



## Is Poverty Rate Related to Population Aging Among Indonesia's Districts?

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### Abstract

Many studies have been done on the impact of an aging population on economic growth, but studies on the impact of aging on poverty are still limited though a higher economic growth rate is not necessarily translated into a lower poverty rate. Yes, it is often argued that an aging population will result in rising poverty. This study fills this gap by analyzing districts in Indonesia. It examines three questions. The first is to examine whether aging is directly related to poverty. The second is to examine whether aging is indirectly related to poverty through per capita Regional Domestic Product. The third is to calculate the net relationship by summing the direct and indirect relationships. It conducts regression analyses on 2010, 2015, and 2020 data sets separately. It concludes that an aging district is not necessarily related to a higher poverty rate in the district. An observation that an aging district is associated with a higher poverty rate is only found in Java Island, with a modern economy and infrastructure as well as higher percentages of older people. In the Outer Java Islands, an aging district is more likely to have a lower poverty rate.

**Keywords:** Older People; Poverty; Economic Growth; District; Indonesia

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## INTRODUCTION

Numerous studies have examined the impact of population aging on economic growth, yielding varied results. Some suggest a positive impact, while others find a negative correlation, and some conclude no significant impact. However, limited research exists on the impact of population aging on poverty, despite poverty being a primary goal in sustainable development. Furthermore, economic growth is not necessarily related to poverty. Therefore, the relationship between population aging and poverty is intriguing to study because older people are often categorized as unproductive and burdensome, raising concerns that an increasing older people population might lead to higher poverty rates in an area without adequate social security and healthcare systems.

The increasing percentage of older people was argued to impact a country's economy, as they were often perceived as "non-productive" consumers, posing a potential strain on the economy. This may lead to reduced savings and decreased investments, and ultimately affect economic growth (Onder and Pestieau, 2014; Van Der Gaag and de Beer, 2015).

Older people may face poverty due to financial inadequacy in old age. This insufficiency can arise from disability, lack of facilities, prohibition from working, or social discrimination. Ananta, Arifin, and Moeis (2021) revealed that older people may struggle to maintain their standard of living as they did before retirement. Therefore, current workers or those planning to retire in the future may desire significantly higher pension incomes and may need to work longer, as working remains the sole reliable source of financial support in old age. Consequently, Chen et al. (2015) stated that the aging process of the population (the increasing percentage of elderly people) is feared to exacerbate poverty in areas with higher aging rates. This concern is based on the assumption that when someone is defined as old based on age, they automatically become unproductive.

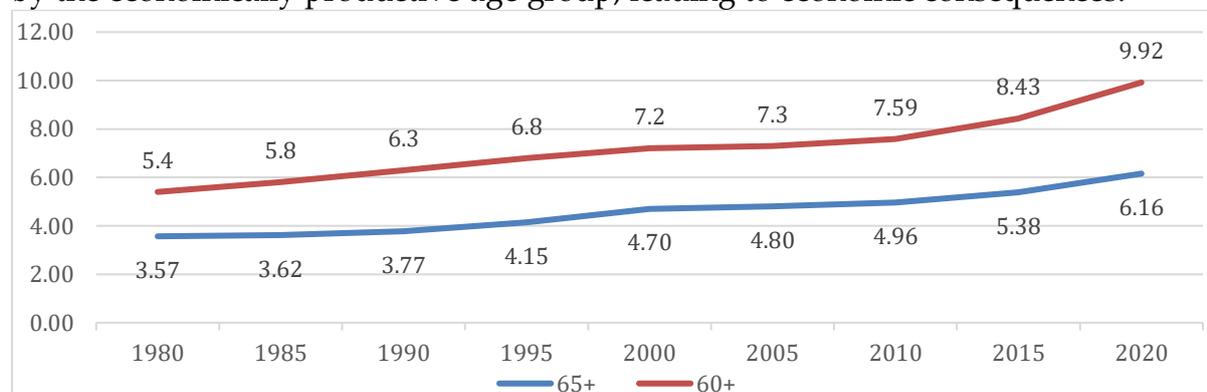
On the other hand, "old" individuals are still very likely to work and earn income, as individuals receive financial support not only from working. This concern also arises because governments in developing countries do not provide sufficient and adequate pension funds for the elderly population.

