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Determinants of Macroeconomic Variables and HDI on Indonesia's GDP Using the ARDL Method

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Abstract
The successful performance of economic development is calculated by constant price economic growth or real Gross Domestic Product (GDP). Indonesia's GDP value from 1990-2021 tends to increase, but its growth fluctuates. This study aims to analyze the effect of macroeconomic variables including household consumption, foreign investment, domestic investment, economic openness and the Human Development Index (HDI) on Indonesia's GDP in the short and long term 1990-2021. The analysis technique uses Autoregressive Distributed Lag (ARDL). Analysis through the EViews application results: 1). In the short term, the consumption variable has a positive impact on Indonesia's GDP. Foreign investment, on the other hand, has a negative impact. Domestic investment shows a significant positive effect, while economic openness has a significant negative effect on GDP. Additionally, the Human Development Index (HDI) variable demonstrates a significant negative impact on Indonesia's GDP in the short term.; 2). Looking at the long term, only the HDI variable exhibits a significant positive effect on Indonesia's GDP. The implications of increasing GDP and economic growth, leading to higher consumption in society in the short term, necessitate the implementation of policies aimed at improving the wage system and social security. Moreover, attracting foreign investment becomes crucial in sectors where the government and domestic investors cannot operate effectively. For domestic investment, it is essential to deregulate investment arrangements and encourage more proactive investment services to support increased productivity and meet domestic needs. Economic openness can be achieved by boosting exports of finished goods rather than raw materials. Simultaneously, efforts to improve the Human Development Index (HDI) must be evenly distributed both in the short and long term.

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1. Introduction

The Preamble to the Constitution of the Republic of Indonesia (UUD '45) states that one of the objectives of the state is to advance public welfare. To realize this goal, it is carried out through efforts to promote development and economic growth (BPHN, 2016). Development and economic growth are two inseparable factors; economic development leads to an increase in GDP, and higher GDP at constant prices results in economic growth. Macroeconomic growth serves as an indicator to assess the success of economic development (Todaro & Smith, 2006). Economic growth refers to the condition in the economy characterized by increased output from one period to another (Sukirno, 2019) It is measured as the percentage increase in GDP from one period to the next. The Central Bureau of Statistics (BPS) defines GDP as the total value of final goods and services produced by all economic units in a country. The value of GDP in a country is calculated using the country's currency as the unit of account. The GDP used to calculate economic growth is real GDP (Sudirman & Alhudhori, 2018).

To increase economic growth (Azwar, 2016)) based on Keynes theory, it is necessary to boost the expenditure components, which consist of consumption, investment, government spending, and net exports. By increasing the consumption component, production can be enhanced. Additionally, production can grow with good investments made by domestic, foreign, and government entrepreneurs. Net exports can also contribute to increasing GDP as export activities allow for obtaining price differences between domestic and overseas markets. However, increasing economic activity requires more than just financial resources; it also relies on quality human resources as the driving force of development. The level of human resource quality can be measured through human development, which is reflected in the Human Development Index (HDI).

During the period of 1990-2021, fluctuations in Indonesia's GDP were affected by various phenomena, such as the 1997-1998 monetary crisis, the 2008-2009 financial crisis, the rising inflation rate in 2013-2015, and the occurrence of the COVID-19 pandemic in 2020. These various phenomena made Indonesia continue to strive to improve and strengthen its economic conditions. Household consumption is one of the factors that has the biggest contribution in the long term to Indonesia's economic growth (Sukirno, 2019). This theory is in accordance with data reported by BPS, which explains that the component from the expenditure side, namely household consumption, has the largest portion, reaching more than 50% of Indonesia's total GDP. The theory that states household consumption has a positive influence in driving economic growth in the short and long term (Al Rasasi et al., 2021; Handriyani et al., 2018). Meanwhile, states that household consumption has a negative effect on economic growth in Jambi Province (Sudirman & Alhudhori, 2018).

