Dynamic Panel Data Analysis of the Human Development Index in Indonesia

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10.24269/ekuilibrium.v20i2.2025.pp229-245

ARTICLE INFO

Article history
Received:
17-02-2025
Revised:
29-08-2025
Accepted:
29-08-2025

Keywords
Dynamic Panel Data
Human Development Index
Macroeconomics
Indonesia
GMM

ABSTRACT

The human Development Index is an important indicator for measuring people's welfare. This study aims to determine the influence of household consumption, Gross Regional Domestic Product, investment, and government expenditure on the human development index (HDI) in 35 provinces in Indonesia for the period 2014-2023. Secondary data was sourced from the Central Statistics Agency and used to estimate the model, a dynamic panel approach was utilized, based on the Generalized Method of Moments. The results showed that Gross Regional Domestic Product (GRDP) has a significant influence on increasing the human development index (HDI), especially through increased consumption for education and health. In addition, achieving economic development in a country requires individual and collective human efforts in improving the quality of life. Important factors that must be built are the quality of human resources, facilities and infrastructure. Government spending focused on sectors that directly affect people's welfare can accelerate the improvement of the quality of human resources. This finding shows the importance of macroeconomic stability and fiscal policy effectiveness in supporting sustainable human development.

1. Introduction

One measure of a country's success can be seen in the quality of its human development. Humans are not only positioned as objects of development, but also as active subjects who contribute to macroeconomic progress (Rossi, 2018). The success of development is not only measured by economic growth, but also by the welfare of the community (Niekerk, 2020). Such progress is substantiated by observed improvements in human development indicators (HDI) (Runtunuwu, 2020). The Indonesian government has made various efforts to encourage human development through policies that support equitable access to education, health, and welfare (Lestari & Arumi, 2024); (Raysharie et al., 2024); (Nasution et al., 2024); (Juardi et al., 2023). Public budgets are directed at expanding access to basic services so that people can obtain health services without the burden of high costs. On the other hand, low income will have an impact on household consumption, as families tend to reduce consumption if income is insufficient (Biltagy & Hamdi, 2024); (Hanun, 2018).

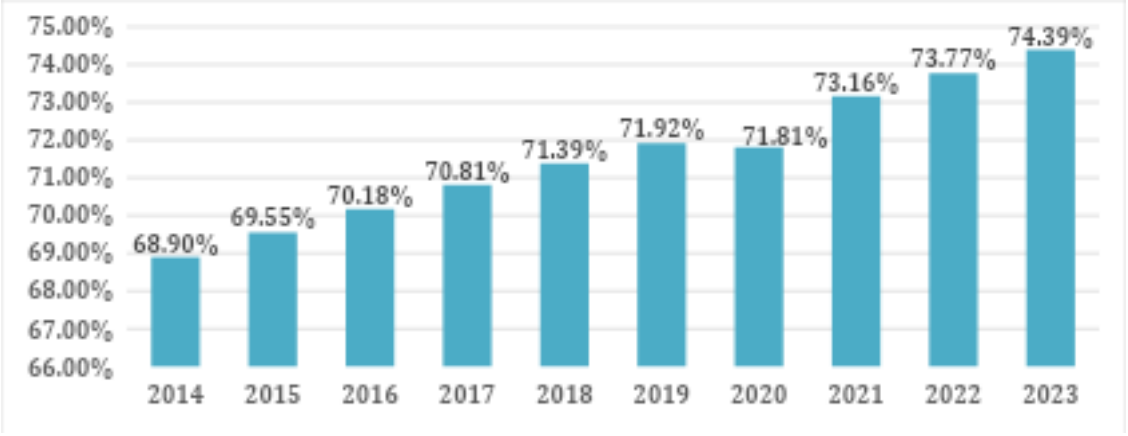

Figure 1. Human Development Index in Indonesia for the period 2014-2023
Source : BPS, 2024

Figure 1 illustrates the condition of Indonesia's Human Development Index which has continued to increase over the past 10 years (BPS, 2024). It was recorded that in 2014 Indonesia's HDI reached 68.90%, and then in 2015 it rose again to 69.55%. Until 2023, Indonesia's HDI reached 74.39%, an increase of 0.84% compared to 2022. From 2020 to 2023, Indonesia's Human Development Index has increased by an average of 0.72% per year. The growth in HDI in 2023 was driven by the recovery in the standard of living dimension, which was influenced by the cost of consumption by family members during a month. In general, the higher the quality of Human Resources (HR), the more it will encourage the development process, especially economic progress (Humiati & Budiarti, 2020).