Therefore, understanding the poverty-aging population relationship is crucial for addressing the challenges of an aging population and informing poverty reduction policies, especially in developing countries with inadequately covered social safety nets (Vu and Nguyen, 2021).

Nevertheless, research on the link between poverty and population aging is scarce, particularly in Indonesia. This study aims to fill this research gap by exploring whether population aging contributes to increased regional poverty in Indonesia, utilizing district/city-level data in Indonesia.

Population aging is a consequence of successful government initiatives to reduce birth rates and increase life expectancy. Indonesia has achieved the success through its Family Planning Program, resulting in a decline in the total fertility rate from 5.7 births in 1960 to 2.4 births per family in 2017. Life expectancy at birth has also increased from 69.81 in 2010 to 71.57 in 2021. Rapid declines in fertility and mortality rates, coupled with improvements in healthcare, have led to the growth of the older people population in Indonesia.

The 2020 Indonesian Population Census data illustrates that if the older people is defined as those aged 65 and above, it constitutes 6.16% of Indonesia's population. However, if the older people is defined as those aged 60 and above, then 9.92% of Indonesia's population has entered retirement age (see Figure 1). Whatever the figure may imply that a larger proportion of the older people will be financially supported by the economically productive age group, leading to economic consequences.



**Figure 1.** Percentage of Older People in Indonesia (Source: Badan Pusat Statistik, 2020; World Bank, 2020)

It is essential to note, though, that some individuals aged 60 or even 65 and above are still economically active. There are also those who financially support younger generations, especially their children or grandchildren. Further examination of these dynamics is necessary to understand their impact on a country's economy. Therefore, the specific research question in this study is whether an aging district is necessarily associated with the district's poverty in Indonesia.

Furthermore, existing studies on the impact of population aging on poverty primarily concentrate on older people's poverty using micro-level individual data. However, research at the macro-aggregate level remains scarce. Gasparini et al. (2007) found that the older people's poverty rate is similar to the overall poverty rate in countries with weak social security systems but lower in countries with well-developed pension systems. Barrientos et al. (2003) found that poverty among older people households is higher than other age groups, while (Deaton & Paxson, 1995; Pal & Palacios, 2011) found that poverty rates among older people are lower than in non-older people households.

This study is a macro-level analysis, focusing on the relationship between aging population and poverty in districts in Indonesia, using 2010 and 2020 census data and the 2015 Population Inter-Census Survey (SUPAS) data.

## LITERATURE REVIEW

The aging population can impact economic growth through government spending, consumption levels, and income sources, with varying effects between developed and developing countries (Alders and Broer, 2004). Some argued a potential negative relationship due to increased older people population ratios leading to reduced workforce participation, savings, and capital demand, slowing economic growth (Bloom et al., 2011).

However, other studies found a positive relationship between population aging and economic growth. Li and Zhang (2015) applied the Solow model to examine the aging effect on China's economy from 1978 to 2012, finding a positive impact on per capita GDP. Using China's provincial panel data from 1985 to 2005, Li et al. (2012) identified a positive effect of an aging population on savings and investment, enhancing economic growth.

Research by Priebe (2017) using SUSENAS data in Indonesia indicated significantly higher poverty rates among older people compared to other populations. Chen et al. (2015) studied the impact of aging populations and economic growth on rural poverty in China from 2009 to 2012, revealing a correlation between increasing older people populations in rural areas and rising poverty ratios.

Srivastava and Mohanty (2012) explored older people's poverty in India during 2004-2005, finding that poverty is higher among older people individuals living alone or with other older people persons, particularly in rural areas. Vu and Nguyen (2021) examined trends and determinants of older people's poverty in Vietnam in 2013, revealing that overall, older people's poverty is lower than the general population, but certain older people groups are more vulnerable, especially those in rural areas.

Rodrigues and Reuenthip's (2019) research suggested that age plays a minimal role in explaining household poverty likelihood after considering other socioeconomic factors. Overcoming poverty requires a structural approach addressing the socioeconomic losses of individuals and their families across all age groups.

Population aging issues affecting a country's economy actually echo concerns from the 1960s and 1970s about the fear of a population explosion due to high fertility rates. This concern relates to the rising dependency ratio, comparing "non-productive" to "productive" populations. A higher dependency ratio is feared to impose a higher economic burden, as one productive individual must support more non-productive individuals. The difference now is that the dependency ratio in the 1960s and 1970s referred to the young age group, while now it pertains to older people. Furthermore, this model assumes a sequential relationship: high consumption (high dependency ratio) leads to low savings, followed by low investment, ultimately resulting in low economic growth (Ananta and Arifin, 2019).

