Demographic Transition and Economic Growth in Indonesia

Endang Rostiana[1*], Anggia Rodesbi[2]
[1,2]*Fakultas Ekonomi dan Bisnis Universitas Pasundan Bandung, Indonesia*
[1]*endangrostiana@unpas.ac.id,* [2]*anggia28rodesbi@gmail.com, *corresponding author*

Abstract
Demographic transition in Indonesia indicated by an increase in the productive age population, a decrease in the unproductive age population, and leads to a decrease in the dependency ratio. This study analyzes the relationship between demographic transition and Indonesia's economic growth. If the population structure changes contribute positively to economic development, it means that Indonesia has enjoyed a bonus from their demographic transition. The analysis used was multiple regression, with economic growth rate as dependent variable and population growth rate, capital, young age dependency ratio and old age dependency ratio as independent variables. This study has found that the demographic transition, represented by growth of young age dependency ratio, growth of capital, and economic crisis dummy variable partially contributes positively to economic growth. It can be concluded that the demographic transition in Indonesia provides a bonus that is in the form of a positive contribution to economic growth.

Keywords: economic growth, capital, population, dependency ratio

Transisi Demografi dan Pertumbuhan Ekonomi Indonesia

Abstrak
Transisi demografi di Indonesia ditandai dengan penurunan tingkat fertilitas dan mortalitas, yang berdampak pada peningkatan persentase penduduk usia produktif dan penurunan persentase penduduk usia tidak produktif. Hal ini menyebabkan angka beban tanggungan menjadi semakin kecil. Penelitian ini bertujuan untuk menganalisis hubungan transisi demografi dengan pertumbuhan ekonomi Indonesia. Jika transisi demografi berkontribusi positif pada pertumbuhan ekonomi, maka dapat dikatakan Indonesia telah menikmati bonus demografi. Model analisis menggunakan persamaan regresi, dengan pertumbuhan ekonomi sebagai variabel terikat. Variabel bebasnya adalah pertumbuhan penduduk, pertumbuhan modal, pertumbuhan *dependency ratio* penduduk usia muda, dan pertumbuhan *dependency ratio* penduduk usia lanjut. Hasil regresi menunjukkan bahwa transisi demografi yang diwakili oleh pertumbuhan *dependency ratio* penduduk usia muda, pertumbuhan modal, dan variabel *dummy* krisis ekonomi secara parsial berpengaruh positif terhadap perumbuhan ekonomi Indonesia. Hasil tersebut dapat disimpulkan bahwa transisi demografi memberikan bonus berupa kontribusi positif terhadap pertumbuhan ekonomi di Indonesia.

Kata kunci: pertumbuhan ekonomi, modal, penduduk, dependency ratio

INTRODUCTION

Currently Indonesia's population is the fourth largest in the world. In 1960, Indonesia's population was only 87,792,515 people. In 2017, the number increased by 193% to 263,991,379 people. With such a large population, Indonesia should have great potential in providing human resources in economic development. However, the development of the Indonesian economy which is shown by the rate of economic growth shows conditions that are not linear with the condition of Indonesian population number. This condition can be seen from the average economic growth rate in Indonesia during 2000-2018 compared to neighboring countries in ASEAN which have less population than Indonesia (Table 1.). Data in the Table 1 shows economic annual growth rate in Indonesia averaged to 5.27 percent from 2000 until 2018. Among the 10 ASEAN countries, Indonesia's average

economic growth rate ranks seventh. So, large population is not the main indicator to measure how potentially human resources have in the economic development of a country, especially in Indonesia.

Table 1. ASEAN Countries Average Economic Growth Rate 2000 - 2018

No.	Country	Average Economic Growth Rate (%)
1	Myanmar	9.93
2	Cambodia	7.79
3	Laos PDR	7.17
4	Vietnam	6.45
5	Philippines	5.35
6	Singapore	5.28
7	**Indonesia**	**5.27**
8	Malaysia	5.09
9	Thailand	4.06
10	Brunei Darussalam	0.80

Source: calculation result based on World Bank data

In the development of economic growth theories, population has always been used as one of the aspects that determines economic growth besides the availability of natural resources, capital accumulation, and technological progress. In the Solow growth model, it is explained how growth of the capital stock, growth of the labor force, and technological progress interact in the economy and affect a country's total output of goods and services (Mankiw, 2016). Furthermore, in the endogenous growth theory it is explained that economic growth is a function of technological progress. The development of technology is a function of human capital. Human capital represents the quality of the human resources. The better quality of human resources will be able to increase worker productivity and encourage economic growth. According to the endogenous growth theory, labor is used as a variable that determines economic growth both in terms of quantity and quality. Just like the endogenous growth theory, it is also mentioned that in addition to capital and technology in the new growth theory, labor in terms of both quantity and quality has a role in the economic growth of a country (Mankiw, 2016).
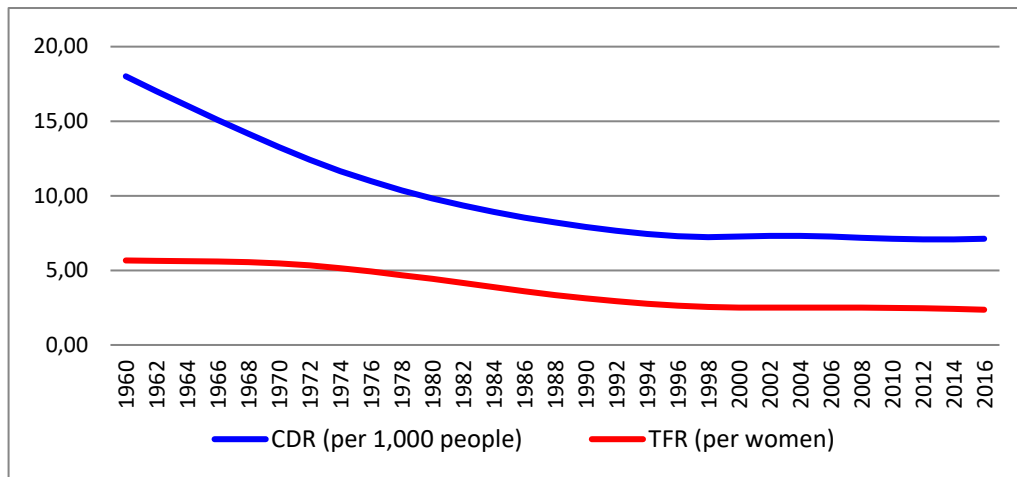
The role of the population in economic development can be explained in three different views (D. Bloom & Canning, 2001; D. J. Bloom & Williamson, 1997). There are pessimistic, optimistic, and neutral opinions. Pessimists argue that population growth will hamper economic development. This opinion is based on the theory of population growth from Thomas Robert Malthus. Thomas Robert Malthus explained that there will be a condition where the number of consumption goods is insufficient to meet the needs of population in which the number continues to increase. The second view is optimistic, which argues that population is a resource for economic growth. This opinion is based on the concept of human capital which explains that the development of science and technology will increase worker productivity and encourage economic growth. The last opinion is a neutral opinion based on several empirical research results in various countries which

