Can the Demographic Bonus be a Strength or a Weakness for Economic Growth in Indonesia?

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Abstract

This study analyzes the demographic dividend as a stock of human capital that can increase economic growth in several provinces representing the western and eastern regions of Indonesia. Using panel data for the period 2010 to 2019 for 16 provinces on the islands of Sumatra and Sulawesi in Indonesia obtained from the Central Statistics Bureau (BPS). The model uses the Arellano-Bond GMM dynamic difference panel. The results show that there is a response to economic growth on human capital and physical capital in the provinces in Sumatra and Sulawesi, Indonesia. However, higher education has not been able to positively affect increased productivity. Apart from education, both exogenous and endogenous health factors are also important variables in increasing productivity. In the end, it can be said that the demographic dividend can provide benefits for economic growth in the selected provinces in the sample.

Keywords: Human Capital, Education, Skills, Health, GMM Panel

Introduction

The implications of demographic changes can be a dividend for increasing a country's economic growth [1]. But it can also be a drawback - namely the problem of unemployment if not managed properly. The demographic dividend can be an opportunity for the formation of an unlimited availability of human capital. Success in taking advantage of demographic opportunities can drive economic growth [2]. The demographic dividend is a comparison between the population of non-productive age and the population of productive age, where the population of productive age is greater than that of the non-productive age [3].

The effect of demographic changes on economic growth has been extensively studied in the demographic and economic literature of the population. The demographic contribution can be explained by the increase in the productivity component, which arises from changes in the age structure of the population [4]. Increases in educational attainment are key in explaining productivity and income growth derived from demographic dividend [5]. The demographic dividend can be said to be the availability of human capital.

Indonesia is an archipelago with various cultural characteristics and has the fourth largest population in the world after China, India and America. Indonesia's dependency ratio in 2010 was 50.5. In 2015 the dependency ratio was 48.6. This dependency ratio will be smaller in 2020 to 2030. The dependency ratio is the ratio of the population of non-productive age to the population

of productive age. The smaller dependency ratio shows that the productive age population aged 15 to 64 years is larger than the non-productive age population aged under 15 years and over 64 years. It is estimated that Indonesia will experience the window of opportunity in 2020-2030. The window of opportunity is a condition where the dependency ratio occurs at the lowest, this is what is known as the demographic dividend which can be used as an opportunity to achieve high economic growth and a potential market source [3]. Demographic changes and educated human capital have been linked since the beginning by Bloom & Williamson [6], in studying the growth rate of real per capita gross domestic product (GDP).

Standard achievement indicators for the success of human development in each region can be seen through the Human Development Index. National HDI achievements in Indonesia have increased from 1990 to 2018, from 0.525 to 0.7 according to data from UNDP. However, the size of the HDI achievement that is good from UNDP is 0.8 to 1. For the case of perprovinsi, HDI / HDI achievements have also increased with an average score of above 0.6, only DKI Jakarta province has reached 0.8. However, it is unfortunate that the HDI achievement is not supported by the significant economic growth of each province because there are still several provinces whose GDP growth rate is still below 5%, as happened in the provinces on the island of Sumatra. Apart from this phenomenon, the problem of the open unemployment rate is still dominated by the educated labor force, especially vocational high school graduates. Developing countries often face problems with uneducated workers and a large number of workers who are not accompanied by the skills / skills required for the industrial sector. The formation of human capital aims to create skills for the population as a productive source and can provide profitable jobs [7].

Many economists have conducted research on the contribution of human capital that affects economic growth for cases in several countries through the level of education, as has been done by economists [8]; [9]; [10]; [11]; [12]; [13], and others. Institutional channels also have a role in influencing human capital [14]. The trade openness factor, both at the international level and between provinces, shows the level of human capital innovation that can contribute to economic growth [15]; [16]. For the case in Indonesia, research on the contribution of human capital has also been carried out [17]; [18]; [19] through various channels, namely education level, quality education, abundance of knowledge between regions, household consumption, age, and health factors. However, there were other argued which say that human capital has no correlation or has a weak correlation with productivity [20]; [21]; [22]; [23].

