

The Economic Growth and the Elderly

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Abstract: This study explored those relationship between the mean population, unemployment rate, population growth rate, Gross Domestic product(GDP) per head and the ratio of elderly population within 6 countries from 2010 to 2015, highlighting the vital role of older workers (as measured by labor force participation of older people) in the national economy. A statistic table below illustrates the relationship between those factors and the degree of the influence with the topic. The result shows that the positive association between GDP per head and the elderly, same with the strong relationship with in the population and the elderly. Elderly population has a positive association with unemployment rate as well, but inversely proportional to the population growth rate. This indicates that the marginal impact of elderly population aging on economic growth depends on the size of population. Within different countries, the indicators are different as well. The range of countries are involved in both developed economies and developing economies, considering the population size and the economic situation, taking those representative sample to investigate the economic growth and the elderly population.

Keywords: Population size, Population growth rate, GDP per head, Unemployment rate, Ratio of elderly population and the total population

1. Introduction

As the society and the world is developing, the gap between each economies is becoming more and more significant. Each country varies from each other, however there is one trend that has already turned into a truth-the Earth becomes older than before. It's not the actual age of the Earth, but the residents, which is mankind that are getting older. According to the website *Our World in Data*, for over the past 20 years, the elderly population increased from 423.26 million people to 761.27 million people. This is because the growth of the technology and civilization level, the mean expected living years has grown rapidly, the Human Developing Index(HDI) rose a lot. For instance, in 2000 the HDI figure in China 0.58, which is a medium level as HDI figure is between 0 and 1; Change time settlement into 2021, even the whole world is under the threat of Covid-19, this figure for China still increased dramatically from 0.58 to 0.77. Or change in another location that is less developed such as Africa, in 2000 those are the information for those countries: Nigeria 0.45, Chad 0.29, South Africa 0.63, Madagascar 0.44, Zambia 0.44, Zimbabwe 0.45. Those HDI figures were quite low because it's under 0.5 which is a medium level, except South Africa whose HDI is above the medium. In 2021, this figure changed a lot among those nations the study mentioned above, according to the *Our World in Data*, the figures now become to: Nigeria 0.54, Chad 0.39, South Africa 0.71, Madagascar 0.50,

Zambia 0.56, Zimbabwe 0.59. As the figure clearly shown, the HDI figure will increase as the human society develops.

Elderly population has become an issue of great concern in many parts of the world. For example, South Korea is suffering from its low birth rate (population growth rate) and high rate of elderly population. Up to now, the due is 2021, according to the *Our World in Data*, the birth rate of the South Korea is 5.58%, while the rate of aging people is 16.7%. Which means that the nation will become “older”, this will put pressure on the Treasury as the amount of young people is becoming less, the number of labor force is declining, the people that hand in tax are getting less. However, government need to distribute the pension to the elderly, so government is likely to run into a budget deficit.

This study aims to investigate the role of economic growth and the aging population and see the how significant the influence that one factor can cause on to the other factor. In addition, the study also includes about the factors that can cause the deviations such as unemployment rate, GDP per capita etc, among the year 2010 to 2015. The reason why this period is selected is that before the 2010 was the Global Financial Crisis, after that, in 2019, here comes the Padamic which is the Covid-19, the global economies had suffered a severe blow.