Another component that has the second-largest contribution to GDP and is able to boost economic growth is capital formation, also known as investment. The economic growth model put forward by Harrod-Domar also states that, in an effort to achieve strong economic growth in the long term, the role of investment is needed as a condition that needs to be fulfilled (Kambono & Marpaung, 2020). The investment can be in the form of foreign investment or domestic investment. Previous research are in line with the theory put forward by Harrod-Domar, stating that foreign investment has a positive effect on GDP and economic growth (Kambono & Marpaung, 2020; Nuraini & Mudakir, 2019). As for domestic investment, previous research proves that there are findings that support this theory, indicating that domestic investment has a positive effect on increasing economic growth (Mahriza & Amar B, 2019; Sani et al., 2018; Saqib et al., 2013). However, not all research aligns with these findings, stated that foreign investment has a significant negative effect on economic growth in Pakistan (Saqib et al., 2013).

Apart from relying on increasing investment funds, a country also needs to engage in economic relations with other countries in order to expand opportunities in the country's economic activities and foster economic openness. Economic openness can provide a wide opportunity for a country to carry out export and import activities, which, in turn, can encourage economic growth (Nuraini & Mudakir, 2019). One aspect of economic openness is trade openness, which is calculated through the ratio of trade (exports + imports) to GDP. Trade openness has a positive effect on GDP growth

(Bayar, 2016; Nuraini & Mudakir, 2019). This is because economic openness facilitates technology transfer and leads to increased productivity in economic activities.

Apart from being influenced by economic factors, the creation of economic growth is also significantly impacted by the human factor. According to the United Nations Development Program (UNDP), humans are the true source of a country's wealth (BPS, 2021) Additionally, growth theory states that human capital is an endogenous factor that influences economic growth (Anyanwu, 2014). To measure the quality of human capital, a concept known as the Human Development Index (HDI) is used (Dewi & Sutrisna, 2014). Previous research has shown that increasing human development will create more opportunities for economic growth (Elistia & Syahzuni, 2018; Sani et al., 2018; Susanto & Rachmawati, 2013).

Based on the inconsistencies found in some of the results of previous studies and the disparity between theory and the observed phenomena, this research was conducted to analyze the effects of household consumption, foreign investment, domestic investment, economic openness, and the Human Development Index (HDI) on Indonesia's GDP in both the short and long term.

2. Method

This study employs the Autoregressive Distributed Lag (ARDL) method as the data analysis approach. The purpose of using this analysis is to address the research objectives, which involve examining the influence of independent variables and dependent variables in both the short and long term. The ARDL model utilizes past and present data from the independent and dependent variables. The ARDL method involves the following analysis stages:

1) Unit Root Test

The unit root test, or stationarity test, is performed on each data series to avoid the occurrence of spurious regression. The Augmented Dickey Fuller (ADF) test is used for the stationarity test. If a data series is found not to be stationary at the level or I(0) level, then the stationarity of the data can be examined by conducting the ADF test at the first difference, second difference, and so on. However, the ARDL method will only consider data that is stationary at the level or I(0) level, as it is not suitable for data that is stationary at the second difference level (Fitriani & Hakim, 2021).

2) Optimum Lag Determination

To address autocorrelation issues, the optimum lag is determined. The optimum lag test is also employed to ascertain the appropriate lag length to be used in the subsequent analysis stage (Gujarati & Porter, 2013). The determination of the optimum lag is based on the value of the Akaike Information Criterion (AIC). A smaller AIC value indicates a better-fitted model (Ekananda, 2016).

a) The Classical Assumption Test
   The classical assumption test is carried out through heteroscedasticity tests, autocorrelation tests, and normality tests to ensure that the models used are not biased and comply with econometric rules and test requirements (Ghozali, 2009).
b) The Stability Test
   Stability test is carried out to see the stability of the parameters in the short term and long term testing. The test was carried out using the Cumulative Sum of Square of Recursive Residuals (CUSUMQ) with a 5% confidence level. Through CUSUMQ the stability of the model can be seen when the position of the CUSUMQ line is in the form of an irregular line between the 5% significance line, so at that position the model can be said to be stable (Ekananda, 2016).
c) ARDL Model and Cointergration Test
   After determining the stationarity of the data, then the model is tested with the ARDL model. In this study the ARDL model used is as follows:

$$Y_t = \alpha_0 + \sum_{i=1}^{p} \beta_1 \Delta Y_{t-1} + \sum_{i=1}^{q} \beta_2 \Delta X_{1_{t-1}} + \sum_{i=1}^{r} \beta_3 \Delta X_{2_{t-1}} + \sum_{i=1}^{s} \beta_4 \Delta X_{3_{t-1}} + \sum_{i=1}^{t} \beta_5 \Delta X_{4_{t-1}} + \sum_{i=1}^{u} \beta_6 \Delta X_{5_{t-1}} + \delta_1 Y_{t-1} + \delta_2 X_{1_{t-1}} + \delta_3 X_{2_{t-1}} + \delta_4 X_{3_{t-1}} + \delta_5 X_{4_{t-1}} + \delta_6 X_{5_{t-1}} + \mu_t$$

Where the α_0 is constrant, $X_{1,2,3,4,5}$ is the independent variable used, namely in the form of household consumption, foreign investment, domestic investment, economic openness, and HDI, $\beta_{1,2,3,4,5,6}$ is the coefficient for short-run analysis, $\delta_{1,2,3,4,5,6}$ is the coefficient for long-term analysis, as well μ_t is the error term.

Furthermore, a cointegration test is conducted to determine whether a long-term relationship exists between the independent variables and the dependent variable. The bound testing approach is utilized to analyze this relationship, and it is evaluated based on the F-statistical value. If the resulting F-statistic value is greater than the upper bound value, it indicates the presence of cointegration (long-term relationship) between the variables. On the other hand, if the F-statistic value is less than the lower bound value, it suggests no cointegration between the variables (Ekananda, 2016).

d) Short Term Model Estimation
After conducting the long-term estimation, an error correction representation of the ARDL model will be derived, in the form of an error correction model (ECM) and an error correction term (ECT). This step is taken to examine whether there is a short-term effect or not. If the ECT coefficient (-1) is negative and significant at the5% level of confidence, it indicates the presence of a cointegration relationship between variables. The negative sign of the coefficient suggests the existence of a correction mechanism for long-term equilibrium deviations. Moreover, an analysis is performed on the short-term coefficients to determine the effects between variables, both positive and negative (Ekananda, 2016). This analysis allows for a comprehensive understanding of how the variables interact in the short run.

e) Long Term Model Estimation
After conducting cointegration testing and confirming that the variables have a long-term relationship, the next step involves estimating the long-term model for the ARDL model. This estimation allows for the examination of the long-term coefficients to determine the effects between variables, whether they are positive or negative (Ekananda, 2016). By analyzing the long-term coefficients, the study aims to understand the magnitude and direction of the influence that each independent variable has on the dependent variable in the long run. This analysis provides valuable insights into the relationships between the variables and their contribution to Indonesia's GDP over an extended period.

3. Result and Discussion

3.1. Unit Root Test

Unit root test or stationarity test on each data with the aim of avoiding the occurrence of spurious regression. Table 1. Stating the results of the unit root test using the Augmented Dickey Fuller (ADF) test.

Table 1. Unit Root Test Results/Stationarity Test

Variabel	Prob.	Notes	Conclusion
Gross Domestic Product	0.7242	*Level*	Not Stationary
	0.0001	*First Difference*	Stationary
Domestic consumption	0.3460	*Level*	Not Stationary
	0.0005	*First Difference*	Stationary
Foreign investment	0.9807	*Level*	Not Stationary

Domestic Investment	0.0000	*First Difference*	Stationary
	1.0000	*Level*	Not Stationary
	0.0343	*First Difference*	Stationary
Economic Openess	0.9999	*Level*	Not Stationary
	0.0148	*First Difference*	Stationary
Human Development Index	0.1790	*Level*	Not Stationary
	0.0012	*First Difference*	Stationary

The results of the unit root test indicate that all variables become stationary at the first difference level after transformation, particularly the Gross Domestic Product (GDP) variable, which is transformed using the natural logarithm (ln). None of the variables were found to be stationary at the second difference level. These outcomes satisfy the requirements of the ARDL method, allowing the study to proceed to the next stage of analysis. With all variables being stationary at the first difference level, the data is suitable for applying the ARDL model, which helps to avoid spurious regression and ensures reliable results in analyzing the short-term and long-term relationships between the independent variables and the dependent variable.