showed that countries with higher population growth rates have lower economic growth rates. This means that population growth rate with economic growth rate is negatively correlated, but this negative correlation is not significant.

Population is one of the factors in the supply side that determines a country's economic growth (Boldeanu & Constantinescu, 2015). Several studies that used the population growth rate as a factor affecting economic growth rate in several countries showed there were a positive relationship between the population growth rate and the economic rate of growth (Guga, Alikaj, & Zeneli, 2015; Klasen & Lawson, 2007; Peterson, 2017; Zhuang & Juliana, 2010). Another population indicator that is used as a variable that affects the economic growth rate of a country is the labor force indicator. Previous research in Sri Lanka showed that the labor force has the most influence on the Sri Lanka economic growth rate, in addition to other variables such as foreign debt and the degree of economic openness (Paudel, Perera, & Paude, 2009). In line with the research in Sri Lanka, other research in Pakistan showed that the labor force and trade have a positive and significant relationship with Pakistan's economic growth rate, while foreign loans do not correlate with this country's economic growth rate (Hasan & Butt, 2008). Other research showed that the level of labor force participation in European countries increased efficiency aggregate economy and potentially increasing economic development in these countries (Ozerkek, 2013).

Previous studies have emphasized that economic growth is determined by population aspect. The population variable used generally was represented by demographic indicators, such as population growth rate, population numbers, fertility rate, and labor force. However, these indicators do not describe the relationship between one demographic indicator to another demographic indicator. Demographic indicator that can represent other demographic indicators are dependency ratio indicators. Rosado et al. (2017) explained that the dependency ratio is a demographic indicator which is determined by other demographic aspects. Dependency ratio is determined by fertility rate, population growth rate, population numbers, working age population, and life expectancy. In other words, dependency ratios describe the conditions of population dynamics more comprehensively than other demographic indicators.

As explained earlier, the condition of a country's dependency ratio is determined by other demographic aspects, including the fertility and mortality rate. These two aspects will determine a country's natural population growth rate. During the period 1961 to 2017, Indonesia population growth rate has decreased significantly. In 1961, Indonesia's population growth rate was 2.6% and decreased to 1.1% in 2017 (World Bank, 2017). This population growth rate decline is due to a decrease in the birth rate (total fertility rate). In 1960, Indonesia's total fertility rate (TFR) was 5.6 (figure 1). It means that in 1961, there was averagely 6 birth children for each woman in Indonesia. In 2016, the TFR in Indonesia has fell to 2.3. This means that in 2016, an average Indonesian woman gave birth to 2 children.
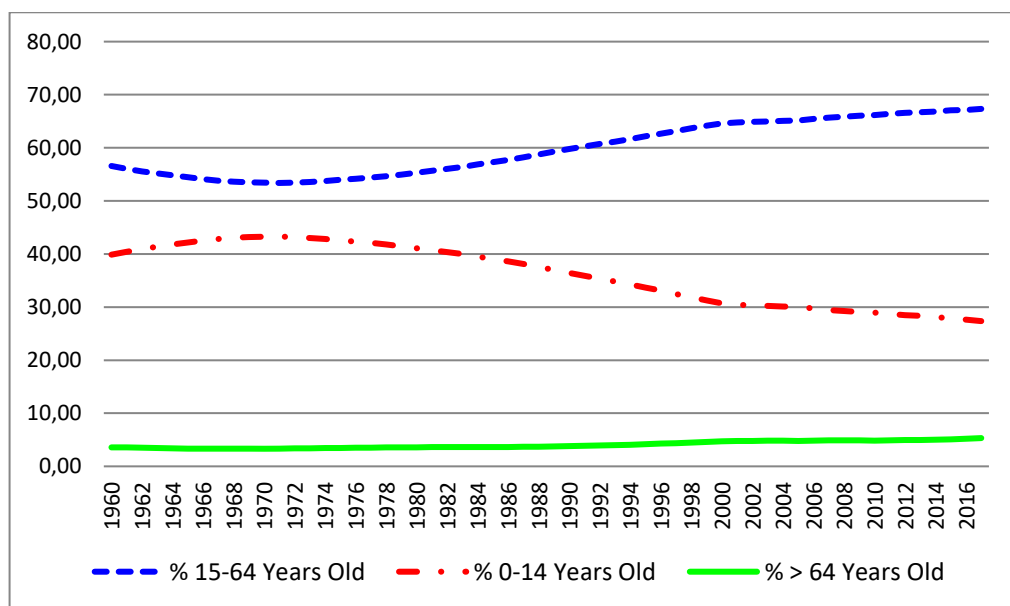
Figure 1. TFR and CDR in Indonesia 1960-2016