HDI growth is generally underpinned by three main dimensions, as defined by the United Nations Development Programme (UNDP), namely longevity and lifestyle, a decent education, and an adequate standard of living (Azfirmawarman et al., 2023). However, an increase in HDI without stable economic growth can put pressure on infrastructure and public services, increase social inequality, and narrow employment opportunities. Therefore, it is important to examine the economic factors that directly or indirectly affect human development. Theoretically, Romer (1986) endogenous approach states that the quality of human capital is key to long-term economic growth Factors such as household consumption, Gross Regional

ISSN (print) 1858-165X | ISSN (online) 2528-7672

Domestic Product (GRDP), investment and government spending play an important role in supporting this achievement. Household consumption, for example, reflects the level of community welfare and is closely related to purchasing power and quality of life (Hanggarany, 2022). However, if consumption is still dominated by primary needs, such as food, then this indicates that welfare conditions are not optimal (Jawak et al., 2024).

The standard percentage of a country's HDI depends on its socio-economic characteristics. According to (UNDP, 2023), a human development index with a percentage above 80% is considered very high and reflects optimal human development. Developed countries generally have an HDI percentage above 85%, while developing countries are advised to set a minimum target of 70% to ensure the welfare of their population. Therefore, in addition to focusing on increasing HDI, the government needs to implement sustainable economic policies to avoid social inequality and ensure inclusive development. A decent life in society is seen from the amount of household consumption (Bjarnason & Haartsen, 2024). Low economic development is partly due to the slow development of household consumption (Thahir et al., 2021). The level of consumption development always coincides with the pace of the economy (Syahbana et al., 2024).

GRDP is an indicator that serves as a measure of the economic performance of a region and the fiscal capacity of local governments. An increase in GRDP is generally positively correlated with the government's ability to finance development programs, including the education and health sectors (Mashita & Anggresta, 2022). Many factors are considered to influence HDI as suggested by experts who have previously researched. In the macroeconomic realm, GRDP is one of the main indicators used to measure economic stability. Research conducted (Hannyfah et al., 2023) on GRDP on HDI in Indonesia can be seen from the relationship between community welfare in a region. GRDP reflects the welfare of society, while HDI measures the quality of human resources (Mukarramah & Zulkarnain, 2024), (Yusuf et al., 2022).

Investment also contributes significantly to economic growth and job creation, which in turn has implications for increasing HDI (Sunariyah, 2003); (Naila et al., 2024). Efficiently allocated government expenditure, especially in strategic sectors, has proven to have a positive impact on improving the quality of human resources. Panel data study conducted by Nugroho (2016) government spending contributes positively to economic growth. Expenditures on health and infrastructure have been found to contributes positively and significantlyon the Human Development Index (HDI) through their effect on economic growth. However, in regions characterized by low HDI levels, only education spending demonstrates a positive association with improvements in human development. Whereas in government spending research Jawak et al., (2024) explains that the role of government has a positive effect on HDI with targeted government spending can encourage public welfare.

However, the findings of various previous studies still show inconsistencies, such as a study conducted by Noviansyah et al., (2019) the findings indicate that household consumption contibutes positively and significantly effect on the Human Development Index (HDI). However, this contrasts with the study conducted by (Jawak et al., 2024) which found that household consumption has no impact on HDI. (Bakar, 2020) government expenditure contributes negatively effect on HDI, but study (Palayukan, 2019) explains that government spending from the education and health sectors has no effect on HDI. Research conducted by Noviansyah et al.,

ISSN (print) 1858-165X | ISSN (online) 2528-7672

(2019) explains that investment variables have no effect on HDI. In addition, most previous studies are still limited to multiple linear regression approaches or time series analysis, so they have not been able to comprehensively describe the dynamics focusing on the short-run fluctuations and long-run associations among the variables, so it is not known how short-run and long-run relationships are. This analysis makes use of the gross regional domestic product variable which has never been done by previous studies, this is because many studies highlight gross regional domestic product as an exogenous variable.

This research will complement previous research conducted by (Palayukan, 2019), (Noviansyah et al., 2019), (Jawak et al., 2024), (Bakar, 2020), (Simarmata & Iskandar, 2022) which explains the effect of the relationship between variables between household consumption, investment, and government spending on the human development index. Thus, the gap that can be completed in this research is being able to see the short-term and long-term relationships including the human development index influenced by the human development index itself. As a novelty, this research is conducted to test using FD-GMM and SYS GMM analysis to estimate the parameters of the data given by a model.