3.2. Optimum Lag Determination

The optimum lag test is conduct to determine the appropriate lag length to be used in the subsequent analysis stage.

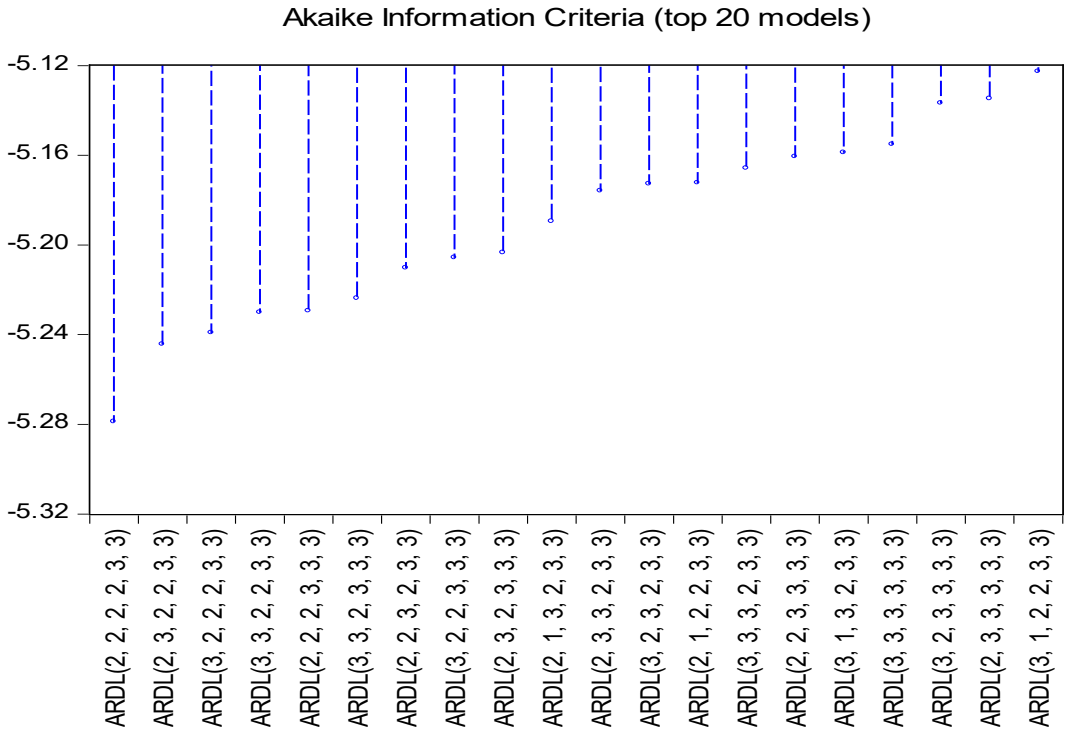

Figure 1. The Result of Optimum Lag Determination

Figure 1 shows that the best ARDL model chosen is ARDL(2,2,2,2,3,3) because it has the smallest AIC value of -5.279. This means that the variables GDP, household consumption, foreign investment, and domestic investment have an optimum lag of 2, while the variables of economic openness and HDI have an optimum lag of 3.

3.3. Classical Assumption Test

1) Heteroscedasticity Test

The heteroscedasticity test was conducted to determine whether there is inequality in the variance of the residuals in the regression. In this study, the Breusch-Pagan-Godfrey test was utilized to assess the presence of heteroscedasticity symptoms, yielding the following results.

Tabel 2. Heteroscedasticity Test

Value	
Obs*R-Squared	13.40458
Prob. Chi Square	0.8172

Table 2. The Chi-Square probability value on obs*R-squared is 0.81, which indicates that it is greater than 0.05. Therefore, it can be concluded that there is no heteroscedasticity in the data.

2) Autocorrelation Test

The autocorrelation test was conducted to determine whether there is autocorrelation in the data being used. In this study, the Breusch-Pagan-Godfrey test was employed to assess the presence of autocorrelation symptoms, yielding the following results.

Table 3. Autocorrelation Test

	Value
Obs*R-Squared	4.944114
Prob. Chi Square	0.0844

Table 3 shows that the Chi-Square probability value on obs*R-squared is 0.08, which means that the value is greater than 0.05. Therefore, it can be concluded that there is no autocorrelation in the data.