2. Literature review

There are a random variety of reasons that can influence size of population of elderly. The essay *The role of older workers in population aging–economic growth nexus: evidence from developing countries*[1] illustrates that developing countries have an aging population. This is happening because people are having fewer babies and living longer. This will be likely to cause a big impact on a country's social and economic development. This study above considers about how older workers can help to reduce the negative connection between aging population and economic growth in developing countries, which is not often studied. Throughout its all passage and the data collecting method it use, the majority shortage is that it mainly focused on how older workers can help with the negative connection between aging population and economic growth in developing countries. It didn't look at other things that might affect economic growth, like social security and pension schemes. These data were specific to each country, so there wasn't enough data to compare. However, the study above hopes to inspire more research on how older workers can explain the correlation between aging population and economic development in developing countries at the national level. In overall, the relationship between economic growth and the elderly is deep. Economic growth can improve people's living standards and healthcare, which can help raise life expectancy and lead to an increase in the aging population. On the other hand, the increase in the aging population can also have an impact on economic growth. Older people tend to consume less and have a lower labor force participation rate due to retirement, which may drag down economic growth. In addition, aging can also put pressure on the social security system, as the increase in the number of older people leads to an increase in social security expenses such as pensions and medical insurance. If these expenses exceed the income of the social security system, it can lead to fiscal deficits, which can have a negative impact on economic growth. This paper also included the conclusions that other essays made, for instance, in the paper: *The Influence of China's Population Aging on Economic Development*[2]. It mainly discusses the impact of population aging on China's economic development from two aspects: labor productivity probability and labor supply. The author believes that with the acceleration of population aging, China is facing the pressure of insufficient labor supply, and points out that if labor productivity cannot be effectively improved, it may lead to slowing economic growth. In addition, the article also highlights the positive role of population aging in the development of the elderly industry, and emphasizes the need to strengthen attention and research on aging issues in order to cope with the challenges they bring. Meanwhile, this paper also concluded the essay: *The Impact*

of Aging on Economic Development. Party and Government Forum (Cadre Digest)[3]. It mainly tells on the impact of aging on savings and consumption, as well as its connection with economic improvement. Firstly, it is pointed out that the direct impact of aging on savings and consumption is relatively small, especially in the early stages of aging. Secondly, it was analyzed that China's reform and opening up and rapid economic development have led to a rapid increase in savings and consumption. At the same time, due to the intensification of aging caused by the family planning policy, there has been a phenomenon of savings and consumption increasing with the development of aging. However, in reality, this phenomenon masks the negative impact of aging on savings and consumption. Next, by introducing the development situation in Japan and Taiwan, it reveals the negative impact of aging on the manufacturing industry in the context of rising labor prices and raw material shortages. This has led to the forced transfer of manufacturing to underdeveloped countries, hindered the development of emerging industries, and led to a "stagnant decade", resulting in stagnant income growth, decreased consumption, and reduced savings for residents. Finally, it is pointed out that aging has a significant indirect impact on economic development, rather than being solely determined by population aging itself. It is also believed that economic deterioration cannot be solely caused by a single factor of aging, but rather by a series of comprehensive economic and social changes, and aging is only one of the important links. The last essay that the paper need to quote is the *Population Aging and Economic Development Level: International Comparison and Enlightenment[4]* writtern by Yao Congrong and Li Jianmin. This paper mainly investigated the correlation between the elderly and the economic growth and drew the following conclusion: Firstly, government's attitudes and actions towards current fertility and aging issues, It is a key factor determining the future aging crisis of a country or region. Next, the elderly issue is not the preference from the nature, in fact, it's humans' behaviour that conduct this consequences.

3. Methodology

3.1. Data

The data that the study mention is all from the website of *Our World in Data*. Taking samples from the six distinct economies with particular characteristics considering their own situation. Some of the economies are developed economies which are countries with high levels of economic and social development, and high standards of living. These countries usually have strong economies, welfare systems. They usually have high levels of education and healthcare systems while some of the economies are developing nations with lower levels of economic and social development, and lower standards of living. These countries usually have weaker economies, less developed welfare systems, poor education and sanitation. Taking several indicators such as the unemployment rate, GDP per capita, population growth rate etc. The time interval is from 2010 to 2015.

3.2. Formulae Presentation

According to the United Nations' *World Population Prospects* report. Elderly process is a process where the proportion of older people in a population increases as the time passes by. This increase can be caused by an increase in the total population, an increase in life expectancy, or a decrease in birth rates. Elderly process is a long-term process that usually has a substantial influence on society, the economy, and politics.

$$y_{it} = \alpha + \beta_{it} + X_{it} + \epsilon_{it}$$

On the formulae above, y_{it} represent the elderly population(elderly population rate%); α represents the Gross Domestic Product(GDP) per capita/head; β stands for the average size of the population(million); X_{it} means the unemployment rate and ϵ_{it} stands for the population growth rate.