The condition of Indonesia's population that changed significantly is also shown by the mortality rate, as measured by the crude mortality rate (CDR). Figure 1 shows clearly the decrease in the mortality rate over the period 1960-2016. In 1960, Indonesia's CDR rate was 18. This means that there were 18 deaths per 1,000 population in Indonesia at that time. The death rate dropped significantly in 2016, to an average of 7 deaths per 1000 population in Indonesia.

The declining trend in fertility rate has an impact on the decline in the percentage of the young population. Meanwhile, the reduction in mortality rates has an impact on increasing the population percentage in productive and elderly age. Figure 2 shows that during the period 1960-2017, there was a declining trend in the percentage young age population (0-14 years), while the percentage productive age population (15-64 years) and elderly population (> 64 years) had an increasing trend.

Figure 2. Percentage Population by Age Group in Indonesia, 1960 - 2017

Table 2. Young Population, Productive Age Population, Old Population,
and Dependency Ratio in Indonesia, 1960 - 2017

Year	Young Population (0-14 Years Old)	Productive Age Population (15-64 Years Old)	Old Population (> 64 Years Old)	*Dependency Ratio*	*Young Age Dependency Ratio*	*Old Age Dependency Ratio*
1960	39.87	56.55	3.58	76.85	70.51	6.34
1961	40.42	56.03	3.55	78.47	72.13	6.33
1971	43.28	53.38	3.35	87.35	81.08	6.27
1981	40.74	55.65	3.61	79.70	73.22	6.49
1991	35.87	60.27	3.86	65.92	59.52	6.40
2001	30.46	64.77	4.77	54.40	47.04	7.36
2010	28.97	66.18	4.85	51.10	43.77	7.33
2017	27.36	67.32	5.32	48.54	40.63	7.90

Source: calculation results based on World Bank data

Changes in population structure by age groups have an impact on changing in the ratio that compare the proportion of the productive age population (15-64 years old) to proportion of the nonproductive age population (0-14 years old and over the age of 64). This ratio is known as the dependency ratio. As shown in Table 2 in 1960, Indonesia's dependency ratio was 76.85. It means that in 1960 every 100 productive people in Indonesia must support around 77 nonproductive people. In 2017, the conditions were very different. Now, Indonesia's dependency ratio has dropped significantly to 48.54. That means 100 productive age people in Indonesia must bore almost 49 unproductive age people.

The declining in young population (0-14 years old) results in a decrease in the young age dependency ratio. In 1960, every 100 Indonesia's productive age people had to bear around 71 young people (0-14 years old), whereas in 2017 the young population number who are be borne by 100 productive age people was around 41 people. Conversely, a decrease in mortality rate causes an increase in the number of old age populations (over 64 years old), resulting in an increase in the old age dependency ratio, from 6.34 in 1960 to 7.90 in 2017.

Population dynamics are characterized by changes in population structure as a result of a decrease in birth rates and mortality rates, which then have an impact on the economic growth acceleration in one country. This population phenomenon is known as demographic bonus (Gribble and Bremner, 2012). It is called a bonus because this phenomenon does not occur continuously and the occurrence is only brief. What is meant by bonus here is an increase in economic development as seen from an increase in economic growth and the population welfare. Previous studies indicate that countries in Asia such as China, Hong Kong, South Korea, Singapore, Thailand and Taiwan were countries that received this demographic bonus (Gribble & Bremner, 2012; Mason, Andrew and Tomoko Kinugasa & Kinugasa, 2005).

Not every country that changes in its population structure experiences the phenomenon of demographic bonus. Countries whose population structures have changed

but do not have an impact on accelerating their economic growth are said to not receive demographic bonus. In the underdeveloped countries, generally countries in Africa, they do not get a bonus from changes in their population structure (Mason, Andrew and Tomoko Kinugasa & Kinugasa, 2005). It is because that changes in the population structure does not provide a bonus in the form of increasing economic growth or improving the country's economic conditions directly. Changes in population structure must be followed by policies in the fields of education, health, economics and government management system that support the improvement quality of human resources so that they have a positive impact on economic development and the population welfare.

Several studies that analyze the relationship between demographic transition which is represented by the dependency ratio indicator and economic growth rate, showed that the demographic transition was correlated with economic growth rate. Bloom and Williamson (1997) have recognized that in some East Asian countries the demographic transition has an important role in its economic growth. The research taken by Bloom and Canning (2001) showed that demographic divergence has an impact on economic divergence, whereas if every country can benefit from the demographic bonus, demographic convergence also has an impact on economic convergence. Other research conducted in several Arab countries have recognized a causal relationship between demographic variables and economic variables. The demographic variables consisted of the dependency ratios, number of working age population, and unemployment rate. The economic variables were government and private expenditure on health and education, population education level, and women's participation in education. The result of that research indicated that in the short term the demographic bonus has an interesting impact on the economies of the Arab countries, especially for the economic sectors which are dominated by autocratic leaders. However, in the long run, the impact of this demographic bonus must be followed by economic openness and globalization (Harkat & Ahmed Driouchi, 2017).