However, Ananta and Arifin (2019) questioned the above concerns. *First*, the economic model remains income-focused and does not align with sustainable development goals outlined by the UN post-2015, where poverty takes precedence. *Second*, the model assumes that a decrease in the labor force's quantity and percentage, or even the working-age population, harms economic growth. It neglects the productivity (including health and education) of the workforce. A large workforce may not positively impact the economy, and may even be detrimental if its productivity is low. Conversely, a smaller workforce can be an asset if highly productive. *Third*, the model operates in a closed economy, disconnected from the global economy. Nearly all countries today are open economies, where investments are not solely dependent on domestic savings. Foreign Direct Investment (FDI) is often used to inject capital when domestic savings are low. *Fourth*, the model does not consider the possibility of financial aid programs such as Microfinance, which can assist poor households with loans for productive purposes. *Fifth*, the model overlooks the possibility that high expenditures on health and education for children can be productive, as high-quality children become a highly productive workforce. *Sixth*, the model does not account for technological advancements that can enhance the productivity of the entire population. Technological utilization can minimize the negative impact of a declining working-age population.

## CONCEPTUAL FRAMEWORK

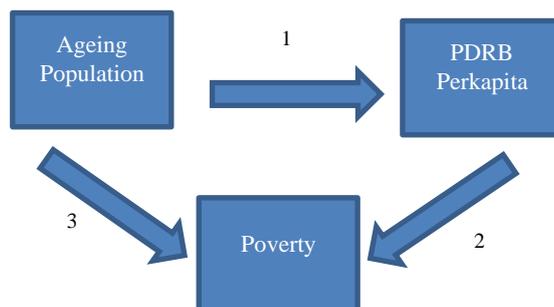
This study seeks to elucidate the conceptual relationship between an ageing population and poverty based on the findings of Chen et al. (2015). It argues that the impact of an ageing population extends beyond direct effects on poverty and can also influence it indirectly through economic growth, measured here by per capita Gross Regional Domestic Product (GRDP). Ageing populations can lead to a decline in societal savings, followed by reduced investments, ultimately impacting economic growth and per capita income (Onder and Pestieau 2014; Van Der Gaag and de Beer 2015). The decline in per capita income contributes to the rise of poverty in a region, suggesting that an ageing population can indirectly affect regional poverty.

Moeis et al. (2022) outlined four financial sources for individuals, including the elderly: labor market, family, community, and the state. The labor market requires individuals to work and save for retirement. Larger families often serve as the main financial support in old age, while communities provide informal social protection. The government, through the state, ensures the welfare of individuals, including the elderly.

As individuals age, they often stop working due to age or physical limitations, leading to a loss of their primary income. In many developing countries, government

support is insufficient, leaving older individuals reliant on family and community income. This vulnerability contributes to increased poverty in countries with aging populations.

The hypothesis posits that older individuals experience impoverishment due to the loss of their primary income and the underdevelopment of social security systems in developing countries. Consequently, a growing aging population is associated with higher poverty rates. Figure 2 illustrates the transmission of an aging population to population poverty, with lines 1 and 2 depicting an indirect relationship through per capita GRDP, and line 3 representing the direct link between aging population and poverty.



**Figure 2.** Transmission of Population Aging to Poverty

## DATA AND STATISTICAL MODEL

### Data and Variables

The data for this study were collected by the Statistics-Indonesia (Badan Pusat Statistik or BPS), using data from all districts (consisting of regencies and cities) in Indonesia in 2010, 2015, and 2020. Out of a total of 514 districts, 482 were included in the study, excluding 32 regencies/cities that resulted from territorial expansions after 2010 and their parent regencies.

The dependent variable in this study is district's poverty, measured as the percentage of poor people to the total population in each district. This study employs the poverty concept defined by Statistics-Indonesia (BPS), where poverty is viewed as an economic inability to meet basic needs, focusing on food rather than non-food expenditures. Individuals are categorized as poor if their average monthly per capita expenditures fall below the poverty line. The research calculates the percentage of the population in a district/city with expenditures below the poverty line compared to the total population in that area.