It seems that this gap arises due to differences in funding capacity, population and regional characteristics in each country, so increasing the quality of human capital stock still requires hard effort, especially for developing countries. Quality human capital stocks are higher in developed countries than in developing countries [24]. According to data from the world bank in 2018, Indonesia's R&D fund allocation was only 0.23 percent of GDP. When compared with countries that are included in the middle income category, the allocation of R&D to Indonesia's GDP is still relatively small, where the average allocation of R&D funds to GDP is 1.57 percent. This is the reason for researchers to analyze how the relationship between human capital and the level of economic growth in selected provinces in Indonesia is measured by the level of productivity. In addition, this research is also a development of previous researchers Tampubolon [25] by using different methods.

Literature Review

According to Adam Smith and Veblen, human capital is very important in production. Adam Smith emphasized on the state capital stock where the ability of the entire population obtained is beneficial. According to Veblen, technological knowledge and skills are immaterial equipment or intangible assets of society, without human capital, physical capital is not productive [7]. The

Solow-Swan model has provided the first theoretical contribution in analyzing the problem of economic growth through productivity levels using the Cobb-Dauglas production function. Physical capital and human capital are considered as production factors which are exogenous factors [26]; [27]. Other researchers who state human capital as an exogenous factor are Kuznets [28] and Mankiw [29].

However, this argument has been refuted by other economists. In the AK model, human capital is an endogenous factor that can affect economic growth in the long run [30]. In other research results, he said that technological change as measured by the cost of research and development as an investment in physical capital and human capital is also a factor affecting economic growth [31]. Another proponent of this endogenous theory is Lucas [32] which states that productivity is measured based on the level of education. The formation of human capital is a process of obtaining and increasing the number of people who have the skills, education and experience that are decisive for the economic and political development of a country. The formation of human capital is related to investment in humans and their development as a creative and productive source [7]. Similar empirical results are also shown by Abbas & Nasir [33], Horii et al.[34], and Hanushek [8] who analyze growth with human capital as a factor of production, indicating that secondary school participation or higher education has positive and significant impact on economic growth. A quality population through increased education can produce a more productive labor force and have a significant contribution effect to economic growth [35]. In contrast to the empirical results which examine the relationship between human capital, public spending on health and education, infrastructure expansion, institutions and economic growth, it shows that only institutional is the only variable that significantly affects human capital in short term and, therefore, pursuing good governance with a view to strengthening institutions can be used to increase human capital in Africa [14].

The health factor is also an input required for the formation of quality human capital [36]. There is a potential relationship between the conditions in which people live and their life span and health status, as well as the relationship between health status and economic productivity and well-being [37]. The health effects on human capital can be seen from the empirical results of research Cuaresma et al [5] who show that the effect of labor productivity, which is claimed to accompany the demographic dividend, can be explained by changes in levels of educational attainment that go along with declining fertility. The demographic dividend effect needs to be understood in the context of the expansion of education that accompanies observed changes in age structure. Human capital is not only based on formal education and labor force participation but also on skills, cognitive functioning, and health.

According to research results Ahmed [38], it shows that the drivers of productivity in ASEAN countries and parts of East Asia are the result of the contribution of physical capital, labor, Information and Communication Technology (ICT), and human capital. Other empirical evidence also shows gaps regarding technological achievements and the imbalance of labor demand and supply in China [16]. The results show that the total human capital stock is still relatively low in China's provinces, but still plays an important role in economic growth. There is a positive correlation between the level of openness and economic growth in China on innovative human resources. At the level of openness and innovation of human capital, the western region is the lowest, the eastern region the highest. The more the level of regional openness, the more reserves of human resources it has. Short-run fluctuations in economic growth are influenced by fluctuations in the short-run stock of innovative human capital and deviations from the long-run equilibrium.

Research Methods

This research was conducted in 16 provinces in Sumatra Island and Sulawesi Island in Indonesia. The data was taken from 2010 to 2019. The data source used was secondary data by taking data from the Indonesian Central Statistics Agency. The criteria for selecting this sample are based on the characteristics of the population projection outside Java, where Sumatra is second and Sulawesi is third based on data from the Indonesian Central Bureau of Statistics. In addition, the island of Sumatra, which is located in the western region, is the second support for economic growth after Java, but there are still provinces that have GRDP growth below 5%. Meanwhile, the island of Sulawesi which ranks fourth and is in the eastern region, there are no provinces that have GRDP growth below 5%. As a dependent variable for this study is income percapita, and independent variable are domestic investment, the number of labor force over 15 years old, and explanatory variable such as health, technology, and trade openness.