Other previous researches have shown that there was a negative relationship between dependency ratio and economic growth. A declining in the dependency ratio means that the percentage of productive age population is greater than the percentage of unproductive age population (young and old population). The greater composition of the productive age population, supported by policies to improve the quality of human capital, has contributed positively to economic growth in several countries (Gribble & Bremner, 2012; Mason, Andrew and Tomoko Kinugasa & Kinugasa, 2005; Rosado et al., 2017; Sundman, 2011).

Dependency ratio can be divided into (1) young age dependency ratio and (2) old age dependency ratio. Several studies have found a negative relationship between young age dependency ratio and economic growth in several countries. The negative relationship between young age dependency ratio and economic growth was found in research conducted by Song (2013). Song's research used 13 countries economic growth model in Asia during period 1965-2009. A prior research that used data from 33 developing countries showed that the old age dependency ratio has a negative effect on economic growth, whereas the young age dependency ratio has a positive relationship with economic growth (Dao, 2012).

The question is, does population structure changing in Indonesia contribute positively to economic development in this country? If indeed, the Indonesia's population structure changes contribute positively to economic development indicators in Indonesia, such as the economic growth rate. It means that Indonesia has enjoyed a bonus from their demographic transition. In other words, in Indonesia, there has been a phenomenon of demographic bonus.

Although there are many studies that examine the relationship between dependency ratios and economic growth, the research which especially distinguish between young dependency ratio and old dependency ratio and their relevantion with economic growth in Indonesia remains limited. A new approach is therefore needed for the research. For this study, it was of interest to investigate the different relationship between young dependency ratio and old dependency ratio, with economic growth in Indonesia. The main objective of this study is to analyze the population transition represented by young and old dependency ratio, population growth rate, and economic variables represented by the rate of capital growth, and their relationships with economic growth in Indonesia during period 1961-2017.

METHOD
Estimation Model
This research is quantitative research, using multiple regression analysis method. The model is used to analysis the objective of this research based on the production function theory. In the production function theory, output is determined by its inputs. Inputs or factors of production are generally divided into two groups: (1) capital (K) and human resources or labor (L). By adding technological factors (A) that are exogenous, the production function can be written as:

$$Y = A f (K, L) \dots\dots\dots\dots (1)$$

Equation (1) shows that the output value (Y) is determined by the input (K & L) and the level of technology (A). Improvements and advancements in technology (with certain K & L) will increase K & L productivity, and increase the output. Assuming marginal product of labor (MPL) and marginal product of capital (MPK) is positive, an increase in input (K, L) will cause an increase in output (Y).

Equation (1) shows the form of the level function. The output level is a function of the input level and technology. If the function is written in the form of growth accounting equation, it becomes:

$$\frac{\Delta Y}{Y} = (1 - \theta)\frac{\Delta L}{L} + \theta\frac{\Delta K}{K} + \frac{\Delta A}{A} \quad \dots\dots\dots\dots (2)$$

In equation (2), $(1-\theta)$ is the share of labor factor (L), $\Delta L / L$ is labor growth (L), θ is the share of capital factor (K), $\Delta K / K$ is capital growth (K), and $\Delta A / A$ is the level of technological progress (A).

Based on that production function, this empirical study analyzes the economic growth model which is using the growth of output as dependent variable and growth of inputs (K, L) as independent variables. The output variable is measured by gross domestic product

(GDP). Capital variable is measured by gross fixed capital. Variables related to labor that also represent demographic aspects are measured by young age dependency ratio, old age dependency ratio, and population growth rate. Therefore, the analysis model can be written in the regression equation as follows.

$$GGDP_t = \beta_0 + \beta_1 (GKAP)_t + \beta_2 (GPOP)_t + \beta_3 (GDRY)_t + \beta_4 (GDRO) + \beta_5 D1998 + \varepsilon_t \ldots (3)$$

where:

GGDP	= growth of GDP (% per year)
GKAP	= growth of capital (% per year)
GPOP	= growth of population (% per year)
DRY	= growth of young age dependency ratio (% per year)
DRO	= growth of old age dependency ratio (% per year)
D98	= dummy variable for year 1998 (economic crisis period)
β_0	= constant value
$\beta_1, \beta_1, \beta_3, \beta_4, \beta_5$	= coefficient regression of variables
ε	= error term
t	= yearly period, 1961 – 2017

In the regression equation (equation 3) a dummy variable was added, to represent the economic crisis conditions in 1998. In 1998, as in almost all countries, Indonesia also experienced an economic recession that had a profound impact on the Indonesian economy. This condition was marked by a decrease in GDP or negative economic growth rate of Indonesia in 1998 which was significantly very different compared to the years before and after 1998. Therefore, to represent the crisis conditions, special treatment is given by using a dummy variable to distinguish 1998 with the year before and after.

Data Operationalization

The data used for the regression model analysis as formulated in equation (2) is sourced from the World Bank, for several data categories. The analysis used annual period from 1961 to 2017. The operationalization data for each dependent and independent variable, as well as the hypothesis of the relationship between these variables are explained in the following table.

