimated to be significantly negative in all specifications, which means that, when the aging speed is expected to increase, the savings ratio would not rise but eventually fall. This result contradicts the IMF (2017) estimates.

The estimated coefficients of interactive terms between demographic variables and (1 – financial openness) are not statistically significant. However, when the variable "financial openness" is independently used to estimate savings ratio, the coefficient of the variable is estimated to be significantly negative, which means that the increase in financial openness reduces the gross savings ratio. This may be because foreign savings can substitute for domestic savings required in financially open economies.

Table 4: Panel regression of savings rates on demography and openness

Explained variable: Gross savings/GDP ratio (%) (1970-2015, 99-104countries) (Panel regression by the country fixed effects model)

Explanatory variables	1. Annual model (1970-2015)				2. 5-yr. average model (1970-2015)			
	Spec 1	Spec 2	Spec 3	Spec 4	Spec 1	Spec 2	Spec 3	Spec 4
Constant	11.354*** (7.39)	-2.109 (-0.71)	11.031*** (7.19)	-2.481 (-0.83)	10.259*** (3.68)	-5.058 (-0.95)	9.112*** (3.27)	-6.371 (1.20)
High saving gen. / Working age pop. (%)	**0.179*** (3.60)**	**0.531*** (7.04)**	**0.179*** (3.59)**	**0.450*** (5.83)**	**0.175* (1.90)**	**0.543*** (4.05)**	**0.126 (1.40)**	**0.436*** (3.22)**
Old age dependency ratio (%)	**-0.546*** (-6.83)**	**-0.596*** (-7.45)**	**-0.523*** (-6.55)**	**-0.460*** (-5.47)**	**-0.373*** (-2.92)**	**-0.396*** (-3.11)**	**-0.283** (-2.27)**	**-0.225* (-1.72)**
Aging speed		**-0.428*** (-5.52)**		**-0.394*** (-4.90)**		**-0.466*** (-3.48)**		**-0.436*** (-3.16)**
GDP per capita growth rate (%)	0.248*** (8.93)	0.242*** (8.68)	0.187*** (6.45)	0.189*** (6.29)	0.445*** (4.88)	0.430*** (4.72)	0.406*** (4.07)	0.436*** (4.01)
GDP per capita growth rate (%, 1pd lag)			0.183*** (6.71)	0.169*** (5.87)			0.353*** (4.21)	0.312*** (3.64)
Ln(GNI per capita (Current dollar))	1.329*** (5.14)	1.765*** (6.14)	1.299*** (4.98)	2.047*** (6.77)	1.167** (2.50)	1.744*** (3.37)	1.283*** (2.65)	2.145*** (3.79)
Financial openness				**-1.919*** (-3.32)**				**-2.003* (-1.66)**
Adjusted R^2	0.602	0.601	0.607	0.614	0.629	0.629	0.674	0.679
Country/Observation	104/3274	103/3229	104/3263	99/3033	104/768	103/755	104/727	99/681

（Notes）Figures in parentheses are t values. *,** and *** indicate significance at the 10%, 5% and 1% significance level, respectively.

（Source）Estimation by author.

(6) Demographic Simulations of Interest Rates, Stock Returns and Savings Ratios

Figure 2 shows the simulated results of "real government bonds interest rates" in East Asian economies during the period 1950-2080, using the estimated coefficients of the "5-year average model" (deflated by CPI) and the respective data for demographic variables (retrieved from United Nations (2019)), Chinn-Ito financial openness index and IMF SDR interest rates. Future data for financial openness and SDR interest rates are calculated by assuming that the financial openness of each economy and SDR interest rates in 2015 would continue. As a result, real government interest rates in financially closed economies are expected to rise sharply from their recent very low levels, due to the rises in their old age dependency ratios. On the other hand, the real interest rates of financially open economies, such as Japan and Singapore, hover near the level of world interest rates.