There are two main independent variables : aging population and per capita regional/ district gross domestic product (RGDP). The RGDP is also the intermediate variable between aging and poverty. The RGDP is calculated as the Gross Regional/ District Domestic Product for the applicable year divided by the population of the district.

Aging is measured as the percentage of the older people to the total population in each district. As dependency in aging may be affected by the threshold of age, this study examines three measurements of the older people based on ages 60 and above, 65 and above, and 70 and above. It conducts regression analyses separately for each definition of aging. The definition of the older people population as 60 and above is commonly used in developing countries. Developed countries often define older

people as 65 and above. The selection of 70 and above as the definition for older people is a choice to explore aging at an even higher age.

Control variables include government expenditure (govexp), which reflects the government's intervention in addressing poverty. Education control variables use the average years of schooling to examine the number of years the population spends on formal education. Finally, health status control variables use Life Expectancy data for each district.

### Statistical model

Based on the conceptual framework to determine whether there is a direct and indirect relationship between the aging population and poverty, a statistical model with an intermediate variable is constructed, following Wu et al. (2021). The analysis employs regression analyses, conducting cross-sectional assessments for the years 2010, 2015, and 2020 separately. The equations explain both the direct and indirect effects (through per capita RGDP) of the aging population and other control variables (government expenditure, education, and health) on poverty.

To capture the possible direct and indirect correlation between aging and poverty, there are two equations as the following.

$$\text{RGDP percapita}_{it} = \delta + \gamma_1 \text{Ageing}_{it} + \gamma_2 \text{Govexp}_{it} + \gamma_3 \text{Educ}_{it} + \gamma_4 \text{Health}_{it} + \varepsilon_{it} \quad (1.1)$$

$$\text{Poverty}_{it} = \alpha + \beta_1 \text{RGDP percapita}_{it} + \beta_2 \text{Ageing}_{it} + \beta_3 \text{Govexp}_{it} + \beta_4 \text{Educ}_{it} + \beta_5 \text{Health}_{it} + \varepsilon_{it} \quad (1.2)$$

The term  $\beta_2$  in equation 1.2 represents the direct impact of aging on poverty. The indirect impact of aging on poverty through per capita RGDP can be observed through the multiplication of  $\beta_1$  in equation 1.2 and  $\gamma_1$  in equation 1.1. Thus, the total effect or net effect can be obtained by summing the direct and indirect relationships, namely:

$$NE = \beta_2 + \beta_1 \gamma_1$$

Where:

<i>Poverty<sub>i</sub></i>	= poverty level in district <i>i</i>
<i>Ageing<sub>i</sub></i>	= ratio of older people to the total population in district <i>i</i>
<i>Per capita RGDP<sub>i</sub></i>	= per capita Gross Regional Domestic Product in district <i>i</i>
<i>Govexp<sub>i</sub></i>	= government expenditure in district <i>i</i>
<i>Educ<sub>i</sub></i>	= education level, average years of schooling in the community in district <i>i</i>
<i>Health<sub>i</sub></i>	= health indicator, Life Expectancy in district <i>i</i>
$\varepsilon_i$	= error term

## RESULTS

### Descriptive Analysis

Before examining the relationship between population aging and district's poverty, the initial step is to determine whether the older people is poorer than other age groups in Indonesia. The study uses data from SUSENAS 2010, 2015, and 2020, randomly collected from individuals and households in 34 provinces in Indonesia. The sample size for SUSENAS in 2010 was 1,178,494 individuals, in 2015 there were 1,097,719 individuals, and in 2020 there were 1,258,328 individuals. The SUSENAS data for this research is processed by separating the population into older people age groups of 60+, 65+, and 70+, and two other age groups: all of those below 60 years old and its subset the "productive" age group of 15-60 years.

The results are shown in Table 1 below. The older people age group tends to be poorer compared to other age groups. Furthermore, the older the age threshold of aging, the higher the poverty rate. This data aligns with the initial hypothesis stating that the older people population tends to be poorer than other groups.

