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## Does Population Aging Contribute to Increased Fiscal Spending?

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### Abstract

**Purpose** – With rapid population aging in Korea, changes in the population structure will result in a rise in the fiscal burden. This paper investigates the effects of population aging on fiscal spending based on Korea's province data and country panel data from the OECD.

**Research design, data, and methodology** - We use province-level fiscal data from Local Finance Integrated Open System and the Korean Statistical Information Service and also collect country panel data from the OECD. To investigate the relationship between population aging and fiscal expenditures, our analysis uses the fixed effects model.

**Results** - The empirical analysis based on Korean local finance and country panel data show that population aging has a positive impact on social welfare expenditures and it also has a positive impact on spending related to children and the elderly, implying that population aging may lead to an increase in fiscal spending via an increase in social welfare expenditures and spending related to children and the elderly.

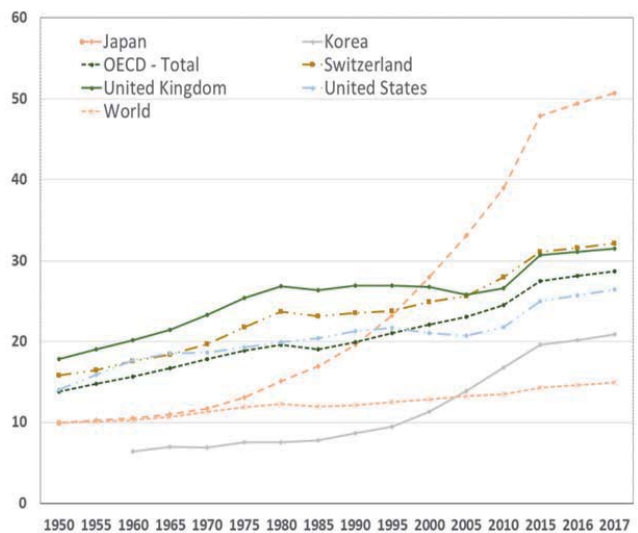
**Conclusion** - These empirical results suggest that countries like Korea that expect to experience rapid population aging need to pay more attention to prepare for the expected increase in age-related spending in the near future.

**Keywords:** Population Aging, Fiscal Expenditure, Social Securities

**JEL Classification:** E62, H20, R5.

## 1. Introduction

Korea is experiencing rapid population aging with the retirement of baby boomers who were born from 1963 to 1966, and low fertility in recent years. <Figure 1> shows the age dependency ratio, which is the ratio of the number of people 65 and above to those aged from 15 to 64, which is the working-age population across countries. As shown in <Figure 1>, the age dependency ratio of Korea started to go beyond the world average and the speed of population aging measured as the (elderly) dependency ratio has surpassed most developed countries. With this rapid population aging of Korea, policymakers are concerned about the impact of the rapid demographic transition on the fiscal burden along with other socioeconomic consequences.



Source: UN Population Database

Figure 1 : Comparison of Population Aging

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As Korea becomes an aged society, the aged population is considered one of the factors that might have a significantly negative impact on the country's economic growth, rise in support costs for the aged population, and fiscal balance. The challenge of a declining working age population seems to continue or become even worse in the near future. <Table 1> shows the prospects of population aging using the UN population database, and it provides comparisons of the degree of population aging among Korea, the average of the OECD and the world average using a dependency ratio. It demonstrates that Korea's population aging is far more severe compared to the world average and the speed is much faster relative to the OECD and the rest of the world.

**Table 1** : Prospects of Population Aging

	2020	2025	2030	2035
Korea	23.70	31.61	41.40	51.40
OECD	30.58	34.16	37.97	41.11
World Average	16.12	17.98	20.20	22.44

Source: UN Population Database

The demographic data so far shows that population aging in Korea will cause a rapid demographic change in the near future. What is notable when we look at the demographic data of Korea by province is that the degree or speed of demographic change within the country varies quite a bit, as shown in <Figure 2>. It shows that most large regions – Seoul, Busan, and Gyeonggi – experience a relatively low degree of population aging, and the degree of population aging in other regions is above the country's average, implying that there are discrepancies in the degree of population aging. What is notable is that the level and speed of population aging is quite different among regions. For instance, the dependency ratio of Jeollanam-do is about 30 percent and the dependency ratio of Gyungbuk is about 15 percent, confirming that the demographic change within the country varies greatly between regions. The data shows that the aged population is mostly concentrated in rural areas and suggests that the impact of population aging on fiscal expenditures differs between regions or the degree of population aging of a province. Regions with a high level of population aging expect to experience a deteriorating fiscal balance, equivalently implying a decline in tax revenues and increase in age-related expenditures, and a shortage in labor supply, which might result in sluggish regional economic growth.