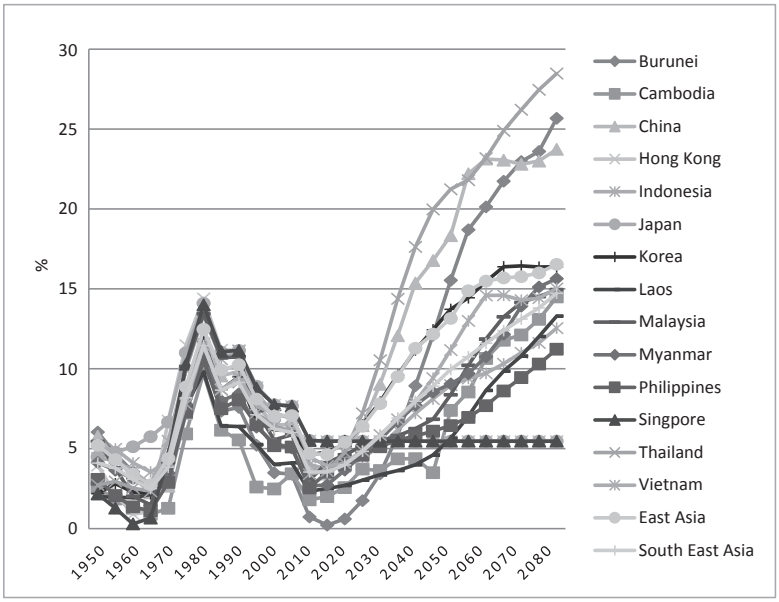

Figure 2: Real Government Bond Interest rates（simulated by estimated results）

(Note) Calculated using the following formula;

Real government bond interest rates ==5.378-0.091{youth dependency ratio × (1 – financial openness)}
+0.449{old age dependency ratio × (1 – financial openness)} - 0.527{aging speed × (1 – financial openness)
+0.836 × SDR real interest rates

(Source) Calculation performed by author using United Nations (2019) and other data.

Figure 3 shows the simulated results of "real stock return" in East Asian economies during the period 1950-2080, by using the estimated coefficients of the "5-year average model" (deflated by GDP deflator) and the respective data for demographic variables (retrieved from United Nations (2019)) and the Chinn-Ito financial openness index. As a result, the real stock returns of financially closed economies are expected to fall sharply in the future, reflecting substantial rises in old age dependency ratios. The decline in real stock returns of financially open economies, such as Japan and Singapore, are restricted.

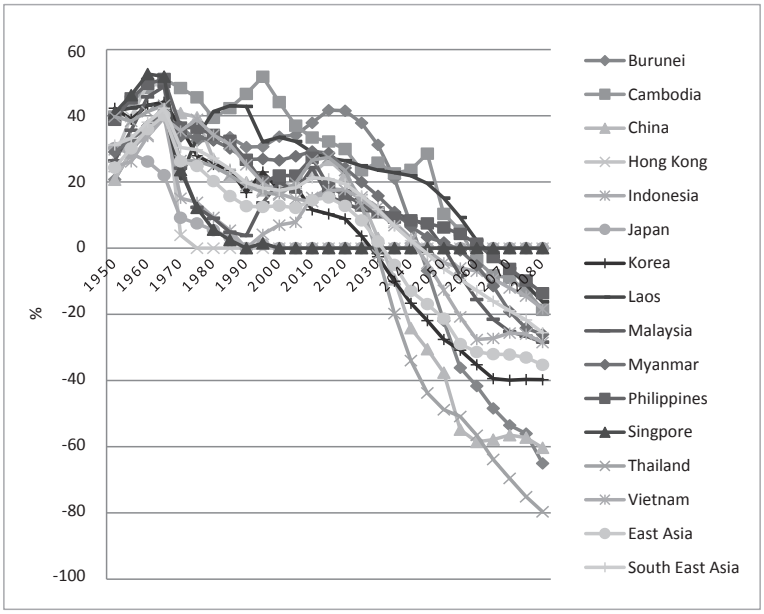

Figure 3: Real Stock Returns (Simulated by estimated results)

(Note) Calculated using the following formula;

Real stock return = 0.632{youth dependency ratio × (1 – financial openness)} - 1.668{old age dependency ratio × (1 – financial openness) + 3.326{aging speed × (1 – financial openness)}

(Source) Calculation performed by author using United Nations (2019) and other data.