**Table 1.** Percentage of Poor Older People in Indonesia

Age Group	2010		2015		2020	
	#of Population	% of the Poor	#of Population	% of the Poor	#of Population	% of the Poor
< 60	218.723.020	20.138.292 (9,21%)	233.396.752	25.579.975 (12,86%)	243.494.534	36.998.004 (15,19%)
15-59	150.001.463	12.106.142 (8,07%)	161.904.473	15.571.777 (9,62%)	172.562.824	24.631.765 (14,27%)
60+	19.435.877	2.035.931 (10,48%)	21.500.193	3.027.873 (14,08%)	26.817.290	5.155.707 (19,23%)
65+	12.881.223	1.475.380 (11,45%)	13.258.842	2.128.296 (16,05%)	16.604.695	3.416.108 (20,57%)
70+	8.060.645	1.010.274 (12,53%)	8.178.101	1.431.947 (17,51%)	9.577.491	2.119.739 (22,13%)

Source: calculated from SUSENAS (2010, 2015, and 2020)

Furthermore, Table 2 describes the district's poverty rates, showing the average poverty rate in each district, which declined from 15.45% in 2010 to 11.82% in 2020. At the same time, the average percentage of older people increased in each age group (60+, 65+, and 70+). The average per capita Gross Regional Domestic Product (PGDP) in each district has also increased during 2010 - 2020. The descriptive statistics indicate that an aging district is not likely to have a higher poverty rate, but a district with a higher RGDP is likely to have a lower poverty rate.

**Table 2.** Summary of Descriptive Statistics

Variable	2010				2015				2020			
	mean	Sd	min	max	mean	sd	min	Max	mean	sd	min	max
Poverty	15.45	9.50	1.67	49.58	13.34	8.31	1.69	45.74	11.82	7.56	2.02	41.76
Aging60	6.80	2.91	0.43	18.28	8.17	3.02	1.35	19.46	9.17	2.87	2.01	20.38
Aging65	4.46	2.18	0.13	13.44	5.11	2.19	0.25	13.53	5.70	2.07	0.34	14.67
Aging70	2.71	1.46	0.05	8.9	2.92	1.44	0.05	8.85	3.16	1.35	0.06	9.76
PDRBPer kap	2.04e+09	2.03e+1	333	3.29e+11	3.09e+9	3.13e+1	549	5.31e+11	3.81e+9	3.85e+1	517	6.66e+11
GovExp	7.99e+08	6.80e+0	5.33e+0	6.81e+9	1.60e+9	1.34e+0	173	1.34e+10	1.80e+9	1.45e+0	1.38e+0	1.51e+10
Educ	7.17	1.74	0.25	11.91	7.82	1.72	0.64	12.38	8.37	1.66	1.13	12.65
Health	68.2	3.87	52.6	77.32	68.72	3.67	54.0	77.43	69.59	3.49	55.2	77.75

Note: 482 districts in each year; Source: prepared by the author

## ECONOMETRIC ANALYSIS

### Aging and Poverty in 2010

Table 3 displays the regression results for the direct and indirect relationships between population aging in a district and the poverty rate in the district for the year 2010. Columns 1-3 show the regression results of population aging on per capita Gross

Regional Domestic Product (RGDP) using equation (1.1). The results show negative coefficients of aging, regardless of the measurement of aging. In other words, aging in a district is associated with lower per capita RGDP in the district.

Columns 4-6 use equation (1.2) to find the relationship between aging and poverty and between per capita RGDP and poverty. Here, the relationship between aging and poverty reveals a direct relationship between aging and poverty. The results show a negative coefficient of aging regardless of the measurement of poverty. It implies that an aging district is directly related to the lower poverty rate of the district.

Furthermore, columns 4-6 also indicate that per capita RGDP does not have any significant coefficient on poverty. That is, a district with a higher RGDP is not associated with the district's rate of poverty. As aging is negatively related to per capita RGDP (columns 1-3) and per capita RGDP is not correlated with poverty (columns 4-6), there is no indirect relationship between aging and poverty through RGDP.