3) Normality Test

The normality test is utilized to determine whether the data is normally distributed or not. In this study, the normality test was conducted using the Jarque-Berra (JB) test, and the following results were obtained.

Table 4. Normality Test

Value	
Jarque-Berra	3.135528
Probability	0.208511

Table 4 shows the Jarque-Berra probability value of 0.20 which means more than 0.05. Therefore, from these results it can be concluded that the data is normally distributed.

4) Stability Test

In the ARDL method, conducting a stability test is crucial to determine whether the model used remains stable for analysis at a later stage. The results of the stability test are presented in Figure 3.

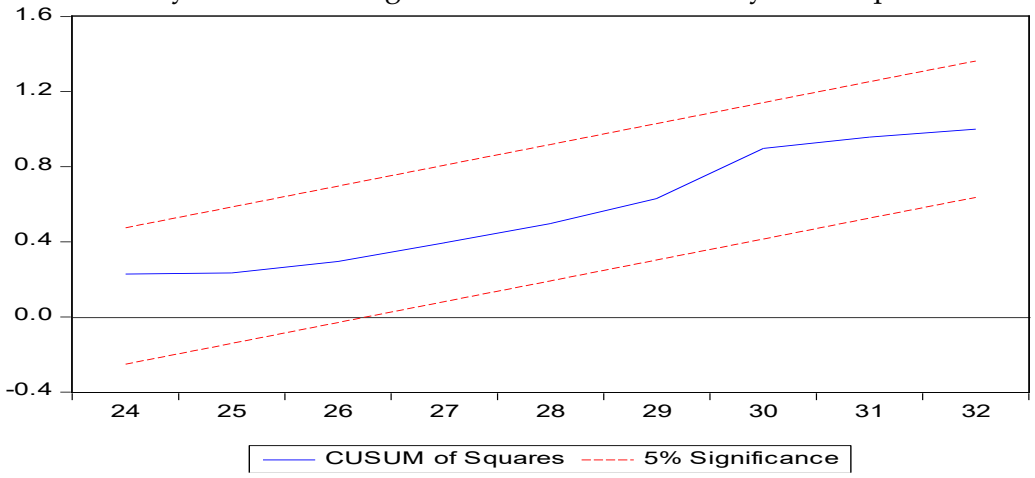

Figure 2. Stability Test

Figure 2 illustrates that the CUSUMQ plot, represented by the blue line, falls within the 5 percent significance line or lies within the 5 percent critical bound interval area, indicated by the red lines. This observation indicates that the model used remains stable for further analysis.

5) Model ARDL and Cointegration Test

The next step involves estimating the ARDL model using the predetermined lag and with the automatic selection mode on Eviews. According to Table 5, the Adjusted R-squared value is 0.999754, which corresponds to 99.9 percent. This indicates that 99.9 percent of the dependent variable, GDP, can be explained by the independent variables, namely household consumption, foreign investment (PMA), domestic investment (PMDN), economic openness, and HDI. The remaining 0.1 percent is attributed to other variables outside the model.

Table 5. ARDL Model Estimation

Variabel	Coefficient	Probability
LN_GDP(-1)	0.312479	0.0380
LN_GDP(-2)	0.591223	0.0009
Consumption	0.000118	0.0399
Consumption (-1)	0.000423	0.0005
Consumption (-2)	-9.62E-05	0.2214
Foreign Investment	-0.000352	0.0094
Foreign Investment (-1)	0.000160	0.1109
Foreign Investment (-2)	0.000202	0.0622
Domestic Investment	0.001351	0.0287
Domestic Investment (-1)	-0.002223	0.0168
Domestic Investment (-2)	-0.001867	0.0152
Openess	1.94E-06	0.9903
Openess (-1)	0.000574	0.0052
Openess (-2)	-0.000105	0.5905
Openess (-3)	0.000569	0.0095
HDI	-0.030037	0.0780
HDI (-1)	-0.042093	0.0405
HDI (-2)	0.026505	0.1017
HDI (-3)	0.059238	0.0012
C	-0.088417	0.7487
R-squared	0.999754	
Adjusted R-squared	0.999234	

The cointegration/bound testing is conducted to determine whether there is a long-term relationship between variables. The results of the cointegration test are presented in Table 6. It shows that the F-statistic value is 12.18, indicating a value greater than the upper bounds value of 3.79 and the lower bounds value of 2.62 at a significance level of 5 percent. Therefore, there is a cointegration relationship between the variables used.