Figure 4 shows the simulated results of "gross savings/GDP" ratios in East Asian economies during the period 1960-2080 using the estimated coefficients of specification (4) of the "5-year average model" in Table 4 and the respective data for demographic variables (medium variants of United Nations (2019)), GDP per capita growth rates, GNI per capita and the Chinn-Ito financial openness index. GDP per capita growth rates are forecast by assuming that the growth rates in 2015 would continue. The forecasts of GNI per capita also assume growth at the same rates as GDP per capita growth. Except for Japan, Korea and Thailand, many economies will experience rises in savings ratios, as shown in Figure 4. This is, however, due to the relatively large increase in projected growth rates of GDP and GNI per capita, which contributes to a rise in the savings ratio.

In fact, when savings ratios are simulated by the same functional forms, but excluding the terms GDP per capita growth rates and GNI per capita, all economies would reach the peaks of their savings ratios around 2060, after which the ratios would begin to decline due to the demographic "dissaving" effects, as is shown in Figure 5.

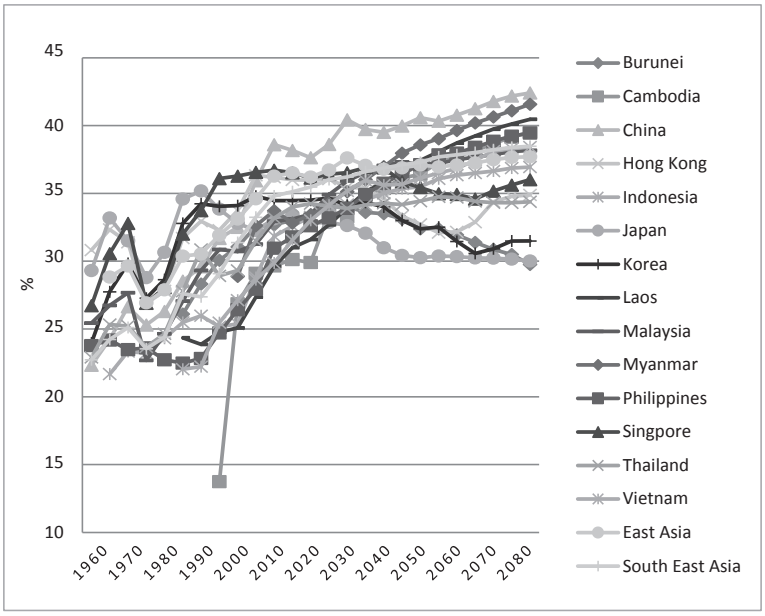

Figure 4: Gross Savings/ GDP (Simulated by estimated results)

(Note) Calculated using the following formula;

Gross savings/GDP (%) = 0.436 × high-saving generation / working age population - 0.225 × old age dependency ratio - 0.436 × aging speed + 0.436 × GDP per capita growth rate + 0.312 × GDP per capita growth rate (one period lag) + 2.145 × Ln (GNI per capita) - 2.003 × financial openness

(Source) Calculation performed by author using United Nations (2019) and other data

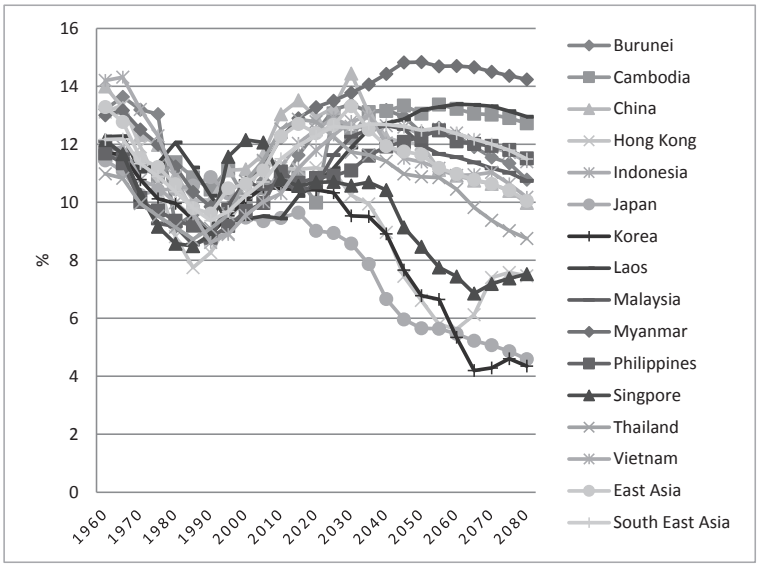

Figure 5: gross savings/ GDP (%) (Effects of demography and financial openness)

(Note) Calculated using the following formula;

Gross savings / GDP (%) = 0.436 × high saving generation / working age population – 0.225 × old age dependency ratio - 0.436 × aging speed - 2.003 × financial openness

(Source) Calculation performed by author using United Nations (2019) and other data.

