
Econometric Model of Economic Growth in Indonesia Using Dynamic Panel Data Using the FD-GMM Arellano-Bond and Sys-GMM Blundell-Bond Approaches

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ABSTRACT

Economic growth is measured by changes in a country's Gross Domestic Product (GDP) which can be broken down into population and economic elements. This research was conducted to determine the conditions of economic growth in the country of Indonesia with a total of 34 provinces in the 2016-2021 observation period, a total of 204 samples. The data collection technique was carried out by downloading files on the official website of the Central Bureau of Statistics in Indonesia for 2016-2021, while data analysis was carried out using econometric models by comparing the FD-GMM Arellano-Bond and Sys-GMM Blundell-Bond models, then for the second stage determining which model is the best to use in modeling. Data processing in research using Stata software version 17.0. In panel data, economic variables are dynamic, meaning that the value of a variable can be influenced by the value of another variable and the value of the variable concerned, in the previous period, in addition to knowing the short-term and long-term impacts of economic growth. Based on panel data regression estimation, the best model is obtained. -GMM Blundell-Bond). The results of the study revealed that researchers found the results of data processing using the System Generalized Method of Moment (Sys-GMM Blundell-Bond) and FD-GMM ARELLANO-BOND economic growth in Indonesia is influenced by the human development index, poverty level, agglomeration, with the impact of elasticity on economic growth short term and long term.

Keywords: Economic Growth, Human Development Index, Rate Poverty, Agglomeration

INTRODUCTION

Economic growth is measured by changes in a country's Gross Domestic Product (GDP) which can be broken down into population and economic elements (Fatmawati 2022; Magdalena and Suhatman 2020; Mahtta et al. 2022; Shan et al. 2021; Verma et al. 2021). Economic growth is a process of increasing Gross Domestic Product income. Economic growth is also a process of changing economic conditions in a country on an ongoing basis towards a more prosperous state for all its people in a period (Chen, Kumara, and Sivakumar 2021; Magdalena and Suhatman 2020). Continuously increasing economic

growth will have a positive impact on all aspects of economic development, including reducing the poverty rate ratio and improving people's welfare (Nugraha 2020). Maintaining ever-increasing economic growth is an obligation that must be carried out by the government.

Classical growth theory explains that natural resources are the most basic means of production activities in society, because available natural resources have a maximum limit for the growth of an economy, while human resources (population) play a passive role in the output growth process (Nihayah and Kurniawan 2021; Oyinlola, Adedeji, and

Bolarinwa 2020). Meanwhile, the Solow growth theory or often called the neoclassical growth model uses two main production factors, namely capital and labor and new elements, namely technology, capital and labor, which are two things that replace each other (Abreu 2021; Cvetanović, Mitrović, and Jurakić 2019).

The GDP growth rate in each country needs to be realized as evidence that economic growth can be achieved well, so that factors affecting economic growth such as the Human Development Index and the poverty rate must be taken into account properly, therefore, researchers are interested in mapping the econometric model of GDP growth in Indonesia, in order to be able to find out its own characteristics in resource wealth, so that the factors causing the growth of Indonesia's GDP. The Central Bureau of Statistics recorded the rate of economic growth in Indonesia for the last six (6) years (2016-2021) as follows:

Table 1. Indonesia GDP Rate 2016-2021

Country	Year	GDP (%)
Indonesia	2016	5,02
Indonesia	2017	5,07
Indonesia	2018	5,17
Indonesia	2019	5,02
Indonesia	2020	-2,07
Indonesia	2021	3,69

Economic growth shows economic activity that causes an increase in the production of public goods and services (Polasky et al. 2019). Indonesia's economic growth rate experienced good growth except in 2020 it experienced a minus due to the co-19 pandemic. Economic growth can increase people's welfare which can be shown through the Human Development Index (IPM) and reduce poverty rates. The following is HDI data in Indonesia in Table 2.

Table 2. Human Development Index

Country	Year	HDI (%)
Indonesia	2016	70,18
Indonesia	2017	70,81
Indonesia	2018	71,39

Indonesia	2019	71,92
Indonesia	2020	71,94
Indonesia	2021	72,29

The human development index is one way to determine the quality of life of the community and to determine the success rate of development in the long term (González-Díaz et al. 2021). Empirically, Indonesia's fluctuating economic growth rate in 2016-2021 was able to have a positive impact on the continuous increase in HDI from 2016-2021. Economic growth will have an impact on reducing poverty (Omar and Inaba 2020).