As described in the data, the level of population aging and its speed are quite different among provinces. Given this feature, we examine the fiscal implications of population aging in Korea. We investigate this issue based on the question whether different levels and speeds of population aging matter for age-related fiscal expenditures. If

population aging results in age-related expenditures, it means that local governments either adjust other fiscal expenditures to maintain fiscal balance or try to raise more taxes to support increased spending. Hence our empirical analysis focuses on the question of whether population aging indeed contributes to changes in age-related expenditures.

**Table 2** : Degree of Population Aging by Province

	1990	1995	2000	2005	2010
Country	7.18	8.33	10.23	12.96	15.60
Seoul	4.76	5.66	7.13	9.56	12.64
Busan	4.71	6.15	8.21	11.57	15.68
Dasegu	5.21	6.26	8.12	10.96	14.04
Incheon	5.10	6.41	7.78	9.77	11.83
Gwangju	5.88	6.54	7.81	10.03	12.52
Daejeon	5.81	6.38	7.57	9.65	11.88
Ulsam	-	-	5.69	7.37	9.36
Gyeonggi	6.45	6.95	8.28	10.22	12.23
Gangwon	9.57	11.46	14.09	18.69	22.47
Chungcheongbuk-do	10.58	11.77	13.96	17.57	19.97
Chungcheongnam-do	11.37	14.45	17.75	21.20	22.79
Jeollabuk-do	10.77	13.15	16.36	21.30	24.38
Jeollanam-do	11.51	15.81	20.38	27.76	32.10
Gyeongbuk	12.02	13.94	16.78	21.26	24.46
Gyeongnam	8.22	9.27	12.99	15.69	17.86
Jeju	8.45	9.60	12.15	15.43	18.85

The rest of the paper is as follows. The next section reviews existing literature related to population aging and fiscal spending. In Section 3, we set up our main tests based on Korea and present the results. Section 4 explores the robustness of our findings in Section 3 using country-level data and discusses the results. Section 5 provides conclusion and policy recommendations.

## 2. Related Literature

became an aged society due to a low fertility rate and prolonged life expectancy and it is one of the society's great concerns. As seen in the previous section, the level and speed of population aging in Korea are quite severe compared to other advanced economies and there are several researches on the impact of population aging in various dimensions – population aging might affect GDP growth (Prettner, 2013), it can also change labor-force participation and savings (Hu, 2015), it would also affect the asset prices (Takáts, 2012; Zeng, Zhang, Wang, & Zeng, 2019), and it might also cause a fiscal burden (Ruggeri & Zou, 2007) for the government due to a rise in age-related

spending.

There is one strand of literature that emphasizes the role of demographic changes on asset price, especially real estate price. Jang, Gu, Kim, and Ping (2014) and Wang and Kim (2014) investigate the relationship between demographic changes and real estate prices. Wang, Hui, and Sun (2018) analyze the same issue based on China and conclude that population aging indeed play a significant role in the rise of housing price. They show that population structure indeed matters in the growth in real estate prices.

Population aging expects to lower labor-force participation and saving rates which lead to slow economic growth of a country (Bloom, Canning, & Fink, 2010). Given the relationship between population aging and economic growth and there is no consensus whether population aging has negative impact on growth. For instance, Yashiro (1997) finds that the population aging of Japan contributes not only fiscal burden but also lower economic growth through the decline in saving ratio. Loayza, Schmidt-Hebbel, and Servén (2000) also suggest that the rise of population aging measured as old-age dependency ratio can lead to decline in private national and private savings. However, Futagami and Nakajima (2001) investigate the role of demographic changes on economic growth using theoretical model and conclude that population aging might not result in lower economic growth.