(7) Policy Implications for Financial Markets

The policies proposed by IMF (2017) to prepare for aging societies are quite similar to those proposed thus far by IMF (2004) and Kihara (2015). For instance, the following reforms in the retirement system are proposed;

(i) The introduction of new financial products to mitigate the saving burden after retirement (e.g., reverse mortgages) and to ensure that longevity risk (e.g., annuities) will reduce precautionary savings.

(ii) As Asia has diverse demographic natures, there are ample opportunities for cross-border risk sharing and financial integration (e.g., savings in aging or aged countries seeking a higher return could be used to finance the large infrastructure gap in pre-aging countries)

(iii) Increasing the availability of "safe assets" (e.g., long-term government bonds or inflation linked securities) can be especially attractive for pension funds and insurance companies.

IMF (2017), and the regression results presented here have clarified that an increase in "financial openness" measured by the Chinn-Ito index mitigates demographic impacts on financial markets, which means that "increasing financial openness" is one countermeasure that can be employed against the adverse impacts of aging.

(8) Financial Markets in Aging East Asia

Aging could have a significant influence on volumes, prices and trading agents in financial markets. Aging reduces savings and financial asset holders sell their assets, thereby causing stock and bond prices to fall and large trading agents such as pension funds to emerge. Are financial markets in East Asia ready for (i) a substantial shift in the demand for assets, (ii) channeling current affluent savings to investment, and (iii) making efficient use of expectedly-reduced-savings to invest?

Cihak, Demirguc-Kunt, Feyen and Levine (2012), utilizing the Global Financial Development Database (GFDD) in 205 countries/economies, creates "indices" to characterize the financial systems of these countries/economies; i.e., "depth" (sizes of financial institutions and markets), "access" (utilization of financial services), "efficiency" (efficiency of promotion of financial intermediation and transactions) and "stability" (stabilities in financial institutions and markets). Based on recent GFDD data, World Bank (2020) ranks each characteristic and overall financial market of a specific country and economy by "quartiles" (from "1" for the lowest 25% to "4" for the top 25%). The results indicate that the financial markets of ASEAN countries, except for Singapore, Malaysia and Thailand, are ranked up to 3 or "not available," which means that some financial challenges remain, whereas almost all characteristics are ranked 4 (top 25%) in Japan.

Since the East Asian financial crisis in 1997, ASEAN countries have made efforts to strengthen financial markets to prevent "double mismatches" in maturity and currency of their assets and liabilities. In particular, on local currency denominated bond markets, such initiatives as ABMI (Asian Bond Market Initiative) and ABF (Asian Bond Fund) have greatly advanced.

The volumes of bond markets in ASEAN countries have grown rapidly. ADB (2020) reviews the situation in local currency denominated bond markets in emerging East Asia, and finds that the outstanding amount of the markets reached more than USD16 trillion at the end of 2019, which represents 83.3% of the GDP of the region and 30 times more than the amount at the end of 1996 (USD0.53 trillion).

Although the volumes of bond markets in East Asia have expanded enormously, the markets still face many qualitative challenges. ADB (2019) quotes a "2019 bond market liquidity survey" which presents structural issues in government and corporate bond markets. The most important structural issues in emerging East Asia as a whole are the lack of derivatives to operate a "hedging mechanism" and "low diversity in investor profiles" caused by a concentration of bond holdings by banks and other financial institutions.

4. Rising Prospect for Aging Speed and Behavioral Economics

(1) The Impacts of Aging Speed on Demand for Financial Assets

It is expected that a rise in "aging speed" (i.e., increased life expectancy) requires an increased amount of life-time expenditure and savings to finance it[3]. The empirical results, however, indicate that an increase in aging speed substantially reduces savings, but induces a reduction in interest rates and an increase in the stock return. This "conundrum" can be understood by thinking that an increase in aging speed causes a substantial shift in the demand for assets from physical resources to financial ones, and thereby rises in the prices of financial assets and falls in their yields (interest rates).