Table 6. The cointegration/bound testing

F-*statistic*	*Significance*	*Critical Value Bounds*	
		Upper Bounds I(1)	*Lower Bounds* I(0)
12.18175	5%	3.79	2.62

3.4. Short Term Model Estimation

The short term model estimation in this study is based on the coefficient values, which are used to determine the effect of the independent variables on the dependent variable, taking into account both positive and negative effects. The probability values are examined to assess the significance of these effects.

Table 7 provides evidence of a cointegration relationship between the variables. This is evident from the negative value of the Error Correction Term at lag -1 (ECT(-1) = -0.09). However, this coefficient is not significant, as indicated by its probability value of 0.4413, which is greater than 0.05.

This implies that the dependent variable, GDP, is capable of adjusting to changes in the independent variables (household consumption, foreign investment, domestic investment, economic openness, and HDI) within the same time period.

Tabel 7. Short term estimation result

Short Term			
Variabel	Coefficient	Probability	Conclusion
D(LN_GDP(-1))	-0.591223	0.0009	Negative Significant
D(CONSUMPTION)	0.000118	0.0399	Positive Significant
D(CONSUMPTION(-1))	0.000096	0.2214	Positive Insignificant
D(FOREIGN INVESTMENT)	-0.000352	0.0094	Negative Significant
D(FOREIGN INVESTMENT(-1))	-0.000202	0.0622	Negative Insignificant
D(DOMESTIC INVESTMNET)	0.001351	0.0287	Positive Significant
D(DOMESTIC INVESTMNET (-1))	0.001867	0.0152	Positive Significant
D(OPENESS)	0.000002	0.9903	Positive Insignificant
D(OPENESS(-1))	0.000105	0.5905	Positive Insignificant
D(OPENESS (-2))	-0.000569	0.0095	Negative Significant
D(HDI)	-0.030037	0.0780	Negative Significant
D(HDI(-1))	-0.026505	0.1017	Negative Insignificant
D(HDI(-2))	-0.059238	0.0012	Negative Significant
CointEq(-1)	-0.096298	0.4413	Negative Insignificant

Based on the research results in Table 7. in the short term the household consumption variable has a significant positive effect on GDP, this is because an increase in household consumption will provide encouragement for producers to produce more goods to meet public demand, so this increase in production has a positive effect on increasing GDP figures. The results of this study are in line with prior research that in the short term household consumption variables have a positive effect on increasing national income and economic growth (Al Rasasi et al., 2021; Handriyani et al., 2018). However, the study reported a negative effect of household consumption on economic growth in Jambi Province (Sudirman & Alhudhori, 2018).

The foreign investment variable has a significant negative effect, this is due to the fact that in the short term the large amount of incoming foreign investment has not been fully absorbed by the economy, such as the low number of workers absorbed from this investment. The results of this study are in line with previous research which states that foreign investment has a negative effect on economic growth (Alvarado et al., 2017; Anyanwu, 2014; Saqib et al., 2013). Nevertheless, another research state that foreign investment has a positive effect on economic growth (Kambono & Marpaung, 2020; Nuraini & Mudakir, 2019).

In contrast to foreign investment, domestic investment in the short term exhibits a significant positive effect on GDP. This is due to the substantial amount of domestic investment acting as a capital source for national or regional development, stimulating economic activity within the country or region. The research findings on the domestic investment coefficient reveal that all indicate a positive influence of domestic investment on increasing national income and economic growth (Mahriza & Amar B, 2019; Sani et al., 2018; Saqib et al., 2013).

Indonesia also needs to promote economic openness to foster economic activity and establish favorable international relations. However, based on the results of this study, the variable "economic openness" exhibits a significant negative effect on Indonesia's GDP in lag 2. This negative impact is attributed to the economic conditions necessitating advanced adjustments to various policies and international trade flows. Consequently, in the short term, economic openness does not have a positive effect on Indonesia's GDP. Its inline with the previous research asserts a positive influence of economic openness on economic growth (Nuraini & Mudakir, 2019).