There exists a variety of literature studying the relationship between population aging and fiscal expenditures through health care system. Cai, Feng, and Shen (2018) examine whether China's population aging results in increase in social spending in China. Given the assumptions, they conclude that policy-makers would face rapid expansion up to 30 percent by 2050 which suggests that substantial increase in fiscal revenues might be necessary in the near future. İmrohoroğlu, Kitao, and Yamada (2016) calculate the fiscal burden using accounting model concerning demographic changes along with other variables and suggest that additional policy reforms might help Japan achieve fiscal stability. In line with İmrohoroğlu et al. (2016), Hsu and Yamada (2019) concern the cost of health care system and suggest policy reforms that might mitigate the negative effect of population aging on health care system and fiscal policies.

This paper contributes to the existing literature on how demographic changes influence fiscal expenditures. We investigate this issue using detailed information on age-related spending, which is different from previous studies that consider the cost of health care system or pension, it rather focuses on age-related spending for our empirical analysis and shows that how demographic changes might have significant effect on fiscal outcomes.

### 3. Does Population Aging Increase Fiscal Spending? The Case of Korea

This section investigates the impact of population aging on age-related fiscal spending. Given the different levels and speed of population aging across regions, we first examine whether the degree of population aging matters for fiscal spending based on the fiscal spending of Korea's local governments from 2008 to 2016. We use the local finance statistics from the Local Finance Integrated Open System of the Ministry of the Interior and Safety. Based on the settlement data, we need to find proper age-related spending based on its function. Our empirical analysis focuses on fiscal spending for social welfare, which consists of basic livelihood support and spending on marginal classes, childcare, families, women, senior citizens, juveniles, labor, patriots and veterans' affairs, housing and general affairs. We also consider fiscal spending on senior citizens and juveniles for empirical analysis since some items in spending on social welfare are not directly related to age-related spending. In addition, our data on the population of each region in Korea comes from the Korean Statistical Information Service.

<Table 3> presents simple correlations among key variables for our empirical analysis. Not surprisingly, it shows that there exists positive correlation between the dependency ratio and expenditures on senior citizens and juveniles. However, the dependency ratio and expenditures on social welfare have a negative correlation even though there exists a positive correlation between expenditures on senior citizens and juveniles and expenditures on social welfare. The simple correlation test suggests that population aging will increase age-related spending, and it does not result in a rise in expenditures on social welfare, implying that population aging does not exacerbate fiscal balances with an expansion in age-related spending. In the following, we will examine whether the same relationship exists between population aging and fiscal expenditures in detail.

**Table 3** : Correlations Between Fiscal Spending and Population Aging

	Old dependency ratio	Expenditures on senior citizens and juveniles	Expenditures on social welfare
Old dependency ratio	1		
Expenditures on senior citizens and juveniles	0.1152	1	
Expenditures on social welfare	-0.0746	0.9579	1

To investigate the relationship between population aging

and fiscal expenditures, in the following, we examine the following equation using the fixed effects model (Kim and Go, 2017):

$$\ln(\text{Expenditure}_{i,t}) = \alpha \cdot \text{Old Dependency Ratio}_{i,t} + \beta \cdot \text{GDP per capita}_{i,t-1} + \gamma \cdot \text{GDP growth rate}_{i,t-1} + \varepsilon_{i,t} \quad (1)$$

where  $\text{Expenditure}_{i,t}$  denotes fiscal spending on social welfare and senior citizens and juveniles and  $i$  refers to region and  $t$  is the year. The  $\text{Old Dependency Ratio}_{i,t}$  is the share of the population aged over 65 to the population aged from 14 to 64. We also include the GDP per capita and its growth rate as additional control variables. In our empirical analysis, our main question is whether fiscal spending will increase with the growing needs of age-related spending. The coefficient on the old dependency ratio,  $\alpha$ , would be positive and also statistically significant if age-related fiscal spending increases with the level of population aging after controlling the level and growth rate of income per person in each region. As a measure of population aging, it additionally uses an aging index, which is the ratio of elderly people above 65 years old to young people aged from 0 to 14 for the following empirical analysis. This additional measure has higher values as the population of a country or region grows older, similar to the old dependency ratio.

<Table 4> shows the results based on equation (1) based on senior citizens and juveniles. The first and third column include the old dependency ratio as a measure of population aging and the second and fourth column is the aging index. The results show that population aging has a positive impact on fiscal expenditures on senior citizens and juveniles, implying that population aging might increase fiscal spending via age-related expenditures. From column (1) to (4), the empirical results consistently indicate that there is a positive relationship between age-related spending and population aging, as expected.