Table 3. Rate Poverty

Country	Year	Rate Poverty (%)
Indonesia	2016	10,78
Indonesia	2017	10,38
Indonesia	2018	9,74
Indonesia	2019	9,3
Indonesia	2020	9,9
Indonesia	2021	10,06

The poverty rate is one of the targets in development in an area with the aim of getting a smaller income gap, poverty is a multidimensional problem in development that involves preferences, values and politics (Shen and Li 2022). When the HDI aspect always increases, the poverty rate will decrease. This is a determining factor for the success of economic growth. Economic growth is a process of increasing the capacity of products and services in the long term (Mohsin et al. 2021). Regions with high industrial activity will develop more rapidly than areas with low industrial activity (Zhu et al. 2019). Agglomeration as concentration in a particular location, the theory of agglomeration savings reflects an equilibrium spatial configuration of all economic activity in a region (Wang et al. 2022).

Several studies on the analysis of the factors influencing economic growth continue to be carried out to obtain empirical results. Some of the results of previous studies found

that the human development index, poverty level, agglomeration had a significant positive effect on economic growth through a multiple linear regression approach with panel data so that only static models were obtained. While empirically many economic variables are dynamic, meaning that the value of a variable can be influenced by the value of other variables and is influenced by the value of the variable in question in the past or previous periods. Based on these problems, this research was conducted using dynamic panel data regression through the Arellano-Bond General Method, the Moment Approach (GMM), with the aim of establishing an appropriate economic growth model in Indonesia and knowing the short-term and long-term impacts of an economic policy.

METHOD

This study uses quantitative descriptive analysis with secondary data types sourced

from the Central Bureau of Statistics. The population in this study were 34 provinces in Indonesia with an observation period of 2016-2021, with a total sample of 204, so this study used panel data.

Data collection techniques are carried out by searching and downloading files on the official website of the Central Bureau of Statistics in Indonesia for 2016-2021. The data analysis technique was carried out using econometric models by comparing the FD-GMM Arellano-Bond and Sys-GMM Blundell-Bond models, then for the second stage it was determined which model was the best to use in the modeling. Data processing in research using Stata version 17.0 software. The research model equation is as follows:

$$Egrowth_{i,t} = \delta + Egrowth_{i,t-1} + 1 lipm_{i,t} + 2 Plevel_{i,t} + 3 Aglo_{i,t} + i,t$$

The following is the size of each variable in this study:

Table 4. Research Variable

Variable	Unit	Notation	Scale
Economic growth	% (percent)	$Egrowth_{i,t-1}$	Ratio
Human Development Index	Provincial human development index values obtained from the Central Bureau of Statistics (2016-2021)	$Ipm_{i,t}$	Nominal
Poverty level	% (percent)	$Plevel_{i,t}$	Ratio
Aglo	$Ag = GRDPProvince / GDPCountry \times 100\%$	$Aglo_{i,t}$	Ratio

RESULT and DICUSSION

The research uses estimation in the dynamic panel data regression model by comparing the first-difference GMM approach

and the GMM system. The intercept and slope values for each independent variable using the FD-GMM and SYS-GMM approaches are respectively shown in the following table:

Table 5. Model FD-GMM Arellano-Bond

Variabel	Coefficient	Std.Error	Z-Value	P-Value
$egrowth_{i,t-1}$	-.9688644	.6539098	-1.48	0.138
$lipm_{i,t}$	-354.3448	190.872	-1.86	0.063
$Plevel_{i,t}$	-7.652819	4.917756	-1.56	0.120
$aglo_{i,t}$	-4.947118	4.419	-1.12	0.263
$cons$	1600.975	865.942	1.85	0.064

Table 6. Model SYS-GMM Blundell and Bond

Variabel	Coefficient	Std.Eror	Z-Value	P-Value
$egrowth_{i,t-1}$	-0.1524568	.4623841	-2,10	0.036
$lipm_{i,t}$	-246.2085	134.9669	-2.63	0.009
$Plevel_{i,t}$	-2.303784	3.124705	-2.20	0.028
$aglo_{i,t}$	1.560773	612.3138	-1.58	0.113
$cons$	1075.687	612.3138	2.61	0.009

Next, a model specification test is carried out on all variables that have a significant influence on the model. The best estimation of the dynamic panel data model can be seen from the criteria, namely the instrument variables used are valid and the estimates

obtained are consistent. Instrument variable testing uses the Sargan test and estimation consistency testing uses the Arellno-Bond test. The results of the model specification test can be seen as follows:

Table 7. Model Specification Test

Model	Sargan test		Arellano-Bond test	
	Statistical Value	P-Value	Statistical Value	P-Value
FD-GMM	2.834539	0.5859	-1.1459	0.2518
SYS-GMM	5.669077	0.9318	.49364	0.6216

From the estimation results in the table above, if seen from the p-values of the Sargan test on the Fd-GMM and Sys-GMM models, they are 0.5859 and 0.9318 which are not significant with a probability value that is more than a significance level of $\alpha = 5\%$. This shows that H_0 is not rejected, which means there is no correlation between errors and the value of overidentifying restrictions. This means that there is no problem with the validity of the instrument or overidentifying conditions in the estimation of the model, which is said to be valid. Whereas in the Arellano-Bond test on the FD-GMM and SYS-GMM models with a significance level of α used of 0.05, the probability values are 0.2518 and 0.6216 more than the 0.05 significance level so that H_0 is not rejected, which means that it is not there is an autocorrelation in the 2nd order first difference error so that the estimates produced are consistent. Based on panel data regression estimation, the best model is obtained. (GMM Blundell-Bond) are as follows:

$$Egrowth_t = 1600.975 - 0.9688644 Egrowth_{i,t-1} - 354.3448 lipm_{i,t} - 7.652819 tkemiskinan_{i,t} - 4.947118 aglo_{i,t} + i,t$$

The R2 value of this model is still at a moderate level. The R2 value obtained was 34.38%, which means that the variation in economic growth in Indonesia that can be explained by the independent variables in the model is 34.38% and 65.62% is explained by other variables outside the model.

Dynamic panel data regression can also be used to determine the short-run (short-run multiplier) and long-term (long-run multiplier) effects of the independent variables. The results of the short-term and long-term elasticity of the variables Human Development Index, Poverty Level Percentage, Agglomeration, based on the equation above can be seen in the following table:

Table 8. The Results of Variable Short-Term and Long-Term Elasticity

Variabel	Coefficient	Short-run multiplier	Long-run multiplier
$egrowth_{i,t-1}$	-0.1524568		



$lipm_{i,t}$	-246.2085	-246.2085	-213.638
$tkemiskinan_{i,t}$	-2.303784	-2.303784	-1.99902
$aglo_{i,t}$	1.560773	1.560773	1.3543

From the estimation results in the table above, in the short term the IPM variable is -246.2085 and in the long term -213.638 affects economic growth. In the short term the poverty rate variable is -2.303784 and in the long term -1.99902 affects economic growth. In the short term the agglomeration variable is 1.560773 and in the long term it is 1.3543 affecting economic growth.

CONCLUSION

Based on the results of the analysis and discussion of panel data regression and dynamic panel data regression that have been carried out, the following conclusions are obtained:

1. Based on panel data regression estimation, the best model obtained. Dynamic panel data regression estimation obtained the best model is the Sys-GMM, the model seen from the model specification test value is greater than the FD-GMM model, so that the equation model is obtained at *System Generalized Method of Moment* (Sys-GMM Blundell-Bond) is as follows:

$$Egrowth_t = 1600.975 - 0.9688644 Egrowth_{i,t-1} - 354.3448 lipm_{i,t} - 7.652819 Plevel_{i,t} - 4.947118 aglo_{i,t} + i,t$$
2. The R2 value obtained is 34.38%, meaning that the variation in economic growth in Indonesia that can be explained by the independent variables in the model is 34.38% and 65.62% is explained by other variables outside the model.
3. For further research, you can add other independent variables that are thought to have an effect on economic growth and use the latest research period so that the panel data regression model and dynamic panel data regression obtained better reflect increased economic growth.

4. In the short term the IPM variable -246.2085 and in the long term -213.638 affects economic growth. In the short term the poverty rate variable is -2.303784 and in the long term -1.99902 affects economic growth. In the short term the agglomeration variable is 1.560773 and in the long term it is 1.3543 affecting economic growth.