The data used in the form of panel data is a combination of time series data and cross section data. The advantage of panel data is that it can identify specific parameters or questions, without the need to make limited assumptions, because an individual unit behaves differently at different time periods, for example because of a different past. However, because the panel model that includes the lag of the dependent variable as the regressor in the regression, it can cause endogeneity problems, so that if the model is estimated using a fixed effect or random effect approach it will produce biased and inconsistent estimators [39].

Generalized method of moments (GMM) to control the lag endogeneity of the dependent variable in the dynamic panel model, if there is a correlation between the explanatory variables and the error term in the model. It also controls for omitted variable bias, unobserved panel heterogeneity and measurement error. To solve the problem of biased estimators, Arellano & Bond [40] proposed a method of moments or the so-called generalized method of moments (GMM) approach. This approach is called the first difference GMM approach and was later updated by Arellano & Bover [41] and Blundell & Bond [42] which is known as the GMM System approach. The basic assumptions of this model are: [43]

1. Strict exogeneity : E $[\varepsilon_{it} \mid X_{i,} c_i] = 0$
2. Homoscedasticity and non-autocorelation:
$$E[\varepsilon_{it}\, \varepsilon_{is} \mid x_i, c_i] = \sigma^2{}_i \; if\; i = j \; and \; t = s \; and = 0 \; if \; i \neq j \; or \; t \neq 0$$
3. Common effect rows of the matrix T x K data $X_{i,}$ are x'_{it} , it is not assumed to be independent average, so the impact can be fixed or random, so that $E[c_i \mid X_{i,}] = h(X_i)$

The first difference GMM model for the Arellano-Bond approach can be written as follows [39]:

$$y_{it} - y_{i,t-1} = \gamma(y_{i,t-1} - y_{i,t-2}) + (\varepsilon_{it} - \varepsilon_{i,t-1}) \quad \text{(1)}$$

for i = 1,……, N dan t = 2,................, T

This study divides the model into two groups, namely the first model to see the effect of human capital from the entire labor force, namely:

$$Y_{it} = \alpha Y_{i,t-1} + \beta_0 InvD_{it} + \beta_1 HC_{it} + \beta_2 ICT\_comp_{it} + \beta_3 D\_island_{it} + \gamma_0 Health_{it} + \gamma_1 HC\_shs_{it} + \gamma_2 HC\_vsc_{it} + \gamma_3 HC\_univ_{it} + \gamma_4 InvD_{it} + + \gamma_5 InvD(-1)_{it} + \gamma_6 Net\_trade_{it} + (\eta_i + v_{it}) \ldots \quad \text{(2)}$$

While the second model is to see the productivity response to physical capital and human capital as measured by the number of people aged > 15 years working based on education completed at the vocational high school and university levels:

$$Y_{it} = \alpha Y_{i,t-1} + \beta_0 InvD_{it} + \beta_1 HC\_vsc_{it} + \beta_2 HC\_univ_{it} + \beta_3 D\_island_{it} + \gamma_0 HC\_vsc_{it} + \gamma_1 trade1_{it} + \gamma_2 trade2_{it} + \gamma_3 ICT\_comp_{it} + \gamma_4 InvD_{it} + \alpha_i + \varepsilon_{it} \quad \text{(3)}$$

Where the measurement of the productivity response (Yit) which is measured from GDP per capita to physical capital proxied by the value of domestic investment ($InvDN_{it}$), human capital (HC_{it}) which is proxied by labor force > 15 years old, human capital with education of each senior high school, vocational high school, and university (HC_shs_{it}), (HC_vsc_{it}), and (HC_univ_{it}), communication and technology factors (ICT_comp_{it}), and island location dummy (D_island_{it}): 1 = for provinces on the island of Sumatra, 0 = other

To check the variables containing endogeneity variables, an endogeneity test can be carried out using the 2sls equation which is then carried out by a weak instrument check on the regressor variables [44]. To test the validity of the instrument implemented in GMM, it can be tested through Hansen and Arellano Bond's AR (2) to estimate autocorrelation [45]. The dynamic shape of the variable lag makes the predicted coefficients represent the short-run effects of the explanatory variables.