Extensive research has been carried out over time to address issues related to the Human Development Index (HDI) in Indonesia. Much of the existing literature has emphasized finding out the factors that influence the increase in the human development index and the extent of the impact of macroeconomic variables on the human development index. Most economic variables are dynamic in nature, meaning that their current values are influenced by the values of other variables from previous periods. On the other hand, many variables are dynamic. This can mean that the variable is not only influenced by other variables during the current year but also influenced by variables in the previous year.

The findings of this research may act as a foundation for policy formulation and academic discourse or basic reference for the government in formulating economic policies related to the Human Development Index, which is driven by Gross Regional Domestic Product (GRDP) and government spending in the coming period. Based on these issues, this study was conducted using dynamic panel data regression using the Generalized Method Moment (GMM) approach developed by Arellano Bond. In this dynamic panel data model, the lag of the dependent variable is used which is positioned as an explanatory variable to analyze the short-term and long-term effects. This model will produce unbiased, consistent, and efficient estimators. Thus, the purpose of this study is to analyze the short-term and long-term relationship between these variables and the human development index in Indonesia.

2. Literature Review

Human Development Index

The Human Development Index (HDI) is a composite indicator developed by the United Nations Development Programme (UNDP) since 1990 to measure the overall success rate of human development. The concept of the human development index was first announced by the United Nations Development Program (UNDP) in 1990 (Morse, 2003). The HDI is built on three main dimensions: longevity and healthy life, access to education, and decent standard of living. Each dimension is measured using indicators of life expectancy, literacy and educational enrollment rates, and Gross Domestic Product (GDP) per capita. The HDI is calculated using the following formula:

ISSN (print) 1858-165X | ISSN (online) 2528-7672

HDI = (IndexX_1 + IndexX_2 + IndexX_3)/3……..(1)

Information:

X_1 = Long life

X2 = Level of Education

X3 = Decent Living Rate

HDI is an important measure in assessing the effectiveness of a country's development policy, because it does not only focus on economic growth, but also on the distribution of development benefits to the community (Rapanna and Sukarno, 2017).

Household Consumption

Household consumption reflects people's purchasing power and welfare level. When income increases, consumption also increases, although not proportionally (Ayaviri-Nina et al., 2022). J.M Keyner, in his theory, explains that consumption trends reflect the relationship between consumption and income. When income increases consumption will also increase, although the increase is not as large as the increase in income. The Keynesian consumption function provides a framework to understand how household consumption is closely related to income. According to Keynes (1936), consumption is determined by current income, as expressed in the following equation:

Ct = C0 + C1 Y1 ……(2)

Where Ct is current consumption, (Y1 is current consumption, C0 is autonomous consumption, and C1 is the marginal propensity to consume (MPC).

Gross Regional Domestic Product

Gross Regional Domestic Product (GRDP) is the total value of goods and services produced by a region within a certain period. According to (Sukirno, 2001), economic growth is reflected in an increase in the value of GRDP, which reflects the expansion of production activities and an increase in community welfare. In the context of human development, an increase in GRDP indicates the government's fiscal capacity to finance strategic sectors such as education and health (Maulana et al., 2022). Economic growth issues can be categorized as long-term macroeconomic problems that continue from one period to the next. (Runtunuwu et al., 2023); (Endaryono & Djuhartono, 2024). Measuring the average Gross Regional Domestic Product in a region to assess people's welfare can be formulated as follows:

$$\text{GRDP Per Capita} = \frac{Total\ GRDP}{Number\ of\ Population} \quad \ldots\ldots (3)$$

Thus, GRDP is positioned as a macroeconomic determinant that encourages the achievement of HDI through strengthening regional economic capacity.

Investment

Investment has an important role in driving economic growth through job creation and productivity improvement (Dira et al., 2023). In the long run, investment directed at the infrastructure, education and health sectors will contribute to improving people's quality of life, which has a positive impact on HDI. Research by Mongan (2019) shows that an increase in

investment allocation in the social sector is one indicator of the success of human development. The aggregate investment value can be formulated as:

$$\text{Total Investment} = \sum_{i=1}^{n} Investment\ Value\ on\ the\ Project\ to - i \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(4)$$

Where n is the number of projects and the investment value can be the amount of funds spent in currency units.

Government Expenditure

Government spending is an instrument of fiscal policy used to improve people's welfare through public spending, including spending on education, health, and infrastructure sectors. Targeted spending has been proven to improve the two main dimensions of HDI, namely knowledge and longevity (Maulid et al., 2021); (Sukirno, 2013). Previous studies have shown that government spending contributes significantly to increasing HDI if it is focused on priority development sectors. Government expenditure can be measured with the following parameters:

$$\text{Percentage of government expenditure} = \left(\frac{Total\ Goverment\ Expenditure}{Gross\ Domestic\ Produk}\right) x\ 100 \quad \ldots\ldots\ldots\ldots\ldots(5)$$

Where total government expenditure is all government spending (capital expenditure, operational, etc.), Gross Domestic Product is the total value of economic output in a given period.