Table 3. Operationalization of Variables

Variable	Operationalization of Variables	Unit	Hypothesis
GGDP	Growth of GDP constant 2010 in local currency unit	%	
GKCAP	Growth of gross fixed capital constant 2010 in local currency unit	%	Positive
GPOP	Growth of population	%	Positive
DRY	Growth of young age dependency ratio. Young age dependency ratio = $\dfrac{\text{Number of young population} (0-14 \text{ years old})}{\text{Number of productive population} (15-64 \text{ years old})}$	%	Negative
DRO	Growth of old age dependency ratio. Old age dependency ratio = $\dfrac{Number\ of\ old\ population\ (>64\ yaers\ old)}{\text{Number of productive population} (15-64 \text{ years old})}$)	%	Negative
D1998	*Dummy* variable 1998 D = 1 for year = 1998 D = 0 for year > < 1998		Negative

RESULT AND DISCUSSION

Result

Based on regression equation (3) and operationalization of the independent and dependent variables as mentioned in Table 3, the regression result can be written in the equation form as follows.

$$\widehat{GGDP_t} = 2.8205 + 0.1331GKAP_t + 0.4039GPOP_t - 0.7086GDRY_t + 0.1881GDRO_t -$$
$$14.4304D1998_t \dots\dots\dots (4)$$

S.E   (1.0855) (0.0206)   (0.4886)   (0.2088)   (0.3239)   (1.9161)

t-stat (2.5982) (6.4426)   (0.82661)   (-3.3933)   (0.5809)   (-7.5309)

n = 57 R^2 = 0.7874 F-stat = 37.7891

The regression results are then tested for the fulfillment of the classical assumptions. The first classical assumption test is testing the autocorrelation problem to make sure that there is no correlation between members of series of observation ordered in time. To test this autocorrelation problem, the Breusch-Godfrey test or LM-test is used. The autocorrelation test results can be seen in Table 4. Table 4 shows the Prob.Chi-Square value for Obs * R-squared of 0.527 is greater than α = 5%. The results of this test indicate that autocorrelation problems do not occur in the regression results.

Another Classical Assumptions test is testing the heteroscedasticity problem. This heteroscedasticity test is to identify whether the disturbances that arise in the population regression are homoscedastic or heteroscedastic. To test the symptoms of heteroscedasticity, a Breusch-Pagan Gofrey test was used (Table 5). The results of the heteroscedasticity test show the value of Prob. Chi-square for Obs * R-squared of 0.2263 is greater than the value of α = 5% (0.05). It can be concluded that there is no heteroscedasticity problem in the regression results.

Table 4. Autocorrelation Test Results

Breusch-Godfrey Serial Correlation LM Test:			
F-statistic	0.563497	Prob. F(2,49)	0.5729
Obs*R-squared	1.281518	Prob. Chi-Square(2)	0.5269

Table 5. Heteroscedasticity Test Results

Heteroscedasticity Test: Breusch-Pagan-Godfrey			
F-statistic	1.441575	Prob. F(5,51)	0.2255
Obs*R-squared	7.058303	Prob. Chi-Square(5)	0.2163
Scaled explained SS	8.626637	Prob. Chi-Square(5)	0.1249

The next classic assumption test is testing multicollinear symptoms. This test is carried out to ascertain whether in the regression results there is a correlation between the independent variables or not. Testing this multicollinear problem is done by looking at the correlation coefficient values among the research variables, as seen in Table 6. From this table, it can be seen that all correlation coefficient values are smaller than 0.8. This suggests

that in the regression results there is no multicollinear problem or there is no correlation between the independent variables.

Table 6. The Value of Variables Correlation Coefficient

	GGDP	GKAP	GPOP	GDRY	GDRO	D1998
GGDP	1.0000	0.7181	0.0848	-0.0872	-0.0438	-0.7314
GKAP	0.7181	1.0000	0.2512	0.1285	-0.1045	-0.4566
GPOP	0.0848	0.2512	1.0000	0.5636	-0.4443	-0.1223
GDRY	-0.0872	0.1285	0.5636	1.0000	-0.4313	-0.1884
GDRO	-0.0438	-0.1045	-0.4443	-0.4313	1.0000	0.2222
D1998	-0.7314	-0.4566	-0.1223	-0.1884	0.2222	1.0000

The last classic assumption test is normality test. The assumption of normality in the ordinary least square (OLS) method is normality in the residuals, not in the variables. The normality test results can be seen in Figure 4. From this figure it can be seen that the probability value of 0.240193 is greater than α = 0.05. It is clear that the residuals in the regression result are normally distributed.
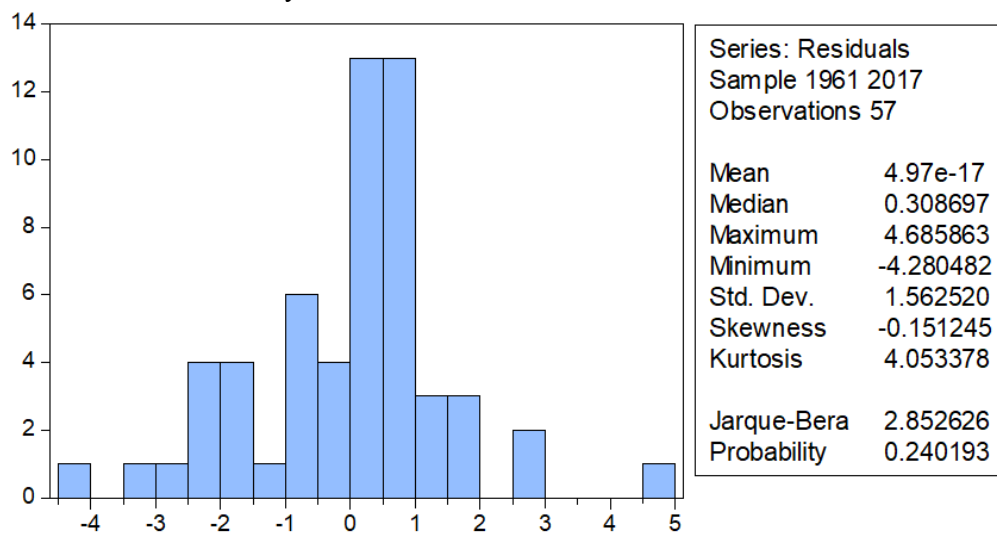

Figure 3. Normality Test Results

R-squared value of the regression results is 0.7874. The results confirm that 78.74% the total variations in the dependent variable (GGDP) can be explained by variations in the independent variables (GKAP, GPOP, GDRY, and GDRO), the remaining 21.26% is explained by other variables outside the model.