Results and discussion

To suspect that the parameters in the model contain elements of endogeneity, it is necessary to do an endogeneity test. There are many ways to perform an endogeneity test. One of them is by using the Durbin-Wu-Hausman (DWH) test [46] which can be tested through estimating non-panel equations with TSLS or GMM.

Table 1. Testing of Endogeneity

	Model 1	**Model 2**
Diff in J-statistic	11.68228 (df =2) p = 0.0029	12.33991 (df = 2) p = 0.0021

Source: Finding Research

The results of this test show that rejected null hypothesis (H0) is the exogenous variable that indicated by a p-value < 0.05. This result shows that the human capital variable is an endogenous variable. The result of instrument test are showing for Model 1 and Model 2 that the Cragg-Donald F-stat are 22.0077 and 15.7416 and the Stock-Yogo value are 19.45 and 13.43 means that the instrumental variables used are in accordance with the existing theory, and have a significant effect. Furthermore, the panel regression for the difference GMM with the results in Table 3 is as follows:

Table 2. GMM Difference Panel Test Results

	Model 1	Model 2
Y (-1)	**0.933811***** (208.8095)	**0.93469***** (501.1802)
HC	**0.041512*****(9.257957)	
INVD	0.000257 (1.468999)	**0.000941***** (4.184828)
D_island	**-0.021238***** (-6.52855)	**-0.021713***** (-6.094139)
ICT_comp	**-0.000651***** (-3.117972)	
HC_vsc		**0.027887***** (34.04577)
HC_univ		**-0.016614***** (-11.97036)
J-statistic	15.62135	13.67888
Prob(J-statistic)	0.270183	0.396841
AR(2)	0.9995	0.9923

Note: ***, **, * denote significance at the level 1%, 5%, 10%
Source: finding research.

Based on Table 2 above, the results for the AR (2) test are not significant, so that the estimator of the GMM-system is not subject to second-order serial correlation. In addition, we also have insignificant results for the Hansen test (J-statistic) which indicates that the methodology we use is valid. We can therefore reasonably consider that our estimators are unbiased and consistent for further analysis. Analysis of the GMM difference model is an analysis in the short term.

As an instrument variable in model 1 we use a variable of high school, vocational and university educated labor force, health, net trade, domestic investment and lag of domestic investment from each province. The influence of other variables in influencing physical and human capital plays a very important role in increasing economic productivity. The education factor is still the most important variable in showing the quality of human capital that can boost economic productivity. The factors of information and technology have a negative significant effect on economic growth, because these factors are not fully as expected. This is because the use of computers has not been able to fully support education in some remote areas. In model 1, besides being directly affected by physical capital and human capital, productivity is also influenced by the level of health. These results are in line with research from [37]. Furthermore, it can be seen that the greatest contribution is given by past productivity which can be shown from the coefficient value of the productivity lag. Dummy variable show the significant effect and has a negative sign, because several provinces in the island of Sumatra still have GDPR growth below 5%. Finally, we can say that the influence of demography (human capital) can provide benefits for increasing productivity in the provinces in Sumatra and Sulawesi. The results in model 1 can be said to be in line with the theory of endogenous growth and the results of previous studies that said population size encourages endogenous economic growth and demographic dividend in the short term increase welfare [47]; [48].

In model 2, the instrument variables used are trade openness (exports and imports), computer technology and information, domestic investment, and human capital from vocational school. As for this model, the characteristics of the labor force based on education level are more pronounced than in model 1. The biggest contribution is still given from the past productivity lag coefficient, as shown by the empirical results in model 1, the effect is positive and significant. Domestic investment factor is that affects productivity, and also plays a role in instrument variables in explaining the endogenous variables of each labor force based on education level. The contribution of physical capital was not too large but had a positive and significant effect. The contribution of the labor force from vocational high school education gives greater results compared to University. This shows that the vocational education labor force on the islands of Sumatra and Sulawesi still has a great influence on productivity to boost the economy. Vocational high school qualifications that are equipped with skills, are able to be competitive. University-educated workers have an effect on productivity, but the effect is negative. This indicates that higher education does not necessarily have high skills. Higher education alone is not sufficient to increase productivity because it depends on the level of skills possessed and their utilization [49]. It is proven that vocational education level affects productivity the most. Because SMK graduates are equipped with skills that are in line with market demand. This result also proves, as stated by [24], that developing countries lack quality capital stocks in the sense that higher education exists but is less equipped with skills that are in line with market demand. Finally, the dummy variable also has a significant result on growth and has a negative sign which indicates that there are still provinces on the island of Sumatra that have economic growth rates below 5%.