3.Research Method

A quantitative method is utilized in this study, involving the use of numerical data for both collection and analysis, resulting in descriptive findings based on the observed phenomena. The amount of data used in this study is 34 provinces in Indonesia with an observation period of 2014-2023, so this study uses panel data with a total of 340 samples. The measurement scale used in this study is a ratio scale, as all variables are quantitative and have an absolute zero point. Techniques collection of data were carried out by searching for, collecting, and downloading data from the official website of the Central Statistics Agency in Indonesia for the period 2014-2023. The study's independent variables include Household Consumption, Regional Domestic Product (GRDP) on a constant basis, Domestic Investment, Government Expenditure, and the dependent variable Human Development Index (HDI). The model of this study is in equation as follows:

$$HDI_{i,t} = \beta_0 + \delta HDI_{i,t-1} + \beta_1 HC_{i,t} + \beta_2 GRDP_{i,t} + \beta_3 I_{i,t} + \beta_4 GE_{i,t} + \varepsilon i,t \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(6)$$

The estimation method used in this study is the Generalized Method of Moments (GMM). This method is used to estimate parameters from data provided by a model. GMM was chosen to overcome potential endogeneity problems and to handle lagged dependent variables used as explanatory variables. GMM is an extension of the method of moments that equates the conditional moments of the population with the conditional moments of the sample (Susilo et al., 2020). To overcome inconsistencies, the instrumental variable estimation method can be used, namely with variables that are correlated with errors. This study uses Stata 17, namely the XTABOND module.

ISSN (print) 1858-165X | ISSN (online) 2528-7672

Arellano-Bond GMM method

The approach used in estimating the dynamic panel data regression model is first-different GMM (FD-GMM). This method produces unbiased, consistent, and efficient estimates. FD-GMM eliminates fixed effects through first difference transformation and uses lag variables as instruments. The GMM estimator for δ can be written in equation as follows:

$$\hat{\delta} = \left[\left(N^{-1}\sum_{i=1}^{N} Z_i\,\Delta y_{i,t-1}\right)\widehat{W}\left(N^{-1}\sum_{i=1}^{N} Z_i\,\Delta y_{i,t-1}\right)\right]^{-1} \left[\left(N^{-1}\sum_{i=1}^{N} Z_i\,\Delta y_{i,t-1}\right)\widehat{W}\left(N^{-1}\sum_{i=1}^{N} Z_i\,\Delta y_{i,t-1}\right)\right] \quad \text{.....(7)}$$

Z_{sys} : Instrument matrix

$\widehat{W}$: Unbiased and consistent estimation for $W_{(LxL)}$ with L being the number of variables instrumen

SYS-GMM Estimation Method

The GMM system estimation (SYS-GMM) is used to estimate the system of equations using a combination of first differences and level moments. This technique has the advantage of strengthening the instruments and producing efficient and more consistent estimates. The GMM estimator δ is obtained by minimizing the weighted quadratic function J(δ) as shown in equation below.

$$\frac{\partial J(\hat{\delta})}{\partial \hat{\delta}} = 2\left[\left(N^{-1}\sum_{i=1}^{N}\Delta y_{i,t-1}\,Z_{sys}\right)\widehat{W}\left(N^{-1}\sum_{i=1}^{N} Z'_{sys}\,\varphi_i\right)\right] +2\left[\left(N^{-1}\sum_{i=1}^{N}\varphi_{i,-1}\,Z_{sys}\right)\widehat{W}\left(N^{-1}\sum_{i=1}^{N} Z'_{sys}\,\varphi_i\right)\right] = 0 \quad \text{.....(8)}$$

With:

Z_{sys} : Instrument matrix

$\widehat{W}$: Unbiased and consistent estimation for $W_{(LxL)}$ where L is the number of instrument variables

The one-step estimator system can be seen in the following equation.

$$\hat{\delta} = \left[\left(N^{-1}\sum_{i=1}^{N}\varphi'_{i,t-1}\,Z_{sys}\right)\widehat{W}\left(N^{-1}\sum_{i=1}^{N} Z'_{sys}\,\varphi_i\right)\right]^{-1} \left[\left(N^{-1}\sum_{i=1}^{N}\varphi'_{i,-1}\,Z_{sys}\right)\widehat{W}\left(N^{-1}\sum_{i=1}^{N} Z'_{sys}\,\varphi_i\right)\right] \quad \text{.....(9)}$$

The estimator, δ. is a consistent estimator that is independent of the weight of, $\widehat{W}$ Blundell and Bond took the δ. obtained on the one-step estimator by substituting, $\widehat{W}$=Ψ.-−1. So a *two-step efficient system estimator* is produced as equation as follows.