We now turn our attention to expenditures on social welfare instead of senior citizens and juveniles. Even though expenditures on senior citizens and juveniles increase, expenditures on social welfare might stay the same or even go down if other expenditures on social welfare decline. Then it is hard to say that population aging contributes to an increase in fiscal spending due to the redistribution of fiscal spending among functions or sectors. However, we can conjecture that population aging has an impact on fiscal spending if expenditures on social welfare rise with the expansion of spending on senior citizens and juveniles. So, we estimate equation (1) using expenditures on social welfare as a dependent variable, and <Table 4> shows the results.

**Table 4** : Population Aging and Expenditures on Senior Citizens and Juveniles

Dependent Variable: Expenditures on senior citizens and juveniles

	(1)	(2)	(3)	(4)
<i>Old Dependency Ratio</i> <sub><i>i,t</i></sub>	0.25*** (0.01)		0.22*** (0.02)	
<i>Aging index</i> <sub><i>i,t</i></sub>		0.02*** (0.00)		0.02*** (0.00)
<i>GDP per capita</i> <sub><i>i,t-1</i></sub>			0.00** (0.00)	0.00* (0.00)
<i>GDP growth rate</i> <sub><i>i,t-1</i></sub>			-0.01 (0.01)	-0.01 (0.01)
Constant	15.94*** (0.23)	18.37*** (0.09)	16.01*** (0.26)	18.23*** (0.15)
R <sup>2</sup>	0.74	0.79	0.72	0.76
N	144	144	128	128

Note: ( ) are standard error

\*, \*\*, \*\*\* denote 1%, 5%, 10% significance level.

Taking a closer look at <Table 5>, the results from column (1) through (4) consistently show that population aging might contribute to an increase in expenditures on social welfare regardless of the measure of the population aging index. This reaffirms the findings in <Table 3> that show that population aging is positively correlated with age-related fiscal expenditures or population aging contributes to an increase in fiscal spending via age-related fiscal expenditures.

**Table 5** : Relationship Between Population Aging and Expenditures on Social Welfare

Dependent Variable: Expenditures on social welfare

	(1)	(2)	(3)	(4)
<i>Old Dependency Ratio</i> <sub><i>i,t</i></sub>	0.20*** (0.01)		0.16*** (0.01)	
<i>Aging index</i> <sub><i>i,t</i></sub>		0.02*** (0.00)		0.01*** (0.00)
<i>GDP per capita</i> <sub><i>i,t-1</i></sub>			0.00*** (0.00)	0.00*** (0.00)
<i>GDP growth rate</i> <sub><i>i,t-1</i></sub>			0.00 (0.00)	0.00 (0.00)
Constant	18.02*** (0.15)	20.02*** (0.06)	18.38*** (0.14)	19.93*** (0.07)
R <sup>2</sup>	0.82	0.84	0.85	0.87
N	144	144	128	128

Given the findings in <Table 4> and <Table 5>, we now turn our attention to the speed rather than the level of population aging, as previous empirical analysis mainly examined the relationship between the size of age-related spending and the degree of population aging at the regional level. This additional empirical analysis will enable us to predict how quickly expenditures related to population aging

are expected to rise. We investigate whether regions experiencing rapid population aging will be more likely to expand their age-related spending using the expenditure on social welfare.

Our empirical analysis is similar to equation (1) except that it uses the growth rate of each variable rather than the size of the variable itself. <Table 6> shows that most of the results are almost similar to the previous results. The results indicate that a region will experience an expansion in its expenditures on social welfare as the region quickly undergoes population aging.

**Table 6 :** Relationship Between Changes in Population Aging and Growth in Expenditures on Social Welfare

	(1)	(2)	(3)	(4)
$\Delta Old\ Dependency\ Ratio_{i,t}$	0.20** (0.10)		0.09** (0.04)	
$\Delta Aging\ index_{i,t}$		0.06*** (0.02)		0.02*** (0.01)
$\Delta GDP\ per\ capita_{i,t-1}$	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
$\Delta GDP\ growth\ rate_{i,t-1}$	0.01 (0.01)	0.01 (0.01)	0.00 (0.00)	0.00 (0.00)
Constant	0.03 (0.05)	-0.22** (0.09)	0.04* (0.02)	-0.03 (0.04)
R <sup>2</sup>	0.04	0.13	0.08	0.11
N	112	112	112	112

#### 4. Relationship Between Fiscal Spending and Population Aging Based on OECD Countries

The previous section examined the relationship between population aging and fiscal spending based on Korean regional data. It showed that regions with higher population aging are more likely to have more age-related spending and expenditures on social welfare. The results also suggest that the size of age-related spending will rise more rapidly as the population aging of a region accelerates. These empirical results imply that a region will experience an expansion in fiscal spending with population aging without the rearrangement of fiscal expenditures. In this section, we investigate whether the empirical results from Korean regional data are supported by country-level data.