Conclusions and suggestions

In the end, this study provides a comprehensive conclusion that, the demographic dividend that is being experienced by Indonesia provides benefits for increasing productivity which in turn

can drive economic growth. However, the analysis conducted in this study is still short term. This means that in the long term, further research is still needed. The dynamic difference GMM panel model can explain the endogeneity of the productivity response to physical capital and human capital in the short term.

Suggestions for policy makers to be able to focus more on developing human resources today, especially in the digital era. Technological change is very fast. For this reason, the adjustment of technology to the education sector to improve the quality of the supply of human resources through infrastructure improvements such as computers, laptops and internet networks that is evenly distributed to villages is very necessary. So that information technology to improve the quality of education can reach remote villages more quickly. The health factor also still needs to be disseminated to the villages). Entrepreneurial socialization must continue to be encouraged to young people, especially those who are still in college, in order to motivate them to be able to innovate in MSME business activities, so that when they complete their education they will not only depend on companies that provide job vacancies but can be independent by starting their own business.

Researchers are aware of the shortcomings of the results of this study due to the limited number of samples, time and analysis. The dynamics of demographic changes in productivity will be more obvious if a sample with a longer timeframe and more locations is used. It is hoped that in the future, other researchers can cover the shortcomings of this research.

References

[1] M. Tienda, "Economic Implications of Demographic Change: Diversity Dividend or Deficit¿," *Bus. Econ.*, vol. 51, no. 1, pp. 11–17, 2016, doi: 10.1057/be.2016.1.

[2] X. Yuan and Y. Gao, "Demographic transition and economic miracles in China: an analysis based on demographic perspective," *Int. J. Econ. Policy Stud.*, vol. 14, no. 1, pp. 25–45, 2020, doi: 10.1007/s42495-019-00030-0.

[3] H. N. Agustini, A. Z. Kumala, A. Nugroho, F. Anggraeni, and Juhaeni, *Analis Statistik Sosial: Bonus Demografi dan Pertumbuhan Ekonomi*. Badan Pusat Statistik, 2012.

[4] M. Sanchez-Romero, G. Abio, C. Patxot, and G. Souto, "Contribution of demography to economic growth," *SERIEs*, vol. 9, no. 1, pp. 27–64, 2018, doi: 10.1007/s13209-017-0164-y.

[5] J. C. Cuaresma, W. Lutz, and W. Sanderson, "Is the Demographic Dividend an Education Dividend?," *Demography*, vol. 51, no. 1, pp. 299–315, 2014, doi: 10.1007/s13524-013-0245-x.

[6] D. E. Bloom and J. G. Williamson, "Demographic transitions and economic miracles in Emerging Asia," *World Bank Econ. Rev.*, vol. 12, no. 3, pp. 419–455, 1998.

[7] M. L. Jhingan, *The Economics of Development and Planning*, 40th ed., vol. 11, no. 1. Vrinda Publications (P) LTD., 2019.

[8] E. A. Hanushek, "Economic growth in developing countries: The role of human capital," *Econ. Educ. Rev.*, vol. 37, pp. 204–212, 2013, doi: 10.1016/j.econedurev.2013.04.005.

[9] O. Kanayo, "The Impact of Human Capital Formation on Economic Growth in Nigeria," *J. Econ.*, vol. 4, no. 2, pp. 121–132, 2013, doi: 10.1080/09765239.2013.11884972.

[10] C. Day and S. Dowrick, "Endogenous growth with R&D and human capital: the role of returns to scale," *Oxf. Econ. Pap.*, vol. 65, pp. 312–322, 2013.

[11] H. U. Rehman, M. Kamran, S. M. A. Basra, I. Afzal, and M. Farooq, "Influence of Seed Priming on Performance and Water Productivity of Direct Seeded Rice in Alternating Wetting and Drying," *Rice Sci.*, vol. 22, no. 4, pp. 189–196, 2015, doi: 10.1016/j.rsci.2015.03.001.