ISSN (print) 1858-165X | ISSN (online) 2528-7672

$$\hat{\delta} = \left[\left(N^{-1}\sum_{i=1}^{N}\varphi'_{i,t-1}\,Z_{sys}\right)\hat{\Psi}^{-1}\left(N^{-1}\sum_{i=1}^{N}Z'_{sys}\,\varphi_{i,-1}\right)\right]^{-1}$$
$$\left[\left(N^{-1}\sum_{i=1}^{N}\varphi'_{i,-1}\;Z_{sys}\right)\hat{\Psi}^{-1}\left(N^{-1}\sum_{i=1}^{N}Z'_{sys}\,q_i\right)\right]$$

.....(10)

Model Specification Test

The model specification test aims to determine the suitability of the dynamic panel data model used for GMM estimation that is capable of meeting the criteria of being unbiased, valid, and consistent. The first step is the Arellano-Bond test, which is used in the context of panel data analysis to identify the presence of first-order autoregression in the model residuals. To assess the suitability of the model, we can look at the results of the AR (1)/order 1 and AR (2)/order 2 values, which are the p-values for first and second order autocorrelated disturbances. The test for AR (1) often rejects H0, but the important indicator is shown by the AR (2) value. The second step is the Sargan test, which is used to determine the validity of using instrument variables whose number exceeds the number of parameters under overidentifying restrictions. The model's validity is determined by the chi-square probability value having a significance level greater than 0.1, 0.5, or 0.01, in which case H0 is accepted, or it can be said that the instrument variables used are valid.

Test of Refraction

The test of unbiasedness is a condition where the GMM estimator lies between the integrated least squares estimator and the fixed effects estimator. Pooled least squares produce estimates that tend to be upward biased when there are individual specific effects. Meanwhile, fixed effects produce estimates that are downward biased.

4. Results and Discussion

This study uses a dynamic panel data model to describe the relationship between the Human Development Index (HDI) variable and household consumption, gross regional domestic product, investment, and government spending. There are two estimates used in the GMM method to estimate the dynamic panel model, namely first difference GMM (FD-GMM) and system GMM (SYS-GMM).

Dynamic Panel Data Regression Model Estimation

At this stage, dynamic panel data regression model estimation is performed using the FD-GMM two-step and SYS-GMM two-step estimation approaches.

Table 1. Estimation of FD-GMM Approach Parameters

Parameter	Coefficient	Standard error	Z	P-Value
$\delta HDI_{i,t-1}$	-0.0458358	0.0614344	-0.75	0.456
$HC_{i,t}$	0.0009333	0.0022333	0.42	0.676
$GRDP_{i,t}$	0.116451	0.0076645	1.52	0.129
$I_{i,t}$	0.0020926	0.0013847	1.51	0.131
$GE_{i,t}$	0.2373345	0.0251028	9.45	0.000
Uji Wald	1594.10			
P-Value	0.0000			

Source: Data processed

ISSN (print) 1858-165X | ISSN (online) 2528-7672

Table 1 shows the results of the analysis using the FD-GMM approach, which shows the coefficient values and probabilities of each variable. Based on the table above, it can be seen that household consumption has a p-value of 0.676, GRDP has a value of 0.129, and investment has a p-value of 0.131. Therefore, the decision made was not to reject H0, whereby household consumption, GRDP, and investment did not have a significant effect on the human development index. However, government expenditure showed significant results on the human development index.

Table 2. Parameter Estimation of SYS-GMM Approach

Parameter	Coefficient	Standard Error	Z	P-Value
$\delta HDI_{i,t-1}$	0.0091493	0.0321965	0.28	0.776
$HC_{i,t}$	0.0008252	0.0020671	0.40	0.690
$GRDP_{i,t}$	0.011204	0.0048743	2.30	0.022
$I_{i,t}$	0.0020148	0.0012679	1.59	0.112
$GE_{i,t}$	0.2407178	0.0142467	16.90	0.000
Uji Wald	1033.86			
P-Value	0.0000			

Source: Data processed

Table 2 shows the results of the analysis using the SYS-GMM approach, which shows the coefficient values and probabilities of each variable. The probability value of household consumption is 0.690 and the investment variable has a p-value of 0.112, so it was decided to reject H0, whereby household consumption and investment do not have a significant effect on the human development index. However, the results of the GRDP and government expenditure analysis show results that have a significant effect on the human development index.