We empirically check whether a rise in "aging speed" eventually increases the demand for financial assets. Table 5 shows the results of panel regressions of outstanding assets of pension funds, deposits, bonds and stocks per GDP (in natural logarithms) on "aging speed"[4]. Table 5 indicates that all estimated coefficients of "aging speed" (reflecting financial openness) are significantly positive, which means that an increase in aging speed raises all financial assets per GDP ratios. Therefore, the increased prospect for a rising aging speed can be considered to raise demand for financial assets, thereby inducing hikes in the prices of financial assets and drops in their yields (interest rates).

Table 5: Demand for Financial Assets and Aging Speed

Explained variables Explanatory variable	Ln (Pension fund / GDP)	Ln (Pension fund / GDP)	Ln (Fin. Inst. Deposit / GDP	Ln (Debt / GDP)	Ln (Stock / GDP)
Constant	1.225*** (8.34)	2.093*** (13.24)	3.187*** (120.06)	0.892*** (5.98)	-0.296* (-1.72)
Aging speed × (1-financial openness)	**0.090***** **(8.46)**	**0.039***** **(3.28)**	**0.061***** **(30.63)**	**0.079***** **(5.85)**	**0.134***** **(8.87)**
AR (1) (First order autoregressive)		0.682*** (9.79)			
Adjusted R^2	0.833	0.963	0.748	0.884	0.872
Country/Obs. (Sample period)	75/966 (1990-2015)	71/879 (1991-2015)	102/3851 (1970-2016)	89/1270 (1999-2015)	89/1267 (1999-2015)

(Notes) Figures in parentheses are t values. *,** and *** indicate significance at t 10%, 5% and 1% significance level, respectively.
(Source) Estimation by author.

(2) The Impacts of Aging Speed on Physical Investment and Assets

Is it true to say that the increase in aging speed reduces the demand for physical assets and investment? We conduct panel estimates of physical investment (gross fixed capital formation /

[3] World Bank (2016) suggests that the effects on household savings depend on the relative strength of two offsetting effects: (a) "the compositional effect" from a higher share of older people in the population and (b) "the behavioral effect" as people save more to finance a longer expected period of retirement. Predictions on which of these effects will dominate in East Asia and the Pacific are mixed, but, according to World Bank (2016), on balance they suggest that concerns about the effects of aging on savings and capital formation in the region may be overstated for three reasons: (i) Household and corporate savings rates are higher in the region than in others. (ii) Survey evidence points to flatter savings and age profiles in the region than in others, and to an increase in savings rates at all ages in the region in recent decades. (iii) Significant inefficiencies in financial markets in the region's developing countries suggest that scope exists for more efficient mediation of savings into capital formation and increased productivity.

Although rising "aging speed" predicts the "behavioral effect" mentioned above, empirical results suggest the opposite. (iii) above provides a reason why developing financial markets in East Asia is a critical task.

[4] Wo-Hausman tests reject cross-section random effects. Therefore, the fixed effects model with white heteroscedastic correction is used to perform the estimations.

GDP) by using the explanatory variables, including financial-openness- adjusted "aging speed"[5]. The results are shown in Table 6, in which the coefficients of financial-openness-adjusted "aging speed" are estimated to be significant at the 1% level and are robustly estimated at around -0.1 to -0.15, regardless of the changes in controlled variables (GDP per capita growth rate and real interest rates; both coefficients are estimated to be significant with the expected signs). Thus, the demand for physical assets declines when aging speed rises.