This variables are mentioned in many essays and reports as the result of widely used into measuring whether the nations are in good condition or not. Moreover, the time interval variables above is between 2010 to 2015. This is because that Global Financial Crisis just occurred in 2008, and the study estimated that economies in the world was recovering from the lost in the Financial Crisis. Therefore, choosing year in 2010 is a better choice. And the study also has the reasons for choosing 2015 as an ending year. In 2015, a lot of economic incidents happened. For instance, the growth rate in China declined, Chinese government started to plan economic structural adjustment and reform. At the same time, The Federal Reserve System(FED) in America increased its interest rate and eliminated the low-interest policy lasted for several years. Meanwhile, The economic growth in the Eurozone is weak, and the debt crisis and refugee crisis continue.

The limitation for the variables are lack of diversity of indicators, which is likely to create uncertainty and inaccuracy. Therefore, the study takes the average of indicators to enhance persuasiveness and universality, and reduce inaccuracy.

3.3. Data Presentation

Through the calculation of mathematical models, this paper finds the relationship between variables, as shown in Figure 1. All variables, whether it is the unemployment rate or the average GDP per capita, will be related to the aging ratio. Because the variables themselves have a relationship, for example, when discussing the relationship between economic growth (average GDP per capita) and aging growth, economic growth can improve people's living standards and citizens can purchase a random variety of goods to enhance the living standard. The growth and improvement of education, medical insurance, and life expectancy index are all making people's life expectancy index grow, so as shown in Figure 1, without considering the factors of other countries, i.e. a single economic entity, the growth rate of GDP and aging have a very strong positive correlation, with a coefficient of 2.341. However, the situation among different economies is different, so when considering the differences among countries, this coefficient is not as large, and further, the growth rate of GDP and aging become a negative correlation, with a coefficient of -1.70. Because among these several sample countries, there are also non-developed countries, that is, economically undeveloped but the proportion of the elderly population is still very large, such as Russia. This has caused a change from positive correlation to negative correlation when considering the differences among countries.

In Figure 1, it is clearly stated that the aging population and population growth have a very strong positive correlation when considering the differences among countries, with a coefficient of 38.48. There is a certain relationship between aging and population base. The population base refers to the total population of a country or region, and aging refers to the continuous increase in the proportion of the elderly population in the total population. The larger the population base, the faster the aging process may be, because the number of elderly people will increase with the increase of the population base. In addition, the population base will also affect the degree of aging, because the larger the population base, the larger the absolute number of elderly people will be. However, the population base is not the only factor affecting aging. Other factors, such as birth rate, life expectancy, and economic development level, will also affect the aging process. Therefore, to fully understand the relationship between aging and population base, multiple factors need to be considered. The difference between developed countries and developing countries is also visible, for example, most developing countries, the medical system and medical insurance have not yet developed to such a high level, so the average life expectancy and expected life expectancy will be lowered. Because a good medical condition can greatly increase the average life expectancy; conversely, the medical system in developed countries is well developed, so the average life expectancy and expected life expectancy will increase, and the possibility of aging problems will be greater. Of course, there are

exceptions, such as China, which is a developing country, but China's medical level is quite good. In the period from 2010 to 2015, China's medical level ranked 46th in the world.

Table 1: The relationships between elderly and indicators.