Dynamic Panel Data Regression Model Specification Test

Specification tests on the panel data regression model were performed using the Arellano-Bond test and the Sargan test. The Arellano-Bond test aims to detect autocorrelation between residual components, both in the FD-GMM and SYS-GMM approaches, which is the same as the Arellano-Bond test equation (Febrianti and Setiawan, 2022). The estimation is said to be consistent if, at the second order difference, there is no autocorrelation between the residuals and the endogenous variables.

Table 3. Arellano-Bond Test

Model	Statistical Value	P-Value
FD-GMM	-1.5358	0.1246
SYS-GMM	-0.92668	0.3541

Source: Data processed

Table 3 shows the results of the Arellano-Bond specification test on the FD-GMM and SYS-GMM models. The statistical values for each model at the second order < Ztable = 1.96 are -1.5358 and -0.92668, respectively, and the P-value for the second order > α = 0.05. Therefore, the conclusion for the second order is that H0 cannot be rejected. It can be concluded that the estimates obtained from both approaches, FD-GMM and SYS-GMM, are consistent and there is no autocorrelation.

The next specification test is the Sargan test, which aims to determine the validity of using instrumental variables that exceed the estimation parameters. The decision taken is to reject H0 if the S test statistic value exceeds the Chi-Square table value or the P value < α 0.05.

ISSN (print) 1858-165X | ISSN (online) 2528-7672

Table 4. Sargan Test

Model	Statistical Value	P-Value
FD-GMM	40.49194	0.2408
SYS-GMM	51.20348	0.1828

Source: Data processed

Table 4 shows the results of the chi-square test for both models, FD-GMM and SYS-GMM. The statistical value S > chi-square table value = 60.48 or P-Value ≥ α = 0.05. In the table above, the statistical values for both models are 40.49194 and 51.20348 > chi-square value = 60.48, which means that H0 cannot be rejected. The second-order P-values for the two models are 0.2408 and 0.1828, respectively, indicating that H0 cannot be rejected for either the FD-GMM or SYS-GMM model. Therefore, the conclusion is that the overidentifying restriction condition in the model estimation is valid.

Test of Refraction

The next test is to determine the unbiasedness criteria by comparing the FD-GMM and SYS-GMM lag estimators with the Fixed Effect Model, which has downward bias, and Pooled Least Squares, which has upward bias. The lag estimator is said to be unbiased if it lies between the FEM and PLS models.

Table 5. Comparison of GMM Estimator with FEM and PLS

Parameter	Coefficient FD-GMM	Coefficient SYS-GMM	Coefficient FEM	Coefficient PLS
$\delta HDI_{i,t-1}$	-0.04583584	0.00914929	-0.3187239	0.13406939***

Source: Data processed

Table 5 shows that the FD-GMM model has a coefficient of -0.04583584, which is not between the FEM model coefficient and the PLS model coefficient, but is smaller than the FEM and PLS model coefficients. Meanwhile, SYS-GMM has a coefficient of 0.00914929, which is between the coefficients of the FEM model and the PLS model. It can be concluded that the model that meets the unbiased criteria is the SYS-GMM model.

Dynamic Panel Data Model Selection

The best model for GMM was selected based on the results of fulfilling the assumption test criteria, namely the consistency test (Arellano Bond test), instrument validity test (Sargan test), and unbiasedness test.

Table 6. Summary of Test Results

Criteria	FD-GMM	SYS-GMM
Consistency	Fulfilled	Fulfilled
Instrument Validity (Sargan Test)	Fulfilled	Fulfilled
Unbiased	Not Fulfilled	Fulfilled

Source: Data processed

Based on Table 6, it can be seen that the best model to use is SYS-GMM because it meets all assumption test criteria. Based on the parameter estimation of the SYS-GMM approach, equation (6) is obtained as follows:

$$HDI_{i,t} = 0.0091493\ HDI_{i,t-1} + 0.0008252\ HC_{i,t} + 0.011204\ GRDP_{i,t} + 0.0020148\ I_{i,t} + 0.2407178\ GE_{i-t} + \varepsilon_{i-t}$$

ISSN (print) 1858-165X | ISSN (online) 2528-7672

The value of 0.0091493 indicates that for every one-unit increase in the Human Development Index (HDI) in the previous period, the HDI will increase by 0.0091493 units. The value of 0.0008252 indicates that HDI increases by 0.0008252 units for every increase of one million rupiah in household consumption. The value 0.011204 indicates that the HDI increases by 0.011204 units for every one billion rupiah increase in Regional Domestic Product (GRDP). The value 0.0020148 indicates that the HDI increases by 0.0020148 units for every one billion rupiah increase in domestic investment. The value of 0.2407178 indicates that the HDI increases by 0.2407178 units for every increase of one thousand rupiah in government expenditure.