[12] Y. Jie and J. Lan, "Dynamic linkages between human capital, natural resources, and

economic growth – Impact on achieving sustainable development goals," *Heliyon*, vol. 10, no. 14, 2024, doi: 10.1016/j.heliyon.2024.e33536.
[13] O. O. Jemiluyi and L. Jeke, "The role of human capital development in urbanization-economic growth nexus: A new insight on Nigeria," *Sustain. Futur.*, vol. 8, no. July, p. 100266, 2024, doi: 10.1016/j.sftr.2024.100266.
[14] M. Shuaibu and P. T. Oladayo, "Determinants of human capital development in Africa: A panel data analysis," *Oeconomia Copernicana*, vol. 7, no. 4, pp. 523–549, 2016, doi: 10.12775/OeC.2016.030.
[15] S. Ma, J. Dai, and H. Wen, "The influence of trade openness on the level of human capital in China: on the basis of environmental regulation," *J. Clean. Prod.*, vol. 225, pp. 340–349, 2019, doi: 10.1016/j.jclepro.2019.03.238.
[16] Y. Xu and A. Li, "The relationship between innovative human capital and interprovincial economic growth based on panel data model and spatial econometrics," *J. Comput. Appl. Math.*, vol. 365, p. 112381, 2020, doi: 10.1016/j.cam.2019.112381.
[17] Y. Liu and F. Yamauchi, "Population density, migration, and the returns to human capital and land: Insights from Indonesia," *Food Policy*, vol. 48, pp. 182–193, 2014, doi: 10.1016/j.foodpol.2014.05.003.
[18] Y. Affandi, D. F. Anugrah, and P. Bary, "Human capital and economic growth across regions: a case study in Indonesia," *Eurasian Econ. Rev.*, vol. 9, no. 3, pp. 331–347, 2019, doi: 10.1007/s40822-018-0114-4.
[19] Nurmalia, D. Hartono, and I. F. U. Muzayanah, "The Roles of Entrepreneurship on Regional Economic Growth in Indonesia," *J. Knowl. Econ.*, vol. 11, no. 1, pp. 28–41, 2020, doi: 10.1007/s13132-018-0557-6.
[20] R. Levine and D. Renelt, "A sensitivity analysis of cross-country growth regressions," *Am. Econ. Rev.*, vol. 82, no. 4, pp. 942–963, 1992.
[21] J. Benhabib and M. Spiegel, "The role of human capital in economic development: Evidence from aggregate cross-country data. Journal of Monetary Economics 34(2), 143–174.," *J. Monet. Econ.*, pp. 123–143, 1994.
[22] S. Devarajan, V. Swaroop, and H. Zou, "Shantayanan Devarajan, Vinaya Swaroop*, Heng-fu Zou," *J. Monet. Econ.*, vol. 37, p. 313 344, 1996.
[23] J. Quiggin, "Human capital theory and education policy in Australia," *Aust. Econ. Rev.*, vol. 32, no. 2, pp. 130–144, 1999, doi: 10.1111/1467-8462.00100.
[24] R. Amir-ud-Din, M. Usman, F. Abbas, and S. A. Javed, "Human versus physical capital: issues of accumulation, interaction and endogeneity," *Econ. Chang. Restruct.*, vol. 52, no. 4, pp. 351–382, 2019, doi: 10.1007/s10644-017-9225-2.
[25] A. Tampubolon and S. Purba, "The effect of demographic bonus, health, and physical capital on economic growth in Indonesia," *J. Ekon.*, vol. 11, no. 02, pp. 821–827, 2022.
[26] R. J. Barro and X. S. Martin, *Economic Growth*, Second. London, England: Massachussetts Institute of Technology (MIT) Press, 2004.
[27] F. de H. Barbosa and L. A. de Lima Junior, *Workbook for Macroeconomic Theory - Fluctuations, Inflation and Growth in Closed and Open Economics*. Springer Nature Switzerland AG, 2020. doi: 10.1007/978-3-030-61548-2.
[28] S. Kuznets, "Modern Economic Growth : and," *Am. Econ. Rev.*, vol. 63, no. 3, pp. 247–258, 1973.
[29] N. G. Mankiw, D. Romer, and D. N. Weil, "A contribution to the empirics of reservation wages," *Q. J. Econ.*, vol. 107, no. May, pp. 407–437, 1992.
[30] P. M. Romer, "Increasing Returns and Long-Run Growth," *J. Polit. Econ.*, vol. 94, no. 5, pp. 1002–1037, 1986.