**Table 3.** Direct and Indirect Relationship between Aging and Poverty in 2010

	(1)	(2)	(3)	(4)	(5)	(6)
	Cap RGDP	Cap RGDP	Cap RGDP	Pov	Pov	Pov
	b/se	b/se	b/se	b/se	b/se	b/se
aging60	-3.3253*** (0.60)			-0.4393*** (0.13)		
aging65		-4.5318*** (0.80)			-0.5275*** (0.17)	
aging70			-6.7453*** (1.19)			-0.7150*** (0.26)
govexp	0.1883*** (0.03)	0.1869*** (0.03)	0.1849*** (0.03)	-0.0062 (0.01)	-0.0062 (0.01)	-0.0064 (0.01)
educ	3.4538*** (1.04)	3.4449*** (1.04)	3.4848*** (1.04)	-2.1547*** (0.22)	-2.1425*** (0.22)	-2.1301*** (0.22)
health	0.9613* (0.53)	1.0023* (0.53)	0.9743* (0.53)	-0.6744*** (0.11)	-0.6879*** (0.11)	-0.7034*** (0.11)
Per capita RGDP				-0.0156 (0.01)	-0.0149 (0.01)	-0.0143 (0.01)
_cons	-54.1491* (31.35)	-59.1691* (31.54)	-59.3288* (31.53)	80.8518*** (6.56)	81.0360*** (6.62)	81.5797*** (6.63)
Observation	482.0000	482.0000	482.0000	482.0000	482.0000	482.0000
F-stat	36.1312	36.4531	36.5115	66.6364	65.8492	65.3321
R-squared	0.2325	0.2341	0.2344	0.4118	0.4089	0.4070
Adj-R squared	0.2261	0.2277	0.2280	0.4056	0.4027	0.4007
P	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

\*=p<0.1. \*\*=p<0.05. \*\*\*=p<0.01; Source: prepared by the author

As a result, aging has only a direct, negative relation with the poverty rate. An aging district is likely to have a lower poverty rate, as opposed to the thesis that aging results in higher poverty in the district.

However, when the analysis is performed in Java Island and Outside Java Islands separately, the result is not seen in Java Island. The relationship in Java Island is positive, where an aging district is likely to have a higher poverty rate. The results remain negative for Outside Java Island.<sup>1</sup>

<sup>1</sup> Tables for Java and Outside Java Islands are not shown due to space limitation.

### Aging and Poverty in 2015

Table 4 presents the regression results for the direct and indirect relationships between population aging and poverty in the year 2015. Columns 1-3 show the regression results of population aging on per capita Gross Regional Domestic Product (RGDP). As found in 2010, aging has a negative relationship with per capita RGDP, regardless of the measurement of aging.

**Table 4.** Direct and Indirect Relationship between Aging and Poverty in 2015

	(1) Cap RGDP b/se	(2) Cap RGDP b/se	(3) Cap RGDP b/se	(4) Pov b/se	(5) Pov b/se	(6) Pov b/se
aging60	-3.7152*** (0.71)			-0.2784** (0.11)		
aging65		-5.2441*** (0.97)			-0.3238** (0.15)	
aging70			-8.4608*** (1.49)			-0.3401 (0.24)
govexp	0.0966*** (0.02)	0.0955*** (0.02)	0.0940*** (0.02)	-0.0006 (0.00)	-0.0006 (0.00)	-0.0006 (0.00)
Educ	4.9681*** (1.29)	4.9262*** (1.28)	4.7674*** (1.28)	-1.8328*** (0.20)	-1.8156*** (0.20)	-1.7894*** (0.20)
health	1.2229* (0.68)	1.2634* (0.68)	1.4495** (0.69)	-0.6945*** (0.10)	-0.7124*** (0.10)	-0.7391*** (0.11)
per capita RGDP				-0.0181*** (0.01)	-0.0175** (0.01)	-0.0165** (0.01)
_cons	-70.8399* (40.32)	-76.6891* (40.49)	-90.0266** (40.93)	78.4584*** (6.15)	78.9210*** (6.20)	79.8591*** (6.31)
Observasi	482.0000	482.0000	482.0000	482.0000	482.0000	482.0000
F-stat	31.2016	31.6707	32.6505	67.6541	67.0379	66.2248
R-squared	0.2074	0.2098	0.2149	0.4154	0.4132	0.4103
Adj-R squared	0.2007	0.2032	0.2084	0.4093	0.4070	0.4041
P	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

\*=p<0.1. \*\*=p<0.05. \*\*\*=p<0.01; Source: prepared by the author

Columns 4-6 demonstrate the relationship between per capita RGDP and poverty in 2015. Unlike in 2010, per capita RGDP is negatively associated with the poverty rate. A district with a higher per capita RGDP is likely to have a smaller poverty rate.