Next, it is also important to test the hypothesis of the relationship between independent variables with the dependent variable using the t-test. The t-table value with degree of freedom (df) = n - k = 57 - 6 = 51 at a significant level of 95% (α = 5%) is 2.00758. The t-test results in Table 7 show that there are two independent variables that are partially not significant influence the Indonesia's GDP growth rate (GGDP) at the 5% level of significance. The two variables are the population growth variable (GPOP) and the growth of old age dependency ratio (GDRO). Both of these variables have a t-statistic value that is

smaller than the t-table value. The other independent variables, capital growth (GKAP), growth of young age dependency ratio (GDRY) and dummy variable (D1998) partially affect the growth of Indonesia's GDP (GGDP) significantly.

Table 7. t-stat Test Result

Variable	t-stat Value
GKAP	6.4426
GPOP	0.82661*
GDRY	-3.3933
GDRO	0.5809*
D1998	-7.5309

*not significant at level α = 5%

The F-stat value is 37.79 which is greater than the F-table value of 2.40, which is obtained with df N1 = k-1 = 5 and N2 = n-k = 51. Based on the F-stat value, it can be explained that all independent variables, capital growth (GKAP), population growth (GPOP), young dependency ratio (GDRY) growth, old dependency ratio (GDRO) growth, and dummy variables (D1998) simultaneously have significant influence on economic growth (GGDP) in Indonesia.

DISCUSSION

Relationship Between Capital Growth and Economic Growth in Indonesia

The variable coefficient value of the capital growth rate (GKAP) is positive. This result provides evidence that the rate of capital growth has a positive relationship with the rate of economic growth in Indonesia as measured by GDP growth (GGDP). The value of coefficient variable capital growth rate is 0.1331. These results indicate that for each 1% increase in capital, the economic growth rate in Indonesia (GGDP) increased by 0.1331%.

This result ties well with the theory postulate that capital growth is a major factor in driving economic growth. Increase in capital will follow by the increase in ability to produce goods and services. Increased production of goods and services is a sign of economic growth that is measured by GDP growth.

This finding overall is in accordance with several previous studies conducted in developed Asian countries, such as Japan, China and South Korea. These previous studies have shown that these countries rely on economic growth on the growth of investment in capital goods (fixed capital formation) and investment in human capital. The research results indicate a positive and significant relationship between investment in fixed capital and human capital and economic growth of these countries (Ding and Knight, 2010; Lee 2016; Maksymenko and Rabbani, 2008; Shinada, 2011). This finding overall is in accordance with that previous studies.

Relationship Between Population Growth and Economic Growth in Indonesia

Besides being determined by capital factors, economic growth can also be driven by the availability of human resources. Indonesia with the fourth largest population is a country where the availability of the human resources is very large. In terms of quantity, Indonesia has a lot of human resources to utilize its abundant natural resources, so it can more encourage the economic development in Indonesia.

The relationship between population and economic growth in Indonesia can be seen from the positive value of the coefficient regression of 0.4039. The result confirmed that for each 1% increase in population growth will lead an increase in Indonesia's economic growth by 0.4039%. Although the positive relationship between population growth rate and Indonesian economic growth is linear with the results of previous studies, this relationship is not statistically significant.

The relationship between population and economic growth actually is still being debated. Many studies showed that in developed countries there has been a slowdown in economic development because their population growth rate continues to decline. But in some other countries, a large population is only a burden for the process of economic development (Peterson, 2017). The relationship between population growth rates and economic growth therefore can be positive or negative. The relationship between the rate of population growth and economic growth is highly dependant on how much influential the increase in the quality of human resources and technological progress compared to the rate of declining natural resources value added (Mulok, Asid, Kogid, & Lily, 2011).

In the case of Indonesia, the population growth rate still contributes positively to economic growth, even though its contribution is not statistically significant. The increase in population number has an impact on increasing the productive age population who are ready to work in various jobs and increasing the level of labor force participation. This positive relationship also shows that the value added contributed by population growth to economic development is still greater than the rate of declining in the natural resources value added that are continuously utilized to meet the population needs. A positive but insignificant relationship between the population growth rate and economic growth rate was found in research in Albania (Guga et al., 2015) and in 19 other countries in the continent of America (Zhuang & Juliana, 2010).

Relationship Between Young Age Dependency Ratio and Economic Growth in Indonesia

Indonesia with the fourth largest population in the world is one of the predicted countries that is in demographic transition condition. One of the characteristics of this demographic transition is the increase in the population at productive age (15-64 years). Meanwhile, the nonproductive age population especially young people (0-14 years) tends to decrease, though the elderly population (over 64 years) not so much yet. This has led to significant changes in the dependency ratio in Indonesia in the past 50 years. The young age dependency ratio as measured by the ratio between the number of young people (0-14 years old) and the number of productive age population (15-64 years old) shows a negative

relationship with the rate of economic growth in Indonesia. The regression coefficient value of this variable is -0.7086. This result confirms that a 1% reduction in young age dependency ratio will lead the increase in Indonesia's economic growth rate by 0.7086%.