We collected data on population, GDP and fiscal expenditures from the OECD database for Australia, Austria, Belgium, Canada, Czech Republic, Denmark, Estonia, Finland, Germany, Greece, Hungary, Iceland, Ireland, Israel, Italy, Japan, Korea, Latvia, Lithuania, Luxembourg, Netherlands, New Zealand, Poland, Portugal, Slovak Republic, Slovenia, Spain, Sweden, Switzerland, the

United Kingdom and United States from 2007 to 2016. The measure of population aging is the same as the previous empirical analysis. However, the different classification of government expenditures between Korea and the OECD makes the empirical analysis challenging. The OECD uses the Classification of Functions of Government (COFOG) it developed, which contains two levels depending on how it broadly defines an expenditure. Given the data classification, we need to decide which of these expenditures should be considered age-related spending, and we use expenditures on Health and Social protection as a measure of age-related fiscal expenditure. It is also worth noting that the OECD does not provide the size of fiscal expenditures in each classification, but rather the share of GDP. Thus, our empirical analysis is not done with the size of expenditures, but the share of fiscal expenditure in GDP for each country. In sum, we estimate with the following equation using the country fixed-effects model:

$$\frac{Expenditure_{i,t}}{GDP_{i,t}} = \alpha \cdot Old\ Dependency\ Ratio_{i,t} + \beta \cdot GDP\ per\ capita_{i,t-1} + \gamma \cdot GDP\ growth\ rate_{i,t-1} + \varepsilon_{i,t} \quad (2)$$

where *i* denotes a country rather than a region.

<Table 7> shows the empirical results based on equation (2). The first two columns present the results based on expenditures on health and the last two columns are based on social protection. For the country panel, we also use the alternative measure of population aging similar to the previous empirical analysis. The empirical results are in line with the previous empirical analysis using Korea regional data. The coefficients on population aging indices appear to all be positive even though only the coefficients on the dependency ratio are statistically significant.

**Table 7 :** Relationship Between Population Aging and Fiscal Spending

	Health		Social Protection	
	(1)	(2)	(3)	(4)
$Old\ Dependency\ Ratio_{i,t}$	0.09*** (0.03)		0.19*** (0.06)	
$Aging\ index_{i,t}$		0.03 (0.02)		0.05 (0.05)
$GDP\ per\ capita_{i,t-1}$	25.72*** (5.16)	24.69*** (5.28)	-50.71*** (12.06)	-53.51*** (12.31)
$GDP\ growth\ rate_{i,t-1}$	-0.05*** (0.01)	-0.05*** (0.01)	-0.17*** (0.02)	-0.17*** (0.02)
Constant	-56.32*** (12.21)	-53.23*** (12.55)	129.67*** (28.51)	138.55*** (29.26)
R <sup>2</sup>	0.32	0.29	0.54	0.52
N	276	276	276	276

The empirical analysis in this section shows that population aging might contribute to a rise in age-related

fiscal expenditures, although the results are not as strong as those in the previous section. The empirical results from the country panel data and province-level data consistently confirm that population aging can indeed be a significant burden for government fiscal spending through an increase in age-related spending without the reallocation or adjustment of other fiscal expenditures.

## 5. Conclusions

This paper examines the possible negative impact of population aging on fiscal expenditures using province-level and country-level data. The empirical analysis based on Korean province-level and country-level reveal that population aging contributes to increase in social welfare expenditures and it also has a positive impact on spending related to children and the elderly, implying that population aging may lead to an increase in fiscal spending via an increase in social welfare expenditures and spending related to children and the elderly. Given the different levels in population aging among provinces in Korea, these results indicate that population aging will exacerbate the fiscal burden for provinces with a higher degree of population aging and fiscal reforms at the province level should be considered for long-term fiscal sustainability.

These empirical results suggest that given the significant impact of population aging on fiscal expenditures, each province or country should make serious efforts to prepare for possible hikes in age-related spending with appropriate revenue and expenditure plans for the near future and to prevent its negative impact on regional economies.

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