Table 6: Demand for Physical Assets and Aging Speed
Explained variables: Gross Fixed Capital Formation /GDP (%)

Explanatory vari.	Spec.1	Spec.2	Spec.3	Spec.4	Spec.5
Constant	24.371*** (84.17)	23.471*** (71.24)	24.305*** (86.44)	23.328*** (86.48)	16.713*** (30.23)
Aging speed × (1-financial openness)	**-0.157*** (-4.81)**	**-0.107*** (-3.18)**	**-0.140*** (-4.53)**	**-0.094*** (-3.28)**	**-0.096*** (-3.31)**
GDP per capita growth rate (%)		0.319*** (6.87)	0.303*** (6.99)	0.212*** (5.62)	0.101** (2.46)
GDP per capita growth rate (%, 1pd lag)				0.369*** (6.10)	0.311*** (4.40)
Real GB int. rates (CPI)			-0.042** (-2.46)	-0.037** (-2.54)	-0.030** (-2.22)
Gross Savings / GDP (%)					0.311*** (10.83)
Adjusted R^2	0.416	0.450	0.553	0.587	0.579
Country/Obs. (Sample period)	100/3717 (1970-2016)	100/3650 (1970-2016)	75/1724 (1970-2015)	75/1704 (1971-2015)	74/1477 (1971-2015)

(Notes) Figures in parentheses are t values. *,** and *** indicate significance at the 10%, 5% and 1% significance level, respectively.
（Source）Estimation by author.

It would appear to be a rationale choice to increase current savings when increases in aging speed and future old dependency ratio (i.e., increased prospects for survival) are expected. The empirical evidence shows, however, that an increase in aging speed induces a reduction in savings, but an increase in demand for financial assets. This "conundrum" can be explained by "behavioral economics" as the phenomena of "delaying savings" due to "time-inconsistency." According behavioral economics, when making decisions ordinary people do not discount future utilities at a constant discount rate, as *Homo economicus* would do (i.e., "exponential discounting"), but at a larger discount rate for the near future and a smaller discount rate for the distant future (i.e., quasi "hyperbolic discounting"). Thus, economic agents who intend to save immediately before retirement tend to greatly discount the utilities of consumption after retirement at the time immediately before retirement. The optimal decision for them is to consume more without saving before retirement (from the Euler equation of hyperbolic discounting model). A "sophisticated economic agent" may make "commitments" to bind their future behavior at the time of decision-making to avoid time-inconsistency. One of the "commitment devices" to prevent "delaying savings" is to invest in "illiquid assets" which include a "pension contract." "Naïve economic agents" may not make a commitment, but tend to hold "liquid assets," including deposits and other financial assets, which

[5] Wo-Hausman tests reject cross-section random effects. Therefore, the fixed effects model with white heteroscedastic correction is used to perform the estimations.

are easy to cash[6]. The empirical results, showing that an increase in aging speed reduces savings and physical investment, but raises demand for financial assets, raising their prices (causing falls in their yields), are consistent with "delaying savings" phenomena based on time-inconsistency.

(3) Promotion of Retirement Savings and Behavioral Economics

The shortage of savings at the time of retirement has been recognized by many countries, and some measures have been introduced to increase enrollment in, and contribution to, pension systems. OECD (2019) identifies the measures to promote retirement savings by two types of financial incentives; i.e., "tax incentives" and "non-tax incentives." Many countries have adopted tax incentives for retirement savings by exempting taxes at the time of contribution and investment, and only taxing the benefits of pensions ("EET" tax system). Non-tax incentives have also been introduced in some countries by making matched contributions by government and employers, or by government subsidizing.

In recent years, retirement savings plans utilizing the knowledge of "behavioral economics" have been introduced by many pension systems in the United States and other countries.

According to Benartzi and Thaler (2013), in the United States, the proportion of workers at risk of having inadequate funds to maintain their lifestyle through retirement is estimated to have increased from 31% in 1983 to 53% in 2010, and roughly half of US employees (78 million) have no access to retirement plans at their workplace. One of the reasons for this "savings crisis" is the ongoing shift in the private, public and local sectors from defined benefit (DB) pension plans to defined contribution (DC) plans. These problems are not faced only by the United States but also by the United Kingdom and New Zealand.

Under these circumstances, "comprehensive pension plans" to facilitate adequate saving for retirement are advocated with following four ingredients; (i) "Availability" for every worker to access, but with the ability to "opt-out," (ii) "Automatic enrollment" where employees are automatically signed up unless they opt out, (iii) "Automatic investment" in which there has to be a "default" investment option once employees are automatically enrolled, and (iv) "Automatic escalation" of the saving rate.

Incorporating the four characteristics above, Benartzi and Thaler devised the "Saving More Tomorrow" (SMT) pension program in generic terms, based on behavioral economics.