The decrease in the young age dependency ratio indicates that there is a decrease in young population number (0-14 years). This decrease is the impact of the decline in Indonesia's birth rates. The young population group is a population group that cannot work because they are still in the school age. This group is categorized as unproductive population group. The decline in the number of young populations therefore will reduce the burden of dependents on the productive age population (15-64 years). This condition will have a positive impact on the rate of economic growth. The reduction in the young population which is borne by the productive age group has an impact on the greater ability of the productive age population to save and invest. Increasing in savings and investment can be stimulate the economic development and leads to increased economic growth in Indonesia.

This negative and significant relationship between young age dependency ratio and economic growth in Indonesia is consistent with what has been found in previous studies conducted in several countries. From Van der Ven and Smits (2011) research which used demographic data from 39 countries, the results showed that the economic growth will increase when young age dependency ratio decreases. Other previous research at Loughborough University which used data from several countries showed the results that there is a negative and significant relationship between young dependency ratio with their economic growth (Kögel, 2007).

Relationship Between Old Age Dependency Ratio and Economic Growth in Indonesia
Contrary to the young age depedency ratio, which has a negative relationship with economic growth, the results of this study show that the old age dependency ratio has a positive relationship with the rate of economic growth in Indonesia. This can be seen from the regression coefficient for the old age dependency ratio variable that is equal to 0.188145. This coefficient value confirms that an increase in the old age dependency ratio by 1% causes an increase in economic growth by 0.188%. But this positive relationship is statistically insignificant.

The positive relationship between the old age dependency ratio and economic growth in Indonesia then provide evidence that the increase in the number of elderly population (over 64 years) does not become a burden for the productive age population group. These results ties well with previous reports by Herzog (2016) which states that in countries that have conditions where the level of savings is still low, or countries with a current account deficit, and countries with an open trade system, he found a positive but not significant relationship between an increase in population of elderly with economic growth. He also mentioned that this positive relationship can occur due to an increase in consumption when entering the old age period. Entering the old age period, where the population no longer has a large family burden, because some of their children are already independent, allowing the elderly population to increase their consumption and reduce the allocation of their savings. Other research findings that are in line with the results of this study are conducted in China

that showed that in the long run there was a positive relationship between the aging of the population and China's economic growth (Li & Zhang, 2015).

In case of Indonesia, improving the quality of population health has an impact on increasing the life expectancy of its population. This condition causes many people in the old age group who are still productive to work. They can pay for their own needs and not burden others, and can even support other family member needs. This delivers the evidence that the increase in the number of old populations does not have a negative impact on economic growth in Indonesia.

Relationship Between Crisis Period and Economic Growth in Indonesia
In 1998, an economic crisis began with a crisis in the monetary sector in almost all countries, including Indonesia. In that recession year, there was a weakening of economic conditions that was very real, marked by negative economic growth with a rate more than 13% compared to the previous year. The negative growth occurred because the crisis caused the business world to experience a recession marked by the number of companies that lost money and eventually went out of business. To distinguish the condition in this crisis year, therefore, this study uses dummy variable to represent the economic growth in 1998 from other periods. The coefficient of the dummy variable has a negative sign with a value of 14.43. These results indicate that in 1998 economic growth rate was lower than other years on average by 14.43%.

Theoretically the use of dummy variables in time series data for long-term periods is common. This is done to distinguish certain periods that may be systematically different from other periods covered by the time series data (Wooldridge, 2013).

Here we are comparing some studies that used dummy variables to distinguish the 1997/1998 economic crisis period as one of the variables that determines economic growth. The first study, conducted by Raz, *et al.* (2012), used countries in East Asia as the object of research. The results of this study indicated that the economic crisis represented by the global financial crisis dummy variable in 1997 and 2008 had a negative coefficient and was statistically significant. From that result, it is clear that there was a significant difference in economic growth in the crisis period compared to the non-crisis period. During the crisis period, economic growth in East Asian countries was significantly lower than the non-crisis period.

Other studies that are in line are a research in Brunei Darussalam. This research analyzes the factors that influence Brunei Darussalam's economic growth and was conducted by Anaman (2004). The result showed that economic growth in Brunei Darussalam during the 1997-2001 crisis was lower than economic growth in the years when there was no crisis. But the difference in economic growth was not statistically significant.

The dummy variable for the 4th quarter in 1997 as a period of economic crisis was also used in the study of Harvie & Pahlavani (2006). This research was conducted in South Korea. One of the results of this study showed that coefficient regression of the dummy variable was negative and statistically significant. This finding can be interpreted that in

South Korea in the fourth quarter of 1997 the rate of economic growth was significantly lower than the rate of economic growth in other periods where there was no economic crisis.

CONCLUSION

The demographic transition in Indonesia has resulted in changes in population indicators. These changes are indicated by a decrease in fertility and mortality rates, which has an impact on changes in the population by age composition. The percentage of productive age population is increasing, while the percentage of nonproductive age population is decreasing. This condition causes the dependency ratio in general to decrease. This decline is due to a decrease in the young age dependency ratio, while the old age dependency ratio increase.

In the process of producing goods and services, capital and population factors are factors of production which also determine the amount of goods and services produced in a country. Although the contribution is not significant, population growth can increase the number productive age population and increase employment participation rate. Two of these aspects have a positive impact on economic growth in Indonesia. The demographic transition in Indonesia represented by a decrease in the young age depedency ratio has a positive and significant contribution to the Indonesia's economic growth rate. On the other hand, changes in the composition of elderly population will add the old age dependency ratio. The addition of the old age dependency ratio has a positive but not significant contribution to Indonesia's economic growth.