REFERENCES

- Abreu, Maria. 2021. "Neoclassical Regional Growth Models." *Handbook of Regional Science* 591–613.
- Chen, Yanyu, E. Kusuma Kumara, and V. Sivakumar. 2021. "Investigation of Finance Industry on Risk Awareness Model and Digital Economic Growth." *Annals of Operations Research* 1–22.
- Cvetanović, Slobodan, Uroš Mitrović, and Marko Jurakić. 2019. "Institutions as the Driver of Economic Growth in Classic, Neoclastic and Endogenous Theory." *Economic Themes* 57(1):111–25.
- Fatmawati, Karina. 2022. "GROSS DOMESTIC PRODUCT: Financing & Investment Activities and State Expenditures." *KINERJA: Jurnal Manajemen Organisasi Dan Industri* 1(1):11–18.
- González-Díaz, Romel Ramón, Ángel Acevedo-Duque, Guido Salazar-Sepúlveda, and Dante Castillo. 2021. "Contributions of Subjective Well-Being and Good Living to the Contemporary Development of the Notion of Sustainable Human Development." *Sustainability* 13(6):3298.
- Magdalena, Suryani, and Rony Suhatman. 2020. "The Effect of Government Expenditures, Domestic Investment, Foreign Investment to the Economic Growth of Primary Sector in Central Kalimantan." *Budapest International Research and Critics Institute-Journal*

- (*BIRCI-Journal*) 3(3):1692–1703.
- Mahtta, Richa, Michail Fragkias, Burak Güneralp, Anjali Mahendra, Meredith Reba, Elizabeth A. Wentz, and Karen C. Seto. 2022. "Urban Land Expansion: The Role of Population and Economic Growth for 300+ Cities." *Npj Urban Sustainability* 2(1):5.
- Mohsin, Muhammad, Hafeez Ullah, Nadeem Iqbal, Wasim Iqbal, and Farhad Taghizadeh-Hesary. 2021. "How External Debt Led to Economic Growth in South Asia: A Policy Perspective Analysis from Quantile Regression." *Economic Analysis and Policy* 72:423–37.
- Nihayah, Dyah Maya, and Gilang Fajar Kurniawan. 2021. "Impact of Road Infrastructure and Foreign Direct Investment to Asean Economy." *Economics Development Analysis Journal* 10(2):233–42.
- Nugraha, A. T. 2020. "The Role of Infrastructure in Economic Growth and Income Inequality in Indonesia." *Economics and Sociology* 13(1):102–15. doi: 10.14254/2071-789X.2020/13-1/7.
- Omar, Md Abdullah, and Kazuo Inaba. 2020. "Does Financial Inclusion Reduce Poverty and Income Inequality in Developing Countries? A Panel Data Analysis." *Journal of Economic Structures* 9(1):37.
- Oyinlola, Mutiu A., Abdulfatai A. Adedeji, and Modupe O. Bolarinwa. 2020. "Exploring the Nexus among Natural Resource Rents, Human Capital and Industrial Development in the SSA Region." *Economic Change and Restructuring* 53:87–111.
- Polasky, Stephen, Catherine L. Kling, Simon A. Levin, Stephen R. Carpenter, Gretchen C. Daily, Paul R. Ehrlich, Geoffrey M. Heal, and Jane Lubchenco. 2019. "Role of Economics in Analyzing the Environment and Sustainable Development." *Proceedings of the National Academy of Sciences* 116(12):5233–38.
- Shan, Yuli, Shuai Fang, Bofeng Cai, Ya Zhou, Dong Li, Kuishuang Feng, and Klaus Hubacek. 2021. "Chinese Cities Exhibit Varying Degrees of Decoupling of Economic Growth and CO2 Emissions between 2005 and 2015." *One Earth* 4(1):124–34.
- Shen, Yangyang, and Shi Li. 2022. "Eliminating Poverty through Development: The Dynamic Evolution of Multidimensional Poverty in Rural China." *Economic and Political Studies* 10(1):85–104.
- Verma, Parag, Ankur Dumka, Anuj Bhardwaj, Alaknanda Ashok, Mukesh Chandra Kestwal, and Praveen Kumar. 2021. "A Statistical Analysis of Impact of COVID19 on the Global Economy and Stock Index Returns." *SN Computer Science* 2:1–13.
- Wang, Yanan, Shiwen Yin, Xiaoli Fang, and Wei Chen. 2022. "Interaction of Economic Agglomeration, Energy Conservation and Emission Reduction: Evidence from Three Major Urban Agglomerations in China." *Energy* 241:122519.
- Zhu, Lingyun, Yu Hao, Zhi-Nan Lu, Haitao Wu, and Qiying Ran. 2019. "Do Economic Activities Cause Air Pollution? Evidence from China's Major Cities." *Sustainable Cities and Society* 49:101593.