According to Benartzi and Thaler (2013), the SMT originally included the following three components;

(i) Employees are invited to "commit now to increase their saving rate later." According to behavioral economics, "self-control" is easy to accept if delayed rather than immediate due to (quasi) hyperbolic discounting.

(ii) Planned increases in the saving rate are linked to pay raises. Because the increase in the savings rate is "a portion" of the pay raises, employees do not see their pay fall. This would diminish the effect of "loss aversion," i.e., the tendency to assign larger weights to losses than gains.

(iii) Once employees sign up for the plan, they remain in it until they reach a preset limit or choose to "opt out." This uses "inertia" to keep people in the system.

In the company that originally introduced SMT, employees who elected to join (and 78% of those offered the plan did) ended up almost quadrupling their savings rate from 3.5% to 13.6% in less than four years. This evidence of success stimulated many companies in the United States to adopt the SMT plan. Take-up then increased considerably, helped by the passage of the Pension

[6] Refer to Ogaki and Tanaka (2014) Chapter.6, pp.111-139.

Protection Act of 2006, which encouraged firms to adopt a combination of "automatic enrollment" and "automatic escalation." Benartzi and Thaler (2013) indicates that by 2011 56% of employers who offer 401(k) plans "automatically enrolled" employees, and 51% offered "automatic escalation," as is seen in Figure 6.

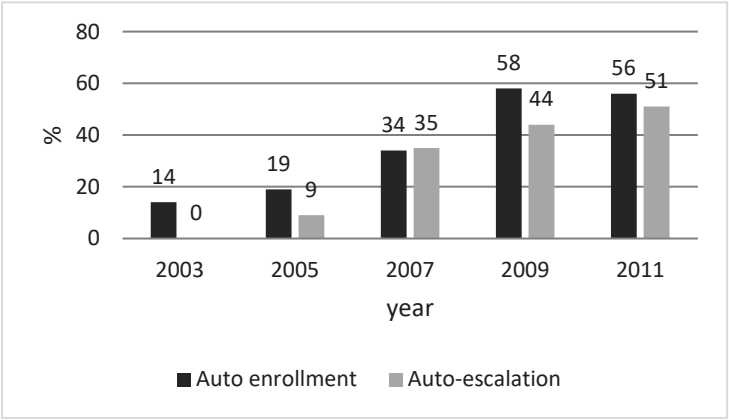

Figure 6: Percentage of us employers who offer 401(k) plans that atutomatically enroll employees and escalate savings rates

(Source) Benartzi and Thaler (2013) and calculation by author]

Does inducing a large contribution to retirement saving actually "increase" total saving, or does it "shift" saving from one place to another? According to Benartzi and Thaler (2013), Danish data that include measures of household wealth suggest that when employees are automatically enrolled into a retirement savings plan, 85% of that saving is new, rather than shifted.

(4) Decision-making, Bottlenecks and Nudges of Retirement Savings

According to Otake (2019), following "nudges" are needed to cope with decision-making and bottlenecks on retirement savings, as indicated in Table 7. The "20-million-yen shortage at retirement" under the current pension system in Japan, which is suggested by a report from the Financial Council, can be the "guideline" to necessitate more retirement savings from the viewpoint of behavioral economics.

Table 7: Decision-making, bottle necks and nudges on retirement savings

Necessary decision	Recognition of importance in retirement savings	How much to allocate to retirement savings?	Enrollment inthe plan	Choosing financial products	Purchas-ing financial products	Checking returns of assets (balancing portfolios)
Bottlenecks	Retirement in distant future	Calculation todecide the amount to save is complicated	Burden to join	Complicated products	Delaying purchase	Burden to check
Nudges	**Loss aversion** (informed about low level of life)	**Guideline onhow much to save,** Application for calculation	Simple procedure, **Obligatory/ automatic enrollment**	**Default investment**	**Automatic purchase**	Automatic information system, **Automatic rebalancing**

（Source） Compiled by author from Otake (2019), pp.66-67

(5) Solutions to the Shortage of Savings

Not only developed countries but aging East Asian economies will have a high possibility of turning into "short-of-savings" economies, where financial resources after retirement are insufficient. Concerns over a shortage of retirement savings are not limited to Japan, where the Financial Council raised the issue of the "20-million-yen shortage" after retirement in 2019, but are also found in such countries such as Malaysia and Singapore, where defined contribution (provident fund type) pension systems prevail. Improvements in "financial systems" to mitigate and solve problems of savings shortages are required, as the problems will have adverse impacts not only on the financial resources of the retired, but on macroeconomies such as growth rates or returns in financial markets.