Regression Elasticity Coefficient

Dynamic panel data regression is not only used to calculate the speed of convergence, but is also useful for determining the short-term and long-term multiplier effects of endogenous variables (Nabilah & Setiawan, 2016). Table 7 shows the results of the analysis, which shows the short-run and long-run coefficients of variables that can influence the Human Development Index based on the Blundell Bond SYS-GMM model which shows the short-run and long-run coefficients of variables that can influence the Human Development Index based on the Blundell Bond SYS-GMM model..

Table 7. Short-Term And Long-Term Elasticity Coefficients

Parameter	Coefficient	Standard Error	z	P-Value	Short-term	Long-term
$\delta HDI_{i,t-1}$	0.0091493	0.0321965	0.28	0.776	-	-
$HC_{i,t}$	0.0008252	0.0020671	0.40	0.690	0.0008252	0.0008329
$GRDP_{i,t}$	0.011204	0.0048743	2.30	0.022	0.011204	0.113075
$I_{i,t}$	0.0020148	0.0012679	1.59	0.112	0.0020148	0.0020334
$GE_{i,t}$	0.2407178	0.0142467	16.90	0.000	0.2407178	0.249405

Source: Data processed

Based on Table 7, it is known that the lag coefficient of the Human Development Index (HDI) indicator contributes positively and significantly effect. It can be concluded that the HDI in the previous period has an influence on the HDI in the current period.

Household consumption has a probability value of 0.690, which is greater than the significance value of 5% (0.05) with a coefficient of 0.0008252, meaning that the household consumption variable contributes positively but insignificant effect on the HDI in Indonesia. The coefficient value for Regional Domestic Product (GRDP) is 0.011204 and the probability value is 0.022, which is less than the significance level of 5% (0.05). This means that GRDP has a significant positive effect on HDI. This positive relationship indicates that if GRDP improvment by 1%, it will improve the HDI by 0.011204 in the short term and by 0.113075 in the long term.

The investment result has a probability of 0.112 greater than the significance value of 5% (0.05) with a coefficient of 0.0020148, so it can be concluded that investment does not have a significant effect on HDI. Investment has a short-term elasticity effect of 0.0020148 and a long-term elasticity effect of 0.0020334. Government expenditure contributes positively and significantly effect on HDI in part. This is indicated by a coefficient of 0.2407178 and a p-value of 0.0000, which is less than the significance level of 5% (0.05). This positive relationship indicates that if there is a 1% improvement in government spending, then in the short term, the HDI will improve by 0.2407178 and in the long term, it will improve by 0.249405.

ISSN (print) 1858-165X | ISSN (online) 2528-7672

The Effect of Household Consumption on the Human Development Index

The results of the analysis show that household consumption contributes positively but insignificant effect on the Human Development Index in both the short and long term. These results indicate that an increase in household consumption does not always contribute significantly to an improvement in quality of life. This is because consumption patterns are more heavily allocated to needs that do not directly contribute to human development.

These results are supported by research conducted by Husni & Amar (2024) and Jawak et al., (2024), which explains that household spending on food does not always affect the HDI. However, different results were found in Tamara & Yeniwati (2020) which states that household consumption has a significant effect on the human development index in Indonesia. The majority of household budgets are focused on food needs, reflecting a level of well-being that is still not optimal. Although household consumption can actually contribute to an improve in the HDI, its effectiveness is greatly influenced by the type of expenditure.

The findings of this study can provide knowledge and serve as a basis for the government to formulate economic policies that optimize policy mixes to maintain stability and promote economic growth by providing subsidies or incentives for education and health, as well as financial literacy programs that encourage households to invest in long-term needs that have an impact on quality of life, particularly improvements in the human development index.

Effect of Gross Regional Domestic Product on Human Development Index

Gross regional domestic product contibutes positively and significantly effect on the human development index in both the short and long term. These results prove that the economic conditions of a region contribute significantly to increase the quality of human resources, one of which is by encouraging community consumption, so that human quality can contribute fully to economic development (Samiani et al., 2024). An increase in GRDP can create job opportunities and increase community income, which will boost household consumption in the human development sector.