Moreover, the HDI variable demonstrates a significant negative effect on Indonesia's GDP in lag 2. This negative impact may arise because the policies aimed at improving human development require considerable time to reach all regions without exception. Uneven distribution of human

development advancements in the short term can exacerbate inequality, consequently adversely affecting GDP growth and overall economic growth.

3.5. Long Term Model Estimation

After conducting cointegration testing and confirming the existence of a long-term relationship between the variables, the next step involves estimating the long-term model. Here are the results of the long-term estimation:

Tabel 8. Long term model estimation result

Long Term

Variabel	Coefficient	Probability	Conclusion
CONSUMPTION	0.004616	0.4397	Positive Insignificant
FOREIGN INVESTMEN	0.000109	0.9490	Positive Insignificant
DOMESTIC INVESTMENT	-0.028444	0.5127	Negative Insignificant
OPENESS	0.010786	0.5375	Positive Insignificant
HDI	0.141349	0.0202	Positive Significant
C	-0.918161	0.8144	

Based on Table 8. in the long term, the household consumption variable has a positive but insignificant effect. According to an economist named Duessenbery, this concept is called the demonstration effect. Therefore, even though consumption seems to be increasing, it is counter-productive and does not have a significant effect on increasing national income. These results are in line with research which states that household consumption has an insignificant positive effect on economic growth in Tana Toraja Regency (Tapparan, 2020).

Similar to household consumption variables, foreign investment variables have a positive long-term effect on GDP. Foreign investment that continues to increase will provide impetus for increasing the number of available jobs, so as to reduce unemployment which will later be followed by increasing people's income and national income. However, if the government pays less attention to industrial prospects that can have a greater impact on investment, then it will not significantly affect Indonesia's GDP. In contrast to foreign investment, domestic investment has a negative effect on Indonesia's GDP. As a result, this has a negative effect on the country's GDP. Domestic investment has no effect on Indonesia's GDP growth (Kambono & Marpaung, 2020).

The variable economic openness, in the long run, it has a nonsignificant positive effect on GDP. This is because, even though export and import activities have a positive effect in encouraging an increase in GDP and economic growth, excessive reliance on them will not have a major impact on increasing the country's GDP. Therefore, there needs to be a balance in every export and import activity to encourage optimal GDP growth.

Furthermore, the results of this study indicate that, in the long term, the variable Human Development Index (HDI) has a significant positive effect on Indonesia's GDP. A high HDI level will increase a person's productivity, contributing to an increase in the value of GDP and encouraging economic growth. Its suggest that enhancing human development will increase opportunities for economic growth (Elistia & Syahzuni, 2018; Sani et al., 2018; Susanto & Rachmawati, 2013).

4. Conclusions

The existence of macroeconomic variables, such as household consumption foreign investment, domestic investment, economic openness, and the human development index (HDI), can positively influence the value of Indonesia's gross domestic product (GDP) and encourage economic growth These macroeconomic and HDI variables can exert their influence in both the short and long term on Indonesia's GDP. Therefore, this study aims to analyze the effects of household consumption, foreign investment, domestic investment, economic openness, and HDI variables on Indonesia's GDP, focusing on short-term and long-term research results.

This study aims to analyze the effect of household consumption, foreign investment, domestic investment, economic openness, and HDI variables on Indonesia's GDP. The research data used is

time series data for the period 1990-2021. The analysis technique used is the Autoregressive Distributed Lag (ARDL) model.

Based on the results of the cointegration test or bound testing it was found that the variables of household consumption, foreign investment, domestic investment, economic openness, and HDI are all cointegrated or have a long-term influence on GDP. From the results of research using the ARDL method, the results were found, namely household consumption variables had a positive effect in the short and long term on GDP. The foreign investment variable has a negative effect in the short term, but has a positive effect on GDP in the long term. The domestic investment variable has a positive effect in the short term, but has a negative effect on GDP in the long term. The variables of economic openness and human development index (IPM) have a negative effect on lag 2 in the short term and have a positive effect on Indonesia's GDP in the long term.

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