[31] P. M. Romer, “Endogenous technological change,” *J. Polit. Econ.*, vol. 98, no. 5, pp. S71–S102, 1990, doi: 10.3386/w3210.
[32] R. E. Lucas, “On the mechanics of economic development,” *J. Monet. Econ.*, vol. 22, no. February, pp. 3–42, 1988, [Online]. Available: http://linkinghub.elsevier.com/retrieve/pii/0304393288901687
[33] Q. Abbas and Z. M. Nasir, “Endogenous Growth and Human Capital,” *Pak. Dev. Rev.*, vol. 40, no. 4 Part II, pp. 987–1007, 2001.
[34] R. Horii, A. Kitagawa, and K. Futagami, “Availability of higher education and long-term economic growth,” *Japanese Econ. Rev.*, vol. 59, no. 2, pp. 156–177, 2008, doi: 10.1111/j.1468-5876.2007.00403.x.
[35] J. S. Han and J. W. Lee, “Demographic change, human capital, and economic growth in Korea,” *Japan World Econ.*, vol. 53, p. 100984, 2020, doi: 10.1016/j.japwor.2019.100984.
[36] S. Li, N. M. Nor, and S. R. Kaliappan, “Long-term effects of child nutritional status on the accumulation of health human capital,” *SSM - Popul. Heal.*, vol. 24, no. October, 2023, doi: 10.1016/j.ssmph.2023.101533.
[37] T. P. Schultz, “Health human capital and economic development,” *J. Afr. Econ.*, vol. 19, no. SUPPL. 3, 2010, doi: 10.1093/jae/ejq015.
[38] E. M. Ahmed, “ICT and Human Capital Spillover Effects in Achieving Sustainable East Asian Knowledge-Based Economies,” *J. Knowl. Econ.*, 2017, doi: 10.1007/s13132-016-0430-4.
[39] M. Verbeek, *A guide to modern econometrics*, Second., vol. 8, no. 4. John Wiley & Sons, Ltd, 2004.
[40] M. Arellano and S. Bond, “Some Test of Spesification for Data Panel: Monte Carlo Evidence and an Aplication of Employment Equations,” *Source Rev. Econ. Stud.*, vol. 58, no. 2, pp. 277–297, 1991, [Online]. Available: doi:10.2307/2297968
[41] M. Arellano and O. Bover, “Another look at the instrumental variable estimation of error-components models,” *J. Econom.*, vol. 68, no. 1, pp. 29–51, 1995, doi: 10.1016/0304-4076(94)01642-D.
[42] R. Blundell and S. Bond, “Initial conditions and moment restrictions in dynamic panel data models,” *J. Econom.*, no. 87, pp. 115–143, 1998, doi: 10.1016/j.jeconom.2023.03.001.
[43] M. Firdaus, *Aplikasi Ekonometrika : dengan E-views, Stata dan R*. Bogor - Indonesia: IPB Press, 2020.
[44] Aliasuddin, E. Gunawan, and Y. P. Sari, “An application of the GMM model on economic growth in Indonesia,” *Opcion*, vol. 35, no. 90–2, pp. 524–540, 2019.
[45] D. Roodman, “How to do xtabond2: An introduction to difference and system GMM in Stata,” *Stata J.*, vol. 9, no. 1, pp. 86–136, 2009, doi: 10.1177/1536867x0900900106.
[46] C. F. Baum, M. E. Schaffer, and S. Stillman, “Instrumental Variables and GMM: Estimation and Testing,” *Stata J. Promot. Commun. Stat. Stata*, vol. 3, no. 1, pp. 1–31, 2003, doi: 10.1177/1536867x0300300101.
[47] K. Prettner and A. Prskawetz, “Demographic change in models of endogenous economic growth. A survey,” *Cent. Eur. J. Oper. Res.*, vol. 18, no. 4, pp. 593–608, 2010, doi: 10.1007/s10100-010-0179-y.
[48] T. Ziesemer and A. von Gässler, “Ageing, human capital and demographic dividends with endogenous growth, labour supply and foreign capital,” *Port. Econ. J.*, vol. 20, no. 2, pp. 129–160, 2021, doi: 10.1007/s10258-020-00176-2.
[49] J. M. Abowd *et al.*, *The relation among human capital , productivity and market value: Building up from micro evidence*. 2005.