A shortage in savings is caused by behavioral economic factors such as "loss aversion" based on (quasi) "hyperbolic discounting," "time inconsistency" and limited rationalities. As aging proceeds in East Asian economies, behavioral-economics-based financial and pension systems should be established, and nudge-utilizing financial products should be developed. For instance, when a DC (defined contribution) type pension is introduced to supplement a DB (defined benefit) type pension, which is widely adopted by East Asian countries including Japan, their pension systems and products should embody the following characteristics, as with SMT:

(i) Produce a "Guideline" to show necessary amounts of retirement savings
(ii) "Automatic enrollment" (Employees are enrolled automatically unless they opt-out)
(iii) "Automatic Escalation" (Members commit to rising saving rates. "Loss aversion" is alleviated by linking it with salary rises)
(iv) "Automatic Investment" (Premiums are allocated by "default" and automatically withdrawn)
(v) "Automatic Rebalancing" (Portfolio is automatically rebalanced according to fluctuation of prices of assets such as stock, and adjusted by age)

5. Concluding Remarks

In the midst of concerns over rapid aging in East Asian economies and its adverse effects on their financial markets, macroeconomic impacts due to demography have been estimated since the early 2000s. One recent example is IMF (2017), in which macroeconomic variables are regressed on demography, financial openness, future aging prospects (aging speed) and other explanatory variables using global panel data. The IMF (2017) estimates, however, define "working age population" as those people aged 30 to 64, which is unusual and differs from previous literature.

This chapter overviews aging in East Asia in the first section, and reviews previous literature in the second section. The third section conducts panel estimates by using similar explanatory variables to IMF (2017), but with different demographic definitions (a working age population aged 15 to 64), with an expanded number of sample countries and lengthened estimation period. The estimated results indicate that an increase in old age dependency ratio substantially raises interest rates and reduces stock return, which differs from IMF (2017), but is consistent with the results of previous literature. The regression results also indicate that an increase in future "aging speed" prospects reduces interest rates and raises stock return. These demographic impacts are, however, restricted to those in financially closed economies. In financially open economies, demographic effects on interest rates and stock return are mitigated, and savings ratio is reduced as foreign savings can substitute for domestic ones. Therefore, policies to increase financial openness can contribute not only to capital market developments, but also to the prevention of the adverse effects of aging. The simulated developments and forecasts of interest rates, stock return and savings rates are shown up to the year 2080 by using estimated coefficients of variables, demographic prospects and other data.

The fourth section considers the relations between future aging speed, on the one hand, and savings, interest rates and stock return, on the other, from the viewpoints of behavioral economics. When prospects for an increase in aging speed are expected, it seems to be a rational choice to increase savings during working age, because an increase in consumption after retirement is naturally anticipated. The empirical results, however, indicate that "prospects for an increase in aging speed" significantly reduce savings, but pull interest rates down and raise stock return. This "conundrum" can be understood by considering that the increased aging prospects induce a large shift in resource holdings from physical assets to financial ones, which drives the prices of financial assets up and their yields down. The estimated results of panel regression demonstrate the robust relationship between an increase in aging speed on the one hand, and an increase in demand for financial assets and a decline in physical investment, on the other.

These empirical findings can be explained by the phenomena of "delaying savings" based on "time-inconsistent" behavior. The number of employees whose savings are not sufficient to cover their expenditures after retirement is increasing in the United States and Europe. Recent studies such as Benartzi and Thaler (2013) advocate savings-promoting pension systems (for example, "Save More Tomorrow") based on "behavioral economics," and these have shown large increases in enrollment and continuation ratios as well as contribution rates. The same type of shortages in savings could be emerging in aging East Asia, as was crystallized by the "20-million-yen shortage after retirement" report by the Japanese Financial System Council. The establishment of financial and pension systems that have embedded "nudges" based on behavioral economics is also required in our region.

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