The same study on GRDP was presented by Efendi et al., (2020) and Arba et al., (2021) that growth will encourage an increase in consumption patterns among the public, which in turn will increase purchasing power. This increase in purchasing power will influence the increase in the human development index, as purchasing power is one of the composite indicators in the formation of the HDI in terms of income. Thus, economic growth will increase if accompanied by an increase in household consumption.

These findings can help in the formulation of policies that promote economic growth by ensuring that increases in GRDP in each region are accompanied by effective policies for equitable development. Kuznet's theory of economic growth explains that one of the signs of modern economic growth is high per capita production. A significant increase in production will encourage an increase in consumption patterns among the population, which in turn will increase purchasing power. The benefits of an increase in the human development index can occur as a result of high purchasing power among the community. This is because purchasing power is one aspect of income, which is an important indicator in determining the Human Development Index.

ISSN (print) 1858-165X | ISSN (online) 2528-7672

The Effect of Investment on the Human Development Index

Based on the results of the analysis, it is known that investment contributes positively but insignificant effect on the Human Development Index. This is because investment flows have not contributed optimally to improving the standard of living of the community. Investment that is not directed towards education, health, and livability can reduce the utilization of human resources in improving the HDI or even the welfare of the community.

A study supporting this finding is Noviansyah et al., (2019), which shows that investment has no effect on the human development index. However, this is not in line with the study conducted by Sayifullah (2021), which discusses the impact of investment on the HDI in the long term. Increased and equitable investment will boost economic activity, optimize natural resources and production factors, and create new job opportunities, which in turn will lead to increased income and improved well-being for the community.

These findings can provide knowledge as a basis for policy-making in the investment sector regarding the human development index in the next period, as an effort to improve the quality of human resources. Investment allocation needs to be directed not only to encourage economic growth, but also to ensure a positive social impact on society by establishing a trusted investment management institution to increase investment in Indonesia, which is then optimally allocated to improve the human development index.

The Effect of Government Expenditure on the Human Development Index

Based on the results of the analysis, it is known that government expenditure contributes positively and significantly effect on the Human Development Index in Indonesia. the reason is because government funds are allocated to education, health, and infrastructure spending with the aim of improving the quality of human development. The fiscal policy implemented by the government for government spending is carried out for the distribution of revenue, allocation of resources, and economic stability so as to boost Indonesia's economic growth.

These results are supported by research (Apriska et al., 2024) which states that the budget allocated by the government to the health sector supports quality health facilities and infrastructure. Thus, a population with good health will have an impact on human development. Research Suprayogi (2023) shows that government spending can drive economic growth in Indonesia through the implementation of fiscal policies via government spending allocated to resources.

This finding confirms that government spending has an empirical effect on HDI. Achieving economic development in a country requires individual and collective efforts to improve the quality of life. Important factors that must be developed are the quality of human resources, facilities and infrastructure, and modern economic institutions. The realization of economic development is highly dependent on the role of the government, as manifested through government spending. Rostow and Musgrave's theory links the development of government spending with the stages of economic development. In the early stages, government investment must provide infrastructure, such as education, health, transportation, and so on.

5.Conclusion

Based on a dynamic panel data approach using the System GMM (SYS-GMM) method with panel data, researchers found that household consumption contributes positively but

ISSN (print) 1858-165X | ISSN (online) 2528-7672

insignificant effect on the human development index, even though household consumption can actually contributing to the increase in the Human Development Index (HDI), but its effectiveness is greatly influenced by the type of expenditure. GRDP contributes positively and significantly effect on the human development index. This result confirms that growth in each region contributes to improving the quality of life of the community, which in turn has an impact on human development. Investment has a positive but insignificant effect on the human development index. Investment that is not directed toward sectors important to human development can reduce the utilization of human resources in improving the HDI. Government expenditure contributes positively and significantly effect on the human development index. The allocation of funded by the government for education, health, and infrastructure spending can drive improvements in the quality of human development.

The results of this analysis show a dynamic relationship, where the values of the variables can influence each other. The human development index is an important indicator in the development of a country that can influence various aspects. The findings in this study can provide knowledge and serve as a basis for policy making by the government in an effort to improve the human development index in Indonesia. Short-term and long-term policies are needed to maintain the stability and improvement of the Human Development Index, along with better facilities to support the well-being of the community year after year. Therefore, recommendations for future research include a broader scope of study, a longer observation period, and the use of other macroeconomic variables as external variables to provide further insights into this issue

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