The direct relationship between population aging and poverty can be observed in the "aging" variable in columns 4-6. The regression results show a negative coefficient for aging 60+ and aging 65+ but not significant for aging 70+. Therefore, population aging has a direct negative relationship with poverty when measured with aging 60+ and aging 65+ in the year 2015, but no relationship when measured with aging 70+.

As the poverty rate is negatively correlated with per capita RGDP and per capita RGDP is negatively correlated with poverty, aging therefore has an indirect positive relationship with poverty through per capita RGDP. An aging district is likely to have a higher poverty rate through per capita GDP, regardless of the measurement.

This indirect, positive, relation between aging and poverty is in contrast to the direct negative relationship between aging and poverty, though only for aging measured at 60+ and 65+. Aging is not related to the poverty rate when measured at 70+. The net effect can be obtained by summing the direct and indirect relationships according to equations 1.1 and 1.2, that  $NE = \beta_2 + \beta_1 \gamma_1$ . Thus, we can calculate NE

Ageing 60+ = -0.2111, and NE Ageing 65+ = -0.2320. It implies that aging is negatively related to poverty. An aging district is likely to have a lower poverty rate.

Measured with 70+, aging is only indirectly related to poverty where an aging district is likely to have a higher poverty rate. There is no direct relation to poverty. Therefore, a district with higher aging is more likely to have a higher poverty rate.

The results are clearer when the analysis is performed separately between Java and Outside Java Island.<sup>2</sup> In Java Island, the net effect is positive regardless of the measurement of aging. In contrast, the net effect is positive in Outside Java Islands.

### *Ageing and Poverty in 2020*

Table 5 displays the direct and indirect relationships between population aging and poverty in 2020. Columns 1-3 present the results of population aging on per capita RGDP, showing that aging is negatively related to per capita RGDP. An aging district is likely to have a lower per capita RGDP, regardless of the measurement of aging. Columns 4-6 describe the relationship between per capita RGDP and poverty, showing that there is no relation between per capita RGDP and poverty. Thus, there is no indirect relationship between population aging and poverty through per capita RGDP.

The direct relationship between population aging and poverty can be observed in columns 4-6. The results show that aging is not directly related to poverty whatever the measurement of aging. Therefore, aging is not related to poverty, both directly and indirectly, whatever the measurement of aging.

Nevertheless, the results for Java Island and Outside Java Islands are different.<sup>3</sup> In Java Island, the net effect shows a positive relationship; in Outside Java Island, negative.

**Table 5.** Direct and Indirect Relationship between Aging and Poverty in 2020

	(1) Capita RGDP b/se	(2) Capita RGDP b/se	(3) Capita RGDP b/se	(4) Pov b/se	(5) Pov b/se	(6) Pov b/se
aging60	-4.1998*** (0.79)			-0.1064 (0.11)		
aging65		-5.7095*** (1.08)			-0.0868 (0.15)	
aging70			-8.3749*** (1.62)			0.0157 (0.22)
govexp	0.1104*** (0.01)	0.1082*** (0.01)	0.1067*** (0.01)	0.0003 (0.00)	0.0002 (0.00)	0.0002 (0.00)
Educ	7.9024*** (1.34)	8.0033*** (1.34)	7.9924*** (1.34)	-1.6857*** (0.18)	-1.6776*** (0.18)	-1.6683*** (0.18)
health	1.1205 (0.75)	0.9900 (0.74)	0.7721 (0.73)	-0.8077*** (0.10)	-0.8280*** (0.10)	-0.8561*** (0.10)
Per capita RGDP				-0.0079 (0.01)	-0.0073 (0.01)	-0.0064 (0.01)
_cons	-82.9931* (45.06)	-80.3581* (44.90)	-70.8670 (44.47)	83.4159*** (5.92)	84.2655*** (5.90)	85.5650*** (5.83)
Observations	482.0000	482.0000	482.0000	482.0000	482.0000	482.0000

<sup>2</sup> Tables for Java and Outside Java Islands are not shown due to space limitation

<sup>3</sup> Tables for Java and Outside Java Islands are not shown due to space limitation

	(1) Capita RGDP b/se	(2) Capita RGDP b/se	(3) Capita RGDP b/se	(4) Pov b/se	(5) Pov b/se	(6) Pov b/se
F-stat	38.8653	38.8724	38.5040	71.5629	71.3405	71.2175
R-squared	0.2458	0.2458	0.2441	0.4291	0.4284	0.4279
Adj-R squared	0.2395	0.2395	0.2377	0.4231	0.4224	0.4219
P	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