This study has found that generally the demographic transition in Indonesia, represented by changes in the composition of productive age population and young age dependency ratio, contributes positively to economic growth in Indonesia. It can be concluded that the demographic transition in Indonesia provides a bonus that is in the form of a positive contribution to economic growth. The main conclusion follows from the study results that the demographic transition in Indonesia provides a bonus that is in the form of a positive contribution to Indonesia's economic growth.

REFERENCES

Anaman, K. A. (2004). Determinants of economic growth in Brunei Darussalam. *Journal of Asian Economics*, *15*(4), 777–796.

Bloom, D., & Canning, D. (2001). Cumulative Causality, Economic Growth, and the Demographic Transition. In *NBER Working Paper Series* (No. 8685).

Bloom, D. J., & Williamson, J. G. (1997). *Demographic Transitions and Economic Miracles in Emerging Asia* (No. 6268). Cambridge.

Boldeanu, F., & Constantinescu, L. (2015). The Main Determinants Affecting Economic Growth. *Bulletin of the Transilvania University of Brasov. Economic Sciences. Series V*, *8*(2), 329.

Dao, M. Q. (2012). Population and Economic Growth. *International Journal of Academic Research in Business and Social Sciences*, *2*(1), 6–17.

Ding, S., & Knight, J. (2010). Why has China Grown So Fast? The Role of Physical and Human Capital Formation. *Oxford Bulletin of Economics and Statistics*, 73(2), 141–174.

Gribble, J., & Bremner, J. (2012). Achieving a Demographic Dividend. *Population Bulletin*, *67*(2), 16.

Guga, K., Alikaj, L., & Zeneli, F. (2015). Population, economic growth and development in the emerging economics. *European Scientific Journal*, *11*(10), 367–374.

Harkat, T., & Ahmed Driouchi, A. (2017). Demographic Dividend & Economic Development in Arab Countries. In *Munich Personal RePEc Archive* (No. 82880).

Hasan, A., & Butt, S. (2008). Role of trade, external debt, labor force and education in economic growth empirical evidence from Pakistan by using ARDL approach. *European Journal of Scientific Research*, *20*(4), 852–862.

Herzog, R. W. (2016). Saving, growth, and age dependency for OECD countries. *Munich Personal RePEc Archive*, (75599).

Klasen, S., & Lawson, D. (2007). *The impact of population growth on economic growth and poverty reduction in Uganda* (No. 133). Georg- August-Universität Göttingen, Volkswirtschaftliches Seminar, Göttingen This.

Kögel, T. (2007). *Youth Dependency, Institutions, and Economic Growth* (No. 2007–14).

Lee, J.-W. (2016). *The Republic of Korea's Economic Growth and Catch-Up: Implications for the People's Republic of China. Asian Development Bank Institute*.

Li, H., & Zhang, X. (2015). Population Aging and Economic Growth: The Chinese Experience of Solow Model. *International Journal of Economics and Finance*, *7*(3), 199–206.

Maksymenko, S. V., & Rabbani, M. (2011). Economic Reforms, Human Capital, and Economic Growth in India and South Korea: A Cointegration Analysis. *Journal of Economic Development*, *36*(2), 39–59.

Mankiw, N. G. (2016). Macroeconomics. In *Animal Genetics* (NINTH EDIT, Vol. 39). New York: A Macmillan Education Imprint New.

Mason, Andrew and Tomoko Kinugasa, T., & Kinugasa, T. (2005). East Asian Economic Development: Two Demographic Dividends. In *Economics Series* (No. 83).

Mulok, D., Asid, R., Kogid, M., & Lily, J. (2011). Economic Growth and Population Growth : Empirical Testing Using Malaysian Data. *Interdisciplinary Journal of Research in Business*, *1*(5), 17–24.

Ozerkek, Y. (2013). Unemployment and labor force participation: A panel cointegration analysis for European countries. *Applied Econometrics and International Development*, *13*(1), 67–76.

Paudel, R. C., Perera, N., & Paude, R. C. (2009). Foreign Debt, Trade Openness, Labor Force and Economic Growth: Evidence from Sri Lanka. *The ICFAI Journal of Applied*

Economics, *8*(1), 57–64.

Peterson, E. W. F. (2017). The role of population in economic growth. *SAGE Open*, *7*(4), 1–15.

Raz, A. F., Indra, T. P. K., Artikasih, D. K., & Citra, S. (2012). Global Financial Crises and Economic Growth : Evidence From East Asian Economies. *Bulletin of Monetary, Economics and Banking*, (October), 35–54.

Rosado, J. A., Alvarado Sánchez, I., Galindo Km, G., & Vía, E. (2017). From Population Age Structure and Savings Rate to Economic Growth: Evidence from Ecuador. *International Journal of Economics and Financial Issues*, *7*(3), 352–361.

Shinada, N. (2011). Quality of Labor, Capital, and Productivity Growth in Japan : Effects of employee age , seniority, and capital vintage. *RIETI Discussion Paper Series*, *11-E-036*, 1–29.

Song, S. (2013). *Demographic changes and economic growth : Empirical evidence from Asia*.

Sundman, M.-L. (2011). *The Effects of the Demographic Transition on Economic Growth: Implications for Japan*. Jonkoping International Business School.

Van der Ven, R., & Smits, J. (2011). *The Demographic Window of Opportunity: Age Structure and Sub-National Economic Growth in Developing Countries* (No. 11–102).

Wooldridge, J. . (2013). Introductory Econometrics: A Modern Approach. In *South - Western Cengage Learning* (5th ed).

Zhuang, H., & Juliana, R. St. (2010). Determinants of economic growth: Evidence from American countries. *International Business & Economics Research Journal*, *9*(5), 65–70.