	(1)	(2)	(3)	(4)	(5)	(6)
	oldage	oldage	oldage	oldage	oldage	oldage
lggdp	2.341 (2.010)	-1.720 (2.559)				-3.409* (1.461)
lgpop			38.48** (11.73)			37.86*** (8.300)
unem				0.519*** (0.129)		0.540*** (0.115)
pogro					-0.694 (1.832)	1.264 (1.111)
_cons	-9.753 (20.57)	23.98 (27.83)	-215.9** (67.43)	0.889 (1.120)	5.066*** (0.650)	-180.1** (50.22)
country	No	Yes	Yes	Yes	Yes	Yes
year	No	Yes	Yes	Yes	Yes	Yes
N	36	36	36	36	34	34
R-sq	0.038	0.995	0.997	0.997	0.996	0.999
adj. R-sq	0.010	0.993	0.995	0.996	0.993	0.998

Standard errors in parentheses

=** p<0.05 ** p<0.01 *** p<0.001"

However, when discussing the impact of unemployment rate and aging, these two variables also have a positive correlation, with a coefficient of 0.519, which is a relatively weak positive correlation. However, the relationship between unemployment rate and aging is complex. On the one hand, as the degree of aging deepens, the supply and demand structure of the labor market may change, leading to changes in the unemployment rate. For example, with the increase of the elderly population, the labor market may experience a shortage of labor supply leading to an increase in the unemployment rate. On the other hand, aging may also affect the demand structure of the labor market, thereby affecting the unemployment rate. For example, with the increase of the elderly population, the demand for low-skilled labor in the labor market may decrease, leading to an increase in the unemployment rate.

The relationship between population growth rate and aging is -0.694, which means that the slower the population growth rate, the more severe the aging. The reason for the negative correlation between aging and population growth rate may be that the development speed of aging is faster than that of population growth. When the development speed of aging is faster than that of population growth, it will lead to more elderly people than young people, and the proportion of elderly people in the population structure will increase, while the proportion of young people will decrease. This will cause

changes in the supply and demand structure of the labor market, such as a decrease in the number of employed people, and the pressure on young people will increase because they have to support the elderly. At the same time, the financial pressure on the government will also increase because the government needs to provide pensions for the elderly. Alternatively, from another perspective, the tax pressure on young people will increase because the government's expenditure on pensions will increase, which may lead to fiscal deficits and cause side effect on the growth of economy, and the government's tax revenue will also increase. These factors will affect indicators such as economic growth and unemployment rate. Therefore, aging and population growth rate are negatively correlated.

In this paragraph, it can be concluded that the data used in the study may not be universally applicable, because the sample characteristics used, such as China, a developing country with the world's largest total population according to data released by the United Nations from 2010 to 2015; and the United States, a nation with the world largest GDP total amount, with the largest population among developed countries according to data released by the United Nations, have an advanced level of representativeness. However, the sample size of these data is not large enough to provide data for all countries and consider some particular situations of certain countries. These special situation may lead to changes in the relationship between variables, so the data mentioned in this study may not be universally, totally applicable and acceptable.

4. Conclusion

In summary, this paper mainly studies the relationship between aging and economic growth through a model with aging and economic development, and uses various factors that may affect the relationship between the two variables to analyze and discuss the regression model. The data used in this paper comes from the *Our World in Data* website, which is published by WB and UN, and has a certain authority. This paper also summarizes the papers of *The role of older workers in population aging–economic growth nexus: evidence from developing countries*[1] and *Aging, Human Capital, and Economic Growth*[5]. Through the above research, the following conclusions are drawn: (1) Economic growth will lead to aging, because economic growth, the development of people's living standards and medical system, and even technological progress will increase people's average life expectancy and expected life expectancy. (2) The proportion of the elderly population and the population base have a strong positive correlation. (3) Unemployment rate and aging are positively correlated, because of the increasing pressure on government fiscal expenditure and young people. (4) Population growth rate and aging are negatively correlated. However, there are also some shortcomings in this paper. Although examples such as China and the United States are used, these countries have prominent characteristics and strong representativeness. However, the sample size used in this paper is still too small, and it is difficult to represent all countries and consider the changes in the relationship between variables caused by special factors in some countries. Although the data in this paper has undergone rigorous statistical testing, in general, the data may not be universally applicable. To improve this paper, the following can be done: take a broader sample to consider special cases between countries; or add other factors that may change the relationship between the two variables to make the data more universally applicable and persuasive.

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