\*=p<0.1. \*\*=p<0.05. \*\*\*=p<0.01; Source: prepared by the author

## SUMMARY

As summarized in Table 6, the net effect of aging on poverty is negative for Indonesia as a whole. That is, an aging district is likely to have a lower poverty rate. An exception is when aging is measured with the percentage of people 70 years old and over in 2015, where an aging district is likely to have a higher poverty rate. Another exception is that there was no association between aging districts and their poverty rates in 2020. These results may indicate that aging does not necessarily result in poverty in the district. Even, an aging district can be more likely to have a lower poverty rate. It may refute the thesis that aging necessarily results in poverty.

However, a different result is found when the sample is separated between Java Island and Outside Java Islands. In Java Island, an aging district is associated with a higher poverty rate, not refuting the thesis. It is negative only in outside Java Islands.

## DISCUSSION

The empirical results show that an aging district is not necessarily having a higher poverty rate. The thesis that aging is related to poverty in the region is only seen in Java Island with a more modern economy and infrastructure. In contrast, among districts located in Outside Java Island, an aging district is more likely to be a district with a lower poverty rate. It should also be noted that districts in Java Island are mostly experiencing higher aging than those in Outside Java Islands. The findings support Chen et al. (2015) that aging in a region worsens poverty in the region with already higher percentages of older people.

**Table 6.** Summary of Results on Relationship between Aging and Poverty among Districts in Indonesia: 2010, 2015, and 2020

	Indirect Relationship through Per capita RGDP	Direct Relationship	Net Effect (NE)
Year 2010	none	negative	negative
Year 2015	positive	negative for aging 60+ and aging 65+; none for aging 70+	NE aging 60+ = -0.2111 NE aging 65+ = -0.2320. positive for aging 70+
Year 2020	none	None	none -
Java 2010	none	Positive	positive-
Java 2015	none	Positive	positive-
Java 2020	none	Positive	positive-
Outside Jawa 2010	none	Negative	negative
Outside Jawa 2015	positive	Negative	NE aging 60+ = -0.7837 NE aging 65+ = -1.0325 NE aging 70+ = -1.5077

	<b>Indirect Relationship through Per capita RGDP</b>	<b>Direct Relationship</b>	<b>Net Effect (NE)</b>
Outside Jawa 2020	positive for aging 60+ and 65+; none for aging 70+	Negative	NE aging 60+ = -0.5183 NE aging 65+ = -0.8998 negative for aging 70+

Source: summarized by the author from the results of the regression analyses

In other words, aging does not necessarily harm the Indonesian economy, especially when measured by the poverty rate across all districts in the years 2010, 2015, and 2020. On the contrary, population aging can reduce the poverty rate, as evidenced by the negative coefficients of the percentage of older people population to the overall population concerning the poverty level in all districts in Indonesia.

The findings suggest that the older people population may still contribute positively to the economy, possibly through continued employment. On the other hand, population aging may lead to an increase in the poverty rate in Java Island with a modern economy and infrastructure as well higher percentages of older people.

### CONCLUDING REMARKS

This study has shown direct and indirect relationships (mediated by per capita Regional Domestic Product) between aging and poverty among districts in Indonesia. The net effects reveal that an aging district is not necessarily accompanied by a higher poverty rate in the region.

This finding may suggest that people should not be worried that an aging population will raise the poverty rate. Other factors may contribute to higher poverty rates. The finding also suggests that improvements in education and health can contribute to reducing poverty in the country, though an increase in local government spending has not yet effectively reduced the poverty rate in Indonesia.

Aging should be seen as a celebration of achieving a long life. The challenge is to live in long healthy life. A reassessment of the definition of older people or those dependent on other age groups is needed. The older people should not necessarily be seen as a cause of poverty. They should continue to be given opportunities to work by increasing the retirement age and eliminating age discrimination.

More studies should focus on the impact of aging on poverty, not simply on economic growth. For example, further and deeper studies should continue this study by using lags for the two main independent variables: aging and per capita RGDP as their impact on poverty may take with lag of time. Further research could also delve deeper into analyzing the impact of social empowerment programs and social assistance on the older people population and their impact on the Indonesian economy.

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